The Effects of Macroeconomic Aggregates on Fertility Decisions: Theory and Evidence from U.S. Annual Data

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First Draft: May 4, 2013
This Draft: December 16, 2013

Abstract

Using U.S. data for 1980-2010, this paper studies the effects of various macroeconomic variables, particularly the national debt, government budget deficits and taxes, on fertility decisions over the business cycle. A rise in the debt-GDP ratio, government spending-GDP ratio and the deficit-GDP ratio reduces fertility over the business cycle. On the other hand, a fall in the tax revenues-GDP ratio is associated with lower fertility rates. These results hold even after controlling for other potential determinants of fertility such as the female unemployment rate, female participation rate in the labor force, inflation rate, GDP growth rate, urbanization rate, female life expectancy, marriage rate and divorce rate. I then show that these findings can only be explained by a business cycle model that accounts for moral behavior. Households find it immoral to give more births during periods of mounting national debt and deficits, even following expansionary fiscal policies in the form of higher government spending or lower taxation, so that their children will not need to repay them in the future.

JEL Classification: D03; E32; H31; H62; H63; J10; J13.
Keywords: Total Fertility Rate; Birth Rate; Debt; Deficit; Taxation; Moral Behavior.

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1 Introduction

This paper studies the macroeconomic factors that affect fertility in the U.S over the business cycle. My main focus is on the effects of the national debt, government expenditures, budget deficits and taxes on fertility decisions. I consider annual data over the period 1980-2010 that include both macroeconomic variables and other variables that have been found, in the past, to be important in shaping fertility decisions. The paper shows that the total fertility rate (TFR) and the birth rate (BR) are both negatively affected by fluctuations in the debt-GDP ratio, government expenditures-GDP ratio and budget deficit-GDP ratio, and positively by the tax revenues as a percentage of GDP. Interestingly, these results are robust to the inclusion of the female unemployment rate, the female participation rate, the GDP growth rate and other potentially important factors. I then construct a business cycle model with moral behavior and show that it can explain these findings. On the contrary, the model that abstracts from moral behavior fails to do that. The results of the paper suggest that, following expansionary policies, households find it immoral to increase their demand for children because they are unwilling to pass the debt to their children.

Studying the behavior of fertility rates over the business cycle is not new: in a theoretical work, Becker (1960) argues that an increase in income leads to an increase in both the quantity and quality of children, but the quantity elasticity is smaller than the quality elasticity. Other theoretical studies, such as Mincer (1963), Becker and Lewis (1973), show how fertility is affected by changes in the incomes of males and females. Generally speaking, a fall in the income of males leads to a lower demand for children (because of the income effect) while a fall in the income of females has an ambiguous effect (as the income and the substitution effects contradict). Becker (1981) suggests that the increase in income leads to a fertility decline because the positive income effect on fertility is dominated by the negative substitution effect that is attached to the opportunity cost of raising children. Previous literature examined also the effects of fertility on economic activity (primarily on economic growth) and female labor supply. Galor and Weil (1996) presents a model in which there is positive feedback from low fertility to higher output per capita, higher relative wages of women, higher female participation rate in the labor force and then lower fertility. Therefore, they suggest feedback effects between economic activity and fertility. Jones et al. (2011) find that the ability of fertility theories to explain the fertility-income relationship is not robust and it depends on certain assumptions that are not equally plausible.

On the empirical side, Mocan (1990) finds that higher unemployment rates of U.S. males and females are associated with lower fertility rates. The analyses also show that, when the divorce rate and the proportion of young marriages are added to the set of regressors,

higher unemployment rates are associated with higher fertility. Wang et al. (1994) show, for the U.S., that the dynamics of labor supply, output growth and fertility are consistent with a model that explicitly accounts for the endogeneity of fertility decisions. They also conclude that shocks to employment and preferences are important in explaining movements in the fertility rate. In a recent study, Schaller (2012) shows that improvements in the labor market conditions of males are associated with higher fertility while improvements in the labor market conditions of females are associated with reductions in fertility. She also shows that higher unemployment rates are associated with lower fertility rates.

This work, however, mainly focuses on the effects of income, female employment and participation in the labor market (and unemployment in general) on fertility decisions. While these are potentially important macroeconomic factors in shaping fertility rates, other factors should be considered as well, ranging from the inflation rate (as a measure for the cost of living), taxes, budget deficits and debt. Consider, for example, the debt-GDP ratio; a rising debt-GDP ratio may be seen as a negative signal about the trajectory of the economy, which discourages the demand for children. A fall in the tax revenues-GDP ratio can encourage or discourage fertility: on one hand, a fall in this variable may lead to a rise in fertility because of the increase in after-tax income. On the other hand, a fall in the tax revenue-GDP ratio implies a less healthy economy, which in itself discourages fertility. A-priori, the overall effect is unclear. Similarly, a higher inflation rate may discourage fertility decisions because of the rise in the cost of living. On the other hand, it may indicate a period of expansion in the economy if this rise in the inflation rate is demand-driven. This factor can possibly encourage fertility and, therefore, the overall effect is not clear.

The results of the paper essentially suggest that the effects of the business cycle on fertility decisions cannot be captured only by the effects of female employment or participation in the labor market. Mounting national debt and deficits are considered less desirable for giving new births. The unwillingness of some people to "pass on the debt to our children" is well reflected in the results of this paper. The effect of taxes is interesting too; in sum, the signal extracted from above-trend taxes is a better functioning economy, which encourages fertility. In the contrary, people perceive tax cuts as a bad signal since, more often than not, they occur in periods of downturn. A rise in the government spending-GDP ratio is associated with a fall in fertility. These two results are undoubtedly interesting; they essentially suggest that the demand for children over the business cycle falls even after expansionary fiscal policies.

Below-trend inflation rate leads to below-trend fertility: inflation is normally higher in expansions and, thus, a higher inflation rate indicates a good time to give new births. The effects of inflation on birth decisions, however, are not robust to the specification of the econometric model in hand. If significant, it has a positive effect on fertility decisions in the

short run. The urbanization rate is the most robust non-macroeconomic factor in shaping fertility decisions; above-trend urbanization rate is associated with below-trend TFR and BR in all specifications considered. Short run fluctuations in female life expectancy have also been found to be important in explaining the behavior of fertility decisions, particularly when BR is considered as the fertility measure. The robustness analyses find no evidence that either the marriage rate or the divorce is important in explaining the behavior of either TFR or BR over the business cycle. The short-run effects of female life expectancy and urbanization rate are highly interesting since, normally, one would expect them to be significant mainly in the long run. I essentially show here that they should be included in the short-run model as well. Studying the long-run effects of the above-mentioned variables is undoubtedly important, but its beyond the scope of this paper.

To reconcile economic theory of fertility decisions with the above findings (some of them are certainly surprising), I consider a business cycle model in which households derive direct utility from children in addition to leisure and consumption. Key to this model is the assumption that households behave in a morally responsible way and that they enjoy the self esteem from behaving responsibly. I show that a model with a moral behavior component can well account for the observed correlations between fertility measures and fiscal policy measures. In particular, this model shows negative correlation between fertility and the debt-GDP ratio, government expenditures-GDP ratio and the budget deficit-GDP ratio, on one hand, and the positive correlation with the tax revenues-GDP ratio, on the other. For comparison purposes, I also present the predictions of a model that abstracts from moral behavior and find that it completely fails to account for these empirical regularities. In fact, it shows exactly the opposite results. This paper, thus, suggests that the inclusion of moral behavior in macroeconomic models can help in explaining empirical observations that cannot be explained otherwise. By so doing, the study contributes to a growing body of research that incorporate moral behavior (or self esteem, identity, etc.,) in our economic models. A detailed review of this literature will be provided in the text.

Previous literature also examined the effects of fertility on economic activity (primarily on economic growth) and female labor supply. Bloom et al. (2009) use a panel of 97 countries over the period 1960-2000 to examine the effects of fertility on female labor force participation during their fertile years. They find that the effects of reducing fertility on female labor force participation are large and that each birth reduces a woman's labor supply by almost 2 years during her reproductive life. Angrist and Evans (1996) find that, among black women, the decline in fertility due to changes in abortion laws led to a rise in the labor force participation rate of these women. Bailey (2006) shows that the legal access of U.S. women to the 1960 birth control pill before the age of 21 led to a significant reduction in the likelihood of a first

birth before the age of 22, a rise in the number of women in the paid labor force and a rise in the number of annual hours worked. The effects of fertility on economic activity are not the topic of this paper, however, and it will not be discussed in what follows.

Section 2 discusses the data I use in this study and presents some descriptive statistics and figures. Section 3 presents the main econometric results about the effects of macroeconomic variables (and others) on TFR and BR. Robustness analyses are presented in Section 4. Section 5 shows some impulse responses. In section 6, I review the work on moral behavior and discuss how the empirical results can be related to economic theory. Section 7 presents the model and Section 8 presents the model-based results. Section 9 concludes.

2 Data

In this section, I discuss the data sample, describe the behavior of the main variables over time, provide basic descriptive statistics and then show, graphically, the cyclical components of the key macroeconomic aggregates with the cyclical components of TFR and BR.

2.1 Data Sample

I use annual data for the period 1980-2010. [1] At the time of writing this version, data on the total fertility rate, birth rate, urbanization rate and life expectancy for 2011 and 2012 have not been available and, therefore, I end my main sample in 2010. Also, up to the mid 1970s, both TFR and BR experienced a significant drop. For this reason, I start my sample in 1980 to allow for better measurement of business cycle fluctuations on fertility decisions in the U.S. A detailed description of all variables can be found in Appendix A.

To test for the short-run effects of macroeconomic variables on fertility decisions over the business cycle, I first calculate the cyclical component of the variables (with the exception of the growth rate of output as it is stationary at the origin), which is defined here as the deviation of each variable from its trend. I make this calculation using standard HP-filtering with a parameter of 100. I then run the cyclical component of the total fertility rate and the birth rate on the cyclical components of other variables. This exercise allows for better accounting for the short-run fluctuations and makes me avoid any effects of changes in the trends of the various variables. Finally, some of the variables considered here may be more important in the long run as opposed to the short run. As noted above, this is not the goal of this paper. [2]

[1] The use of annual data is due to the lack of high frequency data on some of the key variables.

[2] See Herzer et al. (2012) for more discussion on the long-run determinants of fertility. See also Ahituv (2001), McNown (2003) and Angeles (2010).

