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School of Statistics, University of the Philippines Diliman, School of Economics, University of the Philippines Diliman

August 2012

Online at https://mpra.ub.uni-muenchen.de/40750/
MPRA Paper No. 40750, posted 19 Aug 2012 16:27 UTC

Is Income Growth Enough to Reduce Total Fertility Rate in the Philippines? Empirical Evidence from Regional Panel Data[1]

Dennis S. Mapa[2], Michael Daniel C. Lucagbo[3], Arsenio M. Balisacan[4], Jose Rowell T. Corpuz[5] and Czarina Lei S. Ignacio[6]

ABSTRACT

The population debate in the country has been dynamic and contentious. On the one hand, proponents of population management say that the rapid population growth in the Philippines has hindered the country's economic development. On the other hand, others are saying that population growth is uncorrelated with economic growth. The core idea behind the link between population and economic growth is the demographic transition. Demographic transition is a change from a situation of high fertility and high mortality to one of low fertility and low mortality. Advocates of speeding the demographic transition placed emphasis on the need of public efforts to speed up the voluntary reduction in fertility rates as rapidly as possible, arguing that demographic transitions, where they have occurred, have typically been accelerated and even triggered, by proactive government policies. Those that are against direct government intervention argue that fertility rates fall when income rises and therefore, policies to increase income should be the main concern. This paper looks at the relationship between per capita income and total fertility rate (TFR), controlling for other factors, using a regional panel econometric model using data from the National Demographic and Health Survey (NDHS), Family Planning Survey (FPS), Family Income and Expenditure Survey (FIES), Labor Force Survey (LFS) and the Regional Gross Domestic Product (RGDP). The results show that increasing per capita income indeed reduces TFR but its impact is minimal and given that the country average per capita growth is low, it will take some time before the country benefits from the demographic transition through the income effect alone. The results of the analysis can also explain why the decline in fertility rate in the Philippines has been slower in recent times, lagging behind the significant changes in the international scene.

Keywords: Total Fertility Rate, Demographic Transition, Fixed Effects Model

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[1] An earlier version of the paper won the 2010 Best Scientific Poster Award from the National Academy of Science and Technology (NAST) and served as a background paper of the 2011 study *Can Population Management be Mainstreamed in the Philippine Development Agenda?* by the Asia Pacific Policy Center (APPC) in collaboration with the Philippine Center for Population and Development (PCPD). The authors would like to acknowledge the support from PCPD and APPC.

[2] Associate Professor and Director for Research, School of Statistics and Affiliate Associate Professor, School of Economics, University of the Philippines, Diliman, Quezon City and Research Fellow, Asia-Pacific Policy Center (APPC). Email address: cdsmapa@yahoo.com.

[3] Instructor, School of Statistics, University of the Philippine, Diliman, Quezon City

[4] Secretary, National Economic and Development Authority (NEDA) and Professor of Economics School of Economics, University of the Philippines, Diliman, Quezon City and Research Fellow, Asia-Pacific Policy Center (APPC).

[5] Research Associate, Asia-Pacific Policy Center and Ph.D. Candidate, School of Economics, University of the Philippines, Diliman, Quezon City

[6] School of Statistics, University of the Philippines, Diliman, Quezon City

I. Introduction

The rapid population growth in the Philippines over the last several decades has hindered the country's economic development. For the period 2000 - 2010, the Philippines had one of the highest population growth rates in the Southeast Asian region at 1.9 percent and the second largest population of more than 92 million in 2010, next only to Indonesia. It comes as no surprise that in 2009, 26.5 percent of our population, or an equivalent of 23 million Filipinos were living below the poverty line (NSCB).

The core idea which links population and economic growth is demographic transition described as "a change from a situation of high fertility and high mortality to one of low fertility and low mortality." A country that enters into a demographic transition experiences sizable changes in the age distribution of the population and this affects economic growth.

