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Reformulating the Support Ratio to Reflect Asset Income and Transfers

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ABSTRACT

“Reformulating the Support Ratio to Reflect Asset Income and Transfers”:

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The support ratio is a simple and intuitive indicator of the macroeconomic consequences of population aging, and its changes are interpreted as implying corresponding changes in per capita (age standardized) consumption. However, this holds only to the extent that net consumers rely on transfers from net producers. If instead they rely entirely on asset income to smooth consumption, then support ratio variations have no effect on per capita consumption (in an open economy). The same is true across golden rule steady state economies: age adjusted per capita consumption would not vary with population growth rates and age distributions. Here we reformulate a “general support ratio” that reflects both asset income and transfers, and draw on National Transfer Accounts data to compare the results for different countries. When the elderly are funded heavily by public transfers as in Sweden or Austria, the new measure gives the same result as the old one. In countries like the US or Mexico where old age consumption is funded more heavily out of asset income, the new measure suggests that the effects of population aging on consumption will be muted. This new general support ratio incorporates in a simple way a core aspect of the Second Demographic Dividend: population aging can drive asset accumulation. We also show how the general support ratio is related to some results from neoclassical growth models with intergenerational transfers.

Introduction

The support ratio is a simple and intuitive indicator of the economic consequences of population aging. It describes how the number of working age people is changing relative to the numbers of consumers, each weighted by baseline labor income and consumption by age (Cutler et al, 1990). Between 2010 and 2050, the US support ratio will decline by about 12.5% or one eighth. Other things equal, per capita consumption will also decline by that amount, or be 12.5% lower than otherwise, e.g. for given growth in labor productivity.

The Standard Support Ratio can be misleading

But "other things equal" is a strong assumption. If all retirees relied exclusively on some combination of public and private transfers from workers, the support ratio would successfully capture key implications of changes in population age structure. Under other circumstances the support ratio is less useful. Consider a population of workers and retirees. Assume that in aggregate, workers exactly consume their labor income, while retirees use asset income and the sale of assets to finance their consumption fully. Now suppose that population aging leads to a doubling of the ratio of older retirees to workers. The standard support ratio drops in this case, indicating that per capita consumption will fall, other things equal. But why should per capita consumption change at all? Workers will still in aggregate exactly consume their labor income, and retirees will exactly consume their assets and asset income.

If assets are used to finance retirement, aging could affect capital accumulation, interest rates, and wages. In a small open economy, wages and interest rates are determined in international markets. In this case, population aging has no effect whatsoever on the consumption of workers or retirees in this hypothetical economy. Since their relative numbers change, and levels of consumption might be different in the two age groups, overall per capita consumption (the weighted average for workers and retirees) might either rise or fall. Age standardized consumption will not change.

In a closed economy, the capital labor ratio will rise, raising the marginal product of labor and reducing the interest rate. Under most circumstances this will lead to an increase in per capita income and consumption, but there are circumstances when it will not. In either an open or the closed economy a change in the support ratio tells us only about one dimension of the economic consequences of population aging. The support ratio emphasizes the role of labor in production and transfers for smoothing consumption. But in reality, capital also plays an important role in production and asset income is also used to smooth consumption. In the US, aggregate consumption is 30% greater than aggregate labor income and asset-income funds the remainder.

Some Accounting Identities

In general, aggregate consumption, C, is the sum of labor income, Y_l, capital income, rA, less saving, -S, and aggregate net public and private transfers, T. Disaggregating by age,

at each age x consumption equals the sum of labor income, asset income less saving, and net public and private transfers (here combined in τ):

$$c(x) = y_l(x) + rA(x) - s(x) + \tau(x) \tag{0.1}$$

A similar identity holds in aggregate, when we weight each age by population size *N*(x,t) and sum:

