

# **Robust Determinants of Income Growth in the Philippines**

An Overview of the Intra-Country Study on the Impact of  
Population Dynamics on Economic Growth and Poverty Reduction  
in the Philippines

Dennis S. Mapa  
Assistant Professor  
School of Statistics, University of the Philippines Diliman  
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## **Outline of the Discussion**

- ⌘ Background – The Population Debate
- ⌘ Population-Growth-Poverty Nexus, Phase I  
(Cross-Country Results)
- ⌘ Population-Growth-Poverty Nexus, Phase II  
(Intra-Country Results)
- ⌘ Concluding Remarks

## The Population Debate

- ⊖ The population debate has been dynamic and contentious.
- ⊖ The debate centers on the consequences of population growth on economic development.
- ⊖ Does population growth curtail or promote economic growth? Or is it independent from economic growth?

## The Population Debate

- | ⊖ <u>Positive</u>                        | <u>Neutral</u>  | ⊖ <u>Negative</u>   |
|--|---|---|
| ⊖ induces technological change           | Other variables such as <i>institutions</i> and <i>rule of law</i> matter more to economic growth | ⊖ Strain food supply and limit the standard of living of the masses |
| ⊖ stimulates innovation                  |   | ⊖ Studies show that lower fertility rates raise average growth      |
| ⊖ <i>Simon (1981) and Boserup (1998)</i> | <i>Easterly and Levine (2002)</i>   | ⊖ <i>Malthus</i><br>⊖ <i>Barro and Sala-i-Martin (2004)</i>         |

## Demographic Transition: New Mantra on Population-Growth Nexus

- ⌘ In the 1990's, the population debate shifted from the issue of population growth to the age structure of the population. The nation's age structure has an important impact on its economic performance.
- ⌘ Individuals have different economic behaviors at different stages in life.



The young require intensive investment  
in health and education.



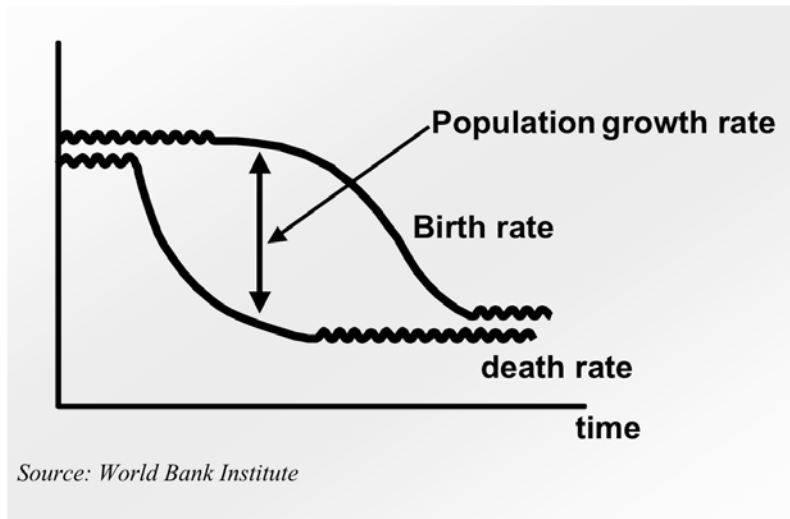
## Prime-aged adults supply labor and saving



