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POLICY PAPER

Ireland's Medium-Term Growth Prospects: a Phoenix Rising?*

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Abstract: This paper considers Ireland's growth prospects through 2030. Real GDP growth averaging 3 per cent per year is possible but will require a stronger labour productivity growth performance than is currently projected by OECD. Success depends on a favourable external environment and would be jeopardised by a return to the pre-crisis "bubble economy" but can be underpinned by exploiting the remaining scope for catch-up growth. "Appropriate growth theory" provides a useful lens through which to review Ireland's growth policy and performance as a "close-to-frontier" economy and this underlines the importance of further strengthening and rationalising innovation policies.

I INTRODUCTION

The objective of this paper is to review medium-term growth prospects for Ireland in a context where it is generally agreed that the level of potential output has been significantly reduced by the financial crisis but it is still not clear what, if any, are its implications for the trend growth rate. The analysis is based on the related propositions that insights can be obtained from growth economics and that supply-side policy matters for growth performance.

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The proximate sources of growth can be found in rates of increase of factor inputs including capital, human capital and hours worked and of the productivity of those inputs. At a deeper level, economics highlights the importance of micro-foundations of growth in terms of the key role played by the incentive structures which inform decisions to invest, to innovate and to adopt new technology and which depend on an economy's institutions and its policy framework but are also influenced by circumstances beyond policymakers' control such as the scope for catch-up growth.

These general ideas can usefully be applied to Ireland but it is also important to take into account aspects of the Irish economy which to some extent make it a special case. Key features which have made pre-crisis Irish economic growth distinctive include a very high degree of openness and, linked to this, an unusual reliance on foreign direct investment, a relatively large ICT production sector and migration flows which are characteristic of a "regional economy". The 1990s saw a remarkable, *sui generis*, growth spurt in the "Celtic Tiger" phase as Ireland seemed to benefit more than most economies from globalisation.

Against this background, the key question to be addressed is how far it may be possible to return to, or even to improve upon, the growth rates observed in the early 21st century before the crisis. The paper proceeds as follows. In Section II, key ideas are briefly reviewed before in Section III the contours of growth in the 20 years or so prior to the crisis are described. Section IV turns to medium term-growth projections by OECD and, in particular, considers prospects for both employment and productivity growth. Some policy implications of this review are drawn out in Section V. Section VI concludes.

II APPROPRIATE GROWTH THEORY

As an identity, a country's output equals the amount of labour inputs employed multiplied by average labour productivity. In terms of growth rates it follows that:

$$\Delta \ln Y = \Delta \ln L + \Delta \ln(Y/L) \quad (1)$$

The growth of employment will reflect labour force participation as well as labour force growth. For Ireland, net migration is, of course, an important aspect of labour force and employment growth.

In traditional neoclassical economics the standard expression for the proximate sources of labour productivity growth can be written as follows:

$$\Delta \ln(Y/L) = \alpha \Delta \ln(K/L) + \Delta nA \quad (2)$$

This gives a decomposition of the percentage rate of growth of labour productivity into contributions from the percentage rate of growth of capital per labour input (capital deepening) and from the percentage growth rate of total factor productivity (TFP). If this formula is linked to the steady-state growth path of the neoclassical growth model, since in equilibrium the capital and output to labour ratios grow at the same rate, then the labour productivity growth rate is predicted to be $\Delta \ln A/(1 - \alpha)$ and the usual interpretation of the model is that capital stock growth will adjust to match the exogenously determined rate of TFP growth. A further prediction of the neoclassical model is that in the steady state, growth is independent of the rate of investment. Increased investment will, however, raise the level of capital and output per worker and there will be a temporary increase in the growth rate of both the capital stock and of output as the economy adjusts to these new levels.

Modern growth economics based on the idea of endogenous innovation modifies this set-up by making TFP growth endogenous. The key ideas are captured in Figure 1, which is adapted from Carlin and Soskice (2006), in which x is the rate of (labour-augmenting) technological progress and k^ is the capital to effective labour ratio. Here the downward-sloping (Solow) line represents the well-known inverse steady-state relationship between technological progress and the capital-intensity of the economy for a given savings rate in the neoclassical growth model.[1] The upward-sloping (Schumpeter) line reflects the endogeneity of technological progress based on the assumption that with a higher capital (and output) to labour ratio stimulates innovation through increases in market size, inter alia. The equilibrium rate of technological progress is established by the intersection of these two lines and, in turn, this determines the rate of economic growth.

Figure 1 implies that the rate of innovation increases when either the Solow and/or the Schumpeter line shifts upward. In the former case, this will be the result of an increased rate of investment which in this model does have growth rate effects. In turn, investment will respond to changes in the economic environment which affect its expected profitability such as the

[1] The intuition for the Solow line is as follows. Steady-state growth means that the rate of growth of the capital stock is equal to the rate of growth of the labour force plus the rate of growth of labour-augmenting technological progress ($\Delta K/K = \Delta L/L + x$) and $\Delta K/K = sY/K$. So, capital stock growth is inversely related to the average product of capital. In the neoclassical model, it is assumed that marginal and average product of capital fall as the capital to labour ratio increases so the rate of growth of the capital stock is inversely related to the capital to labour ratio. In equilibrium faster technological change requires faster capital stock growth and for a given value of s this requires a lower capital to labour ratio. Hence the slope of the Solow line.

corporate tax rate. In the latter case, "higher λ" will be the result of an increase in innovative effort for any given market size which will reflect such changes as greater technological opportunity, lower R & D costs, increased appropriability of returns, and intensified competitive pressure on managers. An important implication of Figure 1 is that the growth rate will be affected by institutions and policies both through their impact on technological progress and on investment.