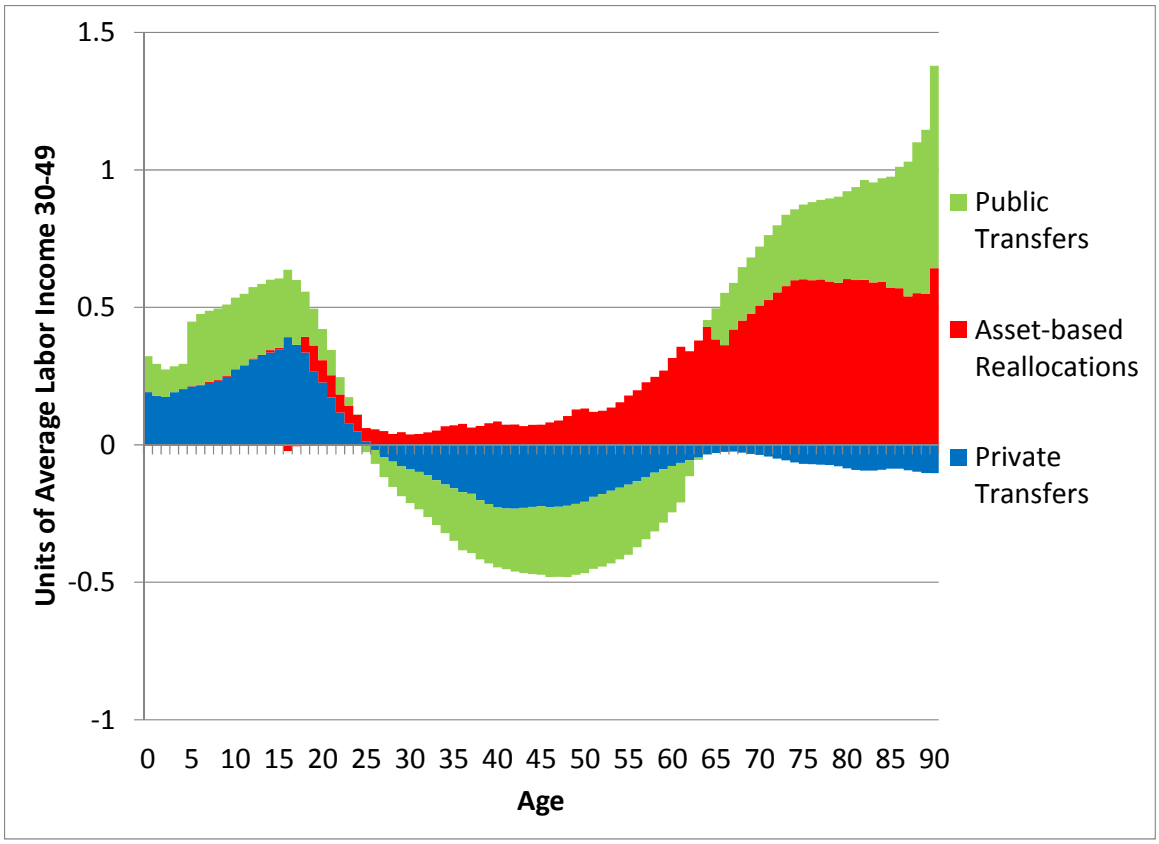
$$C(t) = \int_0^{\omega} N(x,t)c(x)\,dx$$
$$C = Y_l + rA - S + T \tag{0.2}$$

In a closed economy, total transfers T=0, since every transfer given is balanced by a transfer received. However, in an open economy the sum equals net transfers from the rest of the world. For example, in the US many immigrants send remittance income to households in their home countries, and these are counted as negative interhousehold transfers. Likewise, Social Security benefits paid to recipients in other countries are negative public transfers.

The extent to which asset income is used at age x to finance consumption is given by asset income less savings, or rA(x) – s(x). A person might have a lot of asset income, but save it all. In that case, this expression would be zero. A person might have no asset income in a year but sell off some stocks or a house and use that income to pay for consumption. In that case, for that year s(x) is negative, and rA(x) – s(x) is positive, indicating that the person financed consumption by dissaving. A person might have no assets at all at the start of the period, and might borrow some money. If the amount borrowed were spent on consumption then s(x) would again be negative, and the rA(x) – s(x) would be positive. In National Transfer Accounts, rA(x) – s(x) is called "Asset Based Reallocations" or abr(x).

Figure 1 shows how the average individual in the US in 2003 made up the difference between their consumption and their labor income. It can be seen that both public and private transfers are important, but that asset based reallocations are as well.