2.2 Evolution of the Main Variables Over Time: 1980-2010

Figure 1 shows the behavior of the main variables of interest (with their actual values rather than their cyclical components) over the period 1980-2010. During this time period, TFR displayed an increase of roughly 0.2-0.3 relative to its level in the early 1980s (which, in turn, followed a considerable drop in the previous two decades). The debt-GDP ratio had an upward trend during this period, the tax revenues-GDP ratio fluctuated a lot during this period and the inflation rate dropped from its late 1970s-early 1980s peak to lower and more stable levels. Furthermore, I use TFR and BR as measures of fertility both for robustness needs and because, as the figure shows, they had different trends in the past two decades.

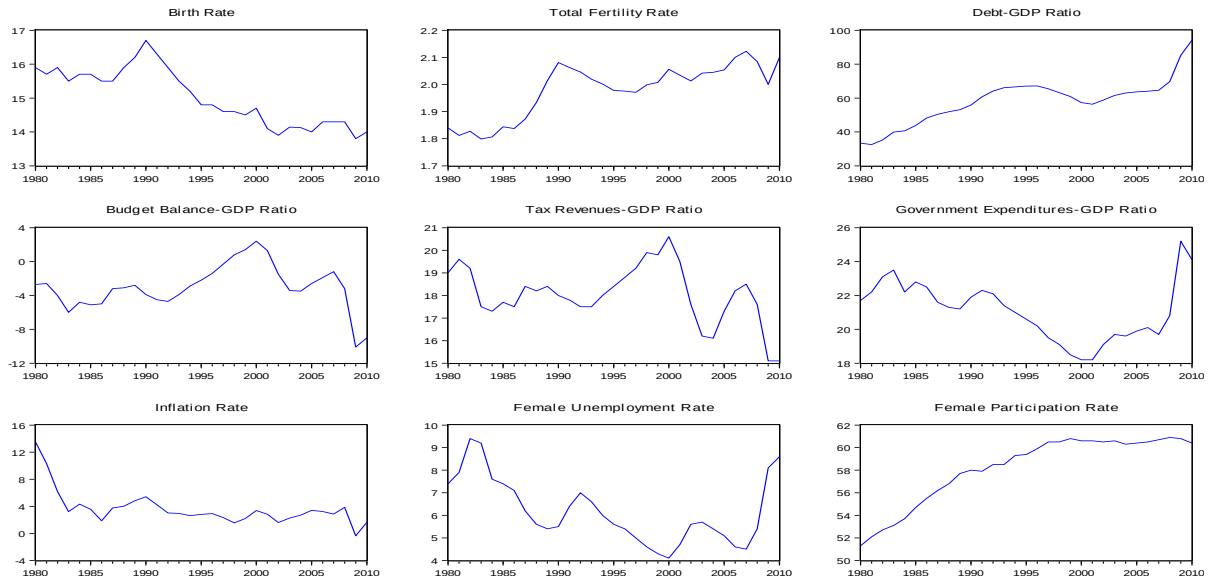

Figure 1: The behavior of the main variables over time, 1980-2010

Variable	Mean	Median	Std. Dev.
Total Fertility Rate	1.98	2.01	0.10
Birth Rate	15.03	14.80	0.83
Debt-GDP ratio	58.21	60.90	13.66
Budget Balance-GDP Ratio	-3.02	-3.10	2.67
Tax Revenues-GDP ratio	18.05	18.00	1.29
Government Expenditures-GDP ratio	21.07	21.10	1.74
Female Unemployment Rate	6.17	5.60	1.45
Female Participation Rate	58.17	59.40	3.01
Urbanization Rate	77.52	77.30	2.82
Female Life Expectancy	79.10	79.10	0.86
Inflation Rate	3.64	3.03	2.56
GDP Growth Rate	2.65	3.07	2.10
Marriage Rate	8.95	8.95	1.16
Divorce Rate	4.40	4.50	0.55
Male Unemployment Rate	6.41	6.10	1.79
Unemployment Rate	6.30	5.80	1.62

Table 1: Descriptive statistics of the main variables

Table 1 presents basic descriptive statistics about the main variables of the study. With few exceptions (e.g. the inflation rate, GDP growth rate and the unemployment rates), the mean values and median values are almost identical. The average U.S. total fertility rate has been around 2 during the previous three decades and average birth rate has been around 15 for every 1000 people.

2.3 TFR and BR vs. Fiscal Policy Variables: 1980-2010

As a first-pass to the regression analyses, this subsection shows the deviations of TFR and BR from their respective trends vs. the most important macro factors considered in this paper. Figure 2 and Figure 3 display, respectively, the cyclical component of TFR and BR vs. the four key macroeconomic variables of interest.

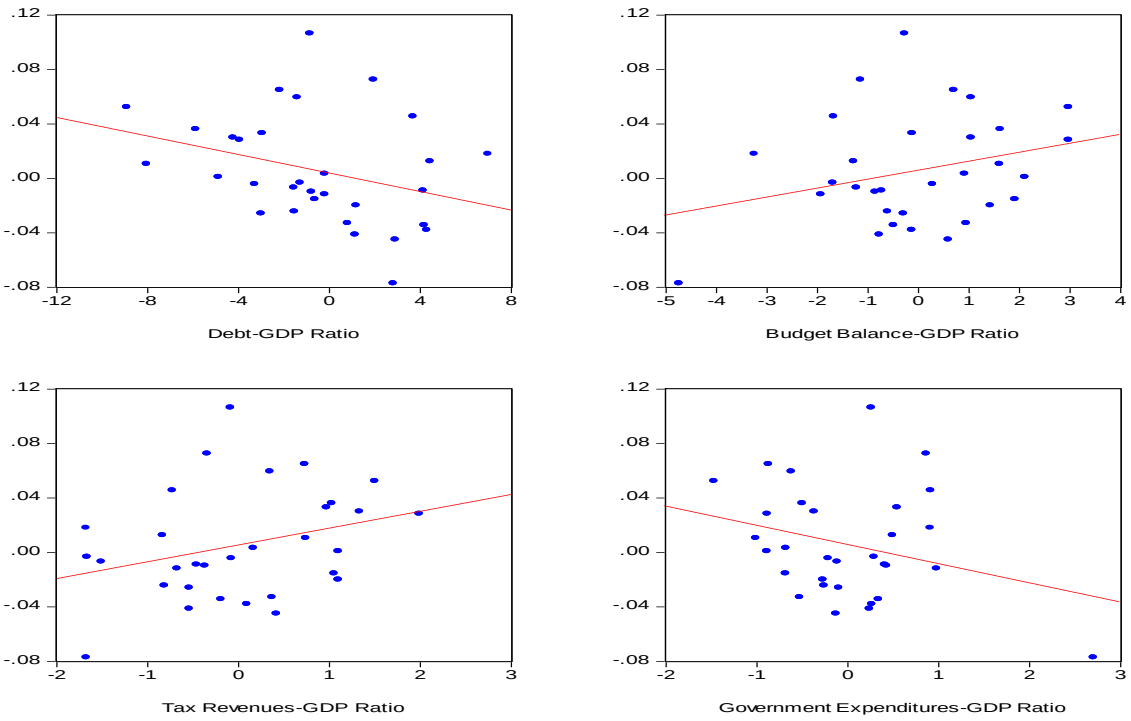

Figure 2: The cyclical component of TFR (vertical axis) vs. fiscal policy measures

The simple trend lines indicate that both the TFR and the BR are below trend when the debt-GDP ratio is above trend, government spending-GDP ratio is above trend and the budget balance worsens (a bigger deficit or a smaller surplus). On the other hand, below-trend tax revenues-GDP ratio is associated with below-trend TFR and below-trend BR. The four variables are obviously correlated, but it is useful to consider the source of the effects of debt and deficits on fertility (i.e., whether it is because of taxation, government spending or both). These figures essentially motivate this study and they suggest that

following expansionary fiscal policies, the demand for children may actually *decrease*. With these observations in hand, the next section conducts formal regression analyses to determine whether these variables are indeed important in explaining the behavior of the U.S. TFR and BR over the business cycle.

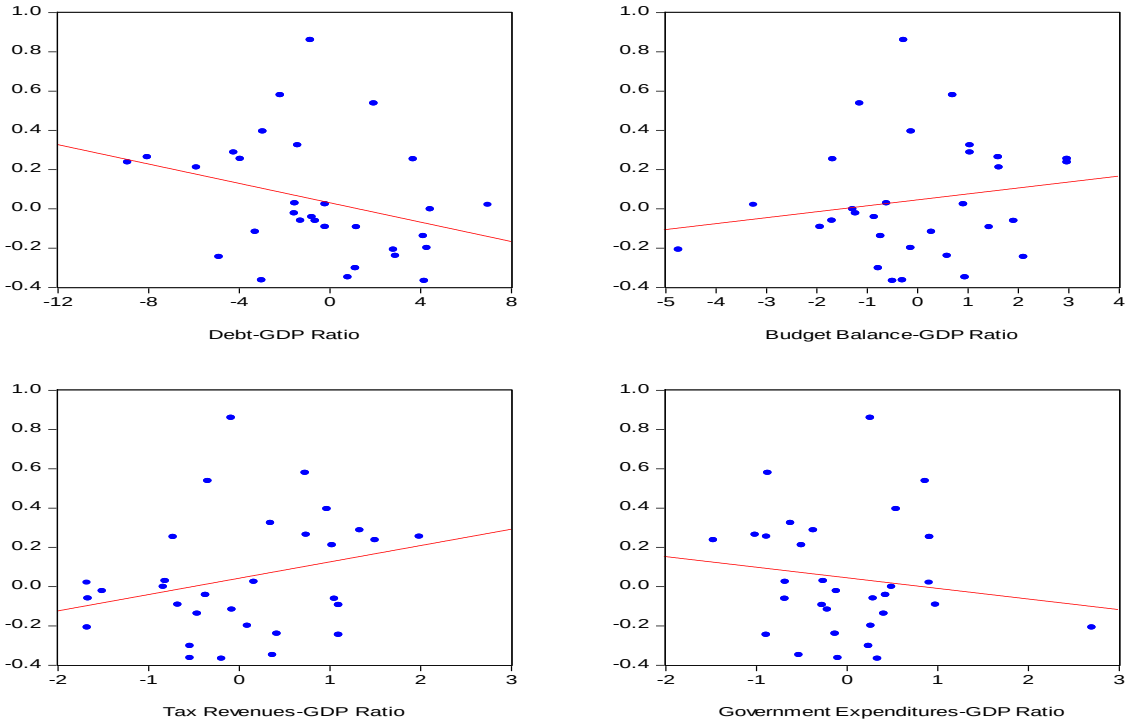

Figure 3: The cyclical component of BR (vertical axis) vs. fiscal policy measures

3 Regression Results

Table 2 and Table 3 present the main regression results for TFR and BR, respectively. As a benchmark, I present the results for both fertility measures with only the unemployment rate and the participation rate of females. The female unemployment rate has a negative and significant effect on both TFR and BR, whereas the participation rate does not. Note, however, that even with the case of the unemployment rate, the ability of the model to explain the cyclical variations in BR and TFR is very low (the R-squard is between 14% and 20%) suggesting that other variables are important in explaining this behavior. Adding other variables to the regressions considerably improves the ability of the model to explain the variations in TFR and BR over the business cycle. In all regressions with BR, the R-squared is about 80% or more and in all cases considered with TFR the model accounts for more than 70% of the variations in this variable over the business cycle. [3]

[3]The adjusted R-squared values for all regressions are lower by roughly 3-4% than the actual R-squared.

