Women, Fertility and Economic Growth
The European Marriage Pattern (EMP) in a modern day context

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Summary of key findings

Using a dataset of over 100 countries for the period 1970-2015, this study finds:

- A reduction in fertility of one birth per woman raises the economic growth rate of an economy by around 0.5% a year and lowers the poverty rate by 7%-points.
- In 1970, China’s birth rate was around 5.5 children per woman and, ten years later, 88% of the population were still living in poverty. By 2010, the birth rate was a much lower level of 1.7 children per woman and the poverty rate had fallen to 11.2%. This paper finds that the decline in the number of births per woman reduced the poverty rate by about 26%-points. In other words, if Chinese women were still giving birth to 5.5 children, the poverty rate in China today would be 37% instead of the current 11%.
- In India, the poverty rate is double that of China, at over 20%, and 70% of this difference in the poverty between the two countries can be explained by China’s lower birth rate.
- Sub-Saharan Africa is the part of the world with the highest birth rate: at around five children per woman. This study finds that reducing fertility to 2.1 births per woman (the level required for a stable population) would cut the poverty rate in the region by half, lifting one in two people out of poverty.
- However, not only is there potential to lower poverty in poor countries, there is also significant potential to do so in rich countries like the USA, where 60% of births to young unmarried women are unplanned. Unfortunately, recent attacks on Planned Parenthood are turning the clock backwards rather than forwards, reducing American women’s access to family planning at precisely the time it is most needed.
- Giving women the freedom they need to take charge of their own fertility will be central to reducing global poverty in the years ahead.
- Policymakers, economists and politicians need to take family planning much more seriously than they do at present.
- Where they fail to do so, it often reflects a vision which sees the world through male eyes, neglecting to think about life from the point of view of the opposite sex.
Abstract

In recent years, the European Marriage Pattern (EMP) has received renewed attention. De Moor and Van Zanden (2010) and Voigtländer and Voth (2006, 2013) have argued that a high age of female first marriage in pre-industrial Europe had a strong hand in explaining why certain parts of Europe, notably England and the Netherlands, were successfully able to advance, and, by inference, why Europe was ultimately able to overtake the East, leading to the West’s economic dominance up to the modern day. Underlying this story is a more general hypothesis of female empowerment, particularly in the years which followed the Black Death in the middle of the fourteenth century.

At a time of growing interest in feminism, and when global bodies such as the World Bank and United Nations are placing emphasis on gender equality as a means to economic development, this type of explanation of European success has significant appeal in the wider public domain. With this modern day agenda in mind, a small number of economic historians have begun to contrast the EMP with conditions in today’s developing countries (see, for example, Engelen and Puschman, 2011, Carmichael, 2011 and Carmichael and van Zanden, 2015). However, the future contribution of economic historians to the question of how poor countries can become rich comes with an important caveat: a question mark over the impact of the relatively high age at marriage on fertility and, more generally, a debate as to the real extent of female empowerment in Europe in the pre-modern period (Clark, 2007, chapter 4; Lee and Wang, 1999; Dennison and Ogilvie, 2014; Humphries and Weisdorf, 2015).

Further exploration is clearly required and there is a particular need to bring together the type of work conducted by economic historians with that of economic growth theorists and development economists. As such, this paper uses data on modern day countries to explore whether factors such as the female first age of marriage and the fertility rate can deliver economic success, as measured in terms of economic growth and poverty reduction. Econometric analysis is carried out on a sample of over 150 modern day countries, whilst a comparison of China and India provides a more detailed case-study. The results provide support for the notion that female empowerment, through its effect on fertility, is an important contributor to economic performance and that it can help account for the difference in performance between China and India over the last three decades.

In particular, this paper finds that one less child per woman raises the economic growth rate of an economy by around 0.5% a year (in per capita terms) and lowers the poverty rate by 7% points. Applying these results suggests that had the birth rate in China not fallen over the last forty years, the poverty rate in the country today would now be 37% instead of the current 11%. Furthermore, we find that the greater success that China has experienced in terms of decreasing fertility compared with India explains 70% of difference in poverty between the two countries. Moreover, not only would reducing fertility help in South Asia, this paper also finds that it would have a dramatic effect in Sub-Saharan Africa, with the results of the data analysis suggesting that reducing fertility to 2.1 births per woman (the level required for a stable population) would cut the poverty rate in the region by half.

Introduction

The question of how the West grew rich and what lessons can be drawn for modern day countries has always been central to research in economic history. However, the new global economic history agenda has made answering this question more difficult than ever before.
Explanations have had to meet increasingly stringent criteria: being consistent not only with the past history of a single economy, but with cross-country comparisons that span the globe – and across many centuries.

Many of the latest explanations for Western success have offered concrete suggestions, including Joel Mokyr’s (2009) Enlightenment theory, Robert C. Allen’s (2009) factor price theory and Deidre McCloskey’s (2010) focus on the bourgeoisie. However, all of these recent explanations tend to suffer from the same problem: gender doesn’t feature. Whilst there is a burgeoning literature on the role of women in history, with significant contributions having been made by scholars such as Claudia Goldin, Jane Humphries, Deborah Oxley and Sara Horrell, and whilst the reproductive aspect of a woman’s life has always been popular amongst demographers, joining the dots between these areas of research and the broader question of how the West grew rich tends to take a back seat. When we think of economic growth in history, it is still the (largely male) entrepreneurs, industrialists and inventors that come to mind – and certainly not the average wife and mother. Influenced by economists’ growth models, our explanations of how we got to where we are today are supposedly gender-neutral but, in reality, are anything but.

Notable recent exceptions in terms of moving gender up the agenda of how the West grew rich are De Moor and Van Zanden (2010) and Voigtländer and Voth (2006, 2013). According to these authors, the exogenous shock of the Black Death in the middle of the fourteenth century, particularly when combined with reasonably well developed internal markets, transformed the position of women in society and, with it, took the economy to a higher growth plane. De Moor and Van Zanden argue that a scarcity of labour boosted women’s position in the labour market, whilst Voigtländer and Voth argue that changing demand patterns (including greater consumption of meat) as a result of the consequential higher incomes increased opportunities for women in agriculture.

In turn, these new opportunities are argued to have freed young women from the fate of early marriage, providing them the financial freedom to determine for themselves whether, when and who to marry. Furthermore, once they did find someone of their own choosing, and having experienced a degree of financial independence, young women were determined to set up their own household, independent of their parents-in-law. This desire for young couples to set up their own household made marriage and, with it, fertility, responsive to economic conditions: if the economy was performing poorly, couples had little choice but to postpone marriage, which helped to lower fertility and prevent the standard of living falling further; if the economy was doing well, couples could afford to marry earlier and fertility increased. In other words, the European Marriage Pattern – most commonly characterised by a high age of marriage – is argued to be a natural consequence of women’s economic empowerment.

Whilst the family system has been generating additional interest, Robert C. Allen’s high-wage (or, more specifically, factor price) theory of the Industrial Revolution has been restated. Through the impact of the European Marriage Pattern on fertility and, as a result, the real wage, the two developments have obvious synergies. The EMP can be argued to have fed through to lower fertility, which fits neatly with Malthus’ notion of a preventive as opposed to positive check, with fertility as opposed to mortality taking the burden of adjustment in response to changing economic conditions. In theory, this responsiveness of fertility to changing economic conditions enabled the economy to sustain a level of income above mere subsistence: a higher-wage economy of the kind that, when combined with relatively cheap capital, has the power to
produce mechanization and industrialization. By feeding into fertility, the European Marriage Pattern could, in this way, have had a powerful influence on the path of the economy.

However, whilst demographers have traditionally emphasised the impact of EMP on fertility, this is not the only channel through which it could have positively affected the economy. De Moor and Van Zanden (2010) also point to the way in which a higher age of marriage may have increased savings and human capital investment. Altogether, this suggests that the family system was affecting all three of the central determinants of economic growth: technological change (via real wages), investment (via savings) and human capital. Taken together, no longer it seems can we assume that Western success was built on the back of (largely male) entrepreneurs and inventors; the decisions of the everyday woman about family, work and fertility were likely just as important.

However, this emphasis on the family system and the importance of women’s empowerment in our explanations of how the West grew rich has not been without resistance. To begin with, demographers have questioned whether European fertility levels really were lower in Europe than in other parts of the world that did not go on to successfully advance at the time. Whilst the age of marriage was high in Europe, which acted to reduce fertility, it is argued that marital fertility was lower in parts of the Far East, compensating for earlier marriage. Furthermore, recent work by Dennison and Ogilvie (2014) has failed to find a connection between the age of marriage and the level of economic performance in Europe in pre-modern times, casting doubt not only on the fertility channel but on other channels of influence as well. Finally, Humphries and Weisdorf (2015) question the impact of the Black Death on women’s wages, finding that whilst male wages benefited, female wages did not consistently do so, which raises a question as to the extent of female empowerment at this time. Hence, with economic historians only having only recently brought women into the story of Western growth, it is not yet clear whether they will remain.

This situation in economic history jars with work conducted by development economists and global institutions, which increasingly highlights the gender dimension in the context of modern day economies. A whole body of literature suggests that lowering gender inequality will be vital for poverty reduction and economic growth in the coming years. In fact, this new focus on the role of gender in modern day economies has inspired the creation of a whole series of gender indices in the last ten years, including the World Economic Forum’s “global gender gap report”, the United Nations’ “Gender inequality Index”, which now appears in the Human Development Report, the OECD Development Centre’s “Social institutions and Gender index” (SIGI), the European Union’s “Gender inequality Index” and The Economist’s “Women’s Economic Opportunity Index”. These and other such indices draw upon evidence relating to health and educational outcomes, labour market performance and political representation to measure the endowments and opportunities open to women, either on an absolute basis or relative to men in the economy. Perhaps the only downside of such indices is that they only go back in time as far as 1995, something which Carmichael, Dilli and Rijpma (2014) have, however, attempted to address with their “Historic Gender Equality Index”. Tracking gender inequality back to 1900 for a selection of countries, this index has revealed that whilst there has been a general improvement in women’s relative position over the long-run, there has been little in the way of convergence between countries in the period 1950-2000.

