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Is Secular Stagnation the Future for Europe?

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Abstract

There are at least two distinct (but related) concepts of 'secular stagnation'. One concerns a possible long-run term trend growth failure and the other a permanent liquidity trap. In the context of poor productivity performance, both are legitimate fears for European economies although technological pessimism is misguided and scope for catch-up is still considerable. In each respect, however, policy responses that have worked in the past are available to address the problem. If European economies were to submit to either type of secular stagnation, it would be a result of policy failure rather than because it is inevitable.

Keywords: liquidity trap; real interest rate; secular stagnation; technological progress; trend growth

JEL Classification: N10; N12; N13; O49

Introduction

Recovery from the financial crisis remains very sluggish in the Euro Area. Fears are growing that growth prospects in Europe over the medium term are significantly worse than anyone would have thought before the crisis. The concept of 'secular stagnation', which dates back to the 1930s, has been revived and was recently the topic of a recent e-book (Teulings and Baldwin, 2014). Indeed, relative to pre-crisis levels, real GDP in the Eurozone countries is similar to that of the hapless economies that remained in the gold standard to the bitter end (the 'gold bloc') rather than that of those who left gold early and experienced a strong recovery by the mid-1930s (the 'sterling bloc'), as is shown in Table 1.

This paper seeks to clarify the different meanings of 'secular stagnation', to assess their relevance to European countries, and, in the light of this analysis, to extract some policy implications. The upshot is a set of conclusions which make uncomfortable reading and which make the point that the design of the Eurozone makes dealing with the problem of returning to strong growth more difficult. However, there is no reason to believe that technological progress will slow down drastically and there is a good opportunity to return to decent growth in the medium term if supply-side policy is supportive.

Secular Stagnation

The first time around, 'secular stagnation' was a hypothesis famously articulated by the early Keynesian economist Alvin Hansen in his presidential address to the American Economic Association meeting in Detroit in December 1938 (Hansen, 1939). Hansen argued that the American economy faced a crisis of under investment and deficient aggregate demand since investment opportunities had significantly diminished in the face of the closing of the frontier, declining population growth and a slowdown in technological progress. It was as if the United States was faced with a lower natural rate of growth to which the rate of growth of the capital stock would adjust through a permanently lower rate of investment. In Europe in the 1930s and 1940s, similar worries were articulated by Keynes himself (Skidelsky, 1998) and his followers.

The second time around, the idea of 'secular stagnation' put forward by Summers (2014) is one of a tendency to deficient aggregate demand such that negative real interest rates are necessary to generate enough investment to stabilize the economy at the NAIRU. This might be a consequence of deleveraging after the financial crisis or a savings glut. If these tendencies are persistent, the economy might face a situation where being in a liquidity trap is the new normal (Krugman, 2014). Clearly, a slowdown in future growth potential will make the need for negative real interest rates more likely. With a capital to output ratio of 3, a decline of 1 per cent per year in steady-state real GDP growth will imply a decline of 3 percentage points in the investment to GDP ratio to bring capital stock growth back into equilibrium. Models have been devised in which, faced with shocks such as those highlighted by Hansen and Summers, it would be necessary to promote a lengthy period of negative real interest rates to avoid a prolonged slump (Eggertsson and Mehotra, 2014).

What kind of policy response might be required? If secular stagnation is seen as a 'depressed economy' at the zero lower bound (ZLB) for nominal interest rates, then the options might also include unconventional monetary stimulus and/or fiscal stimulus. Either way, a successful intervention to escape a liquidity trap works by raising inflationary expectations and reducing ex-

ante real interest rates. However, this strategy may be hard to implement. There is a problem of ‘time inconsistency’ such that the private sector may anticipate that the central bank will change its policy as soon as the economy starts to recover. The central bank must be credibly committed to future inflation – perhaps at a rate well in excess of 2%.¹

If secular stagnation is seen as a serious slowdown in the long-term trend growth rate, then the appropriate strategy is to focus on supply-side policies that might raise the rate of growth of labour productivity and of labour inputs. In a European context this implies reforms to labour and product markets that raise TFP growth and increase employment rates and reverse the falling behind of the United States which has materialized since the mid-1990s. ‘Appropriate growth theory’ suggests that for relatively advanced economies like those of Western Europe improving the quality of education and strengthening competition is a high priority (Aghion and Howitt, 2006).

