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Economic Uncertainty and Fertility

Abstract

In this paper, we conduct an empirical study of how uncertainty alters fertility behavior. The precautionary motive for saving predicts that an increase in income uncertainty increases saving by reducing both consumption and fertility. We examine this prediction using a new measure of economic uncertainty, the World Uncertainty Index and focus on data from 126 countries for the period from 1996 to 2017. The empirical findings indicate that uncertainty decreases the fertility rate, as suggested by theory. This evidence is robust to different model specifications and econometric techniques as well as to the inclusion of various controls. The evidence also indicates that changes in uncertainty may be a factor explaining why fertility is pro-cyclical.

JEL-Codes: J130, D810, D140, E320, C330.

Keywords: fertility, uncertainty, WUI Index, precautionary saving, business cycle, panel data estimation techniques.

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1. Introduction

Research over the last 50 years has established that fertility is affected by several economic and social factors. The main focus of this research is explaining the long downward trend in fertility over the course of economic development—a key component of the *demographic transition*. The slowdown in population growth during the demographic transition, in turn, has dramatic economic consequences on per capita economic growth, aging of the population, and the viability of large social transfer programs built on pay-as-you-go government financing schemes.

Less well known is the connection between fertility and the business cycle. The connection is so strong that fertility has recently been labeled "a leading economic indicator" (Buckles et al., 2018), as fertility seems to react before the full changes in income and employment occur. One explanation for this surprising relationship is that households sense economic uncertainty from news reports, the stock market, and other sources. Concerns over future wages cause them to lose "consumer confidence," reduce current consumption and engage in "precautionary saving." This logic extends to fertility because precautionary saving can be built up by reducing consumption and postponing childbearing (Ranjan, 1999; Sommer, 2016). The precautionary effect is potentially relevant in explaining both cross-country fertility differences and variations in fertility over time within countries.

However, empirical work on the importance of the precautionary motive for fertility has thus far been mixed. We attempt to contribute to the literature by searching for a link between labor market uncertainty and fertility. To identify the precautionary motive for fertility variations, we look at a particular measure associated with income and wage uncertainty—the World Uncertainty Index (WUI) created by the IMF (Ahir et al., 2018). The measure is based on country reports formed by analysts working for a private intelligence company. The reports focus on world events, economic policy, and politics to gauge the level of uncertainty about the economic conditions of a country. Uncertainty over world events affecting international trade and domestic policy reforms create uncertainty over future wages associated with or similar to business cycle fluctuations, as well as longer-term sources of income uncertainty, and should have similar effects on fertility if the uncertainty mechanism is generally valid. Furthermore, world events and policy uncertainty are likely to be exogenous; i.e., it is not expected to be affected by the feedback from fertility to wage volatility (De la Croix and Pommeret, 2018).

Section 2 offers an organizing theoretical framework that highlights the precautionary effect of uncertainty on fertility and allows us to review previous papers on the topic. Section 3 describes the uncertainty measure: The World Uncertainty Index (WUI). Sections 4-6 present an empirical analysis of the effect of uncertainty on the *level* of fertility in the large panel data set, including countries at quite different stages of development. In Section 7, we also consider how uncertainty affects *short-run changes* in fertility in a smaller OECD sample of countries that are at similar stages of development. Variations in the OECD sample are less due to cross-country differences, serving to emphasize the annual changes occurring within countries. The OECD sample is a preferred way of identifying how uncertainty impacts short-run variations in fertility over the business cycle. Section 8 examines if uncertainty impacts human capital in a manner consistent with theories suggesting a close connection between fertility and schooling. Section 9 provides a conclusion.

2. Fertility Theory: A Literature Review

A challenge to fertility theory is to simultaneously explain why income and fertility are *negatively* correlated in the long run (fertility eventually falls over the course of economic development) but are often found to be *positively* correlated in the medium or short-run (e.g., as mentioned in the introduction, fertility is a pro-cyclical variable).[1] Explanations for long-term or short-term variations are more convincing if they are consistent with each other. Empirical investigations using annual panel data across a large set of countries must confront both types of fertility variations: cross-sectional variation in fertility across richer and poorer countries as well as annual variation in fertility within countries.

Of particular interest for our study is the effect of income uncertainty on fertility, which can explain cross-country differences in fertility level if the stability of economic environments changes over the course of development and short-run fertility changes over the business cycle within a country.[2] Utility functions with a convex marginal utility of consumption, or a positive third derivative of consumption, yield "precautionary" saving behavior (Leland, 1968; Sandmo, 1970). A convex marginal utility of consumption implies that increased wage uncertainty raises the marginal value of future consumption relative to current consumption. The wage uncertainty not only raises precautionary saving by lowering current consumption but also by reducing fertility. The theory associated with the precautionary motive was extended to include the fertility choice by Ranjan (1999) and Sommer (2016).

In searching for determinants of fertility, it is important to note that income per se is not viewed as an important factor in explaining the pattern of fertility over the course of development based on theoretical considerations and empirical evidence (e.g., see Galor, 2011: 116-119). The problem is that changes in wage income have opposing income and substitution effects on fertility. The same criticism can be applied to explanations of why fertility varies over the business cycle. The fact that income is varying over the cycle does not imply that the pro-cyclical nature of fertility is caused by assuming a dominant income effect. Just as with explanations for fertility trends, it may be a better strategy to focus on fertility determinants, other than income, that have a less ambiguous theoretical effect.

2.1. Long-run Fertility Trends

To isolate the precautionary motive for fertility, we need to control for other important fertility determinants that can explain fertility differences across countries at different stages of development.

Starting with Becker (1960 and 1981) and Becker and Lewis (1973), economists have examined the connection between human capital and fertility. The increased human capital of parents generates the opposing income and substitution effects associated with wage income changes. However, increased education has a third effect that works through child labor. The more time older children spend time in school, the less time they spend working to generate family income. Rising education levels create an unopposed increase in the cost of raising children. The cost-of-children mechanism helps to explain

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[1] On the demographic transition and the long-run causes of fertility trends, see Becker et al. (1990), Galor (2011: Chapter 2) and Greenwood et al. (2017). For the behavior of fertility across the business cycle and during economic upheavals, see Buckles et al. (2018) and Chatterjee and Vogel (2018).

[2] For example, the collapse of the communist system in Eastern Europe and Russia was associated with heightened uncertainty in labor markets and a decline in fertility. See Kohler and Kohler (2002) and Kregenfeld (2005) for a discussion and analysis.

the *long-run negative correlation between income and fertility*.[3] Empirical support for schooling as an essential long-run determinant of fertility can be found in both calibration and econometric studies. The calibration studies show that a robust causal link from rising schooling to falling fertility is consistent with other features of economic growth and development (e.g., Das et al., 2018: Chapter 9; Lord and Rangazas, 2006). Econometric studies finding a significant negative impact of schooling on fertility include Aaronson et al. (2014), Amin and Behrman (2014), Murtin (2013), and Osili and Long (2008).

While it is generally accepted that greater schooling raises the cost of rearing children, creating an important force that reduces fertility over the course of development, in the early stages of development, fertility tends to rise over time. To explain episodes where fertility rises, with or without a change in schooling, one needs to supplement the quantity-quality of children trade-off with other factors that affect fertility.

