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The economics of a sustainable population

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Executive summary

This paper provides an overview of the economics of a sustainable population and addresses some key policy issues in an Australian context. It is argued that a sustainable population is one that is consistent with sustainable economic development.

The population age distribution is shown to be more important than the population growth rate itself. The age distribution directly impacts average living standards through the ratio of workers to consumers and may also affect labour productivity. The population growth rate itself, however, contains little useful information. Indeed the search for an optimal population growth rate is a futile exercise, as is the notion of Australia's 'carrying capacity'. There are simply too many uncertainties and value judgements required to make such calculations useful—for example, what factors (social, cultural, environmental, economic) to include in social wellbeing and how to measure them, how to value the wellbeing of future generations, how to value contemporaneous gains and losses to various groups in society, economies and diseconomies of scale, the different effects of fertility and immigration as population drivers, and the importance of both the spatial and age distribution of the population in the transition from one population growth rate to another.

A population policy framework however could be useful. Population is a mediating factor in a wide range of public policy areas such as health, education, urban and environmental planning, and infrastructure development. A population policy could guide and connect these decisions.

About the Author

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His current research programme is concerned mainly with the macroeconomic implications of population ageing in Australia and other regions of the world. He has published over 30 refereed journal articles on population economics, broadly defined, and has received four grants in the past 10 years from the Australian Research Council to support this work. He was an invited participant at the Prime Minister's 2020 Summit in 2008 on the basis of his work on population economics.

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Population papers series

Population related issues were among the most contentious areas of public debate prior to and during the recent election period. Given its enduring and multifaceted nature, the debate on population is likely to be of continuing policy interest to senators and members of the 43rd Parliament.

The Parliamentary Library commissioned a series of papers from leading authors on a range of aspects of population including the environment, the economy, demographic trends, public opinion, urban transport and international comparisons. The views expressed do not reflect an official position of the Parliamentary Library, nor do they constitute professional legal opinion.

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Introduction

This paper sets out to provide an overview of the economics of a sustainable population, including a discussion of key controversies in the literature and in policy debates. The Australian context is emphasised.

The first task is to define the field. This is important because sustainability is a contested idea with a range of interpretations. For some it is all about the environment—this could be local through urban congestion, water shortages and planning bottlenecks, and/or global through carbon pollution, for example. Economists generally incorporate these and other aspects of sustainability into a wider view, rooted in the field of economic development. This is the position taken here and population is seen as a mediating factor in achieving sustainable economic development.

Population is shown to affect economic development through a range of channels. The age distribution is arguably the most important of these—more important than the population growth rate itself. The idea of a socially optimal[1] population growth rate or target population level is argued to be a bridge too far, as is the notion of Australia's 'carrying capacity'. There are simply too many uncertainties and too many value judgements required to make such calculations. However, we can analyse the effects of population change on a range of particular variables. This could be done through a population policy framework which would show the role of population in connecting and guiding a range of public policy areas such as health, education, urban planning and regional development. The last two chapters of the third Intergenerational Report are a useful step in this direction.[2]

What does 'sustainable population' mean?

We need to unpack some rather contested terminology. First the term sustainability itself is a slippery concept. If sustainability is to be a goal that can be operationalised it must be defined and it must be measured. As Nobel Prize winning economist Robert Solow said about sustainability: 'talk without measurement is cheap'.[3]

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1. The term socially optimal refers to the best possible outcome for society taking account of everything that we know about the present and future and making assumptions where appropriate.

2. Australian Treasury, *Australia to 2050: future challenges*, Commonwealth of Australia, 2010, viewed 7 October 2010, http://www.treasury.gov.au/igr/igr2010/

3. R Solow, 'An almost practical step toward sustainability', invited lecture on the occasion of the fortieth anniversary of Resources for the Future, 8 October 1992, p. 163.