Unlike its Southeast and East Asian neighbors, the Philippines failed to achieve a demographic transition similar to what its neighbors had in the past three decades. In these countries, including the Philippines, mortality rates broadly declined at similar rates. In the Philippines however, fertility rates dipped slowly, so while population growth rates substantially dropped to below 2 percent a year in other countries (such as Thailand, Indonesia, and Vietnam), the Philippines' high population growth rate of about 2 percent per year hardly changed.

Studies show that demographic transition accounts for a significant portion (about one-third) of the economic growth experienced by East Asia's economic "tigers" during the period 1965 to 1995 (Bloom and Williamson, 1997). The effect of the demographic transition on income growth is known as the *first demographic dividend*. In the course of the demographic transition, countries experience an increasing share of the working age population relative to the total population and this creates favorable effects on the per capita income. In addition to the first dividend, there is another positive effect on economic growth and is referred to as the *second demographic dividend*. This dividend results when individuals accumulate savings in their working years to serve as buffer during their retirement years. While accumulation of capital can be used to deal with the lowering of income in the older ages, this capital also influences economic growth. As Mason (2007) points out, it is when society increases its saving rate that results in a more rapid economic growth – creating the second demographic dividend. Mason estimated that first and second demographic dividend account for 37.7% of the yearly average per capita growth rate of Japan from 1950 to 1980. The Philippines, with its high population growth, has not benefitted from the demographic dividend and partly explains why its economic growth pales in comparison with its East Asian Neighbors. The results of the study by Mapa and Balisacan (2004), using cross-country data from 80 countries over the period 1975 to 2000, showed that the difference in the population structure of Thailand and the Philippine accounts for about 0.768 percentage point of forgone average annual growth (missed first dividend) for the Philippines from 1975 to 2000. This forgone growth accumulates to about 22 percent of the average income per person in the year 2000. It is even more impressive when translated into monetary values. It would have meant that rather than a per capita GDP of US$993 for the year 2000, Filipinos would have gotten US$1,210 instead. Moreover, poverty incidence would have been reduced by about 3.6 million. Less Filipinos would have been counted among the poor by the year 2000. Even Jeffrey Sachs of the Earth Institute at Columbia University observed that the country's TFR is "too high and something should be done to bring down the number of babies born per household to an average of two instead of the current three to promote economic growth and achieve social inclusion."[7]

This paper looks at the determinants of total fertility rate (TFR) using econometric model from regional panel data. The paper argues that while increasing income reduces the TFR in the long run, the reduction is slow and thus, there is a need for an intervention (government initiative) that will voluntarily reduce the country's TFR, particularly among poor households, to a level that is conducive to high economic growth. It achieves this by performing scenario analysis to determine the level of future TFR under two assumptions: (a) reducing TFR through income growth and (b) reducing TFR through a combination of income growth and government intervention.

This paper is divided as follows: section 2 discusses the link between TFR and economic growth and the experiences of countries in East Asia; section 3 presents the econometric model using the regional panel data of the Philippines; section 4 estimates

[7] Statement of Dr. Jeffrey Sachs in a forum organized by the Asian Development Bank (ADB) during the 2012 ADB Annual meeting held in Manila, Philippines.

the country's future TFR under two scenarios previously discussed and section 5 concludes.

II. The *Goldilock Period* and High Economic Growth

As countries move from large families (high fertility rate) and poverty into small families (low fertility), high economic growth and ageing, they pass through what is called a *Goldilock period*: a generation or two in which fertility rate is neither too high nor too low (The Economist; October 2009). This fertility rate consistent with stable population is about 2.1 (also known as the replacement rate of fertility). The fall to replacement fertility is a unique and precious opportunity for higher economic growth. The figures in Table 1 show the Total Fertility Rates (TFR) for select countries in East Asia from the period 1960 to 2006. The table shows that poor and rich countries are racing though the demographic transition and achieving the replacement fertility rate of 2.1: Singapore in the mid-1970s, South Korea in mid-1980s, Thailand in 1990, Vietnam and Myanmar in 2006.

