Contraception and the Celtic Tiger

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Abstract: New cross-country evidence for 1965 to 1995 is presented on the link that runs from population change to economic growth. The estimates indicate that demographic change is a powerful determinant of income growth, operating mainly via the effect of changes in age structure. The estimates also indicate that the benefits of demographic change can be greatly magnified by a favourable policy environment. A case study of economic growth in Ireland suggests that the legalisation of contraception in 1980 resulted in a sharp decline in fertility and a sizeable increase in the relative share of the working-age population. This demographic shift, operating in conjunction with a favourable policy environment, can explain in large measure the birth of the Celtic Tiger. However, given demographic projections for Ireland, the Tiger's roar may become less formidable as it continues to mature.

I INTRODUCTION

Ireland's remarkable economic growth during the last decade has attracted the attention of economists and development specialists around the world. Many factors have been cited as contributing to this growth, including EU membership and subsidies; increased exports; increases in foreign direct investment (partly as a result of tax incentives); delayed convergence; good macroeconomic management; increased levels of education; and a social

contract between government, trade unions and employers (see, for example, Barry (1999); Barry, Bradley and Hannan (2001); Burnham (2003); De la Fuente and Vives (1997); Doyle (2001); Powell (2003); and Walsh (2000)). It has also been suggested that part of the perceived growth is not real – that it is an artefact of transfer pricing. Whatever the reasons, the country's impressive growth rate is clearly worthy of study.

One explanation that has been insufficiently examined in the case of Ireland, however, centres on the link between demographic change and economic growth. Much of the thinking among economists and demographers in past decades has been that population growth, in itself, has no effect on economic growth. Dubbed "population neutralism," this view has held sway in the face of challenges from both "population optimists" and "population pessimists".

New research, in which the authors of this paper have been participants, strongly suggests that there is, indeed, an important link between demographic change and economic growth. But what is important is not the population growth rate, *per se*, but the changing age structure of the population. All countries are at some stage of the "demographic transition": the movement from high rates of mortality and fertility to low rates. Since declines in infant mortality generally precede declines in fertility the first part of this transition is characterised by large cohorts of young people. When fertility falls a "bulge" generation becomes a recognisable feature of the population pyramid. When this generation reaches working age, and if it is productively employed, a country will experience a demographically-induced economic boost.

Young (1994, 1995) in a detailed study of national accounts argued that most of the economic growth in the East Asian "Tiger" economies was due to the accumulation of factor inputs, particularly labour, rather than pure productivity gains. Bloom, Canning and Malaney (2000) tie this surge in labour supply to the demographic changes that took place in East Asia. In this paper we propose that a similar mechanism has been at work in Ireland. Fortin (2001) argues that increases in labour supply have played a large role in the Irish economic boom; we argue that this labour supply boom has been due mainly to demographic factors. Although Ireland has long had low mortality rates, its birth rate, until relatively recently, was high for its level of economic development. The relatively recent fall in its birth rate, starting in 1980, has given Ireland a "bulge" cohort of working-age people. We carry out a cross-country analysis of growth rates over the period 1965 to 1995 and show that the economic boom of the early 1990s was exactly what we would expect given Ireland's changing demographic structure.

Moreover, we connect changes in family planning policy to the speeding up

of the demographic transition in Ireland. As constraints on birth control began to fall in the 1970s, and with its legalisation in 1979, Ireland's fertility rate began to fall faster than it had been. As the ensuing bulge generation began to reach working age, Ireland's economy took off.

While a part of Ireland's phenomenal economic growth over the last decade can be ascribed to demographic factors, it is clearly not the whole story. We show in our cross-country model that the economic impact of the labour supply surges that accompany the demographic transition is not automatic. Countries, such as Ireland (and those of East Asia), that have a range of good economic policies in place are able to take full advantage of demographic changes while others, with poor policies in place, get little benefit. The demographic dividend of greater labour supply is only a potential gain – this labour has to be gainfully employed. A further complication occurs in the case of Ireland. Large-scale migration means that the demography is to some extent endogenous, with labour supply responding to, as well as leading, economic growth. We try to identify the pure effect of exogenous demographic changes on economic growth.

This paper reviews these links between demographic change and economic growth and explores the extent to which this emerging set of ideas can help us understand Ireland's economic performance over the last two decades. It also leads us to predict high rates of growth in the current period but with a slowdown in the Irish economy after 2005, when the ratio of working age to total population will peak and the effect of population ageing starts to lead to a less favourable demographic structure.