More importantly, in almost all regressions, a rise in the debt-GDP ratio or the government expenditure-GDP ratio above trend is associated with a fall in TFR and BR below trend, a fall in the tax revenue-GDP ratio below trend is associated with below-trend TFR and BR and a below-trend budget balance is associated with below-trend TFR and BR. Therefore, the effects of the budget balance-GDP ratio on fertility result mainly from both taxation and government expenditures, but not necessarily- in the case of BR with female unemployment, only the tax revenues-GDP ratio is significant. In almost all cases, the variables are significant at the 1% or the 5% levels and only once (the coefficient of government expenditures with BR and the female unemployment rate) a variable is not significant. The observations from the previous section are, thus, confirmed by the regressions: above-trend debt-GDP and deficit-GDP ratios lead to a reduction in fertility below trend.

The results about taxation and government expenditures are undoubtedly interesting. Expansionary fiscal policies, whether in the form of lower taxation or higher government expenditures or both, do not lead to a rise in the demand for children even if they encourage economic activity, but actually have the opposite effect. To the best of my knowledge, these results are unknown in the literature on fertility and they are among the main findings of this paper. These results cannot be explained by standard fertility theory and certainly not by a theory that suggests pro-cyclical behavior of fertility.

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X
Constant	0.0047 (0.6684)	0.0010 (0.2271)	0.0022 (0.5892)	0.0019 (0.4391)	0.0022 (0.5232)	0.0049 (0.6639)	0.0032 (0.8091)	0.0045 (1.3824)	0.0043 (1.2012)	0.0042 (1.1757)
Debt		-0.0031** (-2.2599)					-0.0023** (-2.0973)			
Budget			0.0118* (3.5674)					0.0102* (4.1813)		
Tax				0.0152** (2.3891)					0.0155* (3.3679)	
Govt. Exp.					-0.0189* (-2.6647)					-0.0194* (-3.3487)
F. Unemp.	-0.0191** (-2.1906)	0.0116 (1.5812)	0.0167** (2.4540)	0.0146*** (1.8547)	0.0090 (1.3807)					
F. Part.						0.0171 (0.6064)	-0.0464* (-2.8270)	-0.0599* (-4.2331)	-0.0647* (-4.0440)	-0.0525* (-3.5062)
Inflation		0.0068*** (1.9937)	0.0020 (0.5744)	0.0045 (0.2287)	0.0023 (0.5861)		0.0068** (2.2009)	0.0018 (0.6101)	0.0035 (1.1582)	0.0019 (0.5705)
Urbanization		-0.3311* (-4.7561)	-0.4436* (-5.9708)	-0.3840* (-4.9274)	-0.3866* (-5.1581)		-0.3343* (-5.4520)	-0.4355* (-7.4791)	-0.4035* (-6.6498)	-0.4108* (-6.6434)
F. Life Exp.		0.0348 (1.0321)	0.0335 (1.1107)	0.0168 (0.4832)	0.0531 (0.0329)		0.0523 (1.6758)	0.0551** (2.1270)	0.0385 (1.3533)	0.0713* (2.5030)
R^2	0.1420	0.7218	0.7780	0.7273	0.7391	0.0125	0.7681	0.8395	0.8124	0.8118

Table 2: Dependent variable- cyclical component of TFR. t statistics in parentheses.
* significant at the 1% level, ** significant at the 5% level, *** significant at the 10% level .

The effect of the female unemployment rate is not robustly significant (especially when BR is the dependent variable), but the participation rate of females is highly robust. Interestingly, the participation rate seems to have a negative effect on fertility decisions; therefore, given the set of variables considered here, a rise in the participation rate of women decreases fertility. The results about the unemployment rate and the participation rate of females in the expanded models suggest that the findings in the restricted model is due to the lack of other explanatory variables. [4] Once these variables are added to the list of regressors, the female unemployment rate and participation rate either cease to be significant or they change their sign. These are a highly important results; essentially, the paper reveals that either some of the previous findings about the importance of female employment and participation rates in the labor market may have been biased due to the lack of other explanatory variables or they do not explain the *cyclical* behavior of fertility measures as they may explain them in the long term.

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X
Constant	0.0353 (0.7152)	0.0106 (0.3991)	0.0198 (0.7473)	0.0175 (0.6456)	0.0197 (0.7155)	0.0298 (0.5541)	0.0197 (0.7618)	0.0291 (1.1597)	0.0276 (1.0997)	0.0277 (1.0518)
Debt		-0.0197** (-2.3259)					-0.0164** (-2.3002)			
Budget			0.0483** (2.0935)					0.0466* (2.4869)		
Tax				0.0731*** (1.7965)					0.0808* (2.4816)	
G. Exp.					-0.0696 (-1.4692)					-0.0781*** (-1.8197)
F. Unemp.	-0.1644* (-2.6152)	0.0472 (1.0519)	0.0499 (1.0523)	0.0494 (0.9808)	0.0161 (0.3704)					
F. Part.						0.2947 (1.4423)	-0.1868*** (-1.7654)	-0.2409** (-2.2268)	-0.2768** (-2.4464)	-0.2024*** (-1.8255)
Inflation		0.0376*** (1.8066)	0.0217 (0.8968)	0.0292 (1.2399)	0.0255 (0.9645)		0.0375*** (1.8887)	0.0205 (0.9069)	0.0248 (1.1451)	0.0247 (0.9933)
Urbanization		-2.5380* (-5.9659)	-2.8940* (-5.5978)	-2.7238* (-5.4564)	-2.6201* (-5.2357)		-2.5495* (-6.4462)	-2.9546* (-6.6414)	-2.8698* (-6.6889)	-2.7916* (-6.0970)
F. Life Exp.		0.5903* (2.8628)	0.5983* (2.8548)	0.5127** (2.2995)	0.6738* (3.0690)		0.6606* (3.2840)	0.6815* (3.4413)	0.5948* (2.9556)	0.7466* (3.5418)
R^2	0.1908	0.8123	0.8057	0.7978	0.7898	0.0669	0.8257	0.8307	0.8306	0.8135

Table 3: Dependent variable- cyclical component of BR. t statistics in parentheses.
* significant at the 1% level, ** significant at the 5% level, *** significant at the 10% level .

In fact, the effects of female participation and employment have never been conclusive and they have changed over time. Adsera (2005) shows that the massive entry of women

[4]The female unemployment rate is introduced with a lag of one year to account for the fact that given a birth takes 9 months from the start of pregnancy. If a woman becomes unemployed today, that can affect her future fertility, not necessarily contemporaneously. Indeed, the model with a one year lag performs far better than the model with the contemporaneous unemployment rate.

in the labor market that started in the 1960s was first accompanied by lower fertility rates in the OECD countries. However, by the late 1980s, female participation in the labor market and fertility rates were positively correlated in those countries. Okada (2011) finds negative correlation between the changes in the fertility rates and female participation rates in OECD countries. As for the U.S., the latter study shows negative correlation between the two variables up to the mid 1970s and positive correlation between those variables in the following three decades. Da Rocha and Fuster (2006) find positive association between fertility and female employment in economies with low probabilities of finding jobs and that the sign of the correlation between female employment ratios and fertility rates across countries could change if the job-finding rate of females increases.

Alternatively, some of the previously reported correlation between female labor force participation and fertility might be a result of the reverse causation- from fertility to female labor force participation. As discussed above, evidence on this issue was found by Bloom et al. (2009) for a panel of countries, Angrist and Evans (1996) and Bailey (2006) for the U.S., among others.

The urbanization rate has a robust significant negative effect on both TFR and BR over the business cycle. The female life expectancy is significant for all specifications with BR, but only with two specifications with TFR. Interestingly, this study suggests that changes in life expectancy of females are important for birth decisions not only in the long run, as one would expect, but also in the short term. In addition, the inflation rate has been found to be significant only in 4 out of the 12 specifications; when significant, it has a positive effect on fertility decisions. The sign of the inflation rate is interesting- as detailed above, an above trend inflation rate signals, more often than not, an improving economy, which in turn encourages fertility.

In sum, both tables show that the debt, budget balance, government spending and taxes are indeed significant for explaining fertility decisions over the business cycle even if other important factors are explicitly present in the regressions. Furthermore, it is revealed that the effects of female employment and participation rates in the labor market depend on whether or not the above-mentioned macroeconomic variables are included in the set of regressors. This section, thus, suggests new important macroeconomic factors that we should consider while studying the short-run variations in fertility measures. In addition, the short-run effects of some factors can differ from their long-run effects, which further supports the need for this study.

4 Robustness Analyses

In this section, I present some robustness analyses. I start by adding the marriage rate and the divorce rate, separately, and then I consider the growth rate of U.S. GDP as the alternative measure of real economic activity. The inclusion of the divorce rate and/or the marriage rate follows the studies of Silver (1965), Mocan (1990) and Schaller (2012), among others. Due to data availability on the marriage rate and the divorce rate, the sample covers only the period 1980-2009. [5]

The results with the marriage and divorce rates are summarized in Tables B.1-B.4 and, overall, they are supportive of the previous findings. With either the marriage rate or the divorce rate, the results reveal negative effects of the debt-GDP and deficit-GDP ratios on BR in all regressions and a positive effect of the tax-GDP ratio on BR when the participation rate of females is included. As for TFR, the inclusion of either the marriage rate or the divorce rate has no effect on the main findings reported above. Furthermore, the marriage rate and the divorce rate appear to be non-significant in explaining the cyclical behavior of either TFR or BR. Consequently, the ability of the regressions to explain the behavior of TFR and BR is not improved with the inclusion of those two variables. The marriage rate and the divorce might be more important in explaining the long-term behavior of either TFR or BR than their short-term fluctuations.

