

Does Demographic Transition with Human Capital Dynamics Matter for Economic Growth? A Dynamic Panel Data Approach to GMM

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Introduction

- The developing world is undergoing the process of demographic transition but with a lag from the developed world
- The demographic changes in the developed countries were gradual whereas developing countries are experiencing a rapid transition
- The demographic transition creates the potential window of opportunity when economically active population is growing and the dependent population is declining, while the old age population is still small.

- Due to this window of opportunity the increased per-capita output is called as demographic dividend or demographic gift (Bloom et al., 2001; Mason, 2001).
- There are three channels for demographic dividend, that is through 1) labor supply; 2) savings and; 3) human capital (Bloom et al., 2001; Bloom and Canning, 2004; Nayab, 2006).
- The motivation to analyze the demographic dividend in the perspective of human capital dynamics (that is third channel of demographic dividend) in developing world is enchanting as all the developing countries are passing through the transition.

- Based on the descriptive analyses, the studies concluded that in order to materialize the economic benefits from demographic transition, policies regarding education, health and labor market flexibility should be framed to reap the demographic benefits, otherwise, it would be a cost to the society (Nayab, 2006; Bloom and Finlay 2008).

- The objective of the study is to analyze whether demographic transition with dynamics in human capital matters for economic growth of the developing countries.
- The study is an addition to the demographic literature and may be distinguished from the prior studies as it augmented a unified theoretical model of demographic and human capital dynamics by extending the conditional convergence growth model.

Methodology

- Based on the theoretical models, the econometric models for economic growth can be estimated as:
- $$g_{\check{y}_{it}} = \alpha_1 Y_{it-1} + \alpha_2 X_{it} + \alpha_3 Z_{it} + \alpha_4 g_{k_{it}} + \alpha_5 g_{N_{it}} + \alpha_6 g_{P_{it}} + \Delta e_{1it} \dots\dots\dots (1)$$
- Where $g_{\check{y}_{it}}$ = GDP per-capita growth rate, Y_{it-1} = log of lagged value of GDP per-capita level, X_{it} = log of lagged value of working-age population ratio, Z_{it} = log of lagged value of labor force participation ratio, $g_{k_{it}}$ = growth rate of capital stock, $g_{N_{it}}$ = growth rate of total labor force, $g_{P_{it}}$ = growth rate of total population and Δe_{1it} = difference of observation specific error term left after the removal of fixed effects error.

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- $$g_{\check{y}_{it}} = \beta_1 Y_{it-1} + \beta_2 X_{it} + \beta_3 Z_{it} + \beta_4 g_{k_{it}} + \beta_5 g_{N_{it}} + \beta_6 g_{P_{it}} + \beta_7 g_{T_{it}} + \beta_8 g_{L_{it}} + \beta_9 \Delta E_{it} + \Delta e_{2it} \dots\dots\dots (2)$$
- In addition to model specification (1), the model (2) adds some economic variables including $g_{T_{it}}$ which shows the growth rate of trade openness (sum of imports and exports divided by GDP), $g_{L_{it}}$ representing the growth rate of life expectancy and ΔE_{it} denoting the difference of human capital. Similarly, Δe_{2it} is the difference of error term excluding country specific fixed effects as in case of model (1).
- $$g_{\check{y}_{it}} = \gamma_1 Y_{it-1} + \gamma_2 X_{it} + \gamma_3 Z_{it} + \gamma_4 g_{k_{it}} + \gamma_5 g_{N_{it}} + \gamma_6 g_{P_{it}} + \gamma_7 g_{T_{it}} + \gamma_8 g_{L_{it}} + \gamma_9 \Delta E_{it} + \gamma_{10} E_{it} + \Delta e_{3it} \dots\dots\dots (3)$$
- Along with all the variables of model specification (2), the model (3) includes E_{it} that is the lagged value of level of human capital.

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- $$g_{\check{y}_{it}} = \theta_1 Y_{it-1} + \theta_2 DR^y_{it} + \theta_3 DR^o_{it} + \theta_4 g_{k_{it}} + \theta_5 g_{N_{it}} + \theta_6 g_{P_{it}} + \theta_7 g_{T_{it}} + \theta_8 g_{L_{it}} + \theta_9 \Delta E_{it} + \theta_{10} E_{it} + \Delta e_{4it} \dots \dots \dots (4)$$
- In model (4), the log of lagged value of working-age population ratio and log of lagged value of labor force participation ratio are replaced by DR^y_{it} which is log of lagged value of youth dependency ratio (ratio of population in the age bracket of below 15 years to population in the age bracket of between 15 and 65 years) and DR^o_{it} which denotes the log of lagged value of old dependency ratio (ratio of population in the age bracket of above 65 years to the population in the age bracket of 15-65 years).