Aghion and Howitt (2006) develop a Schumpeterian growth model which endogenises TFP growth and, in effect, seeks to explain λ. They assume that

$$Y/L = (K/L)^{\alpha}A^{1-\alpha} \tag{3}$$

and

$$\Delta A = \mu_n(\gamma - 1)A + \mu_m(A^F - A) \tag{4}$$

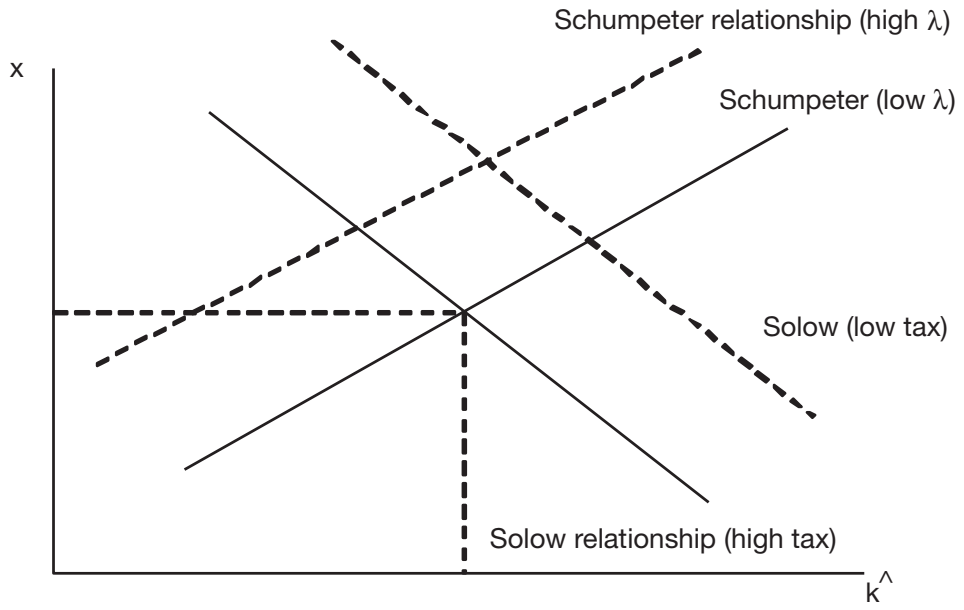
so that

$$\Delta A/A = \mu_n(\gamma - 1) + \mu_m(A^F/A - 1) \tag{5}$$

Here μ_n is the frequency at which "leading-edge" innovations arise, μ_m is the frequency at which "implementation" innovations arise and γ is a scaling factor. The second term takes μ_m to be a function of the TFP gap with the frontier economy and captures the idea that TFP growth depends in part on scope for catch-up. The actual rate of TFP growth depends on the size of μ_n and μ_m which Aghion and Howitt (2006) argue will reflect the quality of institutions and policies. This highlights an interesting distinction between "close-to-frontier" and "far from frontier" economies. Growth in the former (latter) will depend relatively heavily on μ_n (μ_m). Accordingly, it is suggested that tertiary education and strong competition policies will matter more for close-to frontier economies which can only achieve strong TFP growth through high μ_m.

To apply the above models to Ireland, it is important to recognise the implications of its high degree of openness, especially with regard to factor flows. In the neoclassical case, the transitory growth impact of an increase in investment will be stronger and of longer duration because the endogeneity of the labour force reduces the effect of diminishing returns to capital. Similarly, an increase in TFP will attract inflows of capital and labour to re-establish equalisation of factor rewards at the margin while a negative labour market shock will have the opposite effects (Barry and Devereux, 2006). In the endogenous innovation model, the tendency for positive shocks to raise market

Figure 1: *Endogenous Growth*



size by more will make the Schumpeter line steeper and thus have a stronger positive effect on the rate of innovation.

These aspects gain added salience in the context of financial crises which can certainly be expected to have adverse effects on the level of potential output. These can arise through reductions in labour inputs, perhaps through hysteresis effects in the labour market, through reduced levels of capital per worker consequent on impairment of the banking system and higher real interest rates, and through lower levels of TFP as innovation is interrupted (Oulton, 2013). Each of these effects will tend to be amplified by the response of factor flows in the Irish case.

The long-run growth rate effects of banking crises are less clear but in theory they are likely to be negative, at least in the context of the endogenous innovation model in Figure 1 where there could be adverse shifts in either or both curves. These may come from the fiscal implications of a legacy of increased public debt to GDP ratios and structural budget deficits or through adverse implications of higher public debt for the equilibrium capital to labour ratio (Checherita and Rother, 2010). A further possibility is that the policy response to the crisis entails modifications to supply-side policies which lower λ, for example, through a lurch to protectionism (Crafts, 2013).

III IRISH ECONOMIC GROWTH: THE RISE AND FALL OF THE CELTIC TIGER

The Celtic Tiger years comprise the period from the late 1980s till the turn of the 21st century. Growth performance for that period is reported in Table 1. It is generally agreed that GNP is a better measure of output for Ireland than GDP because of the distortions resulting from transfer pricing by multinationals. Labour productivity growth in terms of GNP per hour worked averaged 4.0 per cent per year during the 1990s. Based on strong growth in employment, hours worked grew at 2.8 per cent so that real GNP increased by an impressive 6.8 per cent per year. Growth rates of this magnitude have only previously been observed in Western Europe during the post-war Golden Age. Growth accounting estimates are also displayed in Table 1. These estimates are based on a modified version of Equation (2) which takes into account the contribution of education to labour quality. Here the standout feature is a strong contribution from TFP growth.

At the start of the Celtic Tiger period, Ireland had considerable scope for catch-up growth. In 1987 labour productivity was 48 per cent of the US level and only just above 50 per cent of the European leaders. Unemployment was 17.2 per cent of the labour force. Ireland had underperformed in the Golden Age partly because it was slow to abandon protectionism, had a malfunctioning labour market, and went through a period of macroeconomic disarray prior to a successful stabilisation in the late 1980s. As appropriate growth theory suggests, the catch-up of the 1990s was not automatic but depended on favourable supply-side policies and good institutions. It was also

Table 1: *Growth of Real Output and Labour Productivity (% Per Year)*

(a) Growth Rates	*GDP*	*GNP*	*Hours*	*GDP/HW*	*GNP/HW*
1990-2000	7.5	6.8	2.8	4.7	4.0
2001-2007	5.1	4.1	2.8	2.3	1.3
2008-2012	–1.3	–2.0	–3.8	2.5	1.8

(b) Accounting for Growth of GDP/HW	*K/HW*	*Labour Quality*	*TFP*	*GDP/HW*
1990-2000	1.2	0.2	3.2	4.7
2001-2007	2.0	0.4	–0.1	2.3
2008-2012	3.2	0.2	–0.9	2.5

Note: growth accounting estimates based on $\Delta\ln(Y/L) = \alpha\Delta\ln(K/L) + (1 - \alpha)\Delta\ln E + \Delta\ln A$ where E is the average educational quality of the labour force.
Source: The Conference Board Total Economy Database.

predicated on the continuing globalisation that characterised the late 20th century.

