

Demographic Change and Fiscal Sustainability in Asia

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Abstract Changes in the population age structure can have significant effects on fiscal sustainability since they can affect both government revenue and expenditure. In this paper, we project government revenue, expenditure, and fiscal balance in developing Asia up to 2050 using a simple stylized model and the National Transfer Accounts data set. Rapidly aging countries are likely to suffer a tangible deterioration of fiscal sustainability under their current tax and expenditure system. On the other hand, rapid economic growth can improve fiscal health in poorer, relatively young countries with still-growing working-age populations. Overall, our results indicate that Asia's population aging will adversely affect its fiscal sustainability, pointing to a need for Asian countries to further examine the impact of demographic shifts on their fiscal health.

Keywords Fiscal projection · Tax · Public spending · Fiscal balance · Population aging · Asia

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1 Introduction

Asia-Pacific has experienced very dramatic changes in its age structure over the last few decades and these changes are certain to continue in the future. During the 1950 s and 1960 s, most Asian countries were young countries, with the notable exception Japan, but since 1970, the share of young people has declined rapidly and the share of those of prime working age has increased. The share of older people has also increased in many countries. This second phase of population aging is most noticeable in the sub-region of East Asia.¹

Asia is now entering the third phase of the demographic transition, where the old age population increases dramatically. Changes in population age structure matter for public finances for the simple reason that the beneficiaries of public programmes and taxpayers are different. For both developed and developing Asia, the benefit profiles usually show two peaks. The first peak is for children, driven by public spending on education, and the second peak is for the elderly, driven by public pensions and publicly funded health care spending. On the other hand, the tax burden profiles typically show one peak, at the peak of labor income. Thus, the fiscal balance can worsen rapidly if age-related expenditure such as health care for the elderly increases, while the tax base shrinks due to a decline of the working age population. For wealthier countries with well-developed public sectors, the key issue is whether age-related programs can be sustained as their population age.

In contrast, many developing Asian countries will see an improvement in their fiscal health because their working age populations will continue to expand. The danger is that fast-growing countries with favorable demographics will implement generous transfer systems that ultimately prove to be unsustainable. In fact, many lower income countries spend little on public sector programs for reasons that are largely unrelated to demographic conditions. This pattern is especially evident in the Asia-Pacific region, where the roles of the public sector are very different in high- and middle-income countries than in low income countries. As lower-income countries develop, however, a key issue is whether the public sector can expand while their populations age.

The data needed to document the region's current demographic profile and to project the future course of its population aging is comprehensive and widely available. However, data on the interface between population age structure and the economy is much more rudimentary and underdeveloped. Even less is known about trends in the age patterns of public program benefits. This is a serious gap in the informational base needed to understand how population aging will influence public sector programs and spending needs over the coming decades.

In this paper, we project government revenue, spending, and fiscal balance in developing Asia up to 2050. Lee and Mason (2015) projected public spending for education, health, and social protection spending for the Asia-Pacific,² but there is no study which projects government revenue, spending, and fiscal balance for the region. By using the National Transfer Accounts (NTA) data set, UN population projections, and other data sources for long-term real GDP projections, we estimate future fiscal burdens that result from both economic growth and demographic changes. We also offer a few alternative estimates based on alternative assumptions. For example, as countries anticipate or experience population aging, they are likely to adjust taxes or benefits if they are concerned

¹ See "Appendix Table 11" for population projections of all study countries.

² We follow Lee and Mason (2015), which is consistent with the definition by the Asian Development Bank.

about excessive growth of the government. This scenario is considered and discussed in the paper as well.

2 Estimation

2.1 Methodology

The methodology closely follows Lee and Mason (2015), which incorporates two main factors, namely (1) changes in population age structure and (2) changes in age-specific transfers, into fiscal projections. While Lee and Mason (2015) projected public spending for education, health, and social protection spending, we project government revenue, spending, and fiscal balance (see Sect. 2.1.2 for issue related with this projection).

2.1.1 Projection Method

Let per capita transfers to persons age x in year t in country z be designated by $b(z)\tau(x, t)$. For the purposes of projection we will use a normalized support ratio equal to public transfers per person relative to per capita income, $y(t)$, so that public transfers per person age x in year t in country z is equal to $b(z)\tilde{\tau}(x, t)y(t)$ where $\tilde{\tau}(x, t) = \tau(x, t)/y(t)$. Thus, given the normalized transfer profile per capita, transfers are assumed to increase at the same rate as per capita income.

The normalized profile shifts upward in a stepwise fashion as per capita income increases. In general, the normalized profile in year t is given by:

$$\tilde{\tau}(x, t) = \sum_{k=1}^k D_k[y(t)]\tilde{\tau}(x, k) \quad (1)$$

where $D_k[y(t)]$ is a dummy variable that takes the value of 1 if per capita income in year t falls in per capita income growth k (otherwise the dummy variable is zero) and $\tilde{\tau}(x, k)$ is the model profile for income group k . Please refer to the text for the income groups and the model profiles for each group.

Total transfers as a share of per capita GNP is thus computed as:

$$\begin{aligned} \text{Transfers as a percentage of GNP} &= \frac{b(z)y(t) \sum \tilde{\tau}(x, t)N(x, t)}{y(t)N(t)} \\ &= b(z) \sum \tilde{\tau}(x, t)N(x, t)/N(t) \end{aligned} \quad (2)$$

The model is applied separately to revenue and spending using separate age profiles.

We calculate the changes in the tax burden and spending given the base year age profile of tax and benefits and the projected population age structure:

$$\frac{\sum \tilde{\tau}(x, t_0)N(x, t)/N(t)}{\sum \tilde{\tau}(x, t_0)N(x, t_0)/N(x)} \quad (3)$$

Equation (3) is the ratio of per capita tax (spending) in year t relative to per capita tax (spending) on the program in the base year necessary to maintain the level of tax and benefits per person at each age.

Several features of this specification should be noted. First, it is important to understand that population size itself has no effect on tax revenue or public spending as a percentage of GDP although it affects the aggregate amount of revenue or spending. Since public expenditure, which benefits everyone, is assumed to increase at the same rate as per capita GDP, it does not affect our results. Non-tax revenue is assumed to increase at the same rate as per capita GDP, so they do not affect our results either. Rather, it is the population age structure that has a direct effect on revenue or spending as a share of GDP. Intuitively, we would assume that tax burdens and benefits are concentrated at particular age groups, as discussed above. Second, growth in per capita income within income groups does not affect transfers as a percentage of GDP, all other things being equal. We assume that countries increase tax and spending as per capita income rises. The larger relative size of the government in richer countries supports this assumption. Third, public transfers are scaled to match the initial level (year 2010 in this paper) of tax revenue, spending, and fiscal balance in each country. Countries with large public sectors are projected to have large public sectors in the future.

2.1.2 Issues

The rationales for using the two factors—(1) changes in population age structure and (2) changes in age-specific transfers due to projected changes in per capita income—are rather obvious. Countries are quite different in terms of their taxation and spending component. First, the age profiles of taxation very much depend on the tax base (i.e. the source of tax is labour, asset income, corporate, or consumption) but the base differs a lot across countries. For example, compared with Japan, the Korea, Rep. of (henceforth, Korea) relies less on income taxes. The financing of social welfare expenditure is also different in the two countries.

Broadly speaking, the tax base consists of direct and indirect taxes. The choice between direct and indirect taxes has long been the subject of debate in academic and political circles. Income taxes can be classified as direct taxes and the same is true for most taxes on assets and wealth. Indirect taxes such as value added tax fall on transactions such as consumption. Mstinez-Vazquez et al. (2009) show that in the last three decades the average ratio of direct to indirect taxes has been rising, especially in developed countries. This is in large part due to the implementation of social security contributions. The importance of income taxes has declined in developing countries, whereas it has remained flat in developed countries. Within indirect taxes, there has been an increase in consumption taxes, especially in developing countries.

There is a growing literature on the impact of the tax mix on economic growth, equity, and tax revenue. One part of this literature compares the effects of direct versus indirect tax choices in the context of the dynamic endogenous growth model. The evidence generally indicates that switching toward consumption taxation and away from income taxation has a significant positive impact on growth and a negative impact on income distribution (e.g. Li and Sarte 2004). Different taxes may also result in different evasion outcomes. Since income taxes are easier to evade than indirect taxes, tax authorities are more likely to rely on indirect taxes when there is widespread tax evasion. Developing countries tend to rely more on indirect taxes, whereas developed countries tend to rely more on direct taxes. A number of empirical studies show that reliance on direct taxes rises with per capita income (Hines and Summers 2009; Estrada et al. 2015). This has significant implications for the tax burden by age, since the age profiles are quite different depending on the incidence of tax on income versus consumption.

Second, there is a large variation across countries in terms of the expenditure mix. For example, about 40 % of central government expenditure is non-age related in the median Organisation for Economic Cooperation and Development (OECD) country, compared with nearly 70 % in a country such as Korea. This is because Korea still devotes a relatively large share of government spending to public investment and economic infrastructure rather than social welfare related spending. Hence, Korea is less likely to be affected by population aging if we hold the profiles constant, compared with other OECD countries.

Third, there is an issue specifically relevant to Japan, which provides the target profiles of our model. Japan's tax revenue as a percent of GDP decreased from 14 % in 1990 to less than 10 % in 2012. As a result, Japan's tax burden decreased by 4.2 % points, whereas the average tax burden ratio in OECD changed little during the same period (around 25 %). In fact, Japanese government cut their taxes in 1994, 1998 and 1999, whereas social welfare expenditure rose in large part due to population aging. Furthermore, the compensation of employees has grown little during the same period due to sluggish economy. Thus, the gap between spending and revenue has been expanding, resulting in an accumulation of Japanese government debt. Simulation results in Kim (2015) show that Japan's fiscal position may not have deteriorated in the absence of tax cuts. The point here is that while Japan's welfare expenditure has increased, spending on economic infrastructure and others areas has gradually decreased. Japanese-style debt financing will not be possible for most Asian governments.

Our projections do not explain why some governments are bigger than others. In fact, there is no solid consensus on the determinants of government size, even though richer countries typically have larger governments. Public services require a certain critical minimum size, which implies that smaller economies tend to have bigger governments (Alesina and Wacziarg 1998). Openness may be linked to government size in a variety of ways because openness is a source of destabilising external shocks (Rodrik 1996). Certain modes of political representation, in particular, proportional and parliamentary democratic systems, can also induce bigger government (Persson and Tabellini 2004).

We do not address differences across countries such as the tax base, composition of social expenditure, government size, or reliance on debt financing. In fact, the literature provides little by way of formal modeling of long-term forecasts of how tax revenues or public sector spending will change. Consequently, our projections based on recent revenue and spending trends in higher income Asian countries are a guide to how revenue and spending are likely to change in lower-income Asian countries. In spite of these limitations, it is nevertheless useful to understand the deteriorating fiscal trends in countries like Korea and Japan. For one, understanding Korean and Japanese trends can alert many Asian countries to the unsustainability of their current tax and expenditure systems.

