Equality and Fertility: Evidence from China

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Abstract

In the economic research of fertility, one of the important hypotheses is that a more equitable income distribution contributes to the reduction of fertility. Using largely cross-country data, scholars performed empirical testing of the hypothesis and concluded that equalizing the distribution of income reduces fertility. Some other scholars, however, found conflicting evidence and reached conclusion contradicting the hypothesis. This paper tests the hypothesis in the Chinese context using data from the most recent national one-percent population sample survey. This paper analyses the influence of income and income distribution on fertility in China using aggregated data at the prefecture-level. Ordinary least square regression is performed to examine the effect of income distribution on general fertility rate when controlling for some other socio-economic development variables. Results show that a more equitable income distribution is significantly associated with a lower general fertility rate. Policy implications and some methodological issues are discussed.

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Introduction

China has attained below-replacement fertility in a context very different from many of the other low fertility countries. Most of the studies in Chinese fertility assert that the family planning program played a dominant role in fertility decline in China, while some other studies, having examined the relationship between socio-economic development, family planning program and fertility decline, argue that the level of socio-economic development and the performance of the family planning program are interrelated and both have played an important role in fertility decline. In linking fertility and development, equality is hypothesized to be an important factor affecting fertility. In fact, one of the most rapid fertility declines in the world occurred in China in the 1970s in the context of an egalitarian society.

In the economic research of fertility, one of the important hypotheses is that a more equitable income distribution contributes to the reduction of fertility, and may even be a precondition for such a reduction. Using largely cross-country data, scholars performed empirical testing of the hypothesis and concluded that equalizing the distribution of income reduces fertility. Some other scholars, however, found conflicting evidence and reached conclusion contradicting the hypothesis. This paper tests the hypothesis in the Chinese context using data at sub-regional level. After reviewing the literature on the income distribution and fertility relationship, this paper describes the data, method and the measurement and characteristics of the variables used in this research. The paper next presents regression results and analysis, and finally summarizes the major findings and discusses their implications.

Income Distribution and Fertility: A Literature Review

Studies of impact of economic development on fertility typically examine per capita income or per capita GDP as an explanatory variable either at micro or macro level. Despite the fact that income inequality has long been brought into measurement of economic development, demographers largely fail to account for income distribution in their equations of fertility behaviour. As Bhattacharyya (1975) argues, inequality could be regarded as being functional for economic growth, it is necessary to incorporate a measure of inequality into analysis of the impact of economic development on fertility.

The linkages of income inequality to fertility were for the first time empirically explored and

theoretical proposition that income redistribution would reduce fertility was best developed in a series of studies by Repetto (1974, 1978, 1979). The central idea is that fertility is a non-linear and non-monotonic function of income, positive at the very low levels of income, but quickly turning to negative with an increasing slope, and eventually flattening out at high levels of income. The non-linearity is such that a small increase in the income of the poor reduces fertility more than a similar small increase in the income of the rich, so that the redistribution of income, in an equalizing direction, would reduce the average level of fertility. Repetto's analysis of household data from Puerto and Korea and cross-country data on fertility and income inequality offers empirical evidence and support for the hypothesis that reductions in income inequality lead to declines in fertility. Bhattacharyya's (1975) examination of cross-country data on rural-urban income inequality and fertility also yielded a positive relationship implying that a reduction in inequality will reduce fertility.

Flegg (1979) critically reviewed the studies by Repetto and Bhattacharyya by pointing out mis-specifications of their fertility functions, inadequate measurement of income inequality, and data incomparability. However, using data from 60 countries he also performed empirical testing of the inequality-fertility hypothesis and reached similar conclusions. He concluded that a reduction in inequality will have a considerable depressive effect on fertility and this proposition would appear to be incontrovertible. With a skeptical view, Boulier (1982) carefully examined and evaluated the micro and macro empirical evidence provided by Repetto which, he argues, contains important theoretical and econometric errors. He also stated as serious a reason for viewing the results with caution is the poor data quality and comparability. His empirical examination of household data from the Philippines even suggests a reversed inequality-fertility relation. His conclusion is that there is no evidence for the proposition that reductions in income inequality induce declines in fertility. There are similar arguments from Winegarden's (1985) study based on data from 36 countries that a much more complex model is required to address the income inequality-fertility relationship, and econometric evidence does not support income redistribution as a means of reducing fertility.

