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Routing

The Connection between Wage Growth and Social Security's Financial Condition

by Jagadeesh Gokhale

Executive Summary

The conventional view that faster wage growth would improve Social Security's financial condition rests on several measures of the program's finances that the Social Security trustees emphasize in their annual reports. These measures include annual cash-balance ratios, the 75-year actuarial deficit, the "crossover date," and the "trust fund–exhaustion date." All of these measures show that Social Security's financial condition would improve if future wage growth were faster. This conventional view also suggests that the trustees' relatively conservative assumptions about future wage growth cause the program's financial imbalance to be overstated.

Unfortunately, the measures highlighted in the trustees' annual reports have a short-term orientation that biases calculations toward showing an improvement under faster wage growth. The connection between wage growth and Social Security's finances should be evaluated using measures that are free of a short-term bias. This Policy Analysis evaluates the connection under the more comprehensive infinite-horizon "fiscal imbalance" measure. It uses simple cases of the program's operation to explore the impact of the relevant forces—population aging, wage growth, discount rates, and the projection horizon. It shows that although faster wage growth is desirable in and of itself to increase general prosperity, it would likely worsen Social Security's overall financial condition. By implication, a "do nothing" policy motivated under the conventional view would be diametrically opposed to the correct perspective: Early reforms of Social Security should receive higher priority under faster wage growth.

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Introduction

The widely held view that faster "economic growth" would improve Social Security's finances is driven by the particular way in which Social Security's finances are measured. The Social Security Administration and the program's trustees provide several measures of Social Security's finances: Annual cash-balance ratios, the 75-year actuarial deficit, the dates when various events are projected to occur—such as the *crossover date* and the *trust fund exhaustion date*—and so on (see Box 1). Each of these measures indicates that faster economic growth—faster wage growth in particular—would improve the system's financing. More specifically, they suggest that faster wage growth would lead to smaller annual cash-balance ratios and a smaller 75-year actuarial deficit. Moreover, the *crossover date* and the *trust fund exhaustion date* would both be shifted further into the future under faster wage growth.

A majority of analysts on both the left and the right have embraced this result as gospel truth and use it to support their preferred policies. Liberals, who favor maintaining the status quo on Social Security, point to the post-1995 surge in worker productivity to suggest that the Social Security Administration's productivity and wage-growth assumptions are too conservative. Those assumptions, it is claimed, cause Social Security's financial problem to be overstated. Their belief in the likely persistence of the recent surge in labor productivity and wage growth leads naturally to the policy recommendation that there is no need to adjust Social Security's tax and benefit rules to reduce its officially reported imbalance. Rather, the correct policy is to "do nothing." Conservatives use the conventional view—that faster wage growth would improve Social Security's finances—to argue against growth-retarding policies, arguing that taxes should indeed be cut and kept low to promote economic growth.[1]

Unfortunately, the battery of measures emphasized by the Social Security Administration suffers from a short-term orientation.[2] That orientation biases the measures toward generating the conventional view that faster growth would improve Social Security's finances. Each measure overemphasizes the positive impact of faster wage growth on the program's near-term revenues and de-emphasizes the, again positive, impact on future benefits. Faster wage growth increases the program's revenues immediately. Because benefits are based on past wages, however, faster wage growth beginning today would cause benefits to increase only after a time lag. Therefore, a short-horizon measure generally overstates the salutary impact of faster wage growth on Social Security's finances.

The theoretically proper way to analyze this issue is by adopting a comprehensive measure of Social Security's financial condition—by counting the impact of faster wage growth on *all* future revenues and expenditures—that is, by measuring them in perpetu-

Box 1
Standard Measures of Social Security's Financial Condition

Annual cash-balance ratios are the program's annual cash flow surpluses—tax revenues minus expenditures—as ratios to annual payrolls. The *actuarial deficit* refers to the negative of present value of Social Security's future unfunded obligations—the value of the trust fund plus the discounted value of tax revenues and minus the discounted value of expenditures—as a ratio to the present value of payrolls or GDP calculated over 75 years. The *crossover date* refers to the year when the program's expenditures begin to exceed its tax revenues, currently projected to be 2017. The *trust fund exhaustion date* refers to the year when the program's trust fund is projected to be fully depleted, currently projected to occur in 2042.

ity. Social Security's infinite-horizon actuarial balance ratio (AB_{∞}) provides such a measure. This is none other than the actuarial deficit described earlier, except that the calculation is not restricted to the next 75 years (called AB_{75}) but is extended through perpetuity.