If development economists and global institutions are right to highlight the important role of women in economic development, it suggests that explanations of the rise of Europe which incorporate women could very well be on the right track, despite any criticism they may be
receiving in the quarters of economic historians. If gender equality really is important for economic growth and poverty reduction, it would be difficult to imagine how the West managed to achieve the great feat it did without female empowerment having played some role. The potential impact of the European Marriage Pattern on the wider economy should not, therefore, be disposed of easily. Further work is required before it is confined to the dustbin of history.

To make headway, this paper will look at the European Marriage Pattern in the context of over 150 modern day economies. It will investigate whether the age of marriage feeds through to affect fertility and, in turn, whether fertility affects economic performance, both in terms of economic growth and poverty reduction. The results suggest that contribution of the European Marriage Pattern to the rise of Europe should not be dismissed and that the family system has an important role to play when it comes to explaining differences in economic performance across the world today – a role which economists have sadly missed.

In what follows, Section 1 surveys the long term fertility trends, highlighting the potential link between falling fertility, declining poverty and rising incomes. Section 2 explores the factors which affect fertility, looking in particular at the impact of the female age of first marriage. Section 3 estimates the effect fertility reduction on economic growth whilst Section 4 explores the link between age of marriage and economic growth. Section 5 goes on to consider China’s achievements both in terms of rising prosperity and declining poverty in the context of the results, examining to what extent other countries could follow in China’s footsteps by reducing fertility. Moving from poorer to richer economies, Section 6 considers whether there is still potential to lower poverty in the West by reducing fertility. Section 7 concludes.

1. Fertility: a survey of long-run trends

For the vast swaths of history, life for the majority was “nasty, brutish and short”. In fact, little more than two hundred years ago, 94% of people in the world lived in poverty (Figure 1). For Malthus, the economist born in 1766, this wasn’t a surprise. Despite being a religious man, Malthus believed that attempts to alleviate mass suffering were pointless: the “passion between the sexes” would forever overpower the earth’s ability to provide, pushing up the price of food and raw materials, lowering real wages and condemning us to a life of little more than subsistence.
Fortunately, Malthus’s pessimism proved to be misplaced. Despite population now being seven times that of 1800, standing at a little over 7 billion today, the real price of food and other commodities over the long run has been falling rather than rising, and the average standard of living is higher than ever before. In fact, between 1820 and 1965, the global poverty rate fell from 94% to 60%, whilst between 1980 and 2015, the proportion of people living in extreme poverty across the world fell from 44% to just under 10%.

However, the fact that Malthus’ predictions were proven false does not mean that he has nothing to offer us today, despite suggestions to the contrary. Whilst the global poverty rate has been falling and world income has been on the increase, something else has also been going on alongside: the average number of children born per woman has collapsed. In the eighteenth century, the average woman could expect to give birth to eight children in the course of her life. By 1950 this had fallen to five and, today, it is half that amount (Figure 2).
In the case of Europe, fertility restriction has a long precedent, dating back to the fourteenth century. European demographers have long claimed that the relatively unique way in which European families were organised – known to historians as the European Marriage Pattern (EMP) – appears to have succeeded in naturally reducing fertility by between a half and a third, and all in the age before modern and reliable contraception. In the early-modern period, on the eve of the West’s rise to global economic supremacy in the nineteenth century. The late age at which European women chose to get married meant that women’s peak fertile years – between the ages of 16-25 – tended to fall outside of the period of sexual activity, cutting the number of births by a third, whilst the relatively high proportion of women who never got married reduced births by a further 10-25%. The resultant reduced level of fertility – to around five births per woman – was not reached by the average world economy until 1950 (Figure 2), suggesting that Europe was remarkably precocious.

Table 1 shows the average number of children born per woman for a selection of European countries in the early-modern period, on the eve of the West’s rise to global economic supremacy in the nineteenth century. The late age at which European women chose to get married meant that women’s peak fertile years – between the ages of 16-25 – tended to fall outside of the period of sexual activity, cutting the number of births by a third, whilst the relatively high proportion of women who never got married reduced births by a further 10-25%. The resultant reduced level of fertility – to around five births per woman – was not reached by the average world economy until 1950 (Figure 2), suggesting that Europe was remarkably precocious.
Table 1: Age of marriage and births per woman: selected European countries before 1790

<table>
<thead>
<tr>
<th></th>
<th>Mean age at first marriage</th>
<th>Total fertility rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>24.9</td>
<td>6.2</td>
</tr>
<tr>
<td>England</td>
<td>25.2</td>
<td>4.9</td>
</tr>
<tr>
<td>France</td>
<td>25.3</td>
<td>5.8</td>
</tr>
<tr>
<td>Germany</td>
<td>26.6</td>
<td>5.1</td>
</tr>
<tr>
<td>Netherlands</td>
<td>26.5</td>
<td>4.9</td>
</tr>
<tr>
<td>Scandinavia</td>
<td>26.1</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Source: Clark, Farewell to Alms (2007), Table 4.2, p.76.

However, against this notion of European uniqueness on the fertility front, there is some evidence to suggest that fertility rates in pre-modern East Asia might also have been similarly restrained as a result of what is argued to have been low fertility within marriage. However, since marriage was near-universal in the region and East Asian women were married at a much younger age than their counterparts in Europe, by around nineteen years, it is questionable whether total fertility rates really were able to reach the same low levels that existed in Europe. Furthermore, the types of “birth control” practices that researchers have used to help justify low marital fertility in East Asia have been shown to be hazardous for the women involved, ineffective and, when it comes to practices such as female infanticide, a desperate response to poverty, suggesting that a Malthusian positive as opposed to preventive check prevailed, with higher death rates as opposed to lower fertility rates acting to keep population and economic resources in balance.

Hence, whilst some researchers have contested the uniqueness of European fertility restriction, there is still reason to believe that the high age of marriage in Europe acted to constrain fertility in a way that proved to be helpful to the economy and better for the standard of living of those concerned.

Following its relatively unique and precocious start in terms of fertility restriction, fertility in Europe began to fall even further in the late nineteenth century, albeit with parts of Eastern and Southern Europe lagging behind (Figure 3). Births per woman (the “total fertility rate”) fell from the previous average of around five children to two and a half children by 1940. Elsewhere in the world, fertility began to fall from around the middle of the twentieth century (Figure 4). In India, for example, births per woman have fallen from six children in 1960 to around two and half by the modern day.

Whilst fertility has been trending downwards in many developing countries, in the West, where fertility is now below population replacement levels (which require 2.1 births per woman), there are, however, now signs of an uptick in fertility.
Figure 3


Figure 4

Whilst all of this evidence might suggest that countries are now converging in terms of fertility levels, pockets of stubbornly high fertility still remain. A 2012 report by the World Economic Forum identified 58 high fertility countries, 39 of which are in Africa. The majority of these high fertility countries experience population growth rates of around 2.5% p.a. or greater, meaning that their population is doubling roughly every 35 years. Even factoring in UN projections that fertility will fall over time, to around 2.8 in 2050 and 2.2 by 2100, these high fertility countries will be the key contributors to the rise in global population between the start and end of the twenty-first century.

Table 2: Fertility rates of the ten most populous African nations

<table>
<thead>
<tr>
<th></th>
<th>TFR (1980-85)</th>
<th>TFR (2005-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>6.8</td>
<td>5.6</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>6.9</td>
<td>4.6</td>
</tr>
<tr>
<td>DR Congo</td>
<td>6.7</td>
<td>6.1</td>
</tr>
<tr>
<td>South Africa</td>
<td>4.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Tanzania</td>
<td>6.6</td>
<td>5.6</td>
</tr>
<tr>
<td>Sudan</td>
<td>6.3</td>
<td>4.6</td>
</tr>
<tr>
<td>Kenya</td>
<td>7.2</td>
<td>4.8</td>
</tr>
<tr>
<td>Uganda</td>
<td>7.1</td>
<td>6.4</td>
</tr>
<tr>
<td>Ghana</td>
<td>6.3</td>
<td>4.3</td>
</tr>
<tr>
<td>Mozambique</td>
<td>6.4</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Source: Kohler (2012), Table 1, p.8

According to Kohler (2012), “while fertility has declined from its peak of 6.71 in 1970-75, the 2005-10 TFR levels for SSA of 5.1 exceed that of all less developed countries by 90%. And because more than 42% of the SSA population is below age 15 in 2010, there is considerable population momentum even if fertility were to decline relatively rapidly”. He goes on to note that whilst global food production has more than kept up with population growth since 1960, in Sub Saharan Africa this has not been the case: per capita food consumption has fallen by 7% since 1961, indicating that the region is on a Malthusian knife-edge.

