Special Report – Discussion Paper

The demographic curse: Is there still a way out?

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The aim of this research paper is to re-examine long-term demographic trends and the role of policy intervention. Some authors have considered a deterioration of demographic trends (lower fertility) as inevitable as economies develop. A theoretical part of the paper discusses the crucial role of human capital in development and the negative consequences for development of a sharply declining demographic trend. The paper then applies new econometric techniques to quantitatively investigate the question of whether demographic trends should indeed be considered irreversible as economies develop. A central part of the empirical investigation analyses cases of successful government intervention that have succeeded in stopping or reversing a deteriorating demographic trend. The empirical work includes the cases of Russia and Australia, where cash payments to parents of newly-born babies have been accompanied by improved demographic trends. The final section of the paper analyses the costs and benefits of such policies, which also depend on the funding options available for such demography policy. It is found that the costs to society of such cash payments can be reduced to zero, if they are funded by the central bank through productive credit creation, while the benefits are a multiple of the nominal funds expended, with newly-born citizens on average more than able to repay such sums in tax and social welfare contributions, as well as their productive contributions to society and the economy.

'People's QE' or 'baby QE' would be superior to conventional QE-supporting banking systems, as significant cash payments could be made to parents, likely delivering drastic reversals in demographic trends, at zero cost to society (since productive money creation is not inflationary, unlike the conventional QE, causing asset inflation). The conclusion points to the urgent need for and significant opportunities of investments in babies and education.
Introduction

Demography plays a pivotal role in both the short and long-term economic development of a country. It is also of importance for government planning concerning healthcare and medical services provision. When analysing the situation of developing countries, economists have long considered a high fertility rate as growth-retarding. The United Nations Population Fund has argued that a country with declining fertility, at least when there is still a growing number of people in the workforce, “has the potential to reap a demographic dividend” (UNPF, 2016; Ssewamala, 2015). Several authors have argued that up to a third of high East Asian economic growth has been due to this demographic dividend of declining fertility, declining mortality and (still) growing working age population.¹ Such analysis, rendering high or rising fertility a ‘demographic curse’, is supported by economists and economic development advisers that focus on per capita economic growth. Many policy strategists, including from the IMF and the World Bank, have since the establishment of the Bretton Woods institutions championed a low-fertility policy. Rising income levels, education, an increasingly influential media carrying relevant content, but also policies that effectively discourage child-bearing seem to have had the desired effect: fertility in developing countries has declined. While this facilitates the reporting of higher per capita income growth, any positive effects on long-term economic growth or even healthcare provision in the long-term future are difficult to identify.

For industrialised countries, declining fertility has reached a point where the negative effects have become more tangible and appear to outweigh any temporary ‘demographic dividend’ or public relations benefit from reporting per capita growth (per capital growth is commonly only highlighted in reporting on developing countries). For these advanced economies, the demographic curse primarily consists of the prospect of demographic

¹ Bloom and Williamson (1998); Bloom, Canning, and Finlay (2010); Kelley and Schmidt (2005).
annihilation of indigenous populations. In May 2018, the media reported that “US fertility rates have plummeted into uncharted territory”, as the newly released US general fertility rate for 2017 showed only 60.2 babies were born for every 1000 women of childbearing age (15-44 years), a 3% drop from the previous year and the lowest such figures since records began for the US (Dockrill, 2018). The total fertility rate (or TFR), measuring births per 1,000 women during their lifetimes, dropped to 1.76 in the US, the lowest since 1978.²

At the same time, this development of steadily declining fertility has not been accompanied by higher, but lower economic growth and forecasts of secular stagnation. Figure 1 illustrates these trends by outlining the fertility rate of a major industrialised economy, and that of a major developing (and emerging) economy (Germany and Brazil).

Figure 1: Fertility in Brazil and Germany (Source: OECD)

² TFR is the number of children that would be born to a woman if a woman were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year. See UN Population Division.
Figure 2 shows the UN data on world fertility.

**Figure 2: Fertility in the world (Source: UN Population Division, 2017)**

According to the UN (2017), fertility has recently declined “in nearly all regions of the world. Even in Africa, where fertility levels are the highest of any region, total fertility has fallen from 5.1 births per woman in 2000-2005 to 4.7 in 2010-2015”. With fertility dropping sharply in both industrialised and developing countries, the forecasts by some commentators that by 2050 world population growth would come to a halt do not seem implausible. Imminent “peak baby” has been pronounced by some.³ After 2050, the world population may well shrink on current trends. The major reason behind this shift in world demographics is the fertility decline in many developing countries, although this trend was spearheaded by the earlier onset of demographic decline in advanced economies.

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³ ‘The age of peak child’, as stated by Hans Rosling, quoted supportively in Roser and Ortiz-Ospina (2017). See also media reporting in the popular press, such as Allister Heath (2018).
A declining and ageing world population raises numerous problems. In the words of the UN, “Population ageing is projected to have a profound effect on societies, underscoring the fiscal and political pressures that the health care, old-age pension and social protection systems of many countries are likely to face in the coming decades” (2017). This spells trouble also for the hitherto dominant policy orientation of governments across the world to enhance economic growth and maintain pension and welfare systems, and secure medical coverage for increasingly ageing societies.

The ‘Malthusian trap’ argument sees societies contained and restricted by high fertility demographics. To escape from such a trap and achieve per capita income growth, investment in education is needed that turns the people available to contribute to the economy into growth-enhancing factors. Education and the resulting ability to develop new technologies, conceptualised as human capital growth or, its fruits, technology, have since Abramovitz (1956) been shown by empirical studies as the strongest pillar of economic growth. The theoretical literature had recognised this since Friedrich List (1842) and subsequent German writers, such as Schumpeter (1912), who criticised the static nature of the classical and neo-classical approach to economics developed in Britain. This static outlook meant that it took until Romer (1990) for the role of nurturing and educating new generations in achieving economic growth to be recognised formally in leading English-language economics journals.