Above all, although the tax base and expenditures are key determinants of the age profile, it is clear that projections of government revenues, tax revenues, expenditures, and debt will also depend on economic growth and population age structure. For example, Korea's tax base will shrink and expenditures will increase markedly due to population aging and a decline in the potential growth rate. So it is plausible to assume that the impact of population aging will be substantial even if we allow for diverse patterns of tax bases and expenditure across Asian countries. Due to an older population and slower growth, Korea's public debt to GDP ratio is projected to rise from 35 % in 2015 to over 200 % by 2060 (National Assembly Budget Office 2015).

2.1.3 Literature Review

A numbers of studies indicate that the age structure of the population has a big impact on economic growth (Bloom et al. 2010; Park and Shin 2011; European Commission 2015). Some found that a higher proportion of the elderly reduces productivity and savings, and increases government expenditures (Fougère et al. 2009; Bloom et al. 2010; Sharpe 2011; Walder and Döring 2012). The demographic shift most likely intensifies the old age dependency ratio, implying that a smaller working age group supports a larger elderly group (Navaneetham and Dharmalingam 2012). Many studies uncover a negative correlation between population ageing and economic growth (Narciso 2010; Bloom et al. 2010; Lisenkova et al. 2012; Walder and Döring 2012), which may be due to the weakening of physical ability, tastes and demand. Changes in public expenditure, consumption and saving associated with population are projected to cause significant negative effect on economic growth. Number of studies (e.g., Weil 2006; Sobotka et al. 2010; Börsch-Supan 2013) confirm that population aging is a global phenomenon, although the level and speed of aging differs a lot across countries. The adverse impact of population aging on economic growth has been significant, especially since the global financial crisis (Lee et al. 2011).

Making use of median values for the share of pensioners in the population, Dang et al. (2001) estimated pension benefits, health care spending and other age-related spending of OECD countries over 2000–2050. Their study predicts an increase in age-related spending of around 6 % points of GDP.³ Pension reform can, to a certain extent, compensate for the adverse impact of older populations on sustainability of pension systems.

European Commission (2015) estimated aging forecast public expenditure for 2013–2060. The forecasts were made for age-related expenditures such as pensions, health care, long-term care, education and unemployment benefits. The exogenous macroeconomic variables were labor force participation, employment, unemployment rates, labor productivity and the real interest rate. The empirical results suggest that low fertility, longer life expectancy and migration policy will transform the EU's demographic structure considerably in the coming decades. The overall size of the population is likely to increase by 2060 but will be much older.⁴ The old-age dependency ratio will rise almost twofold over the long-term. In other words, the EU now has four working-age people for every person aged over 65 years but the ratio will drop to about two in the future. The study projects falling labor supply and growing pressures on public expenditures.⁵ The increase in age-related expenditures between 2013 and 2060 are primarily driven by health care and long term care spending.

Using demographic projections from the UN, Clements et al. (2015) make long-term projections on public pension and health care spending for countries around the world between 2015 and 2100. To reduce the fiscal effect of population aging, they suggest policies such as boosting fertility rates. In addition, allowing more migration from younger countries would influence the age structure and create breathing room for helpful reforms. Along with better tax systems and more efficient public expenditures, policies that increase the participation of women and elderly in the labor market can mitigate the effect of

³ They assumed that the change in share of GDP of other government spending and revenues as a constant thus a share of GDP change in age-related spending is fully incorporated in the overall primary balance.

⁴ Up to 2050, the EU population is expected to increase from 507 million in 2013 by almost 5 %, when it will touch the highest at 526 million and will thereafter descent slowly to 523 million in 2060.

⁵ The total employment rate (for individuals aged 20–64) in the EU is projected to increase from 68.4 % in 2013 to 72.2 % in 2023 and 75 % in 2060 whereas the number of employed would shrink.

population aging. The authors estimate that without further reforms, public spending on age-related programs such as pensions and health care would rise by 9 and 11 % points of GDP in developing countries and developed countries, respectively, between 2015 and 2100. Furthermore, declining populations can reduce economic growth and make it more difficult to reduce public debt as share of GDP. Lee and Mason (2015) estimated government spending on education, health care, and social protection in developing Asia up to 2050. In projecting the potential consequences of demographic change and economic growth, they use United Nations' population projections and long-range projections for real gross domestic product (GDP) from other sources. They find that the GDP share of public spending on health care and social protection will grow since demographic change and economic growth are mutually reinforcing. GDP share of public spending on education will decrease in Asia and the Pacific due to declining fertility rate. The magnitude of these effects varies depending on the speed and of demographic change and the current level of public expenditure, which differ a lot across economies. According to the study, social spending in the Korea, Rep. of; the China, People's Rep. of; and Taiwan is projected to more than double as a share of GDP by 2050, while the increase will be more modest in other areas of Asia and the Pacific. Studies comparable with our study have been summarized in "Appendix Table 2".

In sum, at a broader level, most studies propose quite similar policy tools to sustain economic growth and tackle the effect of demographic change when populations are aging. Policy implications such as promoting immigration, extending the retirement age, improving social planning, and increasing the fertility rate of couples are some frequently suggested policy tools. Yet, there is no one-size-fits-all policy tool kit that can adequately tackle the challenge of aging population in all countries all the time. Most of the literature suggests that although the broad contour of policy options may be similar across countries, the actual policy measures must be country-specific to the extent that the speed and scale of aging, as well as impact of aging, differs from country to country. Other policy-relevant parameters, such as the fiscal space available to a country, will also dictate country-specific responses to aging.

2.2 Data

In this section, we describe the data used in our analysis.

2.2.1 Population and GDP Growth

UN World Population Prospects, 2012 Revision (2013a), prepared by the UN Population Division of the Department of Economic and Social Affairs, is used for our analysis. All projections are based on the medium fertility scenario. This scenario assumes that fertility will continue to decline in high fertility countries and will recover towards replacement in low fertility countries. Details are available on the UN Population Division website.⁶

Long-term projections of real GDP are inherently difficult to construct. We rely on three sources of data—OECD projections for Japan, India, Indonesia, Korea, China, and Non-OECD countries up to 2060; Asian Development Bank (ADB) projections for ADB member countries up to 2030; and the International Macroeconomic Data Set from the United States (US) Department of Agriculture for 190 countries up to 2030. Since ADB and USDA provide projections only up to 2030, OECD member and non-member

⁶ <http://www.un.org/en/development/desa/population>.

projections are used as a benchmark for extended projections up to 2050. Countries have been classified into four groups based on these three data sets. The projection results are influenced by the GDP growth assumptions only when countries graduate to a new income group. Many low-income countries do not exceed US \$5000 per capita income throughout the entire projection period, and many others reach a higher income level only near the end of the projection period.

2.2.2 Public Sector Finances

Data on public sector finances are based on National Transfer Accounts (NTA), a new set of economic accounts, which document economic flows to and from ages in a manner consistent with the UN System of National Accounts. Research teams in about 50 countries on six continents are currently collaborating in the construction of NTA. Accounts have been constructed for eleven Asian economies—Bangladesh, Cambodia, China, India, Indonesia, Japan, the Philippines, Korea, Taiwan, Thailand, and Vietnam.

The theoretical foundations of the accounts build on Lee (1994a, 1994b) and some details and preliminary results are reported in Lee et al. (2008) and Mason, Lee et al. (2009). The most recent and comprehensive treatment is Lee and Mason (2011). Methods are fully documented and explained in United Nation Population Division (2013b) and on the NTA website: www.ntaccounts.org.

In NTA, transfer inflows refer to flows received by the beneficiaries of all public programmes, which are used for projections of public spending. Transfer outflows refer to the flows from taxpayers who are funding the programme, which include taxes and other sources of revenue. For example, if the government runs a deficit, transfer outflows are equal to taxes, plus other sources of revenue that make up the difference—grants, net public asset income, and dis-saving represented by the sale of public debt. In NTA, taxes provide the age pattern of all public transfer outflows, but not the macro controls. Instead, the macro controls are equal to public transfer inflows plus any net transfer of the programme to Rest of World (ROW) entities (Table 1).

Public transfer outflows are assigned to taxpayers based on rules that are similar to those followed in generational accounting. It is constructed in two steps. First, age profiles of taxes and social contributions are constructed. Second, these age profiles are combined with information about how each type of government programme is funded (the “source”) to construct age profiles of public transfer outflows by purpose (Table 2).

Public transfer inflows are public benefits, classified by purpose: education, health, pensions, and other public programs. This classification is consistent with the UN Classification of Functions of Government (COFOG), but simplified to emphasize large inter-age transfers. These public transfer inflows provide the age pattern of government spending. Distinguishing the purpose of inflows is important for constructing age profiles. Transfer inflows for many public programs are assigned to the age group of the intended beneficiary of the public program in question using techniques described below. The inflows from public collective goods, e.g., national defense or diplomacy, public administration, and public safety programs are assigned equally among all members of the population, i.e., on a per capita basis.

Public spending on social welfare is much lower in low income Asian countries than in high income countries in per capita terms, but also relative to standards of living. As incomes grow in the region, taxes and public spending will become increasingly important. Exactly how countries adjust to higher income is a matter of policy and will be determined by political decisions within each country.

Table 1 Per capita GDP growth rate assumptions

Group and countries	Annual rate of real per capita GDP growth (%)	
	2010–2030	2030–2050
A: Mongolia, PRC, Bhutan, Sri Lanka, Cambodia, Myanmar, Laos, India, Vietnam	6.0	3.0
B: Maldives Islands, Solomon Islands, Indonesia, Papua New Guinea, Thailand, Macau, Bangladesh	4.0	2.5
C: Hong Kong, Taiwan, Philippines, South Korea, Afghanistan, Pakistan, Nepal, Singapore, Azerbaijan, Georgia, Armenia, Kazakhstan, Malaysia, Tajikistan, Turkmenistan, Uzbekistan	3.0	2.0
D: Japan, Brunei, all others	1.0	1.0

We use age profiles of tax and public spending by age for Asian countries for which NTA profiles are available, as follows. All profiles are per capita flows to persons at each age expressed relative to the average per capita labor income of those aged 30–49. Thus, given a particular profile, per capita flows rise at the same rate as projected per capita labor income for prime age adults. In addition, we assume that as countries become members of higher income groups that they will experience additional changes in their fiscal profiles. Four model profiles, constructed for the varying levels of income shown in Table 1, are used to allow for the effects of income, as shown in Table 3.

The profiles thus obtained for each income group are shown in Figs. 1 and 2. The level of spending and revenue rises relative to income as per capita income reaches higher levels.

In Fig. 1, the age patterns of government spending that are particularly visible for the older people due to the dramatic increase in their health expenditure. For low and middle income countries, the increase in spending on health care at older ages is less pronounced than for higher income countries, where health care spending rises very sharply with age.⁷ All projections are scaled and adjusted proportionately to match the actual observed values of government expenditure in 2010 as a percentage of GDP for each country, provided by ADB. This guarantees that our projections depend on *county specific* growth rate, age structure change, levels of tax revenue versus non-tax revenue, the share of social welfare spending, and the level of debt financing.

Again, Fig. 1 does not include the other public spending, which benefits everyone (i.e. allocated equally to the whole population) such as national defense. Nevertheless, other public spending is assumed to increase the same rate as per capita GDP and we calibrate the aggregate controls for whole countries at their 2010 values. Therefore, using the profiles, excluding the other public spending, which benefit everyone does not affect the results. Likewise, using the tax profile to estimate government revenue, including non-tax revenue will not change our results since we assume that non-tax revenue as a percent of GDP will not change over time.