Furthermore, the results suggest that fertility (particulary TFR) moves counter-cyclically when the divorce rate and the marriage rates are included. Above-trend female employment or participation rates are associated with below-trend TFR in the majority of the regressions. Above-trend female participation rate mostly induces below-trend BR, but there are no significant effects of the female unemployment rate on BR. My results about TFR with the divorce rate are consistent with the findings of Mocan (1990) who shows counter-cyclical fertility when the divorce rate and the proportion of young marriages are present in the empirical model.

Table B.5 shows the results when the growth rate of GDP is used instead of the female unemployment rate and the female participation rate. The idea of this exercise is to test the robustness of the key results of the paper when a broad measure of real economic activity is explicitly present in the model. To economize in presentation, the results of TFR and BR are presented in the same table. Furthermore, the marriage rate and the divorce rate are excluded because of their insignificance in explaining the behavior of TFR and BR.

[5] It is important to notice that both the marriage and the divorce rates can fluctuate over the business cycle. For example, Schaller (2013) recently shows that the a rise in the unemployment rates is associated with lower marriage and divorce rates. See also Hellerstein and Morrill (2011) and Amato and Beattie (2011), among others.

Most of the results above hold here: the debt-GDP ratio is again negatively significant at the 5% level for both the TFR and BR, the budget balance rate is positively significant (implying, as before, that above-trend deficit rate is associated with below-trend TFR and BR) and the and government expenditures-GDP ratio negatively affects TFR. The urbanization rate is very negatively significant (its coefficients are very similar to these presented in Table 2 and Table 3). The inflation rate is found not to be important in explaining the behavior of either TFR or BR; it is significant only in one regression. In addition, the model well accounts for the cyclical variations in TFR and BR.

It appears, however, that the model with the growth rate of GDP is slightly less able to explain the behavior of TFR and BR as can be inferred from the magnitude of the R-Squared. In addition, the GDP growth rate is largely insignificant in explaining the cyclical behavior of TFR and BR when the set of regressors include the variables that this study focuses on. This probably hints that part of the previous association between GDP growth rate and TFR is due to the exclusion of those factors. Finally, unreported regression analyses indicate that the main results of this paper remain unchanged if we use the unemployment rate of males or the total unemployment rate (of males and females) as a proxy for the stance of the real economy. Furthermore, the coefficients of all variables and the R-squared values remain largely unchanged after this modification of the regressions. The formal regression analyses can be provided upon request from the author.

5 Impulse Responses

In this section, I present the responses of TFR and BR to shocks to the debt-GDP ratio, the budget balance-GDP ratio and the tax revenues-GDP ratio. The idea of this exercise is to examine the magnitudes of the impacts of shocks to those variables on TFR and BR and the time period it takes for those shocks to become insignificant, which can shed some light on the key regression results. Each impulse-response function is obtained from a Vector Autoregressive (VAR) system that includes each of the three variables (separately) with the inflation rate, urbanization rate, female life expectancy and either the female unemployment rate or the female labor force participation rate.

All figures suggest that the TFR and BR respond to shocks to the above variables. The effects are in line with the above findings: the debt-GDP ratio and the budget deficit-GDP ratio have negative effects on both TFR and BR, while a positive shock to the tax revenues-GDP ratio has positive short run effects on TFR and BR. Furthermore, the initial effects of those shocks on BR are stronger than their initial effects on TFR. The confidence intervals indicate that the effects of those shocks on both TFR and BR are clearly significant and

they last for roughly two years after the initial shocks. It is undoubtedly, thus, that those variables can have meaningful effects on fertility decisions in the short run.

Figure 4 presents the case with the female unemployment rate. Those VARs essentially correspond to the second through the fourth columns of Table 2 and the second through the fourth columns of Table 3. Figure 5 shows the results with the female labor force participation rate, which correspond to the sixth through the eighth columns of Table 2 and the sixth through the eighth columns of Table 3. The dashed lines indicate the two standard deviations confidence intervals.

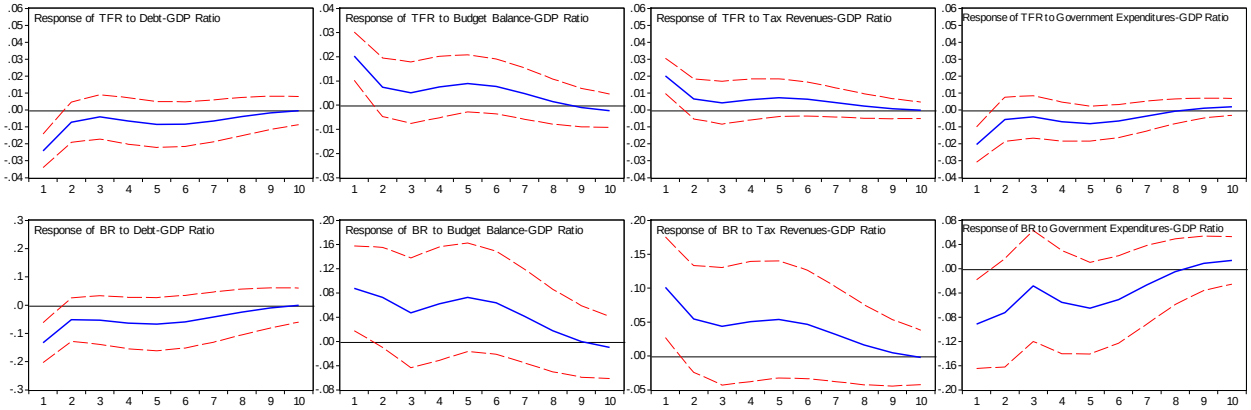

Figure 4: Responses of TFR and BR to shocks, with female unemployment rate.

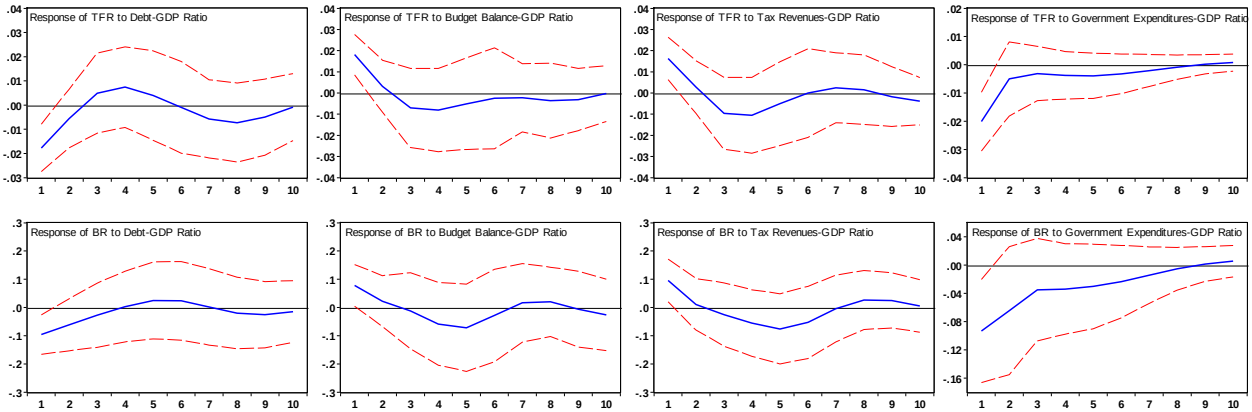

Figure 5: Responses of TFR and BR to shocks, with female labor participation rate.

Generally speaking, the results of this section only support my earlier findings and they indicate that considering the debt-GDP ratio, budget deficit-GDP ratio and the tax revenues-GDP ratio is important to better account for the behavior of the U.S. TFR and BR over the course of the business cycle. These factors are proven significant even in the presence of the more conventional factors that the literature normally account for in order to understand the cyclical behavior of U.S. fertility measures.

6 Economics and Moral Behavior- a Background

The natural question to be asked is what explain these results or, put differently, what economic theory can somehow explain them. If the demand for children over the business cycle is affected by the debt-GDP ratio, budget-balance-GDP ratio, government expenditures-GDP ratio and tax-revenues-GDP ratio even after controlling for female employment, GDP growth and other factors, then a standard model with demand for children cannot alone account for this behavior: the "income effect" is captured by GDP growth (or the unemployment rate) and the substitution effect is somehow accounted for by the female participation rate. Therefore, any model that attempts to explain these results should contain some newer component that is normally abstracted from in this line of literature.

In what follows, I propose a model economy in which the typical household derives utility from regular consumption activates, labor, children and from self image or moral responsibility. Households find it immoral or irresponsible to give births when, say, debt is high because they are unwilling to let their children pay this debt in the future. For this reason, households reduce their demand for children during those periods beyond the direct reduction that would occur because of the stance of the macroeconomy.

Relative to the standard business cycle model, the framework I use here incorporates two additional factors that shape households' preferences: utility from having children and a moral (alternatively self image, self responsibility) component. There is an ample literature about "children in the utility function"; this literature includes Becker (1960), Becker and Lewis (1973), Denton and Spencer (1989), Becker (1992), Portner (2001), Da Rocha and Fuster (2006), Jones et al. (2011), Adda et al. (2011), Wrede (2011), among others.

Akerlof and Kranton (2000) introduce identity, which is the person's sense of self, into economic analysis by assuming that identity directly affects the utility of individuals. They conclude that introducing identity in the model can account for some phenomena that standard economic models cannot well explain and that identity does affect economic outcomes. They also conclude that identity is likely to affect the outcomes in certain areas such as organizational behavior, labor relations and demography. Akerlof and Dickens (1982) have also conclude that a model incorporating "cognitive dissonance" can provide different outcomes and it is able to better explain some phenomena than standard models.

