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Demographic Change and Fiscal Sustainability in Asia

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Abstract: *Changes in the population age structure can have a significant effect on fiscal sustainability since they can affect both government revenue and expenditure. For example, population ageing will increase expenditure on the elderly while reducing potential growth and hence revenue. In this paper, we project government revenue, expenditure, and fiscal balance in developing Asia up to 2050. Using a simple stylised model and the National Transfer Accounts (NTA) data set, we simulate the effect of both demographic changes and economic growth. Rapidly ageing countries like the Republic of Korea, Japan, and Taiwan, 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 countries with relatively young populations and still growing working-age populations. Overall, our simulation results indicate that Asia's population ageing 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 ageing, Asia

JEL Classification: J11, J14, H20, H50, H62

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1. Introduction

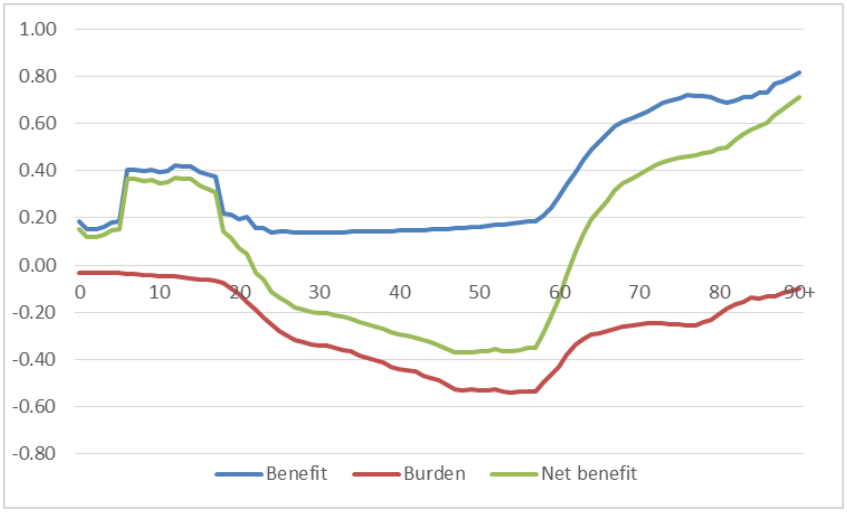
In this paper, we project government revenue, spending, and fiscal balance in developing Asia up to 2050. By using the National Transfer Accounts (NTA) data set, United Nations (UN) population projections, and other data sources for long-range projections for real gross domestic product (GDP), we estimate the fiscal burdens that countries are likely to face as a result of both economic growth and demographic changes. Changes in population age structure matter for public finances simply because the beneficiaries of public programmes are primarily children and the elderly, while the working age population typically bears most of the tax burden. 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.

Asia 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 1950s and 1960s, most Asian countries except Japan, were young countries, 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 over 60-year olds has also increased in many countries, most notably in Japan. Asia is now entering the third phase of the transition, where the old age population increases dramatically. By 2030, 20 of 42 Asian countries will have reached this final phase of demographic transition.

Changes in age structure have a strong effect on financing public transfers. The beneficiaries of public programmes are primarily children and the elderly, whereas most of the fiscal burden is borne by the working age population. Figure 1 shows Japan's per capita public transfer flows by age. These numbers are normalised by dividing the annual flows by the annual per capita labour income of persons aged 30 to 49, the prime working age in most countries.

The benefit profiles for Japan show two peaks. The first is for children, driven primarily by public spending on education, and the second peak is for the elderly, driven primarily by public pensions and publicly funded health care spending. The tax burden profiles peak around ages 45–55 when labour income peaks.

Figure 1: Per Capita Public Transfer Inflows and Outflows by Age

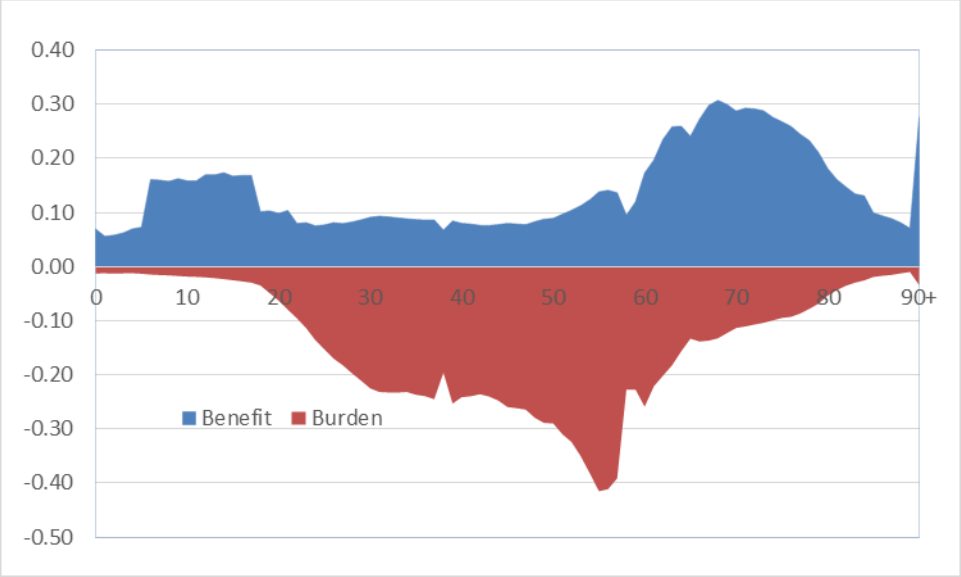


Note: Normalised by dividing them by the average per capita labour income of individuals 30 to 49 years of age. Japan 2004 value.
Source: National Transfer Accounts www.ntaccounts.org (accessed 31 August 2015).