Figure 1. How the gap between consumption and labor income at each age is made up in the US in 2003 (National Transfer Accounts estimate)



Source: National Transfer Accounts

The General Support Ratio: An Alternative Measure of Demographic Pressure on Consumption

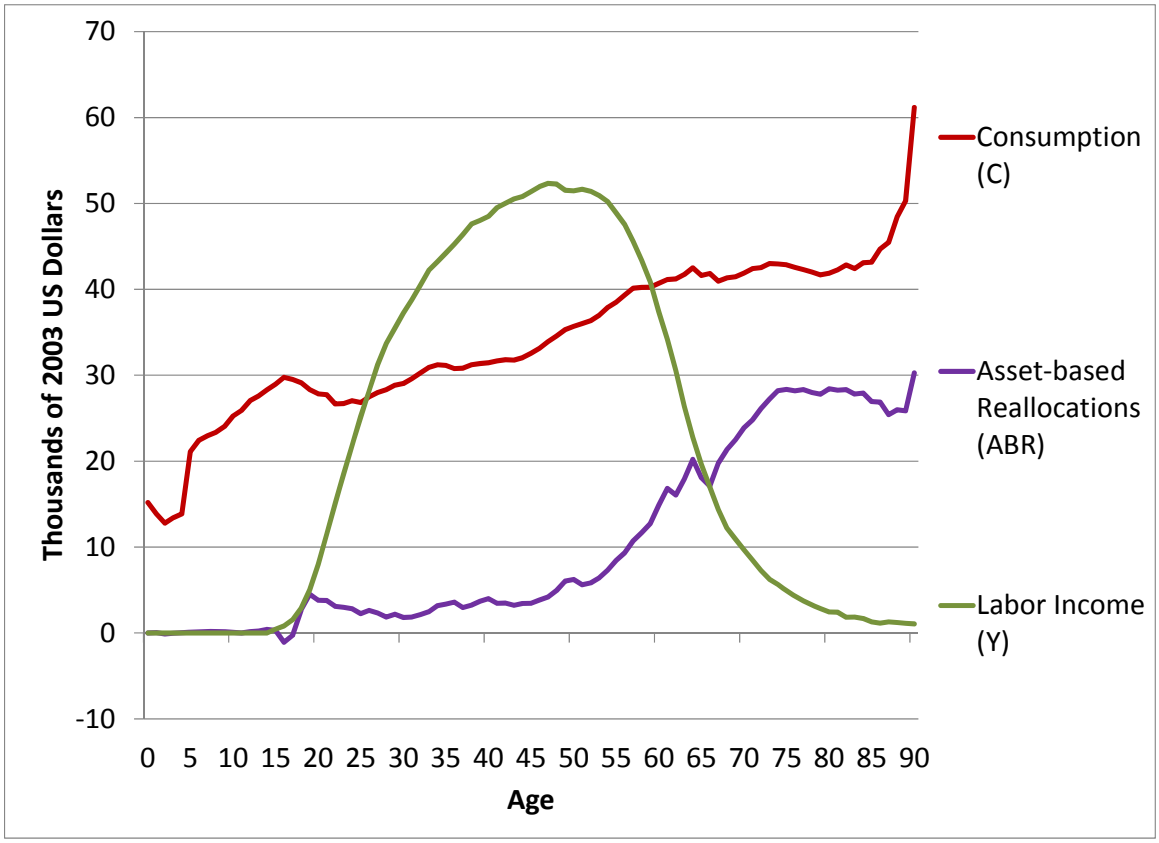
We propose an alternative index of demographic pressure on consumption, call it the generalized support ratio or GSR. Using the population age distribution in year t as weights, and holding fixed the age profiles of $y_l(x)$, A(x), and s(x) for a specific base year which will be 2003 for present purposes, we define:

$$GSR(t) = \frac{\int_0^{\omega} N(x,t)\, y_l(x)\, dx + \int_0^{\omega} N(x,t)\left[rA(x) - s(x)\right] dx}{\int_0^{\omega} N(x,t)\, c(x)\, dx} \qquad (0.3)$$

As a population ages, the standard support ratio (represented by the first integral in the numerator) declines, since the elderly earn little labor income. However, in the US the elderly on average rely heavily on asset income to finance their consumption. Net transfers from the working age population, mostly through the public sector in the form of Social Security benefits, Medicare and Medicaid, make up only about 40% or less of funding for consumption. The second integral, therefore, is most likely positive.

Figure 2 shows these age profiles, estimated for the US in 2003, following National Transfer Accounts methodology.[1] Note that both consumption and asset based reallocations rise strongly with age.