Meanwhile, what had been considered a boon for economic development in the post-war decades – declining fertility – has come to be seen as the cause of a seemingly irreversible economic decline in many countries. While population shifts across borders obscure the problem initially, without a sufficient quantity of qualified people overall, economic growth cannot be sustained in any economy, nor in aggregate in the world economy.
This foreseeable negative demographic trend is presently regarded as a given or inevitable by many authors, including Tsui and Bogue (1978); Westoff (1983); Coale and Watkins (1986); Ancona and Caldwell (1992); Mcdonald (2000); Wilson (2001); Longman (2004); Doepke (2005); Bongaarts (2006); Kohler, Billari, and Ortega (2006); Billari (2008); Billari and Kohler (2004); Hogan, Foreman, Naghavi, Ahn, and Wang (2010); Sobotka, Skirbekk, and Philipov (2011); Knodel (2015). See also the various writings and co-authored research by Wolfgang Lutz (e.g., Lutz and Belanger, 2017). This may be a reason why in recent years the voices of those calling for ‘zero growth’, ‘permanent low growth’, even ‘de-growth’, have increased steadily and have been amplified by the media (e.g., D’Alisa, 2014).

Are researchers attempting to lower our expectations, on the assumption that the demographic collapse of human civilisation is inevitable?

It is recognised that the current demographic trend has disastrous consequences as it may lead to “economic stagnation and …inundation by foreign labour” (Westoff, 1983), “population decline and loss of economic prosperity and innovativeness” (Longman, 2004), decline in population and acceleration of population ageing (e.g., Lee, 2003; Lutz, Sanderson, and Scherbov, 2008; Goldstein, Sobotka, and Jasiiloniene, 2009), negative population momentum and decline in the number of potential parents (e.g., Lutz, O’Neil, and Scherbov, 2003), and it may “constrain the effectiveness of policy interventions aimed at increasing the number of births” (Kohler, Billari, and Ortega, 2002 and 2006). Indeed, some demographers have considered immigration as a key policy response (Lutz and Scherbov, 2008), although in a world of global fertility decline this is tantamount to a beggar-thy-neighbour policy.4

Demographic developments may well explain major episodes of sustained growth and periods of decline (see Figure 3). As population growth seems close to peaking and the

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4 On the challenges of demographic decline, see also Berkman (2012).
world is likely to experience a historic demographic change, researchers have begun to reconsider the received wisdom of the hitherto positive view of declining fertility. Some researchers have even begun to advocate policies aimed at demographic expansion.

Figure 3: Demographic growth, human capital, and policy effectiveness in a stationary environment

What can be rescued from the post-war argument in development economics that population growth is a burden is the more careful proposition that population growth without commensurate education becomes a burden on the economy, ultimately slowing down growth. The process can be reversed if there is a transition from low to high educational attainments. Thus the key to sustainable economic development lies in ensuring that population growth is sufficiently high and always accompanied by education, to transform it into growing human capital. However, such a theoretical proposition is confronted by the robust empirical evidence that prolonged growth of human capital triggers a ‘quantity-quality’ trade-off, because higher education is linked to the choice of having fewer children. In the latter case, a low-fertility trap may ultimately engulf any high-growth momentum, leaving an economy that perennially shrinks at the core (see Cuaresma and Mishra, 2011).
This increases the importance of the question of just what determines fertility. Is the demographic decline really inevitable? It is indeed undeniable that there are cultural factors affecting fertility (see, for instance, Yip, Lee, and Cheung, 2002, on the impact of the Chinese zodiac on fertility in Hong Kong).\(^5\) Such an impact is well known from the one-off collapse in fertility in Japan in 1966, as this is not only the year of the horse in the Chinese zodiac (only slightly modified in Japan by confining it to calendar years, not lunar years as in China), but of a specific type of horse only recurring once every five complete 12-year cycles, i.e., every 60 years: the ‘fire-horse’ (the next fire-horse being due in 2026). As those born in this zodiac are thought to exhibit a head-strong character, parents feared that girls born in that year would not find a husband (either due to actual assertive character, or due to the expectation of such character by potential spouses), so that many considered it too risky to have any children at all – as illustrated in Figure 4).

\(^5\) On below-replacement fertility in Hong Kong, see Yip, Lee, Chan, and Au (2001).
Figure 4: Fertility collapse in 1966 in Japan, the year of the rare ‘fire-horse’

However, it is clear that such cultural factors, while clearly important, are unlikely to provide sufficient significant explanations for the secular pattern of decline in fertility over the past half-century or so (although the diminishing role of cultural factors per se may be important as a structural factor). This trend is likely due to other factors, including the combination of factors. It is therefore reasonable to ask whether it is possible, using appropriate policy interventions, to manipulate fertility. Have policy choices perhaps inadvertently caused the fertility decline? If the argument is that external factors have reduced fertility, then likewise the right external factors may be able to raise it. The task then becomes to identify those factors and suitable ways to manipulate them in the desired direction.

We first discuss the general feasibility of public interventions in the area of fertility, analyse fertility patterns and policy design, and offer theoretical analyses of parental fertility choices that provide an overview of a broad array of child-related policy instruments in a
number of OECD and EU countries. We show that in general it is difficult to gauge the effectiveness of policy interventions like child-care subsidies, support for women’s labour-force participation, and tax incentives. Using an appropriate methodology, it is however possible to produce initial, likely robust estimates on the effectiveness of policy interventions in low-fertility economies. It cannot be denied, nevertheless, that data are often incomplete and causal relations cannot be proved conclusively. For instance, the role of social norms and culture is difficult to account for.

In this paper we study the link between low-fertility, policy instruments, and growth in developed countries by taking the first step of analysing the simplest policy instrument: a lump-sum cash payment to the parents of the child. This has been deployed by some prominent developed countries (such as Russia and Australia).

On the surface, anecdotal evidence on this policy instrument seems encouraging, including from Japan, a country with the lowest fertility rate in the world: Nagicho is a small town in rural Japan of just above 6000 inhabitants; due to ageing and migration to urban areas the population had been in decline. When it was at risk of dropping below 6000, the town administration decided to intervene in order to boost the population through child births. In 2005, the birth rate was at the national average (of 1.4). The town then introduced a number of measures, including, most significantly, a lump-sum payment of ¥300,000 ($2,682) to mothers for giving birth, as well as subsidised baby-sitting services and, when children reach secondary school, a further cash payment of ¥90,000 per annum for each child, to cover the cost of transporting children to school. The local government also pays the health-care contribution for children (of about 30% of costs), which is normally paid by the parents. These measures were combined with measures to attract firms to Nagicho, such as rent-free land for companies or subsidised accommodation. According to the Economist, the local authorities merely raised the share of the town’s annual budget that is dedicated to boosting the fertility rate from 2% to 3% of total expenditure (The Economist,
As a result of these measures, by 2014 the birth rate had doubled to 2.8, compared to 2005 and compared to the national average. As a combination of measures was taken, it is difficult to estimate the impact of the lump-sum payment alone in this Japanese example. Nevertheless, the question is raised as to whether the experience of this Japanese town can be generalised. We focus in our work on hypotheses related to the interlinkage between fertility-policy and growth dynamics.⁶