The short-horizon bias in Social Security Administration's battery of measures is not the only reason that the conventional view turns out to be mistaken in the U.S context. Also relevant but rarely considered is the interaction of the rate of population aging with faster wage growth in determining whether the latter would improve or worsen Social Security's financial condition. Indeed, a careful analysis based on the AB_{∞} measure reveals that the impact of faster wage growth on Social Security's financing is theoretically ambiguous.

This Policy Analysis describes the various channels whereby faster wage growth influences Social Security's finances. Because the outcome is theoretically ambiguous, the actual impact depends on the particular demographic and economic parameters that are in play. This Policy Analysis also analyzes the impact of faster wage growth on Social Security's financial condition—as measured by AB_{∞}—under calculations tailored to reflect U.S. demographic and economic conditions. Those calculations show, contrary to the conventional view, that faster wage growth would worsen Social Security's financial condition as measured by AB_{∞}.

The Relevant Dimensions of "Economic Growth"

Although public discussion of this issue is conducted in terms of the impact of "economic growth" on Social Security's finances, the key factors are labor-productivity growth and wage growth. Labor productivity growth—the increase in the amount of output per worker—is the font of economic prosperity, increasing living standards and promoting economic freedom. The faster that labor productivity grows, the quicker the entire population can enjoy more goods and services—provided, of course, that total work effort in the economy does not decline as productivity increases.

Measuring productivity growth over short periods of time is hazardous because of its volatility. Hence, most economists consider decades-long averages of productivity growth to draw conclusions about changes in its average rate of growth. The record of labor productivity since the mid-1990s has been quite encouraging. U.S. labor productivity grew at an annual average rate of 2.6 percent per year—almost twice as high compared to its average during 1974–95 (1.4 percent per year) and almost as fast as that achieved during the postwar "high-growth" era of 1947–73 (2.8 percent per year).

Those engaged in the Social Security reform debate are particularly glad about the pickup in the trend rate of productivity growth after 1995. To be sure, both productivity and compensation growth are volatile and do not move together over short periods of time. However, the data clearly support the hypothesis that long-term averages of workers' compensation and productivity are positively correlated—as is apparent from Figure 1.[3]

For Social Security, faster wage growth means immediately higher payroll-tax revenues. Because current Social Security benefits are mainly determined by past wages, higher current wage growth does not have a similar impact on current Social Security expenditures. However, growth in Social Security benefits would eventually catch up to wage growth as successive retiree cohorts—with wage histories that include years after the onset of faster wage growth—enter the ranks of Social Security beneficiaries.

The lag between the impact of faster wage growth on payroll taxes versus benefit outlays that causes many people to believe that the recent faster trend in productivity and wage growth could "bail out" the Social Security program from its financial problems. That would obviate the need for politically unpalatable increases in payroll taxes or reductions in scheduled Social Security benefits. This is par-