It is interesting to note that only three (3) countries in the table have TFR of more than 3.0 in 2006: the Philippines (3.30), Lao PDR (3.29) and Cambodia (3.27). Moreover, Lao PDR and Cambodia have reduced their TFR much faster than the Philippines, having TFRs of about 6 during the 1990s compared to the Philippines' TFR of 4.31. It will be disheartening to see that years down the road, Lao PDR and Cambodia will enjoy the dividend associated with the demographic transition and transform their economies to the level that will improve the lives of millions of their citizens, while the Philippines continues to languish in the high population growth-high poverty incidence trap.

Table 1. Total Fertility Rate (TFR) for Selected East Asian Countries

	Year					
	1960	**1970**	**1980**	**1990**	**2000**	**2006**
South Korea	5.67	4.53	2.83	1.59	1.47	1.13
ASEAN 5						
Singapore	5.45	3.09	1.74	1.87	1.44	1.26

Thailand	6.40	5.33	3.21	2.11	1.86	1.85
Indonesia	5.52	5.35	4.36	3.10	2.42	2.23
Malaysia	6.81	5.47	4.21	3.68	2.96	2.65
Philippines	6.96	6.20	5.17	4.31	3.62	3.30
Rest of SE Asia						
Vietnam	6.05	5.89	4.97	3.62	1.90	2.08
Myanmar	6.06	5.98	4.54	3.38	2.41	2.10
Brunei Darussalam	6.83	5.62	4.04	3.20	2.58	2.34
Cambodia	6.29	5.81	5.84	5.73	3.96	3.27
Lao PDR	6.42	6.42	6.41	6.08	4.03	3.29

TFR is the average number of children a woman would bear during her lifetime given current age-specific fertility rates

Speeding up the Demographic Transition

The effects of rapid population growth (or high fertility level) on economic growth and poverty have been carefully studied, documented and quantified by researchers and the results point to the same conclusion: that rapid population growth in poor and developing countries hinders economic development which pushes the next generation into the poverty trap. The Philippines appears to be the only country in all of Asia, and perhaps one of the few in the world, where the population issue remains controversial to this day.

The main policy issue that should be addressed immediately is how to harvest the demographic dividend quickly. Advocates of speeding the demographic transition placed emphasis on the need for public effort to accelerate voluntary reduction in fertility rates as soon as possible. Sachs (2008) pointed out that *"demographic transitions, where they have occurred, have typically been accelerated and even triggered, by proactive government policies."* Thus, there is a need to influence public policies that play an important role in assisting, particularly the poor households, in achieving a voluntary reduction in fertility rates. This will relieve the direct pressures of population growth, particularly unwanted fertility estimated to contribute about 16% of the future population growth, through direct population policies.

The current strategy of reducing total fertility rate by relying on the Natural Family Planning (NFP) methods clearly will not bring us to the *Goldilock period* at a faster pace. Even the then Health Secretary Esperanza Cabral realized this when she acknowledged that *"even as population growth is coming down, it is not coming down at the rate necessary to improve the socioeconomic status of the country."* (Interview, Philippine Daily Inquirer, February 28, 2010)

III. Econometric Model

The econometric model for the determinants of the regional fertility rate is the fixed effects (FE) model for panel data given by,

$$y_{it} = \alpha_i + \underline{x}'_{it}\underline{\beta} + u_{it} \qquad i = 1,2,\dots,14 \;\; and \;\; t = 1,2,3 \tag{1}$$

In here, y_{it} is the fertility rate of region *i* at time *t*, the vector $\underline{x}$ represents the determinants of fertility that include income in real per capita GDP, proportion of household heads who have finished high school, female participation in the labor force and others, $\underline{\beta}$ is the vector of coefficients representing the structural parameters, α_i represents the regional and unobservable fixed effect and u_{it} is the random error term assumed to be normally distributed with mean 0 and constant variance σ^2_u.