⁷ Lee and Mason (2015) project government spending for education, health, and social protection respectively.

Table 2 Mapping of IMF government financial statistics (GFS)—revenue to tax profiles *Source* UN Population Division (2013b)

GFS classification	Suggested NTA tax source
<i>Taxes</i>	
Taxes on income, profit, and capital gains	
Payable by individuals	Labour and asset income
Payable by corporations and other enterprise	Asset income
Taxes on payroll and workforce	Labour income
Taxes on property	Asset holding
Taxes on goods and services	Consumption
Taxes on international trade and transactions	Various
Other taxes	Various
Social contributions	Labour income
<i>Subsidies</i>	
To public corporation	Various
To private enterprise	Various
<i>Grants</i>	
From foreign government	
Current	Rest of the world
Capital	Exclude from NTA flow account
From other general government units	Zero for general government
<i>Other revenue</i>	
Property income	Not a public transfer (asset income)
Sales of goods and services	Other
Fines, penalties, and forfeits	Other
Voluntary transfers other than grants	
Current	Other
Capital	Exclude from NTA flow account
Miscellaneous and unidentified revenue	Other

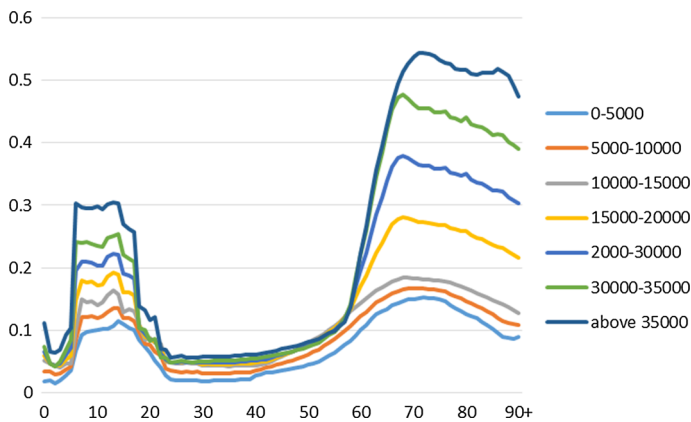
3 Fiscal Projections

In this section, we present our projections for government expenditures, tax revenues, government revenues, and fiscal balance up to 2050.

Actual values (1995–2010) and projections of government expenditure to 2050 are provided in Table 4. Populations are aging, which should push up the level of social welfare spending. In addition, higher levels of per capita income should push up per capita spending on social welfare. For a few countries (see Table notes), spending by all levels of government are included, but in most cases, the values refer to central government spending only.

Table 3 Model profiles based on per capita income

Income range (per capita GDP in US\$ 2005 prices)	Model profiles
Under \$5000	Asian low income countries. For tax, PRC 2002, Cambodia 2009, and Indonesia 2005. For education and health India 2004, Indonesia 2005, Philippines 1999, PRC 2002, Thailand 2004, and Vietnam 2008. For social protection, PRC 2002, Philippines 1999, and Thailand 2004
\$5000–10,000	Interpolated
\$10,000–15,000	Korea 2000 and Taiwan 1998 for tax and expenditure
\$15,000–20,000	Interpolated
\$20,000–30,000	Interpolated
\$30,000–35,000	Japan 1994
\$35,000 or more	Japan 1999 and Japan 2004

**Fig. 1** Model profiles of public transfer inflow on social welfare. *Note* Social welfare on education, health, and social protection by age of recipient as share of labor income 30–49, Asia

3.1 Expenditure

On average, the increase amounts to a 3.3 % rise in the percentage of GDP spent on public expenditure.⁸ The simple average of developing Asian countries increases from 24.4 % of GDP in 2010 to 27.7 %, if we exclude countries with missing data in any particular period. The rise in public expenditure is particularly dramatic in East Asia, with the average share of GDP rising from 16.9 % of GDP in 2010 to 27.5 % of GDP in 2050. In the PRC, the projected rise is from 22.4 to 33.9 % of GDP, a projected increase of 51 %. This sharp increase reflects rapid aging combined with relatively high rates of economic growth. In Korea, it will increase from 19.8 % in 2010 to 32.4 % in 2050, in large part due to population aging. In a number of other countries outside East Asia, public expenditures will also grow quite rapidly.

⁸ The calculation excludes who are missing any period of observations.

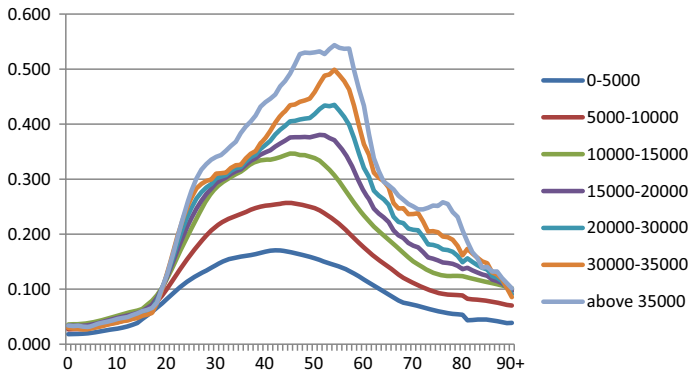


Fig. 2 Model profiles of public transfer outflow by age of tax payers. *Note* Share of labor income 30–49, Asia

For a few countries, only a small increase is projected because projected economic growth and projected population aging are limited. Government expenditure in Bangladesh, India, and Philippines are projected to reach 12.6, 16.5 and 16.9 % of GDP, respectively, in 2050. Note that spending in Singapore is quite low in 2050 (16.9 %), but its mandatory provident fund, the Central Provident Fund, is not included in the figures.

High public spending is not limited to Asia's higher income countries. Several Central and West Asia countries (Armenia, Azerbaijan, Georgia, and Kyrgyz Republic), South Asian countries (Bhutan and Maldives), and Timor-Leste have high levels projected for 2050. These projections may be quite conservative. We only emphasize the kind of benefits which are affected by the age structure. Other public spending may also increase rapidly, but they are not considered here. Other public expenditure can only be assessed with more extensive data with detailed information on the different components of public spending.

3.2 Revenues and Fiscal Balance

Estimates of tax revenue and government revenue as a percentage of GDP for selected economies up to 2050 are presented in Tables 5 and 6. Again, for a few countries (see Table notes) revenue at all levels of government are included, but in most countries, the values refer to central government revenue only. Tax revenues average 15.2 % of GDP (simple average of country values) in Asia. The average figure is projected to increase to 20.2 % of GDP by 2050, ranging between 1.5 and 39.5 % of GDP (Table 7).

The projected increase in revenue is driven by an increase in income level, and in some developing economies by increase in working age population as well. Since we assumed that the share of non-tax revenue as a percent of GDP will not change over time, the percentage change of tax revenue over time is the same as the percentage change of government revenue.

The importance of tax revenue, currently and in the future, varies considerably from country to country. Very large increases are projected for PRC, where tax revenue as a share of GDP soared from 9.9 % in 1995 to 18.2 % in 2010, and it is projected to further increase to 37.3 % until 2050, an increase of 105 % for the next 40 years. But for Korea and Taiwan, tax revenues increase very little since the negative effect of population aging partially offsets the positive effects of growth. High levels of government revenues are not

Table 4 Government expenditure as % of GDP *Source* ADB and calculations by authors

	1995	2000	2005	2010	2020	2030	2040	2050
<i>Developing member economies^a</i>								
Central and West Asia								
Afghanistan	–	–	16.5	20.6	–	–	–	–
Armenia	24.0	20.1	18.0	27.6	28.4	29.7	30.3	32.1
Azerbaijan	20.1	16.2	16.8	27.6	27.7	30.4	30.6	31.1
Georgia	–	16.3	26.6	34.0	34.7	35.8	35.8	36.2
Kazakhstan	25.7	22.2	25.6	22.0	–	–	–	–
Kyrgyz Republic	27.8	18.0	20.4	31.2	31.3	32.8	32.8	33.4
Pakistan	23.0	18.9	16.8	20.2	–	–	–	–
Tajikistan	17.4	14.7	19.4	25.1	25.3	26.1	26.2	26.7
Turkmenistan	20.1	23.9	19.7	14.1	–	–	–	–
Uzbekistan	32.6	28.9	22.5	21.5	–	–	–	–
East Asia								
China, People's Rep. of ^b	–	16.3	18.3	22.4	25.2	26.1	29.3	33.9
Hong Kong, China	16.4	17.4	16.5	17.0	18.7	20.6	21.4	21.8
Korea, Rep. of	15.3	17.2	20.1	19.8	20.9	28.2	30.9	32.4
Mongolia	19.7	30.0	22.7	33.8	–	–	–	–
Taipei, China	14.3	22.6	15.1	13.9	16.6	21.0	25.9	28.2
South Asia								
Bangladesh	14.4	14.5	15.0	12.7	12.5	12.5	12.5	12.6
Bhutan	37.2	42.2	35.4	35.6	34.9	38.5	39.0	43.6
India	14.1	15.5	13.7	15.4	15.3	15.2	15.3	16.5
Maldives	36.6	37.3	45.5	40.3	39.6	44.0	44.4	45.5
Nepal	16.6	16.3	15.3	21.8	21.5	21.1	21.2	21.3
Sri Lanka	29.6	25.0	23.8	22.1	22.5	24.5	24.7	24.8
Southeast Asia								
Brunei Darussalam	66.0	40.6	32.1	36.9	37.2	38.6	39.5	41.4
Cambodia	14.8	14.8	13.2	21.3	21.2	21.4	21.4	21.5
Indonesia	14.7	15.8	18.4	16.2	16.4	16.5	16.8	18.1
Lao PDR	26.7	20.8	18.4	24.2	24.2	24.3	24.5	24.8
Malaysia	22.1	22.9	23.0	25.5	24.6	26.4	26.4	28.6
Myanmar	9.8	3.5	–	18.9	–	–	–	–
Philippines	18.2	18.1	16.9	16.9	16.9	16.8	16.9	16.9
Singapore	15.6	18.5	14.4	14.8	14.5	14.7	14.9	14.8
Thailand	15.3	16.8	17.3	19.2	19.2	22.1	22.6	26.1
Vietnam ^b	23.8	22.6	25.1	27.2	–	–	–	–
The Pacific								
Fiji	26.0	28.5	27.3	27.7	27.7	27.7	27.5	29.9
Micronesia, Fed. States of	77.0	67.2	59.3	67.7	–	–	–	–
Papua New Guinea	28.3	32.9	35.2	30.7	30.6	30.4	30.3	30.2
Samoa	40.5	31.2	32.7	34.7	35.1	35.0	35.0	35.1
Solomon Islands	32.3	31.6	34.6	39.7	–	–	–	–
Timor-Leste	–	–	5.7	18.4	18.3	18.1	18.1	18.6

Table 4 continued

	1995	2000	2005	2010	2020	2030	2040	2050
Tonga	26.3	22.2	21.2	28.0	28.2	28.0	28.1	28.3
Vanuatu	29.3	26.0	18.4	26.3	26.3	26.0	25.9	25.9
Developed member economy ^a								
Japan	16.1	18.3	16.0	18.0	20.5	21.8	23.9	24.8

^a Data refer to central government, except for Bangladesh, Georgia, Kiribati, the Kyrgyz Republic, Pakistan, and Tajikistan, where data refer to consolidated government or general government

^b Expenditure includes local government expenditure

limited to East Asian countries. Several Central and West Asia countries (Armenia, Georgia, and Uzbekistan), South Asian countries (Bhutan and Maldives), and many countries in the Pacific have high level of government revenue. Only Japan (central government) will experience a decline in tax revenue as share of GDP due to its shrinking working age population.

