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Corruption and Fertility: Evidence from OECD countries

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Abstract

This paper uses panel data of OECD countries during the period 1995–2003 to examine how corruption affects fertility. The Corruption Perceptions Index is used to measure the degree of corruption. Fixed effects IV estimation and the Arellano-Bond dynamic panel estimation are employed to control for endogenous bias and unobservable country-specific effects. Results suggest that the fertility rate is higher in less corrupted countries. From this, the argument can be made that lack of political corruption underlies desirable conditions for child rearing in developed countries.

Keywords: Corruption, fertility, political institutions

JEL classification: D73, J13,

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I. INTRODUCTION

It is widely known that fertility rates have declined since World War II in most OECD countries. Consequently, rates are below 2.1 children per woman, which is the level required to secure generational replacement (Sleebos 2003; Vos 2009). Furthermore, some developing countries have followed this trend, and thus fertility rates have been drastically declining in those countries (Das Gupta 1999). A decline in fertility changes not only the structure of the family but also economic conditions. The GDP level partly depends on input factors such as labor and capital. A low fertility rate can reduce the working age population and in turn hamper economic growth. Researchers have explored why fertility declines with a rise in per capita income and institutional changes (e.g., Becker 1981; Docquier 2004; Vos 2009; Hori 2011). It has been asserted that rising per capita income raises the fertility rate up to a point, and thereafter exerts a negative effect on fertility (Winegarden and Wheeler 1992). Contrarily, since the 1990s, the fertility rate has risen gradually for some developed countries, including the United States and countries in Scandinavia (Sleebos 2003). This implies that fertility rates have deviated from a stable level for these countries. Naturally, a question arises regarding why the fertility rate varies even though the per capita income level is similar among developed countries. To address this question, existing work has focused on female labor force participation (e.g., Galor and Weil 1996; Apps and Rees 2004; Sleebos 2003; Kogel 2004) and cost of childcare services (Martinez and Iza 2004)[1]. However, another plausible reason is that political institutions have an

[1] Ahn and Mira (2002) found that in OECD countries, the correlation between fertility rate and female labor force participation was negative during the 1970s and up to the early 1980s. However, thereafter the correlation became positive.

influence on the incentive to give birth, resulting in differences in fertility (Borck 2011).

Institutional factors seem to influence demography (McNicoll and Mead 1989). For developing countries, the establishment of modern governance is conducive to fertility decline (Das Gupta 1999). With respect to developed countries, child bearing decisions depend partly on characteristics of labor markets (D'addio and d'Ercole 2005). The theoretical works of Blackburn and Sarmah (2008) used the dynamic generational equilibrium model to show that high levels of economic development are related to low levels of corruption and high rates of life expectancy. It is well acknowledged that corruption is a critical factor influencing personal decision making and hence economic outcomes. If this is so, corruption inevitably influences the decision about giving birth and child rearing. However, little is known about how corruption is related to fertility rates among developed countries. Hence, this paper aims to examine how corruption influences fertility rate by using panel data of OECD countries. The key finding through various estimations is that the fertility rate is higher in less corrupted countries.

The organization of this paper is as follows. An explanation of the data set is provided as well as an overview of the relation between corruption and fertility in Section II. Section III presents the hypothesis and a simple econometric framework. The results of the estimations and discussion are provided in Section IV. The final section offers concluding observations.

II. DATA

This study uses a panel data set covering the 9-year period 1995–2003. As shown in

APPENDIX Table A1, 22 OECD countries are included. The data are derived from several sources. Crude fertility rates are taken from the World Development Indicators (World Bank, 2010).

The key independent variable of this paper is a proxy for degree of corruption. I use the Corruption Perceptions Index (CPI)[2]. The CPI scale has values from 0 (highly corrupted) to 10 (least corrupted). That is, higher values on the CPI indicate less corruption. This index, which was launched in 1995, is published by Transparency International. The CPI has been widely used to measure cross-country corruption (for example, see Lambsdorff 2006). The CPI is a composite index, drawing on 15 different polls and surveys from nine independent institutions carried out among business people and country analysts, including surveys of residents, both local and expatriate. The CPI focuses on corruption in the public sector. The surveys used in compiling the CPI ask questions in line with the misuse of public power for private benefit with a focus, for example, on bribe-taking by public officials in public procurement. The sources do not distinguish between administrative and political corruption.

Among the set of other independent variables are income, divorce rates, unemployment rates and income inequality. As a measure of income, I use the per capita real gross domestic product in the year 2000 in international dollars taken from the Penn World Tables (PWT v 6.3)[3]. Gini coefficients from the Standardized Income Distribution Database (SIDD) created by Babones and Alvarez-Rivadulla (2007) [4,5] are

[2] An important issue is how to define corruption. There are many definitions, and most share a common denominator which can be expressed as follows: "the abuse of public authority or position for private gains." The data are available at http://www.transparency.org/policy_research/surveys_indices/cpi (accessed February 2, 2011).

[3] The data are available at http://pwt.econ.upenn.edu/php_site/pwt_index.php (accessed January 15, 2010).

[4] The SIDD adjusts the raw World Income Inequality Database (WIID) for differences

a proxy for income inequality. Harmonized unemployment rates are taken from the OECD database to allow for comparisons across countries. I also employ crude divorce rates (per 1,000) taken from the United Nations Common database, Demographic Yearbook[6]. As explained later, I also use urban population rate and population density as instrumental variables for the fixed effects IV estimation. Urban population rate, population density and female labor force participation rate are from World Development Indicators (World Bank 2010).