One idea is based on a lesser-known aspect of the theory developed by Becker. Becker, who is associated with the quantity versus quality of children *trade-off*, actually preferred the term quantity-quality *interaction* (Becker, 1960 and 1981; Becker and Lewis, 1972). He explicitly acknowledged that the interaction could be positive rather than negative. "The net cost of children is reduced if they contribute to the family income by performing household chores, working in the family business, or working in the marketplace. Then an increase in earning potential of children would *increase* the demand for children" (Becker, 1981: 96). Increased schooling of *young* children, who cannot yet work, clearly increases their earning potential when they are older children and able to generate income for the family. Greater schooling for young children, unlike the case with older working-age children, lowers the net cost of children and increases fertility.

Another approach is to argue that a *subsistence constraint* on consumption can generate a theoretically dominant income effect and a rise in fertility in the early stages of development (Abdus and Rangazas, 2011; Das et al., 2018: Sections 4.6-4.7; Galor, 2011; Galor and Weil, 2000). The subsistence constraint places a priority on consumption that suppresses fertility when human capital and income are low. As an economy develops, budget shares shift toward non-food consumption as the force of the subsistence constraint weakens. The smaller marginal value placed on consumption lowers the value of lost consumption associated with raising children creating a positive income effect on fertility. Thus, even if the rise in family income is due to rising human capital, the income effect associated with the subsistence constraint may dominant the rise in the net cost of children causing fertility to increase.

In sufficiently developed countries, the marginal increases in education apply to older children, and the subsistence constraint is less of a factor, making negative correlations between human capital and fertility more likely. In earlier stages of development, where marginal increments in education apply to younger nonworking children and where the subsistence constraint is important, one could see a positive correlation between human capital and fertility.

[3] See Das et al. (2018: Chapter 4) and Galor (2011) for more discussion. Other features have been offered for the decline of fertility with economic development. One of these is the structural transformation away from agriculture and family-based production towards manufacturing and service production in firms (Das et al., 2018: Chapters 7 and 9; Greenwood and Seshadri, 2002); Lord and Rangazas, 2006; Mourmouras and Rangazas, 2013). Another is a decline in infant and child mortality. For the theory, see Barro and Becker (1989), Boldrin and Jones (2002), Ehrlich and Lui (1991), Kalemli-Ozcan (2003) and Sah (1991). For the empirical support, see Bar and Leukhina (2010), Doepke (2005), and Eckstein et al. (1999). Ehrlich and Kim (2005) also provide a unified theory that combines human capital, fertility, and mortality.

Finally, rising fertility during the initial stages of growth take-offs can be due to an increase in the probability that a child survives into adulthood. If parents draw altruistic satisfaction from their surviving children's adult consumption, then medical advances associated with the early stages of growth can dominate other forces, which eventually fertility down, causing fertility to initially rising before falling (see Ehrlich and Kim, 2005: Figure 3b).

2.2. Short-run and Cyclical Variation in Fertility

Apart from the long-run trends in fertility, there are important short-run variations in fertility around its trend values. For example, there is now evidence that fertility is pro-cyclical over the business cycle. A candidate for explaining the business cycle pattern of fertility is income uncertainty. Rather than the cyclical changes in income themselves, which has an ambiguous effect on fertility, economic theory indicates that a rise in consumption uncertainty unambiguously lowers fertility. The precautionary motive for increased saving suggests that households sensing an increase in uncertainty about the economy's future path experience a drop in "consumer confidence" and postpone fertility before a recession or during a period of economic upheaval.

Buckles et al. (2018) find that fertility declines several quarters *before* recessions begin—indicating that fertility may be a leading pro-cyclical variable. They also find that the decline is not driven by abortions or fetal deaths, which may be sensitive to the mental and physical stress of uncertainty, but rather by a fall in conceptions. Fear of consumption loss associated with possible downturns raises uncertainty and reduces the desire to have children. Similarly, optimism about an economic expansion could lower uncertainty and increase fertility.

Changes in life expectancy have also been proposed as a cause of short-run variations in fertility. Unlike the *negative long run* effects of greater longevity on fertility (see footnote 3), shocks due to natural disasters or pandemics can alter the health status of parents or create concern over the health status of unborn and new-born children that *both* lower life expectancy and reduce fertility, creating a *short-run positive* correlation. This positive correlation is similar to that proposed by Erlich and Kim (2005), who argue that health innovations over the course of development may raise fertility. Short-run health shocks may be correlated with economic uncertainty but clearly affect fertility through a different causal channel. The possible confounding of health and economic shocks is an issue for our study.

Empirical work on the importance of the precautionary motive for fertility has been mixed. Hanappi et al. (2017), Hondroyiannis (2010), and Wilde et al. (2020) support a link between greater uncertainty and lower fertility. Chabe-Ferret and Gobbi (2018) also support a negative connection in the first half of the 20^{th} century but one that disappears after WWII. Kohler and Kohler (2002) and Kreyenfeld (2005) find no link between fertility and the rising labor market uncertainty associated with the collapse of communism in Eastern Europe and Russia.

A paper by De la Croix and Pommeret (2018) suggests why it may be challenging to establish a clear negative association between wage uncertainty and fertility. They emphasize that the decision to have children *creates* labor market uncertainty for the woman in a variety of ways. This positive reverse causation running from fertility to uncertain labor market outcomes hampers the ability to identify the fertility effect of an *exogenous* change in labor market uncertainty.

Several studies by demographers have provided evidence supporting the life-expectancy mechanism for short-run variations in fertility (Chandra et al., 2018; Evans et al., 2009; Finlay, 2009; Nobles, 2015).

These results suggest that one should pay special attention to both economic uncertainty and shocks to health when attempting to explain short-run changes in fertility.

We attempt to contribute to the empirical literature by searching for a link between labor market uncertainty and fertility. To identify the precautionary motive for fertility variations, we look at a particular cause of wage uncertainty. Uncertainty over fiscal, regulatory and other policy changes, along with world events affecting relative prices and trade volumes, create uncertainty over future wages similar to business cycle fluctuations or longer-term sources of uncertainty in the economic environment and should have similar effects on fertility if the uncertainty mechanism is generally valid. Furthermore, policy uncertainty and world events are exogenous to fertility, eliminating the feedback identified by De la Croix and Pommeret (2018). We also pay special attention to changes in life expectancy as a possible additional source of fertility variations arising from health-related shocks.

3. The World Uncertainty Index

The novel aspect of our study is the use of a new uncertainty measure, the World Uncertainty Index (WUI), created by Hites Ahir and Davide Furceri of the IMF and Nicholas Bloom of Stanford University (Ahir et al., 2018 and 2020). The measure is based on country reports formed by analysts working for a private intelligence company, the Economist Intelligence Unit. The reports focus on world events, economic policy, and politics to gauge the level of uncertainty in the economic conditions of the country. The index is constructed by *text-mining* the reports: counting the number of times the word "uncertainty" is used relative to the total word count. This construction resembles the *narrative approach* pioneered by Romer and Romer (1989 and 2010) and Ramey and Shapiro (1998), where official documents of government meetings are read and used to identify changes in the stance of monetary and fiscal policy.

