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## Comment      Roberto S. Mariano

In light of declining total fertility rate (TFR), increasing life expectancy, dynamically evolving birth and death patterns, and increasing share of old-age population in the age distribution in Asia, this chapter addresses the big question: “What are the economic consequences of population aging?”

The methodology used in the chapter uses both qualitative and quantitative approaches. The qualitative analysis in the chapter is structural and this part of the chapter brings up interesting research issues which I will not get into. Rather, I will focus my comments on the quantitative part of the chapter.

The main message in the chapter is that the economic impact of population aging depends on behavioral responses, in various dimensions, to the shift in the population age distribution. The major factors are:

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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 expect-