Averaging Equation (1) for each *i* over time, and noting that αi is fixed across time, gives:

$$\bar{y}_i = \beta_1\bar{x}_{i1} + \beta_2\bar{x}_{i2} + \cdots + \beta_k\bar{x}_{ik} + a_i + \bar{u}_i \quad i = 1,2,\dots,14 \tag{2}$$

Subtracting Equation (2) from Equation (1),

$$y_{it} - \bar{y}_i = \beta_1(x_{it1} - \bar{x}_{i1}) + \beta_2(x_{it2} - \bar{x}_{i2}) + \cdots + \beta_k(x_{itk} - \bar{x}_{ik}) + u_{it} - \bar{u}_i \tag{3}$$

Rewriting Equation (3) and adopting a new notation for the *time-demeaned* data obtains,

$$\ddot{y}_{it} = \beta_1\ddot{x}_{it1} + \beta_2\ddot{x}_{it2} + \cdots + \beta_k\ddot{x}_{itk} + \ddot{u}_{it}, \quad t = 1,2,3 \;\; and \;\; i = 1,2,\dots,14 \quad (4)$$

The coefficients $\underline{\beta}$ are to be estimated using the Ordinary Least Squares (OLS) regression. Fixed effects (FE) estimation allows for arbitrary correlation between α_i and the explanatory variables (Wooldridge, 2003). In estimating Equation (4), there is a minor adjustment in the number of degrees of freedom. In the usual OLS case, when there are *k* parameters, *N* cross-sectional units and *T* time periods, the number of degrees of freedom would be $NT - k$. However, for each cross-sectional observation, we lose one degree of freedom due to time-demeaning. Thus the correct number of degrees of freedom is $NT - N - k$. The software used (STATA) by the authors incorporates this correction for degrees of freedom in estimating the regression coefficients.

Heteroskedasticity-Robust Standard Error

In the presence of heteroskedastic error terms (non-constancy of error variance), OLS estimates are still unbiased and consistent. However, they cease to be the Best Linear Unbiased Estimators (BLUE) of the coefficients. They become inefficient, and the reported standard errors are understated. By introducing heteroskedasticity-robust standard errors, White (1980) provided a convenient solution to this problem. His estimator is valid for heteroskedasticity of any form (including homoskedasticity). The robust estimator is given by:

$$\widehat{Var(\hat{\beta}_j)} = \frac{\sum_{i=1}^{n} \hat{r}_{ij}{}^2 \hat{u}_i{}^2}{SSR_j{}^2}$$

where $\hat{r}_{ij}$ is the i^{th} residual obtained by regressing x_j on all other independent variables and SSR_j is the sum of squared residuals from this regression. The square-root of the above quantity is called the heteroskedasticity-robust standard error. It is worth mentioning that in computing the value of the *t*-statistic, the value of the parameter estimate does not change, only the standard error does. As the sample size increases the distribution of the robust *t*-statistics resembles the *t*-distribution more closely.

Definition of the Dependent and Explanatory Variables

A. Dependent Variable (Regional Total Fertility Rate or TFR)

Demographers consider the TFR "the most refined measure of fertility, and the one most often used in fertility trend analysis" (Cabigon, 2006). It expresses the average number of births per woman if all women lived to the end of their childbearing years and bore children according to a given set of age-specific fertility rates in a given period. The 1993, 1998, and 2003 NDHSs and the 2006 FPS are the sources of TFR data.

B. Explanatory Variables

i. Regional Average Income

The measure of Regional income is in terms of GDP per capita. GDP is the total amount of goods and services produced in a given area for a specific time. GDP per capita is computed by dividing GDP by the total population. In this paper, the NSCB is the data source for real GDP per capita.

ii. Index for Education

As an index of the level of education in each region, the authors have looked into the proportion of household heads with at least high-school education. The data set was gathered from the Labor Force Surveys and compiled by the Asia-Pacific Policy Center (APPC). The data on educational profiles of household heads is available per region.