## The elderly requires health care and retirement income

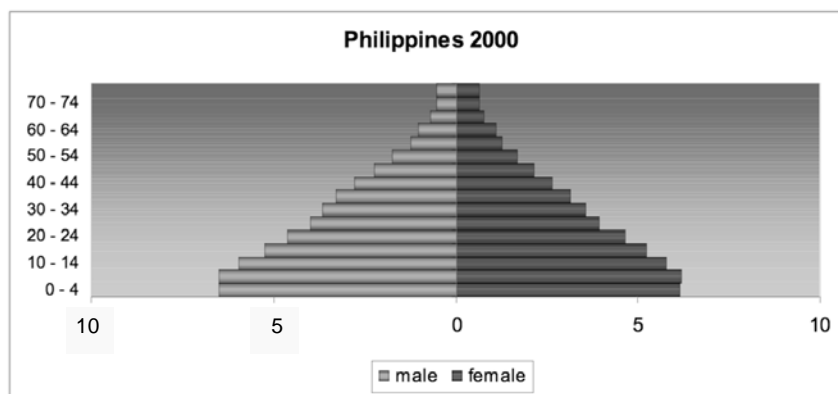


Demographic transition is a change from a situation of high fertility and high mortality to one of low fertility and low mortality.

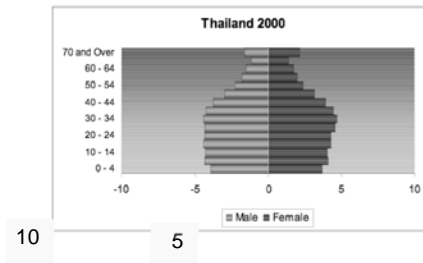


## Three Phases of the Demographic Transition and Its Impact on the Economy

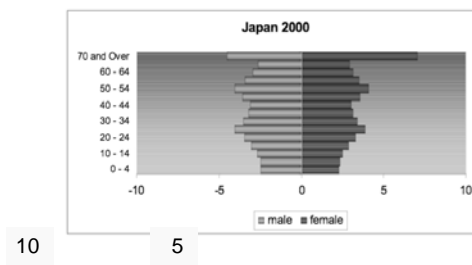
**PHASE 1.** Triggered by initial decline in infant mortality, the youth dependency group swells.



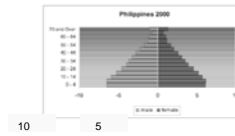
**PHASE 2.** Economic growth promoted about 20 years later when the youth enters the working age group.



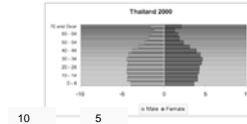
**PHASE 3.** Economic growth may or may not be impeded as the elderly cohort swells. It appears that a rising elderly share does not depress nor elevate the rate of economic growth.



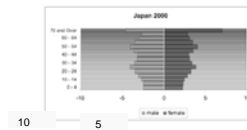
### PHASE 1 - Philippines



### PHASE 2 - Thailand



### PHASE 3 - Japan



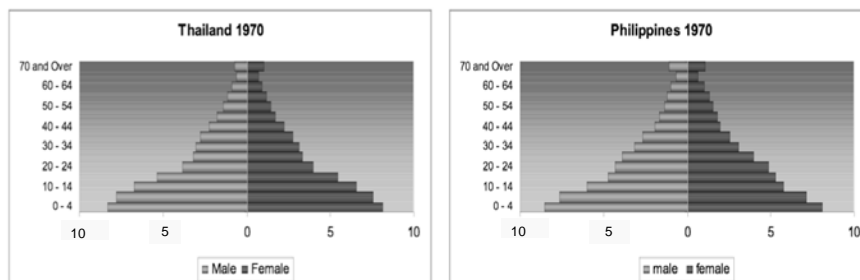
## Demographic Transition

- ⌘ Depending on the position of the bulge on the age pyramid, the value of output per capita, the most widely used measure of economic performance, will change correspondingly.
- ⌘ The change from high to low mortality and fertility can create the so-called “demographic dividend.”