The WUI is constructed for 143 countries quarterly, with data going back 60 years. It is an official measure in the IMF data set and is now part of the St. Louis Federal Reserve Bank's FRED data series for the United States. Figure 1 gives a plot of the WUI averaged across all countries of the world to gauge global economic uncertainty back to 1990.

[INSERT Figure 1]

The sample used in our study begins in 1996, a period characterized by rising uncertainty around the world, as exhibited in Figure 1.

Uncertainty changes are not only due to the presence of the developing and emerging economies contained in the WUI composite index. Advanced economies also experience significant changes in the level of economic uncertainty. Figure 2 gives a plot of the WUI for the United States from the FRED series

[INSERT Figure 2]

These figures suggest that the WUI has a little trend until very recently but does vary significantly over time. We confirm this characteristic of the index in our panel data of 126 countries stretching from 1996 to 2017 by regressing current values of the WUI on one-year and two-year lagged values of the WUI (see Section 4 for the details of our sample). We also run the regression for the smaller sample of OECD countries. The coefficients on the lagged values were negative, and none were statistically significant at a 10 percent significance level. While uncertainty certainly varies across countries, there is also clearly substantial variation in the level of uncertainty across time that is driven by unpredictable shocks.

Particularly important for our examination of what might explain the pro-cyclical nature of fertility (see Section 7), Ahir et al. (2018) find that increases in the WUI are associated with higher stock market volatility and *future* slowdowns in GDP growth. So the WUI appears to be a *leading* countercyclical variable, just as fertility is a leading procyclical variable.

We attempt to verify the predictive power of the WUI for cyclical movements in our OECD sample by running a regression for both current time-t values of the growth rate in GDP per capita and for current time-t unemployment on lagged values of each variable and the change in the WUI. For the change in the WUI, we consider changes from t-1 to t and from t-2 to t-1—relatively contemporaneous changes and lagged changes. Table 1 provides the results for GDP and Table 2 for the unemployment rate.

[INSERT Tables 1 and 2]

The growth rate in period t, annual changes in the GDP per capita from the previous period, is negatively associated with annual changes in the WUI from the previous period. This evidence is consistent but does not independently verify the Ahir et al. (2018) claim that changes in the WUI *leads* the changes in GDP in *quarterly* data. The current unemployment rate is positively associated with changes in the WUI from the previous period, especially from two periods in the past, consistent with unemployment being a variable that lags GDP across the cycle. Thus, consistent with the claims of Ahir et al. (2018), there is a statistically significant association of variations in growth rates and unemployment with changes in the WUI in our sample. Changes in the WUI are associated with, and may well lead, changes in the economic environment across the business cycle. The WUI is a reasonable uncertainty measure that could explain why fertility is pro-cyclical via a precautionary channel, a possibility that we explore in Section 7.

4. Empirical Strategy for the Panel Data Model of Fertility Levels

4.1 The Baseline Empirical Model

We begin with an empirical examination of the entire broad panel data set. This data includes countries at very different stages of development as they grow over time, so we include variables that differ significantly across countries that may help explain cross-country differences in fertility level. Thus, our focus here is on explaining larger *level* differences in fertility *across* countries.

Motivated by the theory discussed in the previous section, we form a parsimonious baseline econometric specification that includes human capital, per capita income, lagged fertility, as well as country-specific WUI. In a later section, we consider adding several other controls to check the robustness of the baseline model estimates.

Human capital is included because of its central role in determining the cost of children. We include per capita income to capture various aspects of economic development on fertility, such as the degree of urbanization and child mortality, as suggested in footnote 3, as well as public health conditions, nutrition of the parents, availability of, and subsidies for contraceptives, and delivery assistance.

Lagged fertility may be particularly useful in accounting for unobservable cultural and religious factors that influence fertility levels.

We estimate the following equation:

$$Fertility_{i,t} = \gamma_0 + \gamma_1 Fertility_{i,t-1} + \gamma_2 Uncertainty_{i,t-1} + \gamma_3 X_{i,t-1} + \vartheta_t + \vartheta_i + \varepsilon_{i,t} \quad (1)$$

In Eq. (1), $Fertility_{i,t}$, and $Fertility_{i,t-1}$, are the current and lagged fertility rates in country *i*.. $Uncertainty_{i,t-1}$ is the measure of economic uncertainty in the country *i* at time *t*.. $X_{i,t-1}$ is a vector of controls, which in the baseline model includes only human capital and per capita income. Finally, ϑ_t, ϑ_i and $\varepsilon_{i,t}$ denote the "year fixed-effects," "country fixed-effects," and the "error term," respectively. The dataset[4] includes yearly data for the period from 1996 to 2017 for 126 countries. We provide a list of the included countries in the dataset in Appendix I.

The dependent variable is the fertility rate obtained from the World Development Indicators (WDI) dataset of the World Bank (2020). To capture the precautionary effect, we use the lagged WUI. We consider a lagged WUI because of the fertility decisions and births and because this helps us avoid a potential reverse causality.[5] The human capital measure is a stock measure of the average years of schooling in the adult workforce introduced by the Penn World Table (PWT) (version 9.1).[6] The per capita income measure comes from the World Bank (2020). Again, given the lag between birth and the fertility decision, especially relevant for births occurring early in the year, we consider specifications where *all* regressors are lagged.

4.2 Extended Models and Robustness Checks

In the robustness checks, we include other controls related to macroeconomic stance, demographics, the role of government, institutional quality, labor market regulations, globalization and income inequality (a complete list is provided in Table 3 below). These controls may affect fertility directly or indirectly, including altering the uncertainty of the economic environment in ways that may not be captured by the WUI. They are useful in controlling for possible income effects on fertility as well as cultural, demographic, and health-related determinants of fertility, as well possible associations between the distribution of income and fertility (Ehrlich and Kim, 2007a).

For the macroeconomic stance, we include the economic growth rate and the unemployment rate, particularly useful in accounting for possible income effects on fertility. For demographics, we include the total population, age-dependency ratio, the urban population share, female labor participation, and life expectancy at birth. These variables capture cultural and population composition aspects of an economy that are believed to affect fertility levels. Life-expectancy, as suggested in section 2.2, may be particularly important not only in explaining cross-country differences in fertility but also shorter-run variations within countries due to health shocks. The demographic indicators are obtained from World Bank (2020).

We consider the Gini market index of income inequality and related data from the Standardized World Income Inequality Database (SWIID) (version 8.3) of Solt (2020). Our government controls include

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[4] We do not purify the business cycles and use annual data instead of four-year or five-year average data.

[5] We also run a formal panel causality test and find no evidence of reverse causality.

[6] For details of measuring human capital in the PWT dataset, refer to Feenstra et al. (2015) and the references therein.

transfer and subsidies, government consumption, and the payroll tax rate (top marginal). Ehrlich and Kim (2007b) argue that the expansion in government retirement programs financed by the payroll tax has reduced fertility. Similarly, we include the index of labor market regulations since it can directly or indirectly affect fertility decisions via employment, wages, and working conditions. All the policy variables are important controls for possible isolating income effects on fertility. The policy data are obtained from the Economic Freedom Dataset of Gwartney et al. (2019).