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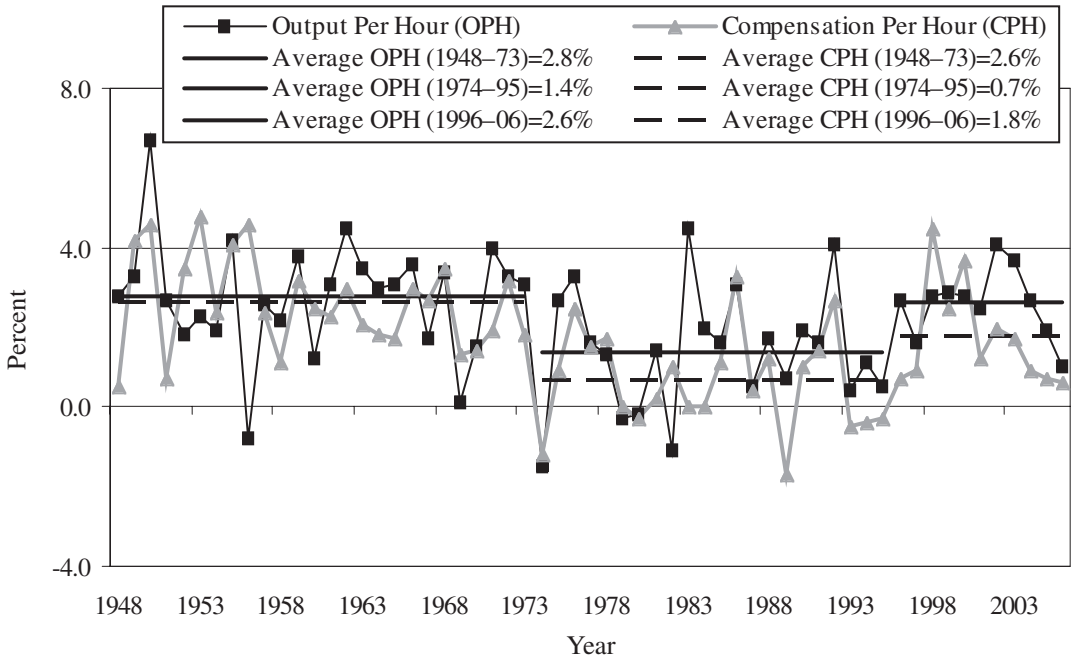
Figure 1
Output and Compensation Per Hour: U.S. Non-Farm Business (Annual Percent Change)



Source: Calculated using data from the U. S. Bureau of Labor Statistics.

ticularly convenient for those politically opposed to both types of changes in Social Security laws. They argue that if future realized productivity growth is faster than the postwar historical average through 1995 (about 2.1 percent per year), current estimates of Social Security's prospective financial shortfalls are overstated. In addition, official estimates of the program's shortfall are based on much smaller estimates of future productivity and wage growth. Under the Social Security trustees' intermediate, U.S. labor productivity is assumed to grow at just 1.7 percent—almost a full percentage point less than the average rate of growth since 1996. That means the official estimate of the program's future financial shortfall is overstated.[4]

A Brookings Institution study by Northwestern University professor of economics Robert J. Gordon suggests that the Social Security Administration's intermediate productivity growth estimate is appallingly low—at best only one-half as large as Professor Gordon's own estimate for the next 20 years (beginning in 2003).[5] Brookings Institution economists Barry Bosworth and Jack Triplett provide another study supporting the assertion that productivity growth is on a permanently faster trajectory. These two economists predict that "Baumol's disease"—the tendency of productivity growth to slow as the service sector, which has fewer productivity-growth opportunities, increases its share in total economic activity—has been cured permanently.[6] If this claim is true, it implies that recent, more rapid increases in labor productivity may be sustained for a long time to come. These studies may have provided the intellectual support for Senator John Kerry's assertion during the 2004 presidential election debates that we could "grow our way out" of Social Security's financial problems.[7]

Recent, more rapid increases in labor productivity may be sustained for a long time to come.

The Conventional View

The conventional view that faster wage growth improves Social Security's finances

has arisen for two reasons: First, one standard measure of Social Security's financial imbalance truncates the program's financial projections at 75 years from the current year. That means worker-payroll taxes during the next 75 years are counted but Social Security obligations payable to them after the 75th year are not counted when calculating the program's financial condition. Faster wage growth would increase both taxes during the next 75 years and benefit obligations to retirees after the 75th year. However, the latter would be ignored in the calculation, making the program's finances appear unambiguously better.

Second, the same conclusion emerges under other standard measures of Social Security's solvency. For example, if we use the "trust fund exhaustion date"—which current estimates peg at 2042—as a metric of the program's financial condition, faster wage growth would move this date further into the future by a few years—again because higher growth would increase tax payments by more than benefit expenditures during the next few decades leading to a larger trust-fund accumulation through 2042 and moving the trust fund exhaustion date further out into the future. If we use the "crossover date"—when Social Security payroll taxes begin to fall short of benefit outlays (currently 2017)—that date also shifts to a later one under a faster wage-growth assumption.