Weak versus strong forms of sustainable development

The Brundtland Commission defined sustainable development as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs'.[4] This has been criticised as being too vague to be of any use as a practical guide to planning.[5] For example, a society living forever at a minimum subsistence level of consumption would satisfy the Brundtland requirement, but it would obviously be wasteful in terms of foregone opportunities to use resources to improve wellbeing. Others however argue that the notion of sustainable development is inevitably vague, but not necessarily meaningless.[6] A definition that is both imprecise but meaningful is one that defines sustainable development as an obligation to leave behind a generalised capacity to create wellbeing.[7] This implies an obligation to give future generations the capacity to be as well off as present generations by preserving the existing capacity for creating wellbeing. That is, future generations are not owed any particular thing; rather they are owed a capacity to enjoy a level of wellbeing at least equal to that of the present. As Aghion and Howitt put it, 'sustainability doesn't require that any *particular* species of owl or any *particular* species of fish or any *particular* tract of forest be preserved'.[8] It is about maintaining a broad measure of capital intact over time. The implication is that all forms of capital, reproducible capital and natural capital for example, are substitutable to some extent in generating wellbeing.[9] This is the 'weak' form of sustainable development.

The term 'wellbeing' in this definition of weak sustainability is open to interpretation. The generally accepted interpretation of wellbeing is that given by the Commission on the Measurement of Economic Performance and Social Progress which defined wellbeing as comprising: material living standards; health; education; personal activities; political voice and governance; social connections and relationships; environment; and insecurity (economic

4.   Brundtland Commission, *Our common future: report of the World Commission on Environment and Development*, United Nations, 1987, viewed 25 October 2010, http://www.un-documents.net/ocf-02.htm

5.   RN Stavins, A Wagner, and G Wagner, 'Interpreting sustainability in economic terms: dynamic efficiency plus intergenerational equity', *Economics Letters*, vol. 79, 2003, pp. 339–343.

6.   R Solow, 'Sustainability: an economist's perspective', in R. Stavins (ed.), *Economics of the environment: selected readings,* 5th ed., Norton, New York, 2005.

7.   R Solow, 'An almost practical step toward sustainability', op. cit., p. 163.

8.   P Aghion and P Howitt, *Endogenous growth theory*, Massachusetts Institute of Technology, USA, 1998.

9.   Reproducible capital refers to capital created by humans (buildings, plant and equipment). Natural capital refers to endowments provided by natural ecosystems such as forests and river systems.

and physical).[10] The Australian Treasury has adopted five alternative dimensions of wellbeing: consumption possibilities; distribution; complexity; risk; and opportunity and freedom.[11]

The 'strong' form of sustainability requires the total stock of natural capital to be maintained intact and therefore disallows any substitution between the total stocks of natural capital and human-made capital. A very strong version would require that particular classes of natural assets, such as species of flora and fauna, should be preserved, and therefore restricts substitution between types of natural assets.[12] How reasonable is this? Consider the counterfactual in which all forms of natural capital are preserved in their pristine state no matter what. That would preclude economic development of the kind that has enabled us to enjoy improvements in health, education, communication, transport, not to mention a vast array of consumer goods and services. Clearly therefore it would not be sensible to argue for an unchanged stock of every form of natural capital. This raises the more controversial issue of the degree of substitution between natural and reproducible capital in generating wellbeing. The important point is to recognise that it cannot be socially optimal to conserve every form of natural capital in its pristine condition.

It is worth noting the problem for the policy maker in choosing among paths for future wellbeing that are all sustainable. Which sustainable path is best? This goes to the critical importance of putting a value on future wellbeing – that is, the degree to which we discount future wellbeing.[13] The debate about discounting future wellbeing has a long history in the economics literature. A zero discount rate leads to what Chichilnisky calls a 'dictatorship of

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10. JE Stiglitz, A Sen and J-P Fitoussi, *Report by the Commission on the Measurement of Economic Performance and Social Progress*, 2009, viewed 7 October 2010, http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf

11. Australian Treasury, 'Policy advice and Treasury's wellbeing framework', *Economic Roundup*, Winter, 2004, pp. 1–20, viewed 7 October 2010, http://www.treasury.gov.au/documents/876/PDF/ER_Winter_2004_compressed.pdf

12   For a further discussion and literature review of the various concepts of capital and sustainability see: W Hediger, 'Reconciling "weak" and "strong" sustainability', *International Journal of Social Economics,* vol. 26, 1999, 1120–1143.