The aggregate flows by age are the product of per capital flows, as shown in Figure 1, and population by age. These values are shown in Figure 2. The influence of Japan's old population age structure is clearly evident. Most public transfers go to the elderly.

In Japan, population ageing and current tax and benefit policies would lead to a fiscal deficit of 52 trillion yen (Y) in 2050 at 2004 values (Figure 3). The projected Y52 trillion deficit comes mainly from the deficit of people aged 65 and older (Y33 trillion), and a decrease in tax revenue from working people aged 20–64 (Y24 trillion). Due to a very low fertility rate, a surplus of about Y6 trillion is projected for people aged below 20 in 2050. Fifty-two trillion yen is about 58 percent of government revenue in 2004. Therefore, taxes must increase by 58 percent, or benefits must decrease by the same amount, or deficits must increase, or some combination of these three cases must occur. This implies tax should increase by 3.5 percent per annum between 2004 and 2050 just to offset the effect of population ageing if benefits and deficits are to remain constant at the 2004 level.

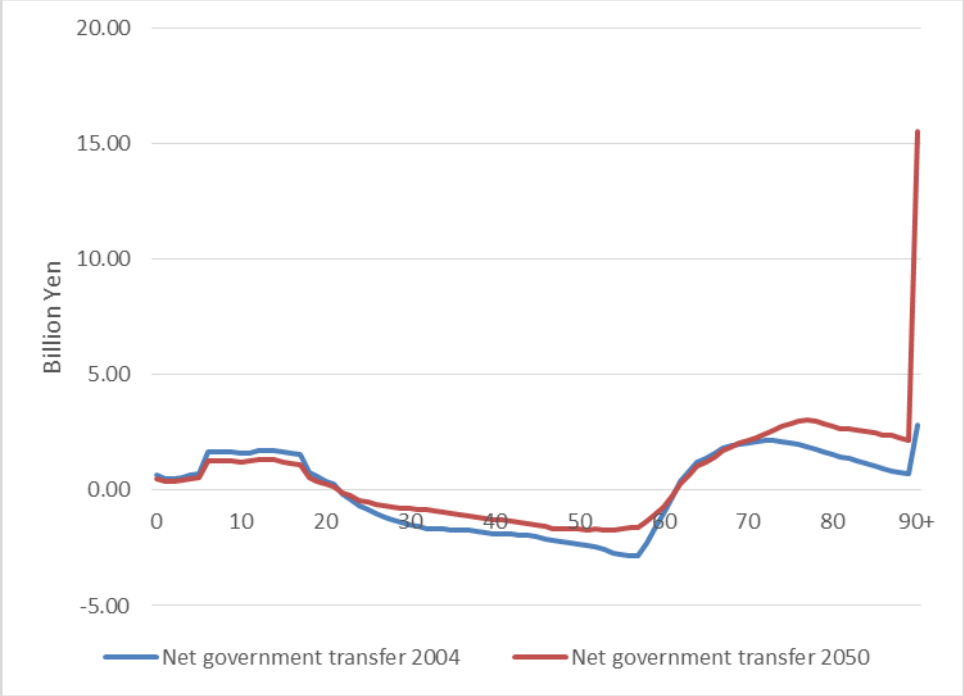
Figure 2: Aggregate Public Transfer Inflows and Outflows by Age*



Note: * Normalised by dividing them by the average of total labour income by single year of age for those 30 to 49. Japan 2004 value.
Source: National Transfer Accounts, www.ntaccounts.org (accessed 31 August 2015).

In contrast, many developing Asian countries will see a decrease in budget deficit or an increase in surplus because their working age populations will continue to expand. Rapid growth will also relax public sector budget constraints. The danger is that countries with favourable demographics and fast growth will implement generous transfer systems that ultimately prove to be unsustainable. In fact, lower-income countries in Asia spend relatively little on public programmes for reasons that are largely unrelated to demographic conditions. As lower-income countries develop, however, the key issue for them is whether the public sector can expand at the same time that their populations are ageing.

Figure 3: Aggregate Net Public Transfer by Age – Japan 2004 vs. 2050



Source: UN Population Division (2013a) and authors' calculations.

2. Methodology

The methodology is similar to Lee and Mason (2015), which was used to project public spending for education, health, and social protection spending. Following Lee and Mason (2015), we consider two main factors for our projections – changes in population age structure and changes in age-specific transfers due to projected changes in per capita income.

2.1. Projection Method

Let per capita transfers to persons aged x in year t in country z be designated by $b(z)\tau(x,t)$. For purposes of projection we will use a normalised support ratio equal to public transfers per person relative to per capita income, y(t), so that public transfers per person aged 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 normalised transfer profile per capita, transfers are assumed to increase at the same rate as per capita income.

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

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

Where $D_k\left[y(t)\right]$ 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:

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

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

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

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

Equation (3) is the ratio of per capita tax (spending) in year t relative to per capita tax (spending) on the programme 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.

2.2. 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. whether 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 Republic of Korea (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. Martinez–Vazquez et al. (2009) showed 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 where tax evasion prevails. Having said that, developing countries may 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 also a large variation across countries in terms of the expenditure mix. For example, about 40 percent of central government expenditure is non-age related in the median Organisation for Economic Cooperation and Development (OECD) country, compared with the nearly 70 percent 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 ageing 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 percent in 1990 to less than 10 percent in 2012. As a result, Japan's tax burden decreased by 4.2 percentage points, whereas the average tax burden ratio in OECD changed little during the same period (around 25 percent). In fact, the Japanese government cut their taxes in 1994, 1998, and 1999, whereas social welfare expenditure rose in large part due to population ageing. Furthermore, the compensation of employees has grown little during the same period due to a 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 whereas 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 parliamentarian 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, there are few previous models for making a long-term forecast of how tax revenue 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 expenditure are key determinants of the age profile, it is clear that projections of government revenue, tax revenue, expenditure, and debt will also much depend on economic growth and population age structure. For example, Korea's tax base will shrink and expenditure will increase markedly due to population ageing and a decline in the potential growth rate. So it is plausible to assume that the impact of population ageing will be substantial even allowing 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 percent in 2015 to over 200 percent by 2060 (National Assembly Budget Office 2015).