Some countries rely much more on non-tax revenues for government spending. Timor-Leste is an extreme case where the tax revenue accounts for only 1.5 % as percent of GDP in 2010, even though government revenue is 22.0 % of GDP in 2010. This is because foreign aid makes up the lion's share of the government budget. Another extreme case is Brunei Darussalam, where the difference between tax revenue and government revenue is about 20 % point as a share of GDP in 2005. The non-tax revenue is revenue from petroleum and natural gas sales. Mongolia is another significant outlier. Projections for these countries are not realistic and hence some estimates are dropped from our analysis.

Fiscal balance is the government's income from tax and other revenues, including the proceeds of assets sold, minus government spending. When the balance is negative, the government has a fiscal deficit. When the balance is positive, the government has a fiscal surplus. The projected fiscal balance is calculated as the difference between the projected increase in tax revenue and projected spending. PRC and Bhutan show the most dramatic improvement in fiscal balance between 2010 and 2050.

However, our projections for revenues as well as fiscal balance should be interpreted with extreme caution. In contrast to our spending projections, our revenue projections are not conservative. In the real world, raising taxes would be more difficult than raising government expenditure. This is especially true for rapidly growing countries, i.e., country group A in our model (Mongolia, PRC, Bhutan, Sri Lanka, Cambodia, Myanmar, Laos, India, and Vietnam). As expected, our results predict fiscal improvement for these countries. For example, PRC recorded a fiscal deficit of 1.7 % in 2010, but our projection shows a fiscal surplus of 6 % in 2050. The same is true for Bhutan, which recorded the fiscal surplus of 1 % in 2010. The surplus is projected to increase further to 10 % in 2050, the highest level among Asian countries.

Figures 3 and 4 present the average of the actual and projected government expenditure, government revenue, tax revenue, and fiscal balance as percent of GDP. These are unweighted simple average of developing Asian countries, which is limited to all countries for which we have estimates and projections for 1995–2050. The simple average shows that on average revenues tend to rise faster than expenditures in our model. As a result, the fiscal deficit declines over time.

In fact, as countries anticipate or experience the effects of changes in their population age structure, they are likely to adjust taxes or benefits if they are concerned about the

Table 5 Government tax revenue as % of GDP *Source* ADB and calculations by authors

	1995	2000	2005	2010	2020	2030	2040	2050
<i>Developing member economies</i>								
Central and West Asia								
Afghanistan	–	–	3.8	8.9	9.8	11.0	12.0	12.7
Armenia	10.6	14.8	14.3	20.2	20.8	21.0	20.8	21.3
Azerbaijan	10.8	12.2	14.0	12.4	12.8	19.2	19.3	18.9
Georgia	–	14.6	20.8	23.5	23.2	22.9	22.5	22.2
Kazakhstan	15.8	20.2	26.3	13.4	19.8	19.9	20.1	26.7
Kyrgyz Republic	15.1	11.7	16.2	17.9	18.1	18.4	19.0	19.1
Pakistan	13.8	10.6	10.1	10.1	10.9	11.5	11.9	12.2
Tajikistan	8.4	13.1	16.5	18.0	18.4	18.9	19.6	19.8
Turkmenistan	–	23.0	–	–	–	–	–	–
Uzbekistan	27.8	–	21.5	20.4	21.7	22.6	23.0	23.0
East Asia								
China, People's Rep. of ^b	9.9	12.7	15.6	18.2	27.3	26.8	34.9	37.3
Hong Kong, China	11.2	9.7	12.3	13.6	15.2	14.5	13.9	13.3
Korea, Rep. of	15.2	17.0	13.9	14.0	14.4	17.0	16.2	15.6
Mongolia	16.2	21.3	22.8	31.9	32.7	33.1	33.3	–
Taipei, China	10.3	13.3	9.1	8.0	8.9	9.6	10.4	9.9
South Asia								
Bangladesh	7.9	6.8	8.6	7.8	8.4	8.8	9.0	8.9
Bhutan	6.6	10.0	9.4	13.3	14.5	22.4	22.7	29.7
India	6.9	6.5	7.3	7.3	7.6	7.9	8.0	12.0
Maldives	13.6	13.8	13.6	10.7	11.6	18.0	18.5	18.2
Nepal	8.4	8.1	9.2	13.4	14.7	15.8	16.4	16.6
Sri Lanka	17.9	14.2	13.7	12.9	12.8	19.0	19.1	19.1
Southeast Asia								
Brunei Darussalam	18.4	23.4	33.1	–	–	–	–	–
Cambodia	5.3	7.3	7.7	10.7	11.2	11.6	11.9	11.8
Indonesia	16.0	8.3	12.5	11.2	11.6	11.9	11.9	17.8
Lao PDR	9.4	10.6	9.7	13.5	14.6	15.6	16.3	16.6
Malaysia	18.7	13.2	14.8	13.7	14.6	19.9	20.1	21.9
Myanmar	3.7	2.0	–	3.2	3.4	3.4	3.4	3.5
Philippines	16.3	12.8	12.4	12.1	12.7	13.1	13.5	13.7
Singapore	15.9	15.1	11.5	13.2	13.1	12.7	12.3	12.0
Thailand	16.4	12.8	15.3	14.6	14.8	21.7	20.9	27.1
Vietnam ^b	19.1	18.0	21.0	22.4	23.5	23.8	23.5	22.7
The Pacific								
Fiji	21.9	19.9	21.0	21.6	21.8	22.1	22.4	33.5
Micronesia, Fed. States of	9.5	11.9	11.7	12.0	12.9	13.6	14.3	14.8
Papua New Guinea	19.5	23.8	24.8	24.4	25.4	26.5	27.4	28.1
Samoa	22.5	20.6	20.6	24.2	24.5	25.1	25.8	26.6
Solomon Islands	21.4	19.1	24.3	34.0	35.3	36.9	38.3	39.5
Timor-Leste	–	–	1.5	1.2	1.2	1.3	1.4	1.5

Table 5 continued

	1995	2000	2005	2010	2020	2030	2040	2050
Tonga	13.4	15.8	19.2	16.1	16.4	17.1	17.5	18.0
Vanuatu	19.6	15.7	16.4	16.0	16.9	17.6	18.2	18.5
Developed member economy ^a								
Japan	10.7	10.4	10.2	8.9	8.8	8.6	8.3	8.1

^a Data refer to central government, except for Bangladesh, Georgia, Kiribati, the Kyrgyz Republic, Pakistan, and Tajikistan, where data refer to consolidated government or general government

^b Tax revenue includes local government tax revenue

growth of the government. To address this issue, an alternative estimate based on the assumption of *status quo* is presented in the appendix table. The *status quo* scenario projects tax revenues as a percent of GDP assuming that all countries maintain the fiscal balance of 2010 until 2050. The “Appendix Tables 13 and 14” shows that the tax revenue as a percentage of GDP for PRC increases to 29.7 % in 2050 instead of 37.3 %, as in the original scenario. The opposite is true for Korea or Taiwan. Tax revenues for Korea are projected to increase to 26.6 % in 2050 (instead of 15.6 %) if fiscal balance is held constant. For Taiwan, tax revenues rise to 22.3 %, instead of 9.9 %.

3.3 Decomposition Results

The projections of tax revenue, public sector spending, and fiscal balance are driven by changes in the level of taxation and spending and changes in age structure. Although the level of taxation and spending have been indexed to per capita income, it would be a mistake to interpret this as a causal relation between income and the level of spending. Instead correlations of income may account for some or all of the changes in the level of spending.

The analysis, presented in Tables 8, 9, 10, is based on a simple decomposition procedure. The value in the first column of numbers, the 2010 value, is the actual share of GDP in 2010. The second column is the projected change in the percent of GDP between 2010 and 2050. The third column reports the effect of changing age structure calculated by holding the level of tax, spending, and fiscal balance at their 2010 levels, using population age structures for 2010 and 2050. The next column reports the difference between the total change and the change due to age structure as the amount due to age specific changes in the level of tax and spending. The interaction between changes in the level of taxes, benefits, fiscal balance, and age structure are reported in the following column. The final three columns in the table report the change due to age structure, age-specific level of spending, and interaction between the two as a percentage of the 2010 value (Tables 8 and 9) or as a percentage of percentage change from 2010 value (Table 10). These values control for the large effect of the initial level of spending and allow us to focus our attention on the importance of age structure and age-specific level of spending.

For government expenditures the effects of changing age structure and changing levels of age specific spending mutually reinforce each other in East Asia (Table 8). The age structure effects are by far the largest in East Asia, and particularly in Korea, Hong Kong, and Taiwan. In those economies, age structure changes will raise government expenditure by 2.5–4.9 % points as a share of GDP by 2050. The effects are large in other countries, but nowhere near this large. The interaction effects are by far the largest in East Asia.

