Is the fertility response to the Australian baby bonus heterogeneous across maternal age? Evidence from Victoria.

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19. November 2012

IS THE FERTILITY RESPONSE TO THE AUSTRALIAN BABY BONUS HETEROGENEOUS ACROSS MATERNAL AGE? EVIDENCE FROM VICTORIA.

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October 2012

ABSTRACT

The Australian baby bonus, offering parents $3,000 on the birth of a child, was announced on May 11 2004. The focus of this paper is to analyse the response to the policy across maternal age levels in order to separate policy effects from prevailing demographic trends such as recuperation of previously postponed births. Using multivariate time series analysis, we find that all age groups except teenagers show a positive fertility response to the policy. The results suggest that the policy may have elicited fertility behaviour change, evidenced by a higher cumulative growth in fertility of maternal age groups 20-24 and 24-30 which is sustained past 2008 even as a growth in birth ratios of older age groups was stabilising. A short term birth timing effect was also estimated to further explore the extent to which incentives matter for decisions around family formation.

Keywords; Baby bonus, fertility, family policy, postponement, recuperation, age specific fertility, STAMP

JEL codes: J11,J13,J18

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INTRODUCTION

Australia, like most developed countries experiencing below replacement fertility levels, has observed a significant ageing of women commencing child bearing and rearing. Fundamental changes in society such as rising education and employment opportunities for women, coupled with greater access to the contraceptive pill, saw women in the mid 2000's more likely to be having children in their early thirties, as opposed to their early 20's, as was the case in the 1960's (ABS 2012). The Australian total fertility rate[2] (TFR) was also declining over this time period and in 2003 the TFR was 1.75, having been below replacement level (2.1) for 28 years (ABS 2011).

Low fertility rates may be a reflection of an inability to achieve desired family size due to an array of constraints including financial, work and partner related, fecundity and not necessarily "for the lack of wanting kids" (Weston et al. 2004). It is estimated that if couples could achieve their desired fertility rate in Australia, the fertility rate would be at, or close to replacement (2.1) (Gray et al. 2008; Holton et al. 2011). This gap between observed and desired fertility, coupled with governmental concerns about structural ageing provides some rationale for the introduction of a birth subsidy policy, reducing financial barriers to desired fertility.

In May 2004 the Australian Government announced the introduction of a universal maternity payment, better known as the baby bonus[3]. The federal government initially paid each mother a lump sum payment of $3,000 for each child born after 30th June 2004, which was increased in July 2006 and July 2008 to $4000 and $5000 respectively[4]. Since the policy introduction

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[2]" The total fertility rate (TFR) represents the number of children a female could expect to bear during her lifetime if she experienced current age specific fertility rates at each age of her reproductive life' (ABS 2012) Catalogue 1367

[3] Refer to table one for a schedule of payments from its introduction in 2004 through to 2009. The maternity payment later called the "baby bonus" replaced two birth subsidy programs, one which was means tested and the other which worked through the taxation system. The maternity payment of $842 was limited to those women on modest incomes while the maternity allowance, which was characterized by low utilization rates, functioned as a delayed tax rebate over a five year period and most benefitted those women on higher incomes in the year prior to maternity leave. See Gans and Leigh (2009) for a more detailed review.

[4] Other significant changes include a change in payment format. From January 2007, payment was made in 13 installments to those mothers aged less than 18. In addition, from January 1 2009 the Baby bonus was payable in installments to all age groups in addition to being means tested if the total family income equaled $75,000 or less, in the first 6 months following the birth of the child.

Australia has observed a turnaround in the decline in period fertility measures with a TFR of 1.89 in 2010.

Extending a baby bonus policy impact analysis presented in an earlier paper by Sinclair et al. (2012), this paper uses Victorian birth data to identify whether there has been any heterogeneous response to the baby bonus policy across maternal age groups. In doing so, it is possible to begin to separate the policy effects from prevailing demographic trends such as postponement and recuperation. This is important, as recuperation of previously postponed births is often cited as the driving force behind the observed increase in the TFR in the years following the policy introduction (Parr and Guest 2011).

The maternal age specific responses to the incentives of the baby bonus are explored using Victorian population data, sourced from the Victorian Perinatal Data Collection (VDPC)[5] and analysed using multivariate structural time series modelling, known as seemingly unrelated time series equations (SUTSE) (Harvey 1991).

BACKGROUND

Policies that change incentives to childbearing can induce a number of fertility effects. Firstly a birth subsidy may increase quantum or level of fertility and secondly it can influence the timing of births, inducing 'tempo' effects such as recuperation or anticipation. Period fertility measures often reflect an interplay between quantum and tempo fertility (Sobotka 2003)[6]. Finally, a short term birth timing effect, where, when possible, parents move birth dates to be eligible for the policy payment, has also been explored by Gans and Leigh (2009).

In the last couple of decades, many OECD countries have experienced changes in fertility patterns due to childbearing postponement and recuperation effects, demonstrated by the fertility rates of younger and older women moving in opposite directions (D'Addio and d' Ecole 2005).[7] Correlation in the decline of TFRs with a delaying of motherhood suggests that fertility postponement may be a causal factor of longer term fertility decline. This relationship

[5] http://www.health.vic.gov.au/ccopmm/vpdc/index.htm

[6] Tempo effects are non-neutral in the longer term and can generate a positive fertility momentum (Lutz and Skirbekk 2005). More policy-induced births today may also positively impact on the number of births in future generations through echo effects.

[7] There are two components of period fertility: Quantum which is underlying fertility and tempo which captures changes in the timing of births (Testa et al. 2011)

between later commencement of childbearing and completed fertility, depends on the levels of recuperation of postponed births. The implications of postponement on completed fertility are most severe if postponement leads to foregone births, due to the fact that older mothers face higher risks of reduced fecundity, infertility and childlessness (Leridon 2010). Interestingly a study of EU member states by Van Nimwegen and Beets (2009) estimate that a stop in postponement would raise completed cohort fertility by 10%. However, the correlation between increasing average age at first birth and declining completed fertility does not hold in all cases, with countries such as Denmark and France observing later ages to childbearing but strong recuperation (Testa et al. 2011; Bratti and Tatsiramos 2010).

Recently in Europe there are some signs of fertility recovery or stabilisation although there are differential effects across countries (Hoorens et al. 2011)[8]**.** It is suggested that differences in family policy provisions across countries may be driving the differential fertility outcomes (Kwalwij 2010). As stated by Hoorens (2011), the extent to which policy has impacted on fertility rates in Europe over this period are uncertain, complicated by policy interventions not being uniform, and the stabilisation of decline in fertility rates at younger maternal ages (Hoorens et al. 2011).Where fertility behaviour is changing, the effects are most pronounced for younger age groups. Where behaviour is not changing there will be age specific effects driven by the momentum of past changes in behaviour, such as the recuperation of previously postponed births (McDonald and Kippen 2007). This importance of identifying an age specific policy response is reiterated by McDonald and Kippen (2007) who state that "A reversal of a trend…. should affect all groups simultaneously but should have a larger impact for more recent cohorts" (McDonald and Kippen 2007).