So far, the evidence in the scientific literature concerning the effect of cash transfer policies on fertility is mixed. In Figure 5, we visually consider the trend of fertility over time (measuring the total fertility rate) and depicting the year of introducing the fertility support programme in each country as an orange vertical line. As Figure 5b reveals, from 1960 until 1999 there had been a general trend of declining fertility in Russia. The cash support programme was introduced in 2007, a time when fertility rates appear to have been bottoming out and were possibly beginning to pick up. This trend seemed to become further established in the aftermath of the cash payments. For Australia and the UK (Figures 5a and 5c, respectively), there is a slight tendency of rising fertility following the support programme. It is too early to tell, but it is possible that the cancellation of such cash transfers to middle-class couples in the UK in 2013 seems to also have had a negative effect. While these visuals point to the potential effectiveness of support programmes for fertility improvement, it remains to be determined to what extent other independent forces have also contributed (with or without interacting with the interventions). These simple graphical presentations thus must be understood against the background of complex relationships between a number of variables.

⁶ For a careful study of demography in Japan in the late 1970s, see Kuroda (1978).
Figure 5a: Fertility Rate and the Introduction of a Cash Transfer (Australia) (Source: OECD)

Figure 5b: Fertility Rate and the Introduction of Cash Transfer (Russia) (Source: OECD)
Figure 5c: Fertility Rate and the Introduction and loss of a Cash Transfer (UK) (Source: OECD)

![Graph showing fertility rate in the United Kingdom with a red vertical line indicating the introduction and loss of a cash transfer.](image)

Figure 5d: Fertility Rate and the Introduction of a Cash Transfer (Canada) (Source: OECD)

![Graph showing fertility rate in Canada with a red vertical line indicating the introduction of a cash transfer.](image)
In the literature the argument has been made that financial incentivisation is a viable way to improve the fertility rate, including in developed countries. Authors indicating a positive relationship between such incentivisation and fertility are numerous. It remains an open question as to whether such incentives operate without complex interaction from other constraints (such as work pressure, benefits, career objectives, etc.) so that the latter can simply be considered constants for analytical purposes. Many studies have been conducted on the impact of individual factors on fertility. Examples include Thyrian, Fendrich, Lange, Haas, and Hoffman (2010), who study the impact of changes to maternity leave policy; Zavodny and Bitler (2010), who investigate the impact of better medical access; Winegarden and Murray (2004) study the impact of early health insurance programmes; Sabatello (1993) studies the impact of induced abortions; Handwerker (1992) studies the impact of family planning programmes (for an overview of research on the impact of women’s empowerment on fertility see Upadhyay, Gipson, Withers, Lewis, and Prata, 2014). The effectiveness of a policy depends on controlling the dynamics of the various interconnected channels. For the same reason, the introduction of a cash-transfer as a fertility-enhancement strategy may be conditional on various factors, such as the work hours-to-leisure ratio, the representation of women in the work-force, the real state of fertility in the country, and the long-term sustainability of such programmes, among others.

It will be necessary to assume constancy of at least some of these factors. Thus in our analysis we assume the following:

- Women’s education and career choices are given the same importance as that of men.
- There is a high level of education.
- Incentivisation schemes combine lump-sum transfers with unchanged career-options.
As both social and family economics have demonstrated that throughout the history of human capital growth and fertility dynamics, women are to a certain extent naturally bound to take care of family and often tend to sacrifice careers for building a family, we adopt a gendered approach: the effectiveness of cash-transfers or similar policies depends on women’s education and their decisions to allocate their time between a career and caring for new-borns. In modern growth theory, where an equitable career choice is assumed, this cost of ‘cohesion’ is addressed by lump-sum transfers and more equitable career progression. We argue that the temporary allotment of lump-sum cash can be steadily transformed into a sustainable long-term gain, through both the monetary mechanism and a long-term demographic dividend from population growth.

One of the innovations of this paper is a gendered approach to the design of policy-effectiveness schemes within a growth-theoretic framework. Another is that we translate the conceptual idea in Figure 5 via a unified growth model and estimate the reduced form equations in a non-parametric domain. The unified growth theory presented here builds on dynamic overlapping generations models (OLG) and accounts for trans-generational resource mobility, whereas the non-parametric approach helps us model the true nature of the data, without imposing too many restrictive assumptions which one often encounters in a parametric framework. Put simply, we attempt to let the data speak, rather than imposing assumptions and restrictions that force the data into a certain mould. The combined deployment of OLG and non-parametric approaches are part of the main innovations in this paper in the pursuit of gauging the effects of a complex relationship between fertility choice and policy variables.

The remainder of the paper is structured as follows: In Section 2, we present the conceptual motivation, in line with the quality-quantity trade-off within the unified growth-theoretic framework. Section 3 presents our model. Section 4 discusses econometric methodology, presents data, and discusses the main results. Finally, Section 5 concludes.
Conceptual motivation

Why do people choose fewer children, as we have been observing in industrialised countries in recent decades? Human capital growth is often cited in response, based on the child quantity-quality trade-off theory, resulting in the transition from the Malthusian stagnation of developing countries to the sustained economic growth hailed in developed economies. Over recent decades this hypothesis has found both considerable theoretical attention, especially in the unified growth-theoretic tradition (following Galor and Weil, 1999; Galor, 2005), and empirical support (see Diebolt and Perrin, 2013b for a review of the literature). While recent empirical research has pointed to the importance of human capital dynamics for facilitating the transition from stagnation to sustained growth, an important though neglected question is the contribution of gender-bias (especially female empowerment) in quantity-quality trade-offs.

During the past two centuries, Europe and North America have witnessed dramatic economic and cultural upheavals. This period has also marked a turning point in demographic and economic trends, which have been similar in these countries, despite some variations in terms of timing and speed of changes (Galor, 2012). Before the Industrial Revolution, all societies were characterised by a very long period of stagnation in per capita income with high fertility rates. Since then, Western countries have observed a complete reversal, with high sustained income per capita and falling fertility (Becker, Cinnirella, and Woessmann, 2012; Klemp, 2018). In parallel with economic and demographic changes, we note profound changes in the structure of the population: formal education became accessible to a vast majority of the population, while drastic changes occurred in gender relations.