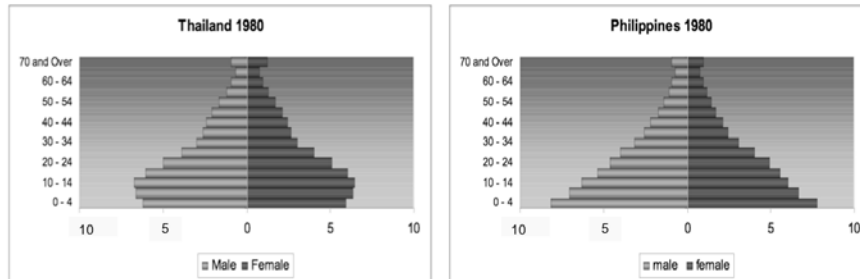
## The Cross-Country Econometric Model (Mapa and Balisacan [2004])

- ⌘ This study investigated the relationship between population growth and the demographic transition on economic growth using cross-country data from 1975 to 2000.
- ⌘ Simulation techniques were used to quantify the effect of population growth in the difference between the Philippines' GDP per person with Thailand.
- ⌘ The data set consisted of 80 developed and developing economies.

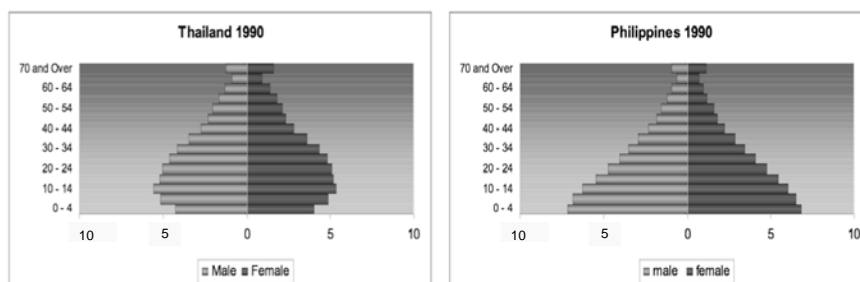
## Comparison of Age Structure (1970)



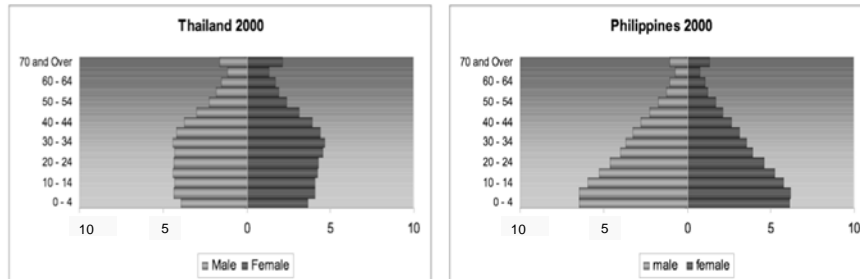
## Comparison of Age Structure (1980)



## Comparison of Age Structure (1990)



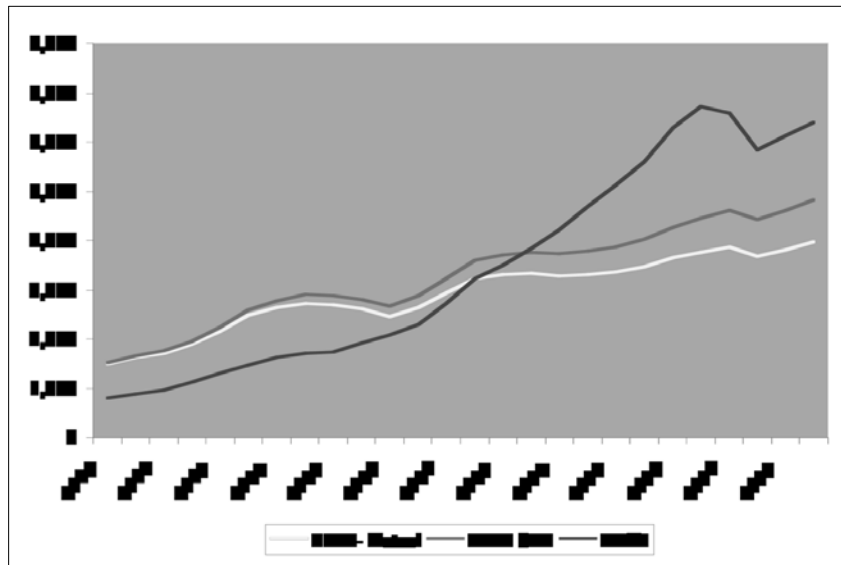
## Comparison of Age Structure (2000)