Rapid growth in employment in the 1990s came from a combination of large reductions in unemployment which had fallen to 4.6 per cent by 2000, a change in net migration flows that saw the traditional out-migration turn into net inflows that amounted to 67,000 between 1987 and 2000, and rising labour force participation, especially of women. The period saw a large reduction in the Non-Accelerating Inflation Rate of Unemployment (NAIRU) underpinned by wage moderation under the auspices of social partnership and increases in human capital per worker (Bergin and Kearney, 2004; Walsh, 2004). In the context of favourable shocks to labour demand, an elastic labour supply prolonged the boom (Barry, 2002).

A central aspect of the Celtic Tiger economy was the prominence of foreign direct investment (FDI). Already by the early 1980s the stock of inward FDI per person was far ahead of the EU15 average (Table 2). "Export-platform" FDI transformed Ireland's revealed comparative advantage, dominated production in high-skilled and knowledge-intensive sectors, and by 2000 accounted for almost half of manufacturing employment and 80 per cent of manufacturing exports (Barry, 2004). Overall, the side-effects of FDI were modestly positive in terms of employment creation in indigenous businesses (Gorg and Strobl, 2005) and labour productivity in domestic firms (Ruane and Ugur, 2005). A major result of FDI was a very large ICT production sector which accounted for a much higher share of gross output than in any other EU country, including Finland, and contributed a little over 2 percentage points per year to TFP growth during the 1990s (van Ark *et al.*, 2003).[2]

Ireland's advantages in attracting FDI have included access to European markets and relatively flexible labour market and light product market regulation (Table 3). In terms of industrial policy, Ireland developed a sophisticated system to select projects for financial support under the auspices of the Industrial Development Agency and made investments in tele-

Table 2: *Inward FDI Stock/Person (Current $)*

	Ireland	*UK*	*EU15*
1985	9,091	1,131	780
2000	33,252	7,820	5,898
2012	63,127	20,928	17,609

Source: UNCTAD, World Investment Report (various issues).

[2] Exports of ICT production were associated with declining net barter terms of trade which implied that real national income grew less rapidly than real GNP by around 1 percentage point per year (Crafts, 2005).

Table 3: *PMR (Product Market Regulation, 0-6), EP (Employment Protection, 0-6) and DB (Ease of Doing Business, Ranking)*

	PMR 1998	*PMR 2008*	*EP 1998*	*EP 2013*	*DB 2013*
Austria	2.25	1.38	2.75	2.37	30
Belgium	2.13	1.37	1.76	1.81	36
Denmark	1.52	0.99	2.13	2.20	5
Finland	2.01	1.12	2.31	2.17	12
France	2.45	1.39	2.34	2.38	38
Germany	2.00	1.27	2.68	2.87	21
Greece	2.91	2.30	2.80	2.12	72
Ireland	1.59	0.86	1.44	1.40	15
Italy	2.53	1.32	2.76	2.51	65
Netherlands	1.59	0.90	2.84	2.82	28
Norway	1.83	1.15	2.33	2.33	9
Portugal	2.18	1.35	4.58	3.18	31
Spain	2.47	0.96	2.36	2.05	52
Sweden	1.86	1.24	2.70	2.61	14
Switzerland	2.41	1.12	1.60	1.60	29
United Kingdom	1.01	0.79	1.03	1.03	10
Czech Republic	2.93	1.56	3.31	2.92	75
Estonia		1.24		1.81	22
Hungary	2.17	1.23	2.00	1.59	54
Latvia				2.69	24
Lithuania					17
Poland	3.86	2.20	2.23	2.23	45
Slovakia		1.54	2.47	1.84	49
Slovenia		1.38		2.60	33

Note: Employment protection is for regular employment.
Sources: OECD Product Market Regulation database and Employment Protection database; World Bank Doing Business 2014 database.

communications and college education, especially in Science, Technology, Engineering and Mathematics (STEM) subjects, that were conducive to FDI (Buckley and Ruane, 2006).

A major factor in Ireland's success in attracting FDI has been the corporate tax regime starting with the Export Profit Tax Relief introduced in the 1950s. It is clear from the literature that the semi-elasticity of FDI with respect to the corporate tax rate is quite high, perhaps of the order of –2.5 or even –3.5 (OECD, 2007). At the start of the Celtic Tiger period the Irish tax rate for manufacturing FDI was easily the lowest in Europe and a study by Gropp and Kostial (2000) suggested that the stock of American manufacturing investment in Ireland was about 70 per cent higher than if Ireland had had a tax rate equivalent to the next lowest in the EU. As trade costs fell, the impact

Table 4: *Effective Average and Effective Marginal Corporate Tax Rates (%)*

	EATR 2000	*EMTR 2000*	*EATR 2012*	*EMTR 2012*
Austria	29.1	17.9	21.6	13.1
Belgium	33.2	17.1	16.0	13.5
Denmark	28.2	19.8	22.4	16.3
Finland	26.1	19.6	22.0	16.2
France	32.0	19.2	29.8	17.9
Germany	32.8	17.0	27.0	18.2
Greece	32.3	13.5	16.1	5.2
Ireland	8.8	11.1	5.3	7.3
Italy	33.8	16.3	23.0	–10.0
Netherlands	30.4	20.4	19.1	8.1
Norway	25.6	20.5	25.9	21.5
Portugal	29.2	14.8	25.2	14.9
Spain	34.0	20.0	30.0	18.2
Sweden	24.7	17.2	23.2	16.0
Switzerland	30.9	19.5	24.9	22.6
United Kingdom	26.9	20.0	24.8	22.2
Czech Republic			16.1	8.3
Estonia	31.1	38.6	25.2	32.2
Hungary	16.1	6.2	18.6	12.5
Poland	25.5	14.8	16.7	10.7
Slovakia			15.8	7.3
Slovenia	19.6	4.5	15.7	9.7

Source: Oxford University Centre for Business Taxation Corporate Tax Database.

of low taxes on FDI appears to have been accentuated significantly and their relative importance for location compared with proximity to demand increased (Romalis, 2007).