The potential interaction between fertility decline and incentive schemes is likely complex. Using UK data from the British Household Panel Survey, Francesconi and van der Klauuw (2007) examine the impact of the reform introduced in 1999 in the UK, including the
working families tax credit (WFTC), which was introduced in 1999, and represented a major reform “to the system of child-contingent benefits” and was accompanied by means-tested income support for families with children (Brewer, Ratcliffe, and Smith, 2012). As a result of these measures, between 1999 and 2003 “government spending per child on these benefits rose by 50 percent in real terms” (Brewer et al., 2012). However, Francescone and van der Klauuw (2007) doubt the efficacy of these measures, which were indeed substantially reduced for middle-income families in 2013 in the UK. Their study argues that the probability of single mothers giving birth to another child is not positively influenced by the benefits, and in fact was negatively affected to some extent: They found a statistically insignificant negative effect of the introduction of the new benefits scheme in 1999 for single mothers. Meanwhile Brewer et al. (2012) clarified that there is a positive effect of the UK policy for mothers who are not single but in couples (For a study on marital fertility, see Beydoun, 2001, on Lebanon).

There is much empirical evidence that demographic trends are influenced by economic variables (e.g., Hoem, 2000; Kohler et al., 2002 and 2006; Billari, 2008; Goldstein et al., 2009; Lutz et al., 2008; Adsera, 2011; Schmitt 2008 and 2012; Pailhé and Solaz, 2012; Goldstein, Kreyenfield, Jasiolioniene, and Örsal, 2013), and more specifically, by economic uncertainty and economic downturns (Mills and Blossfeld, 2005; Kreyenfeld, 2010; Sobotka, Skirbekk, and Philipov, 2011; Neels and Wood, 2013). Colen (2006) studies the effect of an economic boom on US fertility; Liu, Yamada, and Yamada (1996) find economic factors of importance in China. Kodzi, Johnson, and Casterline (2012) find that, next to health, costs of child rearing have an impact on fertility in Ghana.

credits provided by the Earned Income Tax Credit (EITC), which was introduced in the US in 1990, had a negative effect on first births, although it is statistically insignificant. Baughman and Dickert-Conlin focus on the effects of credits on women having first births and on less educated women, based on the assumption that these groups might be more susceptible to this policy. Haan and Wrohlich (2011) examine German data and argue that the German tax credits and transfers had an insignificant effect on fertility, except for highly educated mothers and those giving birth for the first time. Chen (2011), using the difference-in-differences approach, examines French data from 1929 to 1981 and reports mixed evidence on fertility responding to positive or negative reforms in tax incentives. The above studies however represent a minority. In the majority of research papers, a positive relationship between financial incentives and fertility has been reported, yet the conclusions are not taken seriously by many policymakers. One criticism is the large number of factors that potentially influence fertility, making identification or control difficult.

Ideas on how to incentivise women to bear more children can be taken from other parts of the economy and the literature, where there is also a need to attract and incentivise talent. One of the professions that makes significant demands on people’s time, visible through long working hours and not rarely having to be ready to be on call at almost any hour and on any day, including holidays or at night, is the financial sector. Financial sector employment in many countries, including in the UK and the US, requires a high degree of dedication, often long working hours, and also often the need to be available for client meetings, client entertainment, or in order to complete assignments to meet deadlines at short notice and at any time, including overnight. Partly in order to attract highly skilled staff and incentivise them to dedicate larger parts of their lives to the company than is required in other industries, financial sector compensation packages are very high in many countries, such as the UK or the US. Since this relationship between high pay and long working hours
at a demanding job is well established, it stands to reason that such a relationship may also exist concerning the tasks of a mother and financial compensation.

There are a number of countries that have adopted the policy to pay somewhat more substantial cash bonuses for the birth of babies (although the amounts remain extremely modest in absolute terms, and in relative terms appear almost negligible if compared with financial sector compensation), namely Russia and Australia. For our empirical investigation, we consider the case studies of Russia and Australia and we show that modest cash payments to parents for the birth of babies have a disproportionate effect in increasing fertility rates. We discuss the costs and benefits of such policies. In addition, novel and more effective ways to fund such cash-for-babies payments are discussed and evaluated. It is found that another innovation in the financial sector, namely ‘Quantitative Easing’ or ‘QE’ (injections of newly created money by the central bank) could be deployed as fertility policy. Thus a form of ‘People's QE' would be particularly attractive, as more significant cash payments could be made to parents, likely delivering drastic reversals in demographic trends, at no cost to society.

The model

Despite a renewed interest in recent years, empirical evidence of the existence of a parental trade-off between the quantity and the quality of children remains controversial. As pointed out by Becker, Cinnirella, and Woessmann (2010, 2012), most investigations of the quantity-quality trade-off are based on modern data, such as Rosenzweig and Wolpin (1980), Cáceres-Delpiano (2006), Black, Devereux, and Salvanes (2005), Angrist, Lavy, and Schlosser (2010) or Li, Zhang, and Zhu (2008). Historical analyses have recently been discussed by Becker et al. (2010, 2012), Klemp and Weisdorf (2011) and Fernihough (2011), respectively for Prussia, England, and Ireland.
The need to recognise many factors in the determination of fertility has been known (e.g., Khan and Raeside, 1997) but also factors of high fertility as identified by Ahonsi (1991) or Sindiga (1985). Diebolt and Perrin (2013) and Diebolt, Mishra, and Perrin (2016) bring to light new determinants of the long transition process, and reflect the complexity of the interaction of many factors. Specifically, their work incorporates novel and additional mechanisms consistent with observed stylised facts, emphasising the importance of the role played by women in the development process. The main concern of their study is to show to what extent and through which mechanisms gender equality affects decisions taken by members of the household and thus long-run economic development. Through the construction of a cliometric unified growth model, they capture the interplay between fertility, technology, and income per capita in the transition from stagnation to sustained growth. The theory suggests that female empowerment has been at the centre of the demographic transition and the take-off to modern economic growth. Considering dynamics, the increase in gender equality and the rise in technological progress create greater opportunities for women to invest in skilled human capital. The negative correlation linking maternal investments in human capital and fertility (career or family – Goldin, 2006) encourages families to have fewer children, but better educated ones. This process ultimately triggers the demographic transition and plays a central role for the transition from stagnation to modern growth. The model therefore generates documented facts about epochs of stagnation, characterised by high fertility and low output, and modern growth, combining low fertility and sustained output growth.