Table 1 includes variable definitions and descriptive statistics of the variables employed in the empirical analysis. As seen in Table 1, compared with INCOM and UNEMP, standard deviations of key variables such as FERTIL and CORRU are small. As explained, the data set consists of 22 countries and 8 years. Thus, results reflect considerable variation in each variable.

The correlation matrix is presented in Table 2. The coefficient of correlation between FERTIL and CORRU is 0.58, suggesting they are positively correlated. In Figure 1(1), average fertility rate within a country between 1995 and 2003 is shown on the vertical axis, while average value of the CPI is on the horizontal axis. Hence, Figure 1(1) reflects "between effects" of corruption on fertility among countries. As shown in Figure 1(1), fertility rates vary considerably across countries. The highest fertility rates are about 2.0 in Iceland, Ireland, New Zealand and the United States. Scandinavian countries such as Norway and Finland have rates about 1.8, putting them in the next to highest group. The lowest fertility rates are around 1.2, found in South Korea, Italy and Spain.

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in scope of coverage, income definition, and reference unit to a nationally representative, gross income, household per capita standard.

[5] The data are available at http://salvatorebabones.com/data-downloads (accessed March 1, 2011).

[6] Available at http://data.un.org/Default.aspx (Accessed May 10, 2010).

On the other hand, concerning corruption, Iceland, New Zealand and Scandinavian countries are in the highest group with a score of about 9. The lowest group, including Italy and South Korea, has a corruption score below 3. All in all, a cursory examination of Figure 1(1) reveals that the CPI is positively associated with fertility rate. This paper aims to examine effects of corruption on fertility rate after controlling for unobserved country-specific effects considered "between effects", as shown in Figure 1. Hence, I now focus on Figure 1(2) which demonstrates the relationship after controlling for the "between effects". That is, Figure 1(2) illustrates "within effects" of CPI on fertility. In this figure, the positive relationship between CPI and fertility continues to be observed even after controlling for "between effects". However, this relationship is not obvious. In the following section, I explain the regression estimations to more closely examine the relationship after controlling for country-specific effects.

III. HYPOTHESIS AND MODEL

3.1. Hypothesis

The utility of parents partly depends on the level of utility of their child (Becker 1981). Hence, the higher the child's utility becomes, the higher is the utility of the parents. Therefore, factors that influence a child's utility are associated with the parents' utility. If parents predict that a child's attainable utility is decreased because of conditions when they give birth, the incentive to give birth is reduced. Corruption appears to influence fertility rate because it is thought to have an effect on a child's utility. For example, the degree to which human capital can be formed, demonstrated by a child's earning ability, is thought to depend on public investment in education. The rate of public expenditures can be compromised by corrupt activities of government (Mauro 1998; Delavallade 2006). Therefore, a decrease in public expenditure for education leads to a decrease in fertility rate (Zhang and Zhang 2005). Furthermore, as argued by Blackburn and Sarmah (2008), life expectancy relies on the provision of public health, which is also reduced by corruption. Considering them jointly, corruption reduces the incentive of parents to give birth because the child is less likely to become a high earner and have longevity[7]. Hence, I postulate this hypothesis:

Fertility rate is lower in more corrupted countries.

3.2. Model

The empirical model to explain fertility rates and analyze the impact of corruption on fertility takes the following form:

$$FERTIL_{it} = \alpha_1 FERTIL_{it-1} + \alpha_2\, CORRUPT_{it} + \alpha_3\, INCOM_{it} + \alpha_4\, UNEMP_{it} + \alpha_5\, GINI_{it} + \alpha_6\, DIV_{it} + \alpha_7\, FLAB_{it} + k_i + \varepsilon_{it}, \quad (1)$$

where dependent variables in country i and year t are total suicide rates as $FERTIL_{it}$. k_i and ε_{it} represent individual effects of country i (a fixed effect country vector) and the error term of country i and at year t, respectively. The structure of the data set used in this study is a panel; k_i holds the time invariant feature and so can be captured by the random effects model (Baltagi 2005). The regression parameter is represented by α; ε_{it} represents the error term. If CORRUPT takes 10, this indicates an absence of

7 Zhang and Zhang (2005) argue that life expectancy reduces fertility, but raises the growth rate.

corruption. On the other hand, if CORRUPT takes 0, business transactions are entirely dominated by kickbacks, extortion and other corrupted practices. CORRUPT is included to capture the degree of governance corruption. If people are more likely to give birth in less corrupted societies, CORRUPT will take the positive sign.

INCOM and UNEMP (unemployment) are included to capture economic factors. The anticipated sign of INCOM is negative. This is because the higher the income level becomes, the higher the opportunity cost of giving birth. We expect UNEMP and GINI to take the negative sign because higher unemployment and income inequality lead to crime and less desirable childcare options.

When we discuss the fertility rate in developed countries, it is important to consider "trade-offs confronting individual women between having children, on one side, and taking advantage of the education and employment opportunities available to them, on the other" (Sleebos p. 19). Women's decisions regarding fertility depend on the economic cost and benefit (Becker, 1981). Hence, a rise in wage level for women increases the opportunity cost of giving birth and childcare (Galor and Weil 1996). With higher female labor force participation, time spent on childcare is more scarce, thus reducing the female's incentive to give birth. However, in OECD countries, the relation between fertility rate and female labor force participation rate was negative until the beginning of the 1980s, but has become positive since the 1990s (Sleebos 2003; Kogel 2004). Divorce destroys stable partnerships between males and females and thus reduces fertility rate. In OECD countries, fertility rate is negatively associated with divorce rate. However, at the end of the 1990s births occurring outside marriage were increasing (Sleebos 2003). These changes in the effects of female labor force participation and divorce on fertility are open to discussion (Kogel

2004).

