

Unusual days in births and deaths

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With steady improvements in medical intervention, medical professionals and patients now have more control than ever over the timing of births and deaths. But what are the incentives for doctors and relatives? What are the implications for health policy makers? And what is implied about how individuals react to incentives more generally?

In the third century AD, Roman Emperor Marcus Aurelius told his readers that 'Death, like birth, is a secret of nature'. Yet in the ensuing centuries, medicine has done much to unravel the secrets of birth and death. Today, technological insights make it possible for doctors — and parents — to have an influence over when babies are born. Even more surprisingly, it seems that the timing of death may also be prolonged in special circumstances.

In a series of academic papers using daily data on births and deaths, we have been investigating various factors that affect the timing of the start and the end of life. In Marcus Aurelius's day, childbirth and death were as uncontrollable as the movements of the stars. But with the rise of birth inducements, Caesarean section procedures and medical intervention at the end of life, medical professionals and patients now have more control than ever over the timing of births and deaths.

As economists, our primary focus is on incentives. Incentives affect doctors, who might prefer not to deliver a baby on a weekend or during their professional conferences. Incentives affect parents, who might want their child to have an auspicious birth date, avoid an inauspicious birth date, or receive a financial incentive. And incentives affect relatives, who may decide that if the inheritance tax will be abolished tomorrow, it is a good idea to keep Grandpa healthy today.

In this article, we will feature some of the different types of 'unusual days' we have discovered. The investigation has important messages not only for health policy makers but also for understanding how individuals react to incentives more generally.

Unusual days — Type one: the millennium

We start with January 2000, commonly referred to as 'the new millennium'.² Figure 1 shows the pattern of conceptions (proxied by the birth rate nine months later), births and deaths. Relative to other Januaries, the first week of January 2000 saw an anomalous increase in conceptions (up 4 per cent), births (up

12 per cent) and, to a lesser degree, deaths. We can only speculate on the precise causes. An increase in the number of conceptions occurring in January 2000 could be caused by anything from an excess of millennial champagne to relief that the Y2K bug proved to be toothless. A rise in the number of births might be caused by the strategic timing of conception by

to stay alive longer or because they and their families agree to keep life support machines operating so that patients can catch the beginning of the new millennium.

Unusual days — Type two: weekends

The hormones that initiate uterine contractions and lead to childbirth take no account of the day of the

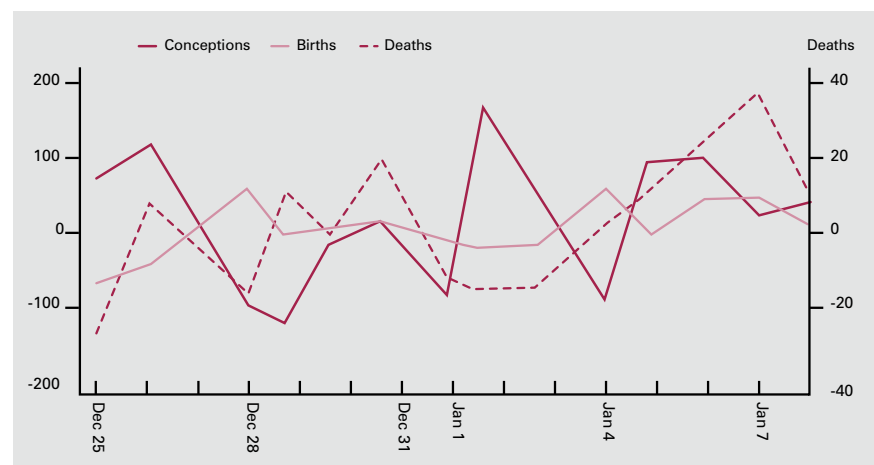
A rise in the number of births might be caused by the strategic timing of conception by parents in March–April 1999 but we think it more likely due to agreement between doctors and parents to shift the timing of medical inductions or Caesarean section procedures into the new millennium.

parents in March–April 1999 but we think it more likely due to agreement between doctors and parents to shift the timing of medical inductions or Caesarean section procedures into the new millennium. This notion of moving planned schedules is, in fact, a recurring theme as we demonstrate below. Deaths may be shifted either because patients will themselves

week. Therefore, if all babies were born without medical intervention, births would be evenly distributed across the week, meaning that 14 per cent (one-seventh) of births would occur on Monday, 14 per cent on Tuesday, and so on.