13. Should we place the same value today on a given level of wellbeing enjoyed by a person in 50 years as on that of a person alive today? What about the same level of wellbeing of a person in 200 years? One reason for placing a lower value today on a given level of future wellbeing is that the world might not exist in the distant future. When we do this we are 'discounting' future wellbeing. For example, if we value a dollar of wellbeing (assuming we can convert well being into dollar values) in 100 years as worth 90 cents today, we are adopting a discount rate of approximately 0.1 per cent. A more controversial reason for discounting future wellbeing is that people are impatient and prefer a dollar today than a dollar tomorrow all else being equal. The controversy arises because although this may well apply to an individual lifetime, it is not clear that society ought to be 'impatient' with respect to whole generations of people who are not yet born.

the future' whereas a positive discount rate leads to a 'dictatorship of the present'.[14] Sir Nicholas Stern in his influential report on the economics of climate change in 2007 came down firmly in favour of the early economists such as Ramsey who regarded the discounting of future wellbeing as fundamentally unethical.[15] Stern discounted future wellbeing at the near-zero rate of 0.1 per cent on the grounds of a tiny but non-zero probability that the human race will become extinct.[16]

Where does population fit in?

So far we have been talking about the sustainability of wellbeing. How does population fit in to this picture? Demographers study the statistical and mathematical properties of human populations. A difficulty with sustainable population from this perspective is that the term sustainability is mathematically vague, unlike notions of steady state, stability and feasibility which have clear mathematical meanings and clear demographic interpretations. A population can be stable,[17] and it can be stationary,[18] but what does it mean to say it is sustainable? In a demographic sense, a population might be defined as sustainable if it does not die out. This might be described as a feasible path in that the population can continue indefinitely. A feasible path would rule out extremely low fertility rates. It may not however rule out very high fertility rates, yet these may not be consistent with the notion of sustainable development—weak or strong forms—discussed above. It seems sensible therefore to define a sustainable population as one that is consistent with sustainable development.

The economics of population sustainability

The message so far is that population sustainability only has meaning in the context of sustainable development, which in turn has its roots in the field of economic development. So a study of population sustainability has to begin by looking at how population change affects economic development.

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14. G Chichilnisky, 'What is sustainable development?', *Land Economics*, vol. 73, no. 4, 1997, pp. 467–91.

15. FP Ramsey, 'A Mathematical Theory of Saving', Economic Journal, vol. 38, 1928, pp. 543–59.

16. N Stern, *The economics of climate change: the Stern review*, Cambridge University Press, Cambridge, 2007.

17. A population for which the percentage of people in each age group remains constant over time, but which may be either growing, shrinking or constant in total size.

18. A stable population that is also constant in size.

The age distribution is important

The size of a population is not as important for economic development as either the age distribution or the spatial pattern of the population.[19] To begin to appreciate this important point, it is helpful to consider the following simple identity:

$$\frac{C}{N} \equiv \frac{C}{Y} \frac{Y}{L} \frac{L}{N} \qquad (1)$$

The symbols in this identity refer to the following national aggregates: C is consumption of goods and services, N is population, Y is output of goods and services (gross domestic product, GDP), and L is employment. Being an identity, this relationship is always true by definition.[20] The ratio C/N is a measure of average living standards, C/Y represents the consumption share of GDP, Y/L is the average labour productivity, and L/N is the employment to population ratio.

C/N is not the same as wellbeing, as noted above, but it is a useful place to start while acknowledging the effect of population on some other determinants of wellbeing such as congestion. Also, the identity in (1) is a contemporaneous relationship - one that holds in the present and in the future, but does not tell us how the present affects the future. It nevertheless allows some key insights into the importance of the population age distribution.

Population change affects living standards through its effect on the three ratios on the right hand side of (1). Starting from the left, consider the effect on C/Y or the consumption share of GDP. An ageing population, for example, tends to have a small positive effect on C/Y. This is because an ageing population usually implies a more slowly growing workforce which means that firms need less capital equipment. For example, fewer new workers in the office means fewer new personal computers are required. This in turn means that less of the nation's output must be siphoned off for investment and therefore more is available for consumption. The result is a dividend in terms of C/N arising from population ageing.[21] Guest estimates that this will increase C/N by 2.7 per cent averaged across OECD countries between 2006 and 2050 (that is, 2.7 per cent in total over the whole period, not per annum).[22]

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19. The age distribution of the population refers to the proportions of the total population represented by various age groups. The spatial pattern refers to the geographic distribution of the population.