3.3. Endogeneity bias

As argued, FLAB and DIV affect the fertility rate. On the other hand, it seems plausible that a female with a small child is less likely to participate in the labor force because she is providing childcare (Veronique at al. 2010). As seen in Table 2, the coefficient of correlation between FERTIL and FLAB is 0.65, implying that fertility rate is positively related to female labor force participation rate. This seems to reflect the situation in OECD countries after the 1990s[8]. Having a child appears to reduce the likelihood of parental divorce because divorce has a detrimental effect on children (Sleebos 2003). Therefore, there is possibly reverse causality between FERTIL and FLAB (or DIV), and the causality between FLAB (or DIV) and FERTIL cannot be identified, resulting in edogeneity bias. For more precise estimation, instrumental variables are used to control for estimation bias.

Various kinds of industries, especially those in the service sector, are concentrated in urban areas. Firms can enjoy the benefit of agglomeration economies through face to face interactions of experts in large cities, resulting in new ideas and new industry (Jacobs 1969, 1984). Glaeser et al. (1992) found that the greater the scale of the city and the more diverse its industrial structure is, the higher the growth rate of employment. This leads me to infer that agglomeration (urbanization) provides workplaces for females, increasing female labor force participation. As a consequence, females can obtain high earnings, contributing to the divorce rate because females are more inclined

[8] In OECD countries, there was a negative correlation between fertility rate and female labor force participation until the early 1980s. However, thereafter a positive correlation was observed (Ahn and Mira 2002).

to become economically independent. Therefore, as instrumental variables I use population density (DENS) and urban population rate (URBAN), which capture agglomeration and urbanization, respectively.

Figures 2 and 3 demonstrate the relationship among various variables, after controlling for country dummies. Figures 2(1) and (2) demonstrate the relation between DENS and DIV, and between URBAN and DIV, respectively. Figure 2(1) reveals that DENS is positively associated with DIV. Figure 2(2) shows that URBAN is positively associated with DIV. As for FLAB, a cursory examination of Figures 3(1) and (2) reveals a positive association between FLAB and DENS and between FLAB and URBAN. What is illustrated in Figures 2 and 3 is in line with the prediction. Instrumental variables are valid only when they are related to the endogenous variables but not to the error term. Roughly, I examine the validity to look at the relation between FERTIL and DENS (or URBAN). Figures 4(1) and (2) demonstrate relations between the error term and instrumental variables, which are obtained after controlling for female labor participation rate, divorce rate and unobserved country-specific effects. Figure 4(1) shows that the slope of the fitted line is almost flat. Therefore, the error term is not related to DENS. Figure 4(2) reveals that the slope of the fitted line is almost flat. Thus, the error term is not related to URBAN. All in all, DENS and URBAN can be considered to be valid as instrumental variables.

In addition to the fixed effects IV estimation model which uses instrumental variables in the fixed effects model, I also employ the Arellano-Bond type dynamic panel estimation which allows me to treat FLAB and DENS as endogenous variables. I use endogenous variables lagged two periods or more as additional instrumental variables (Arellano, 2003, p.168).

IV. EMPIRICAL RESULTS

4.1. Fixed effects and fixed effects IV estimations

Estimation results of the fixed effects and the fixed effects IV models are set out in Table 3(1). The fixed effects results appear in columns (1)–(4) of Table 3(1); the fixed effects IV results are in columns (5)–(7). DENS and URBAN are used as instrumental variables in columns (5) and (6). In addition, the log form of DENS and that of URBAN are used in column (7). An over-identification test examines the null hypothesis that instrumental variables are not correlated with the error term. If the hypothesis is not rejected, instrumental variables can be considered to be exogenous, and thus the fixed effects IV method is valid. As shown in columns (5) and (6), the hypothesis is not rejected, indicating that the fixed effects IV method is valid.

In all estimations of Table 3(1), CORRU yields the positive sign, while being statistically significant at the 1% level. Furthermore, the absolute value of its coefficient is 0.01. This implies that a 1 point increase in the corruption index leads to an increase in the fertility rate of 0.01 point. Apart from CORRU, UNEMP produces the negative sign in all estimations and is statistically significant in columns (1), (2) and (4). Signs for GINI are negative in all estimations and statistically significant with the exception of column (5). This suggests that unemployment and income inequality reduce the fertility rate, consistent with the prediction. As for endogenous variables such as DIV and FLAB, their signs are not stable and statistically insignificant.

The results of the first stage of the fixed effects IV are shown in Table 3(2). The determinants of DIV and FLAB are shown in columns (1) and (2), respectively. As expected, signs of DENS and URBAN are positive. URBAN is statistically significant in column (1); DENS is statistically significant in column (2). All in all, endogeneity of DIV and FLAB can be controlled by instrumental variables. Hence, the effect of CORRU on FERTIL is robust and unbiased.

When DIV and FLAB are included in independent variables at the same time, I use not only DENS and URBAN, but also ln(DENS) and ln(URBAN). However, the choice of ln(DENS) and ln(URBAN) is not based on theoretical reason. Therefore, the IV method might not be fully supported, although the over-identification test shows validity of the IV method in column (7). I also conduct dynamic panel estimation for a robustness check of the results presented above and discuss the results in subsection 4.2.