A cursory look at the countries which experience high fertility reveals that many are also areas in which child marriage is common. In other words, they are in the opposite situation to that which existed in pre-modern Europe. In West and Central Africa, almost one in two women aged 20-49 was married before they were 18, with almost four in ten having been so in Eastern and Southern Africa. The worst performers in terms of child marriage are Niger, Bangladesh, Chad, Mali, Central African Republic, India, Guinea, Ethiopia, Burkina Faso and Nepal, where over 50% of women aged 20-49 were child brides.\textsuperscript{xvi} This suggests that women tend to marry early not only in Africa but also in South Asia, which contrasts markedly with Western countries in the centuries before they became “developed” – and also with East Asia, which has come on leaps and bounds in terms of economic development and poverty reduction over the last three decades.
Table 3: Child Marriage: proportion of women aged 20-49 married before age 18

<table>
<thead>
<tr>
<th>Region</th>
<th>Proportion of women aged 20-49 married before age 18</th>
<th>Fertility rate (birth rate per woman, average 2011-2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Average</td>
<td>29%</td>
<td>2.5</td>
</tr>
<tr>
<td>EAST ASIA AND PACIFIC</td>
<td>21%</td>
<td>1.8</td>
</tr>
<tr>
<td>LATIN AMERICA AND CARIBBEAN</td>
<td>30%</td>
<td>2.2</td>
</tr>
<tr>
<td>SOUTH ASIA</td>
<td>56%</td>
<td>2.7</td>
</tr>
<tr>
<td>MIDDLE EAST &amp; NORTH AFRICA</td>
<td>24%</td>
<td>2.8</td>
</tr>
<tr>
<td>WEST AND CENTRAL AFRICA</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td>EASTERN AND SOUTHERN AFRICA</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>SUB-SAHARAN AFRICA</td>
<td>38%</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Source: UNICEF

In what follows, we will consider the causes of fertility, and, as informed by the economic history literature, will look at the role played by the female age at first marriage. We will go on to examine the relationship between fertility and the economy, both in terms of economic growth and the poverty rate. As we will see, fertility has a marked effect on economic growth, with one less child per woman boosting the growth rate by 0.5% p.a., and, alongside, lowering the poverty rate by 7%-points. Applying the results to a number of modern day countries, including China and India, suggests that economists and policymakers should be taking women’s position in the economy and its effect on fertility even more seriously than is currently the case: that fertility reduction has the power to transform the fortunes of poorer parts of the world in the years ahead.

2. Explaining Fertility: The impact of the female age at first marriage on fertility

Research in economic history suggesting that a high age of marriage fed through to reduced fertility in pre-modern Europe - together with the seeming association between the countries which experience a combination of both high fertility and child marriage in the modern day - suggests that the age of marriage should be considered an important determinant of fertility rates. Moreover, since the female age at first marriage has deep historical roots, should a relationship be found, age at marriage would present itself as an ideal instrument for the next stage of our analysis, where we will be investigating the link between fertility and economic growth.

At a cursory level, the link between the female age at first marriage and the fertility rate should be fairly obvious, particularly in societies where births outside of marriage are deemed culturally unacceptable and where birth control technologies are limited. Simply put, more years within the marital bed would equate to additional years of reproductive activity.

Nevertheless, historical demographers have questioned the extent to which fertility really was restricted in pre-modern Europe (where the female age at first marriage was high) compared with other parts of the world. Some have argued that in pre-modern China, fertility within
marriage was restricted, which offset the greater years within marriage, whilst others have argued that whilst in India young women married in their teens, remarriage upon widowhood was, unlike in Europe, forbidden, which cut short the reproductive lives of many women, particularly in the days of heightened mortality. Furthermore, differences in cultural practice across countries in regard to breastfeeding and sexual abstinence (such as after a birth or during religious periods) have also been noted. It cannot, therefore, be taken for granted that a higher age at marriage in European history – or in the present day – results in a low fertility regime compared with other parts of the world.

More investigation is clearly required. If age at marriage can indeed be shown to reduce fertility, it would leave open the possibility that this fed through to improve economic performance in Europe, potentially contributing to the rise of the West. However, if age at marriage is found to be a relatively unimportant contributor to fertility, this would help to cast doubt on some of the new explanations of Western riches that place women centre stage.

To formally investigate the link between fertility and age of marriage, we employ data on a large number of modern day countries, taking advantage of both extensive data availability and a significant amount of cross-country variation. The data is sourced from the World Bank Development Indicators and Gender Statistics and is summarised in table 4 below for the two years at the start and end of the period we will be considering, 1970-2013.

| Table 4: Female age of first marriage (FAFM) and Fertility rates (births per woman) |
|---------------------------------|------|------|------|------|
| Mean                           | 21.5    | 24.9   | 5.1   | 2.8   |
| Standard Deviation             | 2.4     | 3.8    | 1.9   | 1.4   |
| Coefficient of Variation       | 0.11    | 0.15   | 0.37  | 0.5   |
| Minimum                        | 16.4    | 17.6   | 1.8   | 1.1   |
| Maximum                        | 29.6    | 31.8   | 8.2   | 7.6   |
| Number of observations         | 119     | 135    | 190   | 198   |

Examining this data, what is noticeable is that whilst the average age of marriage has increased (from 21.5 to 24.9) and the average births per woman have fallen (from 5.1 to 2.8), the cross-country dispersion (as measured by the coefficient of variation) has actually widened. This can also be glimpsed in the fact that the difference between the minimum and maximum age of marriage has barely changed over time, as is the case with the minimum and maximum number of births in 2013 compared with 1970. This in turn suggests that there has been surprisingly little in the way of convergence in fertility rates and the age at marriage over the period 1970-2013.

The extent of convergence can be further explored by plotting the change in the birth rate (and the rise in age at marriage) over the period 1970-2013 relative to the initial birth rate (and initial age at marriage). If convergence had been taking place, one would expect to find a significant and positive relationship between the initial level of fertility and the subsequent change in fertility (the decrease in births), indicating that countries with a higher birth rate saw a greater subsequent reduction in the birth rate compared with those that already had a relatively low
level of fertility. As can be seen in Figure 5, whilst a degree of such convergence has taken place, there are a whole series of countries which have not displayed convergence (those in the south-east area of the figure), many of which are in Sub-Saharan Africa.

![Decrease in fertility (1970-2013) relative to initial level of fertility](image)

**Figure 5**

With regard to the female age at marriage, one would expect to find that in countries where the age of marriage was quite low, the subsequent increase in the age of marriage was greater if convergence had taken place. However, as can be seen in Figure 6, the age of marriage has experienced little in the way of convergence. If thought of as an indicator of female empowerment, with a higher age of marriage reflecting greater freedoms for young women, this would also cast doubt over the extent of cross-country convergence in gender equality terms over the last fifty years."
The inference that the age at marriage has shown little in the way of convergence over time is testament to the fact that it is deeply rooted: history casts a long shadow. If a relationship between it and fertility can be confirmed, this would make it a prime candidate as an instrument for fertility when we investigate the link between fertility and economic growth later on.

Moving on to investigate the link between fertility and the female age of first marriage, Figures 7 and 8 plot the fertility rate in 2013 against the female first age of marriage in both 2013 and 1970 (or the closest respective year for which data is available). These scatter plots display a clear and reasonably strong relationship between the female age at first marriage and the fertility rate. However, in order to more formally and econometrically examine the impact of age of marriage on fertility, it is also necessary to perform a regression analysis in which we can consider and control for other variables that are more commonly thought to be determinants of fertility.
Other factors affecting fertility

The factors affecting fertility have been extensively investigated by sociologists, demographers and economists and a debate exists as to the extent to which economic or social factors are in the driving seat. Following in the footsteps of Becker, economists model fertility by treating...
children as a consumption good. The number of and “quality” of children enter directly into the parents’ utility function and indirectly in terms of their effects on other aspects which affect utility (such as income). Here, parents are expected to consider the opportunity cost involved with having children. This line of reasoning suggests that parents compare the benefits and costs of having a child, taking on board both the indirect cost of raising children, which can be thought of as lost wages for the parent(s) involved with child care, together with the more direct cost of raising children (which can be affected by the cost of education, the presence of child labour restrictions, the cost of housing, state support for childcare and so on). This economic approach also identifies a role for infant mortality in affecting fertility choices, with parents targeting a utility-optimising number of children that will survive into adulthood, meaning that higher infant mortality would feed through to higher fertility, albeit with a lagged effect.

More generally, and for the sake of our econometric analysis, these various economic factors can be approximated with the average level of income. However, perhaps one of the greatest criticisms of this Becker-style approach is that it considers the household to be a single unit, when evidence suggests that the bargaining power between a couple is extremely important. Hence, the degree of gender equality needs to be considered in our analysis of the factors affecting fertility alongside the level of income, with the idea being that where women are better integrated into the labour force, not only are the costs of children likely to be greater but they also have wider prospects outside of raising a family. Where women are integrated into the labor market but where non-market work (unpaid housework and childcare) is still seen as “women’s work”, the costs of children from the point of view of women are likely to be even greater as they fall predominantly on the female side. It is this combination of the advancement of women in the world of work but the “unfinished revolution” within the home that has been argued to have led to particularly low levels of fertility in countries such as Italy, leading to a seemingly u-shaped relationship between fertility and gender equality.

Naturally, this economic approach to fertility assumes that women have the freedom to decide whether or not to have children. In the days before modern day contraception, fertility was not so much a choice as a destiny for almost every woman. In the modern day, the availability of reliable contraception has created a disconnect between sexual activity and fertility, as a result of which one would expect the relationship between age of marriage and fertility to be less substantial than it was in the past. However, contraceptive prevalence cannot be taken for granted even in the modern day. Lack of access can easily drive a wedge between desired fertility (including the level suggested by the economic approach) and actual fertility.

Evidence suggests that of the 184 million pregnancies occurring in developing countries every year, four in ten are unintended. The Guttmacher Institute has suggested that of the 818 million women trying to avoid pregnancy, 215 million (over a quarter) are not able to access family planning. Despite a roll out of family planning in developing countries following the first such programme in India in 1951, the initiative “lost momentum” in the 1980s. In fact, the reduction in family planning funding from donors since 1995 has been the equivalent of a 50% cut in funding for each woman, something which the Gates Foundation is now attempting to address.

Whilst the Guttmacher Institute estimates that it would cost an extra $3.6 billion to expand coverage to the currently underserved women across the world, which equates to approximately $17 per woman, it is important to note that calculations suggest that the benefits far outweigh the costs. Based on calculations by Bernstein (2006), the UN Population Division (2009) notes that for every $1 spent of birth control, there is a saving of between $2 and $6 in
terms of other interventions needed to achieve their development goals. This is consistent with a detailed study of Kenya (USAID Health Policy (2009)) which suggests a benefit to cost ratio of 4:1 (based on the savings that come from education, water and sanitation, maternal healthcare and so on). Factoring in the wider benefits of family planning, including reduced maternal and child mortality as a result of fewer pregnancies and longer gaps between births leads to a benefit to cost ratio of over 30:1. Incorporating more indirect benefits, such as increased labour force participation and earnings, improvements in the health of women and their children and the ability for women to stay in education for longer leads to an even greater benefit to cost ratio of 60:1.