20. As seen by cancelling out Y and L on the right hand side.

21 For the seminal technical analysis see: DM Cutler, JM Poterba, LM Sheiner, and LH Summers, *An aging society: opportunity or challenge?,* Brookings Papers on Economic Activity, 1990, pp. 1–74.

22. R Guest, 'Can OECD countries afford demographic change?', *Australian Economic Review,* vol. 40, no. 2, 2007, pp. 1–16.

The effect of the population age distribution on Y/L (average labour productivity) is more complicated and controversial but potentially more significant.[23] A range of effects is possible. Older workers have accumulated more human capital than younger workers, but may be less adept at assimilating new technology than younger workers.[24] Complementarities between the skills of older and younger workers could potentially boost productivity as the workforce ages by changing the mix of older and younger workers. Guest estimates the latter effect as providing a consumption dividend across OECD countries between 2006 and 2050 of somewhere between zero and 30 per cent—a wide range but, importantly, not negative.[25] A further potential consumption dividend via Y/L is due to the higher saving rates of middle aged workers. If population ageing implies a higher share of middle aged workers then the average saving rate should be higher than otherwise. The estimate by Guest of this effect is two per cent across OECD countries between 2006 and 2050—small but, again, not negative.[26]

On the other hand a fewer absolute number of workers implies fewer productive minds and hence potentially fewer innovations.[27] Any such negative effect on the rate of discovery of ideas can be compounding, as knowledge begets knowledge - discoveries lead to further discoveries. This is the so-called endogenous growth school of thought led by Lucas and Romer.[28]

There are other potential effects on Y/L that depend on whether the changes in the age distribution are driven by fertility rates or immigration. These are considered further below. In summary the picture is not clear—changes in the age distribution can affect average labour productivity positively and negatively.

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23. For surveys of early literature see Chapters 4 to 7 in N Birdsall, A Kelley and W Sinding, *Population matters: demographic change, economic growth and poverty in the developing world,* Oxford University Press, New York, USA, 2001; also see Chapters 1 to 8 in A Mason, *Population change and economic development in Asia: challenges met, opportunities seized*, Stanford University Press, California, USA, 2001.

24. C Day and S Dowrick, 'Ageing Economics: Human Capital, Productivity and Fertility', *Agenda*, vol. 11, no. 1, 2004, pp. 3–20.

25. A consumption dividend means a boost in average living standards that is 'free' in the sense that it does not require any resources. It is therefore like the effect of a boost in productivity. Guest, *Australian Economic Review,* op. cit.

26. Guest, *Australian Economic Review*, op. cit.

27. C Jones, 'Sources of US economic growth in a world of ideas', *American Economic Review*, vol. 92, 2002, pp. 220–239.

28. R Lucas, 'On the mechanics of economic development', *Journal of Monetary Economics*, vol. 22, no. 1, 1988, pp. 3–41; PM Romer, *Capital, labor, and productivity*, Brookings Papers on Economic Activity, 1990, pp. 337–367.

The third ratio in (1) is L/N, the employment to population ratio or 'support ratio'.[29] Population ageing lowers the support ratio by lowering the working age population share. There are a number of reasons to expect the decline in the support ratio as the population ages to be mitigated by a rise in the labour force participation rates (LFPRs) of older workers in the future. Younger cohorts of the population are better educated than their predecessors, which implies that when they are older, their LFPRs will be higher than that of current older cohorts, the reason being that better educated people participate at higher rates in the labour market. In Australia, for example, Day and Dowrick provide evidence that the decline in fertility since the 1960s has been associated with a substantial increase in female LFPRs.[30] They argue that this will continue - in particular with respect to older women, as the higher educational attainments of young women today will result in much higher LFPRs of older women in the future. In OECD countries considerable policy attention is being directed towards increasing LFPRs of older workers and ensuring that there is demand for their labour. Pro-fertility policies being adopted in many OECD countries may also have an effect. Guest estimates the negative effect of lower L/N on living standards to be in the order of 15 per cent across OECD countries between 2006 and 2050.[31] That is, living standards would be 15 per cent lower in 2050 than they would be if L/N were to remain constant.

Is there an optimal population growth rate?