4.2. Dynamic panel estimation

Estimation results of the dynamic panel model (two step estimation) are presented in Table 4. Columns (1)–(4) exhibit results where all independent variables are treated as exogenous. On the other hand, columns (5)–(7) provide results where DIV and FLAB are treated as endogenous, and therefore endogeneity bias is controlled for. Furthermore, Table 4 presents the results of Sargan's over-identification test and second-order serial correlation test (Arellano 2003). These tests are necessary to check the validity of the estimation results in the dynamic panel model. The null hypothesis of Sargan's over-identification test is that the instrumental variables do not correlate with the residuals. If the hypothesis is not rejected, the instrumental variables are valid. Furthermore, the test for the null hypothesis (that there is no second-order serial correlation with disturbances in the first-difference equation) is important because the estimator is consistent when there is no second-order serial correlation. Tables 4 shows that both hypotheses are not rejected in all estimations, suggesting that the estimation results are valid.

CORRU yields positive signs and is statistically significant in all estimations. The value of CORRU is 0.01. These results are the same as the results shown in Table 3(1), implying that the significant positive effect of CORRU on FERTIL is robust. Concerning other independent variables, UNEMP takes significant negative signs, with the exception of column (6). Significant negative signs for GINI are observed in columns (1)–(4). Results for UNEMP and GINI are similar to those exhibited in Table 3(1). DIV produces significant negative signs with the exception of column (7), in line with the prediction, implying that divorce reduces the fertility rate. However, signs of FLAB are not stable and statistically insignificant, very similar to the results provided in column 3(1). In my interpretation, as observed in Sleebos (2003), female labor force participation has negative and positive effects on fertility rate, causing the effects to be neutralized.

The two-step estimation of the dynamic panel caused the standard errors to be biased. Hence, for more closely examining the effects of CORRU, I conduct one-step dynamic panel estimations and exhibit these results in Table 5. To conserve space, I only present the results of CORRU although other independent variables, such as Ln(INCOM), UNEMP, GINI, DIV, and FLAB, are included in each estimation. DIV and FLAB are treated as exogenous for results reported in columns (1)–(4), whereas they are treated as endogenous for results in columns (5)–(6). Only the first lagged FERTIL are included as independent variables in columns (1) and (5). The first and second lagged FERTIL are included as independent variables in columns (2) and (6). The first, second and third lagged FERTIL are included as independent variables in columns (3) and (7).

The first, second, third and fourth lagged FERTIL are included as independent variables in columns (4) and (8). The null hypothesis regarding no second-order serial correlation with disturbances in the first-difference equation is not rejected with the exception of columns (3) and (7). However, it should be noted that only results of column (8) pass both the second-order serial correlation test and Sargan's test. Therefore, careful attention is called for when estimation results are interpreted. CORRU yields significant positive signs in all estimations, which is consistent with results shown in Tables 3(1) and 4. Furthermore, values of coefficients are between 0.01–0.04. This suggests that a 1 point increase of CPI leads to a 0.01–0.04 increase in fertility rate.

As a whole, combined results set out in Tables 3–5 strongly support the hypothesis that the fertility rate is lower in more corrupted countries. Furthermore, I argue that quality of governance has a critical influence on child bearing decisions. A rise in fertility rate has been observed in Scandinavian countries (Sleebos 2003). There are a number of reasons why the fertility rate is higher in developed countries, for example, cash transfers to families with children (or tax deductions) and characteristics of the labor market (D'Addio and d'Ercole 2005). In addition, lack of government corruption is considered to be an important factor in increasing fertility rate in OECD countries.

Political conditions and economic development are thought to be profoundly related (Lipset 1959). Researchers have stressed the role played by politically and historically formed institutions and considered the effect on economic outcomes (e.g., Acemoglu et al. 2001, 2002; Greif 2006). Institutions are considered to underlie policies that enhance economic growth. Previous works have examined the relation between institutions and economic development (e.g., Przeworski and Limongi, 1993; Glaeser et al. 2004). A growing number of works have explored the relation between corruption and growth (e.g., Mauro 1995; Del Monte and Papagni 2001; Toke et al. 2008; Shaw et al. 2011). There are various channels through which corruption influences economic growth. This paper reveals another channel: corruption decreases fertility rate, reducing quantity of labor and in turn hampering economic growth even in OECD countries.

V. CONCLUSIONS

As generally known, fertility rates have declined and reached low levels in developed countries (Sleebos 2003; Vos 2009). Given this situation, it is important to investigate what encourages a rise in fertility levels. Since the 1990s, the fertility rate has risen gradually for some developed countries such as those in Scandinavia (Sleebos 2003). Understanding the rise in fertility rate in these countries may be the key to addressing this issue. Scandinavian countries are characterized by high trust and less corrupted governments, which facilitates the sustainable existence of a welfare state (Bergh and Bjørnskov 2011). Good governance is important for improvement in health conditions (Klomp and De Haan 2008). Therefore, it seems plausible to argue that good governance is related to life expectancy, affecting population size and composition of generations. Blackburn and Sarmah (2008) showed that high levels of economic development are related to low levels of corruption and high rates of life expectancy. However, little is known about how governance is associated with fertility.

Thus, it is worthwhile to investigate how and the extent to which corruption affects fertility rate. To this end, this paper sheds light on government corruption by using panel data of OECD countries to examine the effect of corruption on fertility. Labor force participation and divorce were expected to influence fertility rate. Thus, they should be included as independent variables. However, these variables caused endogeneity bias. To alleviate this bias, the fixed effects IV estimation and the Arellano-Bond type dynamic panel estimation were employed. These methods also controlled for unobservable country-specific effects. Results from these regression models provide evidence that there is a higher fertility rate in less corrupted countries. It follows from this that lack of political corruption underlies desirable circumstances for child rearing in developed countries. Findings in this paper lead me to argue that the degree of government corruption in part explains why the fertility rate has increased in Scandinavian countries since the 1990s. Even within developed countries such as those in the OECD, fertility rate varies according to governance. As argued previously, corruption reduces not only productive investments such as education but also fertility rate, which in turn impedes economic growth in the long run. Human capital formation and size of the labor force is hampered by corrupted government. That is, corruption has a detrimental effect not only on the quality of labor measured, but also on quantity of labor. If this is so, corruption appears to make a difference in economic growth among developed countries.