However, when we plot the actual distribution of births across the week, it turns out that fewer births occur

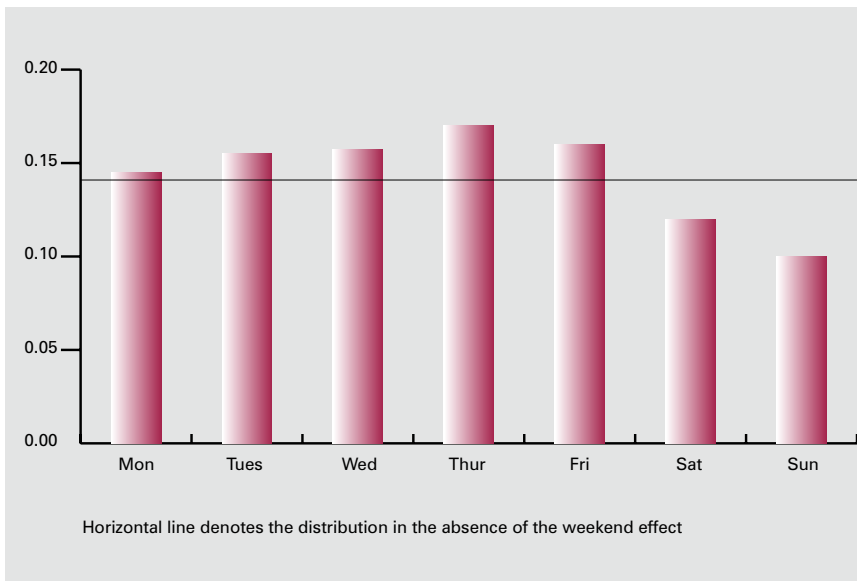
Figure 1: The Millennium Effect — Conceptions, Births and Deaths (December 25 1999 to January 2000)



Note: Conceptions are imputed from birth rates 266 days later.

on weekends and more on weekdays. Across a typical week, only 12 per cent of babies are born on Saturday, and only 10 per cent on Sunday. By contrast, the birth rate is higher than 14 per cent on most weekdays (Figure 2).³

Figure 2: Weekends — share of births



The likely reason for this pattern is planned birth timing. But whose preferences do these represent? Do parents really prefer to have their child born on a weekday rather than a weekend? This seems unlikely. Indeed, there are a number of reasons to think that a weekend birth is more convenient for parents: there is less traffic on the roads; most fathers do not need to immediately get time off work; and it is easier to find a babysitter to take care of younger siblings.

More likely, the move towards weekday births is caused by the preferences of doctors. Like most workers, it seems reasonable to think that obstetricians prefer to work on a weekday than on a weekend,

since working on a weekend typically means less time spent with their family and friends. The move away from weekend births may also be driven by hospital administrators, who typically receive a standard payment from the government or

Unusual days — Type three: obstetrics conferences

Annual conferences are an important part of a professional's career development. Along with regular professional development meetings, they provide an opportunity for practitioners to learn from international and domestic experts. The challenge is how to minimise the inevitable disruption that comes from professionals attending a major meeting. For academics, annual conferences are regularly scheduled during teaching breaks. For litigation lawyers, annual conferences are held while the courts are closed. But obstetricians are always 'on call'. So what happens when their annual conferences take place?

To examine this, we (with our co-author Elena Varganova) looked at the impact of obstetrics conferences on births.⁴ In Australia, we found that the birth rate fell by 4 per cent

Like most workers, it seems reasonable to think that obstetricians prefer to work on a weekday than on a weekend, since working on a weekend typically means less time spent with their family and friends. The move away from weekend births may also be driven by hospital administrators, who typically receive a standard payment from the government or private health insurance companies but have to pay weekend overtime to some staff members.

private health insurance companies but have to pay weekend overtime to some staff members. Another clue that leads us to think that the move away from weekend births reflects doctors' preferences is the third set of unusual days: obstetricians' conferences.

during the week of the obstetrics conference. (We also looked at the United States, where there is a smaller but still significant impact — a fall in births of around 2 per cent.) In both cases, we found some evidence of an increase in births during the week prior to

the conference, probably because obstetricians were scheduling a small number of inducements and Caesarean section procedures prior to the conference. Figure 3 shows the proportionate impact of Australian obstetrics conferences on births. This amounts to 116 births per year that are 'moved' because of the annual Australian obstetrics conference.