iii. Participation of Women in the Labor Force

This paper also studies the effect of the female labor force participation rate (LFPR). The index used is the proportion of women ages 15 and above in the labor force. This is computed by the following formula:

$$female\ LFPR = \frac{employed + unemployed}{women\ ages\ 15\ and\ above}$$

where the old definition of unemployed is used (without work and seeking work or not seeking work due to some qualified reasons). The data source for this variable is the Asia Pacific Policy Center (APPC) compilation, which uses the figures from the Labor Force Survey (LFS).

iv. Proportion of Elders

The proportion of elders 64 years old and above will also be considered as an explanatory variable for fertility. A greater share of the elderly in the total population indicates that the age-structure does not bulge at the youth age, and should lower fertility. The data also come from the APPC-compiled LFS figures.

v. Contraceptive Prevalence Rate (CPR)

Contraceptive Prevalence Rate measures the percentage of married women aged 15-49 years who were using some method of family planning at the survey date. Use of contraceptive methods is a known fertility depressant; this justifies the need for a measure of contraceptive use in any estimation of fertility. The data were obtained from the ORC Macro (2006).

Empirical Results

The figures in Table 2 are the Regional TFRs for the survey periods 1998, 2003 and 2008. Of the 17 regions, only the National Capital Region (NCR) had a TFR (2.3) that is near the replacement rate of 2.1 in 2008. The rest of the 16 regions had an average TFR of at least 3.0, with six regions having a TFR of at least 4.0 in 2008. The last column of Table 1 shows the change in the TFR from 2003 to 2008 and the figures suggest that the drop in TFR has been slow during the last five years, with only six regions (NCR, CAR, MIMAROPA, Western Visayas, Northern Mindanao and SOCCKSARGEN) experiencing a drop of at least 0.1 per year in TFR.[8]

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[8] If this trend continues, it would take at least 10 years before the TFR in these regions (with the exception of the NCR) will be near the replacement rate of 2.1.

Table 2.Regional Total Fertility Rates (TFR)				
Region	Total Fertility Rates			
	1998	2003	2008	Change ('08-'03)
NCR	2.5	2.8	2.3	-0.5
CAR	4.8	3.8	3.3	-0.5
Ilocos Region	3.4	3.8	3.4	-0.4
Cagayan Valley	3.6	3.4	4.1	0.7
Central Luzon	3.5	3.1	3	-0.1
CALABARZON	3.7	3.2	3	-0.2
MIMAROPA	-	5	4.3	-0.7
Bicol Region	5.5	4.3	4.1	-0.2
Western Visayas	4	4	3.3	-0.7
Central Visayas	3.7	3.6	3.2	-0.4
Eastern Visayas	5.9	4.6	4.3	-0.3
Zamboanga Peninsula	3.9	4.2	3.8	-0.4
Northern Mindanao	4.8	3.8	3.3	-0.5
Davao Region	3.7	3.1	3.3	0.2
SOCCSKSARGEN	4.2	4.2	3.6	-0.6
Caraga	4.7	4.1	4.3	0.2
ARMM	4.6	4.2	4.3	0.1

Sources: NDHS 1998, 2003, 2008 final Reports, National Statistics Office (NSO); Collado (2010).

The first two regression models using the panel fixed effects (FE) models are shown in Table 3a. The results show that all of the explanatory variables used are fertility depressants (an increase in these variables is expected to reduce fertility), hence the negative signs. It is important to note that the signs of the estimates agree with theory. The output affirms the significance of income as a determinant of fertility. Its estimates in both models are significant at the 1% level. Any attempt to reduce fertility rate should zero-in on policies that foster production at both the national and regional levels. Economic growth in all places including (and especially) the rural areas is an unfailing way to claim the promises of demographic transition.

