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## Demographic transition, economic growth and labor market dynamics

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## Chapter 1

# Introduction and Summary of Findings

### 1.1 Motivation

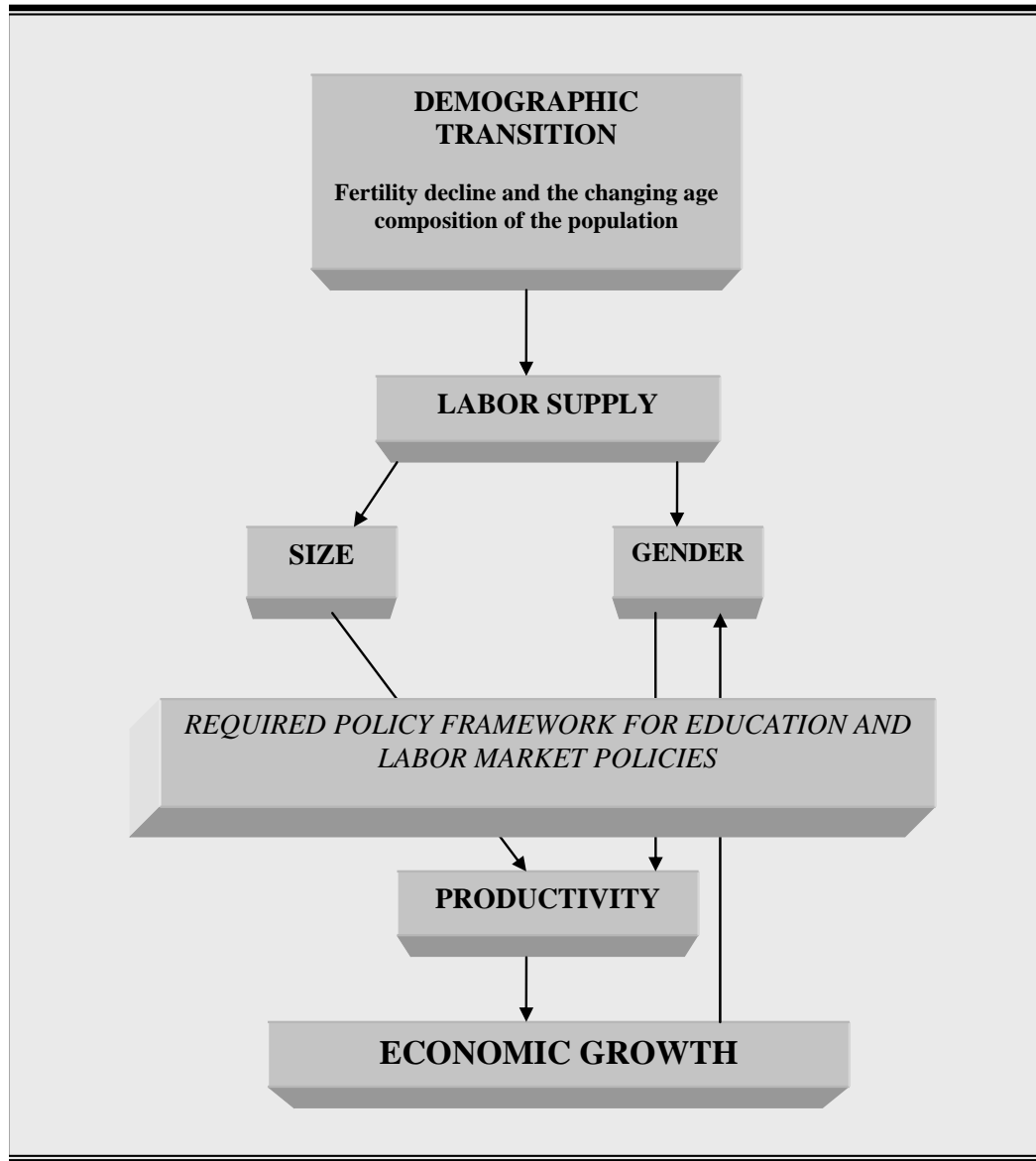
The change in the distribution of the population across different age groups is an important explanatory factor for economic and productivity growth (Bloom and Williamson, 1998; Mason, 2005). As a consequence of demographic transition, the number of working-age adults grows larger over time relative to the dependent population. This increase of the working age population share leads to a potential opportunity of rapid economic growth, known as the *Demographic Dividend* (Bloom *et al.*, 2002). In this thesis demographic transition is defined as the process of change from a situation of both high birth and death rates (at or near equilibrium) to a situation in which both birth and death rates are low (at or near equilibrium). The demographic dividend may lead to faster economic growth as different population age groups have specific economic characteristics. Young people (0-14 years) require investment in education and health, prime-age adults (15-64 years) provide labor and savings, while the aged (65+) need health care and retirement income. If the number of working-age adults grows larger relative to the dependent population, less expenditure are needed to meet the needs of the youngest and the oldest age groups, as a result of which resources become available for investment in human development and general economic welfare. However, an optimal utilization of the demographic dividend requires a careful assessment of the changing population age structure and the accompanying policy framework. The demographic dividend is not an automatic phenomenon, but requires an integrated policy framework (health, education, labor