The evidence presented above is based on data from OECD countries. For a closer examination, and to reconsider and scrutinize the results here, it is necessary to use individual level data. Furthermore, this paper does not explore precisely the mechanism by which corruption influences government expenditure and in turn affects fertility rate. Hence, it seems of value to explore the channel through which corruption reduces the incentive to give birth. These are issues remaining to be addressed in future research.

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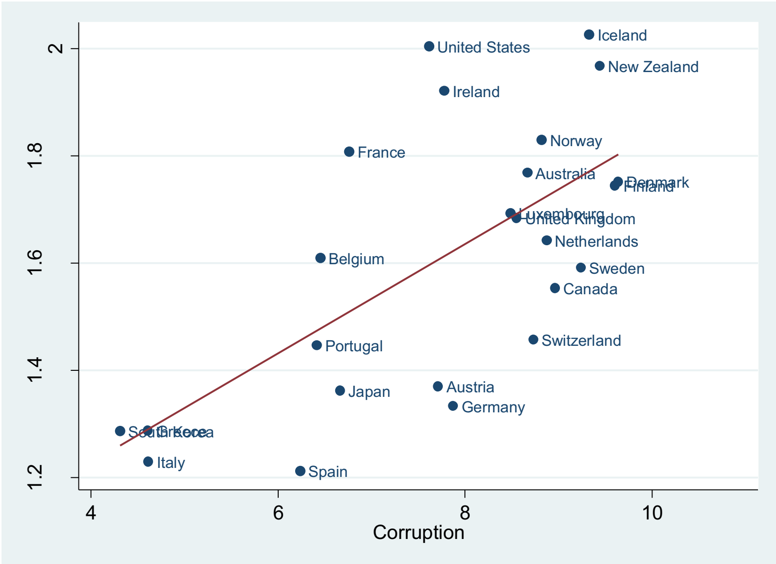

Figure 1(1). Association between average fertility rate and corruption

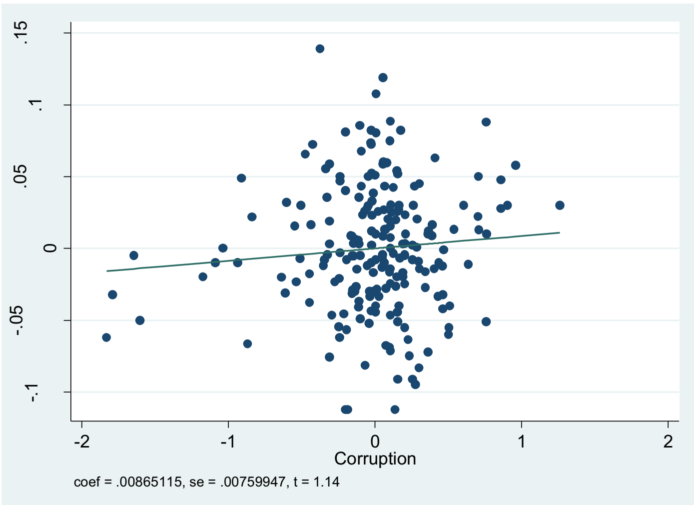

Figure 1(2). Association between average fertility rate and corruption

Note: Figure 1(1) demonstrates the relation between average corruption level and fertility rate within a country during 1995–2004. The relations in Figure 1(2) are obtained after controlling for unobserved country-specific effects and are illustrated using the avplot command in STATA 11.