It is possible to do such a calculation if we make enough assumptions, not least ignoring the effect of population growth on the natural environment since there are too many uncertainties. Indeed if we ignore all the environmental and social factors that contribute to wellbeing and simply focus on maximising average living standards defined as average consumption of goods and services (C/N), and also make assumptions about relative consumption needs of young and old people, we can find the optimal population growth rate. Weil for example calculates this as 0.7 per cent per year for the United States.[32] For Australia, Nevile, using a somewhat different methodology, calculates a value of 1.3 per cent per year.[33]

The first point to note is that these growth rates are in the ballpark of current and projected growth rates for many advanced countries, which might suggest a sanguine view of current population trajectories. For example, Australia's projected population growth rate from 2010 to 2050 is approximately equal to Nevile's optimal growth rate of 1.3 per cent. However,

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29.   This term derives from the idea that employed workers, L, 'support' the number of consumers, N.

30.   C Day and S Dowrick, *Agenda*, op. cit.

31.   Guest, *Australian Economic Review*, op. cit.

32.   D Weil, 'Population growth, dependency and consumption', *Australian Economic Review*, vol. 89, no. 2, Papers and Proceedings, 1999, pp. 251–255.

33.   J Nevile, *The effect of immigration on Australian living standards*, Bureau of Immigration Research, Commonwealth of Australia, 1990.

apart from the qualifications about what to include in wellbeing, there are other issues. The optimal growth rates cited are growth rates of stable populations—that is, where the dependency ratios are not changing.[34] Most advanced countries are undergoing a process of population ageing in which old age dependency ratios are rising. Weil's analysis shows that any transition to a higher stable population growth rate would necessarily result in lower living standards for two or three decades, simply because youth dependency would rise but old age dependency would not fall during this transition period. Similarly, the costs of population ageing that we are experiencing now may simply be the transition costs of a shift to a lower stable population growth rate. Weil shows that changes in the age distribution have a much bigger effect on living standards than do variations in stable population growth rates.[35] For example a stable population with a growth rate 1 per centage point above or below the optimal growth rate would imply living standards only 2 per cent below that of an optimally growing population, whereas the transition to a new stable population growth rate results in changes in living standards of many times that magnitude.

There are other important problems in deriving optimal population growth from models of optimal average living standards or optimal economic growth. Changes in average living standards do not tell us anything about the distribution of gains/losses among the pre-existing population and the new arrivals (whether new born or immigrants). Where population growth is due to immigration (which it mostly has been in Australia in the last decade), most of the gains from population increase accrue to the immigrants rather than the pre-existing population.[36] The pre-existing population benefit from the increase in the price of land but they lose out due to the downward pressure on average wages in turn caused by the increase in the labour force. The immigrants on the other hand are unambiguously better off on average due to the higher wages in their new country.

There is also a simple numerical reason why average living standards across both pre-existing residents and immigrants are a misleading indicator of the effect of population growth. Clarke gives the following simple example.[37] Take a population of 20 million people with average living standards of $20 000. Now allow an extra 10 million immigrants over 50 years. Suppose that these immigrants enjoy an increase in their individual incomes from $5000 to $10 000 per head; and further assume that the pre-existing resident incomes increase by a smaller proportion from $20 000 to $22 000 as a direct result of the benefits of immigration. Note that both pre-existing residents and immigrants enjoy higher living standards. But average living standards across the whole population have fallen to $18 000. Hence using

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34. The dependency ratio is the non-working population (i.e. both young and old age dependents) as a proportion of the total population.

35. Weil, *Australian Economic Review*, op. cit.

36. H Clarke and Y-K Ng, 'Immigration and economic welfare: resource and environmental aspects', *The Economic Record*, vol. 69, 1993, pp. 259–273.

37. H Clarke, 'Should Australia target its population size?', *Economic Papers*, vol. 22, no. 1, 2003, pp. 24–35.

average living standards across the whole population as the criterion for evaluating immigration would be misleading.

Economies and diseconomies of scale are another factor not usually captured in models of optimal economic growth or optimal living standards. Economies of scale occur for when population in a region becomes large enough to support, for example, a viable visual and performing arts industry, or many quasi-public goods in the fields of health and education, or transport infrastructure, sports stadiums and the like. Economies of scale also include the effect of population size on the rate of innovation, as implied by endogenous growth theory mentioned in the previous section. Diseconomies of scale on the other hand derive from the clustering of populations, and include road congestion, pollution and environmental degradation. However problems of congestion, pollution and inadequate infrastructure can be seen as problems of inadequate environmental pricing and inadequate urban planning rather than problems of population size per se.