Table 3a. Determinants of Fertility
Dependent Variable: Regional Total Fertility Rate (TFR)

	MODEL 1		MODEL 2	
Variable	Coefficient	S.E	Coefficient	S.E
Regional Per Capita Income (in natural logarithm)	-2.51***	0.855	-2.78***	0.594
Education	-1.87*	0.998	-2.08**	0.964
Labor Force Participation	-1.85	2.673	-1.78	2.57
Proportion of Elderly	-11.82	18.001	-15.82	15.73
Contraceptive Prevalence	-0.008	0.014	---	---
Constant	29.49***	7.54	31.77***	5.27
Overall adjusted R^2	0.50		0.48	

*significant at 10%; ** significant at 5%; *** significant at 1%

Three of the five explanatory variables included in the model did not result in significant t-values. These are Female Labor Force Participation, Proportion of Elderly to Population, and the use of Contraceptives yielding p-values that are larger than 0.10. The final reduced model chosen by the authors is the model that best explains the variability in the TFR. The output is given in Table 3b.

Table 3b. Final Model Determinants of Fertility
Dependent Variable: TFR

	MODEL 3	
Variable	**Estimate**	**s.e.**
Log of Income	-2.71***	0.754
Education	-1.75*	1.02
Labor Force Participation	---	---
Proportion of Elderly	-16.54	19.21
Contraceptive Prevalence	-0.007	0.015
Constant	30.48***	6.86
Overall adjusted R^2	0.52	

*significant at 10%; **significant at 5%; ***significant at 1%

In the three models the significance of education in reducing fertility is very clear. It is without question that efforts at increasing income in the regions must be accompanied by efforts at raising the level of education in these areas. The tandem of higher income and higher education is perhaps the most reliable way of managing the country's population.

IV. Simulation Analysis of Total Fertility Rate (TFR) under Two Scenarios

The slow pace by which the total fertility rate has been reduced from 6.96 in 1960 to 3.30 in 2008 or a measly 1.6 percent per year can be attributed to a lack of concrete and proactive government policies on population management aimed at accelerating the demographic transition. The estimate of the coefficient of the logarithm of income in Table 3b may be interpreted as follows: Other things being the same, a 1% increase in income causes the TFR to decrease by 0.0271. The TFR for 2008 was 3.2, and for a TFR of 2.1 (replacement rate) to be reached, per capita GDP should increase by 45%. Assuming an average growth rate of 2% per year, the country will have to wait until 2030 before hitting the replacement rate, all other things being equal.

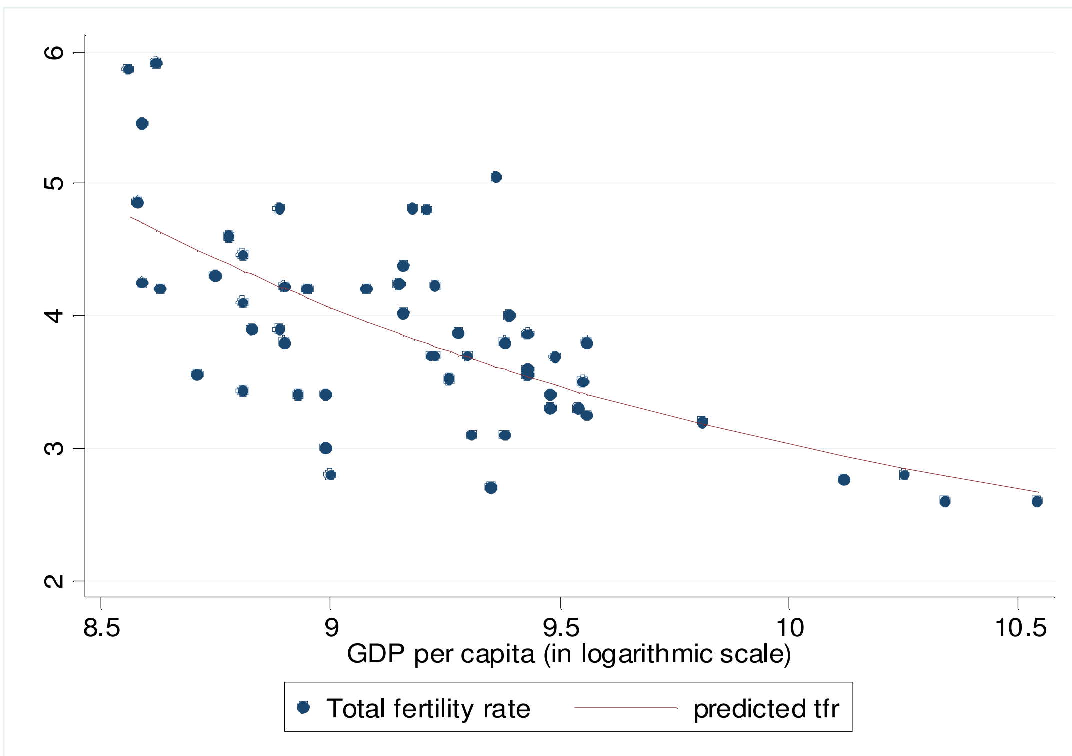
This wait is too long, and a little help from the educational sector is needed. If every year the proportion of household heads with at least a high school education increases by 0.1, the diminishing effect on TFR would be roughly 0.18 per year. The data shows that the proportion of household heads who are high school graduates is approximately 0.33. Thus it is still possible to raise this proportion to levels that depress fertility. This calls for a mammoth investment in education (in particular, an investment in high school education). For example, raising the level of education in the countryside to that of NCR's levels will reduce TFR by 0.6, a huge drop that would bring the country much closer to the replacement rate. Assuming that the proportion of household heads with at least a high school education could increase by 0.1 each year is quite unrealistic. However, if it is to be assumed that this proportion could increase at a *constant* rate of 0.02 per year, and if real per capita GDP *also* grows at a constant rate of 2%, the replacement rate could be achieved in ten years.