Furthermore, fertility decisions may be affected through channels of economic globalization, including globalization shocks that may contribute to uncertainty or may cause changes in income levels (Potrafke, (2015)). We include the revised version of the KOF indexes of globalization (the index of economic globalization and overall globalization) constructed by Gygli et al. (2019).[7]

Finally, we control for the level of institutional quality and the conflicts. Following the spirit of Acemoglu et al. (2019), we include the level of institutionalized democracy (index from 0 to 10) in the regressions. Other institutional quality measures included are the concept of the executive constraint (index from 1 to 7) and the Polity2 (index from -10 to +10). All of these data are obtained from the Polity IV Annual Time Series proposed by Marshall et al. (2018). The measure of conflicts (indexed from 0 to 10) are obtained from the Major Episodes of Political Violence dataset of Marshall (2019). We test whether the results for the WUI are robust to the inclusion of the measures of institutional quality and conflicts since formal institutions and conflicts may work via an uncertainty channel. Conflicts also capture possible health shocks on the parents and child. Details of all variables and a summary of the descriptive statistics can be found in Table 3.

[INSERT Table 3]

4.3. Estimation Procedures

We estimate the benchmark regressions based on (1) using fixed-effects estimation, which is the standard estimation technique in the literature. Besides, we estimate (1) using the Generalized System Method of Moments (GMM) technique, which can solve possible problems due to autocorrelation and the presence of different orders of integration (Arellano and Bover, 1995 and Blundell and Bond, 1998). A two-stage estimation procedure is utilized to avoid possible multicollinearity among the right-side variables. We collapse the instruments following the suggestions of Roodman (2009).[8] In so doing, we address a solution to the possible endogeneity problem between economic uncertainty and the fertility rate by instrumenting them with suitable lagged variables. To obtain efficient findings in the System GMM estimations, we need evidence for the validity of the first-order autocorrelation in the residuals, but second-order autocorrelation must be rejected.[9] We run the Sargan test to avoid possible over-identification problems. Finally, we include country fixed effects and year fixed-effects since there could be unobserved heterogeneities affecting the fertility rates.

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[7] For the details of the original KOF indexes of globalization, refer to Dreher (2006) and Gozgor (2018). For the revised version of the index, refer to Gygli et al. (2019).

[8] We run the xtabond2 Stata Package written by Roodman (2009).

[9] This evidence is due to the assumption that the instruments must be uncorrelated with the error terms. Still the instruments must be correlated with the instrumented variables in the system GMM estimations.

5. Empirical Findings

5.1 Baseline Findings

In Table 4, we report the fixed-effects estimations of the baseline models from (1) for the total fertility rate for the period from 1996 to 2017.[10]

[INSERT Table 4]

In the full sample, the estimated coefficients of WUI are around –0.4[11], and they are statistically significant at the 1% level. The results for 93 non-OECD countries are reported in column 2, while the findings for 33 OECD countries are provided in column 3. The effects of uncertainty on the fertility rates are adverse, and the coefficients are statistically significant at a 5% level and lower. To analyze the magnitude of the effect, we compute that an increase of one standard deviation (0.836 points) in the WUI leads to a 0.332-point decrease (0.2 standard deviations) in the fertility rate.

Looking at the controls, the per capita GDP is positively related to the fertility rate in all groups of countries. The index of human capital is positively associated with the fertility rate in the sample with all countries. Still, it is negatively associated with the fertility rate in a narrower sample of OECD countries. This finding is consistent with our discussion in section 2, indicating that a negative relationship between human capital and fertility is more likely in more developed countries. The lagged coefficients of the fertility rate are also found to be statistically significant.

Interestingly, the adverse effects of uncertainty on the fertility rate are much stronger in the OECD countries than in the non-OECD countries. This evidence could be because the non-OECD countries have lower parental human capital than the more prosperous OECD economies. In theory, wages are the product of the after-tax market rental rate and the stock of human capital. Policy shocks that change the rental rate will cause larger swings in wages and the higher is the stock of human capital. It could also be because the informal income sources that are important in developing countries are not as sensitive to the uncertainty that is being measured by the WUI as market income.

5.2. Findings of the System GMM Estimations

In Table 5, we report the results of the system GMM estimations for the baseline models in (1) for the total fertility rate, once again using data from the period from 1996 to 2017.

[INSERT Table 5]

System-GMM estimations can address a potential endogeneity bias.[12] The findings of the Sargan test indicate that there is no over-identification problem. The results of the Arellano-Bond autocorrelation test for AR(1) and AR(2) illustrate that the first-order autocorrelation is statistically significant, but the second-order autocorrelation is not statistically significant. The findings also show a significant and very high level of persistence in the fertility rates. We continue to find that a higher level of (both lagged and current) WUI yield lower fertility rates, in line with the baseline fixed-effects estimations. The next section provides a battery of robustness exercises

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[10] Note that the results of the cluster-robust Hausman test indicate that the fixed-effects estimations are consistent.

[11] We report the coefficients of WUI multiply by 100 to ease the exposition of the findings.

[12] Note that the findings of the Panel Granger causality tests indicate that lagged fertility rates do not significantly affect the level of WUI.

6. Robustness Checks

6.1. Robustness to the Inclusion of Other Controls

In Table 6, we report the findings of robustness checks for the baseline lagged models in (1) for the fertility rates using the period from 1996 to 2017.

[INSERT Table 6]

Each additional control discussed in section 4.2 is added individually to the regression. The table reports the estimated coefficient on lagged WUI. The findings are in line with the baseline evidence and are robust to the inclusion of these controls. In all cases, the negative impact of uncertainty on the fertility rate remains statistically significant. Of particular importance, the controls related to after-tax income effects—such as economic growth, unemployment, fiscal and regulatory policy, and globalization—do not alter the magnitude or statistical significance of the WUI estimate. This evidence supports the interpretation that uncertainty, and not just expected income, is influencing fertility.

Inclusion of life-expectancy is the one control that substantially lowers the value of the coefficient on WUI, suggesting that there is some interaction between the two determinants of fertility because general economic uncertainty and life-expectancy are correlated. However, the inclusion of the conflict control variable, which should also constitute an important source of health-related shocks, does *not* cause much change in the estimated effect of WUI on fertility. Furthermore, the sign on life expectancy control is *negative*, consistent with the conventional view that increasing life expectancy is a factor *lowering fertility over the course of development* (see footnote 3). However, the negative sign is not consistent with health shocks being an explanation for the *procyclical* nature of fertility. To explain procyclical fertility, if negative health shocks have an important correlation with the economy during downturns, one would expect to see a *positive* coefficient—drops in life expectancy causing drops in fertility. We further investigate the possible *short-run* fertility effects of life expectancy changes across time in section 7.

6.2. Robustness to the Outliers

In Table 6, we also report the findings of robustness checks by excluding outliers from the dataset. First, we exclude the extreme observations for the measures of the fertility rates and the WUI. Following Gozgor and Ranjan (2017), we define the "extreme observations" as those who are more than two standard deviations away from the mean. The findings are robust to excluding these observations from the panel dataset. Second, we separately exclude the observations of the Latin American and the Caribbean as well as East Asia and Pacific countries. We find that the results are robust to the exclusion of each region; that is, observations from these regions do not determine the benchmark findings.

In short, a battery of robustness analysis shows that policy uncertainty lowers fertility, as we have observed in Table 4.

7. Pro-cyclical Fertility

Our analysis to this point establishes a robust negative connection between uncertainty and fertility in an extensive panel data set of countries at different stages of development. In this section, we attempt to shed some light on the *cyclical* connection between these two variables. We do this in two ways.