II THE EFFECTS OF DEMOGRAPHIC CHANGE ON ECONOMIC GROWTH

There is a sizeable literature on the effect of population growth on economic growth. Although it is often argued that rapid population growth has a negative effect on the growth rate of income per capita, compelling evidence on this point has been rather elusive and counterarguments abound. Most studies find little cross-country evidence of a significant effect, holding constant myriad other influences on the rate of economic growth. Whether this result reflects the true unimportance of population growth, offsetting negative and positive influences of population growth on economic growth, inadequate control variables or other model specification errors, poor data, or reverse causality, continue to be open questions. Nonetheless, this body of empirical research has tended to support what has come to be known as the population neutralist view: population growth neither systematically impedes nor

promotes economic growth. This view has been the dominant academic belief in this area since the early 1980s and contributed to the marginalisation of population and reproductive health as an instrument of economic development among key development agencies like the World Bank. (See Ahlburg (2002); Birdsall, Kelley and Sinding (2001); Bloom, Canning and Sevilla (2003); Kelley (1988, 2001); and Kelley and Schmidt (2001)).

New evidence and thinking has emerged in the past few years that challenges, and is beginning to unseat, this longstanding view. This new evidence relates to the importance of population age distribution in the determination of macroeconomic performance.

There are two main ideas here. The first is that people's economic needs and contributions vary over their life cycle. For example, young people tend to be net consumers, while working-age people tend to be net producers and savers, with the elderly falling somewhere in between. This implies that the age structure of a population may be very consequential for its economic performance – as measured by income per capita. Large youth and elderly cohorts might slow down the pace of economic growth, while large working-age cohorts might speed it up.

The second idea is that not just population growth, but also changes in the age structure of the population, are consequences of the well-established and widely prevalent phenomenon known as the demographic transition. The characteristic feature of this transition from high rates of fertility and mortality to low rates is that the decline in mortality occurs before the decline in fertility. The lag causes population growth, but initially it also swells the youth share of the population since the mortality declines tend to be disproportionately experienced by infants and children. The swelling goes down subsequently as fertility rates decline. It shows itself as a pronounced "bulge" in the age structure, and operates over time as a "demographic wave" that works its way from the base to the apex of the population pyramid.

In recent years, economists have integrated these observations about age structure and life cycle into modern frameworks for studying economic growth. Contrary to the neutralist view, the emerging evidence indicates that population does matter to economic growth, with age structure playing a central role. As the dependency ratio falls, opportunities for economic growth tend to rise, creating what is now referred to as a "demographic dividend".

East Asia's macroeconomic performance is tracked very closely by its demographic transition and resulting changes in age structure. Estimates indicate that as much as one-third of its "economic miracle" can be accounted for as a "demographic dividend (Bloom and Williamson (1998), Bloom, Canning, and Malaney (2000), and Mason (2001)). By contrast, the absence of demographic change also accounts for a large portion of Africa's economic

debacle (Bloom, Canning, and Sevilla (2002); Bloom and Sachs (1998) and Sachs and Warner (1997)). In addition, the introduction of demographics has reduced the need for the argument that there was something exceptional about East Asia or idiosyncratic to Africa. Once age structure dynamics are introduced into an economic growth model, these regions are much closer to obeying common principles of economic growth (Bloom and Canning (2001), Bloom, Canning, and Malaney (2000).

It is also clear, both theoretically and empirically, that there is nothing automatic about the link from demographic change to economic growth (Bloom and Canning (2001), Bloom, Canning, and Sevilla (2002); Bloom and Canning (2003)). Age distribution changes merely create potential for economic growth. Whether or not this potential is captured depends on the policy environment, as reflected, for example, by the quality of governmental institutions, labour legislation, macroeconomic management, openness to trade, and education policy. This realm is where Latin America seems to have stumbled. During 1965 to 1990, its demographics resembled those of East Asia, but its economic performance lagged well behind. Episodes of high inflation, political instability, adversarial labour relations, and an inward orientation with respect to trade through much of the period appear to have prevented many Latin American countries from exploiting its demographic window of opportunity, at least in its early phases. On the other hand, Ireland appears to have exactly the type of beneficial policy environment that enabled East Asia to take full advantage of its demographic dividend.