Given that most Australians (and Americans) have no idea when annual obstetrics conferences are held, it seems highly likely that the 'obstetrics conference effect' is driven by the preferences of doctors and hospital administrators, and not by expectant parents. It also provides supporting evidence for the hypothesis that the move away from

weekend births is caused by medical professionals rather than parents.

It is probably inevitable that annual obstetrics conferences will have some disruptive effect. But the natural way to minimise the impact of annual conferences on births would be to schedule them at a time of year when births are at a minimum. Using daily births data for 1990–2003, the line in Figure 4 shows the annual seasonal birth pattern for Australia, while the bars indicate days upon which the Royal Australian and New Zealand College of Obstetricians and Gynaecologists have held their annual scientific meetings. Although the numbers of births fall in late December and early January, conferences are never scheduled at this time of year. More surprising still, recent conferences have been held in October, the highest annual birth season. Fortunately, conferences in the next few years have been scheduled around April, a decision that is likely to lessen the disruptive impact.

Figure 3: The Effect of Obstetrics Conferences on Births

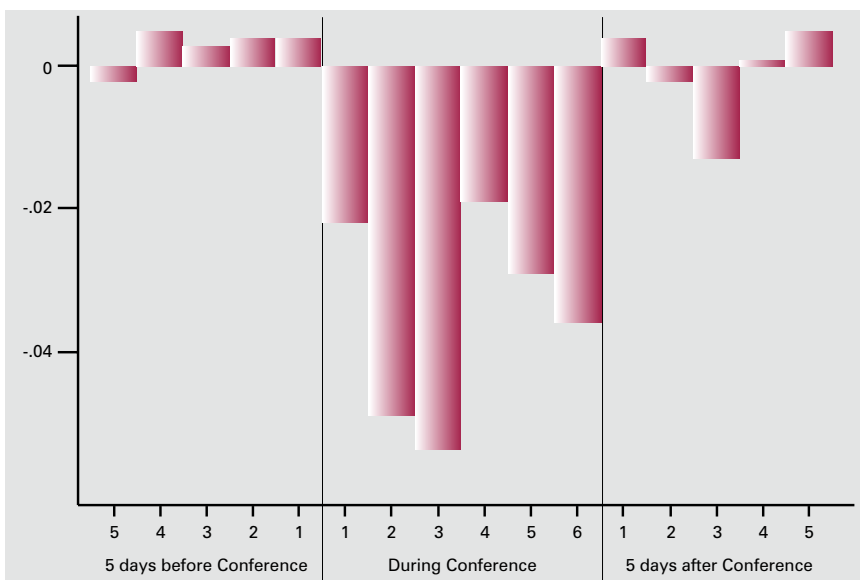
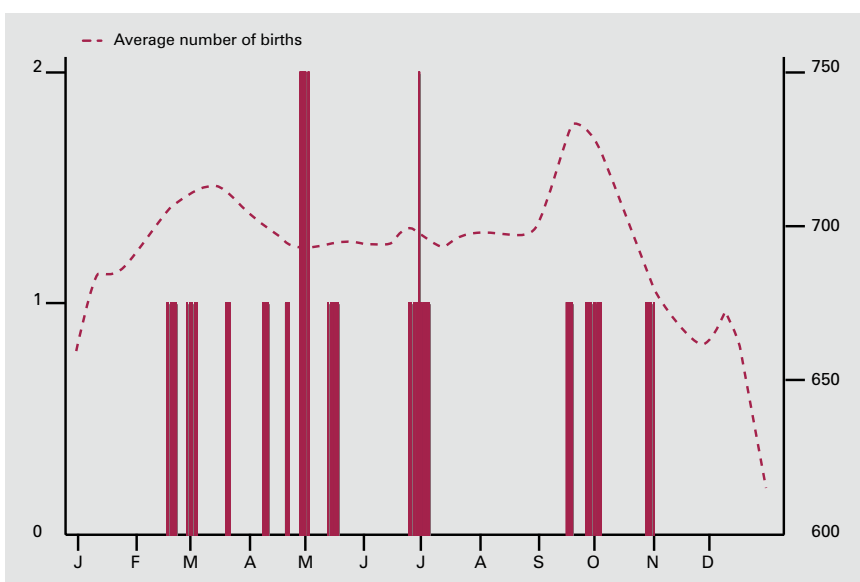


Figure 4: The Annual Birth Cycle and the Timing of Obstetrics Conferences



Unusual days — Type four: 29 February and 1 April

Significant decreases in births at the time of obstetrics conferences are almost certainly driven by doctors. By contrast, changes in birth rates on inauspicious dates are very likely to be driven by parents. Few doctors are superstitious enough to worry about delivering a child on 29 February or 1 April but plenty of parents are worried that their child may be disadvantaged by having a birthday on one of these two dates.