Table 6 Government revenue as % of GDP Source ADB and calculations by authors

	1995	2000	2005	2010	2020	2030	2040	2050
<i>Developing member economies^a</i>								
Central and West Asia								
Afghanistan	–	–	6.9	10.8	11.7	12.9	13.9	14.6
Armenia	14.4	15.9	16.2	21.7	22.3	22.5	22.3	22.7
Azerbaijan	11.8	14.7	16.3	26.8	27.2	33.6	33.7	33.3
Georgia	–	15.5	27.1	27.1	26.8	26.4	26.1	25.8
Kazakhstan	19.6	22.9	27.6	14.2	20.5	20.6	20.9	27.4
Kyrgyz Republic	16.7	14.2	19.8	23.1	23.4	23.7	24.3	24.4
Pakistan	17.3	13.4	13.8	14.0	14.8	15.4	15.8	16.1
Tajikistan	10.0	14.1	19.2	19.3	19.7	20.2	20.9	21.2
Turkmenistan	20.5	23.5	20.5	16.1	–	–	–	–
Uzbekistan	29.7	28.0	22.6	21.8	23.1	23.9	24.4	24.3
East Asia								
China, People's Rep. of ^b	10.3	13.5	17.1	20.7	29.8	29.3	37.4	39.8
Hong Kong, China	16.1	16.8	17.5	21.2	22.8	22.1	21.5	20.9
Korea, Rep. of	17.8	21.4	20.8	21.4	21.8	24.3	23.6	22.9
Mongolia	20.8	28.3	27.4	36.7	37.4	37.8	38.0	–
Taipei, China	13.3	18.0	14.8	11.1	12.1	12.8	13.6	13.1
South Asia								
Bangladesh	9.8	8.5	10.6	9.5	10.1	10.5	10.6	10.6
Bhutan	19.1	23.2	17.0	27.4	28.6	36.5	36.8	43.8
India	9.9	9.8	9.7	10.6	10.9	11.1	11.3	15.2
Maldives	25.8	30.0	29.8	23.4	24.3	30.7	31.2	30.9
Nepal	10.4	10.5	11.9	15.1	16.3	17.5	18.1	18.2
Sri Lanka	20.6	16.4	15.5	14.6	14.5	20.7	20.7	20.7
Southeast Asia								
Brunei Darussalam	36.5	49.1	53.2	54.3	–	–	–	–
Cambodia	7.6	10.0	10.6	13.2	13.8	14.2	14.4	14.4
Indonesia	17.7	14.7	17.8	15.4	15.8	16.0	16.1	22.0
Lao PDR	11.1	13.1	11.7	15.3	16.4	17.4	18.2	18.5
Malaysia	22.9	17.4	19.6	20.0	20.9	26.2	26.4	28.1
Myanmar	6.5	4.2	–	14.2	14.4	14.4	14.4	14.5
Philippines	18.9	14.3	14.4	13.4	14.0	14.4	14.8	15.0
Singapore	34.8	29.8	20.7	22.5	22.4	22.0	21.6	21.3
Thailand	18.1	14.7	17.4	16.8	17.0	23.9	23.1	29.3
Vietnam ^b	21.9	20.1	25.7	26.7	27.8	28.1	27.8	27.0
The Pacific								
Fiji	25.5	25.4	23.9	25.4	25.5	25.8	26.1	37.2
Micronesia, Fed. States of	26.4	22.5	20.8	21.8	22.7	23.5	24.2	24.6
Papua New Guinea	24.0	25.7	26.8	26.1	27.2	28.2	29.1	29.8
Samoa	29.9	25.6	24.0	27.3	27.5	28.2	28.9	29.7
Solomon Islands	27.7	21.6	26.7	37.0	38.2	39.9	41.3	42.5
Timor-Leste	–	–	9.7	22.0	22.0	22.1	22.2	22.3

Table 6 continued

	1995	2000	2005	2010	2020	2030	2040	2050
Tonga	25.6	21.1	22.8	20.1	20.5	21.2	21.6	22.1
Vanuatu	24.2	18.7	18.5	17.6	18.5	19.2	19.8	20.1
Developed member economy ^a								
Japan	12.2	12.0	11.9	11.2	11.1	11.0	10.6	10.4

^a Data refer to central government, except for Bangladesh, Georgia, Kiribati, the Kyrgyz Republic, Pakistan, and Tajikistan, where data refer to consolidated government or general government

^b Government revenue includes local government revenue

Somewhat surprisingly, the increase is much smaller in other Asian countries which are also aging rapidly, for example Thailand. There are two underlying reasons for this. First, aging in poorer countries has a smaller impact because welfare expenditures often do not rise as rapidly with age as in richer countries. While their welfare spending is projected to reach higher levels between now and 2050, the increase in pensions, health care and other elderly-oriented expenditures will be more limited than in richer countries. The second factor is the shape of the age profile. An increase in the 70+ population has a much bigger impact on expenditure than an increase in the number of 60-year-olds. East Asian DMCs are further along in their aging process and hence relative to Thailand, the very elderly account for a larger share of the increase in the old-age population.

The decomposition analysis for government revenue is presented in Table 9. We do not report the results for tax revenue and government revenue separately since the decomposition results are same. All changes in government revenue are driven by tax revenue, not by non-tax revenue. Non-tax revenues and grants are assumed to increase as a fixed share of GDP in our model.

The share of the working age population is declining in East Asian economies and, hence, the impact of changing population age structure is to reduce tax revenues in this region. The impact is not big enough to offset the increase in tax revenues though. On average, changing age structure could reduce tax revenues by between 6 and 8 % in East-Asia. The same is true for Singapore and Thailand too. On the other hand, most countries in South Asia and Southeast Asia experience increase in tax revenues between 2010 and 2050. The effects in others regions vary a lot, ranging from 1 to 21 %. The interaction effect is quite small.

The effects of changes in the level of taxation are non-negative in every country since the per capita age-specific level of taxation is assumed to rise as countries grow richer. The rising level of age specific tax is large enough to offset the effects of changing age structure in all countries. The age specific tax revenue increase is largest in countries that are expected to grow rapidly, such as PRC and Thailand. This is due the assumptions underlying our projections, which are based on observed data.

Table 10 shows the decomposition of the fiscal balance. The last columns are negative if fiscal balance worsens and positive if it improves. If the contribution due to age specific change in the level is nil for both revenue and expenditure, then all change is due to age structure. For example, most countries in Central and West Asia, and the Pacific will not experience any change due to change in growth. All changes in their fiscal balance will thus be due to change in their age structure. Only demographic effects matter in countries that are very poor, or grow very slowly, and hence do not reach the income threshold that leads to an upward shift in the health profile. At the same time, only demographics matter

Table 7 Fiscal balance as % of GDP *Source* ADB and calculations by authors

	1995	2000	2005	2010	2020	2030	2040	2050
<i>Developing member economies^a</i>								
Central and West Asia								
Afghanistan	–	–	–4.5	2.5	–	–	–	–
Armenia	–5.9	–4.9	–1.9	–5.0	–4.8	–1.0	–1.2	–2.1
Azerbaijan	–5.2	–1.0	–0.7	–0.9	–1.1	–2.1	–3.0	–4.3
Georgia	–	–1.3	1.2	–5.6	–6.6	–8.1	–8.4	–9.1
Kazakhstan	–4.0	–0.1	0.6	–2.4	–	–	–	–
Kyrgyz Republic	–11.5	–2.2	0.2	–4.9	–4.7	–5.9	–5.3	–5.8
Pakistan	–5.6	–5.4	–3.0	–5.9	–	–	–	–
Tajikistan	–7.4	–0.6	0.2	–7.1	–6.9	–7.2	–6.6	–6.8
Turkmenistan	0.4	–0.3	0.8	2.0	–	–	–	–
Uzbekistan	–2.9	–1.0	0.1	0.3	–	–	–	–
East Asia								
China, People's Rep. of ^b	–	–2.8	–1.2	–1.7	4.6	3.2	8.2	6.0
Hong Kong, China	–0.3	–0.6	1.0	4.2	4.1	1.5	0.1	–1.0
Korea, Rep. of	0.3	1.0	0.4	1.3	0.6	–4.1	–7.6	–9.7
Mongolia	–1.3	–6.4	2.4	0.5	–	–	–	–
Taipei, China	–1.0	–4.5	–0.3	–2.8	–4.5	–8.2	–12.4	–15.1
South Asia								
Bangladesh	–2.2	–4.5	–3.7	–2.8	–2.0	–1.6	–1.5	–1.6
Bhutan	0.1	–3.9	–6.6	1.5	3.5	7.8	7.6	10.0
India	–4.2	–5.7	–4.0	–4.8	–3.2	–1.2	–1.2	–2.6
Maldives	–6.4	–4.4	–8.2	–15.6	–14.1	–12.6	–12.0	–12.0
Nepal	–4.5	–4.3	–2.4	–3.5	–3.9	0.2	0.1	–0.0
Sri Lanka	–8.8	–9.3	–7.0	–8.0	–7.5	–7.3	–7.1	–4.4
Southeast Asia								
Brunei Darussalam	15.1	10.9	21.1	17.3	–	–	–	–
Cambodia	–7.2	–2.1	–0.7	–3.2	–3.0	–2.9	–3.1	1.4
Indonesia	3.0	–1.1	–0.5	–0.7	0.4	1.2	1.8	1.9
Lao PDR	–12.9	–4.6	–4.5	–2.2	–0.5	3.0	3.2	2.7
Malaysia	0.8	–5.5	–3.4	–5.4	–	–	–	–
Myanmar	–3.2	0.7	–	–4.6	–3.9	–3.7	–3.5	–3.6
Philippines	0.6	–3.7	–2.6	–3.5	–2.9	–2.4	–2.1	–1.9
Singapore	14.0	9.9	6.3	7.7	7.9	7.3	6.7	6.4
Thailand	2.6	–2.8	0.1	–2.4	–	–	–	–
Vietnam ^b	–1.3	–4.3	–1.0	–2.1	–1.9	2.1	0.8	3.6
The Pacific								
Fiji	–0.3	–3.1	–3.3	–2.2	–	–	–	–
Micronesia, Fed. States of	–0.4	–3.5	–4.9	0.5	0.4	1.1	1.9	2.6
Papua New Guinea	–0.5	–2.0	0.1	0.7	–	–	–	–
Samoa	–7.2	–0.7	0.3	–7.4	–6.6	–5.6	–5.0	–4.6
Solomon Islands	–4.6	–0.6	–0.9	8.3	8.4	8.7	9.2	17.8
Timor-Leste	–	–	4.0	3.5	3.6	3.9	4.0	3.6

Table 7 continued

	1995	2000	2005	2010	2020	2030	2040	2050
Tonga	1.0	-0.3	3.0	-2.7	-2.6	-1.7	-1.4	-1.1
Vanuatu	-2.7	-6.2	2.9	-2.0	-0.9	0.4	1.3	2.2
Developed member economy ^a								
Japan	-3.9	-6.3	-4.1	-6.7	-9.4	-10.9	-13.3	-14.4

^a Data refer to central government, except for Bangladesh, Georgia, Kiribati, the Kyrgyz Republic, Pakistan, and Tajikistan, where data refer to consolidated government or general government

^b Fiscal balance includes local government balance

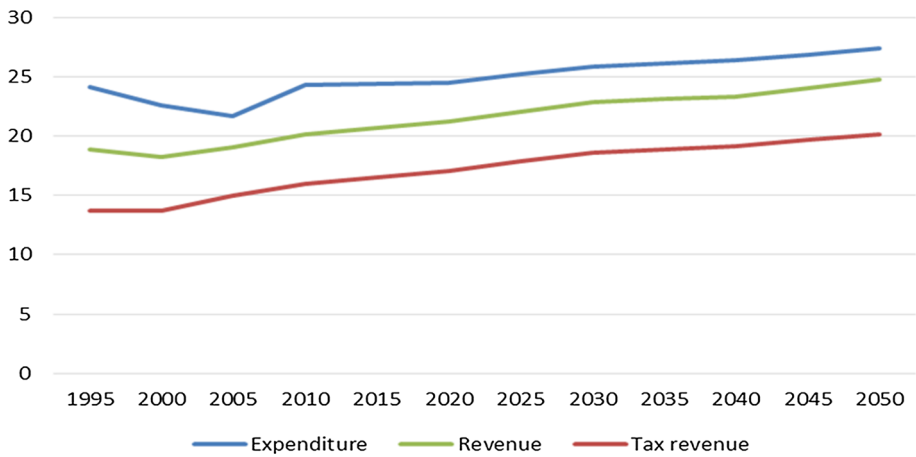


Fig. 3 Average government expenditure, revenue, and tax revenue as % of GDP. Note GDP of 1995–2050, unweighted average of DMCs