Calculations of the annual balance ratio perhaps provide the strongest case for the conventional view. That's because faster wage growth *increases* annual balance ratios in *all* future periods: Revenues increase immediately but benefits increase only with a time lag. Hence, in general, faster wage growth reduces today's "income rate" (the ratio of tax revenues to total payrolls) but not today's "cost rate" (the ratio of benefit expenditures to total payrolls) because today's benefits depend on past wages that are fixed. But there's a surprising twist even here: Despite the fact that annual balance ratios are reduced throughout the future, it does not follow that Social Security's finances are unambiguously improved. As argued below, increased annual balance ratios in response to faster wage growth is only one of two elements that must be taken into account when judging whether Social Security's finances improve with faster wage growth.

All of this raises the question: Would Social Security's financial condition improve if it were measured comprehensively—that is, by counting *all* future taxes and benefits under current Social Security rules, including those falling outside the 75-year (or any other) "budget window"?

Logically, avoiding the imposition of a "budget window" requires making financial imbalance calculations through perpetuity. However, $1 available this year is not identical in value to $1 available 10, 20, or 50 . . . etc. years hence. That's because today's dollar could be invested at a safe market interest rate to generate more than $1 a few years hence. Placing all (current and future) dollars on a level playing field requires discounting future dollars for expected inflation and real interest costs. Hence, the proper metric for comprehensively measuring Social Security's prospective financial condition—the infinite horizon actuarial imbalance measure—uses standard present-value discounting of Social Security's future (taxable) payrolls, revenues, and expenditures.[8]

The Impact of Wage Growth on Social Security's Fiscal Imbalance

Social Security's infinite-horizon actuarial balance (AB_{∞}) ratio is the difference between the present discounted values of its projected tax revenues and expenditures divided by the present discounted value of future payrolls. Thus,

$$AB_{\infty} = \frac{PV\_revenues - PV\_expenditures}{PV\_payrolls} \qquad (1)$$

In equation (1), all present values (as of 2007) of taxes, benefits, and payrolls are calculated through perpetuity. AB_{∞} indicates how large

The annual balance ratio perhaps provides the strongest case for the conventional view that Social Security's finances are unambiguously improved from faster wage growth.

The worker-to-retiree ratio is, indeed, projected to decline in the United States during the next two decades.

the present value of Social Security's future financial surpluses are relative to the present value of its future payroll base.[9] The most recent (2007) estimate of the Social Security trustees indicates that this ratio equals –4.0 percent.[10]

The AB_{∞} measure is just that—a *measure* of how large Social Security's future shortfalls are relative to its payroll base. Some observers interpret it as showing the additional rate of tax that must be imposed immediately and permanently to cover Social Security's future shortfalls, but that policy approach may be neither desirable nor necessarily feasible—in the sense that any current excess of taxes over benefits that emerges is unlikely to be effectively saved, invested, and devoted to funding Social Security under the system's current institutions. Alternative policies—such as announcing future reductions in scheduled benefits—may be better, more credible, and more desirable.

To begin the analysis of how AB_{∞} responds to faster wage growth, I make several assumptions: (a) that Social Security's claims on the U.S. treasury via its trust fund can be ignored;[11] (b) that the population's age structure is fixed—that is, the ratio of retirees to workers remains constant through time, (c) that *current* retiree benefits are based on the *current* wage level of workers, and (d) that the total population is fixed. I call this "Case 1." Assumptions (b), (c), and (d) of Case 1 are obviously unrealistic, but examining what happens under them leads to insights useful for understanding the impact of faster wage growth under more realistic assumptions, as discussed below.

Under assumptions (a)-(d), faster wage growth would trigger *proportional* increases in the present values of future (1) payrolls, (2) payroll taxes and (3) Social Security benefits.[12] Therefore, AB_{∞} would remain unchanged despite faster wage growth. In other words, AB_{∞} is neutral to wage growth under Case 1.