So far we have considered what is effectively the demand side and the supply side of fertility control, which brings us to the work of Coale (1973). Coale identified three preconditions for fertility decline:

1) Fertility must be subject to conscious choice
2) Fertility reduction must be beneficial (in what economists would consider utility maximising terms) - the demand-side of fertility
3) Effective birth control technology needs to be available – the supply-side of fertility control

By considering (2) and (3), we have been implicitly taking (1) for granted. However, sociologists have pointed out that conscious fertility control should be considered an innovation in and of itself (one which it is easy to take for granted in modern day developed countries), with the acceptance and diffusion of this form of behavior having attracted detailed study. Here, factors such as an individuals parent’s fertility behavior (such as their age at first birth), the behavior of colleagues and of friends has been found to be influential. However, they tend to be the object of study at the micro as opposed to macro level, as will be employed here.

Regression results

Controlling for other factors, we will analyse the impact of age of marriage on fertility using the following regression model specification for a panel of 158 countries between the years 1970-2014:

\[ F_{i,t} = \alpha + \beta_1 \text{Age}_{i,t} + \beta_2 \text{Age}_{i,t}^2 + \beta_3 \text{Income}_{i,t} + \beta_4 \text{mortality}_{i,t} + \beta_5 \text{GPI}_{i,t} + \beta_6 \text{C}_{i,t} + \epsilon_{i,t} \]

Where F is fertility rate (the number of births per woman), Income\text{\textsc{initial}} is GDP per capita (in constant $US 2005), with the initial year (rather than period average) having been selected in order to limit any problems that could be caused by reverse causality. Age\text{\textsc{initial}} is the female first age of marriage at the start of each period, mortality is the mortality rate of under fives (deaths per 1000), GPI is the gender parity index (enrollment of girls versus boys in primary and secondary education), and C is contraceptive prevalence. A squared term for the female age at first marriage is also included in order to allow for the effect of a rise in age at marriage on fertility to decline as the age of marriage increases.

Table 5 provides the results of applying panel estimators to the 158 countries for three periods of time: 1970-84, 1985-1999 and 2000-2014. Unless indicated otherwise, the data used involves averages for the relevant panel period and is sourced from the World Bank Development Indicators and Gender Statistics.
Table 5

<table>
<thead>
<tr>
<th>Fertility</th>
<th>REG. 1 Fixed Effects</th>
<th>REG. 2 Fixed Effects (with controls)</th>
<th>REG. 3 Random Effects</th>
<th>REG. 4 Random Effects (with controls)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (female age at first marriage)</td>
<td>-1.96 (-8.49)</td>
<td>-0.66 (-2.18)</td>
<td>-2.16 (-13.60)</td>
<td>-0.039 (-2.02)</td>
</tr>
<tr>
<td>Age²</td>
<td>0.035 (7.70)</td>
<td>0.012 (2.07)</td>
<td>0.039 (11.99)</td>
<td>0.0064 (1.78)</td>
</tr>
<tr>
<td>Income (initial, per capita)</td>
<td></td>
<td>0.0000038 (0.30)</td>
<td>-0.00000072 (-0.02)</td>
<td></td>
</tr>
<tr>
<td>Mortality rate (under fives)</td>
<td></td>
<td>0.0095 (3.31)</td>
<td>0.012 (5.40)</td>
<td></td>
</tr>
<tr>
<td>Gender Parity Index</td>
<td>-0.039 (-0.05)</td>
<td></td>
<td>0.506 (0.78)</td>
<td></td>
</tr>
<tr>
<td>Contraceptive prevalence</td>
<td>-0.042 (-7.59)</td>
<td></td>
<td>-0.038 (-10.52)</td>
<td></td>
</tr>
<tr>
<td>constant</td>
<td>29.77 (13.76)</td>
<td>32.58 (9.610)</td>
<td>309</td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.47</td>
<td>0.83</td>
<td>0.47</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Notes: t-statistics in brackets; robust standard errors were used in all cases due to the presence of heteroskedasticity

Across all four regressions, the age of marriage shows a strong and statistically significant relationship with fertility. As might be expected, as the female age of first marriage initially increases, it has a sizeable effect on fertility, an effect which then diminishes as the age of marriage increases further. Using the coefficients on the age of marriage and squared age of marriage terms, and controlling for all other variables (i.e. using REG.2 and REG.4), the estimated impact on fertility of an increase in the age at which women marry from 15 to 25 is around 2 less children being born per woman.xxxiii

The strength of the impact of age of marriage on fertility can be glimpsed not only in the size of the effect implied by the estimated coefficients but also in the fact that: (i) as regressions 1 and 3 reveal, even by itself age of marriage explains a good deal of the variation in fertility rates across countries (with a high R-squared in both cases) and (ii) as can be seen in regressions 2 and 4, age of marriage trumps both average income per capita and the gender parity index as a determinant of fertility.

Other than the age of marriage, the only other two variables which are found to have a significant effect on fertility are as follows:

- Contraceptive prevalence: with the estimated coefficient suggesting that in a country where contraception is available to all women, women give birth to around four fewer children compared with a country in which women are unable to access contraception.
- Mortality rate of under fives: with the estimated coefficient suggesting that a decline in mortality from the maximum experienced by any of the countries in our data set to the
Evidence of a significant impact of the female age at first marriage on fertility rates in the modern day countries suggests that the relatively high age at marriage of women in pre-modern Europe, particularly in countries such as Britain and the Netherlands, is indeed likely to have fed through to lower fertility rates compared with other parts of the world – despite some suggestions in the literature that this might not have been the case. In fact, since the relationship has been found to be strong for the modern period – one of contraceptive technology and a greater acceptance of births outside of marriage – one can infer that the relationship would have been even stronger in pre-modern times, when most births took place within marriage and when birth control technology was relatively limited, meaning that age of marriage would have had a particularly powerful effect.

This conclusion leaves open the possibility that a relatively low level of fertility in pre-modern Europe helped to push the continent ahead of other parts of the globe, leading to the rise of the West. In order to investigate further, the next section will therefore take advantage of modern day data to explore the extent to which fertility can affect the economic growth rate of an economy.

3. The effect of fertility on economic growth

Evidence of a significant difference in fertility between many of the now rich economies in advance of their own economic rise and many of today's poorer economies suggests that reduced fertility could be an important contributor to why the former were able to advance so early on in history – and why many poor economies are still struggling to do so today. However, despite this marked difference when comparing “developing” countries past and present, along with the more general decline in fertility across the globe in the last two centuries, a period which has come hand in hand with marked improvement in economic performance across the globe, falling fertility is not always thought to be an especially important driver of economic improvement. Instead, economic improvement tends to be attributed to, on the right, the power of capitalism to incentivise invention and innovation, allowing the earth to provide for ever more people, and, on the left, an expansion of state-led welfare and public-good interventions, including in the areas of education and healthcare.

If anything, Western policymakers increasingly take a negative view of falling fertility and, with it, falling population growth rates, emphasising a demographic time-bomb and its potential contribution to a slowdown in economic growth. According to Newsweek, the choice to be childless is “bad for America”, whilst The Economist has paid attention to how governments can “break the baby strike”. Rather than being thought of as a central driver of economic performance, the fertility rate is instead thought to be a consequence of economic variables, as seen in the previous section with the economic approach to fertility. In fact, any attempt to model economic growth as a function of fertility soon comes under fire for being, in Ashraf, Weil and Wilde’s own words “fundamentally flawed” by the prospect of reverse causality: in other words, by the notion that it is the economy driving fertility, rather than the other way around.

A general skepticism over the benefits of reduced fertility in the West contrasts markedly with a growing concern with high fertility in less developed regions. Whilst only 38% of African governments viewed fertility as being “too high” in 1976, this increased to three-quarters by minimum experienced reduces fertility by around 3-4 births per woman.
According to Campbell (2007), the silence of economists in regard to the impact of high fertility and population growth on the economy has created a “perfect storm” that is undermining development efforts. At least some in the West are starting to think again about the relationship between fertility and growth. A new revisionist picture has emerged as a result of a small number of recent empirical studies, all of which suggest that lower fertility is beneficial for the economy. Furthermore, on the theoretical side, Galor and Weil (2000) and Galor (2011) have connected the emergence of modern economic growth to the demographic transition. However, there is still a marked degree of skepticism regarding the contribution of lower levels of fertility to economic growth, along with a clear caveat that whilst fertility reduction might be necessary, it is in no way sufficient.

Ashraf et al (2013) therefore conclude as follows: “For more than half a century, economists and demographers have wrestled with the question of how much reducing fertility in a developing country would raise income per capita. Unfortunately, there is little agreement on the answer...Beyond this disagreement, we detect a general cynicism regarding the ability of social scientists to say anything useful about the economic effects of fertility – the issue is viewed as political rather than scientific”

However, looking to the lives of our female ancestors, it seems apparent that declining fertility has a significant impact on income and poverty. Feeding two children is expensive enough, but taking care of eight would really take its toll. The way in which high fertility feeds through to poverty at the household level was a central part of the campaign to expand access to birth control in the early twentieth century, with leading figures such as Margaret Sanger and Marie Stopes noting the connection from their own observations and experiences within poor communities in the USA and Britain. Lacking the ability to take charge of their own fertility, it’s not that difficult to understand why poverty was, until recently, a fact of life for the majority of families. Evidence from the modern day suggest that even in today’s rich economies, the risk of falling into poverty almost doubles for families with three or more children compared with those with a single child (Table 6).