Figure 2. Age profiles of consumption, labor income and asset-based reallocations for the US, 2003

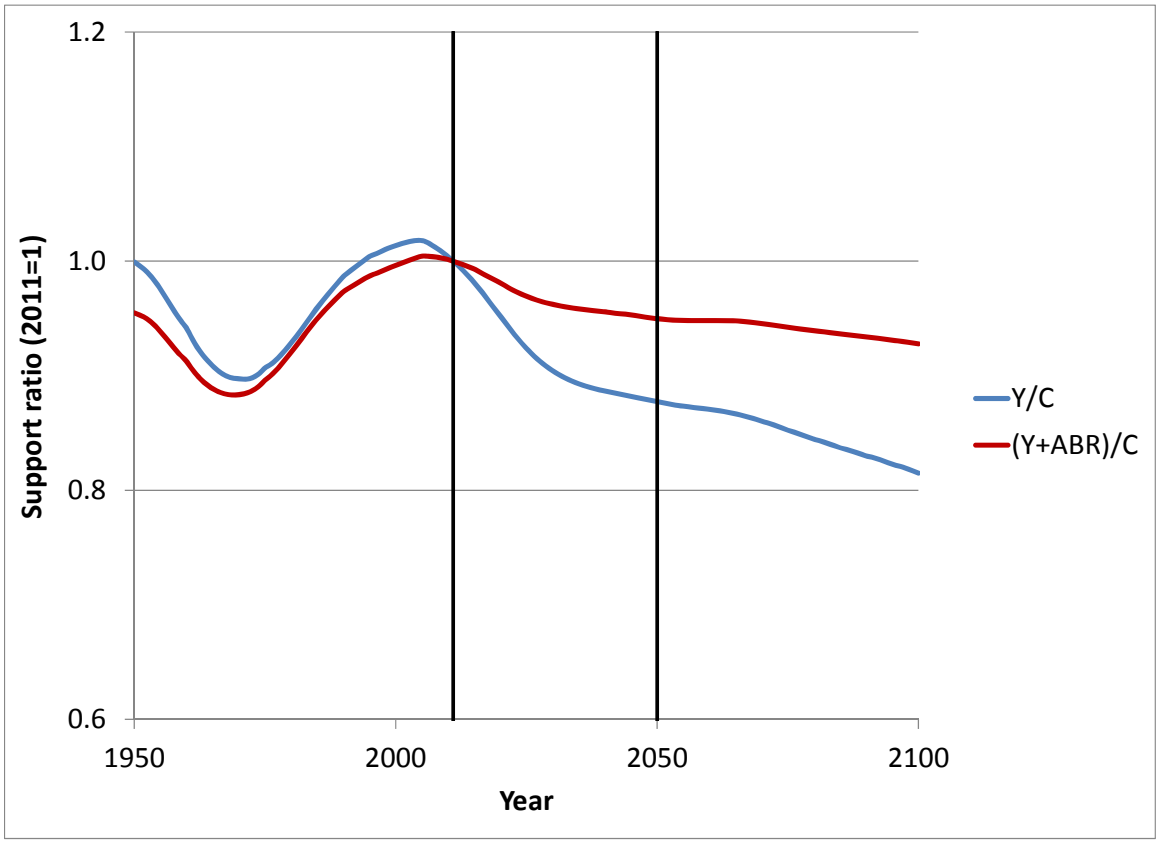


Source: National Transfer Accounts

The General Support ratio can be calculated using the age profiles in Figure 2 combined with standard projections of the population by age. The result is shown in Figure 3.

[1] Consumption includes private household expenditures imputed to individual household members, plus in-kind government transfers such as Medicare, Medicaid and Public Education and prorated shares of government expenditures that cannot be allocated by age, such as defense or research. Labor income includes pre-tax wages plus fringe benefits, as well as two thirds of self-employment income. Household asset income and savings are imputed to the household head. For more details, see http://www.ntaccounts.org.

Figure 3. Standard support ratio and alternative support ratio reflecting reliance on asset income by age



Source: Calculated from data in National Transfer Accounts and population estimates and projections from United Nations World Population Prospects 2010, Medium variant for projections.

Between 2011 and 2050, the standard support ratio drops by 12%. The General Support Ratio, however, drops by less than half this amount – about 5%. Over the 39 year period, these translate into annual rates of decline of .34% and .13%. From 2050 to 2100, the Standard Support Ratio is projected to decline more than three times as much as the General Support Ratio.