III THEORETICAL MODEL

Most empirical models of economic growth have focused on the growth of income per capita. Income per capita is a convenient summary of the standard of living and a useful measure of the level of economic development. However, in theoretical terms, models of income growth usually rely on a production function that links factor inputs and total factor productivity to output. Dividing the production function through by labour gives us a relationship in which output per worker is due to the level of inputs per worker and the productivity with which inputs are used. Letting z_0 be the initial level of income per worker, we can write the growth rate of income per worker g_z as

$$g_z = \lambda(z^* - z_0)$$

where z^* is the steady state level of income per worker and λ is the speed of convergence. The steady state level of income per worker depends on any

factors (such as capital stock and education levels per worker, and total factor productivity levels) that may affect labour productivity. We write the vector of variables that can affect steady state labour productivity as X, which gives us $z^* = X\beta$ and so

$$g_z = \lambda(X\beta - z_0)$$

This type of growth model is discussed extensively in Barro and Sala-i-Martin (1995). We now wish to develop a theory of the growth of income per capita. We start with an accounting identity that links income per capita (Y/N) to income per worker (Y/L)

$$\frac{Y}{N} = \frac{Y}{L} \frac{L}{WA} \frac{WA}{N}$$

In this identity WA represents the population of working age. The identity merely states that the level of income per capita equals the level of income per worker times the participation rate (L/WA) times the ratio of working age to total population (WA/N). In growth rate terms this implies that

$$g_{Y/N} = g_{Y/L} + g_{L/WA} + g_{WA/N}$$

and making the following substitutions,

$$y = \log \frac{Y}{N}, \quad z = \log \frac{Y}{L}, \quad p = \log \frac{L}{WA}, \quad c = \log \frac{WA}{N},$$

we can derive

$$g_y = g_z + g_p + g_c$$

Hence we have (since $y_0 = z_0 + p_0 + c_0$)

$$g_y = \lambda(X\beta + p_0 + c_0 - y_0) + g_p + g_c$$

This final equation is similar in form to the normal regressions run in growth theory. It relates growth in output per capita to a range of variables, X, and the initial level of income per capita, y_0. However, several other terms appear. The participation rate and the ratio of workers to total population appear both in level terms and in growth terms. Due to the identity used to derive this regression, the coefficients on these terms are fixed (equal to λ, or minus the coefficient on initial income per capita for the level terms and equal to one for the growth terms).

IV   DATA

We construct a panel of countries observed every five years from 1960 to 1995. Data on GDP per capita are obtained from the Penn World Tables version 6.0 (this data is an update of Summers and Heston (1991)). We measure a country's labour supply by the size of its economically active population using data from the International Labour Office (1997). This labour supply measure does not adjust for unemployment or for hours worked. Data on the working age (those 15 to 64 years old) and total population come from the United Nations (1998).

In addition to these variables, we include in our regressions a number of indicators that explain why labour productivity varies across countries (the variables in our vector X in the theory section above). Schooling is measured by the average total years of schooling of the population aged 15 years and older from Barro and Lee (2000). Life expectancy data are from the United Nations (1998). We use these as a proxy for the health of the workforce, even though they measure mortality rates rather than morbidity. Higher life expectancy is generally associated with better health status and lower morbidity (Murray and Chen, 1992; Murray and Lopez, 1997). Schooling and health can be thought of as indicators of the quality of labour.

We also include a range of geographic and institutional factors that may affect factor productivity. Our governance variable is based on the index created by Knack and Keefer (1995), which gives an average indicator of the quality of public institutions. The index is based on data for 1982 and does not vary within a country over the period we analyse. Data on the percentage of land area in the tropics and a dummy for being landlocked come from Gallup, Sachs, and Mellinger (1999). We include some country-specific variables that may affect the long run level of total factor productivity. We also use a measure of ethno-linguistic fractionalisation from Easterly and Levine (1997), and the Sachs and Warner (1995) measure of openness to trade (which also depends on a country's market institutions to some extent).

V   EMPIRICAL RESULTS

We explain growth in per capita output in the five-year period by a fairly standard set of explanatory variables but adding our demographic variables, for a panel of countries over the period 1965-1995. The results are reported in Table 1. In column 1 we report the results of estimating the relationship by ordinary least squares. We find that open economies, with good institutions, that have fairly homogeneous populations (i.e., low ethno-linguistic

fractionalisation), have higher rates of economic growth. In our regression being landlocked, or being located in the tropics, is not statistically significant. The average years of schooling of the workforce did not appear to be significant either, though better health in the form of higher life expectancy did have a significant positive effect on growth. The coefficient on the initial level of income per capita was negative, indicating catch-up to a steady state defined by the other variables as set out in the theory section.