What then will the TFR of the country in the future under the same set of policies (e.g. gearing towards the use of the natural family planning methods)? When do we achieve the *Goldilock period* that is conducive for higher economic growth under the status quo?

An essential variable that reduces fertility rate is income. The econometric model shows that as the income of the household increases, the fertility rate tends to decrease.

The figure 1 shows the relationship between regional per capita income (in natural logarithm) and the regional total fertility rates from 1993 to 2006. The figure shows that as the income of the regions increase, the TFR decrease. Again, it should be noted that no region has reach a TFR of 2.1.

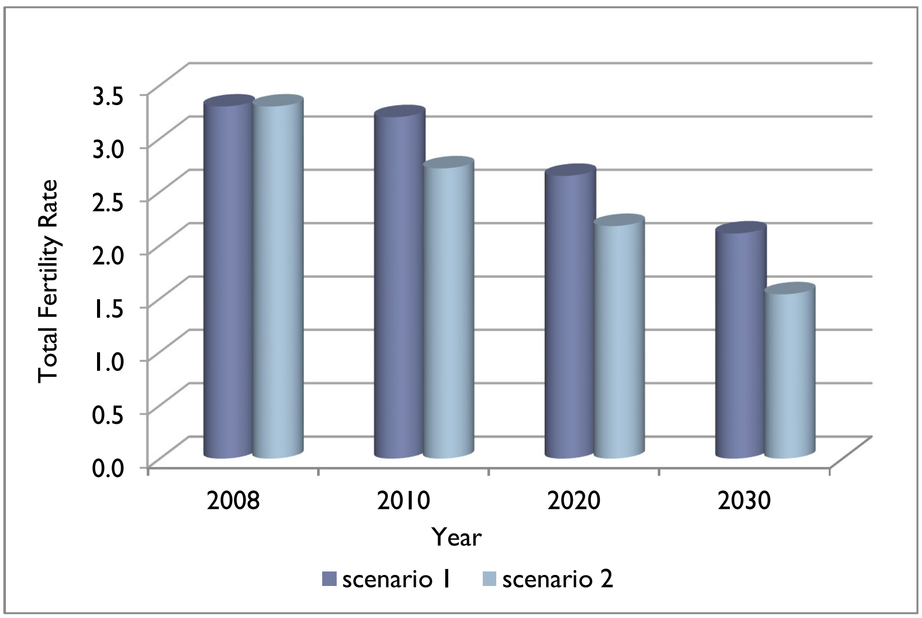
Figure 1. Relationship between TFR and per capita GDP by Philippine Regions (1993 to 2006)