3. Data

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

3.1. 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 (http://www.un.org/en/development/desa/population/).

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 projections are used as a benchmark for extended projections up to 2050.[1] 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$5,000 per capita income throughout the entire projection period, and many others reach a higher income level only near the end of the projection period.

1) OECD projections for Japan, India, Indonesia, Korea, China, and Non-OECD countries up to 2060, (http://www.oecd.org/eco/outlook/lookingto2060.htm); 2) ADB projections for ADB member countries up to 2030 (http://www.iadb.org/intal/intalcdi/PE/2011/09482.pdf); and 3) The International Macroeconomic Data Set from the U.S. Department of Agriculture for 190 countries up to 2030 (http://www.ers.usda.gov/data-products/international-macroeconomic-data-set/). As ADB and USDA provide projections only up to 2030, OECD member and non-member projections are used as a benchmark for extended projections up to 2050.

Table 1: Per capita GDP Growth Rate Assumptions

Groups and Countries	Annual Rate of real per capita GDP Growth (%)	
	2010–2030	2030–2050
A: Mongolia, China, Bhutan, Sri Lanka, Cambodia, Myanmar, Lao PDR, India, Viet Nam	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 Darussalam, all others	1.0	1.0

Source: Authors' calculations. See footnote 1 for details.

3.2. 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 Viet Nam.

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 Nations 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.

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).

Table 2: Mapping of IMF Government Financial Statistics (GFS) – Revenue to Tax Profiles

GFS classification	Suggested NTA tax source
Taxes	
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**
Subsidies	
To public corporation	Various
To private enterprise	Various
Grants	
From foreign government	
Current	Rest of the world
Capital	Exclude from NTA flow account
From other general government units	Zero for general government
Other revenue	
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

Source: UN Population Division (2013b).

Public transfer inflows are public benefits, classified by purpose – education, health, pensions, and other public programmes. This classification is consistent with the UN Classification of Functions of Government (COFOG), but simplified to emphasise 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 programmes are assigned to the age group of the intended beneficiary of the public programme in question using techniques described below. The inflows from public collective goods, e.g. national defence or diplomacy, public administration, and public safety programmes, 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.

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 labour income of those aged 30–49. Thus, given a particular profile, per capita flows rise at the same rate as projected per capita labour income for prime age adults. In addition, we assume that as countries become members of higher income groups 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 below in Table 1a.

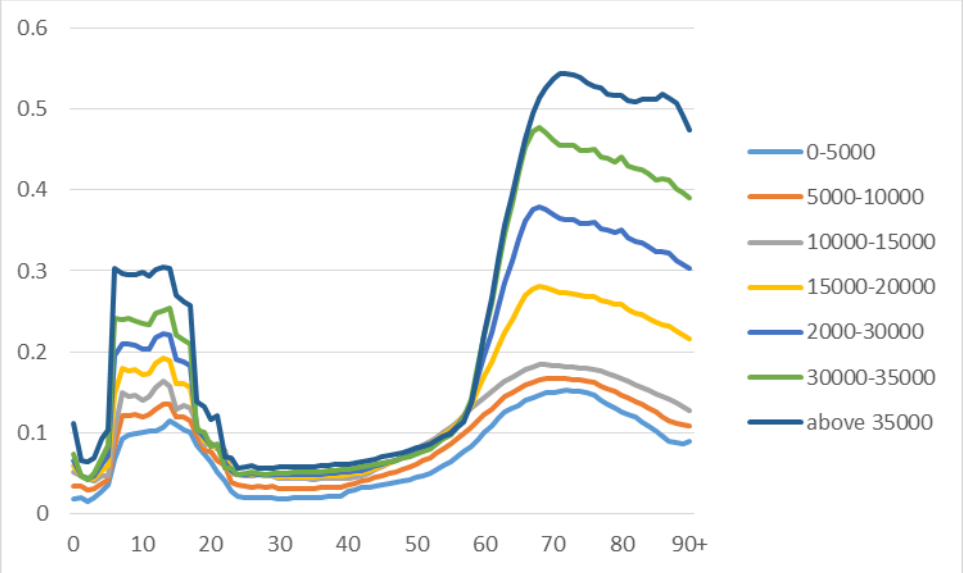
The profiles thus obtained for each income group are shown in Figures 4 and 5. The level of spending and revenue rises relative to income as per capita income reaches higher levels.