There is also a voluminous amount of work on the "moral component", which can be responsibility, self image, identity, etc., in the utility function since the seminal work of Akerlof and Kranton (2000). Studies in this line of research include Brekke et al. (2003) who assumed that individuals derive utility from their self image as socially (or morally) responsible people. Johansson-Stenman and Svedsater (2012) assume that people's utilities

depend also on how their self image is affected by their intentions and actions, with the self image being a function of various factors. Corneo and Jeanne (2009) introduced self esteem in their analysis of tolerance. Johansson-Stenman and Martinsson (2006) also assume that people derive utility from having a good self image and, as a result, they behave and interpret reality in order to maintain or improve such an image. In Santos-Pinto and Sobel (2005), self image is introduced through agents' positive self image in their subjective assessments of their relative abilities. Based on experimental analysis in a paper that focuses on the dynamic aspects of moral behavior, Ploner and Regner (2013) finds that moral balancing is an important factor in individual decision making. Anand et al. (2011) find that empathy and self esteem are the biggest relative contributors to happiness in their sample. Stringham (2011) argues that "many economists have placed too much emphasis on external constraints and that more emphasis should be placed on internal moral constraints." [6]

With these considerations in hand, I turn next to discuss the model economy used in this paper. The model will embed familiar business cycle features and familiar aspects from population economics and behavioral economics. Essentially, the above empirical findings call for using a model with all of these features.

7 The Model Economy

This section outlines the model economy that I use to reconcile the empirical results with economic theory. The economy is populated by households, a representative firm who operates in a perfectly competitive production sector and by a government. The main assumptions of the model are that households derive direct utility from having children and that their utility is affected by their moral behavior. This model is the closest in spirit to Brekke et al. (2003) and Johansson-Stenman and Svedsater (2012) and the reader may refer to these studies for further details.

7.1 Households

There is a continuum of measure one of households. Each household i maximizes expected lifetime utility over consumption $c_{i,t}$, labor $l_{i,t}$, children $n_{i,t}$ and from self image (or moral behavior), which is denoted by $m_{i,t}$. Households have access to a one-period riskless real government bond $b_{i,t}$ that pays a real interest rate of r_t. The real wage rate per hour is given

[6] Other papers that account for a moral component, in one way or another, include Bnabou and Tirole (2002), Starr (2009), Stone (2000), Teraji (2009), among others. See also Tajima (2007) and Kitzmueller and Shimshack (2012) for related discussions.

by w_t and households pay a labor-income tax rate of τ_t^l on their total labor income $w_t l_{i,t}$. Raising a child incurs a cost of q_t and I assume that the number of children is continuous.

One way to see the implications of moral behavior for the demand for children is as follows. We can think about a socially optimal number of children to be given births or that it is not moral to give births in periods of high debt for two reasons: first, the unwillingness to give births in periods of uncertainty about the stance of the economy. Second, the unwillingness to give births when the debt-GDP ratio is high so that these children will not bear the burden of the debt in the future. In fact, claims along these lines have been raised in recent years as the U.S. debt was climbing, making the idea of this paper even more timely.[7]

I assume that, when households act morally, they obtain a utility of k beyond what they would have obtained in a model that abstracts from moral behavior. However, if the actual choice of children ($n_{i,t}$) deviates from the morally optimal number of children (n_t^*), then their utility is reduced. In particular, we assume that the moral component of the utility function is given by $m_{i,t} = m(n_{i,t}, n_t^*)$, with $m_{i,n_t} > 0$ for $n_{i,t} > n_t^*$.

Formally, the problem of household i is to

$$\max_{\{c_{i,t}, l_{i,t}, n_{i,t}, m_{i,t}, b_{i,t}\}_{t=0}^{\infty}} \mathrm{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_{i,t}, l_{i,t}, n_{i,t}, m_{i,t}) \tag{1}$$

subject to

$$c_{i,t} + b_{i,t} + q_t n_{i,t} = (1 - \tau_t^l) w_t l_{i,t} + (1 + r_{t-1}) b_{i,t-1} \tag{2}$$

with $u(c_{i,t}, l_{i,t}, n_{i,t}, m_{i,t})$ being the period utility function and β is the subjective discount factor of households. Optimization yields the following conditions:

$$-\frac{u_{l,t}}{u_{c,t}} = (1 - \tau_t^l) w_t \tag{3}$$

$$u_{c,t} = \beta(1 + r_t)\, \mathrm{E}_t(u_{c,t+1}) \tag{4}$$

$$u_{n,t} = u_{c,t} q_t - u_{m,t} m_{n,t} \tag{5}$$

where the subscript i has been dropped because all households are identical ex post. Equations (3) and (4) are the standard labor supply and the consumption Euler conditions, respectively. Equation (5) governs the demand for children in this model: it defines the number of children as a function of consumption (which represents the "wealth effect" on the demand for children), the cost of raising children and the moral consideration in the choice of children.

[7] See, for example, 1) Jeff Haymond, "Leave it to our Grand-kids; the Immorality of our National Debt" *Bereans @ The Gate*, April 1, 2013. 2) Chuck Bentley, "The Founders Fear of Federal Debt" *The Washington Times*, July 4, 2013.

This formulation of the household's problem assumes only taxation of labor income whereas the empirical analysis focuses on total federal tax revenues-GDP ratio. Alternatively, I could introduce a total tax burden on households in a lump sum fashion that will correspond to total tax revenues collected by the government. I am abstracting from this formulation because introducing taxes on a lump-sum fashion does not affect the optimality conditions of households. To have meaningful taxation, the tax burden is thus introduced as labor-income taxation. This assumption is also justified by the fact that most federal taxes are indeed labor income taxation: for the period investigated above, the fraction of income taxation in total federal taxes averaged about 80%. With these considerations in hand, in what follows I use income taxation as the only source of taxation in the model.

In order to keep the focus on moral behavior, and in line with Galor and Weil (1996) and Da Rocha and Fuster (2006) among others, I abstract from discussions about the quality vs. quantity of children. Also, as discussed in Jones et al. (2011) the empirical evidence on the quantity-quality tradeoff is mixed. However, notice that the cost of raising a child q_t can be seen as accounting for all costs of raising children, including the cost of having high-quality children (e.g. through expenditures on education, health care, etc.,). [8]

7.2 The Production Sector

This sector is perfectly competitive. The representative firm hires labor as the only input to produce output y_t using the following technology:

$$y_t = f(l_t) \tag{6}$$

The firm chooses labor to maximize:

$$\max_{\{l_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} [f(l_t) - w_t l_t] \tag{7}$$

Profit maximization yields the following standard labor demand condition:

$$f_{l,t} = w_t \tag{8}$$

which suggests that, in equilibrium, the marginal product of labor equals the real wage. This condition and condition 3 determines the equilibrium in the labor market.

[8] Since the paper studies the *cyclical* behavior of fertility, n_t in this paper does not exhibit any trend and it is treated like other varaibles. Furthermore, the choice of the infinitely-lived framework follows the finding of Barro (1974) that an Overlapping Generations (OLG) model with altruism, which could be the alternative to my setup, behaves like an innitely lived agent model.

7.3 Market Clearing

In equilibrium, the government budget constraint reads:

$$\tau_t^l w_t l_t + b_t = g_t + (1 + r_{t-1}) b_{t-1} \tag{9}$$

The combination of this condition and the households budget constraint (condition 2) gives the economy-wide resource constraint.

7.4 The Competitive Equilibrium

Definition 1 (Competitive Equilibrium) *Given the exogenous processes of g_t, τ_t^l and r_t, the competitive equilibrium is a sequence of allocations $\{b_t, c_t, l_t, n_t, q_t, w_t\}$ that satisfy the equilibrium conditions (2)-(5) and (8)-(9).*

This definition is general as it considers three exogenous processes. In the calibration part, however, I consider the response of the economy to shocks to g_t and τ_t^l individually, holding other factors constant. Also, since m_t is determined by the level of n_t, the value of the former variable follows the value of the latter. Therefore, it is not added to the list of variables in the above definition. Finally, total factor productivity is assumed to be constant. This assumption is made for simplicity since the idea of this paper is to investigate the effects of fiscal policy measures on fertility decisions.

8 Calibration and Results

The first subsection presents the functional forms, subsection 8.2 presents the parameterization of the model, subsection 8.3 discusses the introduction of shocks in the model, subsection 8.4 presents the main results and subsection 8.5 shows some impulse responses.

8.1 Functional Forms

We assume the following period utility function for households:

$$u(c_t, l_t, n_t, m_t) = \frac{c_t^{1-\sigma}}{1-\sigma} - \chi \frac{l_t^{1+\varphi}}{1+\varphi} + \mu \frac{n_t^{1-\tau}}{1-\tau} + m_t \tag{10}$$

where σ is the curvature parameter of the period utility function of consumption, τ is the curvature parameter of the period utility function of children, φ is the inverse of the intertemporal elasticity of substitution of labor and χ and μ are scaling parameters. For simplicity

and following former studies, I assume that the moral component enters the utility function in an additively separable way.

The production function of the firm is given by:

$$y_t = l_t^{\alpha} \tag{11}$$

with α being the labor share of output.

As in Brekke et al. (2003) and Georgiadis and Manning (2013), I make use of a quadratic function to account for the moral part of the utility function. Specifically, I assume the following functional form:

$$m_t = k - \frac{\gamma}{2}(n_t - n_t^*)^2 \tag{12}$$

This function has a global maximum of k when the actual number of children equals the morally optimal one. Furthermore, the function is increasing in n_t whenever it exceeds the morally optimal number of children. This fact helps us in assessing the importance of the moral consideration mechanism for the behavior of households.

Government expenditures and the labor-income tax rate evolve according to the following AR(1) processes:

$$\log g_t = (1 - \rho_g) \log g + \rho_g \log g_{t-1} + u_{g,t} \tag{13}$$

$$\log \tau_t^l = (1 - \rho_\tau) \log \tau^l + \rho_\tau \log \tau_{t-1}^l + u_{\tau,t} \tag{14}$$

with ρ_g and ρ_τ being the AR(1) coefficients of the government expenditures and the labor tax rate, respectively. The innovation terms u_{g_t} and u_{τ_t} are normally distributed with zero means and standard deviations of σ_u^g and σ_u^τ, respectively.

Differently from government spending and the labor-income tax rate, debt in this model, as well as in standard business cycle models, is not exogenously determined. It is determined, among other things, by households's optimization. Therefore I do not consider an exogenous process to the debt-GDP ratio, but let it determined endogenously in the model. Finally, to simplify matters and because the paper concerns the effects of fiscal measures on fertility decisions, I assume a constant real interest rate (r), but I then experiment on the value of r in the robustness analyses.