Table 1: *Estimates of the Determinants of the Growth Rate of Income Per Capita*

	1 OLS	2 2SLS	3 2SLS
Constant	0.715***	0.757***	0.619***
	(0.173)	(0.175)	(0.186)
Openness	0.071***	0.068***	0. 024
	(0.017)	(0.017)	(0.024)
Institutional Quality	0.015***	0.015***	0.014**
	(0.005)	(0.005)	(0.006)
Ethno-linguistic Fractionalisation	−0.051*	−0.050*	−0.053*
	(0.028)	(0.028)	(0.029)
Landlocked	0.006	0.008	0.011
	(0.018)	(0.018)	(0.021)
Tropical Area	−0.011	−0.018	−0.019
	(0.020)	(0.022)	(0.024)
Initial average years of schooling	−0.0003	−0.0007	−0.0009
	(0.005)	(0.005)	(0.005)
Initial Life Expectancy	0.004***	0.004**	0.006***
	(0.002)	(0.002)	(0.002)
Log initial income per capita	−0.112***	−0.110***	−0.114***
	(0.018)	(0.018)	(0.019)
Log initial working age over total pop	0.257**	0.284**	0.180
	(0.118)	(0.125)	(0.143)
Log initial participation rate	−0.186***	−0.166***	−0.164***
	(0.058)	(0.058)	(0.062)
Growth of participation rate	−0.570*	−0.280	−0.212
	(0.302)	(0.527)	(0.560)
Growth of working age over total pop	0.789**	1.222**	−0.793
	(0.329)	(0.575)	(0.973)
Growth of working age times openness			3.328***
			(1.184)
R squared	0.309	0.306	0.270

Note: Based on 507 observations, from five year panel of countries, over the period 1965-1995. Time dummies included but not reported. Heteroskedastic consistent standard errors in parentheses.

We find that the coefficient on the log of the working age over the total population has a positive and significant sign as expected but the initial participation rate has a negative sign. In terms of growth rates, the growth of the ratio of working-age to total population has a positive sign while the growth in the participation rate again has a negative sign.

One issue with these results is that most of the explanatory variables are measured at the start of the five-year period and therefore are prior to the economic growth being explained. However, the growth in the participation rate and the ratio working-age to total population are contemporaneous with the economic growth being explained and as such possibly endogenous. It seems quite reasonable to expect high periods of economic growth to induce higher participation rates and perhaps, through in-migration, a higher ratio of working-age to total population. To try to control for this potential endogeneity we repeat the regression shown in column 1 but instrument these two growth rates with their lagged values (from the previous five-year period). The results, shown in column 2, do not change much except that now the growth in the participation rate is no longer significant.

The results on the demographic variables in Table 1 are, at first sight, difficult to interpret. Since their inclusion comes from an identity (see the theory section above) we could actually exclude them from the estimation and impose the parameters directly from the identity. However, there is a good reason for estimating their effect; our model may suffer from omitted variable bias. Increases in the participation rate, and the ratio of working-age to total population, increase the labour force. Provided the measures of human capital (such as health and education) in our model capture any changes in the quality of the labour force during this inflow of workers, the coefficients from the identity are correct. However, it seems likely that large expansions of the labour force lead to changes in average quality in ways we do not measure. We estimate, rather than impose, the coefficients on our demographic variables allowing these labour quality effects are included in our estimates.

For the ratio of working-age to total population, the coefficients in Table 1 (columns 1 and 2) are in line with what we expect from our model. The coefficient on the growth rate is close to one, while the coefficient on the initial level is close in magnitude (though opposite in sign) to that on the initial level of income per capita. For the participation rate, however, the effects seem to go in the wrong direction with higher levels of labour market participation being associated with lower levels of steady-state income.

One reason for this anomaly may be that participation rates tend to be very high (close to 100 per cent) in very poor countries and to fall with the level of development (to around 50 per cent). Only in the most developed countries do we find higher levels of participation (essentially increases in female

participation) being associated with higher levels of income. It may be that high levels of participation are acting as a proxy for some unobserved variable that is linked to low levels of income, and low income growth, in our data.

The effect of increases in the working-age population on labour supply is to give a supply-side boost to potential output. However, the availability of extra workers will have little effect if they are not employed. In column 3 of Table 1 we report estimates of the parameters of a regression model that is specified to include an interaction effect between the ratio of working-age to total population and the degree of openness of the economy. This allows us to test whether the effect of increasing the working-age ratio depends on the flexibility of the economy as measured by its openness.

We find a large positive coefficient on this interaction term, indicating that a completely open economy (openness equal to one in our measure) will enjoy about three times the impact of demographic change as compared with an average country as modelled in column 2. In addition, the results in column 3 indicate that a country with a closed economy (openness equal to zero) will have no gain from the demographic change (the coefficient on the growth in the working-age ratio in column 3 is negative but not statistically different from zero). This indicates that the impact of demographic change may be to increase labour supply but how well this extra supply of workers is put to productive employment depends on the economic system and policies being used.