It seems that the income inequality-fertility relationship is far from conclusive. Contradicting evidence and conclusions are reported by different scholars using different data and even reached by different scholars using the same data. Studies of the Chinese case using provincial level data in the early 1980s have confirmed the hypothesis that reduced income inequality leads to lower fertility (Birdsall and Jamison, 1983; Lee, 1990). However, over the last 20 years, China's experienced rapid and tremendous social and economic changes, with

a notable trend in widening income inequality in the population and across the regions, while fertility decline levelled off or stagnated. The objective of the present analysis is to re-examine the income inequality-fertility hypothesis using the latest data from China where the transition to a market economy is well under way. Lee (1990) stated that there is a possibility that the fertility-depressing effect of the equal income distribution may be invalid given absence of market incentive system in the early 1980s.

Data and Method

This paper uses data from China's most recent national one-percent population sample survey. The survey was conducted in 2005, commonly called mini-census in China occurring in the inter-censual period. This survey collected individual and household information on a wide range of demographic and socio-economic variables including income and fertility. This paper analyses the influence of income and income distribution on fertility in China using aggregated data at the prefecture-level, a administrative division level between province and county. China has more than 300 administrative divisions at the prefecture-level, while there are 31 provinces and nearly 3000 counties in mainland China. The dataset used in this paper is a sub-sample of the 2005 national population survey. The sub-sample is about 20% of the national sample.

Table 1 presents descriptive statistics of the variables included in the analysis. All the variables are from the 2005 survey, calculated from data at the individual level to aggregate to data at the prefecture-level. The final sample includes data of 345 prefectures (region or city). The dependent variable in the analysis is general fertility rate, ranging from 6.5 births to 101.8 births per thousand women aged 15-49. The general fertility rate has a mean value of 31.4 births per thousand women at the prefecture level. Explanatory variables are constructed including income, Gini index, education, urbanization, ethnicity, and migration.

Table 1 Descriptive Statistics of the Variables in the Regression Analysis

	N	Minimum	Maximum	Mean	Std. Deviation
general fertility rate	345	6.452	101.796	31.439	15.035
gini	345	0.286	0.605	0.411	0.054
income	345	202.038	1633.679	553.808	247.053
schooling	345	1.182	11.708	8.083	1.448
urban	345	0.039	1.000	0.403	0.187

minority	345	0.000	1.000	0.161	0.269
migrant	345	0.004	0.935	0.113	0.122

The equality of income distribution is measured by Gini coefficient of income distribution, which ranges from 0.29 to 0.61 and averages at 0.41 at China's prefecture level. The income variable is the income obtained last month asked in the survey, which has a mean value of 554 Chinese yuan and varies from 202 yuan to 1634 yuan. Education is measured by number of years of schooling, which ranges from 1.2 years to 11.8 years, and has a mean value of 8.1 years. Urbanization is simply the percentage of urban population, ranging from 3.9% to 100% and averaging at 40.3% at the prefecture level. The ethnicity variable is constructed at the prefecture level which is represented by the proportion of the population that is of ethnic minority, which has a low of 0% and a high of 100%, with an average of 16.1%. It shoud be noted that urbanization and ethnicity variables also roughly capture the effect of China's family planning policy which differs considerably between the urban and rural areas and between the Han majority and other ethnic minority populations. Since there has been a tremendous change in population mobility in China, and migrants tend to have lower fertility than non-migrants, a variable representing the percentage of the population who are migrants is also taken into account. The percentage of migrant population, averaging at 11.3%, ranges from 0.4% to 93.5% at the prefecture level.

Ordinary least square regressions are performed to examine the effect of income distribution on general fertility rate when controlling for the other socio-economic development variables. Since the distribution of general fertility rate is highly positively skewed, log transformation of general fertility rate is used to be the dependent variable in the regression equations. This also has made roughly linear the non-linear relations between the dependent variable and some of the independent variables except for the minority and migration variables. Hence, the minority and migration variables are also log transformed in the regression analyses.

Regression Results

Two OLS models are performed to examine impact of income and income distribution on fertility while controlling for the other variables. In the first model which is similar to the micro-level analysis of Repetto and of Boulier, fertility is regressed against income and income squared plus the other variables. Other things being equal, the second model introduces Gini coefficient of income distribution into the first model, which resembles the macro-level approach of Repetto, Flegg and others. The two regression equations are as

follows:

Model 1:	$Ln(GFR) = B_0 + B_1 \times Income + B_2 \times Income^2 + B_3 \times Schooling + B_4 \times Urban + B_5 \times Ln(Minority) + B_6 \times Ln(Float)$
Model 2:	$Ln(GFR) = B_0 + B_1 \times Gini + B_2 \times Income + B_3 \times Schooling + B_4 \times Urban + B_5 \times Ln(Minority) + B_6 \times Ln(Float)$