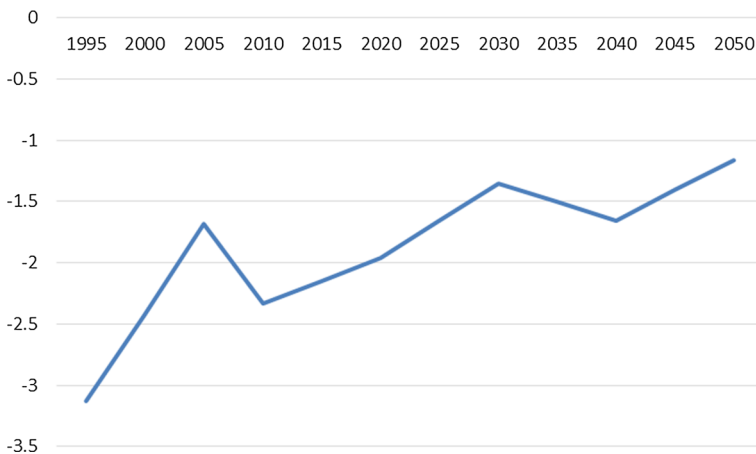


Fig. 4 Average fiscal balance as % of GDP. Note GDP of 1995–2050, unweighted average of DMCs

Table 8 Government expenditure as % of GDP, decomposition of change *Source* ADB and calculations by authors

	Value in 2010		Percentage point change, 2010–2050						As % of 2010 value							
		Total change	Due to age structure	Due to level	Due to interaction	Due to age structure	Due to level	Due to interaction	Due to age structure	Due to level	Due to interaction					
												Due to age structure	Due to level	Due to interaction	Due to age structure	Due to level
<i>Developing member economies^a</i>																
Central and West Asia																
Afghanistan	20.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Armenia	27.6	4.5	4.1	0.2	0.2	0.2	0.2	15	1	1	1	1	1	1	1	1
Azerbaijan	27.6	3.6	1.7	1.7	0.1	0.1	0.1	6	6	6	6	6	6	6	6	6
Georgia	34.0	2.2	2.2	0.0	0.0	0.0	0.0	6	0	0	0	0	0	0	0	0
Kazakhstan	22.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Kyrgyz Republic	31.2	2.2	2.2	0.0	0.0	0.0	0.0	7	0	0	0	0	0	0	0	0
Pakistan	20.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tajikistan	25.1	1.5	1.5	0.0	0.0	0.0	0.0	6	0	0	0	0	0	0	0	0
Turkmenistan	14.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Uzbekistan	21.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
East Asia																
China, People's Rep. of ^b	22.4	11.5	1.5	7.0	2.9	2.9	2.9	7	31	13	13	13	13	13	13	13
Hong Kong, China	17.0	4.9	2.9	1.4	0.6	0.6	0.6	17	8	3	3	3	3	3	3	3
Korea, Rep. of	19.8	12.5	4.5	3.8	4.3	4.3	4.3	22	19	22	22	22	22	22	22	22
Mongolia	33.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Taipei, China	13.9	14.3	4.9	4.4	4.9	4.9	4.9	35	32	36	36	36	36	36	36	36
South Asia																
Bangladesh	12.7	–0.1	–0.1	0.0	0.0	0.0	0.0	–1	0	0	0	0	0	0	0	0
Bhutan	35.6	8.0	0.3	6.8	0.9	0.9	0.9	1	19	2	2	2	2	2	2	2
India	15.4	1.1	0.0	1.1	0.0	0.0	0.0	0	7	0	0	0	0	0	0	0
Maldives	40.3	5.3	1.1	3.5	0.6	0.6	0.6	3	9	2	2	2	2	2	2	2
Nepal	21.8	–0.5	–0.5	0.0	0.0	0.0	0.0	–2	0	0	0	0	0	0	0	0
Sri Lanka	22.1	2.7	1.0	1.6	0.1	0.1	0.1	4	7	1	1	1	1	1	1	1
Southeast Asia																

Table 8 continued

	Value in 2010	Percentage point change, 2010–2050				As % of 2010 value					
		Total change		Due to age structure		Due to interaction		Due to age structure		Due to interaction	
Brunei Darussalam	36.9	4.5	1.5	2.3	0.6	4	6	2			
Cambodia	21.3	0.2	0.2	0.0	0.0	1	0	0			
Indonesia	16.2	1.9	0.8	1.0	0.1	5	6	1			
Lao PDR	24.2	0.6	0.6	0.0	0.0	2	0	0			
Malaysia	25.5	3.2	-0.6	3.6	0.2	-3	14	1			
Myanmar	18.9	-	-	-	-	-	-	-			
Philippines	16.9	0.0	0.0	0.0	0.0	0	0	0			
Singapore	14.8	0.0	0.0	0.0	0.0	0	0	0			
Thailand	19.2	6.9	0.7	5.0	1.1	4	26	6			
Vietnam ^b	27.2	-	-	-	-	-	-	-			
The Pacific											
Fiji	27.7	2.3	-0.2	2.2	0.3	-1	8	1			
Micronesia, Fed. States of	67.7	-	-	-	-	-	-	-			
Papua New Guinea	30.7	-0.5	-0.5	0.0	0.0	-2	0	0			
Samoa	34.7	0.3	0.3	0.0	0.0	1	0	0			
Solomon Islands	39.7	-	-	-	-	-	-	-			
Timor-Leste	18.4	0.3	0.3	0.0	0.0	1	0	0			
Tonga	28.0	0.3	0.3	0.0	0.0	1	0	0			
Vanuatu	26.3	-0.4	-0.4	0.0	0.0	-1	0	0			
Developed member economy ^a											
Japan	18.0	6.8	6.2	0.0	0.6	35	0	3			

^a Data refer to central government, except for Bangladesh, Georgia, Kiribati, the Kyrgyz Republic, Pakistan, and Tajikistan, where data refer to consolidated government or general government

^b Fiscal balance includes local government balance

Table 9 Government revenue as % of GDP, decomposition of change *Source* ADB and calculations by authors

	Value in 2010		Percentage point change, 2010–2050				As % of 2010 value					
			Total change		Due to age structure		Due to interaction		Due to age structure		Due to interaction	
			Due to level	Due to level	Due to level	Due to level	Due to level	Due to level	Due to level	Due to level	Due to level	Due to level
<i>Developing member economies^a</i>												
Central and West Asia												
Afghanistan	10.8	3.8	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Armenia	21.7	1.0	-0.1	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Azerbaijan	26.8	6.5	0.2	5.8	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Georgia	27.1	-1.3	-1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kazakhstan	14.2	13.2	0.1	12.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Kyrgyz Republic	23.1	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pakistan	14.0	2.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tajikistan	19.3	1.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turkmenistan	16.1	-	-	-	-	-	-	-	-	-	-	-
Uzbekistan	21.8	2.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
East Asia												
China, People's Rep. of ^b	20.7	19.1	-1.3	20.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Hong Kong, China	21.2	-0.3	-1.8	1.7	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
Korea, Rep. of	21.4	1.5	-1.3	2.9	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Mongolia	36.7	-	-	-	-	-	-	-	-	-	-	-
Taipei, China	11.1	1.9	-0.6	2.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
South Asia												
Bangladesh	9.5	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bhutan	27.4	16.4	1.6	12.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
India	10.6	4.7	0.8	3.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Maldives	23.4	7.5	1.4	4.8	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Nepal	15.1	3.2	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sri Lanka	14.6	6.2	-0.2	6.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Southeast Asia												

Table 9 continued

	Value in 2010	Percentage point change, 2010–2050				As % of 2010 value			
		Total change		Due to age structure		Due to age structure		Due to interaction	
		Due to level	Due to interaction	Due to level	Due to interaction	Due to level	Due to interaction	Due to level	Due to interaction
Brunei Darussalam	54.3	–	–	–	–	–	–	–	–
Cambodia	13.2	1.2	0.0	0.0	9	0.0	0	0	0
Indonesia	15.4	6.6	0.7	5.2	0.6	5	34	4	4
Lao PDR	15.3	3.2	3.2	0.0	0.0	21	0	0	0
Malaysia	20.0	8.1	1.3	5.5	1.3	6	27	7	7
Myanmar	14.2	0.3	0.2	0.0	0.1	1	0	1	1
Philippines	13.4	1.6	1.6	0.0	0.0	12	0	0	0
Singapore	22.5	–1.3	–1.3	0.0	0.0	–6	0	0	0
Thailand	16.8	12.5	–1.3	14.1	–0.4	–8	84	–2	–2
Vietnam ^b	26.7	0.3	0.3	0.0	0.0	1	0	0	0
The Pacific									
Fiji	25.4	11.8	0.9	10.0	0.9	4	40	3	3
Micronesia, Fed. States of	21.8	2.8	2.8	0.0	0.0	13	0	0	0
Papua New Guinea	26.1	3.7	3.7	0.0	0.0	14	0	0	0
Samoa	27.3	2.4	2.4	0.0	0.0	9	0	0	0
Solomon Islands	37.0	5.5	5.5	0.0	0.0	15	0	0	0
Timor-Leste	22.0	0.3	0.3	0.0	0.0	1	0	0	0
Tonga	20.1	1.9	1.9	0.0	0.0	10	0	0	0
Vanuatu	17.6	2.4	2.4	0.0	0.0	14	0	0	0
Developed member economy ^a									
Japan	11.2	–0.8	–0.9	0.0	0.1	–8	0	1	1

^a Data refer to central government, except for Bangladesh, Georgia, Kiribati, the Kyrgyz Republic, Pakistan, and Tajikistan, where data refer to consolidated government or general government

^b Fiscal balance includes local government balance

Table 10 Fiscal balance as % of GDP, decomposition of change *Source* ADB and calculations by authors

	Value in 2010						As % of % point change, 2010–2050					
	Percentage point change, 2010–2050			As % of % point change, 2010–2050			Due to level			Due to interaction		
	Total change	Due to age structure	Due to level	Due to age structure	Due to level	Due to interaction	Due to age structure	Due to level	Due to interaction	Due to age structure	Due to level	Due to interaction
<i>Developing member economies^a</i>												
Central and West Asia												
Afghanistan	–	–	–	–	–	–	–	–	–	–	–	–
Armenia	–5.0	2.9	–1.5	–	4.0	0.4	–	–	–	–	138	14
Azerbaijan	–0.9	–3.5	–4.2	–	0.4	0.3	–	–	–	–	11	9
Georgia	–5.6	–3.5	–3.5	–	0.0	0.0	–	–	–	–	0	0
Kazakhstan	–	–	–	–	–	–	–	–	–	–	–	–
Kyrgyz Republic	–4.9	–0.9	–0.9	–	0.0	0.0	–	–	–	–	0	0
Pakistan	–	–	–	–	–	–	–	–	–	–	–	–
Tajikistan	–7.1	0.3	0.3	–	0.0	0.0	–	–	–	–	0	0
Turkmenistan	–	–	–	–	–	–	–	–	–	–	–	–
Uzbekistan	–	–	–	–	–	–	–	–	–	–	–	–
East Asia												
China, People's Rep. of ^b	–1.7	7.7	–2.8	–	13.1	–2.6	–	–	–	–	171	–34
Hong Kong, China	4.2	–5.2	–4.7	–	0.3	–0.9	–	–	–	–	6	–17
Korea, Rep. of	1.3	–11.0	–5.8	–	–0.8	–4.4	–	–	–	–	–8	–40
Mongolia	0.5	–	–	–	–	–	–	–	–	–	–	–
Taipei, China	–2.8	–12.4	–5.5	–	–2.0	–4.8	–	–	–	–	–16	–39
South Asia												
Bangladesh	–2.8	1.2	1.2	–	0.0	0.0	–	–	–	–	0	0
Bhutan	1.5	8.4	1.3	–	5.1	2.0	–	–	–	–	61	23
India	–4.8	2.2	0.3	–	1.3	0.6	–	–	–	–	57	29
Maldives	–15.6	3.6	3.6	–	0.0	0.0	–	–	–	–	0	0
Nepal	–3.5	3.4	–1.1	–	4.5	0.0	–	–	–	–	132	1
Sri Lanka	–8.0	3.6	0.8	–	2.2	0.5	–	–	–	–	63	15
Southeast Asia												