Microeconomic theory predicts that individuals respond to incentives and thus cash subsidies would increase fertility (Becker 1965; Becker and Barro 1988). Underlying this relationship is the assumption that parents, in general, make rational choices about the timing and number of children they have within a cost – benefit framework. A subsidy to lower the cost or "price" of children would be expected to increase the quantity demanded of children and this would be reflected in higher birth numbers.

[8] Bongaarts and Sobka (2010) attribute the recent rises in European fertility to a slowing of the pace of fertility postponement, inevitable given the natural fertility age limits

Fertility behaviour is a function of the direct costs of children, but also the opportunity cost in terms of loss of income, career progression and or education (capital investment) possibilities due to childbearing. The interaction of these social and economic variables is complex, for example rising female labour participation rates, less gender specialisation, and higher human capital investment and wages for women represents rising family incomes yet a higher opportunity cost to childbearing[9]. Women with strong attachments to the labour force can benefit by delaying births to minimize the effect of forgone wages and foregone human capital accumulation. Indeed Miller (2009) finds that delay of motherhood leads to increase of lifetime earnings of 9% per year, hence higher opportunity costs to childbearing at younger age drives postponement (Miller 2009).

The first contribution of this paper is to identify if Victorian women of different age groups react differently or simultaneously to the policy and in doing so separate policy induced fertility outcomes from underlying demographic trends such as postponement and recuperation effects.

The second contribution of this paper, is to identify if the policy induced an age specific short term birth timing effect. Gans and Leigh (2009) estimate that due to the anticipated introduction[10] of the baby bonus policy that over a 1000 births were "moved" to ensure eligibility for the payment in July 2004 (Gans and Leigh 2009). This parental response to economic incentives is observed in the analysis presented in an earlier paper by Sinclair et al (2012). In this paper the previous analysis is extended to determine the existence of a heterogeneous short run birth timing response to the policy introduction across maternal age groups (Sinclair et al. 2012).

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[9] Studies have documented that the correlation between TFR and female labour force participation changed sign since the 1980's where female labour force participation more recently is associated with a positive effect on fertility (Ahn and Mira 2002; Thévenon and Gauthier 2011)

[10] The introduction of the policy was announced on the 11th May 2004 and introduced 1 July 2004

EMPIRICAL LITERATURE REVIEW

Given the predicted adverse social and economic consequences of low fertility, primarily due to high dependency rates of future generations, governments worldwide have been examining policy options to help families achieve their fertility preferences. According to Bongaarts (2008) policies will be most likely to succeed if they focus on closing the gap between actual and ideal period fertility[11]. In line with Lutz and Skirbeck (2005), Bongaarts (2008) advocates that policies which reduce or reverse tempo effects can have substantial impacts on future dependency ratios (Bongaarts 2008).

Empirically, there is mixed evidence on the impact of policy measures on both the timing and quantum effects of fertility. Hoorens et al (2011) in their analysis of European fertility, concede that policies can have an effect on reproductive behaviour although individual policy effects can be small (Hoorens et al. 2011). The policy fertility causality is complex and difficult to quantify especially when comparing across countries where policy, economic and social contexts vary (Gauthier 2007). A review of empirical evidence linking family policies and fertility by Gauthier (2007) generally finds small positive effects on fertility. Gauthier points out the complexity of the fertility decision making process and the resulting need to isolate the impact of policies from other possible determinants. Indeed a more recent paper by Gauthier and Thevenon (2011) suggests that the impact of policies on fertility is often underestimated due to the difficulty in assessing the long term effects.

Luci and Thevenon (2012) identify a positive effect of "in cash" benefits in the year after childbirth when considering the policy of 18 OECD countries from 1982 to 2007. They also identify that fertility reacts in a time delayed manner to the changes in the policy environment. An often cited paper by Gauthier and Hatzius (1997) simultaneously considers cash benefits and maternity leave. Their results found the decision to bear a child was affected by "its direct cost which is lowered by the government subsidy, but not by the opportunity costs involved in taking time off work"(Gauthier and Hatzius 1997). An earlier paper by Buttner and Lutz (1990) examines the fertility impact of a pronatalist policy in the German democratic republic in 1976 – a policy aimed at obtaining replacement fertility in the longer term. The dependent variables used in this case are age specific fertility rates, and a comparison of fertility rates pre

[11] Ideal family size is the most commonly used preference indicator, and is derived from answers to questions about ideal or desired numbers of children in opinion surveys

and post the policy indicate that the period fertility rate responded well to the policy. Policy impacts are inferred from the changes in maternal age patterns of fertility. Relative stability of maternal ages across parities were interpreted as a signal that observed increases did not just reflect anticipation of births which would be offset by subsequent decreases. (Buttner & Lutz 2010)

The linkage between financial incentives and fertility in Israel is explored by Cohen et al (2007). Constructing an individual level panel data set over the period 1999 to 2005 they test the price effect of child subsidy changes (reduction in 2003). The subsidy changes were most significant for third and higher parity children and their analysis suggests that policies that lower the marginal price of a child are effective in raising fertility over a short time horizon (Cohen et al. 2007). Laroque and Salanie (2008) using French data find that fertility is sensitive to financial incentives for the first and third births but not so for the second birth. Other positive policy effects were identified by Castles (2003) and d'Addio & d'Ercole (2005) analysis of total fertility rates across OECD countries find that fertility rates are higher where direct costs of children are lower. Thevenon and Luci (2012) find that while a financial transfer in the year of birth has a positive fertility effect, it is not the most effective policy lever.

A policy implemented in the Canadian province of Quebec between 1986 and 1997 that paid families up to $8,000 for having a child[12] provides a natural experiment in fertility choice and has been the topic of a number of empirical studies. This policy like the Australian baby bonus, was a generous universal cash payment, however it differed in that the payment increased across parities. Milligan (2005) finds evidence that the policy achieved its goal of increased fertility and attributes 93,000 births to the policy over the ten year period. Preceding Milligan (2005), Duclos, Lefebvre and Merrigan (2001) find that family benefits do have an effect on fertility rates, in particular providing strong incentive to give birth to a third child in Quebec.

There has yet to be a detailed study of the effect of the baby bonus on Victorian fertility choice in particular across age, however there has been much academic interest in the Australian policy outcomes.

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[12] The Allowance for Newborn Children, gave a payment of $500 for a first child and up to $8,000 for a third.