### What is the Impact on Economic Growth?

- ⊞ Population dynamics (demographic transition) has significant impact on economic growth.
- ⊞ Simulation exercise showed that had the Philippines followed Thailand's population growth path results to an additional increase of at least 0.77 percentage point per year, for the period 1975 to 2000, on the average income per person.
- ⊞ Translates to a cumulative increase of about 22% on the average income per person in the year 2000.

## Actual and Simulated Income per Person



## Determinants of Provincial Per Capita Income Growth Rate (1985 to 2003)

## The Intra-Country Analysis

- ⌘ An intra-country econometric model is estimated to study the relationship between population growth and the demographic transition (population dynamics) on economic growth using provincial data from 1985 to 2003.
- ⌘ The data set consists of 74 provinces.
- ⌘ Simulation techniques are used to quantify the effect of population dynamics on the differences in income per person of the provinces.

## Definition of the Variables

Variable of Interest (Dependent variable):

Average **Growth Rate of Provincial Per Capita Income** of the 74 provinces from 1985 to 2003. Income is measured in 1997 pesos and adjusted for price differences in the provinces.

Determinants of Growth:

A. INITIAL ECONOMIC CONDITIONS:

1. Natural Logarithm of the mean income (1985) of the provinces;
2. Average Education of the Household Head (measured as number of years of schooling);
3. Mortality rate per 1,000 of 0-5 year-old children;

## Definition of the Variables

4. Infrastructure Index; provincial average of binary variables indicating presence of street pattern, highway, phone, telegraph, postal service, community waterworks system and electricity;
5. Measure of Income Inequality as measured by the expenditure Gini (and its square) in 1985;

### B. INITIAL GEOGRAPHICAL CONDITIONS:

6. Landlock, a dummy variable with value 1 if the province is landlocked and 0 otherwise;
7. Dummy Variable for the provinces in ARMM; and,
8. Average annual number of typhoons;

### C. INITIAL DEMOGRAPHIC CONDITIONS:

9. Proportion of young dependents (aged 0 to 14 years) in 1985 defined as the ratio of young dependents to the total population;
10. Number of within country net migrants (x 1000) from 1985 to 1990;

## Definition of the Variables

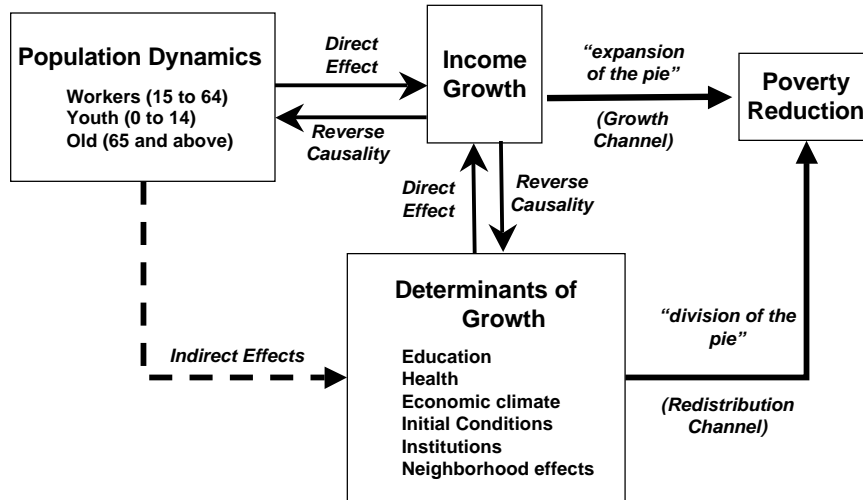
### D. TIME-VARYING POLICY VARIABLES:

11. Change in the proportion of households with access to electricity from 1988 to 2003;
12. Change in Road Density from 1988 to 2003; and,
13. Change in the proportion of cumulative CARP (DENR and DAR) accomplishments to 1990 Potential Land Reform Area from 1988 to 2003;

### E. NEIGHBORHOOD EFFECTS:

14. Neighborhood Effects measured by the growth rate of per capita income of the neighboring provinces.

# Theoretical Framework



## Summary Statistics

VARIABLE	Mean	Maximum	Minimum	Std Dev.
Growth rate of provincial per capita income	1.87	5.66	-1.36	1.36
Log of initial income	9.73	10.4	9.07	0.29
Education	6.6	9.8	3.4	1.05
Proportion of young dependents	41.56	48.92	33.15	3.47
ARMM dummy	0.07	1	0	0.25
Change in CARP	0.8	1	0.26	0.14
Change in electricity	21.92	67.92	-13.25	16.5
Change in road	0.12	2.47	-0.08	0.29
Expenditure GINI	0.34	0.49	0.19	0.06
Square of expenditure GINI	0.12	0.24	0.04	0.04
Infrastructure index	0.41	0.91	0.08	0.16
Landlock	0.2	1	0	0.4
Mortality rate	0.85	1.21	0.56	0.15
Neighborhood effect	1.83	3.52	0.21	0.63
Net migration	0	39.63	-83.52	21.61
Typhoon	0.5	1.55	0	0.38

## Results of the Econometric Models

**Dependent Variable: Growth Rate of Per Capita Income from 1985 to 2003  
Least – Squares Estimation (LS)**

Variable	MODEL 1		MODEL 2	
	Coefficient	s.e. $\alpha$	Coefficient	s.e. $\alpha$
Log of initial income	-3.0720***	0.429	-2.4620***	0.493
Education	0.1483	0.164	-	-
Proportion of young dependents	-0.0912***	0.031	-0.0752*	0.040
Expenditure GINI	43.0895**	19.018	46.9507**	20.720
Square of expenditure GINI	-64.1636**	26.271	-69.3848**	28.292
ARMM dummy	-2.2910***	0.668	-2.1451***	0.671
Net migration	-0.0080*	0.004	-	-
Neighborhood effect	-0.3257*	0.176	-0.4381**	0.211
Infrastructure index	-	-	1.6724**	0.793
Change in electricity	-	-	0.0091	0.008
Constant	28.2902***	5.365	21.2817***	7.049

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

$\alpha$ : standard errors are White's heteroscedasticity consistent standard errors

N	74	74
R-squared	0.5599	0.5657

## Results of the Econometric Models

**Dependent Variable: Growth Rate of Per Capita Income from 1985 to 2003  
TOLS (Model 3) and GMM (Model 4)**

Variable	MODEL 3 <sup>a</sup>		MODEL 4 <sup>b</sup>	
	Coefficient	Std. Error	Coefficient	Std. Error
Log of initial income	-3.1957***	0.4839	-3.4786***	0.4192
Education	0.1360	0.1869	0.2715*	0.1509
Proportion of young dependents	-0.1306**	0.0534	-0.1011**	0.0408
Expenditure GINI	49.1290**	21.9622	68.4040***	13.9076
Square of expenditure GINI	-73.1441**	29.6190	-99.7146***	19.7577
ARMM dummy	-2.2077***	0.6602	-1.1409***	0.34023
Net migration	-0.0051	0.0069	-0.0060*	0.0033
Neighborhood effect	-0.3640*	0.2139	-0.3852**	0.1756
Infrastructure index	-	-	-	-
Change in electricity	-	-	-	-
Constant	30.2969***	7.1310	27.4932***	5.4357

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

N	74	74
R-squared	0.5944	0.5640
Adjusted R-squared	0.5404	0.5059

## Results of the Econometric Model

- ⌘ The natural logarithm of initial income is negatively and significantly correlated with income growth.
- ⌘ The population variable, proportion of young dependents, has a negative and significant effect on income growth, all things being the same.
- ⌘ The measures of initial inequality are both significant but of opposite signs, with initial inequality having positive sign, while its square, a negative sign, all things being the same.