Growth performance for the post-Celtic Tiger pre-crisis period of 2001-7 is also reviewed in Table 1. Growth in hours worked continued at a similar pace. There was no further contribution to employment growth from a falling unemployment rate but the contribution of immigration to labour force growth strengthened with 338,000 non-Irish employed in 2007 compared with 59,900 in 2000. Growth of real GNP and of labour productivity slowed down quite markedly, from 6.8 to 4.1 per cent per year and from 4.0 to 1.3 per cent per year, respectively. This was entirely accounted for by a sharp decrease in TFP growth from 3.2 to –0.1 per cent per year which more than offset bigger contributions from physical and human capital deepening. In a tight labour market, slackening productivity growth and wage inflation were accompanied by a marked reduction in international competitiveness with the ECB index based on relative unit labour costs standing at 128.1 in 2007Q4 (1999Q1 = 100).

By 2000, real GNP per hour worked was 65.5 per cent of the American level, quite similar to the relative position of leading European countries at the end of the Golden Age in the 1970s when their productivity growth slowed down by around 2.5 percentage points per year.[3] In each case there were big declines in TFP growth as scope for catch-up was reduced but even so TFP growth continued, albeit at a slower pace. So, Irish TFP growth post-2000 can only be described as very disappointing. Beyond reduced scope for catch-up, the reasons for this poor performance include a reduced contribution from the ICT production sector, a shift towards construction and non-market services which together accounted for 35.2 per cent of employment by 2007, and excessive capital-deepening which contributed to negative TFP growth in manufacturing.[4] The first was largely unavoidable as the weight of the ICT sector declined (Oulton, 2012) but the other two reflected policy errors. The loss of international competitiveness, which was a big factor in a major reduction in export growth (Nkusu, 2013) and held back output and employment growth in manufacturing, reflected pro-cyclical fiscal policy and, in particular, growth of public consumption (Lane, 2009). The construction boom was fuelled by an explosion of mortgages and loans to property development (Whelan, 2014).

Table 5 highlights another surprising weakness in Irish productivity performance, namely, the relatively low level of ICT capital-deepening. At 0.4 per cent per year its contribution is lower than in any other country apart from Italy and Spain. In 2005, across the whole economy ICT capital per hour worked was only 13 per cent of the American level compared with the EU15 average of 51 per cent (Inklaar and Timmer, 2008). This is all the more surprising given that Ireland scores well in international comparisons for not having onerous regulation and for educational attainment of the labour force which are the variables that empirical analysis flags up as most important for the diffusion of ICT (Cette and Lopez, 2012). However, a closer look suggests a serious weakness in ICT skills in the Irish labour force; 24.2 per cent of 16-34 year olds in OECD's skills survey failed the ICT core test (OECD, 2013c).

As a relatively "close-to-frontier" economy, it might be expected that the emphasis of Irish supply-side policy would change as the Celtic Tiger period came to an end and this was indeed the case. In particular, with a view to increasing the role of leading-edge innovations, Ireland increased support for

[3] Comparing 1950 to 1960 with 1970 to 1990, labour productivity growth fell by 2.45 percentage points per year in France and 2.48 in West Germany; TFP growth fell from 2.6 to 0.8 per cent per year and from 2.0 to 0.7 per cent per year, respectively (Bosworth and Collins, 2003).

[4] The data in EUKLEMS show that in non-ICT manufacturing the capital to labour ratio grew at 9.6 per cent per year during 2001-7 while TFP growth averaged –1.3 per cent per year.

Table 5: *Sources of Labour Productivity Growth in the Market Sector, 1995-2005 (% per year)*

	Labour Quality	*ICTK/HW*	*Non-ICT K/HW*	*TFP*	*Labour Productivity Growth*
Ireland	0.2	0.4	2.1	1.8	4.5
Sweden	0.3	0.6	1.1	1.6	3.6
Finland	0.1	0.6	–0.1	2.6	3.2
UK	0.5	0.9	0.4	0.8	2.6
Netherlands	0.4	0.6	0.1	1.0	2.1
France	0.4	0.4	0.4	0.9	2.1
Austria	0.2	0.6	0.1	1.1	2.0
Portugal	0.2	0.6	1.3	–0.3	1.8
Belgium	0.2	1.0	0.4	0.1	1.7
Denmark	0.2	1.0	0.2	0.2	1.6
Germany	0.1	0.5	0.6	0.4	1.6
Spain	0.4	0.3	0.5	–0.8	0.4
Italy	0.2	0.3	0.5	–0.7	0.3
USA	0.3	1.0	0.3	1.3	2.9

Note: growth accounting with standard neoclassical formula adapted to distinguish two types of capital and labour productivity measured in terms of hours worked (HW).
Source: Timmer *et al.* (2010).

R & D in a number of ways including the establishment of Science Foundation Ireland in 2000 to promote research excellence in ICT, biotechnology and, later, energy, introducing an R & D tax credit in 2004 and adopting a target of 2.5 per cent of GNP by 2010 (Haugh, 2013). Payoffs from these policy moves would, however, take time.

IV MEDIUM-TERM POST-CRISIS GROWTH PROJECTIONS

The obvious starting point is the high-profile OECD modelling exercise, the most recent version of which is in OECD (2013a). The core of this approach is a conditional convergence framework in which there is scope for catch-up but the eventual steady state growth path on which productivity advance is at the rate of the leader allows for different levels depending on policies, institutions etc. It is assumed that the crisis has only had a levels effect – substantial in the Irish case – but no effect on the trend growth rate. Catch-up is accentuated in the case of countries with scope for structural reforms because it is assumed that they make steady progress towards best practice

which has a productivity payoff. The aftermath of the crisis is assumed complete by 2018 after which actual growth matches potential growth.