Drago et al. (2010) make use of HILDA[13] household panel data to assess if the baby bonus increased fertility *intentions* and thereby births, and if the effects were temporary or sustained. Their analysis included variables that capture the opportunity cost of birth such as labour force status, education and income. They found that fertility intentions rose after the announcement of the Baby Bonus, and the birth rate was estimated to have risen modestly as a result.

Risse, (2010) also analysing HILDA data finds that the baby bonus positively affects household fertility intentions. Interestingly, this effect is particularly pronounced for women aged 25 to 34 when compared to other age groups in the year of the policy introduction. In the subsequent years 2005 and 2006, intentions rise for those women aged 25-44 however annual fluctuations in growth of childbearing intentions are observed across age categories.

Regional specific impacts of the policy have been analysed for NSW (New South Wales) and WA (Western Australia). However, the papers of Lain et al (2009) using NSW data and Langridge et al (2010) in WA found conflicting effects on maternal age specific fertility. In NSW (Lain et al. 2009) the largest change relative to the pre policy trend in births was found to be teenagers, although proportionally the largest increase was in those women aged 30 and over, whilst in WA, Langridge et al. (2010) find no significant difference in response across maternal age groups.

Gans and Leigh (2009) have analysed the short term birth timing effects of the introduction of the policy. Illustrating that economic incentives matter for fertility related decision making, they conclude that up to 1,000 births (primarily discretionary caesareans) may have been delayed as a result of the introduction of the baby bonus. Based on similar analysis of the 2006 baby bonus increase, they conclude approximately 600 births were delayed in this instance (Gans and Leigh 2007). Other examples of short term birth timing effects induced by policy related economic incentives include Tamm (2009), Neugart and Ohlsson (2012), and Kuhn and Brunner (2011).

While the aforementioned research demonstrates empirical evidence of a positive impact on fertility, a paper by Parr and Guest (2011) raises questions about the co-incidence of

[13] Refer to Wooden and Watson (2007) for a detailed description of the Household, Income and Labour dynamics in Australia Survey (HILDA).

Australia's observed fertility increase and policy initiatives[14]. The authors attempt to disaggregate family policy effects from socio demographic trends and stress that Australia's increase is not unique in the context of other OECD countries[15]. They suggest that the contribution of the baby bonus to increased fertility has been small and that a range of socio demographic variables such as the interaction of age and parity, primarily structural tempo distortions, but also education, marital status, income and occupation were more significantly impacting on fertility (Parr and Guest 2011).

DATA AND METHOD

The data used is Victorian perinatal data from January 1983 – December 2008. Victoria is Australia's most densely populated and urbanised state, with an estimated population of 5.6 million in 2012[16]. It is among the fastest growing and more diverse societies in Australia (ABS 2012) and has been subject to postponement transition[17]. Data was sorted according to maternal age, and births ratios were generated using Victorian population estimates for women aged between 15-44 (ABS 2010). The age specific birth ratios[18] (ASBRs) are categorised according to the following age groups: 15-19, 20-24,25-29, 30-34, 35-39,40-44 .

The times series generated are shown in Figure 1: Age specific Birth Ratio's – Victoria 1983 – 2009

FIGURE 1: VICTORIAN AGE SPECIFIC BIRTH RATIO'S

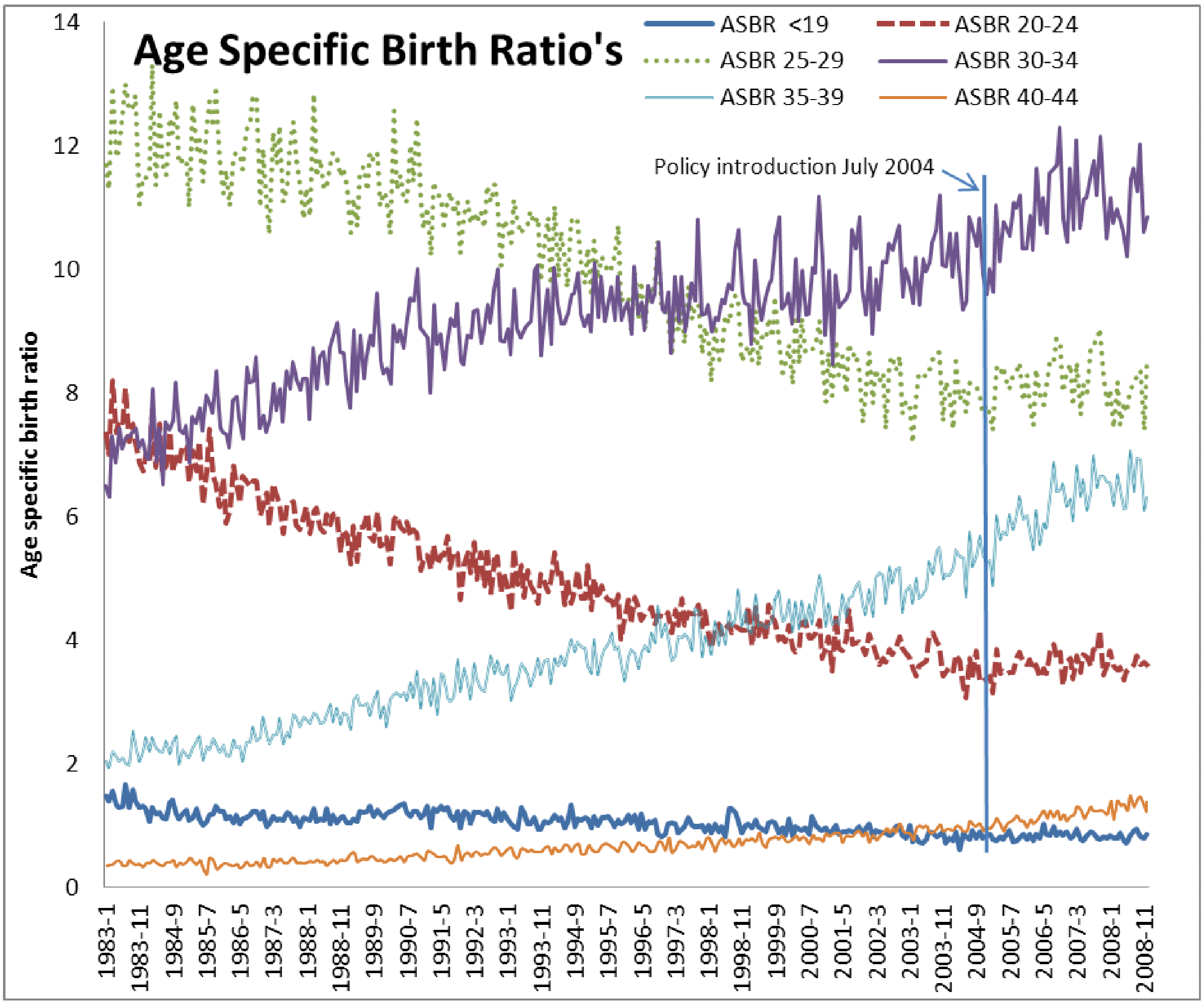
[14] The analysis by Parr and Guest uses data from waves 1-7 of the Household Income and Labour Dynamics survey in Australia (HILDA). Wave 7 was collected in 2007 providing three years of post-policy introduction sample data

[15] However, it could be argued that other OECD countries experiencing fertility rebounds are doing so as the result of family policies.