<table>
<thead>
<tr>
<th></th>
<th>One child</th>
<th>Two children</th>
<th>Three or more children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Austria</td>
<td>6</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Belgium</td>
<td>7</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Canada</td>
<td>11</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>Denmark</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Finland</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>France</td>
<td>6</td>
<td>7</td>
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</tr>
<tr>
<td>Germany</td>
<td>13</td>
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<td>14</td>
</tr>
<tr>
<td>Greece</td>
<td>8</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>Hungary</td>
<td>5</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Iceland</td>
<td>7</td>
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<td>10</td>
</tr>
<tr>
<td>Ireland</td>
<td>12</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>7</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Mexico</td>
<td>11</td>
<td>16</td>
<td>26</td>
</tr>
<tr>
<td>Norway</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Poland</td>
<td>15</td>
<td>18</td>
<td>31</td>
</tr>
<tr>
<td>Portugal</td>
<td>10</td>
<td>17</td>
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</table>
### Table

<table>
<thead>
<tr>
<th>Country</th>
<th>10</th>
<th>16</th>
<th>29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>10</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>Sweden</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>4</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>United States</td>
<td>14</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>OECD Average</td>
<td>8</td>
<td>10</td>
<td>15</td>
</tr>
</tbody>
</table>


Not only does the number of children to which a woman gives birth affect the experience of poverty at the level of the individual household, it can also in theory be argued to affect the wider economy in a number of possible ways:

*Firstly, with fewer children per woman, there is less downwards pressure on wages. According to Allen (2009), higher wages not only help to boost the standard of living, they provide incentives for businesses to search for mechanised techniques, increasing the technological base and productivity of the economy, enabling further improvements in wages and the standard of living, placing the economy in a virtuous circle.

*Secondly, and in line with De Moor and Van Zanden (2010), with smaller families, parents can better afford to nurture and educate their children, adding to the skill base of the economy, increasing “human capital”.

*Thirdly, not only can smaller families better afford to educate their children, they can also afford to save for the future, generating a pot of funds for investment in the economy, increasing “physical capital”. This benefit comes in addition to the standard way in which slower population growth reduces the degree of capital shallowing, as visible in the Solow model.

*Fourthly, and in a Malthusian context, if certain resources (such as land and minerals) are fixed, a smaller population can be beneficial. More generally, higher fertility costs the planet. Reducing fertility is by far one of the most cost-effective ways to tackle climate change. Pound-for-pound, family planning delivers a greater return for the planet than does solar, nuclear and wind power, second generation biofuels or carbon storage. Whilst it takes only $7 spending on birth control to reduce carbon emissions by around one metric ton, to get the same bang for your buck using low-carbon energy-reduction technologies would leave you out of pocket by $32. Not only does the planet benefit, so do the poorest people in the world, those who have been shown to bear the greatest portion of the cost of climate change.

*Fifthly, lower fertility means less time needs to be dedicated to child care, which increases the labour market participation of both sexes, or, where child care is assumed to be “women’s work”, that of women in particular.

*Sixthly, political scientists have argued that high fertility can create added pressures for the younger generation, including higher levels of unemployment and inequality as they compete for jobs and resources, leading to potential civil and political unrest.

It is worth noting that the part of the world which, after the West, has experienced not only the most impressive poverty reduction but also significant economic growth is East Asia, where fertility reduction has been significant compared with other parts of the world. In China,
fertility has fallen astronomically, from over five children per women in 1970 to just under three by 1980 and then around one and a half by the mid-1990s. China has successfully combined three decades of rapid economic growth with significant poverty reduction: the poverty rate has fallen from 84% in the early 1980s to around 10% today.

Hence, despite the general cynicism regarding the impact of fertility on economic growth, the relationship between fertility, economic growth and poverty reduction deserves further investigation.

Regression analysis

When investigating the link between fertility and growth, researchers tend to take one of three approaches: micro-level (household) studies, simulations and macro-level regression analysis.

Household studies have the advantage of allowing a researcher to look at fertility behavior at the level of individuals, providing extensive data sets, but have the disadvantage that there can be a wedge between individual effects and the broader effects on the wider economy. The second approach, simulations, as taken by Ashraf et al (2013) therefore attempt to bring together a number of individual channels of influence, but ultimately depend on all channels being accurately included. The third approach, macro-level regressions has come under heavy fire. The economic approach to fertility suggests that modelling the economies economic growth rate as a function of fertility is bound to result in a reverse causality problem, making the results of such analysis untrustworthy. In the simplest of possible terms, making it difficult to distinguish the effect of fertility on growth from the effect of growth on fertility. Lacking an appropriate instrument to help tease out the relationship, this approach has, therefore, been pushed to the side. This is disappointing as of all three approaches it is the one that allows us to zoom into the wider economic effects of fertility reduction.

In what follows, the macro-level regression approach will therefore be pursued. As we will see later on in this paper, the problem of reverse causality has, unfortunately, been overblown, which has hampered investigations of the impact of fertility on the economy. However, acknowledging the existence of concerns, we will nevertheless attempt to resolve the supposed reverse causality problem by using age of marriage as an instrument for fertility – a variable that the previous section has shown to be strongly linked with births per woman.

We will adopt a panel growth regression approach, as applied to the 123 modern day countries for which the data is available and for the three time periods 1970-84, 1985-99 and 2000-2014. The regression specification controls for what are often thought by economic historians to be the “deep” causes of growth, institutions and geography, as measured at the start of the forty-five year period under consideration:

\[ G_{t1} = \alpha + \beta_1 \text{(Fertility}_{\text{INITIAL}})_{1t} + \beta_2 \text{(Income}_{\text{INITIAL}})_{1t} + \beta_3 \text{(Institutions}_{\text{INITIAL}})_{1} + \beta_4 \text{(Geography)}_{1} + \epsilon_{1t} \]

Fertility (TFR) is births per woman at the start of each period (1970, 1985 and 2000). Institutions are measured using an average of Freedom House’s index of civil and political liberties (using the year 1972, the closest year to the start of our period) and the geographic variables controlled for are latitude and longitude, height above sea level and distance from the coast or nearest sea navigable river, with the data being sourced from the Harvard Centre for International Development, with thanks to the work of Gallup, Mellinger and Sachs. The data on economic growth rates is sourced from the World Bank.
The data is summarised immediately below and Table 7 presents the results.

<table>
<thead>
<tr>
<th></th>
<th>Mean value</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertility (initial)</td>
<td>4.2</td>
<td>0.94</td>
<td>8.9</td>
</tr>
<tr>
<td>Income p.c. (initial)</td>
<td>9288</td>
<td>132</td>
<td>122,439</td>
</tr>
<tr>
<td>Institutions</td>
<td>4.3</td>
<td>1</td>
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</tr>
<tr>
<td>Latitude</td>
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<tr>
<td>Elevation</td>
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<tr>
<td>Distance</td>
<td>342</td>
<td>7.95</td>
<td>2386</td>
</tr>
<tr>
<td>Age of marriage</td>
<td>23</td>
<td>15.4</td>
<td>33</td>
</tr>
<tr>
<td>Economic growth (p.c)</td>
<td>2.00</td>
<td>-7.97</td>
<td>35.44</td>
</tr>
<tr>
<td>Poverty rate (% of population)</td>
<td>27</td>
<td>0</td>
<td>85</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Economic Growth</th>
<th>REG.1 FE (robust)</th>
<th>REG.2 RE (robust)</th>
<th>REG.3 IV (age of marriage as instrument)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertility (initial)</td>
<td>-0.304 (-2.67)</td>
<td>-0.37 (-4.36)</td>
<td>-0.53 (-3.15)</td>
</tr>
<tr>
<td>Income (initial)</td>
<td>-0.00012 (-5.62)</td>
<td>-0.000085 (-7.21)</td>
<td>-0.000092 (-5.55)</td>
</tr>
<tr>
<td>Institutions</td>
<td>n/a</td>
<td>-0.103 (-1.25)</td>
<td>-0.077 (-0.75)</td>
</tr>
<tr>
<td>Latitude</td>
<td>n/a</td>
<td>0.016 (2.74)</td>
<td>0.015 (1.74)</td>
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<td>Longitude</td>
<td>n/a</td>
<td>0.0085 (4.44)</td>
<td>0.0077 (2.66)</td>
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<td>Elevation</td>
<td>n/a</td>
<td>0.00057 (1.86)</td>
<td>0.00047 (1.24)</td>
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<tr>
<td>Distance</td>
<td>n/a</td>
<td>-0.00052 (-0.93)</td>
<td>-0.000027 (-0.04)</td>
</tr>
<tr>
<td>constant</td>
<td>4.13 (7.69)</td>
<td>4.15 (10.16)</td>
<td>4.68 (5.50)</td>
</tr>
<tr>
<td>N</td>
<td>327</td>
<td>327</td>
<td>297</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.06</td>
<td>0.19</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Regressions 1 and 2 are the standard panel estimators, but using robust standard errors due to the presence of heteroskedasticity. The Hausman test cannot reject a systematic difference in
the estimated coefficients between the two estimators, suggesting that the random effects results can be safely considered.

The choice of using the initial level of fertility (for the years 1970, 1985 and 2000) should minimise concerns about reverse causality. In effect, we are looking at the extent to which economic growth over each fifteen-year period has been greater (or lower) in countries which were originally low as opposed to high fertility. Contrary to reverse causality concerns it is, in fact, worth noting that the analysis of the previous section did not find a significant impact of income per capita on fertility. Age of marriage was, instead, shown to be much more strongly linked with fertility and, since this is a variable with deep historic roots, it presents itself as an appropriate instrument for fertility. Regression 3 therefore employs an instrumental variables approach, instrumenting fertility with the female age of first marriage at the start of each period (or for the closest year).

As is clear, the effect of fertility on economic growth is even stronger in these versions of the model, suggesting that the correlation between fertility and economic growth is not seriously hampered by economic growth driving fertility, but, to the contrary, the reverse is true: fertility affects economic growth. In fact, a reduction in fertility by one birth per woman is found to increase the rate of economic growth by 0.5%-points p.a.. In other words, in countries where women give birth to an extra child, the growth rate suffers by 0.5%-points a year.