The OECD projections for the period 2018 to 2030 are summarised in Table 6. Using the decomposition of Equation (1), Ireland is projected to have real GDP growth at 3 per cent per year comprising 1.3 per cent employment growth and 1.7 per cent labour productivity growth. Both components are questionable and, prima facie, employment growth seems a bit optimistic and productivity growth a bit pessimistic.

Labour force growth in Ireland depends heavily on net migration and, as the last 25 years has underlined, this has varied greatly over time. Based on projections by CSO (2013), employment growth at 1.3 per cent per year would require a migration component of a little over 30,000 per year, similar to the early 2000s and in the top quartile of the last quarter century and slightly above the high-migration scenario presented by CSO (2013). By contrast if the migration component were 10,000 per year or –5,000 per year, the middle and low migration scenarios in CSO (2013), labour force growth would be only 0.7 or 0.3 per cent per year, respectively.

OECD's labour productivity growth places Ireland just below the Euro Area average and well below Greece which is projected to outperform Ireland because it has more scope for catch-up and a much greater opportunity to improve productivity by structural reforms, given that supply-side policies in Ireland are much closer to "best practice" (cf. Table 7). Unlike every other country listed in Table 6, including the Euro crisis countries, Irish performance in 2018 to 2030 is projected to be weaker than in 2001 to 2007. The projection implies no catching-up of the United States which is also expected to achieve labour productivity growth of 1.7 per cent per year. This seems an unlikely baseline in terms of the conceptual framework of OECD's model and seems to result from an unfortunate implementation in which the scope for catch-up is proxied by the real GDP per person gap with the United States. If, instead, this is measured in terms of labour productivity based on Irish real GNP per hour worked, then Irish labour productivity growth would be projected at least to be a bit better than the Netherlands and the UK.[5] In any event, with labour productivity at about 70 per cent of the American level the scope for catch-up growth is surely not exhausted.

It certainly seems possible that real GDP growth might average 3 per cent per year between 2018 and 2030 but, if so, this might more plausibly be on the basis of employment growth of 0.7 per cent per year combined with labour productivity growth of 2.3 per cent. However, this analysis is quite superficial

[5] Real GNP per hour worked in Ireland in 2012 was 1990GK$27.96 compared with real GDP per hour worked of $33.64 in the Netherlands, $29.77 in UK and $40.02 in USA. Both the Netherlands and UK have less cope for structural reform to raise productivity according to Table 7.

Table 6: *OECD Long-Term Growth Projections*

(a) Potential Real GDP Growth (% per year)	*2001-2007*	*2012-17 (actual)*	*2012-17 (potential)*	*2018-30*
OECD	2.1	2.2	1.9	2.3
Euro Area	1.7	1.2	1.0	2.0
USA	2.4	2.5	2.0	2.1
Austria	2.1	1.7	1.7	1.8
Belgium	1.8	1.3	1.5	2.2
Denmark	1.4	1.2	1.0	1.8
Finland	2.7	1.5	1.5	2.1
France	1.7	1.6	1.5	2.3
Germany	1.2	1.1	1.2	0.9
Netherlands	1.9	1.3	1.4	2.1
Norway	3.0	3.0	2.7	2.4
Sweden	2.6	2.6	2.7	2.5
UK	2.5	1.8	1.7	2.6
Switzerland	1.9	2.0	2.1	2.2
Greece	2.8	0.1	0.5	3.2
Ireland	5.4	2.5	1.4	3.0
Italy	1.1	0.3	0.1	2.0
Portugal	1.6	0.5	0.2	2.1
Spain	3.3	1.4	0.8	3.0

(b) Growth of Potential Real GDP/Worker (% per year)	*2001-2007*	*2012-17*	*2018-2030*
OECD	1.3	1.3	1.8
Euro Area	0.8	0.9	1.8
USA	1.7	1.5	1.7
Austria	1.1	1.0	1.6
Belgium	0.8	0.8	1.9
Denmark	0.9	0.8	1.6
Finland	1.5	1.4	2.3
France	0.8	1.2	2.1
Germany	0.8	1.0	1.5
Netherlands	0.9	0.9	2.1
Norway	1.7	1.6	1.9
Sweden	2.0	1.9	2.2
UK	1.6	0.9	2.0
Switzerland	0.8	1.0	1.9
Greece	1.6	0.2	2.6
Ireland	2.4	1.1	1.7
Italy	0.2	0.0	1.6
Portugal	1.2	0.5	1.8
Spain	0.6	1.1	1.8

Source: OECD (2013a, Ch. 4).

Table 7: *Potential Impact on Real GDP per Person of Structural Policy Reforms (%)*

	Labour Market	*Taxation*	*Product Market Regulation*	*Education*	*R & D Incentives*	*Total*
Moving to OECD Average						
USA	0.3	1.4	0.0	2.5	0.0	4.2
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
Netherlands	1.8	1.3	0.0	0.0	0.1	3.2
UK	1.1	0.0	0.0	4.6	0.0	5.7
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
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
"10 per cent Reforms"						
OECD Average	5.1	3.3	3.8	11.6		23.8

Source: Barnes *et al.* (2011).

and a closer look is required. A first step is to consider the contributions of TFP, labour quality and capital deepening that might deliver labour productivity growth 2.3 per cent per year.

On the standard neoclassical balanced growth path, $\Delta Y/Y = (\Delta L/L + \Delta A/A)/(1 - \alpha)$. Taking $\Delta L/L = 0.9$ per cent per year, based on the middle migration labour force growth of 0.7 plus a continuation of early 21st century labour quality growth of 0.2, and $\alpha = 0.4$, this implies that TFP growth of 0.9 per cent per year would be required to yield real GDP growth at 3 per cent. This path would entail a capital deepening contribution of 1.2 per cent per year, roughly the rate observed in the Celtic Tiger years, so that real GDP per hour worked grew at 2.3 per cent per year.