Table 1a: 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, China 2002, Cambodia 2009, and Indonesia 2005. For education and health India 2004, Indonesia 2005, Philippines 1999, China 2002, Thailand 2004, and Viet Nam 2008. For social protection, China 2002, Philippines 1999, and Thailand 2004.
$5,000 to 10,000	Interpolated
$10,000 to 15,000	Korea 2000 and Taiwan 1998 for Tax and Expenditure
$15,000 to 20,000	Interpolated
$20,000 to 30,000	Interpolated
$30,000 to 35,000	Japan 1994
$35,000 or more	Japan 1999 & Japan 2004

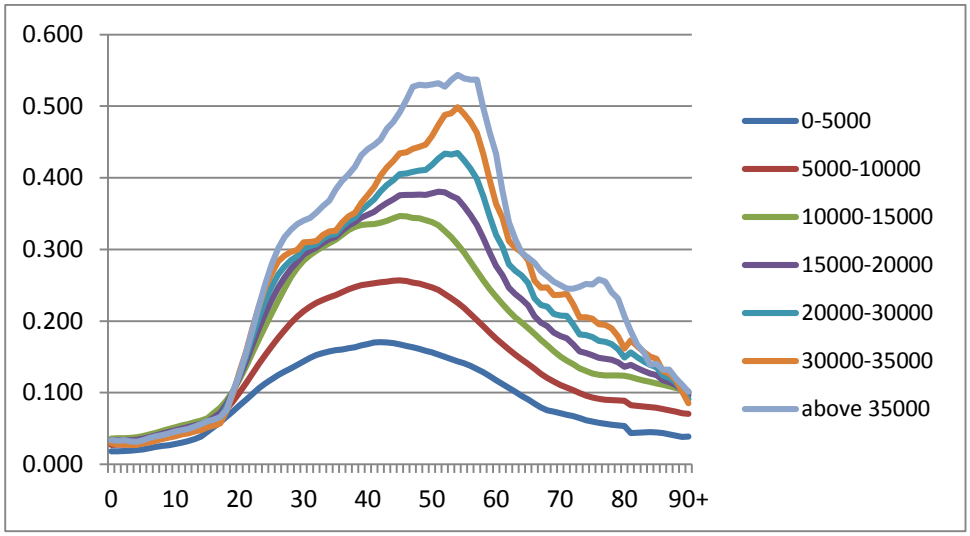
Source: National Transfer Accounts (www.ntaccounts.org) and calculations by authors.

Figure 4: Model Profiles of Public Transfer Inflow on Social Welfare



Note: Social welfare on education, health, and social protection by age. Normalised by dividing the numbers by the average of the per capita labour income of individuals 30 to 49 years of age. .
Source: National Transfer Accounts (www.ntaccounts.org) and calculations by authors.

Figure 5: Model Profiles of Public Transfer Outflow by Age of Tax Payers



Note: Normalised by dividing the numbers by the average of the per capita labour income of individuals 30 to 49 years of age.
Source: National Transfer Accounts (www.ntaccounts.org) and calculations by authors.

In Figure 4, the age patterns of government spending that are particularly visible are for 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.[2] 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 *counrty 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, Figure 4 does not include other public spending that benefits everyone (i.e. is allocated equally to the whole population) such as national defence. Nevertheless, other public spending is assumed to increase at 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 other public spending that benefits everyone does not affect the results. Likewise, using the tax profile to estimate government revenue,

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

including non-tax revenue, will not change our results since we assume that non-tax revenue as a share of GDP will not change over time.

4. Fiscal Projections

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

Actual values (1995–2010) and projections of government expenditure to 2050 are provided in Table 3. Populations are ageing, which should push up the level of social welfare spending. Moreover, 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 is included, but in most cases the values refer to central government spending only.

4.1. Expenditure

On average, the increase amounts to a 3.3 percentage rise in the percentage of GDP spent on public expenditure.[3] The simple average of developing Asian countries increases from 24.4 percent of GDP in 2010 to 27.7 percent in 2050, 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 percent of GDP in 2010 to 27.5 percent of GDP in 2050. In China, the projected rise is from 22.4 percent to 33.9 percent as a share of GDP, a projected increase of 51 percent. This sharp increase reflects rapid ageing combined with relatively high rates of economic growth. In Korea, it will increase from 19.8 percent in 2010 to 32.4 percent in 2050, in large part due to population ageing. In a number of other countries outside East Asia, public expenditure will also grow quite rapidly.

[3] The calculation excludes countries with missing periods of observations.

Table 3: Government Expenditure as % of GDP

	1995	2000	2005	2010	2020	2030	2040	2050
Developing Member Economies (a)								
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 (b)	..	16.3	18.3	22.4	25.2	26.1	29.3	33.9
Hong Kong	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	..	..	..	..
Taiwan	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
Viet Nam (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
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
	25.4	23.4	22.7	25.4	24.6	26.0	26.5	27.7
Developed Member Economy (a)				25.5				27.6
Japan	16.1	18.3	16.0	18.0	20.5	21.8	23.9	24.8

Note: [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.

[b] Expenditure includes local government expenditure.

Source: ADB and calculations by authors.

Table 4: Government Tax Revenue as % of GDP

	1995	2000	2005	2010	2020	2030	2040	2050
Developing Member Economies								
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 (b)	9.9	12.7	15.6	18.2	27.3	26.8	34.9	37.3
Hong Kong	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	..
Taiwan	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
Viet Nam (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
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
	13.9	13.9	15.0	15.1	16.1	17.6	18.1	19.0
Developed Member Economy (a)								
Japan	10.7	10.4	10.2	8.9	8.8	8.6	8.3	8.1

Note: [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.

[b] Expenditure includes local government expenditure.

Source: ADB and calculations by authors.

Table 5: Government Revenue as % of GDP

	1995	2000	2005	2010	2020	2030	2040	2050
Developing Member Economies (a)								
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 (b)	10.3	13.5	17.1	20.7	29.8	29.3	37.4	39.8
Hong Kong	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	..
Taiwan	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
Viet Nam (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
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
	19.1	19.1	19.7	21.0	21.2	22.7	23.2	24.1
Developed Member Economy (a)								
Japan	12.2	12.0	11.9	11.2	11.1	11.0	10.6	10.4

Note: [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.
[b] Expenditure includes local government expenditure.

Source: ADB and calculations by authors.