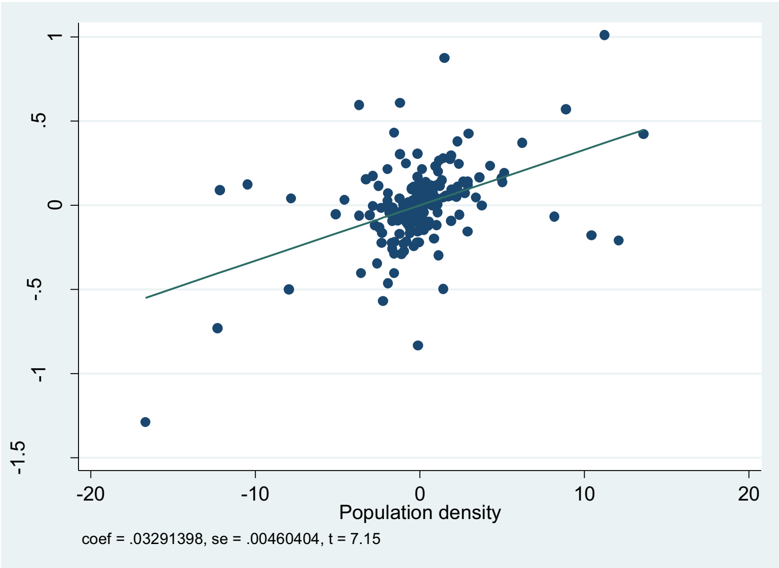

Figure 2(1). Association between divorce rate and population density

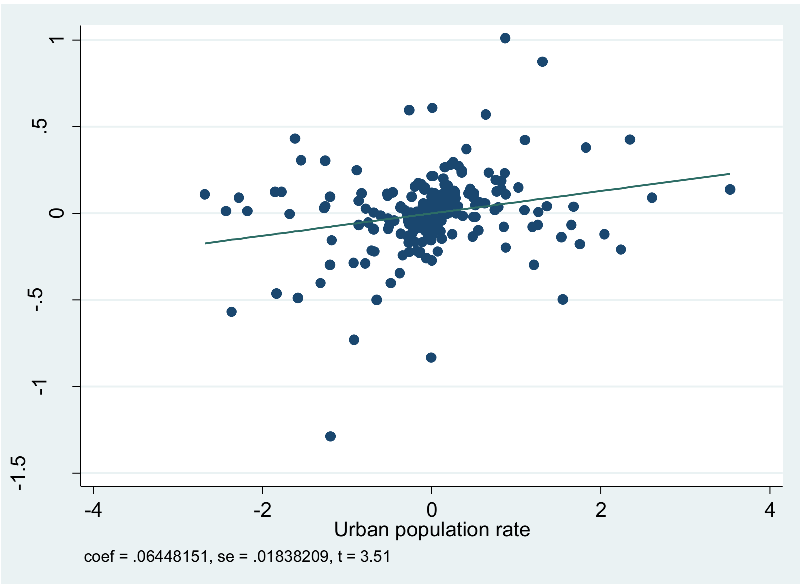

Figure 2(2). Association between divorce rate and urban population rate

Note: These relations are obtained after controlling for unobserved country-specific effects and are illustrated using the avplot command in STATA 11.

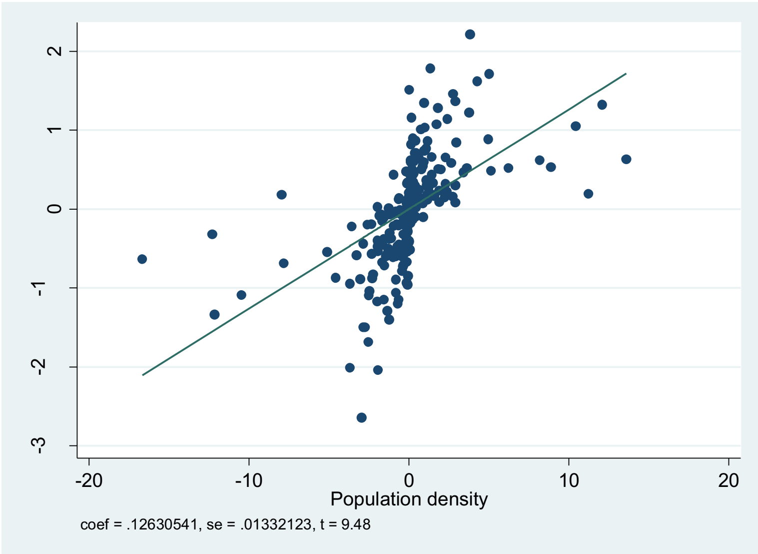

Figure 3(1). Association between female labor force participation rate and population density

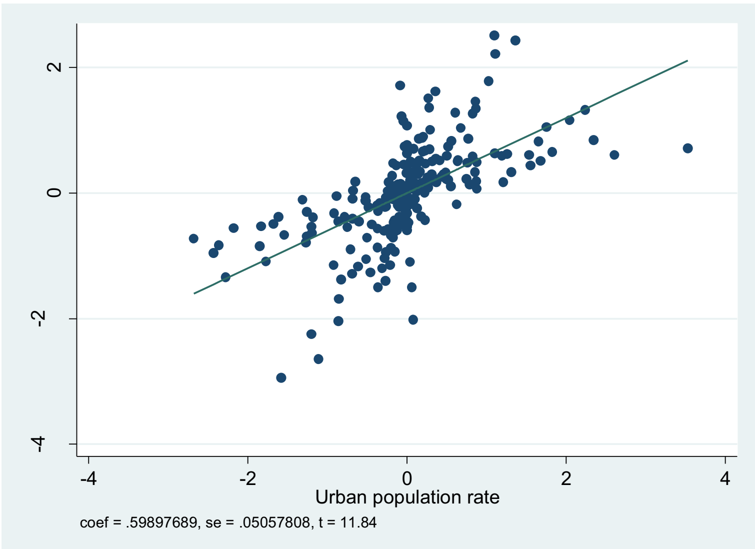

Figure 3(2). Association between female labor force participation rate and urban population rate

Note: These relations are obtained after controlling for unobserved country-specific effects and are illustrated using the avplot command in STATA 11.