VI CASE STUDY OF IRELAND

Ireland had been slow to complete the demographic transition. The death rate in Ireland, which drifted down only slightly during the period 1950-2000, has been relatively low by international standards (in the neighbourhood of 10 per thousand) and comparable to the rest of Europe. By contrast, the birth rate was much higher through the early 1980s (over 20 per thousand). Indeed, Ireland has long been seen as a demographic outlier within Europe, since its fertility rate was still moderately high when other European countries had fallen to near, or below, replacement level. Figure 1 shows the total fertility rate in Ireland compared with the United Kingdom; comparisons with other European countries would look very similar. The difference between a high birth rate and a low death rate would have led to rapid population growth were it not for Ireland's historically high rate of out-migration.

One reason for Ireland's high fertility rate was undoubtedly the legal ban on the use of contraception. From the founding of the Irish State in 1922 until 1979, Ireland placed severe restrictions on access to contraception,

Figure 1: *Total Fertility Rate, Ireland and UK*
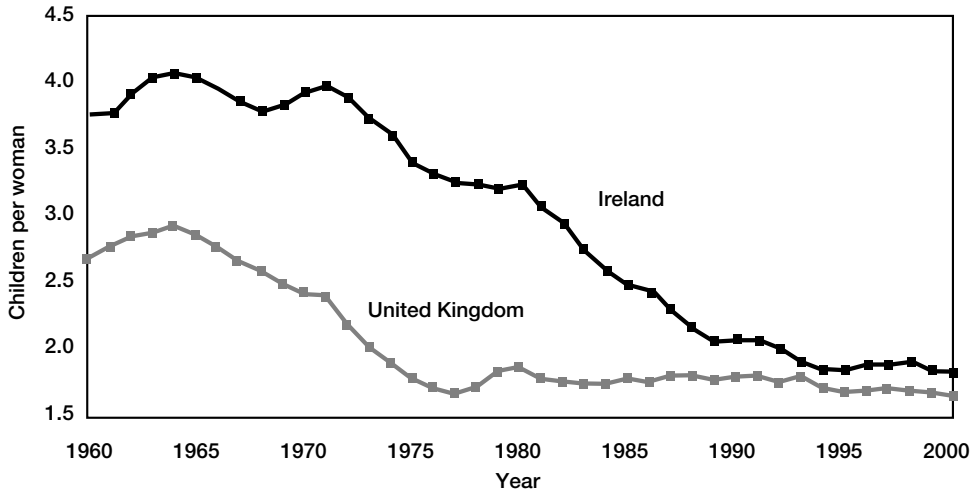
importation of contraceptives, and literature about contraception. Irish women and some medical institutions resisted these restrictions and by the late 1960s women were increasingly obtaining oral contraceptives under the legally-acceptable guise of regulating their menstrual cycle. The Irish women's movement took up this issue and in 1973 the Irish Supreme Court ended the ban on contraception by legalising the importation of contraceptives for personal use; this change was not, however, formally legally implemented until 1979 (see Murphy-Lawless and McCarthy, 1999). In that year, the sale of contraceptives for use in family planning was made legal upon presentation of a doctor's prescription. From 1985 on contraceptives could be sold to all those aged 18 and over without a prescription. Legalisation of contraception was not a sudden or unexpected shock. It arose out of women's struggles for reproductive freedom and from Ireland's gradual incorporation into a broader cultural world in which contraception was widely available and sexual mores were changing. Nevertheless, legalisation was important, as it codified societal norms and, as suggested by the data, seems to have been tightly connected to a rapid fall in fertility.

As a result of societal and legal changes regarding contraception, fertility rates in Ireland began to decline in the 1970s. This decline accelerated in the 1980s and the crude birth rate fell sharply during that decade, from 21.0 per thousand to 14.2 per thousand.

Ireland's falling birth rate led to falling youth dependency and a higher share of working-age people. Figure 2 shows the ratio of the working age (15-64) to the non-working age (<15 or >64) population in Ireland from 1950 to