markets policies) to transform the potential opportunity of high economic growth in reality. In absence of such required changes in the policy framework and proper planning, the potential demographic dividend can turn into a demographic burden in the form of an army of unskilled, uneducated and unemployed youth.

The potential opportunity to utilize the demographic dividend well is currently quite strong for emerging market economies. The process of demographic transition for developed countries took far longer than it will take for emerging economies. Bloom *et al.* (2003) show that the demographic transition process in Western Europe started in the middle of the eighteenth century and took nearly 150 years, whereas it will take only 50-75 years in East Asia. Consequently, the share of the population in productive age groups is also expected to be higher. The World Population Prospects Report of the United Nations (2008) reveals that the share of prime-age adults in developed countries peaked in 2005 and started to decline afterwards, but it will continue to rise in less developed economies up to 2040.

Although differences in the pace of demographic transition are important, we need to point out that other country-specific determinants may affect economic growth too. In his Nobel Prize memorial lecture in 1971, Simon Kuznets already discussed the wide disparity of growth patterns between pre-industrialized developed and current developing countries. Referring specifically to China, India and Pakistan, he mentioned that *...no country that entered modern economic growth (except Russia) approached the size of India or China, or even of Pakistan and Indonesia; and no currently developed country had to adjust to the very high rates of natural increase of population that have characterized many less developed countries over the last two or three decades.* In the same lecture Kuznets also pointed out that, while the stock of material and social technology that can be tapped by less developed countries today is much larger than that in the nineteenth and even early twentieth century, the technological backwardness is also much greater now. In spite of these observations back in 1971, the emerging economies of China and India managed to achieve extraordinary growth rates of which a significant part can be attributed to the demographic dividend, as we will show in this thesis.

**Figure 1.1 : Demographic transition and economic growth**



### **1.1 Research questions and analytical framework**

The main research question of this thesis is: *What are the mechanisms behind the relationship between demographic transition and economic growth?* To answer this question, this thesis focuses on the distribution of the population across different age groups and its implication for economic growth and productivity. There are various channels through which demographic transition can affect these key economic targets, of which an increase in labor supply, labor productivity, investment in human and

physical capital, and saving are the most important.