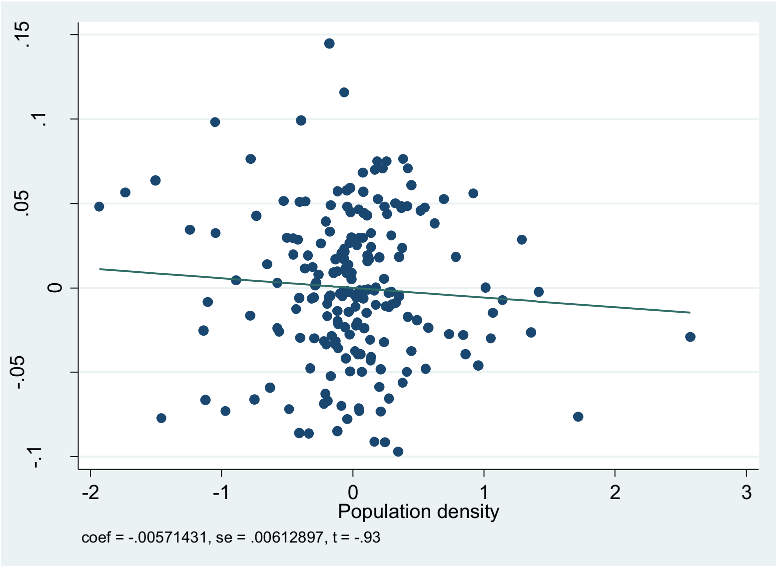

Figure 4(1). Association between fertility rate and population density

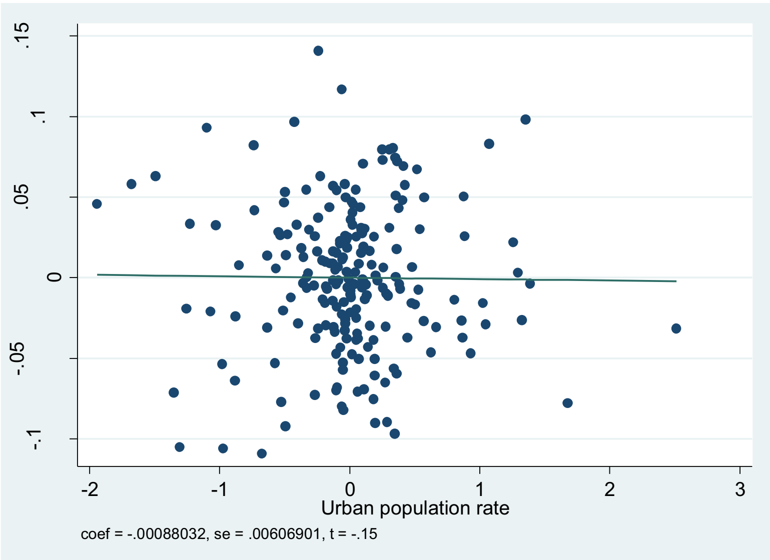

Figure 4(2). Association between fertility rate and urban population rate

Note: These relations are obtained after controlling for female labor force participation rate, divorce rate and unobserved country-specific effects and are illustrated using the avplot command in STATA 11.

Table 1.
Variable definitions, means and standard deviations

Variables	Definition	Mean	Standard Deviation
FERTIL	Fertility rate	1.60	0.25
CORRU	Degree of corruption	7.64	1.68
INCOM	Per capita income (1000 US$)	28.6	83.9
UNEMP	Unemployment rate (%)	6.78	3.22
GINI	Gini coefficients	0.42	0.10
DIV	Divorce rate (%)	2.19	0.76
FLAB	Female labor force participation rate (%)	43.3	3.08
	Instrumental variables		
DENS	Population density (km^2)	144.2	143.8
URBAN	Urban population rate (%)	76.0	12.2

Table 2.
Correlation matrix

	FERTIL	CORRU	INCOM	UNEMP	GINI	DIV	FLAB	DENS	URBAN
FERTIL	1.00								
CORRU	0.58	1.00							
INCOM	034	0.32	1.00						
UNEMP	-0.32	-0.41	-0.55	1.00					
GINI	0.07	-0.34	-0.02	0.16	1.00				
DIV	0.61	0.59	0.37	-0.36	0.02	1.00			
FLAB	0.65	0.78	0.26	-0.34	-0.26	0.68	1.00		
DENS	-0.31	-0.19	0.01	-0.20	0.16	-0.09	-0.37	1.00	
URBAN	0.32	0.31	0.19	0.06	0.32	0.49	0.24	-0.04	1.00

Table 3(1). Dependent variable is $FERTIL_t$: (Fixed effects and fixed effects IV models)

	(1) Fixed	(2) Fixed	(3) Fixed	(4) Fixed	(5) Fixed IV	(6) Fixed IV	(7) Fixed IV
$FERTIL_{t-1}$	0.60***	0.60***	0.61***	0.61***	0.60***	0.60***	0.61***
	(11.2)	(11.1)	(10.9)	(11.1)	(10.2)	(9.94)	(10.3)
$CORRU_t$	0.01**	0.01*	0.01**	0.01**	0.01**	0.01***	0.01**
	(2.54)	(1.97)	(2.58)	(2.00)	(2.06)	(2.60)	(2.14)
$Ln(INCOM)_t$	0.02	0.03	0.07	0.06	0.14	-0.008	0.06
	(0.52)	(0.62)	(0.75)	(0.71)	(1.13)	(-0.04)	(0.32)
$UNEMP_t$	-0.006*	-0.007**	-0.005	-0.006*	-0.002	-0.005	-0.005
	(-1.96)	(-2.18)	(-1.54)	(-1.83)	(-0.46)	(-1.35)	(-1.15)
$GINI_t$	-0.14**	-0.13**	-0.14**	-0.13**	-0.10	-0.15**	-0.13**
	(-2.44)	(-2.23)	(-2.40)	(-2.20)	(-1.38)	(-2.55)	(-2.12)
DIV_t		-0.01		-0.01	-0.09		-0.03
		(-0.93)		(-0.95)	(-0.91)		(-1.08)
$FLAB_t$			-0.004	-0.002		0.006	0.002
			(-0.55)	(-0.41)		(0.32)	(0.13)
Endogenous variables					DIV	FLAB	DIV FLAB
IV variables					DENS URBAN	DENS URBAN	DENS URBAN Ln(DENS) Ln(URBAN)
Over-identification test <P-value>					0.57 <0.44>	1.36 <0.24>	-1.58 <0.46>
R-square(Within)	0.54	0.55	0.54	0.55	0.49	0.55	0.57
Number of groups	22	22	22	22	21	21	21
Observations	170	166	170	166	159	163	159

Notes: Numbers in parentheses are z-statistics. *, **, and *** indicate significance at 10, 5, and 1 percent levels, respectively. Luxembourg is not included in the sample used for estimation in columns (5)–(7) because instrumental variables were not available.