The source of population growth also matters, partly because the age distribution matters. Between 1970 and 2000 immigration has contributed on average nearly 50 per cent of Australia's annual population growth and more than 50 per cent since 2000; for the year ended 31 December 2009 the immigration figure was 64 per cent, with 36 per cent coming from a natural increase.[38] A relatively high proportion of immigrants is of working age. At 30 June 2009, 76.3 per cent of the overseas-born population in Australia was aged between 15 and 65, compared with 64.5 per cent of the Australian-born population. This means that, in terms of the identity in (1), immigration tends to increase L/N which has a positive impact on living standards. In addition, the increasing proportion of skilled visa migrants is raising average labour productivity (Y/L). The Productivity Commission estimated that a 50 per cent increase in skilled migrants (on 2005 levels, amounting to another 39 000 migrants) over a 20 year period would increase income per capita by 0.6 per cent in total over the 20 year period—a small but nonetheless positive impact.[39] Again, however, this analysis says nothing about the distribution of the gains.

The effect of population growth via natural increase (fertility) is more complex because there are a number of potential feedback effects which are difficult to tease out. Lower fertility rates, for example, may boost human capital creation because parents can afford to spend

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38. Australian Bureau of Statistics, *Australian demographic statistics*, ABS, Catalogue 3101.0, viewed 7 November 2010, http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3101.0Mar%202010?OpenDocume nt; Productivity Commission, *Economic impacts of migration and population growth*, Final Report, April 2006.

39. 'Income' is close to GDP (currently about 5% less in Australia's case). An increase in income per capita would allow an equal increase in average living standards (C/N) for a given saving rate.

more on the education of each child, on average.[40] This suggests a negative relationship between fertility and human capital creation, which is reinforced through parents' human capital levels in that parents who have high levels of human capital face a high opportunity cost of having children which typically outweighs any positive income effect and therefore lowers fertility. This negative bi-directional relationship between fertility and productivity is supported by recent empirical evidence for Australia.[41]

These are just some of the many complexities in determining an optimal population growth rate for a country, which renders it essentially a futile exercise. So is the question of a country's 'carrying capacity'. This was recognised by the Jones Committee on Australia's Carrying Capacity which stated: 'There is no numerical population level beyond which the social fabric and environmental quality might be expected to go into precipitate decline'.[42]

Population policy

To say that population targets are futile is not to say that a population policy framework is futile. The economic implications of population ageing, urban and environmental planning, health, education and infrastructure development are all areas of public policy that are mediated by population. A population policy can guide and connect these decisions. The two chapters at the end of the third Intergenerational Report—'Climate Change and the Environment' and 'A Sustainable Society'—are a step in this direction.[43] State governments have regional plans (such as the South East Queensland Regional Plan) which could be integrated into a much broader national population framework.

Pronatalist policies

The closest Australia has come to population policies in recent decades is immigration targets and a set of family policies that have had an explicit pronatalist intent. The effect of immigration was discussed above, noting the Productivity Commission finding that immigration tends to have a small positive effect on income per capita. Pronatalist policies

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40.   G Becker, K Murphy and R Tamura, 'Human capital, fertility and economic growth', *Journal of Political Economy,* vol. 98, no. 5, 1990, S12–37.

41.   R Guest, and R Swift, 'Fertility, income inequality and labour productivity', *Oxford Economic Papers*, vol. 60, no. 4, 2008, pp. 597–618.

42.   B Jones, *Australia's Population Carrying Capacity*, Long Term Strategies Committee, Australian Parliament, Canberra, 1994. This Committee was under the auspices of the House of Representatives Standing Committee on Long Term Strategies chaired by the Hon Barry Jones. The population carrying capacity was described in the Terms of Reference as the 'population which can be supported in Australia within and then beyond the next fifty years, taking account of technology options, possible patterns of resource use and quality of life considerations'.

43.   Australian Treasury, *Australia to 2050: future challenges*, op. cit.

deserve mention because there is controversy as to their effectiveness in raising fertility, quite apart from other social or economic merits of such a policy objective.