- $$g_{\check{y}_{it}} = \phi_1 Y_{it-1} + \phi_2 DR^y_{it} + \phi_3 DR^o_{it} + \phi_4 g_{k_{it}} + \phi_5 g_{N_{it}} + \phi_6 g_{P_{it}} + \phi_7 g_{T_{it}} + \phi_8 g_{L_{it}} + \phi_9 \Delta E_{it} + \phi_{10} E_{it} + \phi_{11} Y_{it-1} * E_{it} + \Delta e_{5_{it}} \dots\dots\dots (5)$$
- Specification (5) has the same variables as (4) except $Y_{it-1} * E_{it}$ which is the interaction term of lagged dependent variable and lagged value of level of human capital.

- We have used a panel data set of 67 developing countries (see Appendix A for the sample) for the years 1960-2014.
- The values in the sample of data-set are taken at five year interval. The purpose of using five year interval is to account for missing values and more importantly to dampen the business cycle fluctuations. This is fairly a standard approach in practice for demographic studies (see Benhabib and Spiegel, 2002; Bloom et al., 2012).

Results and discussion

Dependent Variable: GDP per-capita Growth			
Variables	Specification 1	Specification 2	Specification 3
Convergence Variable			
Y_{it-1} (GDP per-capita growth rate)	-0.430 [0.225]*	-0.391 [0.201]*	-0.432 [0.234]**
Demographic Variables			
X_{it} (Working age population ratio)	0.662 [0.339]*	0.549 [0.271]**	0.598 [0.204]***
Z_{it} (Labor force participation ratio)	1.395 [0.932]	1.521 [0.772]*	1.254 [0.259]***
$g_{N_{it}}$ (Growth rate of total labor force)	2.499 [1.249]**	2.536 [1.307]*	2.421 [0.851]***
$g_{P_{it}}$ (Growth rate of population)	0.491 [1.325]	0.352 [2.657]	0.450 [1.061]
Economic Variables			
$g_{k_{it}}$ (Growth rate of capital stock)	2.301 [1.142]**	2.458 [1.119]**	2.479 [0.412]***
$g_{L_{it}}$ (Growth rate of life expectancy)		0.210 [0.101]**	0.237 [0.112]**
$g_{T_{it}}$ (Growth rate of trade openness)		0.163 [0.085]*	0.182 [0.083]**
ΔE_{it} (Difference of human capital)		0.072 [0.073]	0.155 [0.071]**
E_{it} (Level of human capital)			0.112 [0.019]***
Sargan Test of Over-identifying Restrictions			
P-value	0.1531	0.3512	0.5009
Arellano-Bond Test for Autocorrelation			
P-value AR(1)	0.0015	0.0283	0.0451
P-value AR(2)	0.3960	0.2714	0.5521

Dependent Variable: GDP per-capita Growth		
Variables	Specification 4	Specification 5
Convergence Variable		
Y_{it-1} (GDP per-capital growth rate)	-0.607 [0.291]**	-0.575 [0.258]**
Demographic Variables		
DR^y_{it} (Lagged value of youth dependency ratio)	-1.254 [0.599]**	-1.273 [0.173]***
DR^o_{it} (Lagged value of old dependency ratio)	-0.198 [0.138]	-0.191 [0.098]*
$g_{N_{it}}$ (Growth rate of total labor force)	2.125 [1.002]**	2.381 [0.941]***
$g_{P_{it}}$ (Growth rate of population)	0.954 [1.821]	1.047 [1.075]
Economic Variables		
$g_{k_{it}}$ (Growth rate of capital stock)	2.210 [0.992]**	1.975 [0.277]***
$g_{L_{it}}$ (Growth rate of life expectancy)	0.231 [0.126]*	0.342 [0.127]***
$g_{T_{it}}$ (Growth rate of trade openness)	0.210 [0.102]**	0.282 [0.138]**
ΔE_{it} (Difference of human capital)	0.253 [0.135]*	0.295 [0.129]**
E_{it} (Level of human capital)	0.113 [0.051]**	0.108 [0.024]***
Interaction Term		
E_{it} * econometric Model Specifications lagged value of labor force participation ratio and lagged value of level of mean * Y_{it-1} (Interaction term of lagged dependent variable and lagged value of human capital)		-2.911 [0.029]***
Sargan Test of Over-identifying Restrictions		
P-value	0.2523	0.5632
Arellano-Bond Test for Autocorrelation		
P-value AR(1)	0.0285	0.0149
P-value AR(2)	0.6103	0.5274