Table 6: Fiscal Balance as % of GDP

	1995	2000	2005	2010	2020	2030	2040	2050
Developing Member Economies (a)								
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 (b)	..	-2.8	-1.2	-1.7	4.6	3.2	8.2	6.0
Hong Kong	-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	..	..	..	..
Taiwan	-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	..	..	..	..
Viet Nam (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
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
	-2.1	-2.1	-0.6	-1.5	-1.8	-1.3	-1.4	-1.1
Developed Member Economy (a)								
Japan	-3.9	-6.3	-4.1	-6.7	-9.4	-10.9	-13.3	-14.4

Note: [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.

[b] Fiscal balance includes local government balance.

Source: ADB and calculations by authors.

For a few countries, only a small increase is projected because projected economic growth and projected population ageing are limited. Government expenditure in Bangladesh, India, and Philippines are projected to reach 12.6, 16.5, and 16.9 percent of GDP, respectively, in 2050. Note that spending in Singapore is quite low in 2050 (16.9 percent), 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 emphasise the kind of benefits that are affected by the age structure. Other public spending may also increase rapidly, but it is not considered here. Other public expenditure can only be assessed with more extensive data with detailed information on the different components of public spending.

4.2. Revenue 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 4 and 5. 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 revenue averages 15.2 percent of GDP (simple average of country values) in Asia. The average figure is projected to increase to 20.2 percent of GDP by 2050, ranging from 1.5 to 39.5 percent of GDP.

The projected increase in revenue is driven by an increase in income level, and in some developing economies by an 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 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 increase are projected for China, where tax revenue as a share of GDP soared from 9.9 percent in 1995 to 18.2 percent in 2010, and is projected to further increase to 37.3 percent in 2050, an increase of 105 percent

for the next 40 years. But for Korea and Taiwan, tax revenue increases very little since the negative effect of population ageing partially offsets the positive effects of growth. High levels of government revenue are not 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 levels of government revenue. Only Japan (central government) will experience a decline in tax revenue as a share of GDP due to its shrinking working age population.

Some countries rely much more on non-tax revenue for government spending. Timor–Leste is an extreme case where tax revenue accounts for only 1.5 percent of GDP in 2010, even though government revenue is 22.0 percent of GDP in 2010. This is because foreign aid makes up the larger part of the government budget. Another extreme case is Brunei Darussalam, where the difference between tax revenue and government revenue is about 20 percentage points 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.

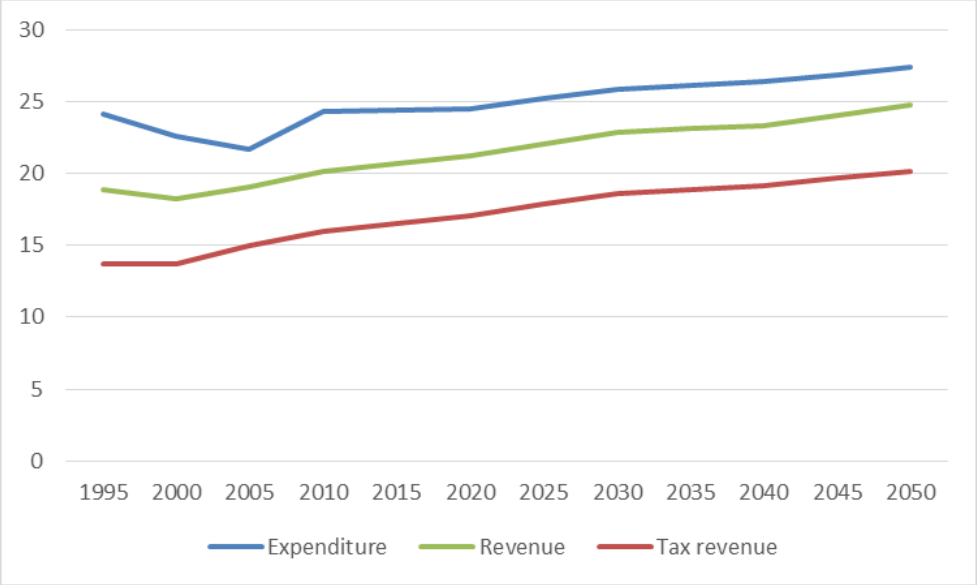
Fiscal balance is the government's income from tax and other revenue, including the proceeds of assets sold, minus government spending. When the balance is negative, the government has a fiscal deficit. When the balance is positive, the government has a fiscal surplus. The projected fiscal balance is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

However, our projections for revenue 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, China, Bhutan, Sri Lanka, Cambodia, Myanmar, Lao PDR, India, and Viet Nam). As expected, our results predict fiscal improvement for these countries. For example, China recorded a fiscal deficit of 1.7 percent in 2010, but our projection shows a fiscal surplus of 6 percent in 2050. The same is true for Bhutan, which recorded a fiscal surplus of 1 percent in

2010, which is projected to increase further to 10 percent in 2050, the highest among Asian countries.

Figures 6 and 7 present the averages of actual and projected government expenditure, government revenue, tax revenue, and fiscal balance as share of GDP. These are unweighted simple averages 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 revenue tends to rise faster than expenditure in our model. As a result, the fiscal deficit declines over time.