The results arrived at in this section can be compared with those elsewhere. Kohler (2012) concludes that a reduction in the population growth rate of 1% p.a. would raise the growth rate by a similar amount. However, Ashraf et al’s (2012) simulation finds that a reduction in fertility from the UN medium-variant to the UN’s low-variant projection would boost economic output by 11.9% (in per capita terms) over a fifty-year horizon, somewhat smaller than that implied by our own analysis.

**Impact of fertility on poverty**

In addition to exploring the impact of fertility on economic growth, it is also worth considering the impact on the poverty rate. Table 8 therefore reproduces the regression results but using poverty as the dependent variable.

The poverty data is the proportion of the population living on less than $1.9 per day (at 2011 PPP), using averages for each of the three panel periods between 1970-2014. The data is drawn from the World Bank Development Indicators.

The results suggest that, controlling for everything else, and alongside the boost to economic growth, a reduction in fertility by one child per woman lowers the poverty rate of a country by around 7%-points.
4. The effect of gender equality on economic growth

Not only do high fertility regions tend to be regions where the age of marriage is low, they are also regions with marked gender inequality. Where women lack opportunities outside the home mean, they have little control over their lives: over whether, when and who to marry. Lacking alternatives, they tend to marry young and have large families. It is in this sense that the female age at first marriage neatly captures aspects of female empowerment that can be difficult to measure in other terms and certainly over the length of time required for an analysis to take place.

Measuring the impact of fertility on economic growth allows us to capture one of the many ways in which the empowerment of women can feed through to have a significant effect on the economy. However, it is only one of many possible channels, suggesting that we need to go further if we wish to more fully examine the impact of the position of women in society on the economy. To do so, we need a measure of women’s empowerment. Whilst there has been a flurry of different measures over the last decade, many do not go back far enough to allow us to fully investigate the effect on economic growth and, whilst Carmichael, Dilli and Rijpma (2014) have constructed an “Historic Gender Equality Index”, it is only available for a select group of countries for which the data can be found. Using the female age of first marriage as a proxy for gender equality would allow us to formally investigate the extent to which improvements in women’s position in society contributes to economic growth.

Table 8

<table>
<thead>
<tr>
<th>Poverty</th>
<th>REG.1 FE (robust)</th>
<th>REG.2 RE (robust)</th>
<th>REG.3 IV (age of marriage as instrument)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertility (initial)</td>
<td>5.90 (4.46)</td>
<td>6.64 (6.38)</td>
<td>6.86 (4.09)</td>
</tr>
<tr>
<td>Income (initial)</td>
<td>-0.00097 (-0.63)</td>
<td>-0.0022 (-2.68)</td>
<td>-0.0019 (-1.68)</td>
</tr>
<tr>
<td>Institutions</td>
<td>n/a</td>
<td>2.22 (1.98)</td>
<td>1.84 (1.55)</td>
</tr>
<tr>
<td>Latitude</td>
<td>n/a</td>
<td>-0.24 (-2.43)</td>
<td>-0.23 (-2.48)</td>
</tr>
<tr>
<td>Longitude</td>
<td>n/a</td>
<td>0.050 (1.59)</td>
<td>0.055 (1.73)</td>
</tr>
<tr>
<td>Elevation</td>
<td>n/a</td>
<td>-0.00032 (-0.09)</td>
<td>-0.00062 (-0.19)</td>
</tr>
<tr>
<td>Distance</td>
<td>n/a</td>
<td>0.0055 (0.76)</td>
<td>0.0063 (1.00)</td>
</tr>
<tr>
<td>constant</td>
<td>5.11 (0.63)</td>
<td>-6.35 (-0.75)</td>
<td>-6.43 (-0.59)</td>
</tr>
<tr>
<td>N</td>
<td>156</td>
<td>156</td>
<td>149</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.57 (between 0.63) (within 0.40)</td>
<td>0.62 (between 0.66) (within 0.40)</td>
<td>0.62 (between 0.67) (within 0.36)</td>
</tr>
</tbody>
</table>
Drawing upon the resurgence in interest in the European Marriage Pattern, historians have already started to examine the link between age at marriage and economic performance. Looking at historical data for a number of European countries in the pre-modern period, Dennison and Ogilvie (2014) failed to find a connection between a higher age of marriage and higher level of economic performance, thereby seeming to cast doubt on the impact of women’s supposed empowerment after the Black Death on the economy. However, one of the disadvantages of Dennison and Ogilvie’s study is that it is focused on European countries alone, thereby missing a large degree of potential variation across countries. Modern day data allows us to exploit this extensive variation to better investigate the impact of the female age at first marriage on economic performance.

Table 9 therefore shows the result of including age at marriage in our growth regressions, using the following specification for the 123 countries for which data is available:

\[ \text{Gr}_{i,t} = \alpha + \beta_1 (\text{Age}_{\text{INITIAL}})_{i,t} + \beta_2 (\text{Income}_{\text{INITIAL}})_{i,t} + \beta_3 (\text{institutions})_i + \beta_4 (\text{geography})_i + \varepsilon_{i,t} \]

Whilst age at marriage has deep historical roots, suggesting that reverse causality is much less of a concern than is more normally the case when carrying out growth regressions, the initial value of the age at marriage was chosen (i.e. for the years 1970, 1985 and 2000) so as to minimise any such concerns. Using regressions 1 and 2 in Table 9, we can see that the female age of first marriage does indeed have a significant effect on economic growth. In fact, in a country where women marry on average at the age of 25 as opposed to 20, the economic growth rate is around 1%-point per year higher.

<table>
<thead>
<tr>
<th>Economic Growth</th>
<th>REG.1 FE (robust)</th>
<th>REG.2 RE (robust)</th>
<th>REG.3 FE (robust) incl. fertility</th>
<th>REG.4 RE (robust) incl. fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of Marriage (initial)</td>
<td>0.203 (2.84)</td>
<td>0.17 (3.43)</td>
<td>0.12 (1.38)</td>
<td>0.067 (1.15)</td>
</tr>
<tr>
<td>Income (initial)</td>
<td>-0.00014 (-4.77)</td>
<td>-0.000103 (-6.43)</td>
<td>-0.00012 (-4.13)</td>
<td>-0.000097 (-6.04)</td>
</tr>
<tr>
<td>Institutions</td>
<td>n/a</td>
<td>-0.18 (-1.96)</td>
<td>n/a</td>
<td>-0.12 (-1.31)</td>
</tr>
<tr>
<td>Latitude</td>
<td>n/a</td>
<td>0.028 (4.12)</td>
<td>n/a</td>
<td>0.0203 (3.30)</td>
</tr>
<tr>
<td>Longitude</td>
<td>n/a</td>
<td>0.0084 (3.64)</td>
<td>n/a</td>
<td>0.0081 (4.00)</td>
</tr>
<tr>
<td>Elevation</td>
<td>n/a</td>
<td>0.00055 (1.57)</td>
<td>n/a</td>
<td>0.00050 (1.58)</td>
</tr>
<tr>
<td>Distance</td>
<td>n/a</td>
<td>-0.00073 (-1.07)</td>
<td>n/a</td>
<td>-0.00036 (-0.52)</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.48 (1.45)</td>
<td>-0.955 (-0.87)</td>
<td>1.15 (0.53)</td>
<td>2.44 (1.72)</td>
</tr>
<tr>
<td>FERTILITY</td>
<td>-0.2 (-1.4)</td>
<td>-0.305 (-2.68)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>297</td>
<td>297</td>
<td>297</td>
<td>297</td>
</tr>
</tbody>
</table>
The link between age of marriage and growth is consistent with the work of Carmichael and Van Zanden (2015), who take an ethnographic approach to measuring family systems across the globe, constructing what they call a “female friendliness” measure of family life. Their results suggest that Europe is (and was) relatively unique in terms of the female friendliness of its family system. The high age at marriage was, in other words, a product of a broader set of circumstances that fostered gender equality. The only other part of the world that comes reasonably close to the West in terms of the female friendliness of its family system is South-East Asia, which, as we have already noted, has also performed well in recent history, with family systems in Kerala (India), Sri Lanka, Japan, and Mongolia allowing for a greater degree of female agency than in most other parts of the world, albeit closer to that in northern or central Europe than in western Europe.1

Regressions 3 and 4 in Table 9 explore what happens when we add fertility back into the regression model, meaning that both age of marriage and fertility are directly present at the same time. The fact that the age at marriage becomes insignificant implies that fertility is the dominant factor, suggesting that fertility is a central channel through which age at marriage affects the economy.

This finding that the fertility channel is of great importance when it comes to female empowerment is of interest in light of the recent focus across the world on the extent to which lowering gender inequalities could boost economic performance. One notable report published last year by the McKinsey Global Institute found that “advancing women’s equality could add $12 trillion to global growth” – in other words, boosting global GDP by $12 trillion between now and 2025. In fact, in what they call a “full potential scenario” – one where, in their words, “women play an identical role in labour markets to that of men”, a much greater figure of $28 trillion could be added to GDP by 2025, equivalent to a boost to income of 26%.

However, whilst such conclusions are of immense importance in pushing forward the equality agenda, the calculations tend to treat women as duplicates of men, considering the way in which gender equality would influence, as in the McKinsey case, female labour force participation and, with it, the production of goods and services. The more direct impact of women’s empowerment on fertility – and the way in which this feeds through to the economy – tends to receive much less emphasis, a point to which we will return later on but which in part reflects the economics discipline’s failure to take seriously the consequences of the reproductive difference between men and women.

5. Poverty reduction in China versus India and Sub-Saharan Africa: what role does fertility play?

The contribution of East Asia to reducing the global poverty rate in the last forty years cannot be overestimated. Breaking down global poverty reduction by region reveals that the majority of the decline in global poverty rates is a result of trends in East Asia (Figure 9, dark blue region).11

Many explanations have been offered – from helpful state interventions to successful market liberalization. However, one other clear candidate is the reduction in fertility, including the
influence of the controversial One Child Policy. Using our results, we can now precisely estimate how much of the decrease in poverty in China is a result of a reduction in fertility.