Now modify Case 1 slightly by relaxing assumption (b). Let the ratio of workers to retirees decline over time. This change brings the case a step closer to reality because the worker-to-retiree ratio is, indeed, projected to decline in the United States during the next two decades—from about three workers per retiree today to about two workers per retiree by 2030. This change in the U.S. worker-to-retiree ratio is built into the population's structure and is unavoidable. The retirement of 76 million baby-boomers beginning in 2008 will simultaneously deplete the ranks of workers and swell those of retirees. In this case ("Case 2"), assumptions (c) and (d) are maintained. That is, current Social Security benefits are still based on workers' current wages and the total population is assumed fixed in all future years. A decline in the ratio of workers to retirees is accomplished in this stylized case by assuming that nobody dies and nobody is born and that workers gradually enter retirement as they become older.

What would happen to AB_{∞} under Case 2 if wage growth accelerated? The answer, clearly, is that it would become larger. If wage growth increases permanently beginning in 2007, *PV_expenditures* will grow more than in proportion to *PV_revenues*. That's because the former now grows for two reasons: faster wage growth and a growing pool of retirees. Moreover, both *PV_revenues* and *PV_payrolls* grow less than proportionally with wage growth because worker ranks are depleting. Hence the numerator becomes a larger negative number and the denominator becomes smaller under Case 2 (whereas under Case 1 all three—*PV_expenditures*, *PV_revenues*, and *PV_payrolls*—increase proportionally in response to faster wage growth). Thus, the introduction of population aging—a decline in the worker-to-retiree ratio—worsens Social Security's actuarial imbalance ratio by making it a larger negative number.

Now for "Case 3" where assumptions (a), (b), and (d) are maintained as under Case 1, but assumption (c) is relaxed. Specifically, Social Security benefits in each period are based on past rather than current wages. Again, this corresponds more closely to reality compared to Case 1. Under U.S. Social Security's benefit formula, a worker's retirement (and other) benefits are based on his or her wage history—counting the 35 highest years of past earnings indexed for past wage growth.

How much each past year's wage growth influences total benefit expenditures in a given year depends on the age structure of the retiree population in that year. The older they are on average, the greater is the influence of wage growth from the distant past in determining total benefits, and the smaller is the influence of wage growth in the near past. Hence, the older retirees are, on average, the slower will an acceleration in wage growth beginning today become incorporated in future growth of annual benefit expenditures. Thus, faster wage growth under Case 3 would increase *PV_payrolls* and *PV_revenues* proportionally (as under Case 1) but *PV_expenditures* will increase less than proportionally because of the lagged impact of faster growth on benefits. Thus, AB_{∞} would increase and Social Security's finances would improve under Case 3 in response to faster wage growth.

Bottom line question: What happens to AB_{∞} in the case where both assumptions (b) and (c) are relaxed? The answer depends on whether the effect of relaxing assumption (b)—which tends to worsen AB_{∞} in response to faster wage growth—dominates the effect of relaxing assumption (c)—which tends to improve AB_{∞} in response to faster wage growth. Which effect actually dominates depends on the parameters that determine the conditions under which the Social Security program operates. Those parameters include the current wage growth rate; the amount by which wage growth accelerates beginning from today; the rate of population aging; and the degree to which wages in the distant past influence each year's benefits relative to those in the near past.

The next section shows calculations of the impact of faster wage growth on AB_{∞} under conditions specific to the United States. The parameters enumerated above are determined from current U.S. demographic conditions and projections provided by the Social Security Administration. The calculations are implemented for the most realistic case where all assumptions (a) through (d) are relaxed. That is, Social Security's existing trust fund is taken into account (the cost on the rest of the federal budget for repaying its liabilities to Social Security are ignored); population aging is allowed to proceed as projected for the United States; each year's benefit expenditures depend on past wages and the degree of dependence is calibrated to the age structure of retirees; and the total size of the population is allowed to increase as consistent with projected (positive) fertility, mortality, and immigration rates.