[16] http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0

[17] The typical women giving birth in 2008 was 4 years older than her counterpart in 1985 - Births in Victoria 2007 2008 (CCOPMM, 2011)

[18] Defined as the monthly number of births to women if a particular age group per 1000 women of that age group.

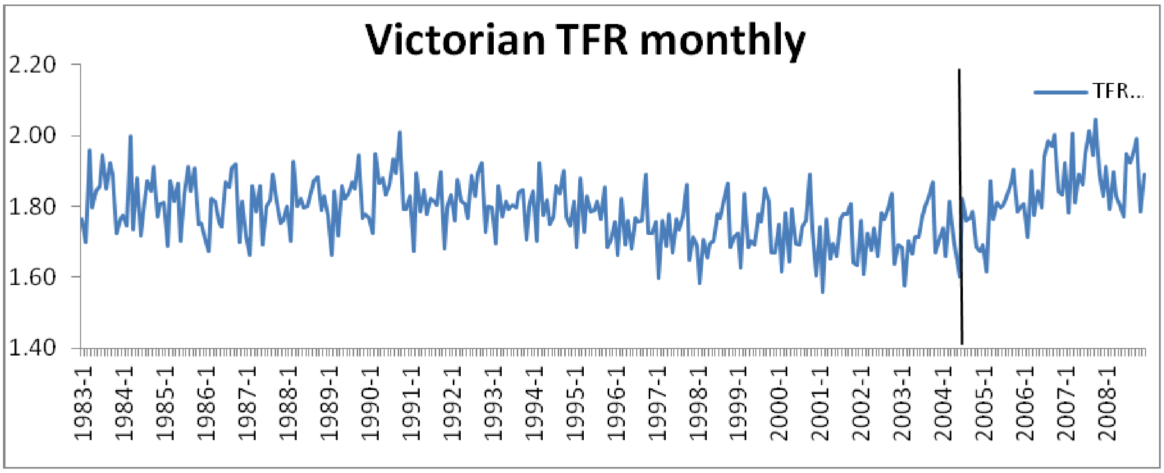


Source: VDPC Perinatal Birth data AND ABS estimated Victorian annual population data. Cat: 310104 2009. *Note the ASBR is calculated as the number of births to women of a given age category as a proportion of estimated female population in that age category.

By visually inspecting the series a few key features can be noted post the policy introduction. Firstly there is a general downward trend in teenage births over the period and this does not appear to change post July 2004. Also it can be observed that there is a general upward trend in those women having children aged 40 and over but this trend does not appear to change greatly after the baby bonus introduction. Following the policy introduction on July 2004 the decline in the births per 1000 of women aged 20-24 and 25-29 appears to stabilise. Historically we can observe a growth in the trend of the series relating to women aged 30-34 but post 2004 this growth appears to strengthen**.**

To give a general overview of Victorian fertility trends, the TFR can be calculated using the generated age specific births ratios.

FIGURE 2 VICTORIAN TOTAL FERTILITY RATE



Source: The TFR as shown here is generated using ASBR calculated from VDPC perinatal data.

Following the policy introduction in 2004 an increase in the Victorian TFR can be observed. However, the TFR has limitations because if women are progressively giving birth at older ages the TFR measure will be too low and if this postponement is slowing it may result in period TFR measures which are too high (Ni Bhrolchain 1992).

To formally test the age specific impact of the baby bonus a multivariate state space model is employed. The model is referred to as seeming unrelated time series equations (SUTSE), a multivariate generalisation of standard structural time series models. For a N-vector of age specific birth rates at time t, denoted as y_t, the model takes on the form:

$$y_t = \mu_t + \gamma_t + \Theta X_t + \Phi Z_t + \varepsilon_t, \qquad \varepsilon_t \sim \text{NID}(0, \textstyle\sum_{\varepsilon}^{2}), \qquad (1)$$

$$\mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t, \qquad \eta_t \sim \text{NID}(0, \textstyle\sum_{\eta}^{2}), \qquad (2a)$$

$$\beta_t = \beta_{t-1} + \varsigma_t, \qquad \varsigma_t \sim \text{NID}(0, \textstyle\sum_{\varsigma}^{2}), \qquad (2b)$$

$$\gamma_t = \sum_{j=1}^{s/2} \gamma_{j,t},$$

$$\begin{bmatrix} \gamma_{j,t} \\ \gamma_{j,t}^{*} \end{bmatrix} = \begin{bmatrix} \cos\lambda_j & \sin\lambda_j \\ -\sin\lambda_j & \cos\lambda_j \end{bmatrix} \begin{bmatrix} \gamma_{j,t-1} \\ \gamma_{j,t-1}^{*} \end{bmatrix} + \begin{bmatrix} \varpi_{j,t} \\ \varpi_{j,t}^{*} \end{bmatrix}, \qquad \varpi_t \sim \text{NID}(0, \textstyle\sum_{\varpi}^{2}). \qquad (2c)$$

Equation 1 is often referred to as the observation equation whereas (2a-c) are denoted as the component or state equations. The inter-relationships are captured through the NxN variance covariance matrixes denoted as ∑ (Harvey 1991).

This is an extension of the modelling technique applied in Sinclair et al. (2012) and while one could simply model each ASBR series individually, by extension to a multivariate analysis the dynamic interactions between the series can be captured.

The bolded characters denote N-Vectors, here N denotes the number of the series. In particular y_t denotes a vector of observations at time t (for example age specific monthly birth ratio's). The term Z_t denotes a set of explanatory variables, while X_t represents the set of policy intervention variables at time t. The terms μ_t, β_t and γ_t denote vectors of trends, growth and seasonal rates at time t. The association between the series is captured by the off-diagonal elements of the various (NxN) ∑ matrices. The trend (equations (2a) and (2b)) is made up of two components, μ_{t-1} and β_{t-1}, where β_t captures the growth rate in the series and μ_{t-1} the level. The seasonal component is captured in equation 2c. Both disturbances (ε_t, and η_t,) are assumed to be normally disturbed with a zero mean and constant covariance matrix. The disturbances are assumed to be strictly independent (Koopman et al. 2006).