It is not difficult to envisage why parents might prefer to avoid having their child born on February 29

or April 1. Since February 29 only occurs every four years, people born on that date must celebrate their birthday on another date in non-leap years. Parents might, therefore, think

inauspicious weekday. The parents want the weekend. Who wins?

To test this, we compare the number of births when 1 April falls on a

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that their child would be better off being born on February 28. April 1 is an 'inauspicious' date, since parents might plausibly feel that being born on April Fool's Day has the potential to stigmatise the child at school, and in later life.

Using daily birth rate data, we found that in Australia about 11–16 per cent of births are shifted off those days each year. Moreover, the extent to which births are moved off February 29 and April 1 has grown in magnitude over time; presumably due to the increased use of planned birth procedures.

What is most interesting about this pure parental preference is that it may occasionally conflict with doctor preferences. Suppose that doctors are very reluctant to plan a birth procedure on a weekend, and parents do not want their child born on 1 April. Now suppose that 1 April falls on a Monday. If hospital space allows, both will be happy with Tuesday 2 April. But if this date is unavailable, the preferences of doctors and parents will conflict. The doctor wants the

Friday or Monday to the number of births when 1 April falls on another weekday. Our results indicate that doctors win about three-quarters of the time.⁵ Interestingly, we can reject the hypothesis that doctors have all the power in determining birth dates. This raises the intriguing possibility that parents may be able to persuade their doctors to move birth dates based on non-medical reasons.

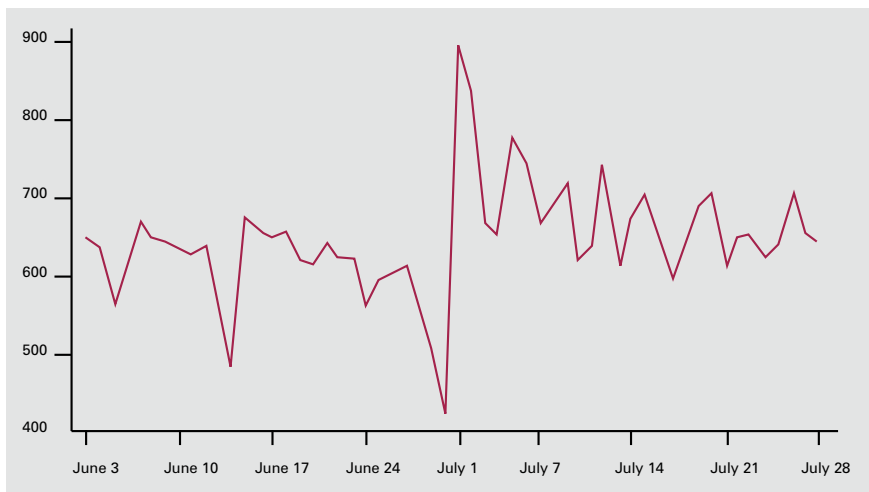
Unusual day — Type five: 1 July 2004

Daily births data for Australia are available for a 30-year period. Over this time, family size has shrunk as the population has grown, so the number of births has remained fairly constant (at around 600–700 births per day). Over the past 30 years (i.e. nearly 11,000 days), one date stands out: 1 July 2004 had the highest number of births. On that date, 978 babies were born.

The reason why so many babies were born on 1 July 2004 is not that there were more conceptions nine months beforehand. Instead, the rise in births in early July 2004 is a direct result of a symmetrical fall in births in June 2004. Figure 5 shows the trend in births over June and July 2004 (adjusting for the day-of-week effect).