Figure 1 provides a graphical description of the mechanisms behind the relationship between demographic transition and economic growth that will be investigated in this thesis. Mason (2005) divides demographic dividend as a result of demographic transition into two parts: one that occurs as a result of a changing age structure and one that occurs due to a higher saving rate and more investment in human capital as a result of lower mortality and longer life spans. This thesis focuses primarily on the impact of a changing age structure, although we will not ignore the investment component of the growth story.<sup>1</sup> Figure 1.1 shows that the age structure effect consists of two elements. First, a higher concentration of population in productive ages may lead to an increase in labor supply, provided that labor market can absorb the large number of workers in a productive way. Second, due to a decline in family size and saving of childcare time, relatively more women are likely to enter the labor market, both in terms of higher participation and in a larger number of working hours. Consequently, our four sub-questions are:

- (i) What is the impact of demographic transition, i.e., a change of the distribution of the population across different age groups, on economic growth? (chapter 2)
- (ii) How does female labor force participation behavior change with fertility decline and economic development? (chapter 3)
- (iii) What is the impact of an increase in labor force participation of different age groups and by gender on labor productivity growth? (chapter 4)
- (iv) How does the effect of different determinants of labor productivity vary at different levels of age dependency? (chapter 5)

By answering these questions we should be better able to find out whether the expected demographic changes can accelerate economic growth, or pose a threat that can hinder economic growth.

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<sup>1</sup> The impact of a changing age structure on savings and investment is beyond the scope of the current thesis but will be the topic of future research in the near future (Choudhry, 2010).

## **1.2 Thesis outline and value addition**

The thesis consists of five chapters addressing the impact of demographic transition on economic growth through labor market dynamics in developing and emerging economies.

Chapter 2 determines the contribution of demographic variables to economic growth. For this purpose, we use an augmented Solow-Swan neoclassical growth model extended to include demographic variables. The demographic variables that will be included are the growth differential between the working-age population and the total population, child dependency and old-age dependency ratios. These variables are motivated by a transition of the augmented Solow-Swan neoclassical growth model formulated in output per worker growth into a comparable model formulated in output per capita growth. To estimate this model we use data for seventy countries over the period 1961-2003. Modern panel data techniques are employed in the empirical estimation. A comparison with the traditional cross-section approach shows that the panel data approach performs better due to the dynamic nature of the population age distribution.

The added value of the second chapter is twofold. First, we extend the theoretical framework for economic growth by incorporating the demographic variables in the model. Our results show that change in age composition of population and age dependency matters for economic growth. Second, we calculate the role of demographic variables in explaining the economic growth in China, India and Pakistan. Although the main objective of this chapter is to analyze the overall effect of demographic transition on economic growth, we focus on the impact of demographic variables on economic growth in China, India and Pakistan over the last four decades. In addition, we forecast their role in coming decades and provide policy suggestions to properly utilize their potential. From a policy viewpoint, our results underline the strong need to better understand the pace and timing of the demographic transition process and the transformation process of “demographic dividend” into economic growth. Most of the developing and emerging market economies are passing through or are about to enter a stage where they can actually get the benefits from the demographic transition. But there is no guarantee that the true quantum of

these benefits will be realized. Reasons are unpreparedness and lack of an adequate policy framework to utilize the demographic dividend.

Chapter 3 focuses on the change in female labor force participation as a result of fertility decline and economic development. This chapter determines the impact of demographic transition on female labor supply behavior for different age groups and investigates the relationship between women's labor force participation and per capita income levels. Several behavioral changes may occur along the demographic transition process. Long life expectancy can lead to changes in investment in human capital, saving behavior, the retirement decision and the attitude towards women in society. If the fertility rate declines and child care responsibilities diminish, women also have more time to participate in the labor market (Bruno and Rodrigo, 2007). Goldin (1995) and Mammen and Paxson (2000) show that the relationship between female labor force participation rates and per capita income around the world is U-shaped. To analyze the role of demographic dynamics on women's labor force participation and to investigate the existence of a U-shaped female labor supply behavior, we use a panel of 40 countries over the period 1960-2005. As the fertility rate may not be exogenous, since several studies found that those who participate in the labor force tend to have fewer children (Lesthaeghe, 1995; Sundström, 2000), we overcome the problem of reverse causation by treating the fertility rate as an endogenous variable and use an instrumental variable approach to estimate the parameters of our model.