The coefficients Θ and Φ measure the direction and size of the explanatory and policy intervention variables respectively. By including a set of policy intervention variables it is possible to measure the departure from the underlying trend[19] in fertility rates coinciding with

[19] Note the *underlying trend* is a general term referring to the whole data generating process as depicted by all equations of the structural time series model excluding the term ΦZ_t.

the introduction and subsequent modifications in the baby bonus policy (see Table 1 for a timeline of significant policy events which informs policy intervention dates).

TABLE 1 TIMELINE OF EVENTS

11 May 2004	Announcement of the introduction of the baby bonus policy
1 July 2004	Policy introduced – $3,000 (indexed to inflation)
1 July 2006	The baby bonus increased to $4,000(indexed to inflation)
1 January 2007	All mothers under the age of 18 received the payment in 13 equal instalments
1 July 2008	The Baby bonus increased to $5,000/ paid in 13 equal instalments to those less than 18 and a means tested ceiling of combined annual income of $150,000 or $75,000 in the 6 months post the birth of the child.
1 July 2009	Means tested baby bonus paid to all families in 13 equal instalments

Source: **FaHCSIA – Family Assistance Guide: Chapter 1.2 version 1.1.55 (2012)**

The approach stated above can measure structural changes in the ASBR series that correspond to the policy introduction while controlling for other determinants of fertility choice. While it is difficult to identify a counterfactual, particularly when there may be certain demographic changes which may or may not be influenced by the policy, a consideration of changes in the age specific birth does assist in separating policy effects from prevailing demographic trends such as recuperation of previously postponed births (Bongaarts and Sobotka 2012). Furthermore, while a natural age cap on fertility may cause the postponement process to slow, this would be reflected in incremental changes in the ASBR series being modelled. The methodology used to capture structural changes induced by baby bonus will model the changing fertility behavioural patterns in the underlying trend.

Two models are developed and tested. The first tests a series of policy specific impulse intervention variables which capture any discretionary change in the timing of births around introduction, increments or change in payment format. Changes in the trend in any of the

ASBR series i.e., in the level and or slope will be captured by intervention or impulse variables in the state equations. The second model will extend the analysis to include explanatory variables to capture fluctuations in economic conditions, expectations and the structure of the labour force.

In the first model, age specific birth ratios are the dependent variables. Age specific fertility effects are captured by extending the methodology used in Sinclair et al (2012). A structural break in the level of the series is tested for in March 2005 approximately ten months post the policy announcement. The national debate surrounding the baby bonus introduction served to heighten the impact and awareness of the policy to the general public. The combination of ongoing media discussion and also the potential of a social multiplier effect, could result in more delayed effects, therefore a growth in the series is tested in January 2006. It would seem reasonable to expect that some of the growth in the series may slow as the initial informational impacts and the initial rise in births from changed tempo effects slowed (bringing forward of births) and so a change in the cumulative growth of the ASBR series is tested for in January 2008 .

The impulse variables relate to the birth timing effects identified by Gans and Leigh (2009). The relevant dates are June 2004 and July 2004. As the policy has been modified on several occasions (the first of these was an additional increment of $834 on July 1 2006 bringing the Baby bonus to $4,000) impulse variables in June and July 2006 are also modelled for each age group.

The analysis extends the Gans and Leigh model to identify if there are any age specific short term birth timing responses. Due to concerns about teenage mismanagement of funds, in January 2007 the baby bonus was changed from being paid in a lump sum to being paid in instalments for teenagers. Given the change in incentives, impulse variables are included in the model in December 2006 and January 2007 to capture any short run changes to timing of births for the teenage age group only.

RESULTS AND DISCUSSION

TABLE 2: RESULTS MODEL 1

Table 2 Coefficient Estimates and Selected Diagnostics						
Age specific birth rate (ASBR) (births per 1,000 females of given age category)	ASBR <19	ASBR 20-24	ASBR 25-29	ASBR 30-34	ASBR 35-39	ASBR 40-44
Dependent variable	Co-eff(p)					
Outlier 2004(6)	0.02	-0.43**	-0.07	-0.43	-0.39**	-0.05
	(0.80)	(0.04)	(0.80)	(0.12)	(0.04)	(0.46)
Outlier 2004(7)	-0.09	-0.01	0.08	0.54*	0.47**	0.12*
	(0.25)	(0.95)	(0.77)	(0.05)	(0.01)	(0.06)
Outlier 2006(6)	0.01	-0.05	0.08	-0.18	-0.10	-0.00
	(0.88)	(0.79)	(0.78)	(0.52)	(0.60)	(0.93)
Outlier 2006(7)	-0.07	0.04	0.18	0.40	0.06	0.13**
	(0.38)	(0.81)	(0.55)	(0.16)	(0.75)	(0.04)
Outlier 2006(12)	0.02					
	(0.79)					
Outlier 2007(1)	-0.09					
	(0.26)					
Level break 2005(3)	-0.008	0.18 *	0.42**	0.43**	0.45***	0.06**
	(0.87)	(0.08)	(0.01)	(0.01)	(0.00)	(0.01)
Slope break 2006(1)	0.001	0.02***	0.02**	-0.00	0.01*	0.006***
	(0.72)	(0.00)	(0.04)	(0.63)	(0.09)	(0.00)
Slope Break 2008(1)	0.003	-0.02	-0.03	-0.03*	-0.04***	0.00
	(0.66)	(0.24)	(0.20)	(0.09)	(0.00)	(0.49)
Normality *	2	0.52	0.93	1.98	15.83	2.31
Heteroskedasticity (2 sided F test) (distributed as F(h,h), with df=96	0.505	0.72	0.59	1.64	2.1	1.63
Durbin-Watson statistic	1.91	1.91	1.77	1.92	1.91	2.16
Piortmanteau Box-Ljung Q-statistic	25.11	19.81	28.71	36.16	22.18	28.65
R^2	0.45	0.48	0.43	0.48	0.53	0.59

*The critical value for the Normality test (where null corresponds to normality) is 5.99 (c^2_2; Koopmans et al 2006, 201) thus indicating the residuals are normally distributed. The p-value for Durbin Watson is 0.41 which indicates autocorrelation is not present (Harvey 1990).

* p=0.10; ** p=0.05; *** p=0.001

Fertility choice effects of the policy were initially modelled by fitting a structural break to the level of the ASBR series approximately 10 months after the policy announcement. The fertility response to the policy (as captured by the level break in 2005) is positive and consistent across all maternal age groups, except teenagers. As discussed above, McDonald and Kippen (2009) state that in order to identify behavioural change with respect to fertility choice, a policy would need to have an impact across all groups, with a stronger effect on those in the younger age groups. The most striking result to emerge from the data is that there is a significant positive structural break in the level of the series for women aged less that 30 (except teenagers). The suggestion that the policy has driven behavioural change is therefore supported by the positive cumulative growth in birth ratios for these younger groups, the coefficients of which are greater than that of older age groups. The results above suggest that the policy may have elicited behaviour change and may have acted as a catalyst in slowing of postponement. A slowing of postponement is a key factor in stabilising fertility levels.