Figure 2: *Ratio, Working-Age to Non-Working-Age Population*
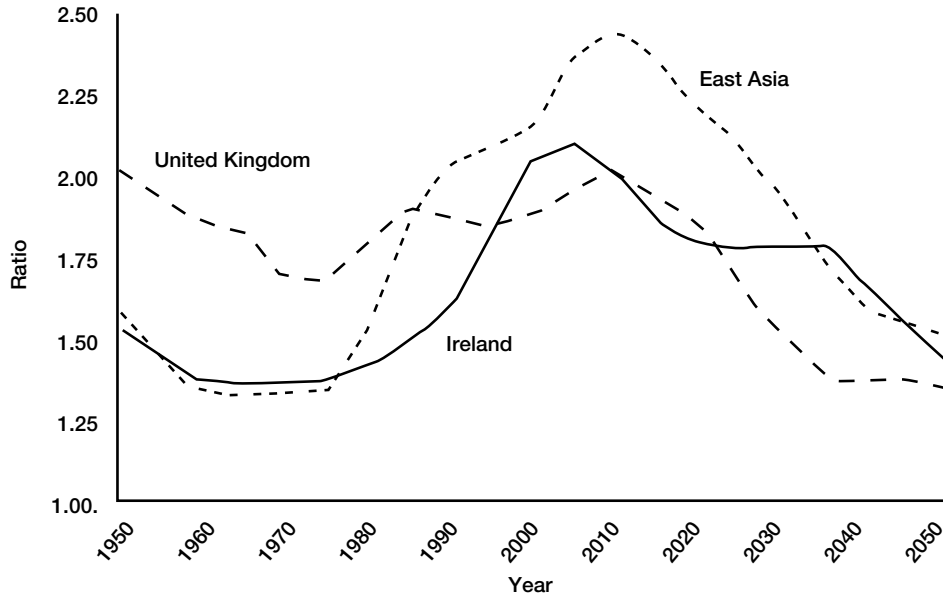
2000 (and projected to 2050 using UN population projections). Comparative data for East Asia and for the United Kingdom are also shown. It is clear from this figure that the dependency burden (i.e., the reciprocal of the indicator in Figure 2) in Ireland mirrored that in East Asia through the mid-1970s. At that point, East Asia's fertility transition, which had begun in the mid-1960s, was well underway and its dependency burden was falling sharply. By contrast, Ireland's dependency burden shows signs of sharp decline by the latter portion of the 1980s, as a consequence of a declining birth rate during the 1980s. By the mid-1990s the dependency burden in Ireland had dropped to a level below that in the United Kingdom.

We hypothesise that Ireland's rapidly falling fertility rate, in conjunction with a constructive set of social, economic, and political policies, facilitated rapid economic growth in Ireland, just as it did in East Asia. To begin we note that from 1960 to 1990, the growth rate of income per capita in Ireland was approximately 3.5 per cent per annum. In the 1990s, the growth rate jumped to 5.8 per cent, which is well in excess of any other European economy, thereby giving rise to the notion of the "Celtic Tiger." This boost in the growth rate coincides closely with the falling dependency rate in Ireland. Thus, the raw data are consistent with the view that demographic change contributed to Ireland's economic surge in the 1990s.

We explore this hypothesis further by comparing actual growth rates of

income per capita in Ireland to fitted growth rates from our estimated econometric model reported in column 3 of Table 1. The results of this exercise are reported in Figure 3. The model tracks the actual growth rates extremely well in terms of growth rates changes. It also tracks the data reasonably well in terms of growth rate levels, especially given the absence of fixed effects in the model. The results do suggest, though, that Ireland's economy may have under-performed relative to its potential from 1965 to 1985.

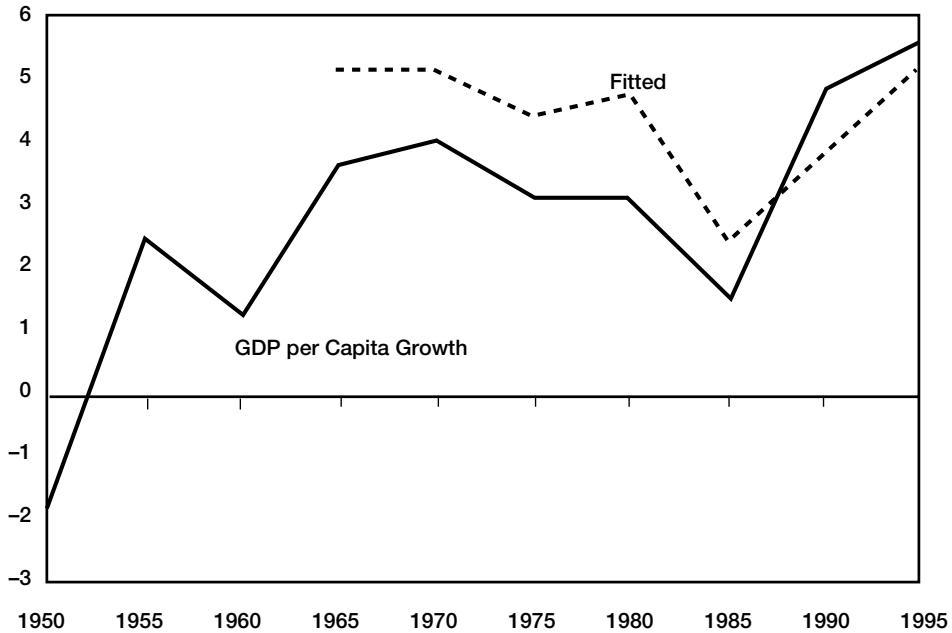Figure 3: *GDP Per Capita Growth in Ireland*

Figure 4 decomposes the fitted growth rate into three components. The first component – represented by the solid line – is the catch-up effect, that is, the change in income per capita that corresponds to the partial adjustment of Ireland's actual income to its steady-state income corresponding to our estimate of the term

$$\lambda(X\beta + p_0 + c_0 - y_0)$$

in the theory section above. The catch-up effect represents about 3.5 percentage points of growth in 1965, but declines to about 2.5 percentage points by 1995 as Ireland's income converges to its steady-state level.