Why Was Alvin Hansen Wrong?

Alvin Hansen was spectacularly wrong. The United States achieved a strong recovery from the Great Depression post-1933 and in the following decades enjoyed its strongest ever growth performance. Neither type of secular stagnation was experienced.

Between 1933 and 1937, real GDP rose by 36 per cent compared with a fall of 27 per cent in the previous four years taking the level in 1937 back to about 5 per cent above that of 1929 (cf. Table 1).² The main stimulus to recovery in the United States was monetary not fiscal policy. This was driven by (largely-unsterilized) gold inflows after the United States left the gold standard. M1 grew at nearly 10 per cent per year between 1933 and 1937 and real interest rates fell dramatically. The role of the New Deal was to change inflationary expectations rather than to directly to boost aggregate demand.³

The key was ‘regime change’. Leaving the gold standard was a clear signal that the deflationary period was over. Roosevelt’s several actions on taking office, comprising leaving gold, announcing an objective of restoring the prices to pre-Depression levels, and implementing New Deal spending amounted to a credible policy that delivered a major change in inflationary expectations which drove down real interest rates and raised the expected money supply, i.e., the classic recipe for escaping the liquidity trap based on ‘unconventional’ monetary stimulus (Eggertsson, 2008).⁴ A key feature of the period was the Federal Reserve Bank lost its independence and became subservient to the Treasury after the exit of the United States from the gold standard (Meltzer, 2003).

Over the longer run, American growth was underpinned by strong total factor productivity (TFP) growth, both in the 1930s and after World War II (cf. Table 2). Gordon (2000) described these years as the crest of the ‘big wave’ in long-term productivity growth centred on advances in technologies

¹ A so-called ‘foolproof’ way to escape the liquidity trap is to combine a price-level target path with an initial currency devaluation and a crawling exchange-rate peg which requires a higher price level in equilibrium and can be underpinned by creating domestic currency to purchase foreign exchange (Svensson, 2003). Even so, credibly committing to such a policy can be difficult as was the case in 1990s’ Japan (Svensson, 2006).

² Real GDP per person did not regain its 1929 level till 1941 and recovery was interrupted by a severe recession in 1937 when monetary stimulus was abruptly withdrawn, see Crafts and Fearon (2013).

³ It is well-known that the fiscal stimulus provided by the New Deal was small (Fishback, 2013).

⁴ Eggertsson (2008) estimated that ‘regime change’ accounted for about three-quarters of GDP growth between 1933 and 1937.

such as chemicals, electricity, and the internal combustion engine. Field (2011) stressed that technological progress was broadly based and facilitated productivity growth not just in manufacturing but transport, communications, distribution, public utilities etc. while the TFP growth of the 1950s and 1960s was set in train by the national innovation system that had been established during the interwar period. This was based on investments in corporate laboratories and modern universities and delivered a significant fall in the costs of research as experimental science improved and the supply of specialized human capital expanded rapidly (Abramovitz and David 2001). Private investment as share of GDP was averaged 15.6 per cent during 1948-66 – roughly the level of the 1929 peak – as business responded to the opportunities created by this dynamic economy.⁵

By the 1950s, the successful productivity performance of the United States as the leading economy had by the 1950s created a great opportunity for rapid catch-up growth in Western Europe which enjoyed a Golden Age of growth through the early 1970s (Crafts and Toniolo, 2008). This was based on the rapid diffusion of American technology together with big improvements in supply-side policies including, notably, moves to greater European economic integration stimulated initially by the conditionality of the Marshall Plan and consolidated by the formation of the European Economic Community.⁶ The productivity gap between Europe and the United States was rapidly reduced.⁷

The Eurozone's Policy Response to a 'Depressed Economy'