A clear pattern of change is also shown for the age groups over 30. Older maternal age groups exhibit a positive response to the policy, and a significant positive shift in the level of the series is observed. The coefficient representing births to those women aged 40-44 is smaller than that of the younger age groups but this may be due to the fact that although the fertility intentions may have increased in response to the policy, fecundity constraints maybe reduce the probability of a positive outcome or birth. It is interesting to note that there is a slowing of growth in the birth ratios of older mothers that is not observable in the younger age groups after 2008, so the cumulative growth in total birth ratios during this period is driven by births to women in younger age groups.

Although it is difficult to establish an exact counterfactual, any slow moving changes in demographic patterns are incorporated into the trend analysis and therefore the methodology ensures that the policy intervention variables capture effects over and above slower moving demographic trends. Unless the move to an end to postponement is sudden and exactly contemporaneous to our policy intervention dates we can interpret the findings above as policy induced

The short term birth 2004 introduction effect exhibits some heterogeneity in response across maternal age. This discretionary birth timing effect is found to be most significant in the older age groups particularly those women aged 35-39. An abnormal increase in births is observed in July for all maternal ages over 30. Although these increases are matched by a significant decrease in June for the 35-40 year old only, negative signs are observed on the coefficients of both the 30-34 and 40-44 age groups.

These results would concur with the notion that women in these age groups are most likely to have higher rates of scheduled caesarean sections[20] and private health care cover and thus may have more discretion around the timing of births. Interestingly a significant decline in June 2004 is observed for women aged 20-24 but again not matched by a significant simultaneous increase in July.[21] The incremental rise in the baby bonus in July 2006 by $834 appears not to

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[20] A population study of Victorian women has found that older women are found to be associated with higher risk of caesarean delivery (Biro et al. 2012).

[21] The rate of caesarean section in Australia exceeds 30%, according to a study by Robson et al. in 2009 maternal request is an important contributor to these rates (Robson et al. 2009). In 2009 27.7% of women admitted as public patients and 38.9% of those admitted as private patients had caesarian sections.

have affected birth timing although there was an increase in births to women aged 40+ in July 2006.

ECONOMICS VARIABLES

Given the motivation for this paper is to identify age specific effects of the policy, economic variables are added to the model to control for the possibility that the generated results could be impacted by non-policy related economic factors. Although the analysis present in Sinclair et al (2012) finds that the economic variables were not significant across the total population, it may be that disaggregation across age groups show differing results on the sensitivity of fertility choice to economic circumstances.

To establish if the results from model 1 are robust, a second multivariate model is run subject to inclusion of unemployment and labour force participation variables but also Victorian specific household sentiment variables (as captured by the Westpac consumer sentiment index)[22]. Note the Victorian specific CSI data is only available from 1996. A quarterly conversion of the data to test GDP or state final demand is also modelled. It was found that the results in model 1 are robust and, in particular the level break in 2005 strengthens across age groups (except for teenagers and those aged greater than 40). The results also hold for the quarterly conversion to control for GDP / state final demand[23].

CONCLUSIONS

An increase in fertility rates have been observed following the introduction of the Australian baby bonus in 2004. An analysis of age specific birth ratios goes some way to disentangle the policy effects from prevailing demographic trends such as recuperation of previously postponed births

The results show that all age groups except teenagers showed a positive fertility response to the policy. Behavioural change is evidenced by a higher cumulative growth in fertility of maternal age groups 20-24 and 24-30 which is sustained past 2008 even as a growth in birth ratios of older age groups was stabilising. The results suggest that the policy may have elicited fertility

[23] Refer to the appendix for the co-efficient estimates and diagnostics

behaviour change and acted as a catalyst for an end or a slowing of postponement which has long term positive implications for population growth.

This research helps to determine the effectiveness of the policy assuming a pronatalist policy motivation, but also it should be noted that a differential impact across maternal age groups may have broader policy implications. In addition to controlling for demographic trends and birth timing effects, analysis of age specific impacts of the policy gives some insights into the "welfare implications" and potentially unintended consequences of the policy. If the baby bonus was found to have an impact on maternal age at birth, this can have implications for child and maternal health (Biro et al. 2012)

One limitation of this analysis is that, although it is observed that there is an increase in births to younger mothers, and not simply older mothers recuperating previously postponed births the issue of parity is ignored. Research is needed to further determine the impact of the baby bonus and whether it encouraged women to commence childbearing earlier without a change in cohort fertility.

REFERENCES

Ahn N, Mira P (2002) A note on the changing relationship between fertility and female employment rates in developed countries. Journal of Population Economics 15: 667–682

Australian Bureau of Statistics (ABS) (2012) Year book Australia 2012, Catalogue number 1301.0 Australian Bureau of Statistics , Canberra, Australia. [cited 20 June 2012] Available from : Http://www.abs.gov.au

Australian Bureau of Statistics (ABS) (2011) Births Australia, ABS Catalogue number 3301.0 Australian Bureau of Statistics , Canberra, Australia. [cited 20 June 2012] Available from : Http://www.abs.gov.au

Australian Bureau of Statistics (ABS) (2010) Australian Demographic statistics , ABS Catalogue 3101 Australian Bureau of Statistics , Canberra, Australia. [cited June 2010] Available from : Http://www.abs.gov.au

Becker GS (1965) A Theory of the Allocation of Time. The Economic Journal 75: 493–517

Becker GS, Barro RJ (1988) A Reformulation of the Economic Theory of Fertility. NBER Working Paper No. 1793, National Bureau of Economic Research, Inc.

Bhrolchain Ni MN (1992) Period Paramount? A Critique of the Cohort Approach to Fertility. Population and Development Review 18: 599–629

Biro MA, Davey MA, Carolan M, Kealy M (2012) Advanced maternal age and obstetric morbidity for women giving birth in Victoria, Australia: A population-based study. Australian and New Zealand Journal of Obstetrics and Gynaecology 52: 229–234

Bongaarts J (2008) What can fertility indicators tell us about pronatalist policy options? Vienna Yearbook of Population Research 2008, pp 39–55

Bongaarts J, Sobotka T (2012) A Demographic Explanation for the Recent Rise in European Fertility. Population and Development Review 38: 83–120

Bratti M, Tatsiramos K (2010) The effect of delaying motherhood on the second childbirth in Europe. Journal of Population Economics 25: 291–321

Buttner T, Lutz W (1990) Estimating Fertility Responses to Policy Measures in the German Democratic Republic. Population and Development Review 16: 539–555

Castles FG (2003) The World Turned Up-Side Down: Below Replacement fertility, Changing Preferences and Family Friendly Public Policy in 21 OECD Countries. Journal of European Social policy 13

CCOPMM (2011) Births in Victoria 2007 and 2008. Department of Health, Melbourne.