## Results of the Econometric Model

- ⌘ The indicator variable for the provinces in the ARMM has a negative and significant impact on the average provincial income growth.
- ⌘ Net migration has a negative and significant effect on average provincial growth rate.
- ⌘ Neighborhood effect, represented by the average growth rate of the neighboring provinces, has a negative and significant effect on the average income growth of the “home” province.

## Results of the Econometric Model

- ⊖ The education variable, measured by the number of years of schooling of the household head is positive and significant in explaining variations in the average provincial income growth in the Philippines.
- ⊖ The infrastructure index is a significant and positive determinant of income growth, all things being the same.

Is population dynamics strongly related to growth?

## Robustness of the Coefficients

- ⌘ The coefficients of the Growth Regression model were subjected to diagnostic procedures known as Bayesian Averaging of Classical Estimates (BACE) to check whether the signs and magnitudes of the coefficients change depending on the presence of other explanatory variables in the model.
- ⌘ The BACE was performed under the assumptions that there are 7 explanatory variables in the model (a typical number for growth regression) and with log of initial income (initial condition) and education (measure of human capital) always present in the models.

Robustness of the Coefficients: Bayesian Averaging of Classical Estimates

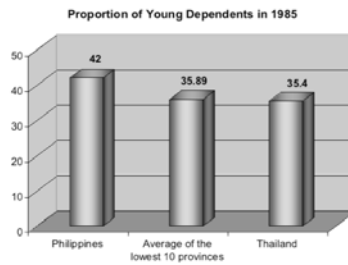
VARIABLE	Mean Beta	Mean S. E.	Sign Certainty Probability	Remark
Proportion of young dependents	-0.09	0.00140	0.99	robust
ARMM dummy	-2.15	0.62946	1.00	robust
Expenditure GINI	43.76	397.2149	0.99	robust
Square of expenditure GINI	-65.21	719.2251	0.99	robust
Neighborhood effect	-0.36	0.03827	0.97	marginal
Net migration	-0.01	0.00003	0.97	marginal
Landlock	0.42	0.09433	0.91	not robust
Infrastructure index	1.21	1.00117	0.89	not robust
Change in CARP	-1.12	1.19384	0.85	not robust
Change in electricity	0.01	0.00010	0.84	not robust
Typhoon	0.29	0.15905	0.77	not robust
Change in road	0.25	0.94198	0.60	not robust
Mortality rate	0.15	1.49960	0.45	not robust
Education	0.16	0.03103	always included	not tested
Log of initial income	-2.81	0.28752	always included	not tested

## **Robustness of the Coefficients**

- ⊖ The result suggests a robust relationship between income growth and proportion of young dependents under the BACE procedure.
- ⊖ The robustness (BACE) procedure suggests that the proportion of young dependents is a “robust determinant” of income growth in the Philippines.
- ⊖ The probability that its relationship is negative, high proportion of young dependent has contracting effect on income growth, is at least 0.99.