Given that there has been zero growth in the Euro Area in the past seven years, it is not surprising that economists have started to worry that the Euro Area has entered a period of secular stagnation in that the neutral real interest rate is significantly negative (Rawdanowicz et al., 2014). The confidence interval about such estimates is, of course, quite large but there is at least serious cause for concern in the context of possibly lower potential growth. Dogged by difficult financial conditions and policy uncertainty, the rate of business investment continues to be very weak (Lewis et al. 2014) while lower levels of potential output and possibly trend growth make deleveraging both more urgent and more difficult. Levels of debt for the private sector in the Eurozone are still above pre-crisis levels and a prolonged period of slow deleveraging is a serious impediment to recovery (Buttiglione et al., 2014). The gloomy assessment of the medium-term future which results from sophisticated extrapolation of recent growth performance by European Commission economists (see Table 3) casts a long shadow over the present and is not conducive to an investment-led recovery.

Continuing fiscal consolidation under the auspices of the Fiscal Compact is unlikely to be expansionary; on the contrary, the implications are likely to be deflationary. The ECB has eventually embarked on quantitative easing which will offer some monetary stimulus but even so it is reasonable to suppose that post-crisis fiscal adjustment is likely to be a drag on medium-term growth in the Eurozone. Priority has been given to restoring relative low levels of public debt to GDP which, along with banking union, has a strong rationale in the context of removing the 'doomloop' of potentially devastating feedbacks between sovereign debt default and bank failures leading to a financial crisis and a massive recession. This has, however, precluded significant fiscal stimulus in

⁵ In addition, demographic pessimism was confounded and (for reasons that are not entirely understood) the baby boom began in the late 1940s.

⁶ Badinger (2005) estimated that economic integration had raised European income levels by nearly 20 per cent by the mid-1970s.

⁷ Real GDP per hour worked in the EU 15 rose from 38.1 percent of the United States level in 1950 to 62.9 per cent by 1973 (Crafts, 2013).

the short term and, in the absence of fiscal union, it seems unlikely that a strong fiscal response to a depressed economy is a weapon at the Eurozone's disposal.

Short term secular stagnation issues, i.e., those relating to the need for negative real interest rates to escape from the doldrums of flat-lining GDP at below potential output, were addressed effectively by the regime change associated with the New Deal. In principle, a similar recipe could be followed now but the architecture of the Eurozone, including notably the design of the ECB, precludes this. A central bank more suited to a 'depressed economy' would be 'subservient' to a finance ministry rather than independent and thus more able credibly to commit to future inflation and willing to facilitate 'financial repression' thereby easing the drag of fiscal consolidation as happened in 1930s Britain (Crafts, 2014). The main point is that the type of central bank that was embraced throughout the OECD during the Great Moderation does not dominate other models in all circumstances and especially not when mired in a persistent liquidity trap with nominal interest rates stuck at the ZLB.

Perhaps the most radical proposal would be to implement unconventional monetary and fiscal stimulus through a helicopter money drop, i.e., a temporary fiscal stimulus financed permanently by an increase in the stock of base money. There are good reasons to believe both that this should never be contemplated in normal circumstances but also that this would be an effective antidote to the threat of secular stagnation of the Larry Summers variety (Buiter, 2014). Clearly, however, this is completely unacceptable to Germany and is ruled out by Article 123.1 of the European Treaty.

In sum, raising inflationary expectations and thereby lowering real interest rates is not compatible with the design of the Eurozone. In particular, a credible commitment by the ECB significantly to raise the rate of inflation is not possible. The central bank was designed for normal times rather than to deal with the policy issues raised by a depressed economy. Its unsuitability for the latter is underlined by the lengthy delay before quantitative easing was introduced in January 2015 about 6 years after the policy was adopted by the Federal Reserve and the Bank of England.

Medium-Term Growth Prospects: Extrapolating Recent Trends

One way to predict future medium-term growth is to assume that recent trend growth will continue. The trend can be estimated using quite sophisticated time-series econometrics but the analysis is essentially backward-looking. Since recent European growth performance both pre- and post-crisis has generally been disappointing, approaches of this kind are pessimistic about future growth. This is not only true for Europe but also to some extent for the United States where productivity growth slowed down after the ICT boom of the late 1990s.