Table 3(2). Dependent variables are DIV_t and $FLAB_t$: (Fixed effects IV model: first stage)

	(1) Dependent variable DIV	(2) Dependent variable FLAB
$DENS_t$	$0.33*10^{-3}$	0.06***
	(0.04)	(3.98)
$URBAN_t$	0.05*	0.04
	(1.78)	(0.82)
$FERTIL_{t-1}$	-0.18	0.13
	(-0.52)	(0.21)
$CORRU_t$	0.06	0.008
	(1.51)	(0.12)
$Ln(INCOM)_t$	0.54	7.01***
	(1.12)	(8.20)
$UNEMP_t$	0.03	0.08**
	(1.59)	(2.35)
$GINI_t$	0.45	0.73
	(1.31)	(1.16)
	Corresponding to column(5) in Table 3(1)	Corresponding to column(6) in Table 3(1)
F-statistics	65.3	231.8
<P-value>	<0.00>	<0.00>
Observations	159	163

Notes: Numbers in parentheses are z-statistics. *, **, and *** indicate significance at 10, 5, and 1 percent levels, respectively.

Table 4. Dependent variable is $FERTIL_{t}$: (Dynamic panel model: two step estimation)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$FERTIL_{t-1}$	0.43*** (6.51)	0.41*** (5.62)	0.47*** (6.58)	0.41*** (5.60)	0.43*** (5.89)	0.46*** (7.07)	0.45*** (5.05)
$CORRU_{t}$	0.01*** (4.43)	0.01*** (3.93)	0.01*** (3.73)	0.01*** (3.22)	0.01** (2.47)	0.01*** (3.36)	0.01*** (3.16)
$Ln(INCOM)_{t}$	0.01 (0.52)	0.03 (1.13)	0.05 (0.59)	0.11 (1.35)	0.04 (1.10)	0.10 (0.76)	-0.04 (-0.22)
$UNEMP_{t}$	-0.004*** (-3.90)	-0.005*** (-4.14)	-0.003* (-1.71)	-0.004** (-2.17)	-0.006*** (-3.66)	-0.003 (-1.24)	-0.007* (-1.68)
$GINI_{t}$	-0.14** (-2.33)	-0.76** (-2.33)	-0.17*** (-2.63)	-0.12* (-1.68)	-0.07 (-0.36)	-0.12 (-0.57)	-0.14 (-1.15)
DIV_{t}		-0.01*** (-2.56)		-0.02*** (-2.95)	-0.03* (-1.68)		-0.04 (-0.92)
$FLAB_{t}$			-0.003 (-0.48)	-0.006 (-1.05)		-0.007 (-0.70)	0.009 (0.49)
Endogenous variables					DIV	FLAB	DIV FLAB
Sargan test	20.7	19.7	19.8	21.0	20.1	20.1	18.8
<P-value>	<0.79>	<0.83>	<0.83>	<0.78>	<1.00>	<1.00>	<1.00>
Serial correlation	-0.94	-0.89	-0.95	-1.04	-0.97	-1.04	-0.62
Second order <P-value>	<0.34>	<0.37>	<0.33>	<0.29>	<0.32>	<0.29>	<0.52>
Number of groups	22	22	22	22	22	22	22
Observations	146	142	146	142	142	146	142

Notes: Numbers in parentheses are z-statistics. *, **, and *** indicate significance at 10, 5, and 1 percent levels, respectively.

Table 5. Dependent variable is $FERTIL_{t}$: (Dynamic panel model: one step estimation)

	(1)	(2) Second lagged	(3) Third lagged	(4) Fourth lagged	(5)	(6) Second lagged	(7) Third lagged	(8) Fourth lagged
$CORRU_t$	0.01*	0.03**	0.04**	0.03***	0.01*	0.03**	0.04***	0.04***
	(1.73)	(2.23)	(2.40)	(2.84)	(1.65)	(2.52)	(2.92)	(3.45)
Endogenous variables					DIV FLAB	DIV FLAB	DIV FLAB	DIV FLAB
Sargan test	67.4	61.4	55.7	40.9	110.2	97.4	84.9	64.4
<P-value>	<0.00>	<0.04>	<0.00>	<0.00>	<0.01>	<0.04>	<0.09>	<0.29>
Serial correlation	-0.99	-1.15	-1.83	0.16	-1.09	-0.79	-1.83	-0.82
Second order <P-value>	<0.32>	<0.24>	<0.06>	<0.86>	<0.27>	<0.42>	<0.06>	<0.40>
Number of groups	22	21	21	21	22	21	21	21
Observations	142	122	102	82	142	122	102	82

Notes: The same set of independent variables used in columns (4) and (7) of Table 4 is included, but to save space not reported. Numbers in parentheses are z-statistics. *, **, and *** indicate significance at 10, 5, and 1 percent levels, respectively. Z-statistics are calculated using robust standard error.

APPENDIX

Table A1.
OECD countries in regression analysis

Australia	Greece	Portugal
Austria	Ireland	Spain
Belgium	Italy	Sweden
Canada	Japan	Switzerland
Denmark	Luxembourg	United Kingdom
Finland	Netherlands	United States
France	New Zealand	
Germany	Norway	