The added value of the analysis in chapter 3 is threefold. First, it evaluates the impact of fertility decline on female labor supply behavior of ten different age groups over the period 1960-2000. It is found that fertility decline has a positive effect on female labor force participation but that the impact varies across different age groups. As was to be expected, we find that the positive effect of fertility decline is higher in the child-bearing age group of women aged 15-44. Nevertheless, the impact on other age groups also appears to be significant, which implies that studies that restrict the analysis to certain (prime) age groups will underestimate the overall impact of fertility decline on female labor supply. Second, the impact of fertility decline depends on the level of economic development of a particular country. In low income countries the impact of fertility decline is different than in high-income countries. A model with

interaction effects is used to capture the impact of various determinants of female participation at different levels of the capital stock per worker (as a proxy for economic development). Previous studies of Pampel and Tanaka (1986), Tansel (2002) and Fatima and Sultana (2009) already considered the square of the level of income per worker. In these three studies the coefficient of the level of income per worker is found to be negative and significant and that of its square to be positive and significant. However, since we find that the coefficients of other interaction effects are significant too, we conclude that only one interaction effect is not sufficient to uncover the supposed U-shaped relationship. Third, this chapter not only finds that the impact of fertility transition differs between age groups, but it also calculates the turning points of the explanatory variables for different age groups, the income level at which the impact of the explanatory variables changes sign.

The theory of demographic transition predicts that as a result of fertility decline there will be a change in the age composition of the population. The increase of the relative size of the working-age population may lead to more labor supply. Chapter 4 focuses on the impact of increasing labor force participation rates on labor productivity. One would assume that one of the factors affecting labor productivity is the availability of productive and decent employment. However, in developing countries, where there is already a substantial level of unemployment and underemployment, a rise in labor supply often results in further underemployment and unemployment, since these economies do not have the capacity to produce employment opportunities for the new entrants on the labor market. To evaluate the impact of increased labor supply, the relationship between labor force participation and productivity growth needs to be investigated (McGuckin and van Ark, 2005; Broersma, 2008). This chapter contains an empirical analysis of this relationship for 45 countries in different regions of the world over the period 1980-2005, with a particular focus on transition and developing economies.

The added value of the fourth chapter is threefold. First, our results show that there exists a tradeoff between productivity and labor force participation in the short term. Second, this tradeoff tends to fade away after several years, revealing that the increase in labor force participation has a positive effect on economic growth in the medium to long term. However, due to this short-term tradeoff effect, largely related



to the pro-cyclicality of productivity, previous findings that an increase in working-age population share opens a window of opportunity should be taken with care (Bloom *et al.*, 2002; Kelley and Schmidt, 2005; Mason, 2005). Third, although a number of studies already identified a tradeoff between productivity and labor force participation (Beaudry and Collard 2002; McGuckin and van Ark, 2005; Becker and Gordon, 2008; Broersma, 2008), most of these studies are restricted to high income countries. This chapter investigates the nature of this relationship for developing and emerging economies and finds that the intensity of this tradeoff varies across countries and is related to the income level. The tradeoff is weakest in developed high income economies, where it fades away in less than five years. By contrast, in developing and transition countries the tradeoff is stronger and weakens more slowly after multiple years.

Chapter 5 provides further insights on the divergence of labor productivity across different regions and income groups around the world. The purpose of this chapter is to test whether the age composition of population affects the impact of different determinants on labor productivity across countries. The empirical analysis is based on a panel of up to 110 countries over the period 1980-2005. Using a model with interaction effects, among which the age dependency ratio and social, economic and infrastructural determinants of labor productivity, we find that at higher levels of age dependency, the impact of certain productivity determinants becomes insignificant.