The key to this calculation is the TFP growth rate so what chance is there that 0.9 per cent per year might be achieved? Here the starting point is the contribution from a relatively large ICT production sector. Estimates of its possible contribution might be based on those of Oulton (2012) reported in Table 8 which put the prospective Irish TFP contribution at 0.5 per cent per year. Clearly, these estimates make assumptions both about the sector's weight and the scope for continued technological progress in ICT. A recent review of the prospects for further technological advances concludes that there

Table 8: *ICT and Long-Run Growth Potential (% per year)*

	ICT-Use Own β	*ICT-Use Swedish β*	*ICT-Output*	*ICT Income Share (% GDP)*	*ICT Output Share (% GDP)*
Austria	0.46	0.76	0.22	4.25	3.15
Belgium	0.64	0.73	0.13	6.03	1.90
Czech Republic	0.53	0.81	0.27	4.54	3.81
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
Hungary	0.58	0.79	0.44	5.08	6.27
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
Slovenia	0.28	0.62	0.28	3.09	3.97
Spain	0.53	0.76	0.10	4.83	1.39
Sweden	0.70	0.70	0.24	6.93	3.39
UK	0.60	0.66	0.16	6.34	2.26
Un-weighted Average	0.52	0.73	0.26		

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

These projections are based on a neoclassical growth model with two types of capital, ICT capital and other capital and two types of output, ICT production and other production. Each output has a similar production function $y = Ak_{NICT}\, \alpha k_{ICT}\, \beta$ 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 cent per year. ICT income and output shares were obtained from the EUKLEMS database.
Source: Oulton (2012).

is, of course, considerable uncertainty but that the rate of TFP growth in the sector assumed by Oulton (2012) is about at the midpoint of the possible outcomes (Byrne *et al.*, 2013). This implies that the TFP growth contribution of the rest of the economy would need to be 0.4 per cent per year which would look quite reasonable by historical standards if the policy errors of the early 21st century, and the imbalances that they generated, are not repeated.

Going beyond this simple formulation, three refinements of the argument can be made. First, to deal adequately with the possible impact of ICT on

future growth it is useful to move beyond the one sector neoclassical growth model to a two-sector formulation where the economy has ICT and other goods production sectors and uses two types of capital, namely, ICT capital and other capital, as in Oulton (2012). Given that TFP growth in the ICT production sector is relatively fast and that this makes ICT capital relatively cheaper over time, steady-state growth will be characterised by the ICT capital stock growing faster than non-ICT capital. Growth will be positively related to TFP growth in ICT production and to both the income share of ICT capital and the output share of ICT production.[6]

The implications of this formulation for Ireland are shown in Table 8. Paradoxically, while Ireland has the second largest ICT- production sector it makes the least use of ICT capital of any of these countries. Even so, there is considerable scope for relatively rapid growth of the ICT capital stock to raise labour productivity growth in the medium term – by 0.39 per cent per year at existing income shares. Were the further diffusion of ICT to raise its income share to the Swedish level, then the steady-state growth contribution would rise to 0.94 per cent per year.[7] Clearly, this is a rather stylised calculation but it does underline the possible upside from continuing technological progress in ICT and offers scope for catch-up.

Second, in the past and especially in the Celtic Tiger period, Ireland's growth has depended heavily on FDI. This raises the question of whether Ireland is still well-positioned to punch above its weight in attracting FDI. Success in this regard would help sustain the re-balancing of the economy away from non-tradables such as construction and back towards exportable manufacturing and services activities in which multinationals account for about 90 per cent of exports. Obviously, some of Ireland's original advantages have either disappeared or been reduced. Even in 1999 hourly labour costs in Ireland were only about 65 per cent of the German level but by 2012 this had risen to 96 per cent and the accession countries now play the role of the low-wage locations within the EU with hourly labour costs at 25 to 30 per cent of the Irish level. Ireland remains an economy with a low corporate tax rate but, as Table 4 shows, gaps have narrowed and the accession countries generally have lower tax rates than the EU15. Ireland's scores on product market regulation and employment protection have improved since the late 1990s and still are close to top of the class but again gaps are narrowing and more countries offer a relatively-low regulation profile (Table 3). Ireland continues to achieve a high "Doing Business" ranking but continues to be held back by low scores for construction permits and electricity supply.

[6] So, technological progress in ICT raises growth in a country with no ICT production through the growth of the (imported) ICT capital stock.

[7] The impact is relatively large for Ireland because the share of labour in output is relatively small.

Nevertheless, there are good reasons to believe that Ireland will continue to benefit from a strong share of FDI based on a different mix of advantages that will attract and retain multinationals producing higher value-added services such as software and hi-tech manufacturing in sectors such as pharmaceuticals and medical devices (Barry and Bergin, 2012). These activities can be attracted by continuing to upgrade the national innovation system, by further increasing the supply of highly educated workers and by the agglomeration benefits offered by already established clusters. Ireland has sustained a very strong revealed comparative advantage in high-tech knowledge-intensive services in recent years (Ruane *et al.*, 2013).

Third, as a very open economy, Ireland is exposed to external shocks. While these were favourable in the Celtic Tiger period, arguably they could be adverse in future. In particular, Ireland is exposed to problems in the Euro Area, as was highlighted recently in the ESRI's *Medium-Term Review*. This presented two scenarios "recovery" and "stagnation"; in the former, growth resumes in the Euro Area rather as OECD supposes but in the latter the EU is a "zombie economy". Comparing these two scenarios which are summarised in Table 9, with "stagnation" average output growth between 2015 and 2030 is lower by 1.2 and employment growth lower by 1.0 percentage points per year while the investment rate is lower by an average of 2.3 per cent of GNP and the unemployment rate is higher by 6.2 percentage points. Clearly, this would undermine relatively rapid growth based on a resumption of in-migration and the repercussions are more serious in the context of Ireland as a "regional economy".