The reason for this extraordinary shift in births from June to July 2004 can be traced directly to government policy. Parents of a child born at 12.01 am on 1 July 2004 were eligible

Figure 5: The Introduction of the Baby Bonus

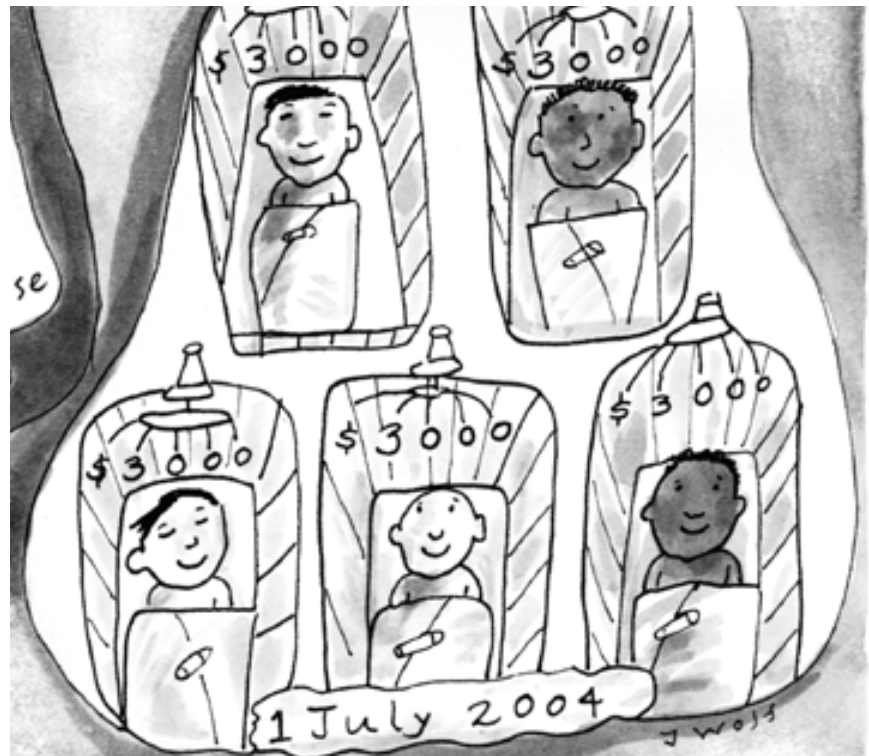


Note: Chart shows daily births for June and July 2004, controlling for day-of-week effects.

for a \$3000 Maternity Payment from the Federal Government (commonly called the ‘baby bonus’). Parents of a child born two minutes earlier were ineligible. Daily births data provide clear evidence that the introduction of this payment affected the timing of scheduled births.⁶

The reason that the baby bonus had such a disruptive effect on births can be traced back to the manner in which it was announced. The baby bonus was revealed by Treasurer Peter Costello in his budget speech on 11 May 2004 (the Treasurer later exhorted Australian parents to have ‘have one for mum, one for dad and one for the country’). However, as with most budget announcements, it would only take effect at the beginning of the next financial year: 1 July 2004. Most likely, Costello and his advisers thought that it was more important to follow standard government accounting procedures than to worry about the introduction effect. But as books such as Steven Levitt and Stephen Dubner’s *Freakonomics* have taught us, incentives — even seemingly small ones — can have a powerful effect on behaviour.⁷

The effect of making an announcement and delaying the policy was profound. We estimate that some 1089 births were shifted from June into July to take advantage of the baby bonus. Most of these (723 births) were shifted around a single week. However, we also found that some 366 births were shifted by more than a fortnight. Appearing on television on the evening of 1 July 2004, the then Health Minister Kay Patterson told an interviewer that she did not think



mothers would put their babies’ health at risk in order to receive the baby bonus.⁸ But the magnitude of the shifts leads us to wonder. Babies born in early July were significantly heavier than average, suggesting that their mothers may have waited too long to deliver them.

Two years later, on 1 July 2006, the Federal Government increased the baby bonus to \$4000. Despite pleas to the government to learn from the events of 2004, it refused to bring forward the increase, or slowly phase it in.⁹ Instead, the benefit increase again took place overnight, creating

Figure 6: The Abolition of Inheritance Taxes



Note: Chart shows daily deaths for June–July 1979.

a sharp incentive for parents to have a child on 1 July 2006 rather than 30 June 2006. It will be interesting to compare the size of the 2004 effect with the 2006 effect (if any).

Unusual day — Type Six: 1 July, 1979

Announcement effects of a tax reduction — or in this case, elimination — can also affect life decisions — or, in this case, end-of-life decisions. On 1 July 1979, Australia abolished federal inheritance taxes. In June 1979, large inheritances would have been subject to a tax rate that could be as high as 28 per cent. In July 1979, no federal inheritance tax applied. For very rich individuals, the abolition of Australian inheritance taxes was worth significantly more than \$3000. It is perhaps not surprising, therefore, that some people adjusted their behaviour accordingly.¹⁰

Figure 6 depicts the deaths by day in the last week of June and first week of July 1979. The fall in deaths in late June and rise in deaths in early July comes from individual deaths being



literally shifted between those weeks. Comparing 1979 with other years, we estimate that 5 per cent of deaths were shifted from the week before inheritance tax abolition to the week after. Since only 9 per cent of all descendants paid inheritance taxes, this indicates a very large response among eligibles. Indeed, our results imply that over half of those who would have paid the inheritance tax in its last week of operation managed to avoid doing so. We can only speculate as to how this 'shift' occurred.