The added value of this final chapter is twofold. First, we find that the main determinants of labor productivity not only have a direct impact on labor productivity but that their impact is also conditional on the age composition of total population. Previous studies have investigated the effect of various determinants on labor productivity, among which gross capital formation, ICT investment, inflation and financial development (Islam, 2008; Belorgey *et al.*, 2006), as well as the effect of labor force participation rates (Feyrer, 2007; Choudhry and Van Ark, Chapter 4 of this thesis). However, to the best of our knowledge, no study before has considered interaction effects. Second, in this chapter, we investigate the effect of different

determinants of productivity in OECD and non-OECD countries separately<sup>2</sup>. Our results indicate that higher age dependency has a negative effect on labor productivity, not only directly but also via other social, economic and infrastructural determinants of labor productivity. This finding implies that if the working-age population grows larger during the process of demographic transition, productivity growth will boost, not only because of the direct effect of age dependency but also because of its interaction effects on other socio-economic determinants of labor productivity. Up to now, these interactive impacts have not been taken into account in the literature. Moreover, our findings also help to explain labor productivity differentials across high-income OECD countries, which are affected by an aging population, and low-income non-OECD countries.

### **1.3 Main findings of the thesis**

This thesis finds strong empirical evidence in favor of the hypothesis that changes in the distribution of the population across different age groups affects economic growth along the process of demographic transition. However, it is also clear that an increase of the relative size of the working-age population does not necessarily transform itself into a demographic dividend unless an adequate policy framework is adopted to realize this potential opportunity.

In relation to the research questions formulated in section 1.2, we draw five main conclusions from this thesis: (i) The distribution of the population across different age groups may boost economic growth temporarily (when working age population share dominates in total population share), (ii) Fertility decline has a positive effect on female labor force supply behavior, (iii) The relationship between women's labor force participation and per capita income around the world is U-shaped because women's labor force participation rates first fall during the process of economic development and then start to increase again, (iv) There exists a tradeoff between productivity and labor force participation in the short term, which fades away in the medium term providing opportunities for catch-up growth for emerging and developing economies, and (v) Age dependency has a negative effect on labor

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<sup>2</sup> In contrast to all those studies explaining GDP per capita, most studies analyzing productivity determinants focused on OECD countries only. One exception is Islam (2008).

productivity growth, as well as a negative effect on the impact of other social and economic variables on labor productivity growth.

### **Age structure and economic growth**

The impact of the distribution of the population across different age groups on economic growth is discussed in chapters 2 and 5 of this study. In chapter 2, we find that GDP per capita growth is positively related to the growth differential between the working-age population and the total population, and negatively related to child and old-age dependency ratios. Based on this model, we find that together these effects explain 46 per cent of growth in per capita GDP in China over the period 1961-2003, 39 per cent in India, and 25 per cent in Pakistan. All three economies show up a positive demographic dividend effect and they will continue to do so in the next decade.

In chapter 5, we also investigate the impact of age dependency on labor productivity. To better understand growth differentials across countries, more and more studies focus on productivity rather than just aggregate GDP effects (Hall and Jones, 1999; Kogel, 2005; Islam, 2008). We find that age dependency has a direct negative effect on labor productivity growth, as well as an indirect negative effect via other determinants of labor productivity. In addition, we find that child dependency is more harmful for economic and labor productivity growth in developing and emerging economies than old age dependency. It implies that declining child dependency in developing and emerging economies will boost labor productivity growth in these economies.

### **Fertility decline and female labor supply behavior**

In chapter 3, we investigate the relationship between fertility and female labor force participation. Fertility appears to have a large negative and significant effect on the participation rate of females in different age groups (15-19, 20-24, ..., 60-64), whereas the interaction effect between fertility and the capital-labor ratio (a proxy for economic development) appears to have a positive effect. This positive effect, however, is only significant for females aged between 15-19 and 20-24. The fact that the coefficient of the fertility variable is negative and that of the product term with the capital-labor ratio is positive indicates that fertility has a negative effect on the female