Using the results of the econometric model that a one percent increase in per capita reduces TFR by 0.027 per year simulation analysis was made to plot the path of the country's TFR under two scenarios. On the one hand, scenario 1 assumes the business as usual scenario where TFR is reduced mainly as a result of increasing income. This scenario assumes that the country's GDP is growing at an average of 4 percent per year (and thus per capita GDP is growing at 2 percent per year, net of the population growth of about 2 percent per year). On the other hand, scenario 2 assumes the same average income growth of 4 percent plus government intervention to relieve the population pressure from unwanted fertility, estimated to account for 16 percent of the future population growth.[9] To be more realistic, scenario 2 further assumes that only 90 percent of the households with unwanted fertility will be covered by the government program.

The current and future TFRs under these two scenarios are presented in Figure 2. Using the 2008 TFR of 3.3 as base value, in the business as usual scenario 1, the *Goldilock period* will be reached by 2030, or twenty years from now. In the second scenario where government intervention targets only households with unwanted fertility, the *Goldilock period* will be achieved 10 years early or in about 2020.

Figure 2. Total Fertility Rates under Two Scenarios



The same simulation exercise was made for the poorest 40 percent of the households, where the TFRs are high. In 2008 for example, while the overall TFR of the country is 3.30, the TFR of the poorest 20 percent (or the bottom quintile) is at 5.20 and the second quintile at 4.20. The values in Table 2 show that, under the status quo, the households in the bottom quintile will not experience the *Goldilock period* in this generation. The TFR of the poorest 20 percent of the households 30 years from now (or

[9] From the study of Herrin and Costello (1996)

in 2040) will be at 3.47. This estimated TFR in 2040 will still be higher than the recorded TFR of Thailand in 1980 at 3.21. Under scenario 2 where government intervenes through proactive population management policies, the TFR of the poorest 20 percent will be at a manageable level of 2.31 by the year 2040.

For households in the second quintile, the TFR will still be at 2.47 in year 2040 under the status quo, while the *Goldilock period* will be achieved earlier in year 2030 when the TFR for this group is projected to be at 2.07.

Table 2. Total fertility rates of the second and bottom quintile under two scenarios

	2008	2010	2020	2030	2040
Second quintile					
Scenario 1	4.20	4.09	3.55	3.01	2.47
Scenario 2	4.20	3.16	2.62	2.07	1.53
Bottom quintile					
Scenario 1	5.20	5.10	4.55	4.01	3.47
Scenario 2	5.20	3.93	3.39	2.85	2.31

V. Conclusion

Addressing the poverty problem is the single most important policy challenge facing the country today and one cannot ignore the growing number of empirical evidence linking population growth on the one hand and poverty on the other. Development policies aimed at addressing the alarming poverty incidence in the country must include measures that will manage the country's bourgeoning population and bring down the fertility rate to a level that is conducive to higher economic growth. Policy makers must address the country's rapid population growth head-on though proactive government policies, such as the Reproductive Health (RH) bill. The failure to pass the RH bill will be very unfortunate for the damage that a rapid population growth will bring to this generation and the next are irreversible. We simply cannot afford to have millions of Filipinos go through the vicious cycle of high fertility and poverty: high fertility rate prolongs poverty in households and poor households contribute to high fertility rates.

Government must intervene to break this cycle by creating policies that will increase the capacity of women to participate in the labor market, invest in health to decrease child mortality and enhance education, particularly of women. These are the policies that have been found successful in reducing fertility rates in households. At the same time, government must also directly intervene by, for example, providing contraceptive services to poor households that cannot afford these contraceptive services for, without such government support, the fertility rates in these households will remain high and unmanageable condemning them to poverty. We cannot afford to ignore the population issue because population gravely affects our country's growth and development and as it is, we are paying a high price for our rapid population growth.

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