Figure 6: Average Government Expenditure, Revenue, and Tax Revenue as % of GDP

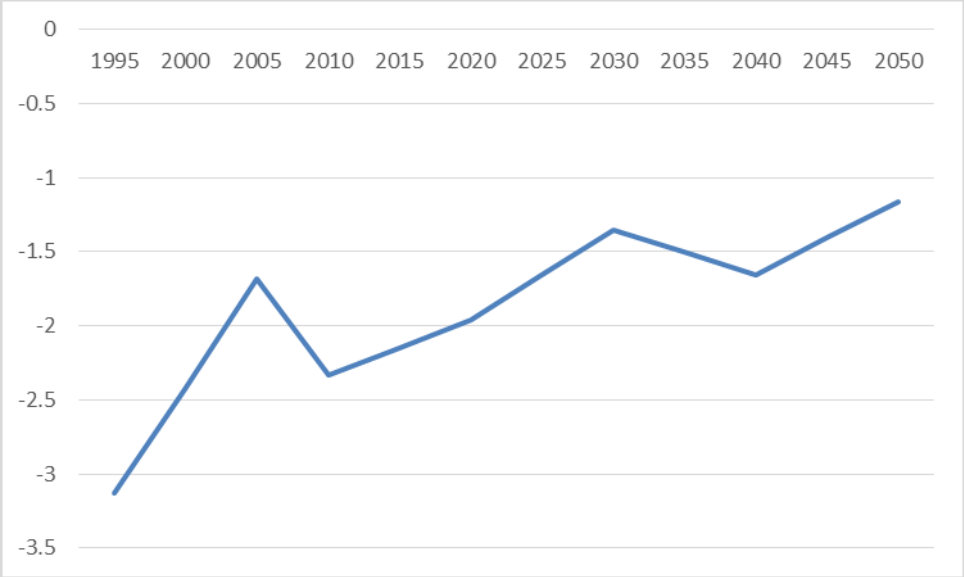


Note: GDP of 1995–2050, unweighted average of ADB Developing Member Countries.
Source: Authors' calculations.

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 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 revenue as a share of GDP assuming that all countries maintain the fiscal balance of 2010 until 2050. The appendix table shows that the tax revenue as a percentage of GDP for China increases to 29.7 percent in 2050 rather than 37.3 percent, as in the original scenario. The opposite is true for Korea and Taiwan.

Tax revenue for Korea is projected to increase to 26.6 percent in 2050 (rather than 15.6 percent) if fiscal balance is held constant. For Taiwan, tax revenue rises to 22.3 percent, rather than 9.9 percent.

Figure 7: Average Fiscal Balance as % of GDP



Note: GDP of 1995–2050, unweighted average of DMCs.
Source: Authors' calculations.

5. 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, correlates of income may account for some or all of the changes in the level of spending.

The analysis, presented in Tables 7–9, 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 share of GDP between 2010 and 2050. The third column reports the effect of changing age structure calculated by holding the levels 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 next 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 7 and 8) or as a percentage of the percentage change from the 2010 value (Table 9). 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 levels of spending.

For government expenditure the effects of changing age structure and changing levels of age-specific spending mutually reinforce each other in East Asia (Table 7). 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 to 4.9 percentage 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.

Somewhat surprisingly, the increase is much smaller in other Asian countries that are also ageing rapidly, for example Thailand. There are two underlying reasons for this. First, ageing in poorer countries has a smaller impact because welfare expenditure often does 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 expenditure 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 Developing Member Countries are further along in their ageing 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 8. 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 revenue and grants are assumed to increase as a fixed share of GDP in our model.

Table 7: Government Expenditure as % of GDP, Decomposition of Change

	Value in 2010	Percentage point change, 2010-50				As % of 2010 value		
		Total change	Due to age	Due to level	Due to interaction	Due to age structure	Due to level	Due to interactio
Developing Member Economies (a)								
Central and West Asia								
Afghanistan	8.9	3.8	3.8	0.0	0.0	..	..	..
Armenia	20.2	1.0	-0.1	0.6	0.5	0	3	3
Azerbaijan	12.4	6.5	0.2	5.8	0.5	2	47	4
Georgia	23.5	-1.3	-1.3	0.0	0.0	-5	0	0
Kazakhstan	13.4	13.2	0.1	12.6	0.5	1	94	4
Kyrgyz Republic	17.9	1.3	1.3	0.0	0.0	7	0	0
Pakistan	10.1	2.1	2.1	0.0	0.0	21	0	0
Tajikistan	18.0	1.9	1.9	0.0	0.0	10	0	0
Turkmenistan	..	..	..	..	..	..	..	..
Uzbekistan	20.4	2.5	2.5	0.0	0.0	12	0	0
East Asia								
China (b)	18.2	19.1	-1.3	20.1	0.3	-7	111	2
Hong Kong	13.6	-0.3	-1.8	1.7	-0.3	-13	13	-2
Korea, Rep. of	14.0	1.5	-1.3	2.9	-0.1	-9	21	-1
Mongolia	31.9	..	..	..	..	..	..	..
Taiwan	8.0	1.9	-0.6	2.4	0.1	-8	30	2
South Asia								
Bangladesh	7.8	1.0	1.0	0.0	0.0	13	0	0
Bhutan	13.3	16.4	1.6	12.0	2.8	12	90	21
India	7.3	4.7	0.8	3.4	0.6	10	46	8
Maldives	10.7	7.5	1.4	4.8	1.3	13	45	12
Nepal	13.4	3.2	3.2	0.0	0.0	24	0	0
Sri Lanka	12.9	6.2	-0.2	6.1	0.2	-1	48	1
Southeast Asia								
Brunei Darussalam	..	..	..	..	..	..	..	..
Cambodia	10.7	1.2	1.2	0.0	0.0	11	0	0
Indonesia	11.2	6.6	0.7	5.2	0.6	6	47	6
Lao PDR	13.5	3.2	3.2	0.0	0.0	23	0	0
Malaysia	13.7	8.1	1.3	5.5	1.3	9	40	10
Myanmar	3.2	0.3	0.2	0.0	0.1	5	1	2
Philippines	12.1	1.6	1.6	0.0	0.0	13	0	0
Singapore	13.2	-1.3	-1.3	0.0	0.0	-10	0	0
Thailand	14.6	12.5	-1.3	14.1	-0.4	-9	97	-3
Viet Nam (a)	22.4	0.3	0.3	0.0	0.0	1	0	0
The Pacific								
Fiji	21.6	11.8	0.9	10.0	0.9	4	46	4
Micronesia, Fed. States of	12.0	2.8	2.8	0.0	0.0	23	0	0
Papua New Guinea	24.4	3.7	3.7	0.0	0.0	15	0	0
Samoa	24.2	2.4	2.4	0.0	0.0	10	0	0
Solomon Islands	34.0	5.5	5.5	0.0	0.0	16	0	0
Timor-Leste	1.2	0.3	0.3	0.0	0.0	27	0	0
Tonga	16.1	1.9	1.9	0.0	0.0	12	0	0
Vanuatu	16.0	2.4	2.4	0.0	0.0	15	0	0
Developed Member Economy (a)								
Japan	8.9	-0.8	-0.9	0.0	0.1	-10	0	1