Two methods of trend extrapolation in current use are dynamic factor models which use high-frequency data to try to identify trend and cyclical components in time series of real GDP or real GDP per worker (Antolin-Diaz et al., 2014) and production-function models which infer potential growth by estimating trends in the supply-side sources of growth including capital and labour inputs and TFP growth (Havik et al., 2014). Using the former methodology, Antolin-Diaz et al. (2014) conclude that trend growth both in the United States and also in the Euro Area has gradually declined since the end of the 20th century very largely as a result of a fall in the trend rate of growth of labour productivity.⁸ They find that trend labour productivity growth and labour input in the Euro Area has

⁸ The 'Euro Area' in this analysis is a weighted average of France, Germany and Italy.

fallen to below 1 per cent per year and about 0 per cent per year, respectively, while trend growth of real GDP in the United States has fallen by about 1 percentage point to about 2 per cent per year based on roughly equal contributions from labour inputs and labour productivity growth.

Using the production-function approach, Havik et al. (2014) also conclude that trend growth is now much lower than pre-crisis, as is reported in Table 3. The halving of European trend GDP growth which they report is mainly driven by reduced labour productivity growth which in turn reflects weaker trend TFP growth.⁹ The results for Europe are actually quite similar to those of the dynamic factor model analysis but, while accepting a growth slowdown, the trends inferred for the United States are rather more optimistic with trend labour productivity growth at 1.5 per cent per year. This is in line with other similar analyses (Fernald, 2014). The striking implication in Table 3 is that, rather than catching up as they did for most of the postwar period, in the 'new normal' European countries will continue to fall behind the United States in terms of productivity levels. Moreover, although it is American economists who have raised the alarm, Europe appears to be at greater risk of secular stagnation than the United States.

Long-Term Growth Prospects: Forward-Looking Projections

What might a more forward-looking approach say? The best starting point for a discussion of potential long-run trend growth for the Eurozone is to ask whether the United States is heading for secular stagnation in the long run based on an exhaustion of technological progress (Cowen, 2011) with the implication that future European TFP growth, which relies heavily on the diffusion of new American technology, will be undermined.

Mainstream opinion among American economists rejects this secular stagnation thesis. Future technological progress is notoriously hard to predict – 1980s' pessimism was, of course, derailed by ICT - but even Gordon (2014), often cited as a notorious pessimist, expects labour productivity growth at 1.3 percent per year based on TFP growth around the average of the last 40 years. He argues that the slowdown in technological progress has already happened and came after the end of the 'one big wave' of the 2nd industrial revolution in the early 1970s although he is sceptical of a future acceleration and believes that ICT has mostly run its course.

Notwithstanding this claim, an obvious factor underpinning American TFP growth is likely to be continuing progress in ICT. A careful review of developments in ICT stresses that semiconductor technology continues to advance rapidly and that (quality-adjusted) prices of microprocessor chips continue to fall steeply such that a baseline projection is that ICT-producing sectors alone will contribute about 0.4 percentage points of TFP growth over the next decade (Byrne et al., 2013). The upside actually seems to offer a considerable chance that productivity growth will strengthen since it seems quite likely that the impact of computerization will intensify in the near future. Frey and Osborne (2013) estimate that 47 per cent of 2010 employment in the United States has at least a 70 per cent chance of being computerized by 2035 (Table 4) with these probabilities being strongly negatively correlated with wages and educational attainment of workers.

⁹ Growth of the capital stock (and thus the capital-deepening contribution to labour productivity growth) adjusts to TFP growth in this model.

If these estimates are correct, this technology alone could deliver labour productivity gains equivalent to, say, 1.5 per cent per year over the next 20 years. Future advances will come in machine learning which will be applied in mobile robotics as hitherto non-routine tasks are turned into well-defined problems, in particular using big data which will allow substitution of (much cheaper) robots for labour in a wide range of low-wage service occupations. Tasks which will not be susceptible to computerization are those involving perception and manipulation, creative intelligence, or social intelligence. This suggests that the issue that Europe confronts is actually not so much an absence of technological change but how to cope with it especially since its factor-saving bias could entail major problems in the labour market.