The greatest deviation between the SR and the GSR occur when changes in the proportions at old ages are declining. Between 1970 and 2010, the change in the GSR and the SR are very similar because the changes in the age distribution were concentrated at young ages and support to children comes almost entirely in the form of transfers. Asset-based reallocations do not play a role.
The Standard Support Ratio assumes that labor income by age remains the same and that the productivity of labor does not change. Labor productivity includes both labor income and asset income (since it is GDP/labor), but both kinds of income are attributed to labor. The General Support Ratio attributes only the marginal product of labor (assumed equal to the wage) to individuals by age, and assumes that this age profile does not change. It also assumes that individuals at a given age continue to save in the same way as in the past, and therefore have asset holdings similar to those in the past, and therefore have

similar Asset Based Reallocations as in the past.[2] These are strong assumptions, but saying anything substantive about the future usually requires strong assumptions. The GSR provides a kind of benchmark, and we can then ask in what ways it is misleading, whether deviations from the assumptions would raise it or lower it, why deviations would occur, and so on.

The General Support Ratio and the Second Dividend

The demographic dividend, or first demographic dividend, refers to a boost to per capita income growth that occurs during the course of the demographic transition when, following the start of fertility decline, the share of the population in the working ages rises and the support ratio along with it. This can add up to .8% per year to per capita income growth for a number of decades. However, soon after fertility bottoms out, the support ratio reaches its highest level and then begins to decline: population aging displaces the dividend phase, and the declining population share of the working ages now subtracts from the growth rate of per capita income. That is the story of the first dividend.

The second demographic dividend occurs when the demographic changes over the transition lead to increased investment in human and physical capital or assets, raising labor productivity and per capita income. Human capital investment rises through the quantity-quality mechanism described in the economic theory of fertility and observed in practice across the transition (Becker, 1981; Lee and Mason, 2011). Our focus here, however, is on asset accumulation and in a closed economy at least, capital accumulation.

Whether or not one is convinced by the life cycle saving theory, it is a fact that in any society, older individuals hold far greater wealth than younger, at least in part because of saving and accumulation over their working years, perhaps assisted by inheritances. If this pattern continues as the population ages, then the rising population share of the elderly would automatically raise assets or capital per worker, generating increased asset income in an open economy and perhaps a closed one, and boosting labor productivity. A continuing pattern of asset holding by age is a conservative assumption, because both declining fertility and rising longevity would be expected to increase savings and asset accumulation, strengthening this effect.

Our general support ratio makes exactly this conservative assumption that patterns of saving and asset accumulation observed in the baseline National Transfer Accounts will be continued in the future. Thus as the population ages, asset income going to each elder will remain the same, and asset income relative to the population will rise. This establishes a lower bound on the second demographic dividend.

[2] There have been recent articles and stories in the media suggesting that the younger workers of today have accumulated substantially less wealth relative to their incomes than was the case for their parents, in part due to massive debt incurred for higher education. Such changes in saving behavior by age and asset accumulation challenge projections of the GSR.

The General Support Ratio and Intergenerational Transfers

Here is another way to think about the GSR calculation. Equations (0.1) and (0.2) are identities. We can rewrite them with net transfers τ(x) or T on the left. Here we might think of transfers as a kind of residual that balances the budget items on the right hand side.

$$\tau(x) = c(x) + s(x) - y_l(x) - rA(x) \tag{0.4}$$
$$T = C + S - Y_l - rA$$

In a closed economy T is initially 0, but if we hold the age profiles on the right fixed then as the population age distribution changes the population-weighted items on the right will no longer sum to 0. To maintain budget balance for the given profiles in (1.4), the transfer profile would have to change. In reality, any of the profiles might change to maintain balance, but it is convenient here to assign T this role. Dividing both sides by C to form a ratio comparable to the Standard Support Ratio, and to express the changed magnitude of transfers as a fraction of C, we have:

$$\frac{T(t)}{C(t)} = 1 - \frac{\left(Y_l(t) + rA(t) - S(t)\right)}{C(t)} = 1 - GSR(t) \tag{0.5}$$