While seeing the EU as a zombie economy is no doubt exaggeration, there are good reasons to doubt the OECD's optimism about future growth prospects for the Euro Area. Until the architecture of the currency Union is fully repaired, the possibility of another financial crisis cannot be completely discounted. More worryingly, if fiscal orthodoxy is the route back to Maastricht, this will entail a long period of high public debt to GDP ratios. The implications of this are unlikely to be favourable for growth and could have a significant negative impact. Although the claim of a 90 per cent threshold beyond which growth declines sharply is probably not robust, the evidence does suggest that growth is likely to be adversely affected by high debt ratios (Egert, 2013) and continuing fiscal consolidation will undermine growth in the absence of offsetting policy stimulus. Economic history also suggests that slow recovery in the Euro Area with few degrees of policy freedom will not be positive in the longer term either for European economic integration or structural reform (Crafts, 2013).

Overall, it is quite possible that the OECD (2013a) estimate of Ireland's GDP growth potential as 3 per cent per year for 2018-30 is correct but, if so,

Table 9: *"Recovery' versus "Stagnation'*

(a) Recovery	*2015-2020*	*2020-2025*	*2025-2030*
Average Growth Rate (% per year)			
Real GDP	4.0	2.2	2.0
Employment	2.2	0.8	1.0
Labour Productivity Manufacturing	6.1	4.0	1.8
Labour Productivity Services	1.2	0.7	1.2
Investment (% GNP)	20.1	20.1	20.2
Unemployment Rate (%)	8.2	5.4	4.7
(b) Stagnation	*2015-2020*	*2020-2025*	*2025-2030*
Average Growth Rate (% per year)			
Real GDP	1.4	1.4	1.8
Employment	0.3	0.3	0.3
Labour Productivity Manufacturing	6.1	3.1	–0.5
Labour Productivity Services	0.2	0.4	0.8
Investment (% GNP)	16.5	18.1	19.3
Unemployment Rate (%)	12.6	10.5	6.8

Source: Bergin *et al*. (2013).

this is likely to be achieved with a higher contribution from productivity and a lower contribution from employment growth than OECD suggests. Ireland has enduring supply-side strengths which will allow FDI-based growth to continue but optimism has to be tempered by worries about its exposure to shocks from and/or stagnation in the Euro Area.

V SOME POLICY IMPLICATIONS

This section briefly discusses four areas of "horizontal" industrial policy which have implications for growth performance over the medium term, all of which are flagged up in Department of Finance (2013), and where there may be scope to improve.

(a) Fiscal Consolidation

The design of fiscal consolidation matters. Generally speaking, relying mostly on cutting public expenditure rather than raising taxes is more likely to be growth friendly. However, this depends on current rather than capital expenditure bearing the brunt. Investment in public capital has positive effects on real GDP where an output elasticity of about 0.2 is a reasonable assumption and also "crowds in" private capital in the medium term (Kamps,

2005a). Using the formula in Kamps (2005b, Table 7), the growth maximising rate of public investment is 3 per cent of GDP if trend growth is 3 per cent per year.

Ireland is emerging from the crisis with a very high public debt; gross debt in 2013 was 126 per cent of GDP. The rules of the Euro Area prescribe a gross government debt ratio of 60 per cent and the debt-convergence rules adopted in the light of the crisis indicate that 1/20th of the excess over this level shall be removed each year. OECD (2013a) calculates that to stay within this rule for every year from 2014 to 2023, Ireland will have to maintain a primary budget surplus of about 3.5 per cent of GDP. The obvious concern is that there may be a prolonged period when capital expenditure is well below 3 per cent of GDP given that it has already fallen to under 2 per cent and that past episodes of fiscal stringency have been notable for their negative impact on public investment (Mehrotra and Valila, 2006). This outcome should be avoided.[8]

(b) Education

There is evidence that the quality of education as measured by cognitive skills has strong positive effects on growth. On this measure, Irish schooling quality is above the OECD average but still well below the best performers (Table 10). It has been estimated that increasing the PISA score in maths and science from 511.5 in 2012 by 25 points, to roughly the average of Finland and South Korea, would raise the long-run growth rate by about 0.3-0.4 percentage points (Hanushek and Woessmann, 2012). It may be that the PISA account of cognitive skills overstates Irish skills since the OECD adult skills survey measures (also reported in Table 10) are significantly less favourable in which case improving educational quality is likely to matter even more.

What does this imply for policy? The obvious point might seem to be that education spending should be protected during fiscal consolidation. That said, it may be more important effectively to address principal-agent problems in the delivery of education. Across countries, about 80 per cent of the variance in cognitive skills is explained by the organisation of the education system (Woessmann *et al.*, 2007). The most important implications of this study for Irish schools may be to review the regulation of private operation of schools and to ensure stronger accountability in the provision of schooling. The key point is that designing better incentive structures could improve the quality of schooling even at a time when expenditure is under pressure.

[8] Ideally, the appropriate fiscal policy for Ireland will be conducive to rebalancing towards tradables which also argues for squeezing public consumption rather than capital spending (Lane, 2009).

Table 10: *Educational Standards in 2012: Cognitive Skills and Tertiary Years*

	PISA	*Adult Skills*	*Adult ICT Skills (%)*	*Tertiary Years*
Austria	506.0	272.2	32.4	0.48
Belgium	510.0	278.0	34.5	0.93
Denmark	499.0	274.6	38.6	0.63
Finland	532.0	284.8	41.6	0.81
France	497.0	258.2		0.64
Germany	519.0	270.8	36.0	0.64
Greece	460.0			0.93
Ireland	511.5	261.0	25.2	1.01
Italy	489.5	248.8		0.33
Netherlands	522.5	282.2	41.6	0.82
Norway	492.0	278.4	41.0	0.85
Portugal	488.0			0.30
Spain	490.0	248.8		0.83
Sweden	481.5	279.2	44.0	0.84
Switzerland	523.0			0.62
United Kingdom	504.0	267.1	34.7	0.68
Czech Republic	503.5	274.8	33.1	0.32
Estonia	531.0	274.5	27.5	0.92
Hungary	485.5			0.53
Latvia	496.5			0.61
Lithuania	487.5			0.84
Poland	522.0	263.4	19.2	0.46
Slovakia	476.5	274.8	25.7	0.38
Slovenia	507.5			0.51
Japan	541.5	292.2	34.6	1.21
South Korea	546.0	268.0	30.4	1.13
USA	490.0	261.3	31.1	1.71

Note: PISA is average of maths and science scores; adult skills are average of literacy and numeracy; adult ICT skills is % at levels 2 and 3 in problem-solving; average years of tertiary education are for population aged 25 and over.
Sources: Barro and Lee (2013); OECD (2013b) (2013c).