An alternative approach is to project future American TFP growth using a growth model based on endogenous innovation. If the naive models of 25 years ago were invoked, then it might be assumed that TFP growth depended simply on R & D expenditures a share of GDP and since these have not fallen, neither will future TFP growth. Unfortunately, the evidence suggests the constant-returns assumption embodied in these models is not valid (Klenow and Rodriguez-Clare, 2005). A more realistic approach may be the semi-endogenous growth model in Jones (2002) in which increases in human capital and in research intensity generate transitory rather than permanent effects on growth. This possibly has the quite pessimistic implication that past TFP growth in the United States has largely come from increases in educational attainment of the population and expansion of the R & D sector which cannot be expected to continue so that future TFP growth may be much slower (Fernald and Jones, 2014). However, even in this model, there may be countervailing tendencies in that new ideas may become easier for researchers to develop. For example, since a major result of the ICT revolution will be the ease of analysis of massive amounts of data, there could be a significant acceleration in TFP growth (Mokyr, 2014). Moreover, world research intensity surely still has the scope to rise significantly as new nations, most obviously China, become major players.¹⁰

On balance, this review does not give strong support to the hypothesis that there will be secular stagnation in the United States based on a dramatic decline in technological progress. This is clearly the view of OECD (2014), as reported in Table 5, which uses a catch-up growth model in which growth in the leading economy (United States) depends on demography and technological progress while long-term TFP growth in (follower) European countries is based on TFP growth in the leader and a component based on reducing the productivity gap with the leader. The OECD projections for European countries in Table 5 are based on the assumptions that the crisis significantly reduced the level of potential output in the short term (Ollivaud and Turner, 2014) but has had no adverse effect on long-run trend growth and gradual conditional convergence towards the leading economy depending on institutions and policies.¹¹ In fact, there is also more scope for catch-up growth in most Eurozone economies than before the crisis. Real GDP per hour worked for the Euro Area as a whole as a percentage of the U.S. level has fallen from 88.7 in 1995 to 79.9 in 2007 and 76.0 in 2013.

It is striking that this framework leads OECD to expect much better TFP growth in the Euro Area as a whole and in its troubled economies compared with pre-crisis outcomes. In particular, this will require a much better performance in TFP growth in market services of which there is no sign as yet

¹⁰ China accounted for 16.2 per cent of world R & D in 2012 compared with 2.3% in 1996 (UNESCO Institute for Statistics, 2014).

¹¹ So the very low growth of the recent past in Europe reflects a levels-effect adjustment resulting from the financial crisis playing out over several years rather than lower long-term trend growth.

(van Ark et al., 2013) and which has been the Achilles Heel of the Euro-Area economies in the context of excessive regulation and weak competition. Nevertheless, prima facie, it seems that with good supply-side policies medium-term growth prospects in the Euro Area are much better than the secular stagnation scenario might seem to suggest.

Supply-Side Policy and Secular Stagnation in Europe

It is certainly possible to believe that the OECD projections are too optimistic for two main reasons. First, it is likely that high public debt to GDP ratios will depress growth and second, market-friendly policies are threatened by high levels of unemployment and slow recovery from the crisis (Crafts, 2013).

Many Eurozone countries face a debt overhang and fiscal consolidation that is likely to last for many years. The long-term implications of high levels of public debt are likely to be unfavourable for growth (Egert, 2013) and the composition of fiscal consolidation may well have adverse effects.¹² Previous episodes of fiscal stringency have been notable for their negative impact on public investment (Mehrotra and Valila, 2006). Moreover, it is notable that, at high levels of debt, addressing a rising debt to GDP ratio typically entails cuts in both public investment and education spending (Bacchiocchi et al., 2011). The strong likelihood that post-crisis fiscal consolidation will undermine these expenditures is not good news for the growth prospects of highly-indebted EU countries.

Across Europe in the 1930s, prolonged stagnation significantly increased the electoral prospects of right-wing extremist parties (de Bromhead et al., 2013) which were not market-friendly. In this context, not only might it be reasonable to worry about recent election results but it should also be recognised that opinion polls show disappointingly low support for the market economy in many countries which have been hit hard by the crisis.¹³ It is also well-known that the Great Depression saw big increases in protectionism. Eichengreen and Irwin (2010) showed that, on average, countries which devalued had lower tariffs. They argued that protectionism in the 1930s is best seen as a second-best policy which was used when the conventional macroeconomic tools, fiscal and monetary policy, were unavailable, as they are for Euro Area economies today. A recent empirical analysis confirms that weak domestic growth and losses in competitiveness continue to be conducive to protectionism (Georgiadis and Gräß, 2013) so it is not surprising that EU countries have been prominent in imposing such measures according to Global Trade Alert (Evenett, 2014).