Using the framework of Diebolt and Perrin (2013) and Diebolt, Mishra and Perrin (2015), our model is presented as follows. We consider a two-sex household that generates utility from consumption by the male, $c_m$, the female, $c_f$, and from the lifetime income of their children, $y_n$ – which results from supplying human capital on a competitive labour market. The parameter $\theta$ represents the female bargaining power in the household decision
process. This bargaining power can be a function of a lump-sum cash transfer. A fraction \( \theta \) of income is spent by the woman on consumption. The remaining fraction \( (1 - \theta) \) of income is spent by the man on consumption. The parameter \( \gamma \) measures the value attached to the number of offspring relative to the labour force participation. The household preferences are represented by the following utility function:

\[
U(c^m, c^f, y_n) = (1 - \theta)ln c^m + \theta ln c^f + \gamma ln(y_n) \quad \text{with} \quad \theta, \gamma \in (0,1) \quad (1)
\]

Each member of the household is endowed with one unit of time. The woman spends a fraction of her time \( r^f \) (with \( r^f > r^m = 0 \)) rearing children. The price of a child is the opportunity cost associated with raising it, \( r_n wh^f \). An individual’s quality is conditional on the endowment in human capital that depends positively on maternal endowment in human capital, \( h^f \), and on one’s own investment in education \( e \). The household lifetime budget constraint is therefore:

\[
c^m + c^f \leq (1 - r_n - e^f)wh^f + (1 - e^m)wh^m \quad (2)
\]

The optimisation problem yields the following first order conditions on education,

\[
e^m = \frac{1 + e}{2} \quad (3)
\]

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\(^7\) The female bargaining power is assumed to be function of the relative stock of human capital of the spouses and can be interpreted as a measure of gender equality within the household.
where $e$ is a fixed cost of education measured in time units that agents have to pay when investing in education.

Everything else being equal, equation (4) depicts a trade-off between female investment in education and fertility. The optimal number of children is decreasing with the time invested by the woman in her education. Consequently, the acquisition of skilled human capital induces women to spend more time on education and to have fewer children.

The household optimal fertility is given by:

$$n^* = \frac{(1 - e)}{r\theta} \frac{\gamma}{(2 + \gamma)}$$

The optimal fertility level is decreasing with the female marital bargaining power within the household. A higher level of gender equality within the household allows women to reduce their fertility and to invest more in education. Hence, women have fewer children but better educated ones. Ultimately, equations (4) and (5) show a trade-off between the number of children and their quality. The quantity-quality trade-off implies the optimal number of children to be decreasing with the time invested in each of them.
When we introduce a lump-sum cash transfer into the framework as a method of incentivisation, the utility function in equation (1) can be modified, using for instance, \( wT \), where ‘\( T \)’ represents transfer and ‘\( w \)’ denotes the amount of transfer. Solving the optimisation problem further, we arrive at a new equation for the optimal fertility (as in equation (5)), where

\[
n^*(T) = \frac{w(1 - \theta)T}{r\theta} \frac{\gamma}{2 + \gamma}
\]  

(6)

Equation (6) implies that the optimal number of children or the optimal fertility is a direct function of lump-sum cash transfers or similar incentivisation schemes, such that as \( T \) rises, optimal fertility also rises proportionately. In other words, our model that is built within a unified growth-theoretic framework predicts that the optimal number of children is an increasing function of lump sum transfer but a decreasing function of education. Therefore, any empirical investigation should account for the weighted effects of education and other factors when gauging the impact of cash transfer on fertility-choice.

**Empirical evidence**

**Data**

Our data comprises annual time series for four countries, Australia, Canada, Russia, and the UK. The data spans four decades (1960-2015). Our main variable of interest is fertility, which we measure by total births per woman in a country. In addition to the incentivisation date (cash transfer, for instance), for which we use a dummy variable to identify the year of intervention, we also control for a number of other variables, such as the unemployment rate, education, the proportion of females in the total population, the population density (as
a measure of technical change/sophistication in a country), and the employment-to-population ratio for both genders, among others. Table 1 presents the details of all variables (note that not all are used in the final regression).

These variables roughly translate equation (6) above into a reduced-form empirical specification. In addition, we also use a measure of policy uncertainty for these countries because we assume that individuals’ reactions vary significantly between periods of relative stability and uncertainty. Whenever there is persistent uncertainty, any incentivisation scheme to promote fertility should take into account its impact on individuals’ utility functions. Our proposition is that when uncertainty is high, individuals cannot be expected to raise more children as it is too costly for them (moreover, they may also risk jobs amidst extreme competition for survival). In other words, persistent uncertainty acts as a crowding-out agent and a dummy for extreme competition such that individuals do not wish to produce more children fearing the high cost of raising them in the future. To accommodate these dynamics, we use the economic policy uncertainty index of Baker, Bloom, and Davis (2017).8

In Figures 6 and 7, we show the policy uncertainty index for Russia and Australia. Literature argues that in the face of economic and political changes total fertility rates can fall significantly. Examining the case for the post-Soviet world, Nolin and Ziker (2016) show that there is a dramatic fertility transition in one community in which the total fertility rate fell from approximately five children per woman before 1993 to just over one child per woman a decade later. Similarly, the authors argue that with heightened uncertainty, the fertility rate can also experience a dramatic rise, thanks to the evolutionary habits of individuals. As evident in Figure 6 (Australia), despite rising uncertainty, the fertility rate shows a slight increase since 1998. For Russia (see Figure 7), the fertility rate initially fell with rising uncertainty and then, possibly in line with a stabilisation of the economic and political

---

8 The data are available at www.policyuncertainty.com
situation, rose afterwards. This is also commensurate with the introduction of policy intervention, where we found that cash-transfers had a significant positive effect on fertility growth.