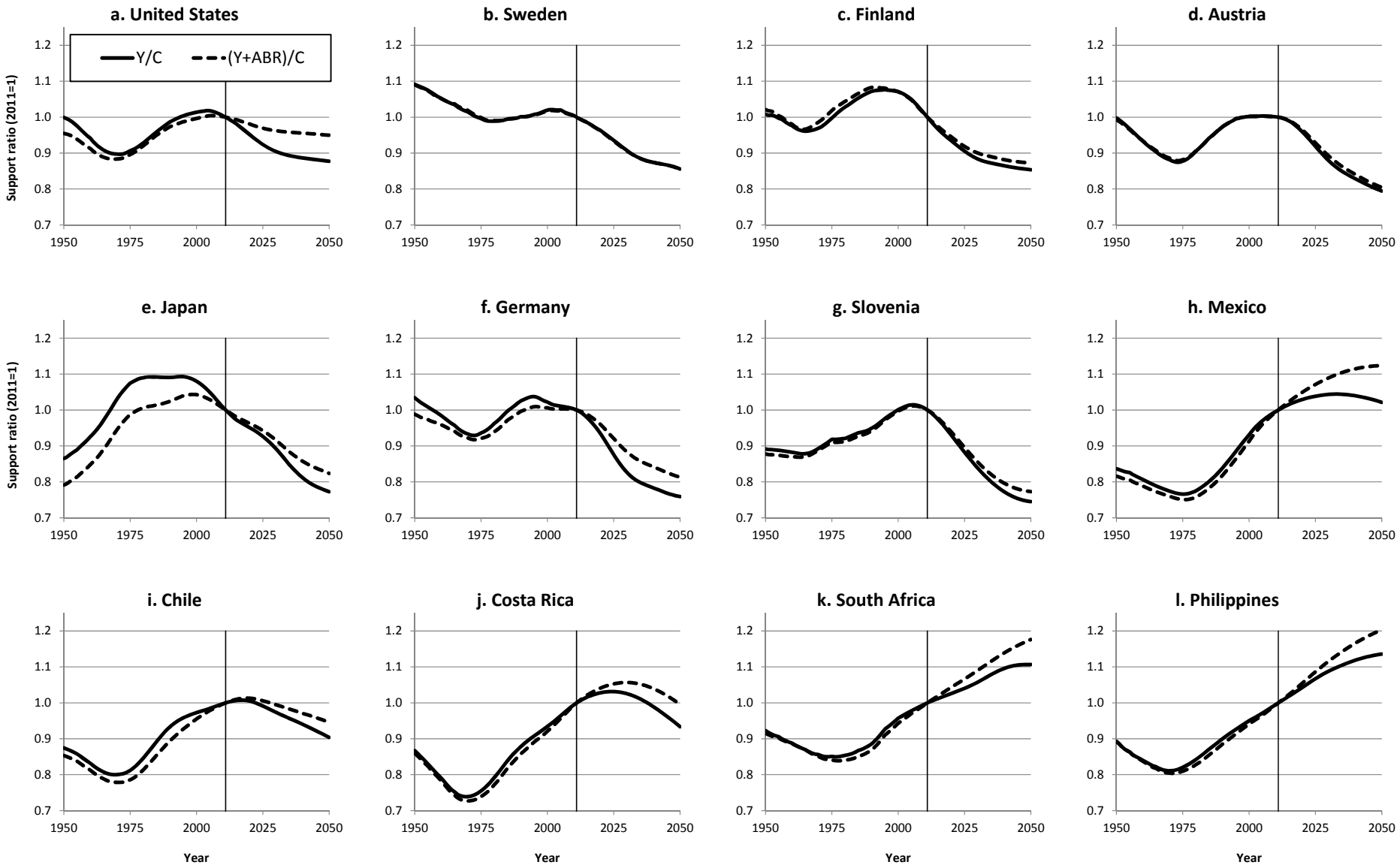
In other words, if we calculate the changes in total transfers implied by the net transfer age schedule in (0.1) together with changing population age distribution, divided by total consumption, we get 1 minus the GSR. Between 2011 and 2050 the GSR declined by 6%, and equivalently aggregate net transfers relative to total consumption increased by 6%. This is really what we want to know: how much would transfers have to increase to offset the costs of population aging? Or equivalently, how much would consumption at all ages have to decline to bear the costs of population aging?

How the General Support Ratio Could be Misleading

If the age profile of asset holdings results more from receipt of bequests than from life cycle saving, then the age pattern of asset holdings might change systematically as populations age. Perhaps the rising number of elderly per child would result in increased bequests and more asset accumulation. Or perhaps the smaller number of children would result in a weaker bequest motive, and asset accumulation would decline. Mechanical calculations cannot shed light on these deeper questions.