Nevertheless, if secular stagnation is a danger, there are policy responses available as is apparent from the economic history of the decades after World War II. Long-run growth prospects can be improved by pro-market supply-side policy reforms that raise future TFP growth and investment as happened through European integration economic integration from the 1950s through the 1990s (Crafts, 2015). Obviously, it is not feasible to repeat the growth of the Golden Age and, unfortunately, Europe cannot match the mid-20th century United States for innovative capabilities

¹² Although there is a significant negative relationship between debt and growth, the magnitude seems to vary across countries and the claim that a particular threshold can be identified at which the adverse effect intensifies is probably not robust (Egert, 2013).

¹³ In response to the question 'Are people better off in a free market economy?' in 2014 only 47% in Greece, 45% in Spain and 57% in Italy agreed (Pew Research, 2014). In 2007, 67% in Spain and 73% in Italy had agreed (no data for Greece).

but it might be possible to exploit scope for catch-up and to address weak growth in service sector productivity by speeding up the diffusion of new technologies and improving resource allocation. For example, reducing restrictive regulation of labour and product markets would speed up the diffusion of ICT (Cetto and Lopez, 2012) in which Europe continues to lag the United States. Column 2 of Table 6 suggests that addressing these issues could potentially underpin a substantial future ICT contribution to growth.

The most obvious way to emulate the success of the early postwar decades is to complete the Single Market in particular with regard to services where barriers remain high and have not been significantly reduced in recent years (Fournier, 2014). Table 7 reports estimates from a dynamic general equilibrium model of the implications of this reform. These are, in fact, likely to be significant underestimates of the possible gains because the model does not capture the productivity implications of greater competition. Even so, the potential impact is considerable, adding perhaps 1 per cent to the growth rate of large Eurozone economies.

Beyond this, there are a range of supply-side policy reforms that could significantly improve growth outcomes over the next 10 or 20 years according to recent quantitative estimates (Varga and in't Veld, 2014; Andrews and Cingano, 2014). These include improvements to the quantity and quality of education, strengthening competition, cutting unemployment benefits, reducing and reforming taxes, and lowering employment protection. These would either raise the growth rate or in some cases provide a transitional boost to growth as the economy moves to higher employment and output levels. OECD economists have done a great deal of research in this area and Table 8 summarizes the conclusions. The authors conclude that addressing all policy weaknesses by moving up to the OECD average level has a potential GDP gain of 10 per cent for the average country after 10 years and 25 per cent eventually (Barnes et al., 2011).¹⁴

The bottom line is that longer term secular stagnation in Europe is not inevitable but would be the result of inappropriate supply-side policies. The politics of implementing growth-friendly policies is challenging but there is a menu available.

Conclusions

It is far too soon to tell whether secular stagnation is the future of the Eurozone but the risk is surely greater than in the United States. The fact that this risk did not materialize in the past does not mean that today's fears are groundless. Nevertheless, if secular stagnation of whatever flavour is the outcome for the Europe, it should be clear that it is not inevitable but will be the result of policy mistakes. Future technological change will continue to permit decent productivity growth if its diffusion is encouraged by good supply-side policies while history gives us a template to escape from depressed economy conditions through regime change.

¹⁴ Some reforms, notably to educational systems, take a long time to pay off.

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Table 1. Real GDP in Two Crisis Periods

	<i>Sterling Bloc</i>	<i>United States</i>	<i>Gold Bloc</i>		<i>Euro Area</i>
1929	100.0	100.0	100.0	2007	100.0
1930	100.4	91.4	97.3	2008	100.2
1931	95.8	85.6	93.6	2009	95.2
1932	96.1	74.4	90.3	2010	97.6
1933	98.8	73.4	93.2	2011	99.2
1934	105.0	81.3	92.5	2012	98.6
1935	109.1	88.6	93.4	2013	98.2
1936	113.9	100.0	94.6	2014	99.0
1937	117.7	105.3	101.0	2015	100.1
1938	119.5	101.6	100.8		

Note: ‘sterling bloc’ comprises Denmark, Norway, Sweden and UK; ‘gold bloc’ comprises Belgium, France, Italy, Netherlands, and Switzerland.