Figure 4: *Sources of Growth in Ireland*
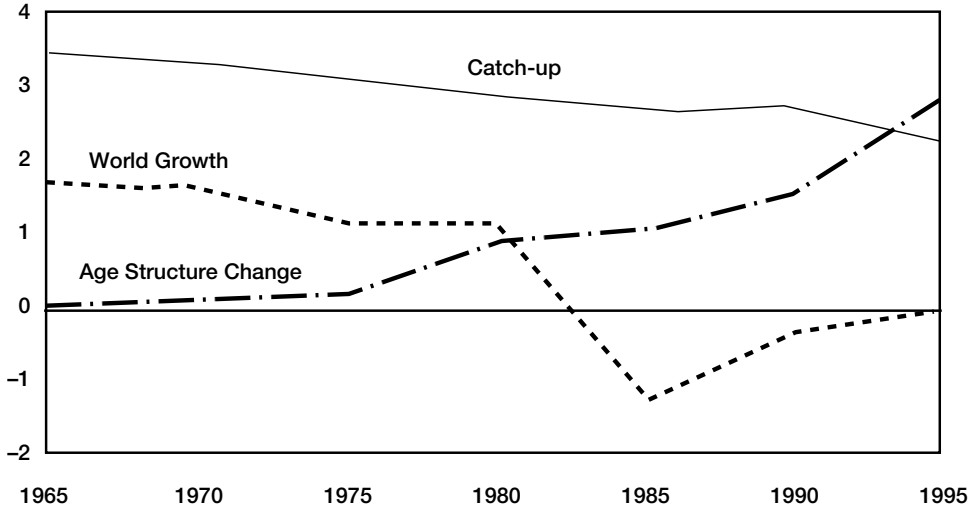
The second component – represented by the dotted line – is world income growth. This component corresponds to the effect of the time dummy variables that were included in the econometric specification (though they are not reported in column 3 of Table 1). The pattern picks up the world economic recession that occurred in the 1980-85 period, as well as the first phases of the subsequent economic rebound.

The final component – represented by the dashed line – is the estimated effect of changing age structure. This effect was zero through the mid-1970s and grew steadily to nearly 3 percentage points by the mid-1990s. Especially notable is the fact that demographic change was estimated to be the largest component of Ireland's income growth in 1995.[1]

Economic growth in Ireland was also fueled by two additional demography-based factors that increased labour supply per capita. The period 1980–2000 saw a substantial increase in female labour force participation rates, particularly in the 25-40 year old age group (see Figure 5). While one would expect rapid economic growth to encourage female labour participation, it seems likely that at least some of the increase was due to the availability of contraception and the increased freedom of women to choose between working and rearing children. In addition, Ireland has historically had high levels of outward migration of young adults (around 1 per cent of the population per year) due to the inability of its economy to absorb the large inflows of young

[1] It should be noted that over half of the estimated effect (in Figure 4) of demographic change on Ireland's economic growth comes from the positive interaction of demographic change and openness.