In 1970, China’s birth rate was around 5.5 children per woman and, ten years later, 88% of the population were still living in poverty. By 2010, the birth rate was a much lower 1.7 children per woman and the poverty rate had fallen to 11.2%. Using the results of Table 8 suggests that the decline in the number of births per woman (of around four fewer children) reduced the poverty rate by about 26%-points. In other words, if Chinese women were still giving birth to 5.5 children, the poverty rate today would be 37% instead of the current 11%.

The next big wave of global poverty reduction will require reductions in poverty in South Asia and Sub-Saharan Africa. The lack of progress in these regions alongside their relatively higher fertility rates compared with China suggests that fertility reduction could have an important role to play in reducing poverty in the years ahead.

The current poverty rate in India is double that of China, despite a similarly long period of economic growth. Whilst fertility has fallen dramatically in the last forty years (see Figure 4 from earlier), the average woman still gives birth to at least one extra child compared with her counterpart in China, and an even greater number of children amongst the poorest groups of society, where child marriage is common. India is, in fact, in the top ten worst offenders across the globe. Using our results, the extra birth per average woman in India is estimated to have increased the poverty rate by around 7%-points compared with where it would be if Indian woman gave birth to the same number of children as in China. Given that the poverty rate in India is 21.3% (2011 figures) compared with 11.2% in China (2010 figures), this difference
goes a long way to explaining India’s poorer record in terms of poverty reduction. In fact, it explains 70% of the higher poverty experienced in India.

In Sub-Saharan Africa, the region which after South Asia contributes most to global poverty (Figure 9, pink region), women still give birth to an average of five children and, as we have seen, child marriage is common. Compared with China, and using our results, this is estimated to have led to an extra one in five people living in poverty. In Nigeria, the poverty rate in 2009 (latest figures) was over 50%, standing at 53.5%. In other words, more than half of the population in the economy is living in poverty. Our calculations suggest that if Nigeria could lower its birth rate from the current 5.7 children per woman to 2.1 births per woman (the replacement ratio for the population), the poverty rate would fall by around 25%-points. In other words, it would be cut in half. In Ethiopia, where women give birth to 4.5 children and where the poverty rate is a smaller 33.5% (2010 figures), a reduction in births to 2.1 per woman would reduce the poverty rate by about 17%-points to around 17%. Like Nigeria, it would also therefore be cut in two, lifting one in two people out of poverty.

Whilst we tend to suppose that low fertility is the result of economic development, the history of the West combined with recent development experience in East Asia, as now supported by the results of our econometric analysis, suggests that the relationship may be best seen the other way around: that low fertility can help economies to successfully combine economic growth and poverty reduction.

**Gender inequality and fertility reduction**

In line with our analysis so far, regional aggregates suggest that, in general, fertility is highest where women’s economic empowerment is weakest (Table 10 and Table 11). Reducing fertility to levels that are consistent with economic growth and poverty reduction doesn’t come from nowhere: it is the result of a changing society, one which places women and men on an equal footing.

**Table 10: Fertility and Gender Equality**

<table>
<thead>
<tr>
<th>Region</th>
<th>Gender inequality Index (UN, 2015)</th>
<th>Fertility rate (birth rate per woman, average 2011-2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OECD</td>
<td>0.231</td>
<td>1.8</td>
</tr>
<tr>
<td>EAST ASIA AND PACIFIC</td>
<td>0.328</td>
<td>1.8</td>
</tr>
<tr>
<td>LATIN AMERICA AND CARIBBEAN</td>
<td>0.415</td>
<td>2.2</td>
</tr>
<tr>
<td>SOUTH ASIA</td>
<td>0.536</td>
<td>2.7</td>
</tr>
<tr>
<td>ARAB STATES</td>
<td>0.537</td>
<td>3.4</td>
</tr>
<tr>
<td>SUB-SAHARAN AFRICA</td>
<td>0.575</td>
<td>5.1</td>
</tr>
</tbody>
</table>

**Table 11: Child Marriage: proportion of women aged 20-49 married before age 18**

<table>
<thead>
<tr>
<th>Region</th>
<th>Proportion of women married before 18</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Average</td>
<td>29%</td>
</tr>
<tr>
<td>EAST ASIA AND PACIFIC</td>
<td>21%</td>
</tr>
<tr>
<td>LATIN AMERICA AND CARIBBEAN</td>
<td>30%</td>
</tr>
<tr>
<td>SOUTH ASIA</td>
<td>56%</td>
</tr>
<tr>
<td>MIDDLE EAST &amp; NORTH AFRICA</td>
<td>24%</td>
</tr>
<tr>
<td>WEST AND CENTRAL AFRICA</td>
<td>46%</td>
</tr>
</tbody>
</table>
The part of the world that has seen the greatest progress in terms of poverty reduction over the last four decades, East Asia and the Pacific, has also been the part of the world where fertility has fallen fastest and where gender inequality is relatively low. As a region, East Asia is not far behind the West in terms of gender empowerment (Table 10) and has the lowest rates of child marriage outside of the group of rich countries (Table 11).

Reducing poverty in parts of the world where it remains stubbornly high will require a concerted effort to improve economic opportunities available to women, enhancing their ability to take charge of their own bodies – to take charge of their own fertility.

**Box: How empowering women in poorer countries could also help Western workers**

Empowering women overseas is not only crucial to reducing poverty and improving economic growth in their own countries, it is also central to tackling the two big economic problems the West currently faces: rising income inequality and a slowdown in economic growth. Greater opportunities for women throughout the world will result in smaller families and slower population growth, improving the bargaining power of all workers, thereby lifting the “global wage”. As the global wage rises, this will in turn help to prevent downward pressure on the wages of the average Western worker, who, since the onset of globalization, has been suffering the consequences of competing with the vast swathes of workers abroad. Not only will this help to lower income inequality in the West, it will also provide businesses with a greater incentive to invest in new capital, helping to lift the economic growth rate. Rising inequality and slow growth in the West in recent years have been the inevitable consequences of opening up the economy to a wider world in which women are not free to control their fertility.

**6. The elephant in the room: fertility reduction and the modern day USA**

Fertility reduction is not only an issue for poorer countries. In richer countries there is a related development which all too often goes under the radar and which hampers poverty reduction: unplanned pregnancy is still a serious problem, particularly for young unmarried women in their 20s. According to Sawhill (2014), 60% of births to young unmarried women result from unplanned pregnancies.

With a declining age of first sexual activity and an increasing age of marriage, young women are at increasing risk of an accidental pregnancy turning into single-motherhood. In the UK, for example, the gap between the two dates has doubled, from about seven years to fourteen years. Across all OECD countries, non-marital births have increased from 11% in 1980 to 33% in more recent years. Cohabitation and the ease of having children before marriage offer much more freedom than in the past, but they also mean greater risks that filter through to high exposure to poverty for the women and children involved (Figure 11). Unmarried parents are statistically less likely to stay together, something which has a powerful effect on the mothers and children involved. The Fragile Families and Child Wellbeing Survey, carried out in the USA, which has been tracing the lives of children born in 1998, has found that whilst most of the unmarried parents “hoped to marry each other one day”, two-thirds had split up by the time the child was five. This is, unfortunately, not a good recipe for economic stability. The
outcomes for the children involved are gloomy, and it is a factor that cannot be ignored in explanations of rising inequality and reduced social mobility, for which family structure has been shown to be one of the most important variables.\textsuperscript{lix}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure10.png}
\caption{Figure 10 (Source: http://www.oecd.org/futures/49093502.pdf p.13, Figure 6)}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure11.png}
\caption{Figure 11 (Source: Figure 1, p.3 of https://www.gc.cuny.edu/CUNY_GC/media/CUNY-Graduate-Center/PDF/Centers/LIS/LIS-Center-Research-Brief-2-2015.pdf)}
\end{figure}

Trying to mitigate the effects through the welfare system has proven costly. Estimates suggest that if the percentage of children growing up in single parent homes in the USA had remained the same as in 1970, by 2012 the child poverty rate would have been 15% - as opposed to an actual value of 21%.\textsuperscript{lix} According to Sawhill, the rise in single parenthood has “completely offset the poverty reducing effects of the growth of cash assistance programs over the past four decades or so. The government is doing more, but the official poverty rate has remained stubbornly high because of the decline in marriage”. In fact, “for every child kept out of poverty
by the earned income tax credit or some other programme, another child is about to be born into poverty because of the wholesale breakdown of the American Family”.\textsuperscript{34} Welfare programs have, effectively, been fighting a losing battle.

In general, two solutions have been offered: on the right, incentivising marriage, and, on the left, greater state involvement in the form of higher levels of child support, family friendly work policies and “socialising care”.\textsuperscript{35} Realistically, however, the first of these is hardly going to be enough to reverse a sea change in society, whilst the second will prove expensive for the tax-payer, particularly if social trends continue.

Fortunately, there is another way forward: placing family planning firmly back on the agenda. Despite the fact that having a child is life-changing, and needless to say expensive, accidents happen. The evidence speaks for itself: in the USA, 52% of unplanned pregnancies are a result of having not used contraception and another 43% are a result of incorrect or inconsistent use of contraceptives such as the condom and the pill.\textsuperscript{36} These accidents need to be avoided if women are to minimise their exposure to poverty.

Contraception must be at the heart of any state policy to lower poverty and reduce inequality – including in its most modern and most reliable forms: we have moved a long way since the pill. Whilst some countries such as Britain already make family planning services available for free to all women, the direction of USA policy has been taking a turn for the worse. Planned Parenthood has come under attack, reducing the availability of free and low cost birth control. If the state truly wants to lower the welfare bill it needs to take family planning much more seriously than at present. In fact, in an age in which sex and marriage have been decoupled, family planning is needed now more than ever. Women need to be in control of their reproduction, before their reproduction takes control of them.