Sources: Maddison (2010) updated using the Maddison Project (2013); OECD (2014)

Table 2. Contributions to Labour Productivity Growth in the United States (% per year)

	<i>K/L</i>	<i>HK/L</i>	<i>TFP</i>	<i>Y/L</i>
1901-1919	0.44	0.19	1.08	1.71
1919-1929	0.30	-0.05	2.02	2.27
1929-1941	-0.06	0.10	2.31	2.35
1941-1948	0.21	0.21	1.29	1.71
1948-1973	0.76	0.11	1.88	2.75
1973-1989	0.70	0.22	0.36	1.28
1989-2000	0.78	0.50	0.79	2.07
2000-2007	0.87	0.34	1.38	2.59

Source: derived from Field (2011) updated using BLS website

Table 3. Growth of Potential Output and Its Sources (% per year)

	<i>Real GDP</i>	<i>Hours Worked</i>	<i>GDP/Hour Worked</i>	<i>TFP</i>
1995-2007				
EA12	2.0	0.6	1.4	0.8
EU15	2.2	0.6	1.6	1.0
USA	3.0	0.8	2.2	1.4
2014-2023				
EA 12	1.1	0.3	0.8	0.5
EU15	1.1	0.3	0.8	0.5
USA	2.4	0.9	1.5	1.0

Source: derived from Havik et al. (2014)

Table 4. Estimates of Computerization Probabilities by 2035 (% 2010 Employment in USA).

≤ 0.3	33
>0.3 but < 0.7	19
≥ 0.7	47

Source: Frey and Osborne (2013)

Table 5. Pre-Crisis Growth and OECD Future Growth Projections (% per year)**a) 1995-2007**

	<i>Real GDP</i>	<i>Employment</i>	<i>GDP/Worker</i>	<i>TFP, 2000-7</i>
United States	3.2	1.2	2.0	1.8
Euro Area	2.3	1.3	1.0	0.0
Austria	2.6	0.9	1.7	1.0
Belgium	2.3	1.0	1.3	0.1
Denmark	2.1	0.8	1.3	0.2
Finland	3.9	1.6	2.3	1.5
France	2.2	1.1	1.1	0.1
Germany	1.6	0.4	1.2	1.0
Greece	3.9	1.3	2.6	0.1
Ireland	7.2	4.3	2.9	1.4
Italy	1.5	1.2	0.3	-1.1
Netherlands	2.8	1.5	1.3	0.9
Portugal	2.4	1.0	1.4	-1.2
Spain	3.7	3.6	0.1	-1.2
Sweden	3.2	0.8	2.4	2.2
United Kingdom	3.3	1.1	2.2	0.8

b) 2014-2030

	<i>Real GDP</i>	<i>Employment</i>	<i>GDP/Worker</i>	<i>TFP</i>
United States	2.4	0.5	1.9	1.6
Euro Area	1.7	0.2	1.5	1.2
Austria	1.9	0.2	1.7	1.5
Belgium	2.0	0.4	1.6	1.1
Denmark	1.6	0.1	1.5	1.0
Finland	2.0	-0.1	2.1	1.9
France	2.2	0.3	1.9	1.2
Germany	1.1	-0.5	1.6	1.5
Greece	2.2	0.2	2.0	1.8
Ireland	2.3	1.2	1.1	0.8
Italy	1.5	0.3	1.2	0.7
Netherlands	2.1	0.2	1.9	1.6
Portugal	1.4	0.3	1.1	0.9
Spain	1.5	0.9	0.6	0.4
Sweden	2.6	0.5	2.1	1.8
UK	2.6	0.6	2.0	1.5

Sources: The Conference Board (2014) and OECD (2014)

Table 6. ICT and Long-Run Growth Potential (% per year)