Table 10 continued

	Value in 2010			Percentage point change, 2010–2050			As % of % point change, 2010–2050			
	Total change	Due to age structure	Due to level	Due to interaction	Due to age structure	Due to level	Due to interaction	Due to age structure	Due to level	Due to interaction
Brunei Darussalam	–	–	–	–	–	–	–	–	–	–
Cambodia	–3.2	4.7	0.0	4.2	0.5	0.5	–1	90	11	11
Indonesia	–0.7	2.6	2.6	0.0	0.0	0.0	100	0	0	0
Lao PDR	–2.2	4.9	1.9	1.9	1.1	1.1	39	38	23	23
Malaysia	–	–	–	–	–	–	–	–	–	–
Myanmar	–4.6	0.9	0.9	0.0	0.0	0.0	100	0	0	0
Philippines	–3.5	1.6	1.6	0.0	0.0	0.0	100	0	0	0
Singapore	7.7	–1.3	–1.3	0.0	0.0	0.0	–100	0	0	0
Thailand	–	–	–	–	–	–	–	–	–	–
Vietnam ^b	–2.1	5.6	–1.9	9.1	–1.5	–1.5	–35	162	–	–28
The Pacific										
Fiji	–	–	–	–	–	–	–	–	–	–
Micronesia, Fed. States of	0.5	2.1	2.1	0.0	0.0	0.0	100	0	0	0
Papua New Guinea	–	–	–	–	–	–	–	–	–	–
Samoa	–7.4	2.8	2.8	0.0	0.0	0.0	100	0	0	0
Solomon Islands	8.3	9.6	1.1	7.9	0.6	0.6	12	82	6	6
Timor-Leste	3.5	0.1	0.1	0.0	0.0	0.0	100	0	0	0
Tonga	–2.7	1.7	1.7	0.0	0.0	0.0	100	0	0	0
Vanuatu	–2.0	4.2	4.2	0.0	0.0	0.0	100	0	0	0
Developed member economy ^a										
Japan	–6.7	–7.6	–7.1	0.0	–0.6	–0.6	–93	0	–7	–7

^a Data refer to central government, except for Bangladesh, Georgia, Kiribati, the Kyrgyz Republic, Pakistan, and Tajikistan, where data refer to consolidated government or general government

^b Fiscal balance includes local government balance

in very rich economies such as Hong Kong, Singapore, or Japan, for the same underlying reason.

Although some Asian countries are currently in good fiscal shape compared with other regions of the world, such as Europe or Latin America (Roy 2015), there is no guarantee that their fiscal health will last. Korea is an example of a country which is expected to simultaneously face a substantial fiscal deficit, slower economic growth, and population aging. Population aging will significantly harm the fiscal health of all East Asian countries. However, healthy economic growth could offset some of the negative impact of population aging. The PRC, which is assumed to grow rapidly until 2050 in our model, is a case in point. But in Korea and Taiwan, both the age effect and the age-specific level effects will adversely affect the fiscal balance. In contrast, both the age effect and the age-specific level effects are benign and mutually reinforcing in many South Asian countries. The size of the working population is still growing in these countries, while social welfare spending remains limited. High growth rate is the key driver of the region's fiscal improvement.

4 Conclusions

Although data limitations impede our analysis of the relationship between demographic change and fiscal sustainability in Asia, our findings nevertheless point to some important issues and considerations. The worsening fiscal health of countries like Korea, Japan, and Taiwan, suggests that current tax and expenditure systems cannot guarantee future fiscal sustainability in aging Asian countries. On a more optimistic note, low income countries, which are still enjoying an expansion of the working age population under the second phase of the demographic transition, can help their own fiscal position substantially by growing rapidly. At the same time, it should be noted that population aging is a universal feature of Asian countries. Only the timing and speed of the demographic transition varies and sooner or later they will face a deterioration of their fiscal health in the future, following the footsteps of Korea, Japan, and Taiwan.

Our results for individual countries are based less on what we know about individual countries and more on what we see as broad patterns across the region based on selective data available for countries at different levels of development. Data about the interaction between the population age structure and the economy remain underdeveloped. The age profiles of tax burdens and benefits are available for only a few countries. Little is known about how slow growth and population aging will influence the fiscal environment in the coming decades. This information gap points to an urgent need to improve the quality of data, particularly data on public transfers in Asian countries.

Public programs are an increasingly important source of support for the elderly, especially in richer Asian countries. The key question is how to sustain or reform current old-age support systems in the face of rapid population aging. According to our results, population aging can lead to very substantial increases in public spending and decreases in revenue, even with constant age profiles. Therefore, a key priority everywhere is to improve our understanding of the connection between age, tax burden, and needs for support. Unfortunately, current policies often depend on definitions of working age or old age that are arbitrary and perhaps increasingly out of touch with changing reality.

Appendix

See the Tables [11](#), [12](#), [13](#), [14](#).

Table 11 Population age structure projections *Source* UN (2013b)

	Share of ages 0–19						Share of ages 65+					
	2010	2020	2030	2040	2050		2010	2020	2030	2040	2050	
	Developing member economies											
Central and West Asia ^a	39.7	36.4	33.2	29.1	27.4		6.0	6.7	9.7	11.4	13.5	
Afghanistan	59.6	53.1	44.0	38.2	32.7		2.2	2.7	3.2	4.1	5.4	
Armenia	29.1	26.0	23.0	20.4	20.1		10.5	11.7	17.0	18.9	22.8	
Azerbaijan	32.7	28.6	26.4	22.5	21.8		5.9	6.7	11.9	14.7	17.6	
Georgia	24.9	24.5	23.3	21.1	21.6		14.2	16.0	21.1	22.9	24.4	
Kazakhstan	33.5	34.1	32.2	29.2	28.9		6.7	7.5	9.8	11.2	12.7	
Kyrgyz Republic	41.3	39.9	38.8	33.5	32.0		4.4	4.5	7.0	8.5	9.6	
Pakistan	46.7	40.7	36.4	32.2	28.6		4.3	4.6	5.8	7.3	9.6	
Tajikistan	47.3	45.5	43.7	38.8	37.1		3.3	3.5	5.3	6.5	7.7	
Turkmenistan	40.3	35.6	32.2	28.2	26.1		4.1	4.9	7.5	9.5	11.9	
Uzbekistan	41.1	35.4	31.8	27.4	25.2		4.4	5.0	7.9	10.1	13.0	
East Asia ^a	25.5	22.1	21.1	19.0	18.4		9.4	13.2	19.5	25.3	29.1	
China, People's Rep. of	26.1	23.7	22.1	19.8	19.7		8.4	11.7	16.2	22.1	23.9	
Hong Kong, China	18.2	16.2	17.3	15.5	15.3		12.9	18.2	26.5	32.1	35.5	
Korea, Rep. of	23.3	18.6	18.2	17.2	16.4		11.1	15.5	23.4	30.5	34.9	
Mongolia	37.1	35.5	33.3	28.7	27.9		3.8	4.4	7.2	10.3	13.2	
Taipei, China	22.6	16.6	14.6	13.6	12.8		10.7	16.1	24.2	31.3	37.9	
South Asia ^a	40.7	35.4	30.8	26.8	24.1		5.3	6.4	8.8	11.9	16.1	
Bangladesh	42.2	35.9	30.9	26.6	23.5		4.6	5.2	7.6	11.3	16.2	
Bhutan	40.4	33.8	29.6	25.4	22.7		4.5	5.5	7.4	10.6	16.7	
India	39.9	35.5	31.9	28.8	26.4		5.1	6.3	8.2	10.2	12.7	
Maldives	41.4	35.1	30.8	24.5	21.7		5.0	5.3	8.3	12.4	18.2	
Nepal	47.7	40.0	32.8	29.2	25.7		4.9	6.0	7.5	9.9	12.6	
Sri Lanka	33.0	31.9	28.9	26.1	25.0		7.8	10.4	14.2	17.1	20.1	

Table 11 continued

Developing member economies	Share of ages 0–19					Share of ages 65+				
	2010	2020	2030	2040	2050	2010	2020	2030	2040	2050
	Southeast Asia ^a	37.0	32.1	28.6	25.6	23.5	5.6	7.8	11.5	15.3
Brunei Darussalam	35.3	30.0	25.4	23.1	21.3	3.7	7.0	13.1	19.6	22.4
Cambodia	43.6	38.8	35.5	30.6	27.7	5.0	6.6	9.1	11.9	16.1
Indonesia	38.5	34.7	30.0	27.5	25.5	5.0	6.3	9.2	12.7	15.8
Lao PDR	49.3	42.7	38.2	32.6	28.4	3.7	4.2	5.5	7.4	10.5
Malaysia	37.7	32.0	29.4	26.2	23.5	4.8	6.9	9.7	12.5	16.5
Myanmar	35.2	30.6	27.4	24.7	23.3	5.1	6.5	9.1	12.2	15.7
Philippines	45.7	41.6	38.1	35.1	32.2	3.7	4.9	6.3	7.7	9.3
Singapore	24.3	20.0	19.1	17.7	16.3	9.0	13.9	20.5	25.4	28.9
Thailand	26.5	21.9	18.7	17.5	16.9	8.9	13.0	19.5	25.9	30.4
Vietnam	33.6	28.2	24.4	20.9	19.6	6.5	8.2	12.9	17.9	23.1
The Pacific ^a	49.1	45.8	42.0	38.9	35.5	4.1	4.9	6.3	7.4	8.8
Fiji	38.5	36.5	33.4	30.2	28.3	4.8	6.9	10.0	11.8	14.6
Micronesia, Fed. States of	49.6	43.0	40.1	37.1	31.8	3.8	5.4	6.6	5.8	7.4
Papua New Guinea	49.3	45.8	42.0	39.0	36.2	2.8	3.3	4.1	5.3	6.5
Samoa	48.7	46.4	42.0	39.3	37.0	5.1	5.9	8.3	10.5	11.4
Solomon Islands	51.1	48.6	44.1	40.6	37.5	3.3	3.5	4.3	5.9	7.4
Timor-Leste	59.8	56.3	54.2	49.8	43.6	3.1	3.7	3.8	3.5	3.3
Tonga	48.0	45.7	40.9	39.1	36.6	5.9	5.9	7.3	9.1	10.1
Vanuatu	47.6	44.2	39.6	36.5	33.5	3.9	4.5	6.0	7.6	9.9
Developed member economy										
Japan	18.0	17.1	16.7	16.5	16.9	23.0	28.6	30.7	34.5	36.5