First, we focus only on OECD countries. Restricting the sample to these richer countries should reduce large variations in fertility and uncertainty across countries with substantial differences in per capita income and other features of development. Second, we look at changes in fertility across time rather than the level of fertility as our dependent variable. Looking at the determinants of changes in fertility across time in a sample of countries at similar stages of development should allow cyclical and shorter-run variations to dominate the estimation.

We use two econometric specifications. In (2a), we relate changes in fertility to the level of current or past levels of uncertainty. In (2b), we relate changes in fertility to changes in the level of uncertainty from t-1 to t and the lagged change from t-2 to t-1.

$$\Delta Fertility_{i,t} = \beta_0 + \beta_1 Uncertainty_{i,t-1} + \beta_2 X_{i,t-1} + \vartheta_t + \vartheta_i + \varepsilon_{i,t} \quad (2a)$$

$$\Delta Fertility_{i,t} = \beta_0 + \beta_1 \Delta Uncertainty_{i,t-1} + \beta_2 X_{i,t-1} + \vartheta_t + \vartheta_i + \varepsilon_{i,t} \quad (2b)$$

Tables 7 and 8 report the estimation results using (2a) and (2b), with and without lags in the regressors.

In all cases, the effect of uncertainty on fertility changes is negative. In three of the four specifications, the estimated effect of uncertainty on fertility is statistically significant at the 5 percent level or lower. The fact that the fertility effect controls for GDP per capita suggest that it is not picking up pure income effects. We know from Section 3 and Table 2 that the WUI is a good predictor of unemployment changes. Thus, the main uncertainty affecting fertility may be due to worries about the deteriorating labor market condition and job losses.

We also conduct regressions that include the life expectancy variable that lowered the WUI coefficient in the larger cross-country sample. The level of life expectancy was added to the regressions in Table 7, and the change in life expectancy was added to the regressions in Table 8. The value and statistical significance of the coefficient on WUI was not altered substantially by the inclusion of life expectancy—the estimated effect of WUI on fertility was somewhat lower than in Table 7 and somewhat higher than in Table 8. The estimated effects of life expectancy were negative in all cases but were statistically significant at the 5 percent level only in the Table 7 regressions. Thus, we find no evidence that health shocks associated with the business cycle cause *procyclical* fertility variations—the sign on life expectancy is negative, not positive, even when we focus on changes in fertility in the smaller sample of higher-income countries. This evidence suggests that the effects of health shocks on fertility, while important, are not confounded with the effects of economic shocks that create uncertainty and generate a procyclical pattern for fertility.

8. Uncertainty and Human Capital

Our results indicate that households living in more uncertain economic environments will have fewer children. Based on the Becker-Lewis theory, this suggests that parents may then trade-off the decline in the number of children by investing more in the human capital of each child. Thus, a more uncertain economic environment could create not only lower fertility but also higher human capital.

Furthermore, the Galor-Weil (2000) variant of the quantity-quality theory stresses that the *rate* of technological progress raises the average return to education. The idea is that in a changing economic environment, more educated workers can better adapt and take advantage of new opportunities. It follows that more educated workers should be better equipped to deal with changes and uncertainty in general and not just those associated with technological progress. Thus, more uncertain environments may raise the average return to human capital investment and reduce fertility via a different path from the precautionary saving motive per se.

However, the tight association between schooling and fertility changes is not always expected. Households with family farms or informal business generate income flows that have been shown to affect fertility but *not* schooling (Das et al., 2018: Chapters 7-9; Lord and Rangazas, 2006; Mourmouras and Rangazas, 2009). In developing and emerging countries, large portions of the population predominately receive income from informal sources. For these economies, changes in the uncertainty over informal income flows could affect fertility but not schooling. Furthermore, Ehrlich and Kim (2007b: Proposition 1) show that, in the absence of financial saving and intergenerational transfers, changes in wage taxation will only affect fertility and not human capital. This issue provides another example of why fertility and human capital may not move together in poorer countries. Thus, it is unclear, a priori, how an environment with more uncertain income may affect human capital investment, especially in developing countries.

We investigate the empirical effect of uncertainty on human capital by following the Becker-Lewis theory that assumes education investments are made in close conjunction with fertility choices. Under the baseline Becker-Lewis theory, parents plan simultaneously for the quantity and quality of children, so a reduced form human capital regression equation should include the same set of independent variables as the equation we used for fertility. The same variables found to be important determinants of fertility should also affect human capital formation.

The measure of human capital we have been using is from the Penn World Tables (Freenstra et al., 2015), which in turn is based on the Barro and Lee (2015) estimates of the average years of schooling in the workforce. Average years of schooling reflect schooling and fertility decisions in the entire country over an extended period. This evidence means that the most meaningful variations from the panel data set for studying human capital will be long-run, cross-country variations that capture how different average levels of uncertainty in a country affect fertility and schooling choices across the population over many years. This interpretation is confirmed because when we include lagged human capital as an independent variable in the human capital regression, the estimated coefficient is highly significant and equal to one. No other variables are statistically significant. In other words, the times series feature of the panel data is not informative about what causes human capital because the sample includes little variation in the human capital measure *across time within countries*.[13]

The human capital regression includes the same independent variables used in the fertility regressions—lagged values of uncertainty, fertility, per capita income. However, for a reason discussed above, in place of lagged human capital, we used lagged public education expenditure as a share of GDP. The regression estimates are reported in Table 9.

We also ran regressions with the public education spending share as the *dependent* variable instead of human capital. The signs of the estimated effects of all independent variables were the same as in the human capital regression, but only the lagged education share was statistically significant. One can argue that the education investment that is most directly affected by households is student attendance and not the amount of public school spending that in many countries is set by government officials well above the local level. This evidence is a particularly relevant consideration in countries where fiscal policies are set by a political elite (see, for example, Acemoglu, 2009: Chapter 22; Banerjee and Duflo, 2011: Chapter 4; Sochirca and Neves, 2020).

In the complete sample, we find results that are expected from the baseline version of the Becker-Lewis theory. An uncertain economic environment not only lowers fertility but also raises human capital as parents' trade-off fewer children for higher "quality" ones. However, the full sample masks some important differences between developing and developed countries. In the Non-OECD sample, while uncertainty does affect fertility, it does *not* have a significant effect on human capital. This evidence is consistent with the extension of the Becker-Lewis theory that includes family farms and informal businesses as important sources of income and in settings where household saving is low. It is only in OECD countries, where market wages are the dominant source of income for most households and saving is nontrivial, that we see the close association between fertility and schooling decisions. In richer countries, more uncertain environments discourage fertility and raise schooling per child. In poorer countries, the primary effect of uncertainty is on fertility alone.

9. Conclusion

This paper contributes to the literature searching for a link between economic uncertainty and fertility. We use a particular measure of economic uncertainty—the World Uncertainty Index (WUI) created by Ahir et al. (2018). The measure is based on reports focusing on economic policy and international events to gauge the level of uncertainty in the economic conditions of a country. Uncertainty over world events and economic policy, as captured by the WUI, is statistically associated with business cycle fluctuations and economic uncertainty over wages and consumption. In addition, the measure has the advantage that the uncertainty is likely to be exogenous to the fertility choice.