8.2 Parameterization

Table 4 summarizes the benchmark parameterizations of the model. The values of some parameters (e.g. the labor share of output, the consumption curvature parameter and the subjective discount factor) are standard in this literature. I follow Galor and Weil (1996)

by assuming that the utility function is logarithmic in the number of children. The steady state value of the labor tax rate is set to $\tau^l = 0.27$ so that the tax revenues-GDP ratio in this model is 18%, and the value of g is set to 0.0742 so that the budget deficit-GDP ratio is -3.02%, in line with the empirical evidence shown in Table 1. The parameter χ is set so that the steady state of labor (l) is 0.21, corresponding to a workweek of about 35 hours. The labor supply elasticity implies a linear disutility in labor, which helps in capturing the business cycle properties in a model that abstracts from explicit unemployment margin; see Hansen (1985). The standard deviation of each shock is set so that the standard deviation of output is 2%, which is the standard deviation the U.S. output during the period investigated.

Parameter	Description	Value
β	Households' discount factor	0.960
σ	Consumption curvature parameter	1.000
φ	Inverse of labor supply elasticity	0.000
τ	Children curvature parameter	1.000
γ	The identity function parameter	1.000
α	Labor share of output	2/3
ρ_g	AR(1) coefficient of g_t	0.900
ρ_τ	AR(1) coefficient of τ_t^l	0.610
σ_u^g	Std. Dev. of the g_t shock	0.047
σ_u^τ	Std. Dev. of the τ_t^l shock	0.030

Table 4: Values of the parameters

With a logarithmic utility in consumption and children, condition 5 yields:

$$\frac{\mu}{n_t} = \frac{q_t}{c_t} + \gamma(n_t - n_t^*) \tag{15}$$

which defines the number of children n_t as an implicit function of consumption c_t, the morally optimal number of children n_t^*, the cost per child q_t and the parameters γ and μ. [9] Assuming this parametrization, the morally optimal number of children is given by: [10]

$$n_t^* = \mu \frac{c_t}{q_t} \tag{16}$$

which suggest that the morally optimal number of children is increasing in consumption (the

[9] The dynamics of n_t are easier to see if we assume linear utility in children ($\tau = 0$), which implies that households have the same marginal utility from each additional child. In this case, equation 5 reads: $n_t = n_t^* + \frac{1}{\gamma}\left(\mu - \frac{q_t}{c_t}\right)$. Therefore, the number of children will be higher for a lower cost per child and γ and for a higher morally optimal number of children and consumption.

[10] This condition is obtained by maximizing the welfare function subject to the resource constraint or, alternatively, by maximizing social welfare when all households behave in the same way. See Brekke et al. (2003) for more details.

"wealth effect"), decreasing in the cost per child (the "substitution effect") and increasing in the weight of children in the utility function μ. The value of this parameter is set so that the morally optimal number of children is 2 in the deterministic steady state of the model, which is in line with the average total fertility rate in the United States.

Finally, I use the second-order approximation procedure of Dynare in order to obtain the decision rules that solve the approximation to the competitive equilibrium of this model. Using Dynare is very popular in recent years; see, for example, Correia et al. (2013) and Guerrieri and Iacoviello (2013).

8.3 Introducing Shocks

Before turning to the shocks I consider, notice that the tax revenues-GDP ratio in this paper is giving by $\frac{\tau_t^l w_t l_t}{y_t}$, which, giving the functional form assumed in this paper is only equal to $\alpha\tau_t^l$. Therefore, the tax-GDP ratio in this model is proportional to the labor-income tax rate and it will fluctuate with fluctuations in the latter. This fact supports my choice of only labor taxation in the model because, in the end, the fluctuations in total tax revenues-GDP ratio can be captured by fluctuations in the labor tax rate.

To introduce a shock to deficit, I consider three cases that correspond to expansionary fiscal policy. First, the government raises expenditures without changing the tax labor rate (hence no change in the tax revenues-GDP ratio). Second, the government lowers the labor tax rate without changing government expenditures. Third, the government increases expenditures and cut the labor tax rate concurrently. These shocks can capture shocks to the budget balance-GDP ratio and, as a result, also shocks to the debt-GDP ratio.

8.4 Results

The main results of the model are presented in this subsection. I consider each time a different shock (or set of shocks) as outlined in the previous subsection. Table 5 presents the correlation coefficients between the number of children (n_t) and the four measures in the U.S. data as well as their values in two different scenarios in our model- a model with a moral component and the benchmark model without it (i.e. $\gamma = 0$). Using both the TFR and BR, the U.S. data indicate negative correlation between fertility and the debt-GDP ratio and government spending-GDP ratio, on one hand, and positive correlation between fertility and the other two measures, on the other. For almost all cases, the correlation coefficient is roughly 30% in absolute value. These findings are, of course, in line with the regression results presented above.

Consider first the benchmark model ($\gamma = 0$). In the three cases considered, this model

indicates positive correlation between fertility and the debt-GDP ratio and negative correlation with the deficit-GDP ratio. When the economy is hit by a government Expenditures shock with no change in the labor-tax rate, this model suggests that this expansionary policy is associated with a rise in the demand for children. Similarly, when the economy is subject to only a shock to the tax rate (but no change in government spending), the demand for children is negatively correlated with the tax revenues-GDP ratio, suggesting that a reduction in this ratio is associated with a rise in the number of children. Those results holds, qualitatively, also when the economy is hit by simultaneous shock to the tax rate and government Expenditures. The benchmark model, thus, fails in replicating the basic empirical findings of this paper, not only quantitatively, but also qualitatively. In fact, the values of the different correlation coefficients are very far from their empirical counterparts indicating that this model is not even close to replicate the basic empirical regularities.

Shock to Government Expenditures				
	U.S. Data		Model	
	TFR	BR	Benchmark	With Moral Behavior
Debt-GDP Ratio	-0.3194	-0.3114	0.9206	-0.2664
Budget Balance-GDP Ratio	0.2795	0.1726	-0.5246	0.4832
Tax Revenues-GDP Ratio	0.3027	0.2737	-	-
Govt. Expenditures-GDP Ratio	-0.2835	-0.1461	0.5246	-0.4832
Shock to the Tax Rate				
	U.S. Data		Model	
	TFR	BR	Benchmark	With Moral Behavior
Debt-GDP Ratio	-0.3194	-0.3114	0.5957	-0.9879
Budget Balance-GDP Ratio	0.2795	0.1726	-0.2947	0.9567
Tax Revenues-GDP Ratio	0.3027	0.2737	-0.5497	0.9982
Govt. Expenditures-GDP Ratio	-0.2835	-0.1461	-	-
Shocks to the Tax Rate and Government Expenditures				
	U.S. Data		Model	
	TFR	BR	Benchmark	With Moral Behavior
Debt-GDP Ratio	-0.3194	-0.3114	0.8509	-0.3917
Budget Balance-GDP Ratio	0.2795	0.1726	-0.4303	0.4785
Tax Revenues-GDP Ratio	0.3027	0.2737	-0.3522	0.3513
Govt. Expenditures-GDP Ratio	-0.2835	-0.1461	0.3699	-0.4174

Table 5: Correlation coefficients of fertility measures with fiscal policy measures

On the other hand, the model with moral behavior well accounts for the right correlations between fertility and these measures over the business cycle. Regardless of the shock introduced, the model accounts for the negative correlations with the debt-GDP ratio and government spending-GDP ratio, on one hand, and the positive correlations with the budget balance-GDP ratio and the tax revenues-GDP ratio, on the other. Technically, the moral be-

havior function m_t implies a cost for deviating from the morally optimal number of children and, therefore, it discourages the demand for children, leading to the above results.

The case with a shock to government spending and the case with simultaneous shocks do better than the case with only a shock to the tax rate at the quantitative side and they well account for the actual correlation coefficients of the U.S. fertility measures with the other variables. This is particulary true for the TFR and the debt-GDP ratio. This is perhaps the case because the debt-GDP ratio is not exogenous in this model (which is the case in reality) and because the model accounts for the number of children (which is closest in nature to TFR). In addition, as could be seen in the regression analyses section, the four key variables of this study have been more robustly significant in explaining the variations in TFR than BR. This is particularly true for the government expenditures-GDP ratio and the tax revenues-GDP ratio.

I close this subsection with a robustness analysis on the real interest rate, r. In Table B.6, I redo the above analyses for real interest rates of roughly 3% and 5%. For comparison purposes, I also show the results under the benchmark parameterization of the model. The main findings of this subsection are very robust to the choice of the real interest rate. The model with no moral behavior once more cannot replicate the right signs of the correlation coefficients. On the contrary, the model with moral behavior does well in accounting for the true correlation coefficients, both qualitatively and quantitatively, particularly when the economy is hit by a government expenditure shock. Furthermore, a real interest rate between 3-4% is the most likely to replicate the true correlation coefficients when a shock to government expenditures is considered.

8.5 Impulse Responses

Figure 6 and Figure 7 present the behavior of the variables of interest to a positive shock to government expenditures (g_t) and a negative shock to the labor tax rate (τ_t^l), respectively. [11] I first show how fiscal policy variables behave: following a rise in g_t, the government expenditures-GDP ratio rises, the budget balance worsens and the debt-GDP ratio increases. At the same time, the demand for children clearly falls. This leads to a positive linkage between the number of children and the budget balance-GDP ratio, on one hand, and negative correlations with the government expenditures-GDP ratio and the debt-GDP ratio, on the other.

The fall in the labor tax rate leads to a fall in the tax revenues-GDP ratio and to a rise

[11] Since few variables are already in ratios, I show the deviations from the steady state values rather than the percentage deviation from them. For example, in the top panel, the government expenditures-GDP ratio increases from roughly 21% to roughly 21.8%.

in the budget deficit-GDP and the debt-GDP ratios. The demand for children falls in this case as well. Beginning by the second year, the demand for children behaves almost exactly as the tax revenues-GDP ratio, which in turn follows the path of the labor-income tax rate.