^a Simple country average, not weighted by population

Table 12 Summary of other studies

Studies	Projection period & countries	Estimation	Baseline projection versus other scenarios
Dang et al. (2001)	2000–2050 OECD countries	Fiscal impact of age-related spending Old-age pension spending Early-retirement programs Health care Long-term care Education Family and child allowances	Age-related spending increase around 6–7 % of GDP Scenario 1 higher fertility (−0.85 %) Scenario 2 increased longevity (1.4 %) Scenario 3 higher migration (−0.3 %) Scenario 4 lower older worker participation (0.5 %) Scenario 5 lower female participation (0.5 %) Scenario 6 fall in unemployment rates (−0.3 %) For the EU as a whole, the projected increase in total age-related expenditure is 1.4 pp. of GDP in the baseline scenario
European Commission (2015)	2013–2060, 28 EU member states	28 EU member states pensions health care, long-term care and education	TFP risk scenario is included, with a lower TFP growth rate (Increase 1.7 pp. of GDP) AWG risk scenario assume an upward convergence of coverage and costs to the EU average is assumed to take place in long-term care (Increase 3.4 pp. of GDP)

Table 12 continued

Studies	Projection period & countries	Estimation	Baseline projection versus other scenarios
Clements et al. (2015)	2015–2100 37 more developed countries and 64 less developed countries	Pension health care	<p>Age-related expenditures are projected to increase over 2015–2100</p> <p>Baseline scenario from 16.4 % of GDP to 24.8 for developed countries, from 5.5 % of GDP to 16.0 % for developing countries</p> <p>Increase fertility rate</p> <p>21.0 and 14.0 % GDP of more developed countries and developing countries respectively</p> <p>Allow higher migration</p> <p>22.9 and 16.2 % GDP of more developed countries and developing countries respectively</p> <p>Increase labor force participation of women</p> <p>23.3 and 14.7 % GDP of more developed countries and developing countries respectively</p> <p>Increase labor force participation of elderly</p> <p>23.7 and 15.7 % GDP of more developed countries and developing countries respectively</p> <p>Increase retirement age by five years over 2015–2100</p> <p>22.6 and 14.2 % GDP of more developed countries and developing countries respectively</p> <p>Lower excess cost growth</p> <p>20.5 and 12.9 % GDP of more developed countries and developing countries respectively</p>

Table 12 continued

Studies	Projection period & countries	Estimation	Baseline projection versus other scenarios
Lee and Mason (2015)	2010–2050 40 countries in developing Asia	Government spending on education, health care, and social protection in developing Asia	<p>Importance of education is projected to decline to an average value of 2.7 % of GDP in 2050 ranging between 0.6 and 5.0 % of GDP</p> <p>The simple average increases from 2.8 % of GDP in 2010 to 3.6 % in 2030 and to 4.7 % in 2050</p> <p>In many economies, the percent of GDP devoted to social security and welfare is projected to double or more</p>

Table 13 Government tax revenue as % of GDP (holding 2010 fiscal balance constant) *Source* ADB and calculations by authors

	1995	2000	2005	2010	2020	2030	2040	2050
<i>Developing member economies</i>								
Central and West Asia								
Afghanistan	–	–	3.8	8.9	–	–	–	–
Armenia	10.6	14.8	14.3	20.2	20.5	17.0	17.0	18.3
Azerbaijan	10.8	12.2	14.0	12.4	13.0	20.5	21.4	22.4
Georgia	–	14.6	20.8	23.5	24.2	25.3	25.3	25.7
Kazakhstan	15.8	20.2	26.3	13.4	–	–	–	–
Kyrgyz Republic	15.1	11.7	16.2	17.9	18.0	19.4	19.5	20.1
Pakistan	13.8	10.6	10.1	10.1	–	–	–	–
Tajikistan	8.4	13.1	16.5	18.0	18.1	19.0	19.1	19.5
Turkmenistan	–	23.0	–	–	–	–	–	–
Uzbekistan	27.8	–	21.5	20.4	–	–	–	–
East Asia								
China, People's Rep. of ^b	9.9	12.7	15.6	18.2	21.0	21.9	25.1	29.7
Hong Kong, China	11.2	9.7	12.3	13.6	15.3	17.3	18.0	18.5
Korea, Rep. of	15.2	17.0	13.9	14.0	15.1	22.4	25.1	26.6
Mongolia	16.2	21.3	22.8	31.9	–	–	–	–
Taipei, China	10.3	13.3	9.1	8.0	10.7	15.1	20.0	22.3
South Asia								
Bangladesh	7.9	6.8	8.6	7.8	7.6	7.6	7.6	7.7
Bhutan	6.6	10.0	9.4	13.3	12.6	16.2	16.7	21.3
India	6.9	6.5	7.3	7.3	6.1	4.3	4.4	9.8
Maldives	13.6	13.8	13.6	10.7	10.1	15.0	14.9	14.6
Nepal	8.4	8.1	9.2	13.4	15.1	12.1	12.8	13.1
Sri Lanka	17.9	14.2	13.7	12.9	12.4	18.3	18.3	15.5
Southeast Asia								
Brunei Darussalam	18.4	23.4	33.1	–	–	–	–	–
Cambodia	5.3	7.3	7.7	10.7	11.0	11.3	11.7	7.2
Indonesia	16.0	8.3	12.5	11.2	10.5	9.9	9.4	15.2
Lao PDR	9.4	10.6	9.7	13.5	12.8	10.3	10.9	11.7
Malaysia	18.7	13.2	14.8	13.7	–	–	–	–
Myanmar	3.7	2.0	–	3.2	2.7	2.6	2.3	2.6
Philippines	16.3	12.8	12.4	12.1	12.1	12.1	12.1	12.2
Singapore	15.9	15.1	11.5	13.2	13.0	13.2	13.3	13.3
Thailand	16.4	12.8	15.3	14.6	–	–	–	–
Vietnam ^b	19.1	18.0	21.0	22.4	23.3	19.7	20.6	17.1
The Pacific								
Fiji	21.9	19.9	21.0	21.6	–	–	–	–
Micronesia, Fed. States of	9.5	11.9	11.7	12.0	13.0	13.0	13.0	12.7
Papua New Guinea	19.5	23.8	24.8	24.4	–	–	–	–
Samoa	22.5	20.6	20.6	24.2	23.6	23.3	23.4	23.9
Solomon Islands	21.4	19.1	24.3	34.0	35.1	36.5	37.4	30.0

Table 13 continued

	1995	2000	2005	2010	2020	2030	2040	2050
Timor-Leste	–	–	1.5	1.2	1.1	0.9	0.9	1.5
Tonga	13.4	15.8	19.2	16.1	16.3	16.1	16.2	16.4
Vanuatu	19.6	15.7	16.4	16.0	15.7	15.2	14.8	14.3
Developed member economy ^a								
Japan	10.7	10.4	10.2	8.9	11.4	12.8	14.8	15.7

^a Data refer to central government, except for Bangladesh, Georgia, Kiribati, the Kyrgyz Republic, Pakistan, and Tajikistan, where data refer to consolidated government or general government

^b Tax revenue includes local government tax revenue

Table 14 Government revenue as % of GDP (holding 2010 fiscal balance constant) *Source* ADB and calculations by authors

	1995	2000	2005	2010	2020	2030	2040	2050
<i>Developing member economies^a</i>								
Central and West Asia								
Afghanistan	–	–	6.9	10.8	–	–	–	–
Armenia	14.4	15.9	16.2	21.7	22.0	18.5	18.5	19.8
Azerbaijan	11.8	14.7	16.3	26.8	27.5	34.9	35.8	36.8
Georgia	–	15.5	27.1	27.1	27.8	28.9	28.9	29.2
Kazakhstan	19.6	22.9	27.6	14.2	–	–	–	–
Kyrgyz Republic	16.7	14.2	19.8	23.1	23.2	24.7	24.7	25.3
Pakistan	17.3	13.4	13.8	14.0	–	–	–	–
Tajikistan	10.0	14.1	19.2	19.3	19.4	20.3	20.4	20.9
Turkmenistan	20.5	23.5	20.5	16.1	–	–	–	–
Uzbekistan	29.7	28.0	22.6	21.8	–	–	–	–
East Asia								
China, People's Rep. of ^b	10.3	13.5	17.1	20.7	23.5	24.4	27.6	32.2
Hong Kong, China	16.1	16.8	17.5	21.2	22.9	24.9	25.6	26.1
Korea, Rep. of	17.8	21.4	20.8	21.4	22.5	29.8	32.5	33.9
Mongolia	20.8	28.3	27.4	36.7	–	–	–	–
Taipei, China	13.3	18.0	14.8	11.1	13.9	18.2	23.2	25.4
South Asia								
Bangladesh	9.8	8.5	10.6	9.5	9.3	9.3	9.3	9.4
Bhutan	19.1	23.2	17.0	27.4	26.7	30.3	30.8	35.4
India	9.9	9.8	9.7	10.6	9.3	7.5	7.7	13.0
Maldives	25.8	30.0	29.8	23.4	22.8	27.7	27.6	27.2
Nepal	10.4	10.5	11.9	15.1	16.8	13.8	14.5	14.8
Sri Lanka	20.6	16.4	15.5	14.6	14.1	20.0	19.9	17.2
Southeast Asia								
Brunei Darussalam	36.5	49.1	53.2	54.3	–	–	–	–
Cambodia	7.6	10.0	10.6	13.2	13.6	13.9	14.3	9.7
Indonesia	17.7	14.7	17.8	15.4	14.7	14.1	13.5	19.4
Lao PDR	11.1	13.1	11.7	15.3	14.7	12.2	12.8	13.5

Table 14 continued

	1995	2000	2005	2010	2020	2030	2040	2050
Malaysia	22.9	17.4	19.6	20.0	–	–	–	–
Myanmar	6.5	4.2	–	14.2	13.7	13.6	13.3	13.6
Philippines	18.9	14.3	14.4	13.4	13.4	13.4	13.4	13.4
Singapore	34.8	29.8	20.7	22.5	22.3	22.4	22.6	22.6
Thailand	18.1	14.7	17.4	16.8	–	–	–	–
Vietnam ^b	21.9	20.1	25.7	26.7	27.7	24.0	24.9	21.4
The Pacific								
Fiji	25.5	25.4	23.9	25.4	–	–	–	–
Micronesia, Fed. States of	26.4	22.5	20.8	21.8	22.8	22.9	22.8	22.5
Papua New Guinea	24.0	25.7	26.8	26.1	–	–	–	–
Samoa	29.9	25.6	24.0	27.3	26.7	26.3	26.4	26.9
Solomon Islands	27.7	21.6	26.7	37.0	38.1	39.5	40.4	33.0
Timor-Leste	–	–	9.7	22.0	21.9	21.7	21.7	22.2
Tonga	25.6	21.1	22.8	20.1	20.4	20.2	20.2	20.4
Vanuatu	24.2	18.7	18.5	17.6	17.3	16.8	16.4	15.9
Developed member economy ^a								
Japan	12.2	12.0	11.9	11.2	13.8	15.1	17.1	18.1

^a Data refer to central government, except for Bangladesh, Georgia, Kiribati, the Kyrgyz Republic, Pakistan, and Tajikistan, where data refer to consolidated government or general government

^b Government revenue includes local government revenue

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