(c) Innovation Policy

Innovation policy is an area which matters both in terms of diffusion of new technologies from abroad and home-grown technological advance and the return to R & D accrues from both aspects (Griffith *et al.*, 2004). As a small, close-to-frontier, country both facets are of importance for Ireland. A weakness that is frequently pointed out is innovative activities are dominated by multinational firms and that "indigenous" SMEs are less innovative than their international counterparts. If this indicates a weakness in absorptive capacity,

as seems likely, this may be a greater concern than that Ireland has not yet realised its ambition to see R & D expenditure at 2.5 per cent of GNP (Table 11).

Recognition of the potential importance of strengthening support for innovative activities has led to a plethora of programmes and agencies seeking to address the issue. Haugh (2013) pointed out that there is a clear need for evidence on the effectiveness of policies to promote innovation especially those targeted at SMEs. UK experience strongly suggests that this is right,

Table 11: *R & D Expenditure (% GDP) and Innovation Active Businesses (%)*

	R & D (GERD) 2000	*R & D (BERD) 2000*	*R & D (GERD) 2011*	*R & D (BERD) 2011*	*Innovation Active 2008-10*
Austria	1.86		2.75	1.87	55
Belgium	2.04		2.04	1.37	61
Denmark	2.30	1.54	3.09	2.09	54
Finland	3.40		3.78	2.66	55
France	2.18		2.24	1.42	52
Germany	2.49		2.88	1.94	80
Greece	0.66	0.20	0.60	0.17	
Ireland	1.35	0.97	2.12	1.46	60
Italy	1.11		1.25	0.68	55
Netherlands	1.90		1.85	0.89	56
Norway	1.62	0.94	1.68	0.86	43
Portugal	0.80		1.49	0.69	60
Spain	0.94		1.33	0.70	41
Sweden	3.96	3.03	3.37	2.34	60
Switzerland	2.57	1.90	2.87	2.11	
United Kingdom	1.84	1.21	1.77	1.09	44
Czech Republic	1.33	0.80	1.85	1.12	51
Estonia			2.41	1.52	57
Hungary	0.80	0.35	1.21	0.75	31
Latvia					30
Lithuania					34
Poland	0.66	0.24	0.74	0.23	28
Slovakia	0.65	0.43	0.68	0.25	35
Slovenia			2.47	1.83	50
Japan	2.99	2.12	3.39	2.61	
South Korea	2.65	1.96	4.03	3.09	
United States	2.72	2.04	2.77	1.89	

Note: Ireland as % GNP; Greece data for 2007; Switzerland data for 2008.
Sources: OECD, Main Science and Technology Indicators; Community Innovation Survey.

especially at a time of fiscal consolidation because the benefit-cost ratios of different initiatives vary greatly even though, in general, the social returns to policies to promote innovation by SMEs are high. Based on an analysis of increases in turnover, Foreman-Peck (2013) found that the social rate of return to all SME innovation policies was at least 46 per cent and probably considerably greater than this; however, the UK grant-based schemes such as SMART and SPUR achieved benefit-cost ratios which were double those from the UK R & D tax credit.

(d) Competition Policy

It is now generally agreed that strong (though not perfect) competition in product markets is good for productivity performance by putting greater pressure on management to perform (Bloom and van Reenen, 2007), especially in liberal market economies like Ireland. The value of effective competition policy is greater in close-to-frontier economies where it matters for its effects on μ_n as well as μ_m (Aghion and Howitt, 2006).

Before the crisis, reviews of Irish competition policy suggested room for improvement. On a scale of 0 to 6, OECD's methodology rated Ireland at 2.34 which was the median rating in the EU15 (Hoj, 2007) and OECD economists suggested that there were too many sectors where producers were sheltered from competition (Rae *et al.*, 2006). Nevertheless, there was a clear trajectory towards strengthening competition legislation as revealed by the 2002 and 2006 Competition Acts. Gorecki (2012) notes that the crisis threatened to reverse this by allowing concerns for financial stability to prevail in merger policy and a growing number of exemptions being proposed. A return to a stronger pro-competition stance was, however, a result of the conditionality imposed by the EU and IMF in the context of the Irish bailout.

This still leaves Ireland below best practice in competition policy. A new set of indicators from OECD places Ireland at 8th equal, 13th and 8th of the EU15 in scope of action, policy on anti-competitive behaviour and probity of investigations, respectively (Alemani *et al.*, 2013). Free of pressure from the troika, Ireland has more policy discretion and it would have been encouraging to see stronger emphasis on maintaining and strengthening competition in *A Strategy for Growth*.

VI CONCLUSIONS

Ireland's GDP could quite possibly grow at 3 per cent per year from the late 2010s to 2030. If this is to be achieved, it will probably require labour productivity growth in excess of 2 per cent per year which will need a

resumption of internationally respectable TFP growth. Scope for catch-up growth is not by any means exhausted, Ireland is still an attractive location for FDI and its overall policy stance remains conducive to good productivity performance.

The risks to this scenario come primarily from the possibility of an adverse external economic environment in which the good fortune of the 1990s is superseded by bad luck in the 2020s. In particular, it is important to recognise that the implications of shocks or policy decisions are relatively large for Ireland because of its "regional economy" characteristics where migration makes labour force growth endogenous.

Ireland's long-term growth prospects would not be well-served by a return to the early 21st century economy. The most obvious indictment of growth performance in that period, prior to the financial crisis that resulted from a badly regulated and supervised banking system, is the weakness of TFP growth. As is widely understood, strong Irish growth will be better sustained by a resurgence of the exportables sector and by policies that guard against a repeat of the appreciation of the real exchange rate that characterised the bubble economy years.

Good supply-side policies have been integral to past growth success. There is, however, some scope for improvement, including in competition and innovation policies, and there are some worries that continuing fiscal stringency will undermine public investment. A priority is to ensure the cost effectiveness of policies to promote the adoption and innovative use of new technologies by SMEs.

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