Source: ADB and calculations by authors.

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 revenue in this region. The impact is not big enough to offset the increase in tax revenue though. On average, changing age structure could reduce tax revenue by between 6 and 8 percent in East Asia. The same is true for Singapore and Thailand. On the other hand, most countries in South Asia and Southeast Asia are expected to see an increase in tax revenue between 2010 and 2050. The effects in others regions vary widely – ranging from 1 percent to 21 percent. 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 China and Thailand. This is due the assumptions underlying our projections, which are based on observed data.

Table 9 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, 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 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 that is expected to simultaneously face a substantial fiscal deficit, slower economic growth, and population ageing. Population ageing will significantly harm the fiscal health of all East Asian countries. However, healthy economic growth could offset some of the negative impact of population ageing. China, 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 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.

Table 8: Government Revenue as % of GDP, Decomposition of Change

		Percentage point change, 2010-50				As % of 2010 value		
	Value in 2010	Total change	Due to age	Due to level	Due to interactio	Due to age	Due to level	Due to interactio
Developing Member Economies (a)								
Central and West Asia								
Afghanistan	10.8	3.8	3.8	0.0	0.0	..	..	..
Armenia	21.7	1.0	-0.1	0.6	0.5	0	3	2
Azerbaijan	26.8	6.5	0.2	5.8	0.5	1	21	2
Georgia	27.1	-1.3	-1.3	0.0	0.0	-5	0	0
Kazakhstan	14.2	13.2	0.1	12.6	0.5	1	89	4
Kyrgyz Republic	23.1	1.3	1.3	0.0	0.0	5	0	0
Pakistan	14.0	2.1	2.1	0.0	0.0	15	0	0
Tajikistan	19.3	1.9	1.9	0.0	0.0	10	0	0
Turkmenistan	16.1	..	..	..	..	..	..	..
Uzbekistan	21.8	2.5	2.5	0.0	0.0	12	0	0
East Asia								
China (b)	20.7	19.1	-1.3	20.1	0.3	-6	97	1
Hong Kong	21.2	-0.3	-1.8	1.7	-0.3	-8	8	-1
Korea, Rep. of	21.4	1.5	-1.3	2.9	-0.1	-6	14	0
Mongolia	36.7	..	..	..	..	..	..	..
Taiwan	11.1	1.9	-0.6	2.4	0.1	-6	22	1
South Asia								
Bangladesh	9.5	1.0	1.0	0.0	0.0	11	0	0
Bhutan	27.4	16.4	1.6	12.0	2.8	6	44	10
India	10.6	4.7	0.8	3.4	0.6	7	32	5
Maldives	23.4	7.5	1.4	4.8	1.3	6	20	5
Nepal	15.1	3.2	3.2	0.0	0.0	21	0	0
Sri Lanka	14.6	6.2	-0.2	6.1	0.2	-1	42	1
Southeast Asia								
Brunei Darussalam	54.3	..	..	..	..	..	..	..
Cambodia	13.2	1.2	1.2	0.0	0.0	9	0	0
Indonesia	15.4	6.6	0.7	5.2	0.6	5	34	4
Lao PDR	15.3	3.2	3.2	0.0	0.0	21	0	0
Malaysia	20.0	8.1	1.3	5.5	1.3	6	27	7
Myanmar	14.2	0.3	0.2	0.0	0.1	1	0	1
Philippines	13.4	1.6	1.6	0.0	0.0	12	0	0
Singapore	22.5	-1.3	-1.3	0.0	0.0	-6	0	0
Thailand	16.8	12.5	-1.3	14.1	-0.4	-8	84	-2
Viet Nam (b)	26.7	0.3	0.3	0.0	0.0	1	0	0
The Pacific								
Fiji	25.4	11.8	0.9	10.0	0.9	4	40	3
Micronesia, Fed. States of	21.8	2.8	2.8	0.0	0.0	13	0	0
Papua New Guinea	26.1	3.7	3.7	0.0	0.0	14	0	0
Samoa	27.3	2.4	2.4	0.0	0.0	9	0	0
Solomon Islands	37.0	5.5	5.5	0.0	0.0	15	0	0
Timor-Leste	22.0	0.3	0.3	0.0	0.0	1	0	0
Tonga	20.1	1.9	1.9	0.0	0.0	10	0	0
Vanuatu	17.6	2.4	2.4	0.0	0.0	14	0	0
Developed Member Economy (a)								
Japan	11.2	-0.8	-0.9	0.0	0.1	-8	0	1

Source: ADB and calculations by authors.