**Table 1: Description of variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>fert_tf</td>
<td>Fertility rate, total (births per woman)</td>
</tr>
<tr>
<td>br_c</td>
<td>Birth rate, crude (per 1,000 people)</td>
</tr>
<tr>
<td>pp_index</td>
<td>Residential Property Price Indices (Index, 2010=100) - Sales of newly-built dwellings; all types of dwellings</td>
</tr>
<tr>
<td>pp_growth</td>
<td>Residential Property Price Indices (Percentage change on the same period of the previous year) - Sales of newly-built dwellings; all types of dwellings</td>
</tr>
<tr>
<td>emp_f15</td>
<td>Employment to population ratio, 15+, female (%) (national estimate)</td>
</tr>
<tr>
<td>emp_m15</td>
<td>Employment to population ratio, 15+, male (%) (national estimate)</td>
</tr>
<tr>
<td>emp_t15</td>
<td>Employment to population ratio, 15+, total (%) (national estimate)</td>
</tr>
<tr>
<td>pop15_64</td>
<td>Population ages 15-64 (% of total)</td>
</tr>
<tr>
<td>pop_d</td>
<td>Population density (people per sq. km of land area)</td>
</tr>
<tr>
<td>Popf</td>
<td>Population, female (% of total)</td>
</tr>
<tr>
<td>Unempf</td>
<td>Long-term unemployment, female (% of female unemployment)</td>
</tr>
<tr>
<td>Unempm</td>
<td>Long-term unemployment, male (% of male unemployment)</td>
</tr>
<tr>
<td>Unempt</td>
<td>Long-term unemployment (% of total unemployment)</td>
</tr>
<tr>
<td>Gdi</td>
<td>Gross domestic income (constant LCU)</td>
</tr>
<tr>
<td>Gds</td>
<td>Gross domestic savings (% of GDP)</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>pcincome_g</td>
<td>Adjusted net national income per capita (annual % growth)</td>
</tr>
<tr>
<td>pcincome_c</td>
<td>Adjusted net national income per capita (constant 2010 US$)</td>
</tr>
<tr>
<td>Pempf</td>
<td>Part time employment, female (% of total part time employment)</td>
</tr>
<tr>
<td>Pempm</td>
<td>Part time employment, male (% of total male employment)</td>
</tr>
<tr>
<td>Sempf</td>
<td>Self-employed, female (% of female employment)</td>
</tr>
<tr>
<td>Sempt</td>
<td>Self-employed, total (% of total employment)</td>
</tr>
<tr>
<td>dum1</td>
<td>A dummy for Australia, dum1=1 for the years followed the year of implementation of fertility programme, dum1=0 otherwise</td>
</tr>
<tr>
<td>dum2</td>
<td>A dummy for Canada, dum2=2 for the years followed the year of implementation of fertility programme, dum2=0 otherwise</td>
</tr>
<tr>
<td>dum3</td>
<td>A dummy for Russia, dum3=3 for the years followed the year of implementation of fertility programme, dum3=0 otherwise</td>
</tr>
<tr>
<td>dum4</td>
<td>A dummy for United Kingdom, dum4=4 for the years followed the year of implementation of fertility programme, dum4=0 otherwise</td>
</tr>
<tr>
<td>gdppc_g</td>
<td>Growth rate of GDP per capita</td>
</tr>
<tr>
<td>Edutotal</td>
<td>Total tertiary education</td>
</tr>
<tr>
<td>Edufemale</td>
<td>Female tertiary education</td>
</tr>
<tr>
<td>Edut</td>
<td>Total tertiary education to total population</td>
</tr>
<tr>
<td>Eduf</td>
<td>Total female tertiary education to total population</td>
</tr>
<tr>
<td>Eduff</td>
<td>Total female tertiary education to total female population</td>
</tr>
</tbody>
</table>
Figure 6: Economic Policy Uncertainty Index for Australia

- Russian Economic Crisis, Close
- Lehman Failure, Global Financial Crisis
- Greek Debt Crisis
- U.S. Debt Ceiling Dispute
- Rudd Ousts Gillard as Labor Leader and PM
- Labor Party Wins landslide

- Tax cuts: 9/11 Attacks
- Invasion of Iraq
- Tax cuts: Fisc And Mining Uncertainty, Eurozone

Australia

Fertility rate, total (births per woman)
Figure 7: Economic Policy Uncertainty Index for Russia

![Graph showing Economic Policy Uncertainty Index for Russia from 1994 to 2017](image)

Russia: Economic Policy Uncertainty Index

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Russia

Fertility rate, total (births per woman)

![Graph showing Fertility rate for Russia from 1960 to 2014](image)
Methodology

We employ a non-parametric regression approach to estimate any effect on the fertility rate of the policy intervention, conditional on a set of covariates. We do not follow the conventional linear framework in describing this relationship, as this would seem simplistic and unlikely. Rather, we adopt a ‘dimension-free’ functional specification which allows us to recover the ‘true’ functional relationship with fewer a priori restrictions. The characteristic feature of our model is that all relevant determinants of fertility (many of them are described in Table 1) are assumed to be additively separable. Denoting by $Z$ the combination of determinants ($X$) and policy intervention (i.e., cash transfer dummy), and assuming an additive separability condition, we can present the relationship between fertility and policy intervention as:

$$Fertility_{it} = \sum f_j(Z_{it}) + \mu_i + \epsilon_{it}, \quad i = 1, \ldots, N; \quad t = 1, \ldots, T, \quad (6)$$

where $Fertility$ denotes, as before, a measure of fertility. The $f_j$ are unknown univariate functions to be estimated non-parametrically. For this purpose, we follow the generalised additive model (GAM) specification (see, Hastie and Tibshirani, 1990). We assume that errors $\epsilon_{it}$ are independent and identically distributed. $\mu_i$ stands for unobserved individual specific effects for which we allow arbitrary correlation with $Z_{it}$. Thus, we make no assumption on $E(\mu_i|Z_{it})$ for any set of dates $t = 1, \ldots, T$. These unobserved effects can be eliminated by differencing or by computing the within-transformation. Very importantly, the first differencing assumption identifies the functions so that we do not encounter potential endogeneity issues.

An innovation in the paper also concerns estimation of the non-parametric relationship at various quantiles of the distribution of the fertility variable. Our idea is that the distribution function of fertility would reflect values from very low to high fertility (cumulative
one over time). We then estimate the effects of various determinants of fertility before and after the break points at three quantiles of the fertility distribution. Moreover, we add a policy uncertainty variable as a proxy for policy intervention. An implication is that governments may, in the presence of significant shocks, introduce some measures to improve economic growth. In our case, a lump sum cash transfer is positively related to growth but may not be related to a rise in uncertainty. Hence, this variable can be taken as an instrument to identify the correct model.