Cohen A, Dehejia R, Romanov D (2007) Do Financial Incentives Affect Fertility? NBER Working Paper No. 13700, National Bureau of Economic Research, Inc.

D'Addio AC, d' Ecole MM (2005) Trends and Determinants of Fertility Rates: The Role of Policies. OECD Social, Employment and Migration working paper No 27

Duclos E, Merrigan P, Lefebvre P (2001) A natural Experiment on the Economics of Storks;Evidence on the impact of differential family policy on fertility rates in Canada. CREFE Working Paper No 136, Université du Québec à Montréal

Drago, R, Sawyer K, Shreffler K, Warren D, and Wooden M.(2011) "Did Australia's Baby Bonus Increase Fertility Intentions and Births?" Population Research and Policy Review 30, no. 3 (2011): 381–397.

Gans JS, Leigh A (2009) Born on the first of July: An (un)natural experiment in birth timing. Journal of Public Economics, Journal of Public Economics 93: 246–263

Gans JS, Leigh A (2007) Born (again) on the first of July: Another experiment in birth timing. The selected work of Joshua S Gans. Available at http://works.bepress.com/joshgans/15

Gauthier A (2007) The impact of family policies on fertility in industrialized countries: a review of the literature. Population Research and Policy Review 26: 323–346

Gauthier A, Hatzius J (1997) Family policy and fertility: An econometric analysis. Population Studies 51: 295–306

Gray M, Qu L, Weston R (2008) Fertility and family policy in Australia. Australian Institute of Family Studies, Melbourne

Harvey AC (1991) Forecasting, structural time series models and the Kalman filter. Cambridge University Press

Holton S, Fisher J, Rowe H (2011) To have or not to have? Australian women's childbearing desires, expectations and outcomes. Journal of Population Research 28: 353–379

Hoorens S, Clift J, Staetsky L, Janta B, Diepeveen S, Morgan Jones M, Grant J (2011) Low fertility in Europe: Is there still reason to worry? RAND Corporation, Santa Monica, CA http://www.rand.org/pubs/monographs/MG1080.html. accessed October 2012

Koopman SJ, Harvey AC, Doornik JA, Shephard N (2006) Structural Time Series Analyser, Modeller and Predictor: STAMP 8.2. Timberlake Consultants

Kalwij A (2010) The Impact of Family Policy Expenditure on Fertility in Western Europe. Demography 47 2 : 502

Kuhn A, Brunner B (2011) Financial Incentives, the Timing of Births, Birth Complications, and Newborns' Health: Evidence from the Abolition of Austria's Baby Bonus. IZA Discussion Paper No. 6141, Institute for the Study of Labor (IZA)

Lain SJ, Ford JB, Raynes-Greenow CH, Hadfield RM, Simpson JM, Morris JM, Roberts CL (2009) The impact of the Baby Bonus payment in New South Wales: who is having "one for the country"? Med J Aust 190: 238–241

Langridge AT, Nassar N, Li J, Jacoby P, Stanley FJ (2010) The impact of monetary incentives on general fertility rates in Western Australia. Journal of Epidemiology and Community Health. 66: 296-301

Laroque G, Salanié B (2008) Does Fertility Respond to Financial Incentives? IZA Discussion Paper No. 3575,.Institute for the Study of Labor (IZA)

Leridon H. (2010) Human Fecundity: situation and outlook. Population and societies 471: 1-4

Lutz W, Skirbekk V (2005) Policies Addressing the Tempo Effect in Low-Fertility Countries. Population and Development Review 31: 703–723

McDonald P, Kippen R (2007) The intrinsic Total Fertility Rate: A New Approach to the Measurement of Fertility. Presented at the Population Association of America, New York.

Miller AR (2009) The effects of motherhood timing on career path. Journal of Population Economics 24: 1071–1100

Milligan, K., 2005. Subsidizing the Stork: New Evidence on Tax Incentives and Fertility. Review of Economics and Statistics 87, 539–555.

Neugart M, Ohlsson H (2012) Economic incentives and the timing of births: evidence from the German parental benefit reform of 2007. Journal of Population Economics 26: 87–108

Nimwegen van N, Erf van der R, Nimwegen van N, Erf van der RF, Heering EL (2009) The demographic situation in the European Union. In: Social Situation Observatory Demography Monitor 2008: demographic trends, socioeconomic impacts and policy implications in the European Union: final report. pp 25–69

Parr N, Guest R (2011) The contribution of increases in family benefits to Australia's early 21st-century fertility increase: An empirical analysis. Demographic Research 25: 215–244

Risse L (2010) "…And one for the country" The effect of the baby bonus on Australian women's childbearing intentions. Journal of Population Research 27: 213–240

Robson SJ, Tan WS, Adeyemi A, Dear KBG (2009) Estimating the rate of cesarean section by maternal request: anonymous survey of obstetricians in Australia. Birth 36: 208–212

Sinclair S, Boymal J, De Silva A (2012) A Re-Appraisal of the Fertility Response to the Australian Baby Bonus. Economic Record 88: 78–87

Sobotka T (2003) Tempo-quantum and period-cohort interplay in fertility changes in Europe. Demographic Research 8: 151–214

Tamm M (2009) The Impact of a Large Parental Leave Benefit Reform on the Timing of Birth around the Day of Implementation (Ruhr Economic Paper No. 0098). Rheinisch-Westfälisches Institut für Wirtschaftsforschung, Ruhr-Universität Bochum, Universität Dortmund, Universität Duisburg-Essen.

Testa MR, Sobotka T, Morgan SP (2011) Reproductive decision-making: towards improved theoretical, methodologocal and empirical approaches. Vienna Yearbook of Population Research 9: 1–9

Thévenon O, Gauthier AH (2011) Family policies in developed countries: a "fertility-booster" with side-effects. Community, Work & Family 14: 197–216

Thévenon O, Luci A (2012) The impact of family policy packages on fertility trends in developed countries. Université Paris1 Panthéon-Sorbonne (Post-Print and Working Papers), HAL

Weston R, Qu L, Parker R, Alexander M (2004) "It's not for lack of wanting kids…" A report on the Fertility Decision Making Project Australian Institute of Family Studies Research report no.11 http://www.aifs.gov.au/institute/pubs/resreport11/main.html.accessed July 2012

Wooden,M. and Watson,N (2007), The HILDA Survey and its contributions to Economic Social Research (So Far) , Economic record 83 (261), 208-31

