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- Response of the female labor force participation to the decline in fertility
- Adjustments in savings and retirement decisions to the increase in life expectancy
- Ability of policy adjustments and financial market developments to keep pace with life expectancy improvements.

There is a wide disparity across Asian countries vis-à-vis the stage of development of financial markets for retirement security in Asia. One question that comes to mind is what products financial markets should promote in Asia to enhance retirement security and financial well-being—annuities, reverse mortgages, longevity risk bonds, long-term care insurance, to mention a few—and how these would impact the economic growth in the region.

The regression analysis in the chapter is a "reduced-form" analysis that quantifies the dependence of growth in per capita income in Asia on population age structure as well as the various behavioral responses to aging. Technically, for the zero mean assumption for the error term in the regression equation to be valid, $(C + O)/P$ must be small (as the authors point out in their footnote). Is this really the case—is $(C + O)/P$ really small?

The estimation procedure uses ten-year lags of age structure (alternatively, lags of fertility and lags of life expectancy) as instruments for the age structure variables to get two-stage least squares (2SLS) estimates. The difference between the ordinary least squares (OLS) and 2SLS estimates can be used to test the endogeneity of the age structure variables. If the difference turns out to be statistically significant, then use the 2SLS estimates, not OLS. (This assumes the instruments used are valid instruments.)

There may be bias in the regression estimates due to omitted variables in the equation. The chapter talks about the behavioral responses (to the shift in age structure) that should be included in the regression equation. Financial market developments may be another set. These variables can be incorporated in the regression equation to extend the analysis, and perhaps get a sharper conclusion than "The effect of aging on economic growth will be ambiguous as the various behavioral responses may impose economic growth effects of differing magnitudes across different countries."

Comment Kwanho Shin

Age structure is significantly changing in Asia. This change is driven by many factors such as decline in total fertility rate, increase in life expec-

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tancy, and dynamic evolution of past variation. In shaping the demography structure, however, the decline in total fertility plays a dominant role. In the chapter, the authors attempt to empirically estimate the impact of aging on growth. They find that while the impact of youth-age population share is negative, the impact of old-age population share, especially in the long run, is not. They conclude that population aging may not impede growth prospective in Asia.

The most intriguing finding of the authors' is that while youth-age population share decreases economic growth, old-age population share does not. They argue that, even if the economy is aging, increased labor force participation of aged workers as well as female workers may help increase growth. They also argue that savings rate may also rise as the life expectancy increases, and hence a subsequent need to fund retirement income increase. They further point out that as the fertility rate decreases, the quantity-quality trade-off kicks in so that investment in human capital increases, leading to higher productivity of labor.

While rising life expectancy may increase saving, this is true as long as those who save belong to the working population. Once they become old, they have to dissave. Most empirical studies actually find that as the economy is aged, the saving rate decreases. See among others, Leff (1969), Mason (1987), Horioka (1989), Higgins (1998), and Bosworth and Chodorow-Reich (2006).

The equation adopted to empirically estimate the impact of youth- and aging-population shares may subject to an endogeneity problem. The authors regress the growth rate of output on youth- and old-age dependency rates and other control variables that determine the steady state level of per capita gross domestic product (GDP). While they have used a reasonable set of control variables, there may remain other unobserved country fixed effects. For example, if some unobserved country fixed effects generate faster TFR growth and at the same time lead to longer life expectancy, higher growth and larger old-age population share can be spuriously correlated.

I believe that how an aging economy affects growth potential is an important question. However aging is expected to influence the economy through a number of channels, which cannot be completely comprehended by estimating a reduced-form, single equation. In order to answer the question, we need more structure of the model and each channel through which aging affects growth potential should be investigated.

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