**Main results**

We now report the main estimation results from the GAM regression for various quantiles of the distribution of fertility over time. In Tables 2 and 3, we have reported the results for three quantiles (25th, 50th, and 75th) for two sets of regressions: namely, before and after the intervention of policy (the cash transfer). The regressions are based on the female population following our theoretical arguments of a unified growth framework.

Table 2 presents the results for Russia. As we can observe for the upper panel of the table (before policy intervention) tertiary education has a significant negative impact on fertility, featuring greater negative effects at a higher quantile and smaller negative effects at lower quantiles. Similar results are found for Australia (see Table 3). Interesting results emerge after the policy intervention; there is a moderating role of education on fertility as the cash transfer appears to dampen some of the negative impacts of education. Overall, the effects of education on fertility are commensurate with the unified growth-theoretic framework in general and the quantity-quality trade-off in particular.

On a similar note, we find from both tables that long-term unemployment exerts large and significant negative effects before policy intervention and smaller effects after intervention. The reason is that policy intervention moderates the role of negative psychological impacts on welfare loss due to unemployment. Following evolutionary
demography theory, fertility transitions are largely a phenomenon based on psychological aspects of perceived benefits and losses from the incumbent environment. Both policy uncertainty and unemployment-related variables exert negative effects. Following a cash-transfer, such effects appear to subside over time. On the other hand, gross domestic savings – being an indicator of national health – has a strong positive effect on fertility. This is because individuals feel secure with higher savings as they prepare on the path of persistent uncertainty and risks of unemployment and macroeconomic uncertainty.

Overall, we find that policy intervention exerted a significant positive impact on fertility transition, namely the low to high fertility over time and across the distribution of fertility. This implies, as also stands to reason, that the psychologically and materially-influenced decision to have or not to have babies can be influenced by policy. The simplest policy with a reasonable prospect of being successful is to pay out a lump-sum to the mother after the birth of a baby.

This supports earlier studies with different methodology, such as by Drago, Sawyer, Shreffler, Warren, and Wooden (2011), who found that cash payments in Australia increased fertility; Luci-Greulich and Thevenon (2013), who found that, comparing different policies to encourage childbirth, in-cash benefits covering childhood after the year of childbirth had a greater potential influence on fertility than other policies; and Aassve and Lappagård (2009), who also found a positive effect of cash payments on fertility and accelerating the decision to have children.

**Funding a fertility policy**

So far, studies of fertility and the efficacy of lump-sum cash payments have neglected the important question of the funding source of the transfer payments to parents. Another innovation in this paper is that the latest findings in monetary economics and finance are
deployed and integrated in a policy recommendation about how to best fund a fertility policy, thereby significantly enhancing its efficiency and cost-effectiveness.

Critics may argue that many fiscally-challenged countries could not possibly afford to make similar cash payments to Australia or Russia, even if, as investments in the long-term future of the country, they stand up well to the scrutiny and assessment of any cost-benefit or discounted present value analysis. The problem, it is pointed out, is the limited availability of fiscal or budgetary sources – in other words, governments are said not to ‘have enough money’ to make significantly sized lump-sum cash payments to mothers.

However, in the disciplines of finance and monetary economics recent research has demonstrated that it is not accurate to describe a government or state as suffering from a budget constraint like any family household, or a non-bank company; nor is it accurate to claim that investment possibilities are restricted by aggregate savings (as loanable funds or growth models in the tradition of Harrod-Domar or Solow assume). Werner (2014, 2016) has empirically shown that savings do not restrict investment, since banks create the savings (deposits) that are newly allocated for investments. Furthermore, Werner (2012) has shown that an efficient means of funding large-scale public expenditure that enhances productivity is the use of the power to create money newly via the central bank or the state treasury (finance ministry).

In all modern economies, money is presently created by banks – central banks or decentralised banks – through the process of credit creation. The Quantity Theory of Disaggregated Credit (Werner, 1997, 2005) has demonstrated that credit creation for the real economy, and specifically for productive purposes, such as business investment to implement new technologies results in non-inflationary economic growth. Since empirical studies have demonstrated that by far the most important source of growth and productivity is technology (Abramovitz, 1956), and it is recognised that markets do not allocate resources sufficiently to maximise the production of technology (Romer, 1990), since all technology is
developed by humans, it follows that higher fertility with commensurate higher investment in education are the most effective ways to enhance long-term economic growth. In that case, there cannot be any more productive and efficient target for the use of newly created money than: (1) to create money to enhance fertility – through simple, large cash payments (Werner, 2001, suggested a bonus of approximately USD 200,000 per baby in order to quickly reverse the Japanese fertility decline); and (2) to create money to fund public investment in education.

The 2008 financial crisis has shown that governments are willing and able to mobilise amounts of resources previously unimagined in peacetime in order to bail out too-big-to-fail banks. Werner (2012, 2014a) has shown that this should not have been funded by existing money (i.e., funded fiscally from the tax payer and via bond issuance, resulting subsequently in ‘austerity’ fiscal belt-tightening programmes in many countries), but through money creation (also in this context referred to as ‘quantitative easing’, Werner, 1995), as it would not inject new money into the non-banking economy, but would rejuvenate banks’ balance sheets and enable them to create credit again (to avoid moral hazard and future crises, banks’ credit extension would henceforth be restricted to productive purposes).

Given the willingness by governments to mobilise hundreds of billions, even trillions of dollars in funds to address problems in a small number of large banks, it is not obvious why they would not mobilise far more modest amounts of resources, which could and should be funded not from tax payers, but through new money creation, in order to reverse the fertility decline and hence solve one of the most important long-term problems for economies and society. This would be a far more productive use of the privilege of money creation and hence would be justified in any cost-benefit analysis.