Our estimates also have consequences for upcoming changes to estate tax laws in the United States. As

December 2009 to January 2010, while the second change should lead to some deaths being moved forward from January 2011 to December 2010.

Conclusion

With a large share of the government health budget devoted to maternal health and palliative care, a better understanding of patterns of births and deaths is important in its own right. Anticipating the disruptive impact of inauspicious dates, obstetrics conferences, increases in the baby bonus, or changes in inheritance taxes can help hospitals and doctors plan for changes in

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economists Wojciech Kopczuk and Joel Slemrod have shown, past changes in US estate taxes also have an impact on the death rate.¹¹ However, the legislated changes in the United States are particularly dramatic. Under current US law, the estate of an individual worth more than \$3.5 million will be taxed at a marginal rate of 45 per cent if they die in the final week of December 2009 but untaxed if they die in the first week of January 2010.

A year later, the change is scheduled to be reversed. Estates of those who die in the last week of December 2010 will be untaxed but large estates of those who die in the first week of January 2011 will be taxed at a marginal rate of 55 per cent. If the Australian experience is anything to go by, the first change should lead to some deaths being moved back from

workload. We hope that our research can better inform health policy in these areas.

But another reason for studying births and deaths is more general: they represent particular cases of more general problems that arise in a wide range of circumstances. Knowing the impact of the introduction of the baby bonus on childbirth patterns may be relevant for the introduction of other government policies. Observing how doctors and parents decide whether to schedule a planned birth on a weekend or an inauspicious day provides insights into professional/client relationships more generally. Understanding how obstetricians manage births during their annual conference is relevant for thinking about the scheduling of other professional conferences. And observing that death can be prolonged

to catch the millennium or avoid inheritance taxes teaches us that, with the right incentives, there is little that cannot be changed. n

ENDNOTES

- ¹ Marcus Aurelius, *Meditations*, IV, 5 (c.170–180 AD).
- ² Joshua S. Gans and Andrew Leigh 2006, 'The Millennium Bub', ANU CEPR Discussion Paper 531, Canberra, Australian National University. Technically, the millennium began in January 2001, but we focus on January 2000 because it received significantly more public attention.
- ³ Joshua S. Gans and Andrew Leigh 2006, 'Bargaining over Labour: Do Patients Have any Power?', ANU CEPR Discussion Paper 528.
- ⁴ Joshua S. Gans, Andrew Leigh and Elena Varganova 2006, 'Minding the Shop: The Case of Obstetrics Conferences', *mimeo.*, Melbourne.
- ⁵ Joshua S. Gans and Andrew Leigh 2006, 'Bargaining over Labour: Do Patients Have any Power?'.
- ⁶ Joshua S. Gans and Andrew Leigh 2006, 'Born on the First of July: An (Un)natural Experiment in Birth Timing', ANU CEPR Discussion Paper 529, Canberra, Australian National University.
- ⁷ Steven D. Levitt and Stephen J. Dubner 2005, *Freakonomics: A Rogue Economist Explores the Hidden Side of Almost Everything*, Morrow: New York.
- ⁸ Interview with Tim Lester, *7:30 Report*, ABC Television, 1 July 2004.
- ⁹ Sarah Price 2006, 'Doctors want premature start to baby bonus rise', *Sunday Age*, 25 June.



- ¹⁰ Joshua S. Gans and Andrew Leigh 2006, 'Toying with Death and Taxes: Some Lessons from Down Under', *The Economists' Voice*, Vol. 3, Issue 6; Joshua S. Gans and Andrew Leigh 2006, 'Did the Death of Australian Inheritance Taxes Affect Deaths?', *Topics in Economic Analysis and Policy*, Vol. 6, No. 1, Article 23.
- ¹¹ Wojciech Kopczuk and Joel Slemrod 2003, 'Dying To Save Taxes: Evidence From Estate-Tax Returns On The Death Elasticity,' *Review of Economics and Statistics*, Vol. 85, no. 2, pp. 256–265.

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