7. Conclusion

On the global stage, increasing emphasis has been placed on the way in which greater gender equality can boost economic performance. One report suggests that global income could increase by as much as 26% if women’s labour market contribution equaled that of men.\textsuperscript{37} However, what such reports often miss is that women’s contribution cannot be assumed to be exactly the same as men. Their reproductive capacity means that they can bring even more poverty reducing and growth enhancing power to the table. In this paper we have found that falling fertility has been central to global poverty reduction, and that differences in fertility rates between countries help explain the differences in economic performance across the globe today.

Our analysis suggests that one less child per woman raises the economic growth rate (per capita) by around 0.5% a year whilst also lowering the poverty rate by 7%-points. Applying these results to China shows that had the birth rate not fallen in the country over the last forty years, the poverty rate today would be 37% instead of the current 11%. In addition, we find that the greater success that China has experienced in terms of decreasing fertility compared with India explains 70% of the higher poverty experienced in the latter country, the other big player in the world economy. In fact, as we have seen, not only would reducing fertility help in South Asia, it is also predicted to have a potentially dramatic effect in Sub-Saharan Africa, with the findings suggesting that reducing fertility to 2.1 births per woman (the level required for a stable population) would cut the poverty rate in the region by half.
Fertility is important for two reasons: it feeds through to affect poverty experience at the level of individual families and, by influencing the economy-wide growth factors (its technological capacity, skill base and savings rate), the broader economy’s economic growth performance. Rather than highlighting the negatives of falling fertility rates and slowing population growth, policymakers need to embrace the benefits that it can bring. South Asia and Sub-Saharan Africa have significant scope to boost economic performance by lowering fertility, and, not only will it help their own economies, it will have significant spillover effects on the West, helping to lower inequality and improve economic growth. Efforts to boost women’s control over their own fertility are not only relevant to poorer countries, here in the West more needs to be done to help younger women who are now at increasing risk of single-motherhood. In the USA, which is moving backwards rather than forwards in terms of birth control rights, there is a particular need to act.

However, whether we are talking about rich or poor countries, little more will be achieved until the relationship between fertility and economic growth is better recognised by economists. The general skepticism which has surrounded fertility’s impact on economic growth in part reflects a view that in the modern technological age, the potentially depressing effect of population growth on the economy can be easily offset by technological innovations. A 1986 National Research Council study certainly took this view, arriving at the conclusion that there was little reason for governments to “interfere” with fertility decisions. At the 1984 International Conference on Population in Mexico, the Reagan Administration declared that “population growth in and of itself is neither good or bad…The relationship between population growth and economic development is not necessarily a negative one”. Indeed, economic growth theorists who like to talk about increasing returns point to the benefits of a rising population, with Kremer (1993) being the most notable contribution.

However, the relative neglect of fertility might also reflect something other than technological bullishness: an implicit sexism in the economic discipline.

For what are predominantly male economists and policymakers, it’s easy to see how physical capital and R&D might affect the economy and to arrive at policies that might help stimulate such areas. However, the whole domain of the reproduction of people (as opposed to the reproduction of capital) is rather more mysterious – something of a black box that is left to the wives and mothers, not particularly worthy of serious consideration by the economist. Where it is considered, such as was famously the case by Becker, it is modelled as a function of economic circumstances, rather than as a driver of those economic circumstances. In other words, whilst fertility has notably declined, it is often thought to be a passive responder – rather than significant contributor – to economic improvements such as rising incomes, faster economic growth and declining poverty rates. After all, to acknowledge that fertility might be an important driver of economic outcomes would be to trump the special power of women to affect the economy and to draw attention to an important area of life which, unlike physical capital, falls outside of male experience and surrounding which men have less control.

Even today, the international organisations and reports that place emphasis on the role of women in economic development generally do so by treating them as equivalent to men, ignoring their special reproductive difference. Calculations of by how much income per capita can be boosted if men and women are equal are carried out on the basis of looking at what would happen if women’s labour market performance (both in terms of participation and pay) rose to the same level as the male of the species. Where fertility is considered, it is indirectly, through its impact on individual women’s labour market participation, education and experience (and through this, wages). The wider ability for fertility to affect the economy
beyond the individual household, such as by affecting labour supply and so the general level of wages in the economy, and the ability and incentive for families to save and educate the next generation, does not always seem to be taken seriously.

Not only does the lack of female perspective in the economic discipline stand in the way of a fuller consideration of the impact of fertility on the economy, so does culture: a presumption that governments “interfering” with fertility – trying to induce lower levels through, for example, birth control – would be morally wrong. Here, the implicit assumption is that all women must be happy – or, at least, should be happy – with having children (and a good number of them). As a result, there is, apparently, no individual welfare loss that could provide a good justification for a government to intervene. Hence why, unlike with R&D and capital investment, government interventions are accused of being “interfering”. The idea of even contemplating the potential benefits for the economy of fertility reduction is brushed to the side before it has the chance of serious consideration. Where governments have chosen to intervene, such as by aiding access to birth control, as is now common in many countries, it is very much seen as a social as opposed to economic imperative.

It is time for fertility to receive more attention as a driver of economic performance: for fertility reduction to be accepted as a means to lift not only individual households out of poverty but whole countries, and as a potential route to solving the problems which currently haunt Western economies. By ignoring the contribution that fertility restriction has and can continue to make, the risk is that policymakers do not do enough to protect and extend women’s birth control rights. As we have seen, funding for family planning initiatives has been on a downward trend since the 1990s, something which Melinda Gates and the Gates Foundation have been seeking to address. However, there are also problems closer to home. In the USA, women’s ability to control their own bodies is coming under increasing attack, with potentially disastrous consequences for future poverty trends.\textsuperscript{lxviii} The attack on the funding of Planned Parenthood has reduced access to cheap contraception for America’s poorest women, with recent evidence suggesting that it has increased the birth rate by as much as 27%. The future of poverty reduction in the USA does not look good. Having achieved so much in the past, it is disappointing that women’s freedom to control their own bodies is neither recognized as an important moral imperative nor as a means to achieve economic improvement, as is the case with other types of freedoms that receive much greater emphasis.

To conclude, there is no excuse for any economist – nor any capitalist who believes in the invisible hand – not to be a feminist who fights for women’s freedom.\textsuperscript{lxix}
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ii On this point, also see Voigtländer Voth (2006).

iii Carmichael, de Pleijt, Van Zanden and De Moor (2014); FAO (2011); Klasen (1999, 2002); Klasen and

iv For a discussion and comparison of these and other such gender equality indices, see Carmichael (2016),
chapter 2.

v For further long-run perspective, see Max Roser’s site: http://ourworldindata.org/data/growth-and-distribution-of-prosperity/world-poverty/

vi Tate (2016).

vii Guinnane (2011). The greatest number of births per woman recorded in a sizeable enough population suitable
(the Hutterites, an Anabaptist Christian society) for study is twelve.


xi On China, see Wolf and Engelen (2008), p.348-9. On the age of marriage of women in Japan and China, see

xii Wolf (2001); Sommer (2010). Estimates suggest that up to 20-25% of girls in China may have died as a result
of infanticide (Lee and Campbell (1997), p.64-75).

xiii Millward and Baten, (2010), p.243. France was an outlier, experiencing declining fertility from the late
eighteenth century. For a summary of the fertility transition, see Guinnane (2011).


xvii Lee and Wang (1999); Lee and Campbell (1997).

Here, data used is for 1970 or, where data for that year is not available, the closest possible year within six years either side of 1970; Data for 2013 is the closest possible year to 2013 (and no earlier than 2005).

This finding is consistent with Carmichael, Dilli and Rijpma (2014).

Murtin (2013) identifies a major role for (primary) schooling.

For a fuller consideration of infant mortality and its impact on fertility, see Angeles (2015).


On the impact of the arrival of contraception on fertility in the West, noted papers include Goldin (2006) and Bailey (2010).

Also see Moreland et al (2010).


Kohler (2012).

For a summary of the relevant studies here, see Kohler (2012).


Balbo et al (2013) provides a good summary of the literature.

Using the first regression, in which other variables are not included, the effect is to reduce the number of children by almost six births per woman.

National Research Council (1986)

See, for example, Crouter and Booth (2005), whose book suggests that small families are “the new population problem”. Also, Lee (2011) and Kohler et al (2002).


The Economist (2015)


UN Population Division (2010).

Studies include Ashraf et al (2013), Kohler (2012), Das Gupta et al (2011), Sinding (2009), Turner (2009) and Campbell et al (2007), the last of which is titled “return of the population growth factor”. Note that this literature, often referred to as the “new revisionism” is returning to the much greater emphasis that was placed on fertility in the 1970s. See for example the National Academy of Science (1971) study.


The data was accessed via: http://www.cid.harvard.edu/ciddata/geographydata.htm#general

Data for earlier period is much more limited.

Carmichael, de Pleijt, van Zanden and De Moor (2015) have since defended the contribution of “girl power” to the rise of the West, noting that the “female friendliness” of the family system goes beyond the female age at first marriage. In particular, consensus and neo-locality (whether newly married couples live independently of their wider family - check) need to be considered alongside the age at marriage. Using this broader approach to measuring the “female friendliness” of the family system, Carmichael, de Pleijt, van Zanden and De Moor (2014) are able to find a much stronger connection between the family system and economic development compared with Dennison and Ogilvie, both using historic data and more recent data.


Also see Deaton (2013), p.45.


http://www.undp.org/content/undp/en/home/ourwork/povertyreduction/focus_areas/focus_gender_and_poverty. html

This section draws heavily upon Bateman (2016).

Sawhill (2014).

The Economist (2016).
Sawhill (2014).

On this point, also see Chetty and Hendren (2013).

Sawhill (2014).

Sawhill (2014), chapter 3 & chapter 5.

Sawhill (2014), ch.5. On the latter see the work of Nancy Folbre.

Sawhill (2014).


Also see Boserup (1981).

Also see Galor and Weil (1996).

The impact on siblings is also, of course, considered (the quality versus quantity trade-off).

Bateman (2016).

Bateman (2015a)