Wage Growth and Social Security's Imbalance: Measurement for the United States

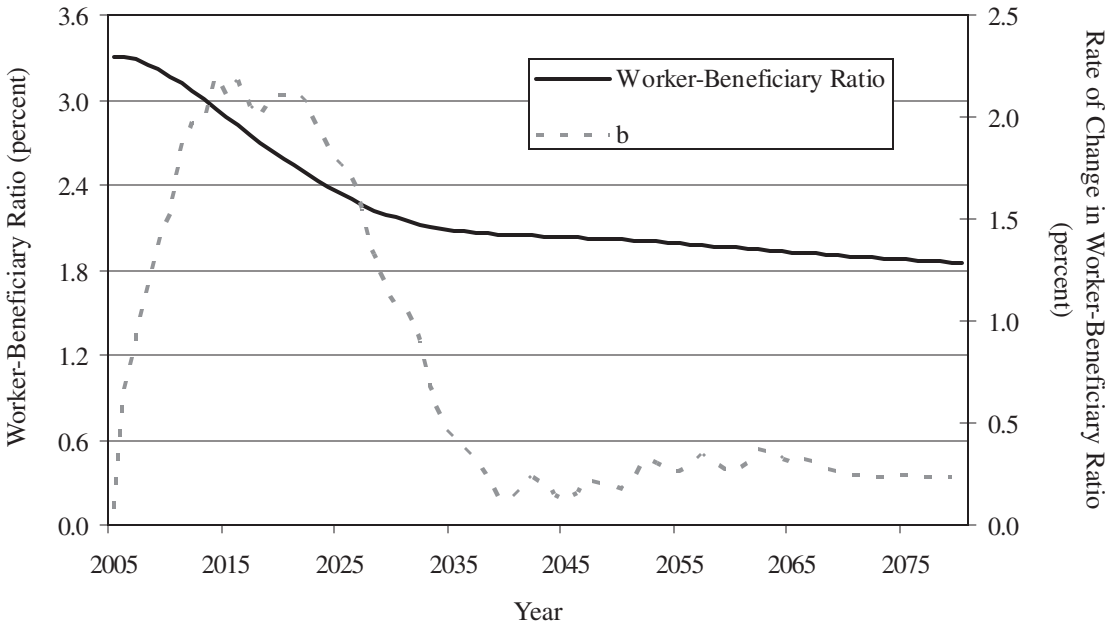
In the simple example developed here, the economy is assumed to have N_0 workers in period 0. Each worker earns W_0 in wages and total payrolls in period 0 is given by $P_0=N0 \times W_0$. If the payroll tax rate equals t, total revenues in period 0 are $R_0=N0 \times W_0 \times t$.[13]

The worker-to-retiree ratio in period 0 is denoted by b_0. Hence, there are N_0/b_0 retirees in period 0. If each retiree receives benefits based on *current* wages (as under assumption [b] above), and the replacement rate (the ratio of retirement benefits to pre-retirement wages) equals r, each retiree's annual benefit equals $W_0 \times r$ and total benefits B_0 are given by $B_0 = (N_0/b_0) \times W_0 \times r$.

The time series of payrolls, P_0, P_1, . . . etc., payroll tax revenues, *R1*, *R2*, . . . etc., and total benefit expenditures *B0*, *B1*, . . . etc., can be discounted using the government's interest rate (assumed to be 3 percent) to form AB_{∞} as in Equation 1. To obtain these three series, however, we need to calibrate the rates of growth of the worker population, wages, and the rate of decline in the worker-to-beneficiary population. The other items, namely the tax rate t, and the benefit replacement rate, r, are set according to current Social Security policies. The payroll tax rate is assumed to be 10.6 percent (for the Old Age and Survivors Insurance part of Social Security), and the replacement

How much each past year's wage growth influences total benefit expenditures in a given year depends on the age structure of the retiree population in that year.

Figure 2
Projected Worker-Beneficiary Ratio and Its Rate of Change (b) in the United States



Source: Andrew Biggs and Jagadeesh Gokhale, "Wage Growth and the Measurement of Social Security's Financial Condition," in *Government Spending on the Elderly*, ed. Dimitri B. Papadimitriou (New York: Palgrave Macmillan, 2007).

The projected worker-to-beneficiary ratio in the United States will decline from 3.3 workers per retiree today to just 2 workers by 2050.