APPENDIX – RESULTS ECONOMIC CONTROL VARIABLES

Table 3 Coefficients controlling for economic fluctuations

Age specific birth rate (ASBR) (births per 1,000 females of given age category) Monthly	ASBR <19 Model 1	ASBR <19 Model 2	ASBR 20-24 Model 1	ASBR 20-24 Model 2	ASBR 25-29 Model 1	ASBR 25-29 Model 2	ASBR 30-34 Model 1	ASBR 30-34 Model 2	ASBR 35-39 Model 1	ASBR 35-39 Model 2	ASBR 40-44 Model 1	ASBR 40-44 Model 2
Dependent variable	Co-eff(p)											
Outlier 2004(6)	0.02	x	-0.43**	-0.46**	-0.07	x	-0.43	x	-0.39**	-0.31	-0.05	x
	(0.8)		(0.04)	(0.01)	(0.80)		(0.12)		(0.04)	(0.13)	(0.46)	
Outlier 2004(7)	-0.09	x	-0.01	x	0.08	x	0.54*	0.69**	0.47**	0.36*	0.12*	0.10
	(0.25)		(0.95)		(0.77)		(0.05)	(0.03)	(0.01)	(0.08)	(0.06)	(0.18)
Outlier 2006(6)	0.01	x	-0.05	x	0.08	x	-0.18	x	-0.10	x	-0.00	x
	(0.88)		(0.79)		(0.78)		(0.52)		(0.60)		(0.93)	
Outlier 2006(7)	-0.07	x	0.04	x	0.18	x	0.40	x	0.06	x	0.13**	0.12
	(0.38)		(0.81)		(0.55)		(0.16)		(0.75)		(0.04)	(0.10)
Outlier 2006(12)	0.02	x										
	(0.79)		NA		NA		NA		NA		NA	
Outlier 2007(1)	-0.09	x										
	(.26)		NA		NA		NA		NA		NA	
Level break 2005(3)	-0.008	x	0.18*	0.18**	0.42***	0.40***	0.43**	0.40***	0.45***	0.45***	0.06**	0.02
	(0.87)		(0.08)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.34)
Slope break 2006(1)	0.01	x	0.02***	0.01***	0.02**	0.01	-0.00	X	0.01*	0.01	0.006***	0.004***
	(0.72)		(0.00)	(0.00)	(0.04)	(.19)	(0.63)		(0.09)	(0.11)	(0.00)	(0.00)
Slope Break 2008(1)	0.003	x	-0.02	x	-0.03	x	-0.03*	-0.03	-0.04***	-0.03*	0.00	x
	(0.66)		(0.24)		(0.20)		(0.09)	(0.32)	(0.00)	(0.07)	(0.49)	
Consumer sentiment index Victoria[a]		-0.002*		x		-0.01***		x		x		0.001**
		(0.05)				(00)						(0.04)
Victorian Female Unemployment[a]		x		x		x		x		x		x
Female Participation rate[a]		x		0.06*		x		x		x		x
				(0.07)								
Male unemployment rate[a]		x		x		x		x		x		x
Normality	2	2.01	0.52	1.54	0.93	1.16	1.98	3.07	15.83	6.74	2.31	3.23
	0.505	0.7	0.72	0.64	0.59	0.85	1.64	1.01	2.1	1.69	1.63	1.47
Heteroskedasticity (2 sided F test)[b]	H (96)	H (40)	H (96)	H (40)	H (96)	H (40)	H (96)	H (40)	H (96)	H (40)	H (96)	H (40)
Durbin-Watson statistic	1.91	2.22	1.91	1.89	1.77	1.78	1.92	2.07	1.91	1.99	2.16	2.33
Portmanteau Box-Ljung Q-statistic	25.11	18.15	19.81	29.48	28.71	25.64	36.16	31.29	22.18	31.96	28.65	29.32
R^2	0.45	0.58	0.48	0.58	0.43	0.5	0.48	0.56	0.53	0.6	0.59	0.67

* The critical value for the Normality test (where null corresponds to normality) is 5.99 (c^2_2; Koopmans et al 2006, page 201) thus indicating the residuals are normally distributed. The p-value for Durbin Watson is 0.41 which indicates autocorrelation is not present (Harvey, 1990).

[a] all explanatory variables are lagged 12 months

[b] Value in brackets indicates the degrees of freedom for the different models.

* p=0.10; ** p=0.05; *** p=0.001

Table 4 Coefficient Estimates and Selected Diagnostics						
Age specific birth rate (ASBR)	ASBR <19	ASBR 20-24	ASBR 25-29	ASBR 30-34	ASBR 35-39	ASBR 40-44
(Quarterly births per 1,000 females of given age category)						
Dependent variable Q (ASBR)	Co-eff(p)					
Outlier 2004(2)	-0.13	-0.71*	-0.05	-1.33**	0.03	-.09
	(0.45)	(0.07)	(0.92)	(0.02)	(0.92)	(0.39)
Outlier 2004(3)	-0.15	0.04	0.18	0.35	0.33	0.16
	(0.42)	(0.91)	(0.76)	(0.54)	(0.41)	(0.15)
Outlier 2006(2)	0.27	-0.23	-0.27	0.41	-0.66*	0.18
	(0.14)	(0.54)	(0.65)	(0.49)	(0.10)	(0.12)
Outlier 2006(3)	0.09	0.45	0.45	1.30**	0.91**	0.25**
	(0.59)	(0.23)	(0.45)	(0.02)	(0.02)	(0.03)
Level break 2005(1)	-0.07	0.33	0.99*	0.75**	1.16***	0.11*
	(0.63)	(0.27)	(0.06)	(0.05)	(0.00)	0.07
Slope break 2006(1)	0.01	0.16**	0.24**	0.12*	0.16***	0.05***
	(0.60)	(0.00)	(0.01)	0.09	(0.00)	(0.00)
Slope Break 2008(1)	0.02	-0.18	-0.39*	-0.42**	-0.38***	0.03
	(0.65)	(0.16)	(0.08)	0.03	(0.00)	(0.34)
State Final Demand % change	0.01	-0.02	0.04	-0.00	0.00	-0.00
	(0.35)	(0.45)	(0.34)	(0.85)	(0.51)	(0.81)
Normality *	24.15	0.56	1.69	0.17	0.02	1.58
Heteroskedasticity H(22)	0.78	0.83	2.09	1.16	1.69	1.63
Durbin-Watson statistic	2.28	2.09	2.17	2.03	2.21	2.94
Portmanteau Box-Ljung Q-statistic Q	8.68	11.75	12.90	12.40	7.90	49.00
R^2	0.46	0.50	0.48	0.57	0.62	0.71

*The critical value for the Normality test (where null corresponds to normality) is 5.99 (c^2_2; Koopmans et al 2006, 201) thus indicating the residuals are normally distributed. The p-value for Durbin Watson is 0.70 which indicates autocorrelation is not

* p=0.10; ** p=0.05; *** p=0.001