We find robust evidence that increases in the WUI reduce fertility in a large sample of countries at different stages of development, consistent with the theory that a precautionary saving motive negatively impacts fertility. To examine the shorter run, cyclical effects of uncertainty, we focus on changes in fertility across time in a sample of OECD countries. Here again, we find evidence that current period changes in fertility are negatively associated with the value and even changes in the value of the WUI in previous periods. This evidence suggests that the pro-cyclical nature of fertility may stem from changes in uncertainty associated with the business cycle.

Our results indicate that uncertainty is a potentially important determinant of fertility, enough so to reveal itself in macroeconomic correlations. To more precisely verify the exact mechanism relating uncertainty to fertility requires finding microdata that can directly match who is experiencing an increase in uncertainty with their individual changes in fertility behavior. Another approach using microdata would be to look at whether abortions are more common during periods of greater uncertainty.

Finally, the COVID-19 pandemic will generate data that may help to further identify the effects of economic uncertainty on fertility. The pandemic is unique in not having severe health impacts on parents and young children, meaning the health shocks that could potentially lower fertility are not present. Our results suggest that fertility will nevertheless decline because of the rise in economic uncertainty. This is consistent with the recent study by Wilde et (2020) that links greater Google searches for unemployment news to lower in fertility. Based on an econometric model estimated using this type of data, they forecast that the COVID-19 pandemic will cause a decline in fertility. Future studies should seek to verify their prediction.

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Table 1
Growth Rate of Per Capita GDP

Regressor	Lagged WUI	No Lag in WUI
Lagged Growth Rate	0.316*** (0.059)	0.337*** (0.056)
Change in World Uncertainty Index	–0.000 (0.002)	–0.441***(0.001)
Constant Term	0.013*** (0.001)	0.012*** (0.001)
Observations	598	599
Number of Countries	33	33
R-squared (Within)	0.096	0.128

Notes: The standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 2
Unemployment Rate

Regressor	Lagged WUI	No Lag in WUI
Lagged Unemployment Rate	0.866*** (0.031)	0.877*** (0.034)
Change in World Uncertainty Index	0.157** (0.062)	0.058 (0.036)
Constant Term	0.960*** (0.241)	0.859*** (0.272)
Observations	598	631
Number of Countries	33	33
R-squared (Within)	0.764	0.779

Notes: The standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3
Summary of Descriptive Statistics

Variables	Definition	Data Source	Mean	Std. Dev.	Min.	Max.	Obs.
Total Fertility Rate	Births per Woman	World Bank (2020)	3.139	1.686	0.901	7.716	2,982
World Uncertainty Index	Index in Logarithmic Form	International Monetary Fund: Ahir et al. (2018)	–2.078	0.836	–4.422	0.232	2,780
Per Capita GDP (Constant 2010 US$)	Logarithmic Form	World Bank (2020)	8.280	1.576	5.229	11.42	2,958
Economic Growth Rate	% (Δ Log Per Capita GDP)	World Bank (2020)	0.023	0.051	–0.973	0.801	2,816
Human Capital	Index	PWT 9.1: Feenstra et al. (2015)	2.387	0.710	1.053	3.734	2,394
Female Labor Force Participation Rate	% of Female Population Ages 15+	World Bank (2020)	56.91	17.45	6.349	88.84	2,982
Total Population	Logarithmic Form	World Bank (2020)	16.42	1.348	13.16	21.04	2,977
Total Unemployment Rate	% of Total Labor Force	World Bank (2020)	8.269	6.186	0.140	44.15	2,982
Age Dependency Ratio	% of Working-age Population	World Bank (2020)	64.01	19.70	16.45	113.2	2,977
Urban Population	% of Total	World Bank (2020)	55.84	22.96	7.412	100.0	2,977
Life Expectancy At Birth	Total (Years)	World Bank (2020)	68.17	9.965	35.92	84.27	2,977
Market Gini	Index	SWIID 8.3: Solt (2020)	0.441	0.067	0.214	0.687	2,527
Transfers and Subsidies	Share of GDP	Economic Freedom Dataset: Gwartney et al. (2019)	9.157	7.875	0.000	30.08	1,977
Government Consumption	Share of Total Consumption	Economic Freedom Dataset: Gwartney et al. (2019)	19.89	8.065	4.100	59.01	2,137
Top Marginal Income Payroll Tax Rate	Percentage	Economic Freedom Dataset: Gwartney et al. (2019)	41.38	13.20	0.000	71.90	1,799
Labor Market Regulation	Index from 0 to 10	Economic Freedom Dataset: Gwartney et al. (2019)	6.154	1.448	2.100	9.730	2,089
Overall Globalization	Index from 0 to 100	KOF: Dreher (2006) & Gygli et al. (2019)	59.20	16.11	22.59	91.16	2,982
Economic Globalization	Index from 0 to 100	KOF: Dreher (2006) & Gygli et al. (2019)	55.53	16.21	17.44	95.43	2,982
Executive Constraints Concept	Index from 1 to 7	Polity IV Annual Time Series: Marshall et al. (2018)	4.970	1.996	1.000	7.000	2,835
Level of Institutionalized Democracy	Index from 0 to 10	Polity IV Annual Time Series: Marshall et al. (2018)	5.558	3.810	0.000	10.00	2,835
Polity2	Index from –10 to 10	Polity IV Annual Time Series: Marshall et al. (2018)	3.647	6.257	–10.00	10.00	2,911
Conflicts	Index from 0 to 10	Major Episodes of Political Violence: Marshall (2019)	0.600	1.499	0.000	9.000	2,961

Table 4
Fixed-Effects Estimations (Lagged Model) Total Fertility Rate (1996–2017)

Regressor	All Countries	Non-OECD	OECD
Lagged Total Fertility Rate	0.978*** (0.003)	0.983*** (0.003)	0.878*** (0.015)
Lagged Log Per Capita GDP	0.017*** (0.005)	0.008 (0.005)	0.133*** (0.018)
Lagged Human Capital	0.065*** (0.009)	0.089*** (0.010)	–0.070*** (0.025)
Lagged Log World Uncertainty Index	–0.391*** (0.108)	–0.282** (0.119)	–0.619*** (0.236)
Constant Term	–0.281*** (0.043)	–0.248*** (0.043)	–0.955*** (0.136)
Observations	2,226	1,617	609
Number of Countries	126	93	33
R-squared (Within)	0.985	0.989	0.865

Notes: The dependent variables are the Total Fertility Rate. The standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5
System GMM Estimations for Model I (Lagged Model) Total Fertility Rate (1996–2017)

Regressor	All Countries	Non-OECD	OECD
Lagged Total Fertility Rate	1.007*** (0.003)	1.010*** (0.002)	0.988*** (0.010)
Lagged Log Per Capita GDP	–0.023*** (0.004)	–0.016*** (0.002)	–0.009 (0.008)
Lagged Human Capital	0.117*** (0.010)	0.112*** (0.005)	0.058*** (0.011)
Lagged Log World Uncertainty Index	–0.776*** (0.108)	–0.581*** (0.049)	–1.096*** (0.156)
Constant Term	–0.160*** (0.033)	–0.206*** (0.021)	–0.098* (0.050)
Observations	2,114	1,536	578
Number of Countries	126	93	33
AR (1) Test Statistic and p-value	–3.58 [0.000]	–2.12 [0.034]	–4.14 [0.000]
AR (2) Test Statistic and p-value	1.48 [0.141]	1.45 [0.147]	0.47 [0.638]
Sargan Test Statistic and p-value	81.4 [0.186]	67.8 [0.516]	30.9 [0.999]