In model 1, we expect the coefficient of the income variable to be negative, as suggested by the literature on the income-fertility or economic development-fertility relationships. We would also anticipate a positive coefficient of the income squared variable if we believe that more equitable income distribution contributes to lower fertility according to Repetto (1979), Flegg (1979) and Lee (1990). Education is expected to be negatively related to fertility, because career aspirations are increasingly competing with childbearing with increased education. Urbanization would also have a depressing effect on fertility, incorporating education and income effect on the one hand while reflecting fertility policy effect on the other hand. China's one-child policy mainly applies to urban areas, while in most of the rural areas there is more-than-one-child policy. The minority variable is expected to be positively related to fertility, because population of ethnic minority is concentrated in the less developed west part of China and enjoys a much looser birth control policy. Causal mechanisms of selection, disruption and adaptation are established to explain lower migrant than non-migrant fertility, suggesting the coefficient of migration variable to be negative. Model 2 is only different from model 1 by adding an income inequality variable—Gini coefficient of income distribution. We expect that the gini variable will have a positive coefficient, implying that reducing income inequality will decrease fertility.

Tables 2 and 3 show the results from the two regression models. The hypothesized relations between fertility and all the independent variables are well established, suggesting a significant development-fertility relationship. In table 2 shows the results from two steps: fertility is regressed on only income and income squared in step 1, while in step 2 fertility is regressed on income and income squared when other variables are controlled for. It is clear that income has significant negative effect on fertility, while income squared has significant positive effect. These results are similar to those obtained by Lee (1990) in studying income effect on fertility using China's 1982 census data at the provincial level. Our results are established at the prefecture level which has a much larger sample and also larger variations in fertility and other variables at prefecture level than at the provincial level. Thus, the

findings reported here provide evidence and support for the argument by Repetto (1979) and Flegg (1979) that reducing income inequality will decrease fertility or redistribution of income from higher income areas to lower income areas would reduce the overall fertility.

Table 2 OLS regression model 1

	B	t	p	B	t	p
Constant	4.484	42.270	0.000	4.542	31.726	0.000
income	-0.228	-8.760	0.000	-0.097	-2.775	0.006
income squared	0.007	4.998	0.000	0.003	1.969	0.050
schooling				-0.055	-2.871	0.004
urban				-0.481	-2.435	0.015
lnminority				0.038	3.835	0.000
lnmigration				-0.055	-1.278	0.202
	F=127.29, p<0.01			F=56.23, p<0.01		
	Adjusted R square=0.424			Adjusted R square=0.493		

The significant negative coefficient of the schooling variable indicates that increase in the population's education will reduce its fertility rate. In fact, out of the determinants of fertility, education has been one of the most important and consistent influencing factors. However, urbanization seems to be less consistent. In Birdsall and Jamison's study on income and other factors influencing fertility in China, urbanization does not significantly affect fertility at the provincial level, even in the case of only income and urbanization being the independent variables. In Lee's study on income-fertility relationships at the provincial level in China, urbanization variable in the fertility regressions where the income variables were controlled for were significantly positive. These results are inconsistent with or contrary to the findings in other developing countries. However, the urban variable in table 2 has a negative coefficient that is statistically significant at 1% level. The "urban" effect on fertility not only exists but also tends to be enlarging in China. On the one hand, urban-rural development gap has been widening over the last 20 years; on the other hand, China applies different family planning policy in urban and rural areas, that is, a strict one-child policy has been implemented in urban areas while looser policy in rural areas. Thus, the urban variable represents a combined effect of development and birth control strength.

In a similar vein, the minority variable has significant effect on fertility. In the literature, ethnic composition has not been considered as an important fertility determinant. However,

as discussed by Coleman (2006), ethnic change has been increasingly important in shaping demographic trends in the developed countries, which might be termed as the third demographic transition. Ethnicity is also a very important variable in demographic change in China. The ethnic minority population, which accounts for 10% of the population of China, is largely residing in the west part of China where socioeconomic development has been much less advanced. On the other hand, China's family planning policy is less rigid for the ethnic minority population, usually a two or three child policy or no limitation policy. Thus, a positive and significant effect of the minority variable on fertility in China is anticipated. Finally the migration variable has an expected negative coefficient but it is not statistically significant. Migration in China is largely from rural to urban areas, and empirical evidence shows that migrant fertility in China is lower than that of the non-migrants in rural areas but higher than that of the non-migrants in urban areas (You and Poston, 2004).