Figure 5: *Female Labour Force Participation in Ireland*
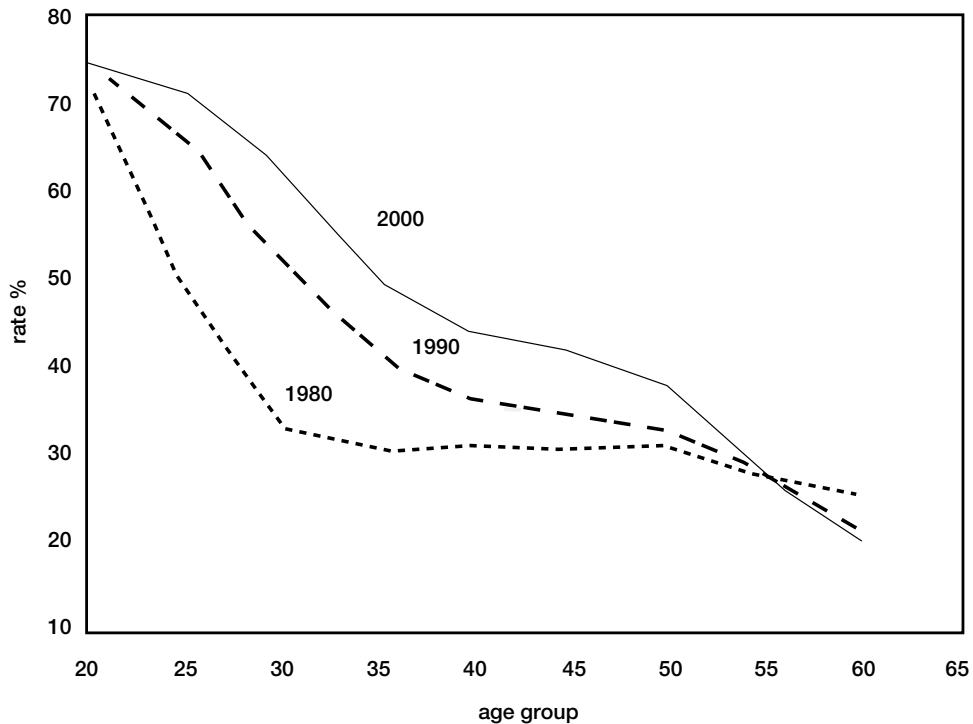
workers created by its high fertility rate. The loss of these young workers of course exacerbated the problem of the high youth dependency rate. The economic growth of the 1990s created enough jobs to reverse this flow, resulting in a small net immigration of workers, mainly from Eastern Europe.

It is important to note that Ireland, like the "miracle" economies of East Asia, had in place economic and social policies that favoured its taking advantage of the demographic shifts it experienced. Two key policies were at work in Ireland. First, in the late 1950s, there was recognition that the "closed economy" model of development had failed in Ireland. This led to new policies with an emphasis on encouraging direct foreign investment in Ireland and promoting exports. Second, from the mid-1960s, free secondary education was introduced, leading to a large increase in school enrolments and subsequent expansions in higher education. The resultant high levels of education, combined with export-oriented economic policies, seem to be powerful factors in ensuring that the benefits of the demographic transition are realised. As discussed in the introduction, there are a wide range of policies that have contributed to Ireland's economic growth. We think these policies also made the Irish economy more flexible and capable of absorbing, and profiting from,

the demographic dividend. In our empirical study we use "openness" as a measure that affects the impact of the demographic dividend, but we see "openness" more as a proxy for good economic policies in general and not an endorsement of export orientation alone (see Bloom and Canning, 2003).

Finally, we note that our estimates suggest that Ireland's demographic window of opportunity has reached a turning point and will soon begin to close. For example, whereas Ireland's working age population grew nearly 2.5 times faster than its total population after the legalisation of contraception (1.24 per cent per year vs. 0.56 per cent per year during 1980 to 2000), it is projected to grow at only three-fourths the rate of the total population during the next twenty years (0.73 per cent vs. 0.95 per cent). The contribution of age structure changes to economic growth will diminish steadily and turn negative around 2005 (see Figure 2), and remain negative during 2010 to 2020. Looking ahead, unless the in-migration of workers accelerates in pace, Ireland's demographic dividend may well turn into a case of demographic drag.

VII CONCLUSION

The economic strength of the Celtic Tiger has been the subject of admiration and investigation from many quarters. In this paper, we have drawn attention to two factors that may underlie the Tiger's success and that have not yet received much attention. First, the legalisation of contraception appears to have given greater impetus to the decline in fertility. As we have noted, this decline was occurring in any case, but it apparently received a boost when increasingly common practices were legalised. Second, this rapid fertility decline gave rise to a dramatic rise in the share of working-age people in the population. This rise, although not quite as stunning as that in East Asia, had the effect of accelerating Ireland's economic growth – an effect that was made possible by the sound policy environment the Irish government had put in place.

What does demography bode for the future economic success of Ireland? The share of working-age people in the population is projected to reach a peak in 2005, and to decline rather quickly thereafter, staying negative throughout the following decade. Whether the "Celtic Tiger" can sustain itself or will later be identified as a transitory and relatively short-lived phenomenon (1990 to 2005) is not yet clear. Based on the estimates reported herein, however, it is clear that Ireland's changing demography and age structure have allowed Ireland a rare opportunity to catch up with the leading developed countries. Moreover, few economies in the world rival Ireland's policy environment with respect to its ability to capture the demographic dividend. The "Celtic Tiger"

is not a miracle but, as in the case of the East Asian Tigers, the result of several positive factors, including demographic change and a positive policy environment, interacting to produce a burst of rapid economic growth.

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