Notes: The dependent variable is the Total Fertility Rate (Model I). The standard errors are in parentheses. The probability values are in brackets. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

Table 6
Sensitivity Analysis for Fixed-Effects Estimations: Total Fertility Rate (1996–2017), (All Countries, Lagged Model)

Sensitivity Analysis	Variable	Coefficient
Results of the Benchmark Regressions	Lagged Log World Uncertainty Index	–0.391*** (0.108)
Including Lagged Female Labor Force Participation Rate	Lagged Log World Uncertainty Index	–0.389*** (0.109)
Including Lagged Log Total Population	Lagged Log World Uncertainty Index	–0.314*** (0.107)
Including Lagged Total Unemployment Rate	Lagged Log World Uncertainty Index	–0.372*** (0.108)
Including Lagged Age Dependency Ratio	Lagged Log World Uncertainty Index	–0.328*** (0.101)
Including Lagged Urban Population	Lagged Log World Uncertainty Index	–0.369*** (0.109)
Including Lagged Life Expectancy at Birth	Lagged Log World Uncertainty Index	–0.207** (0.104)
Including Lagged Economic Growth	Lagged Log World Uncertainty Index	–0.356*** (0.110)
Including Lagged Market Gini Index	Lagged Log World Uncertainty Index	–0.361*** (0.117)
Including Lagged Transfers and Subsidies	Lagged Log World Uncertainty Index	–0.426*** (0.125)
Including Lagged Government Consumption	Lagged Log World Uncertainty Index	–0.420*** (0.117)
Including Lagged Top Marginal Income Payroll Tax Rate	Lagged Log World Uncertainty Index	–0.458*** (0.137)
Including Lagged Index of Labor Market Regulation	Lagged Log World Uncertainty Index	–0.458*** (0.137)
Including Lagged Index of Overall Globalization	Lagged Log World Uncertainty Index	–0.416*** (0.108)
Including Lagged Index of Economic Globalization	Lagged Log World Uncertainty Index	–0.405*** (0.108)
Including Institutional Quality: Lagged Executive Constraints Concept	Lagged Log World Uncertainty Index	–0.393*** (0.112)
Including Institutional Quality: Lagged Level of Institutionalized Democracy	Lagged Log World Uncertainty Index	–0.397*** (0.112)
Including Institutional Quality: Lagged Index of Polity2	Lagged Log World Uncertainty Index	–0.364*** (0.109)
Including Lagged Index of Conflicts	Lagged Log World Uncertainty Index	–0.386*** (0.108)
Excluding Extreme Units of Dependent Variables	Lagged Log World Uncertainty Index	–0.384*** (0.110)
Excluding Extreme Units of World Uncertainty Index	Lagged Log World Uncertainty Index	–0.382*** (0.117)
Excluding Latin American and Caribbean Countries	Lagged Log World Uncertainty Index	–0.462*** (0.129)
Excluding East Asia and Pacific Countries	Lagged Log World Uncertainty Index	–0.417*** (0.113)

Notes: The dependent variables are the Total Fertility Rate (Model I) and Δ Total Fertility Rate (Model II). Controls are included but not reported to save space. The standard errors are in parentheses. *** and ** indicate statistical significance at the 1% and 5% levels.

Table 7
Fixed-Effects Estimations of Eq. (2a)

Regressor	Lagged	No Lags
Log Per Capita GDP	0.103*** (0.019)	0.139*** (0.020)
Human Capital	–0.047* (0.026)	–0.081***(0.027)
World Uncertainty Index	–0.602** (0.248)	–0.676*** (0.254)
Constant Term	–0.917*** (0.143)	–1.179*** (0.154)
Observations	609	578
Number of Countries	33	33
R-squared (Within)	0.074	0.107

Notes: The dependent variable is the Δ Total Fertility Rate. The standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8
Fixed-Effects Estimations of Eq. (2b)

Regressor	Lagged	No Lags
Log Per Capita GDP	0.102*** (0.032)	0.102*** (0.026)
Human Capital	–0.063* (0.037)	–0.059*(0.027)
Change in World Uncertainty Index	–0.003** (0.001)	–0.002 (0.002)
Constant Term	–0.917*** (0.143)	–0.860*** (0.186)
Observations	566	598
Number of Countries	33	33
R-squared (Within)	0.055	0.060

Notes: The dependent variable is the Δ Total Fertility Rate. The standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 9
Fixed-Effects Estimations (Lagged Model) Human Capital Index (1996–2017)

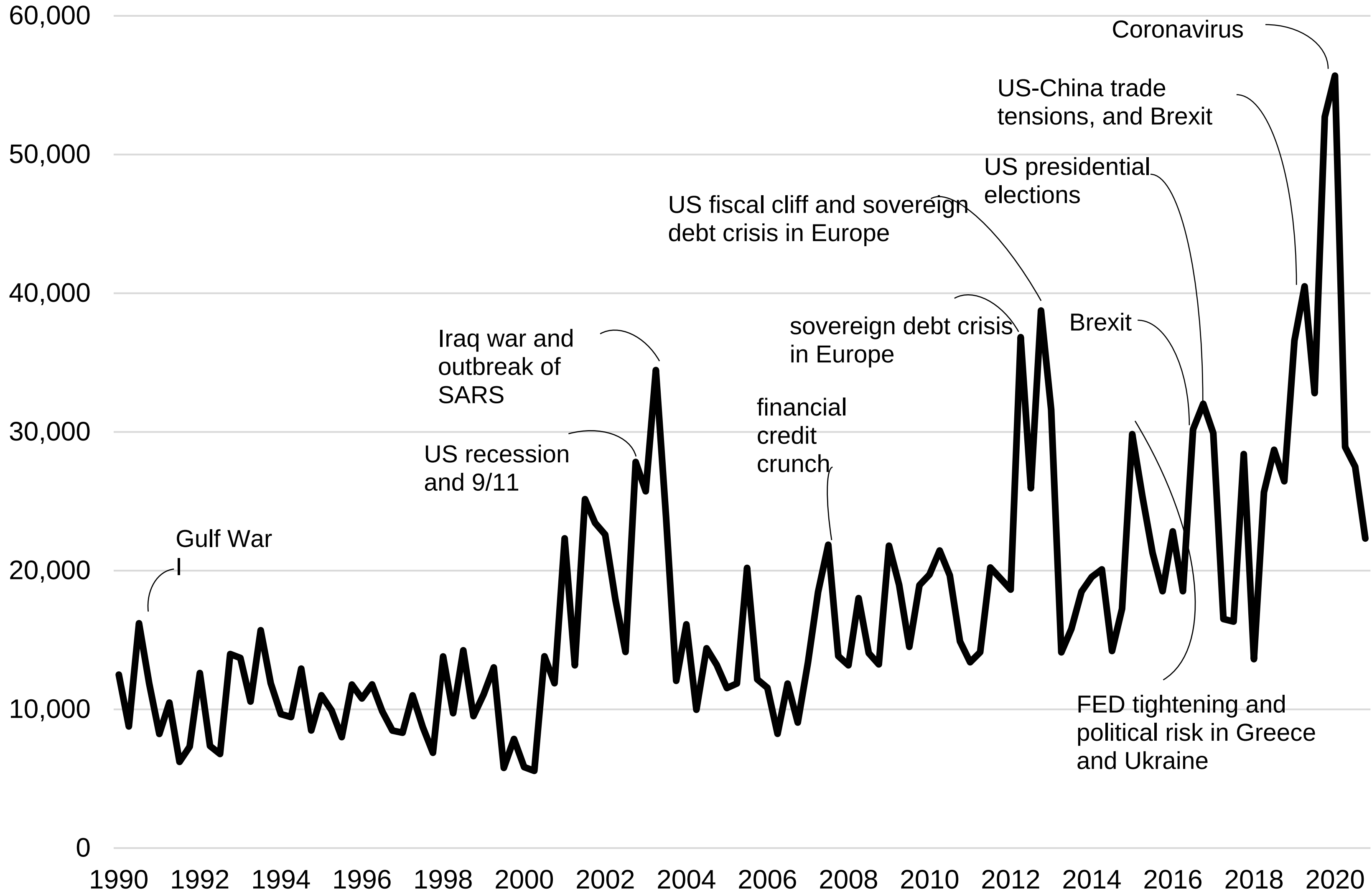
Regressor	All Countries	Non-OECD	OECD
Lagged Education Spending	0.002 (0.006)	0.001 (0.007)	0.024** (0.011)
Lagged Log Per Capita GDP	0.396*** (0.042)	0.334*** (0.055)	0.523*** (0.065)
Lagged Total Fertility Rate	–0.089*** (0.026)	–0.112*** (0.029)	–0.031 (0.081)
Lagged Log World Uncertainty Index	0.011*** (0.004)	0.005 (0.005)	0.017*** (0.005)
Constant Term	–0.587 (0.386)	0.025 (0.470)	–2.219*** (0.667)
Observations	1,311	871	440
Number of Countries	120	87	33
R-squared (Within)	0.514	0.511	0.609