Table 3 presents regression results from model 2 in which a Gini coefficient variable is added into model 1 as an explanatory variable. In the literature, the approach of model 1 is conducted at either micro or macro level analysis of fertility determinants, while that of model 2 is only performed at the macro level analysis, for example, country level or sub-regional level analysis. Using data from the 1970 census for Puerto Rico and the 1974 Korean National Fertility Survey, Repetto (1979) performed regressions of children ever born against per capita income and per capita income squared plus some other variables influencing fertility, and offered empirical testing of the hypothesis that there is a non-linear relation between income and fertility in such a way that income redistribution from the rich to poor reduces fertility. Lee did a similar job using the Chinese 1982 census data but at the provincial level by regressing total fertility rate against per capita output and its squared when controlling for some other variables, which yielded evidence for the argument by Repetto that redistribution of income from high income provinces to low income provinces would reduce national fertility.

Providing additional evidence for the proposition that reducing income inequality decreases fertility, Repetto (1979) examined the relations between income equality and fertility using cross-country data, in which regressions were performed of general fertility rate or gross reproduction rate against per capita income and Gini coefficient of income concentration with some other variables. He obtained results which suggest a strong negative relation between fertility and income while a very strong positive relation between fertility and income inequality. Birdsall and Jamison (1983) adopted a similar approach regressing a measure of inequality on crude birth rate using the Chinese provincial data and obtained a

positive and statistically significant effect. Model 2 in this study is similar to the macro level analysis of Pepetto and Birdsall and Jamison, which yielded evidence for a positive inequality-fertility relationship (Table 3).

Table 3 shows the results also from two steps: fertility is regressed on only income and Gini index in step 1, while in step 2 fertility is regressed on income and Gini index when other variables are controlled for. It is again clear that income negatively affects while income inequality positively affects fertility at the regional level in China, implying that increasing income while equalizing income distribution would significantly reduce the national fertility. These results strengthen the finding from model 1 that in the Chinese case, redistribution of income favouring the poor would further reduce fertility. There are other variables in model 2 which are the same with those in model 1, and their coefficients and significance are also similar which we will not discuss further. But the exception is that the migration variable turned to be significantly affecting fertility.

Table 3 OLS regression model 2

	B	t	p	B	t	p
Constant	3.057	16.954	0.000	3.786	15.377	0.000
gini	2.136	5.510	0.000	1.174	2.852	0.005
income	-0.090	-12.821	0.000	-0.029	-2.287	0.023
schooling				-0.045	-2.291	0.023
urban				-0.473	-2.410	0.016
lnminority				0.036	3.617	0.000
lnmigration				-0.107	-2.625	0.009
	F=131.67, p<0.01			F=57.64, p<0.01		
	Adjusted R square=0.432			Adjusted R square=0.499		

Conclusions

This paper offers empirical tests of the income inequality-fertility hypothesis in the Chinese case. The inequality-fertility relation is first tested by regressing fertility on income and income inequality variables only, then is further established by incorporating some other development variables which might distort the relationship, including education, urbanization, ethnicity, and migration. In model 1, income has significant negative while income squared has significant positive effect on fertility when controlling for other

variables. In model 2, when controlling for income level as well as other variables, Gini coefficient of income distribution has a significant positive effect on fertility. A more equitable income distribution is significantly associated with lower fertility. Regressions also show that education and urbanization have significant negative effect on fertility. The ethnicity variable has a significant positive effect while the migrant variable has a negative effect on fertility, both are statistically significant.

Thus in China at the prefecture level, equality acts directly at lowering fertility. Since income is associated non-linearly with fertility, some increase in income for the poor would have greater fertility depressing effect than the similar increase in income for the rich, and this would consequently reduce overall fertility. However, income redistribution *per se* does not appear to be a fine policy option. The government should direct institutional and policy changes at equalizing opportunities and rights for socio-economic participation and human development. Since the early 21st century, China launched some major social programs directly targeted the rural population. Of major significance are the rural minimum living allowance system, the new rural cooperative medical care system, removing of agricultural tax, free education in rural primary school, and family allowance for rural couples who have only one child or one or two daughters only. These policies have important implications for family well-being, particularly the well-being of the poor in rural China, and could contribute to equalizing distribution of income across the country, hence fertility decline by weakening son preference.

The significance of this study is also in establishing that cross-regional data within a single country are a useful tool in understanding the influence of income distribution on fertility. As mentioned earlier, most of the empirical studies on the equality and fertility relationship utilize cross-country data, there are practices in defining and measuring income, fertility and other variables as well as data quality which vary substantially between different countries in very different contexts. However, this appears to be not a problem in using data from a single country and particularly from a single survey.

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