labor force participation rate in lower income economies and a positive effect in higher income economies. The turning point for the total female working-age population amounts to US \$69,410 available capital stock per worker. In other words, in countries located in Africa, South Asia, the Middle East, North Africa and South America, fertility affects participation negatively, while in countries located in Europe, North America and Oceania, fertility affects participation positively. The explanation is that the latter countries not only provide more child care facilities but also provide more financial support to families with young children, among which paid parental leave and childcare subsidies (Jaumotte, 2003). First, paid parental leaves help mothers of young children reconcile work and family life, and may strengthen labor market attainment through a job guarantee. Second, childcare subsidies reduce the relative price of childcare, thereby increasing the return of market work relative to home production (in addition to increasing effective income). The turning points in terms of capital stock per worker for females in the prime-age groups are higher than those for the younger and older age groups. It implies that teenagers and elderly women are the first who will enter the labor market as a result of fertility decline when income levels rise, then women in the younger age groups 20-24 and 25-29 and, finally, women in the age groups 30-34, 35-39 and 40-44.

Our results also point out that when fertility declines by four births per woman, which represents the difference between fertility rates in low-income and high-income economies, the total female labor force participation rate will rise by about 19 percentage points.

### **Economic development and female economic participation**

Chapter 3 of this thesis finds strong empirical evidence in favor of the hypothesis that the relationship between women's labor force participation and per capita income around the world is U-shaped. A microeconomic framework of the labor force participation decision is aggregated across individuals to show that fertility, the share of employment in agriculture, education and the income level (measured by the capital-labor ratio) are the key variables explaining the female labor force participation rate in countries at different levels of economic development. A quadratic functional form in the capital-labor ratio is estimated for females in ten different age groups using data for 40 countries in different income classes over the

period 1960-2000. For every age group and for every explanatory variable in the model we find a particular point where the regime of falling participation rates change into a regime of rising participation rates. The policy implication is that every country can eventually narrow the gap in labor force participation rate between men and women.

### **Tradeoff between participation and labor productivity**

In chapter 4, we study the relationship between productivity and participation in different regions of the world for the period 1980-2005. There generally is a strong tradeoff between productivity growth and participation, as the former tends to save jobs. However, the causes of this tradeoff as well as their intensity may differ between countries. By analyzing patterns of the participation-productivity tradeoff across regions and different income groups, we find that the intensity of the tradeoff varies across countries and is related to the income level of the country. The tradeoff is weakest in developed high income economies, where it fades away in less than five years. However, the tradeoff is stronger in developing and transition countries and weakens more slowly after multiple years. We also find that the tradeoff has become weaker after 1995 for all regions and income groups except for transition economies. The results show that Africa is a victim of low productivity trap because of unproductive employment growth, whereas the Southeast Asian region shows positive growth both in employment and productivity. Along with pro-cyclical nature of labor productivity, this diversity in the pattern of tradeoffs may be explained by differences in structural transformation phases and dissimilar labor market institutions between transition and developed countries. For example, developing and low income economies still mainly depend on agriculture for employment generation and this sector is less productive compared to other sectors because of high underemployment. The productivity-participation tradeoff is therefore the worst for most of the African and South Asian countries where the agricultural sector in many cases still accounts for half to more than two thirds of total employment.

In chapter 4 we also investigate the extent of this tradeoff for female workers and young and aged workers, and find that the impact of female and young workers (15-24 years) participation on labor productivity growth is negative and significant.

**Age dependency and labor productivity**

In chapter 5, we find that higher age dependency impacts labor productivity negatively not only directly but also modifies the effect of other social, economic and institutional determinants of labor productivity. These findings imply that the performance of these determinants is conditional on different levels of age dependency. At higher levels of age dependency, the impact of certain productivity determinants becomes insignificant. Separate analyses for 27 high income OECD countries and 83 other countries provide very similar kind of marginal impacts of gross capital formation (GCF), information and communication technology (ICT) and labor market reforms (LMR). However, the marginal impact of financial development slightly differs among OECD and other countries, We find that in high income OECD countries, financial development marginal effect on labor productivity curve is more steeper as compared to developing economies which implies that financial development will promote labor productivity at high level of age dependency This may be due to the different nature of age dependency in high income developed and developing economies.

*Introduction and Summary of Findings*