Following forty years of almost continual decrease, Australia's total fertility rate (TFR) increased from 1.73 to 1.97 between 2001 and 2008.[44] The increase in fertility coincided with a range of new family benefits, including the popularly named 'baby bonus' in its various forms, an increase in the means tested 'family tax benefits', a tax rebate for child care costs, and 'parenting payments'. These and other forms of direct family assistance provided by the Australian Government amounted to the equivalent of two to three percent of GDP annually over the decade to 2006.[45] To the extent that family benefits lower the private costs of children, they can be expected to have at least some positive effect on fertility. Indeed a pronatalist effect was one aim of the baby bonus when it was first introduced.[46]

However, establishing the magnitude of the effect on fertility of such increases in family benefits has proved to be difficult, in Australia and overseas. International macroeconometric (economy-wide) studies tend to find a small effect of government policy on total fertility, in the range 1.2 to 2.3 per cent of a typical TFR (of 1.71) for feasible changes in an index of family benefits.[47] Lattimore and Pobke calculated that the increases in family benefits in Australia from 1998–99 to 2006–07 would have raised fertility by somewhere between 2.5 and 3.7 per cent over the period June 1999 to June 2007. Macroeconometric studies of this kind however do not pick up the effect of policies on the spacing and timing of births. Such 'tempo' effects tend to distort aggregate fertility measures such as the TFR. Indeed part of the increase in Australia's TFR in recent years is likely to be a tempo effect—a catch-up effect as women aged 30–39 have been giving birth at higher rates having delayed childbirth when they were younger.

Tempo effects are better captured in microeconometric (household level) studies. These studies tend to produce somewhat larger effects of family policies on fertility but there is more variability in the results. Drago et al. for example find that the baby bonus in Australia (up to 2006) had a small but statistically significant and positive effect on fertility intentions.[48] Guest and Parr conducted simulations of optimal fertility decisions of a typical

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44. ABS, op. cit.

45. R Lattimore, and C Pobke, *Recent trends in Australian fertility*, Productivity Commission Staff Working Paper, Commonwealth of Australia, Canberra, 2008.

46. P Costello, *Address to the media upon the release of the 2004 Federal Budget,* media release, Canberra, 11 May 2004; P Costello, 'Launch of the 2006 Census of Population and Housing', National Press Club, Canberra, 24 July 2006.

47. Lattimore, and Pobke, op. cit.

48. R Drago, K Sawyer, K Sheffler, D Warren, and M Wooden, *Did Australia's Baby Bonus Increase the Fertility Rate?,* Melbourne Institute Working Paper Series, Working Paper No. 1/09, 2009.

household.[49] They found that changes in family benefits can have both timing and quantum effects on fertility but that the increase in family benefits would have to be very large—larger than any increase that has been historically observed or indeed proposed—in order to induce the typical couple to have another child. Their simulations suggest improved child care affordability and/or availability may be more effective in promoting fertility than direct family payments.

The fact that these studies conclude that the baby bonus has such a small effect on fertility is perhaps not surprising given that, according to Lattimore and Pobke it represents only a 1 per cent (roughly) reduction in the lifetime costs for a first child for a typical family.[50]

Conclusions

This paper has looked at the economics of sustainable population through the role of population in economic development. Among the channels through which population affects economic development, the age distribution is arguably the most important—more important than the population growth rate itself. The search for a socially optimal population growth rate or target population level, or even a carrying capacity, is a futile exercise. There are simply too many uncertainties and unresolved issues—for example, what factors (social, cultural, environmental, economic) to include in social wellbeing and how to measure them, how to value the wellbeing of future generations, how to value contemporaneous gains and losses to various groups in society, economies and diseconomies of scale, the different effects of fertility and immigration as population drivers, and the importance of both the spatial and age distribution of the population in the transition from one population growth rate to another.

A more promising approach to population policy is to see population as a mediating factor in a wide range of public policy areas. The two chapters at the end of the third Intergenerational Report are a useful step in this direction—they consider the role of population in environmental policy and in achieving a sustainable society. Further work might include integrating state government regional plans, for example.

49.　R Guest and N Parr, 'The effects of family benefits on childbearing decisions: a household optimising approach applied to Australia', *The Economic Record* (forthcoming).

50.　Lattimore, and Pobke, op. cit.

References

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