Another problem is that we have not considered potentially important public sector responses. Population aging will exert very serious pressure on public sector programs for the elderly, and it is widely expected that government deficits will mount, raising government debt which is negative wealth. It is not clear what the net effect on national wealth and national asset income will be. One could calculate the General Support Ratio for a nation under different assumptions about program reform, but then the simplicity of the measure would be lost.

Figure 4. Standard Support Ratio (solid line) and General Support Ratio (dashed line) 1950 to 2050, for 12 countries, adjusted to equal 1.0 in 2011.

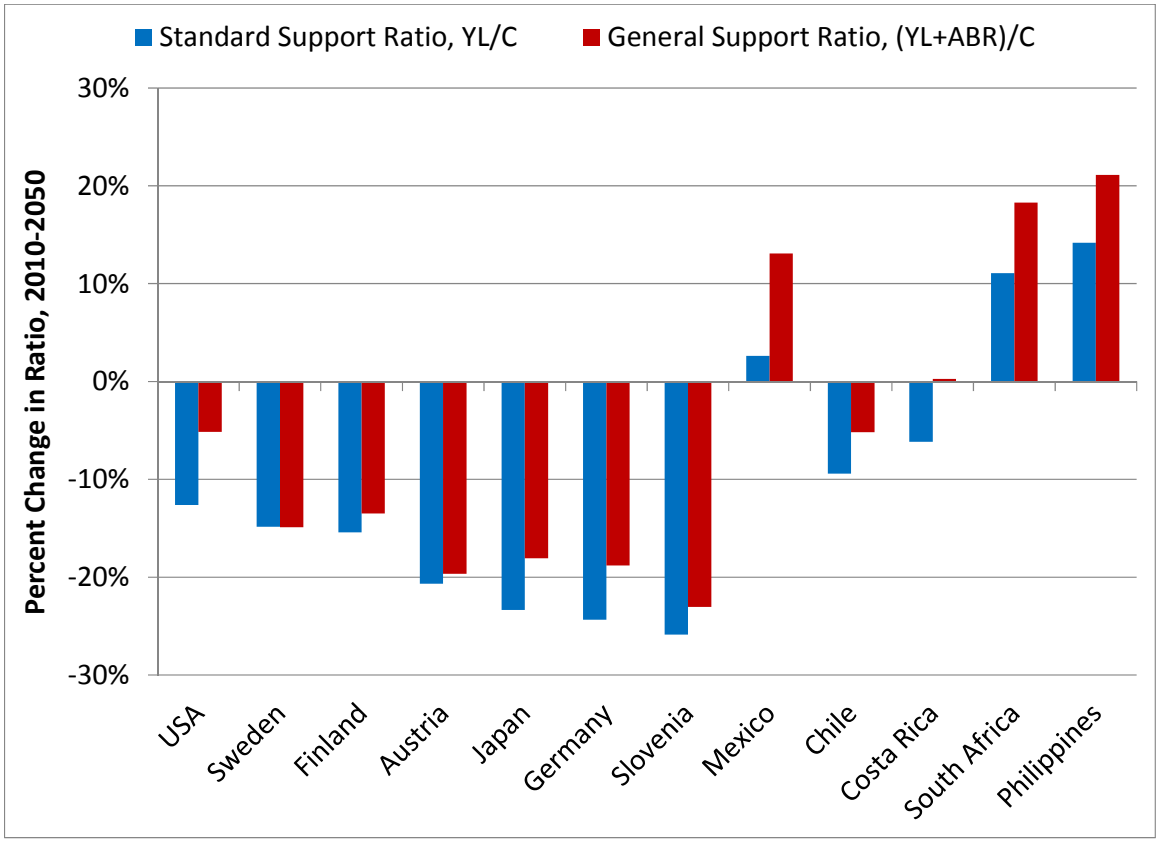


Note: The vertical lines at year 2011 on each graph mark the end of the estimates and 2011 as the first year of projected population data.