Table 9: Fiscal Balance as % of GDP, Decomposition of Change

		Percentage point change, 2010-50				As % of % point change, 2010-50		
	Value in 2010	Total change	Due to age structure	Due to level	Due to interaction	Due to age structure	Due to level	Due to interaction
Developing Member Economies (a)								
Central and West Asia								
Afghanistan	..	..	..	..	..	..	..	..
Armenia	-5.0	2.9	-1.5	4.0	0.4	-51	138	14
Azerbaijan	-0.9	-3.5	-4.2	0.4	0.3	-120	11	9
Georgia	-5.6	-3.5	-3.5	0.0	0.0	-100	0	0
Kazakhstan	..	..	..	..	..	..	..	..
Kyrgyz Republic	-4.9	-0.9	-0.9	0.0	0.0	-100	0	0
Pakistan	..	..	..	..	..	..	..	..
Tajikistan	-7.1	0.3	0.3	0.0	0.0	100	0	0
Turkmenistan	..	..	..	..	..	..	..	..
Uzbekistan	..	..	..	..	..	..	..	..
East Asia								
China (b)	-1.7	7.7	-2.8	13.1	-2.6	-37	171	-34
Hong Kong	4.2	-5.2	-4.7	0.3	-0.9	-90	6	-17
Korea, Rep. of	1.3	-11.0	-5.8	-0.8	-4.4	-52	-8	-40
Mongolia	0.5	..	..	..	..	..	..	..
Taiwan	-2.8	-12.4	-5.5	-2.0	-4.8	-45	-16	-39
South Asia								
Bangladesh	-2.8	1.2	1.2	0.0	0.0	100	0	0
Bhutan	1.5	8.4	1.3	5.1	2.0	16	61	23
India	-4.8	2.2	0.3	1.3	0.6	14	57	29
Maldives	-15.6	3.6	3.6	0.0	0.0	100	0	0
Nepal	-3.5	3.4	-1.1	4.5	0.0	-33	132	1
Sri Lanka	-8.0	3.6	0.8	2.2	0.5	22	63	15
Southeast Asia								
Brunei Darussalam	..	..	..	..	..	..	..	..
Cambodia	-3.2	4.7	0.0	4.2	0.5	-1	90	11
Indonesia	-0.7	2.6	2.6	0.0	0.0	100	0	0
Lao PDR	-2.2	4.9	1.9	1.9	1.1	39	38	23
Malaysia	..	..	..	..	..	..	..	..
Myanmar	-4.6	0.9	0.9	0.0	0.0	100	0	0
Philippines	-3.5	1.6	1.6	0.0	0.0	100	0	0
Singapore	7.7	-1.3	-1.3	0.0	0.0	-100	0	0
Thailand	..	..	..	..	..	..	..	..
Viet Nam (b)	-2.1	5.6	-1.9	9.1	-1.5	-35	162	-28
The Pacific								
Fiji	..	..	..	..	..	..	..	..
Micronesia, Fed. States of	0.5	2.1	2.1	0.0	0.0	100	0	0
Papua New Guinea	..	..	..	..	..	..	..	..
Samoa	-7.4	2.8	2.8	0.0	0.0	100	0	0
Solomon Islands	8.3	9.6	1.1	7.9	0.6	12	82	6
Timor-Leste	3.5	0.1	0.1	0.0	0.0	100	0	0
Tonga	-2.7	1.7	1.7	0.0	0.0	100	0	0
Vanuatu	-2.0	4.2	4.2	0.0	0.0	100	0	0
Developed Member Economy (a)								
Japan	-6.7	-7.6	-7.1	0.0	-0.6	-93	0	-7

Source: ADB and calculations by authors.

6. Concluding Observations

Although data limitations limit our analysis of the relationship between demographic change and fiscal sustainability in Asia, our findings do 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 ageing Asian countries. On a more optimistic note, low-income countries, which are still enjoying an expansion of the working age population in the second phase of demographic transition, can help their own fiscal position substantially by growing rapidly. But it should be noted that population ageing is a universal feature of Asian countries. Only the timing and speed of demographic transition varies and sooner or later they will face a deterioration of their fiscal health, following in 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 are underdeveloped. Age profiles of tax burdens and benefits are available only for a few countries. Little is known about how slow growth and population ageing will influence the fiscal outlook in the coming decades. This points to an urgent need to improve the quality of data in Asian countries, particularly on public transfers.

Public programmes are providing important sources 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 ageing. Our results show that population ageing leads to very substantial increases in public spending and decreases in revenue even with constant age profiles. In all Asian countries, improving understanding of the connection between age, tax burden, and needs for support, should be made an urgent priority. Unfortunately, current policies often depend on definitions of working age or old age that are arbitrary and perhaps increasingly irrelevant.

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Table A1: Government Tax Revenue as % of GDP (holding 2010 fiscal balance constant)

	1995	2000	2005	2010	2020	2030	2040	2050
Developing Member Economies								
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 (b)	9.9	12.7	15.6	18.2	21.0	21.9	25.1	29.7
Hong Kong	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	..	..	..	..
Taiwan	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	..	..	..	..
Viet Nam (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
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

Note: [a] Data refer to central government, except for Bangladesh, Georgia, Kiribati, the Kyrgyz Republic.

[b] Tax revenue includes local government tax revenue.

Source: ADB and calculations by the authors.

Table A2: Government Revenue as % of GDP (holding 2010 fiscal balance constant)

	1995	2000	2005	2010	2020	2030	2040	2050
Developing Member Economies (a)								
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 (b)	10.3	13.5	17.1	20.7	23.5	24.4	27.6	32.2
Hong Kong	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	..	..	..	..
Taiwan	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
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	..	..	..	..
Viet Nam (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

Note: [a] Data refer to central government, except for Bangladesh, Georgia, Kiribati, and the Kyrgyz Republic.

[b] Government revenue includes local government revenue.

Source: ADB and calculations by authors.

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