- **In model specification 1**, working-age population ratio, growth rate of labor force and growth rate of capital stock have shown positive impact on economic growth. However, labor force participation ratio has shown insignificant effect on economic growth.
- The growth rate of population has insignificant effect not only in specification 1 but in all model specifications. It supports the neutralists approach (population growth rate has no effect on economic growth).

- **In model specification 2**, the working-age population ratio, labor force participation ratio and growth rate of labor force have shown positive effect on economic growth
- In this specification all the control variables, i.e. growth rate of physical capital, life expectancy and trade openness have shown positive influence on economic growth. However, change in human capital has shown insignificant impact on economic growth

- **The model specification 3** incorporates the level form of human capital variable in addition to the previous model. It has positive impact on economic growth. The advantage of its inclusion is that the variable of change in human capital has now turned to be significant.
- The coefficients of working-age population ratio and labor force participation ratio are highly significant with positive signs. They confirm the theory that demographic transition plays a significant role in economic growth.
- The coefficients of all control variables like capital stock, life expectancy and trade openness are according to the mainstream theory

- **The model specification 4** includes dependency ratio instead of working-age population ratio and labor force participation ratio. The coefficient of the youth dependency ratio shows negative impact on economic growth but old dependency ratio has indicated insignificant impact
- The growth rate of labor force has positive impact on economic growth
- The control variables like capital stock, life expectancy and trade openness have positive effect.
- Similarly, the coefficients of human capital both in level and difference form are positive and significant hence implying that both stock of human capital and change in it play vital role to spur economic growth.

- **The model specification 5** in addition to specification 4, contains the interaction term of human capital in level form and lagged dependent variable. It has negative coefficient revealing the fact that higher level of initial human capital implies stronger conditional convergence.
- It means that increase in human capital level makes the growth rate of GDP per-capita more sensitive to initial level of GDP per-capita. The finding is intuitive in a way that more human capital increases the adoption of new technology and absorption of new knowledge (Barro, 1996).
- All the control variables like capital stock, life expectancy and trade openness have encouraging effect on economic growth of developing economies

Conclusion

- In the developing economies the working-age population ratio and growth rate of total labor force has shown positive contribution in economic growth with varying magnitudes in different model specifications
- Similarly, coefficient of labor force participation ratio remains more or less positively significant

- The dependency ratios and particularly youth dependency ratio have shown negative impact on economic growth. It shows that the fall in youth dependency means youth cohort enters the working-age population and provides growth opportunity for the economy. If this increasing workforce is swallowed successfully by the job market then it would yield high economic growth.

- On the contrary, the coefficient of growth rate of population appears insignificant suggesting that population growth rate is not important but the distribution of this population matters for the economic growth

- As far as human capital is concerned, the coefficient of change in human capital is insignificant in specification 2 without level form human capital variable. It reveals interesting situation, i.e. the inclusion of level form of human capital makes economic growth more sensitive to changes in human capital.
- The interaction term of human capital and convergence variable has a meaningful insight that is, the initial human capital is high the high will be the absorption of new knowledge and fast will be the technological catching up process.

- The convergence coefficient is negatively significant in all the specifications confirming the conditional convergence of the models.
- All the control variables, i.e. growth rate of physical capital, life expectancy and trade openness have positive effect which are in accordance with the theoretical suggestions.
- In brief, the process of demographic transition brings economic benefits if the right policy is placed which is conducive for economic growth. One major pre-requisite to achieve this benefit is flexible labor markets having capacity to swallow the people entering in the working-age population. Therefore, in order to reap the benefits of demographic transition there is need to create opportunity of right mix of jobs that may allow workers to make their contributions to the economy. The bottom line is that human capital and demographic transition play key

- There are avenues to explore further the role of demographic transition and human capital in economic growth of developing economies. The empirical analysis may be conducted for disaggregated samples of the economies by regions and income groups.



Thanks