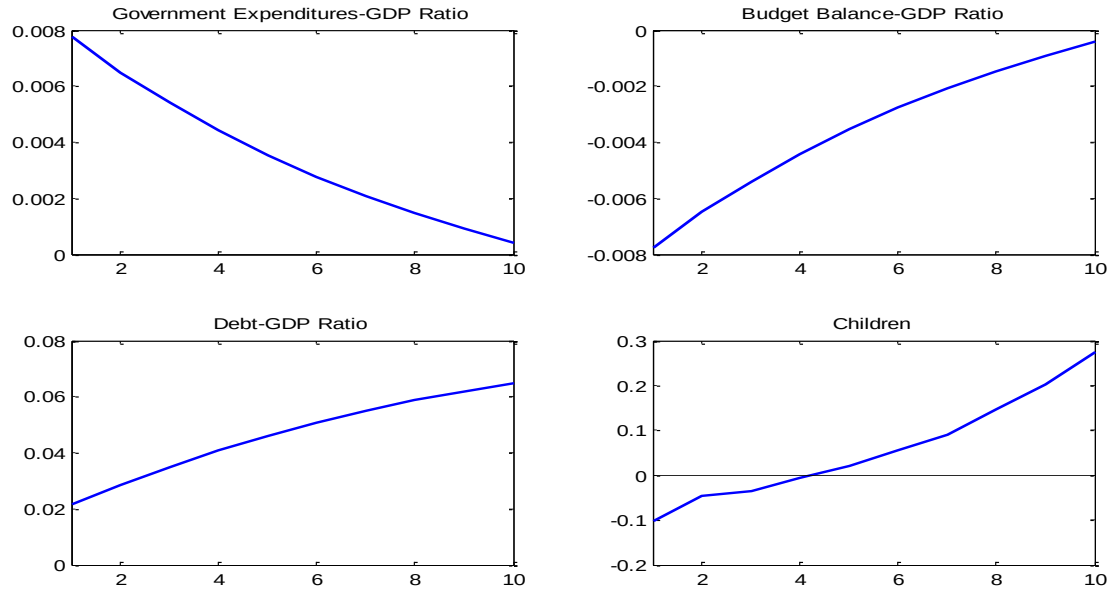

Figure 6: Responses to a government expenditures shock.

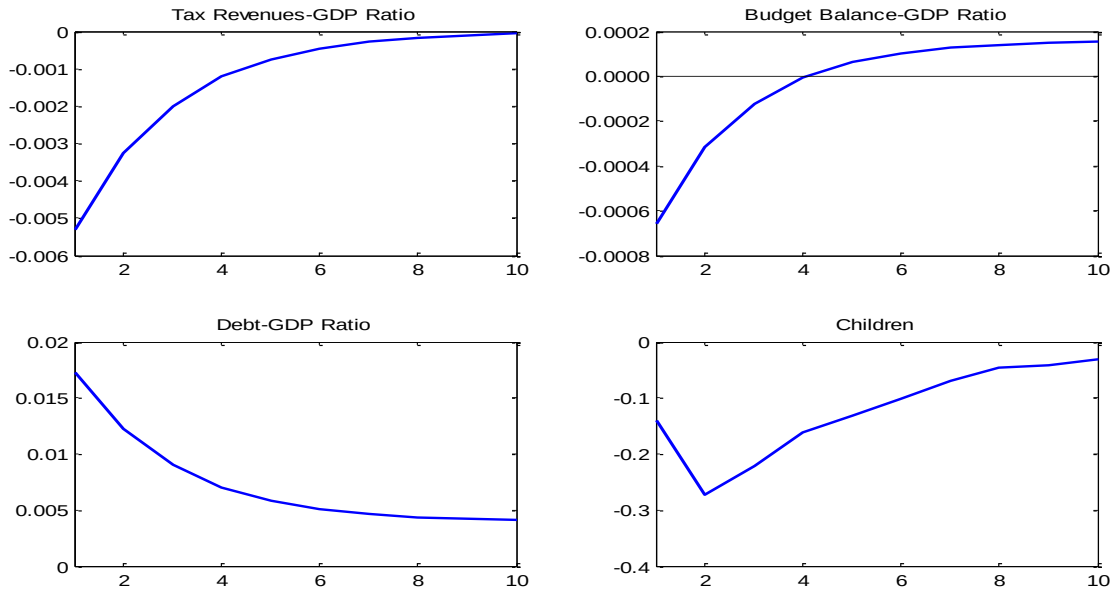

Figure 7: Responses to a tax rate shock.

A possible reason for the different patterns of the number of children in the two panels is obviously the behavior of the underlying shock. The AR(1) coefficient of the labor tax rate is considerably lower than the the AR(1) coefficient of government expenditures, which

implies less persistence of the labor tax rate and thus a smoother behavior by the number of children. In either case, the model replicates the right responses of the number of children following the two types of shocks.

9 Conclusions

Based on U.S. annual data for the period 1980-2010, I study the macroeconomic factors that affect the total fertility rate and the birth rate over the business cycle. I show that the debt-GDP ratio, the government expenditures-GDP ratio and the deficit rate negatively affect short-run fertility decisions whereas the tax revenues-GDP ratio positively affects them. Furthermore, the urbanization rate is one of the most important and robust factors in shaping short-run fertility decisions; the higher the urbanization rate is, the lower are the total fertility rate and the birth rate.

This study adds to the existing work on the factors that shape fertility decisions in the U.S. and it is largely motivated by the recent rise in the national debt and the budget deficit as well as by the fall in both the total fertility rate and the birth rate. In addition, existing literature on the determination of the total fertility and birth rates are either made at the micro level or focused on the unemployment or the participation rates of women and their effects on fertility decisions. Since other macroeconomic factors can affect fertility, this study essentially aims for closing this gap in the literature by conducting a more comprehensive overview of fertility decisions at the "aggregate" level over the course of the business cycle.

It is revealed that periods with mounting debt and deficits discourage fertility even after controlling for variables that capture the state of the economy such as the growth rate of GDP, female unemployment and labor participation rates and the inflation rate. In this regard, the effects of the female unemployment rate and the labor force participation rate have not been robust to the inclusion of other macroeconomic variables. Therefore, some of the previously found effects of female unemployment rate and labor force participation rate on fertility decisions might have been biased due to the exclusion of other factors.

I then build a business cycle model in which households derive direct utility from children and enjoy self esteem from behaving in a morally responsible way. This model does well in replicating the empirical results; in particular, the model captures the negative correlation between fertility and the debt-GDP ratio, government expenditures-GDP ratio and the budget deficit-GDP ratio, on one hand, and the positive correlation with the tax revenues-GDP ratio, on the other. On the contrary, the alternative model that abstracts from moral behavior fails in replicating these empirical findings; it predicts exactly the opposite correlations between the demand for children and the above-mentioned four variables.

The intuition behind these results can be explained as follows. Individuals are less willing to give births when the current debt and the deficit rates are high so that these newborns will not need to repay them in the future. In other words, there is a moral element in the decisions about fertility as parents are unwilling to pass the debt to their children. The results of this paper, thus, support the inclusion of moral behavior in macroeconomic models in order to explain some empirical observations that standard business cycle models cannot account for. Another possible explanation is that current high debt and deficit rates imply future taxation and therefore lower net income in the future. They also indicate undesirable economic episodes, which translates into reduction in the current demand for children.

This work can be further extended. A natural extension is to explore the long-run effects of the above macroeconomic variables on fertility decisions in the United States. Another possible extension is to check whether the empirical results of this study hold for other advanced nations. While important, the aim of this study is to provide a first evidence on the role of some macroeconomic variables in the cyclical behavior of fertility and, therefore, these extensions are left to a future work.

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A Descriptions of Variables

Variable	Description
Total Fertility Rate	The average births per woman
Birth Rate	Number of births per 1000 people
Debt-GDP ratio	Debt to GDP ratio
Budget Balance-GDP Ratio	Government budget balance to GDP Ratio
Tax Revenues-GDP ratio	Total Tax Revenues-GDP ratio
Government Exp.-GDP ratio	Total Government Outlays-GDP ratio
Female Unemployment Rate	The unemployment rate of women (% of female labor force)
Female Participation Rate	The participation rate of women in the labor market
Urbanization Rate	The percentage of the population living in urban areas
Female Life Expectancy	Female life expectancy at birth
Inflation Rate	The rate of change in the consumer price index
GDP Growth Rate	The growth rate of real GDP
Marriage Rate	The number of marriages per 1000 people
Divorce Rate	The number of divorces per 1000 people
Male Life Expectancy	Male life expectancy at birth
Male Unemployment Rate	The unemployment rate of men (% of male labor force)
Unemployment Rate	Total U.S. unemployment rate (% of labor force)

Table A.1: Descriptive statistics of the main variables

B Robustness Analyses- Tables

Variable	I	II	III	IV	V	VI	VII	VIII
Constant	0.0018 (0.4091)	0.0036 (0.9287)	0.0033 (0.7411)	0.0036 (0.8325)	0.0027 (0.6367)	0.0040 (1.2602)	0.0038 (1.0608)	0.0043 (1.1616)
Debt	-0.0041* (-2.6528)				-0.0030* (-2.4611)			
Budget		0.0140* (4.0309)				0.0128* (5.1168)		
Tax			0.0191* (2.7495)				0.0194* (3.9754)	
G. Exp.				-0.0223* (-2.9423)				-0.0219* (-3.5821)
F. Unemp.	0.0116 (1.5812)	0.0167** (2.4540)	0.0146*** (1.8547)	0.0124 (1.6449)				
F. Part.					-0.0481* (-2.8969)	-0.0657* (-4.9044)	-0.0715* (-4.4948)	-0.0539* (-3.5577)
Inflation	0.0081** (2.2766)	0.0027 (0.7789)	0.0054 (1.4425)	0.0029 (0.7289)	0.0071** (2.2433)	0.0012 (0.4219)	0.0033 (1.0794)	0.0020 (0.5883)
Urbanization	-0.3441* (-4.7846)	-0.4719* (-6.2561)	-0.4137* (-5.0461)	-0.4102* (-5.2102)	-0.3297* (-5.3415)	-0.4497* (-8.2743)	-0.4121* (-7.0070)	-0.4142* (-6.6526)
F. Life Exp.	0.0552 (1.5075)	0.0552*** (1.7268)	0.0323 (0.8863)	0.0748*** (2.0317)	0.0613*** (1.8157)	0.0653 (2.5156)	0.0442 (1.5095)	0.0845* (2.6950)
Marriage	-0.0561 (-1.4073)	-0.0584*** (-1.7266)	-0.0557 (-1.4175)	-0.0504 (-1.3369)	-0.0218 (-0.6461)	-0.0202 (-0.7958)	-0.0203 (-0.7106)	-0.0261 (-0.8640)
R^2	0.7440	0.8041	0.7484	0.7571	0.7841	0.8724	0.8383	0.8249

Table B.1: Dependent variable- cyclical component of TFR. t statistics in parentheses.