The post-banking crisis experience over the past decade has shown that there is a source of funding that can be tapped for high national-priority investments, namely money creation by the government. The central banks of the UK, the US, and Japan have created
several trillion US dollars’ worth of new money, not derived from taxation or even issuance of government bonds, but newly created at zero cost to the tax payer. Such ‘quantitative easing’ would be, in terms of long-term economic growth prospects, far more efficient and justified, if it was spent on ‘baby bonuses’ paid to mothers.9

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Linacre College, Oxford University; Convenor, Association for Research on Banking and the Economy (ARBE)

9 On quantitative easing, see Lyonnet and Werner (2012) and the literature reviewed therein, as well as the discussion of the historical origin of this concept.
Table 2: Generalized Additive Model Estimation at different quantiles for temporally variant fertility for Russia (Regression for Female: Before policy intervention)

<table>
<thead>
<tr>
<th></th>
<th>quant=0.25</th>
<th></th>
<th>quant=0.50</th>
<th></th>
<th>quant=0.75</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>P&gt;</td>
<td></td>
<td></td>
<td>Coef.</td>
<td>P&gt;</td>
</tr>
<tr>
<td>Tertiary education</td>
<td>-0.995</td>
<td>0.038</td>
<td>-2.022</td>
<td>0.060</td>
<td>-3.446</td>
<td>0.060</td>
</tr>
<tr>
<td>Long-term unemployment</td>
<td>-0.543</td>
<td>0.029</td>
<td>-0.608</td>
<td>0.000</td>
<td>-0.787</td>
<td>0.022</td>
</tr>
<tr>
<td>Residential property price</td>
<td>-0.449</td>
<td>0.020</td>
<td>-0.651</td>
<td>0.100</td>
<td>-1.754</td>
<td>0.037</td>
</tr>
<tr>
<td>Employment to population ratio</td>
<td>0.034</td>
<td>0.099</td>
<td>0.112</td>
<td>0.188</td>
<td>0.189</td>
<td>0.099</td>
</tr>
<tr>
<td>Gross Domestic Savings</td>
<td>0.768</td>
<td>0.000</td>
<td>2.323</td>
<td>0.000</td>
<td>2.556</td>
<td>0.000</td>
</tr>
<tr>
<td>Policy Uncertainty</td>
<td>0.097</td>
<td>0.000</td>
<td>0.112</td>
<td>0.000</td>
<td>0.203</td>
<td>0.000</td>
</tr>
<tr>
<td>Joint sig: F(10,1591)</td>
<td>44.90</td>
<td>16.01</td>
<td>7.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-value:</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Regression for Female: After policy intervention)

<table>
<thead>
<tr>
<th></th>
<th>τ=0.25</th>
<th></th>
<th>τ=0.50</th>
<th></th>
<th>τ=0.75</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>P&gt;</td>
<td></td>
<td></td>
<td>Coef.</td>
<td>P&gt;</td>
</tr>
<tr>
<td>Tertiary education</td>
<td>-0.795</td>
<td>0.081</td>
<td>-1.252</td>
<td>0.070</td>
<td>-2.236</td>
<td>0.075</td>
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<tr>
<td>Long-term unemployment</td>
<td>-0.343</td>
<td>0.033</td>
<td>-0.509</td>
<td>0.000</td>
<td>-0.887</td>
<td>0.020</td>
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<td>Residential property price</td>
<td>-0.200</td>
<td>0.036</td>
<td>-0.151</td>
<td>0.101</td>
<td>-0.091</td>
<td>0.025</td>
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<tr>
<td>Employment to population ratio</td>
<td>0.049</td>
<td>0.404</td>
<td>-0.054</td>
<td>0.188</td>
<td>0.037</td>
<td>0.636</td>
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<tr>
<td>Gross Domestic Savings</td>
<td>0.958</td>
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<td>0.114</td>
<td>0.088</td>
<td>0.121</td>
<td>0.005</td>
<td>0.189</td>
<td>0.000</td>
</tr>
<tr>
<td>Joint sig</td>
<td>44.90</td>
<td>16.01</td>
<td>7.99</td>
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<tr>
<td>P-value:</td>
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<td>0.000</td>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3: Generalized Additive Model Estimation at different quantiles for temporally variant fertility for Australia (Regression for Female: Before policy intervention)

<table>
<thead>
<tr>
<th></th>
<th>quant=0.25</th>
<th></th>
<th>quant=0.50</th>
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<th>quant=0.75</th>
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<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>$P&gt;</td>
<td>t</td>
<td>$</td>
<td>Coef.</td>
<td>$P&gt;</td>
</tr>
<tr>
<td>Tertiary education</td>
<td>-0.234</td>
<td>0.033</td>
<td>-2.00</td>
<td>0.005</td>
<td>-1.996</td>
<td>0.055</td>
</tr>
<tr>
<td>Long-term unemployment</td>
<td>-0.404</td>
<td>0.025</td>
<td>-0.489</td>
<td>0.000</td>
<td>-0.673</td>
<td>0.020</td>
</tr>
<tr>
<td>Residential property price</td>
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<td>0.020</td>
<td>-0.565</td>
<td>0.100</td>
<td>-1.251</td>
<td>0.035</td>
</tr>
<tr>
<td>Employment to population ratio</td>
<td>0.030</td>
<td>0.090</td>
<td>0.101</td>
<td>0.100</td>
<td>0.175</td>
<td>0.080</td>
</tr>
<tr>
<td>Gross Domestic Savings</td>
<td>1.323</td>
<td>0.000</td>
<td>2.421</td>
<td>0.000</td>
<td>3.333</td>
<td>0.000</td>
</tr>
<tr>
<td>Policy Uncertainty</td>
<td>-0.089</td>
<td>0.080</td>
<td>-0.099</td>
<td>0.000</td>
<td>-0.101</td>
<td>0.000</td>
</tr>
<tr>
<td>Joint sig:F(10,1591)</td>
<td></td>
<td></td>
<td>45.80</td>
<td></td>
<td>14.01</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>6.01</td>
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<td>P-value:</td>
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(Regression for Female: After policy intervention)

<table>
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<th>$\tau=0.50$</th>
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<tr>
<td></td>
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<td>t</td>
<td>$</td>
<td>Coef.</td>
<td>$P&gt;</td>
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<td>-0.652</td>
<td>0.101</td>
<td>-0.677</td>
<td>0.020</td>
</tr>
<tr>
<td>Employment to population ratio</td>
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<td>0.404</td>
<td>0.054</td>
<td>0.070</td>
<td>0.089</td>
<td>0.050</td>
</tr>
<tr>
<td>Gross Domestic Savings</td>
<td>1.332</td>
<td>0.000</td>
<td>1.400</td>
<td>0.000</td>
<td>1.669</td>
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<td>0.050</td>
<td>0.089</td>
<td>0.005</td>
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<td>0.000</td>
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<tr>
<td>Joint sig</td>
<td>F(10,1591)</td>
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<td>45.80</td>
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References