Comparisons of Standard and General Support Ratios for rich and developing nations

In Figure 4, we present comparisons of Standard Support Ratios and General Support Ratios calculated for various rich and developing nations from 1950 to 2050, with the ratios indexed to 1.0 in 2011. The countries are sorted by per capita ppp-adjusted GDP in the year of the age profile estimates, from highest to lowest. During the first dividend phase of the transition when changes in population age structure are dominated by changes in child dependency, the SR and GSR are very similar (in their slopes). In countries with very generous public sector transfer programs, like Sweden and Austria, the trajectories of the two support ratios are virtually identical throughout the century-long period. In countries like Mexico or the US where elderly people rely to a considerable extent on asset income to fund their consumption, the trajectories are quite different. In particular, in the latter countries, the General Support Ratio indicates much less serious consequences of future population aging. The percent change from 2010 to 2050 for both the Standard Support Ratio and the General Support Ratio for these twelve countries are shown in Figure 5, with the countries shown again in order of per capita ppp-adjusted GDP.

Figure 5. Percent change in support ratios from 2010 to 2050, for 12 countries.



Population Age Distributions and Consumption in Golden Rule Economies

Paul Samuelson (1975) considered a society that supported its elderly population through intergenerational transfers from the working age population. He noted that a more rapidly growing population would have a younger age distribution, with more workers available to share the cost of supporting each retiree, but also requiring a higher saving rate to maintain any given capital labor ratio. Samuelson suggested that there would be an optimal population growth rate at some intermediate level that would get the best tradeoff between the costs and benefits of population growth. Unfortunately he turned out to have found the worst growth rate rather than the best (Deardorff, 1976; Samuelson, 1976) but the question he posed remains useful and interesting. Arthur and McNicoll (1978), in a seminal comment on Samuelson's (1975) paper, derived an expression for the derivative of life time utility with respect to the population growth rate across golden rule steady states:

$$\frac{d\ln(C)}{dn} = A_c - A_{y_l} - \frac{K}{c} \tag{0.6}$$

Here, C is the survival weighted discounted value of consumption longitudinally over the life cycle, n is the steady state population growth rate, A_c and A_{yl} are the average ages of consuming and earnings in the stable population, K is capital per worker, and c is cross-sectional per capita income. If A_c is greater than A_{yl} then income is earned at a younger age than it is consumed, and resources flow upwards from younger to older ages, either through transfers or through saving and dissaving. K/c reflects the cost of saving a greater proportion of output to invest to equip the more rapidly growing labor force with capital when n is higher. The assumption of golden rule saving is strong and rarely, if ever, satisfied in reality, but Lee and Mason (2012) have shown that the same condition holds under other conditions that fit the stylized facts of advanced economies fairly closely.

Willis (1988) deepened this result, showing that this derivative was equal to per capita transfer wealth. Willis's result was derived under somewhat more general conditions by Lee (1974). Willis importantly showed that:

$$T = A_c - A_{y_l} - \frac{K}{c} \tag{0.7}$$

where T is aggregate transfer wealth per capita in the population. As a consequence, if follows that:

$$\frac{d\ln(C)}{dn} = \frac{T}{c} \tag{0.8}$$

Without going into the details of measuring transfer wealth, suffice it to say that if there are no net transfers at all at any age, then T=0 and small changes in the population growth rate and the age distribution have no effect on lifetime consumption. This is the case in which all consumption smoothing is accomplished through saving and dissaving. Of

course, transfers are not zero in any society, and children are supported almost entirely by transfers. But to the extent that transfers in general are smaller, this derivative will be smaller. Furthermore, if downward transfers to children are balanced by upward transfers to the elderly in the sense that the average ages of giving and receiving transfers are equal, then T=0 and again small variations in growth rates and stable age distributions have no effect on lifetime consumption.

In related work, Lee and Mason (2012) search for the level of fertility that would maximize the support ratio under a range of assumptions, including those in the Arthur and McNicoll article, based on empirical age profiles from the National Transfer Accounts project.

The GSR is related to these ideas, since it takes into account the extent of dependence on net transfers versus asset income at each age, rather than simply assuming that all gaps are filled through transfers.

Discussion and Conclusions

We have suggested a new measure of the economic pressure generated by population aging, the generalized support ratio or GSR. It provides a more comprehensive indication because it takes into account the degree to which different age groups, including children and the elderly, rely on public or private transfers from the working age population to provide for their consumption in excess of their own labor income. The standard support ratio assumes that the entire gap between own labor income and own consumption is filled by transfers. Since we live in societies in which both capital and labor are important factors of production, and in which other assets such as corporate and public bonds are also important sources of income, it is desirable to use the broader GSR.

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