	<i>ICT-Use Own β</i>	<i>ICT-Use Swedish β</i>	<i>ICT-Output</i>	<i>ICT Income Share (%GDP)</i>	<i>ICT Output Share (%GDP)</i>
United States	0.70	0.71	0.22	6.83	3.10
Austria	0.46	0.76	0.22	4.25	3.15
Belgium	0.64	0.73	0.13	6.03	1.90
Denmark	0.62	0.70	0.20	6.13	2.88
Finland	0.67	0.76	0.57	6.14	8.21
France	0.48	0.68	0.17	4.91	2.46
Germany	0.44	0.68	0.33	4.45	4.75
Ireland	0.39	0.94	0.51	2.88	7.24
Italy	0.36	0.70	0.19	3.52	2.67
Netherlands	0.51	0.71	0.10	5.36	1.36
Spain	0.53	0.76	0.10	4.83	1.39
Sweden	0.70	0.70	0.24	6.93	3.39
United Kingdom	0.60	0.66	0.16	6.34	2.26

Note: β is the factor share of ICT capital; a high value indicates relatively successful diffusion reflecting favourable supply-side policies and is conducive to a higher growth contribution.

These projections are based on a neoclassical growth model with 2 types of capital, ICT capital and other capital and 2 types of output, ICT production and other production. Each output has a similar production function $y = Ak_{\text{NICT}}^{\alpha}k_{\text{ICT}}^{\beta}$ where y is output per worker and k denotes capital per worker with α and β the same in each case but $\Delta A/A$ is bigger in the ICT sector. The relative price of ICT capital falls in line with the TFP growth differential. In the traditional model with one type of capital, steady state labour productivity growth is $(\Delta A/A)/s_L$, where s_L is labour's share of national income. In the modified model, the weighted average of TFP growth in the two sectors is augmented by an additional term $(\beta\Delta p/p)/s_L$ where $\Delta p/p$ is the rate of decline of the price of ICT capital goods relative to other capital goods. The estimates assume that the real price of ICT equipment falls at 7% per year. ICT income and output shares were obtained from the EUKLEMS database.

Source: Oulton (2012)

Table 7. Impact after 10 Years on Level of GDP and Exports of Full Liberalization of Single Market (%)

	<i>GDP</i>	<i>Exports</i>
Benelux	25.3	66.5
France	11.6	42.3
Germany	11.5	57.8
Italy	13.6	66.5
Spain	9.5	61.4
Sweden	10.2	35.9
United Kingdom	7.1	47.0
Small EU Countries	27.9	74.4

Note: 'small EU countries' is the EU27 minus Belgium, France, Germany, Italy, Luxembourg, Netherlands, Poland, Spain, Sweden, UK.

Source: Aussilloux et al. (2011)

Table 8. Potential Impact on Real GDP per Person of Supply-Side Policy Reforms (%)

	<i>Labour Market</i>	<i>Taxation</i>	<i>Product Market Regulation</i>	<i>Education</i>	<i>R & D Incentives</i>	<i>Total</i>
<i>Moving to OECD Average</i>						
United States	0.3	1.4	0.0	2.5	0.0	4.2
Austria	3.4	8.8	0.0	0.1	0.2	12.5
Belgium	5.0	14.7	0.0	0.0	0.0	19.7
Denmark	7.7	2.4	0.0	0.2	0.4	10.7
Finland	6.5	6.4	2.6	0.6	0.0	16.1
France	4.5	10.9	2.2	2.1	1.5	21.2
Germany	6.1	9.9	0.0	0.0	0.0	16.0
Greece	6.0	10.1	22.0	5.8	0.0	43.9
Ireland	6.8	0.9	9.7	0.0	0.0	17.4
Italy	0.3	10.8	0.3	5.4	0.2	17.0
Netherlands	1.8	1.3	0.0	0.0	0.1	3.2
Portugal	7.3	0.7	8.5	21.8	1.3	39.6
Spain	3.5	4.6	0.0	6.3	1.4	15.8
Sweden	6.5	6.4	0.0	0.1	0.0	13.0
Switzerland	5.0	1.1	6.2	0.0	0.9	13.2
United Kingdom	1.1	0.0	0.0	4.6	0.0	5.7

Source: Barnes et al. (2011).