Variable	I	II	III	IV	V	VI	VII	VIII
Constant	0.0006 (0.1379)	0.0021 (0.5086)	0.0016 (0.3572)	0.0023 (0.5204)	0.0022 (0.5233)	0.0036 (1.1577)	0.0031 (0.8808)	0.0038 (1.0489)
Debt	-0.0031*** (-2.0200)				-0.0027** (-2.1990)			
Budget		0.0126* (3.3311)				0.0131* (4.9175)		
Tax			0.0147** (2.1962)				0.0185* (3.7910)	
G. Exp.				-0.0206** (-2.4160)				-0.0230* (-3.3752)
F. Unemp.	0.0105 (1.3050)	0.0166** (2.1855)	0.0138 (1.6126)	0.0096 (1.2819)				
F. Part.					-0.0482* (-2.8820)	-0.0674* (-4.9385)	-0.0706* (-4.4039)	-0.0560* (-3.6380)
Inflation	0.0071*** (1.8803)	0.0012 (0.2871)	0.0052 (1.3058)	0.0014 (0.2843)	0.0071** (2.1440)	0.0000 (0.0080)	0.0035 (1.1158)	0.0003 (0.0717)
Urbanization	-0.3234* (-4.3368)	-0.4494* (-5.5276)	-0.3761* (-4.5472)	-0.3980* (-4.7119)	-0.3272* (-5.2379)	-0.4569* (-8.0917)	-0.4060* (-6.8310)	-0.4251* (-6.4625)
F. Life Exp.	0.0401 (1.0355)	0.0279 (0.8020)	0.0266 (0.6708)	0.0476 (1.2888)	0.0584*** (1.6967)	0.0510*** (1.9274)	0.0442 (1.4684)	0.0659** (2.1471)
Divorce	-0.0215 (-0.3058)	0.0249 (0.3793)	-0.0398 (-0.5904)	0.0296 (0.3914)	-0.0233 (-0.3762)	0.0308 (0.6232)	-0.0310 (-0.5938)	0.0442 (0.7158)
R^2	0.7231	0.7801	0.7305	0.7400	0.7815	0.8711	0.8373	0.8232

Table B.2: Dependent variable- cyclical component of TFR. t statistics in parentheses.

Variable	I	II	III	IV	V	VI	VII	VIII
Constant	0.0134 (0.4654)	0.0215 (0.7417)	0.0203 (0.6900)	0.0213 (0.7139)	0.0169 (0.0159)	0.0246 (0.9175)	0.0235 (0.8742)	0.0258 (0.9183)
Debt	-0.0193*** (-1.9644)				-0.0158*** (-1.9196)			
Budget		0.0451*** (1.7571)				0.0464** (2.1845)		
Tax			0.0685 (1.4920)				0.0798** (2.1594)	
G. Exp.				-0.0623 (-1.2018)				-0.0687 (-1.4751)
F. Unemp.	0.0543 (1.0220)	0.0543 (0.9815)	0.0571 (0.9506)	0.0242 (0.4692)				
F. Part.					-0.1911*** (-1.7260)	-0.2481** (-2.1780)	-0.2823** (-2.3467)	-0.2000*** (-1.7343)
Inflation	0.0389*** (1.7170)	0.0227 (0.8895)	0.0301 (1.2145)	0.0260 (0.9464)	0.0357*** (1.6990)	0.0175 (0.7352)	0.0222 (0.9745)	0.0239 (0.9288)
Urbanization	-2.5773* (-5.6354)	-2.9057* (-5.2220)	-2.7656* (-5.0961)	-2.6563* (-4.9296)	-2.5472* (-6.1955)	-2.9527* (-6.3951)	-2.8652* (-6.4428)	-2.7731* (-5.8483)
F. Life Exp.	0.5957* (2.5587)	0.5820* (2.4684)	0.5034** (2.0850)	0.6330* (2.5115)	0.6234* (2.7729)	0.6299* (2.8567)	0.5478* (2.4725)	0.6856* (2.8713)
Marriage	-0.0202 (-0.0798)	0.0364 (0.1458)	0.0290 (0.1113)	0.0776 (0.3006)	0.1019 (0.4541)	0.1405 (0.6525)	0.1305 (0.6026)	0.1314 (0.5713)
R^2	0.8135	0.8079	0.8014	0.7950	0.8273	0.8341	0.8335	0.8170

Table B.3: Dependent variable- cyclical component of BR. t statistics in parentheses.

Variable	I	II	III	IV	V	VI	VII	VIII
Constant	0.0126 (0.4464)	0.0219 (0.7820)	0.0193 (0.6833)	0.0229 (0.7908)	0.0183 (0.6700)	0.0277 (1.0457)	0.0251 (0.9543)	0.0286 (1.0320)
Debt	-0.0178*** (-1.9056)				-0.0157*** (-1.9097)			
Budget		0.0432 (1.6416)				0.0464** (2.0473)		
Tax			0.0657 (1.5603)				0.080** (2.1898)	
G. Exp.				-0.0575 (-1.0214)				-0.0689 (-1.3229)
F. Unemp.	0.0489 (0.9952)	0.0535 (1.0139)	0.0550 (1.0146)	0.0258 (0.5202)				
F. Part.					-0.1842 (-1.6658)	-0.2413** (-2.0744)	-0.2740** (-2.2796)	-0.1935 (-1.6497)
Inflation	0.0420*** (1.8341)	0.0270 (0.9626)	0.0366 (1.4470)	0.0328 (1.0327)	0.0417*** (1.8973)	0.0226 (0.8558)	0.0299 (1.2696)	0.0289 (0.9545)
Urbanization	-2.5379* (-5.5931)	-2.8735* (-5.0845)	-2.7221* (-5.2144)	-2.6240* (-4.7011)	-2.5206* (-6.1046)	-2.9342* (-6.1004)	-2.8320* (-6.3547)	-2.7548* (-5.4947)
F. Life Exp.	0.6365* (2.7033)	0.6280* (2.5946)	0.5939** (2.3760)	0.6998* (2.8642)	0.7113* (3.1286)	0.7062* (3.1364)	0.6636* (2.9395)	0.7605* (3.2497)
Divorce	-0.2061 (-0.4813)	-0.1385 (-0.3040)	-0.3376 (-0.7936)	-0.1796 (-0.3601)	-0.2246 (-0.5490)	-0.1053 (-0.2502)	-0.3047 (-0.7776)	-0.1140 (-0.2425)
R^2	0.8153	0.8085	0.8066	0.7954	0.8281	0.8315	0.8352	0.8149

Table B.4: Dependent variable- cyclical component of BR. t statistics in parentheses.

	TFR				BR			
Variable	I	II	III	IV	V	VI	VII	VIII
Constant	-0.0099 (-1.2861)	-0.0035 (-0.4703)	-0.0068 (-0.8785)	-0.0019 (-0.2400)	-0.0370 (-0.7873)	0.0016 (0.0323)	-0.0147 (-0.3055)	0.0062 (0.1205)
Debt	-0.0024*** (-1.9749)				-0.0168** (-2.2696)			
Budget		0.0066** (2.1160)				0.0327*** (1.7121)		
Tax			0.0079 (1.5144)				0.0485 (1.4771)	
G. Exp.				-0.0139*** (-1.8384)				-0.0578 (-1.1771)
GDP Growth	0.0040*** (1.7711)	0.0021 (0.9139)	0.0032 (1.3939)	0.0015 (0.5954)	0.0175 (1.2643)	0.0066 (0.4461)	0.0119 (0.8306)	0.0049 (0.3096)
Inflation	0.0056*** (1.6970)	0.0030 (0.7794)	0.0049 (1.2957)	0.0027 (0.6317)	0.0328 (1.6150)	0.0248 (0.9948)	0.0305 (1.2869)	0.0273 (0.9905)
Urbanization	-0.3381* (-4.8714)	-0.3682* (-5.0729)	-0.3471* (-4.6938)	-0.3560* (-4.8845)	-2.5804* (-6.0713)	-2.6717* (-5.6939)	-2.6104* (-5.6322)	-2.5768* (-5.4502)
F. Life Exp.	0.0400 (1.1988)	0.0391 (1.1851)	0.0314 (0.0352)	0.0516 (1.5235)	0.6118* (2.9974)	0.6156* (2.8839)	0.5630* (2.5526)	0.6708* (3.0540)
R^2	0.7281	0.7334	0.7121	0.7231	0.8158	0.7987	0.7956	0.7895

Table B.5: Dependent variables- cyclical components of TFR and BR. t statistics in parentheses.

Shock to Government Expenditures						
	Benchmark			With Moral Behavior		
β	0.95	0.96	0.97	0.95	0.96	0.97
Debt-GDP Ratio	0.9379	0.9206	0.7610	-0.1363	-0.2664	-0.3648
Budget Balance-GDP Ratio	-0.5461	-0.5246	-0.2893	0.4835	0.4832	0.2434
Tax Revenues-GDP Ratio	-	-	-	-	-	-
Govt. Expenditures-GDP Ratio	0.5461	0.5246	0.2893	-0.4835	-0.4832	-0.2434
Shock to the Tax Rate						
	Benchmark			With Moral Behavior		
β	0.95	0.96	0.97	0.95	0.96	0.97
Debt-GDP Ratio	0.6304	0.5957	0.5426	-0.9839	-0.9879	-0.9918
Budget Balance-GDP Ratio	-0.3012	-0.2947	-0.2656	0.9423	0.9567	0.9684
Tax Revenues-GDP Ratio	-0.5781	-0.5497	-0.5032	0.9977	0.9982	0.9987
Govt. Expenditures-GDP Ratio	-	-	-	-	-	-
Shocks to the Tax Rate and Government Expenditures						
	Benchmark			With Moral Behavior		
β	0.95	0.96	0.97	0.95	0.96	0.97
Debt-GDP Ratio	0.8988	0.8509	0.6394	-0.3038	-0.3917	-0.3782
Budget Balance-GDP Ratio	-0.4873	-0.4303	-0.1808	0.5410	0.4785	0.1576
Tax Revenues-GDP Ratio	-0.2718	-0.3522	-0.4973	0.2087	0.3513	0.6250
Govt. Expenditures-GDP Ratio	0.4330	0.3699	0.1094	-0.4961	-0.4174	-0.0689

Table B.6: Correlation coefficients of fertility with fiscal policy measures