**What if the provinces had lower  
proportion of young dependents  
in 1985?**

## Comparison of Young Dependents

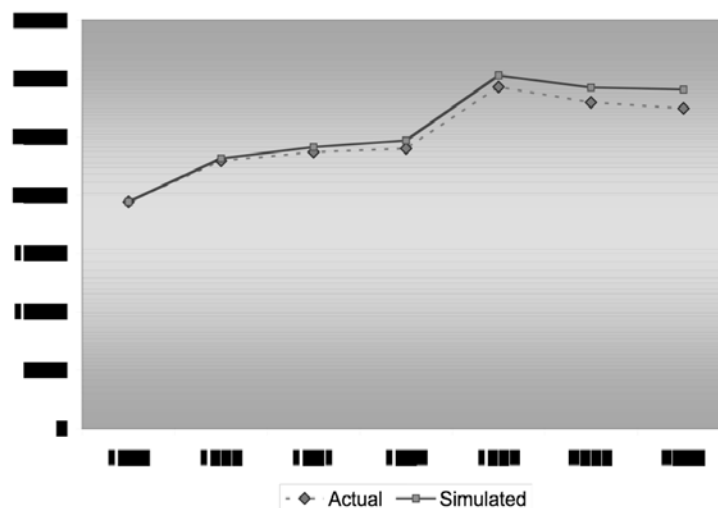


What if the percentage of young dependents in 1985 were equal to 35.89% in the provinces that originally had higher figures than this?

## What is the Impact on Income Growth?

- ⊖ An additional increase of **7.12** percent on the average income per person in the year 2003.
- ⊖ An additional increase on the average income per person of **2,227 pesos** in 2003.

## Actual and Simulated Income (Philippines)



## Reduction in Poverty

Scenarios	Poverty Headcount (Individuals)	
	Number	%
Status quo	20,465,409	26.12
With low proportion of young dependents	17,646,631*	22.52
Difference	2,818,778	3.60

\* assuming the same population in 2003

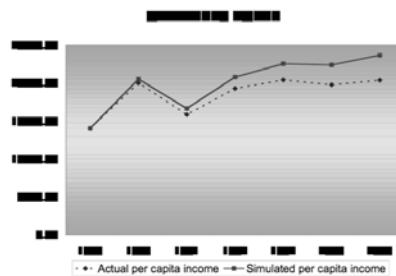
## Reduction in Poverty

If the Provinces had a low percentage of young dependents in 1985:

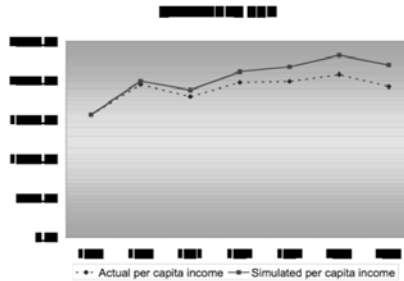
- ⊖ Poverty incidence would have been **3.6** percentage points less.
- ⊖ More people would have been brought out of poverty, roughly, about 3 million more in 2003 (*assuming no change in 2003 population*).

Average per capita income is higher in majority of the provinces.

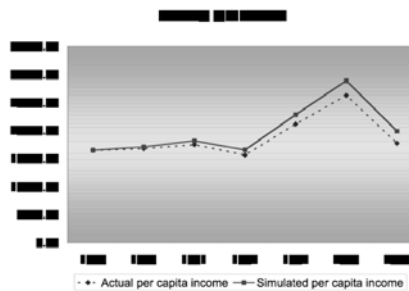
## Actual and Simulated per capita Income



## Actual and Simulated per capita Income



## Actual and Simulated per capita Income



Effect of higher income growth,  
as a result of a lower proportion  
of young dependents, to poverty  
reduction...

### Impact of lower proportion of young dependents on income growth

- ⌘ An additional increase of **7.12** percent on the average income per person in the year 2003.
- ⌘ An additional increase on the average income per person of **2,227 pesos** in 2003.
- ⌘ Poverty incidence would have been 3.6 percentage points less.
- ⌘ More people would have been brought out of poverty, roughly, about 3 million more in 2003 (assuming no change in 2003 population).

## **In conclusion...**

- ⊖ The study does not single out population as the sole culprit to the Philippines' dismal performance over the years.
- ⊖ It *does* say that population makes a significant contribution to a country's economic development.
- ⊖ The study presents empirical evidence, not just mere conjectures, translating effects in terms of currency units.
- ⊖ The study reiterates the call for a clear population policy backed by strong government support.