Notes: The dependent variable is the human capital index. The standard errors are in parentheses.
*** and ** indicate statistical significance at the 1% and 5% levels, respectively.

Appendix I
List of Countries in the Dataset

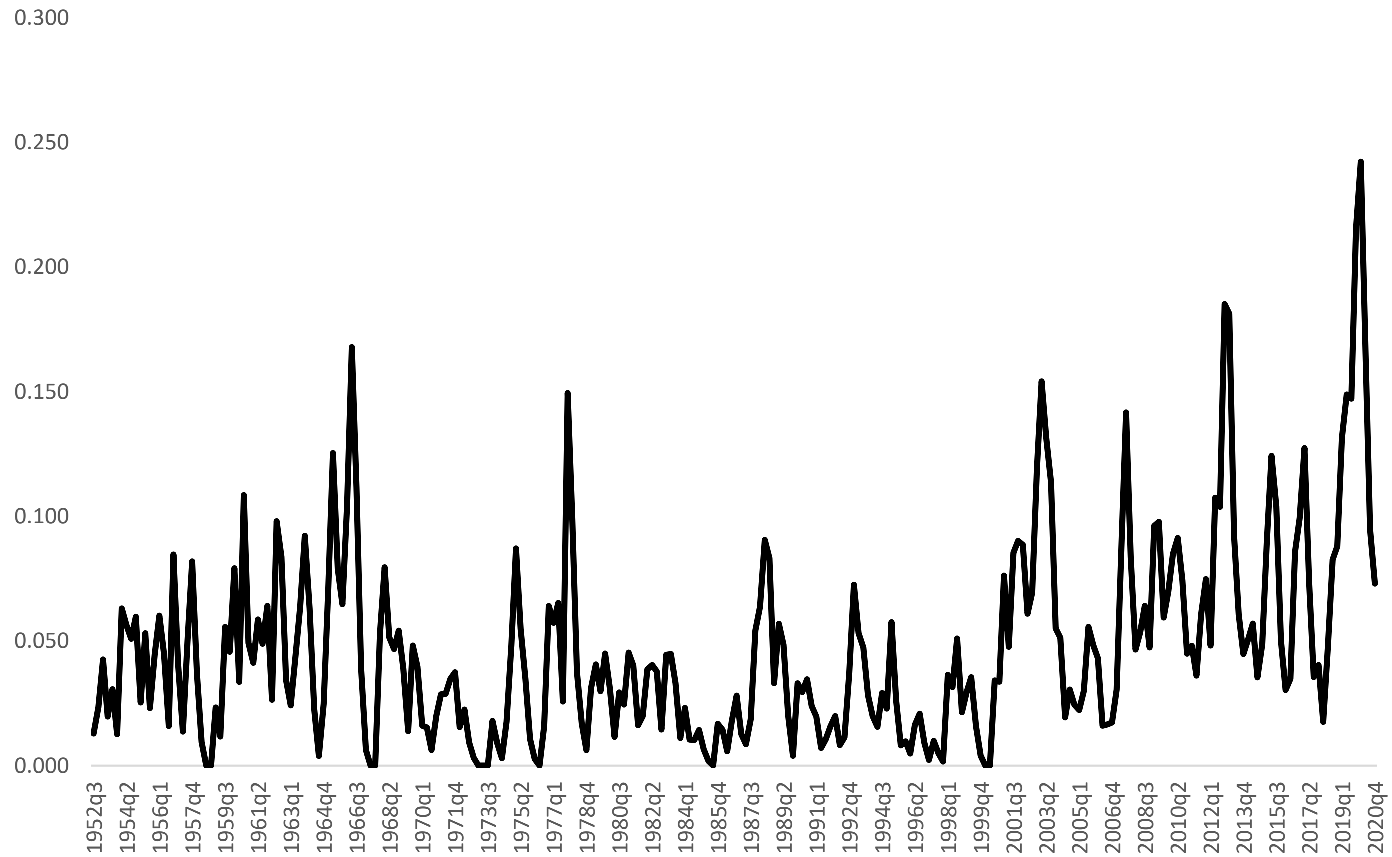
Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Bangladesh, Belgium, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chile, China, Colombia, Congo DR, Congo Republic, Costa Rica, Côte d'Ivoire, Croatia, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Finland, France, Gabon, the Gambia, Germany, Ghana, Greece, Guatemala, Haiti, Honduras, Hong Kong, Hungary, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea Republic, Kuwait, Kyrgyz Republic, Laos, Latvia, Lesotho, Liberia, Lithuania, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, the Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Panama, Paraguay, Peru, the Philippines, Poland, Portugal, Qatar, Romania, Russia, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Tajikistan, Tanzania, Thailand, Togo, Tunisia, Turkey, Uganda, Ukraine, the United Arab Emirates, the United Kingdom, the United States, the Uruguay, Venezuela, Vietnam, Yemen, Zambia, and Zimbabwe.

Figure 1. World Uncertainty Index (1990-2020)



Data Source: Ahir et al. (2018)

Figure 2. World Uncertainty Index for the United States (1952Q3-2020Q4)



Data Source: Ahir et al. (2018)