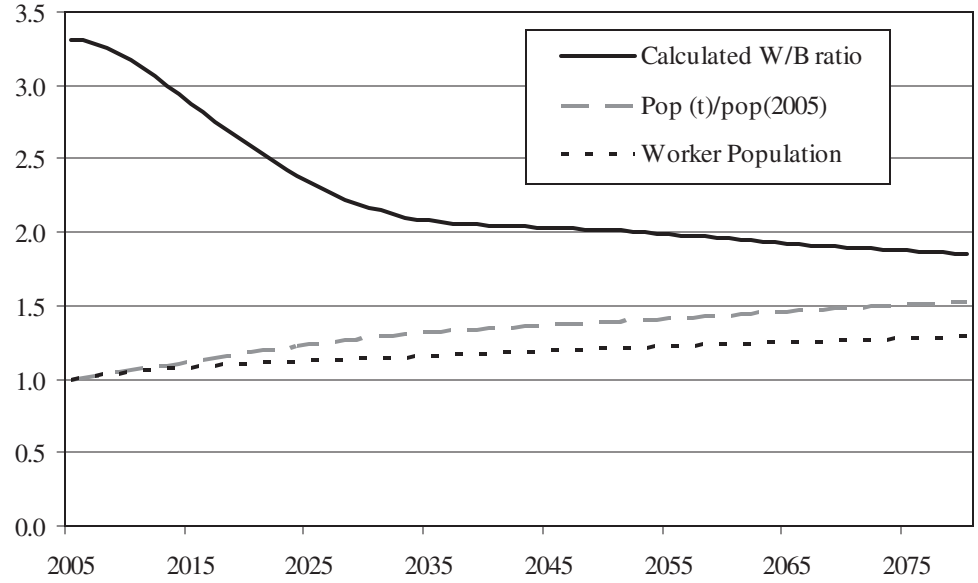
rate is assumed to be constant near its current average rate of 41.5 percent. The initial worker-to-beneficiary ratio, b_0, is set to 3.3—its current value in the United States.

Calibration of AB_{∞} to growth in the U.S. population and its age-structure is based on annual age-specific population projections provided by the Social Security Administration. Figure 2 shows that the projected worker-to-beneficiary ratio in the United States (those covered by Social Security under current laws) will decline from 3.3 workers per retiree today to just 2 workers by 2050. And that ratio is projected to continue declining during the remainder of this century. The most rapid decline occurs during the next 20-year period (through about 2025) as the baby-boomers transition into retirement. During this phase, the rate of decline in the worker-to-beneficiary ratio climbs from zero today to about 3 percent per year. It returns to low levels by about 2035, but remains positive thereafter (that is the worker-to-beneficiary ratio continues to decline).

The decline in the worker-to-beneficiary ratio is projected to occur even as the total population grows larger. Figure 3 shows the worker and worker-plus-retiree populations as projected by the Social Security Administration. Both population series are normalized to their respective population sizes in 2005. The figure indicates that a projected decline in the worker-to-beneficiary ratio does not involve a stagnant total population as assumed under Case 1 earlier. Rather, both populations are projected to grow in absolute size in the United States. A declining worker-to-beneficiary ratio just means that the fraction of the total (and growing) population that would be in the workforce is expected to decline over the next 75 years.

The calculations of AB_{∞} reported below are based on a growing worker population and a declining worker-to-beneficiary population consistent with the conditions projected for the United States. The rate of decline in the worker-to-beneficiary ratio beyond the terminal year of the Social Security Admini-

Figure 3
Worker-Beneficiary Ratio and Population—U.S. Projections



Source: Andrew Biggs and Jagadeesh Gokhale, "Wage Growth and the Measurement of Social Security's Financial Condition," in *Government Spending on the Elderly*, ed. Dimitri B. Papadimitriou (New York: Palgrave Macmillan, 2007).

stration's projections (2080) is assumed to remain constant at its terminal year value.

The final step in the calibration of AB_{∞} is the weighting of past wages in the benefit calculation that is involved in relaxing assumption (c). An equal weighting of past wages in calculating AB_{∞} would be inappropriate because mortality reduces the sizes of older cohorts whose benefits are determined by wages further back in the past. Hence, AB_{∞} should be calculated using declining weights calibrated to the age distribution of retiree cohort sizes over time. Applying smaller rather than equal weights to wage levels further back in the past implies that the impact of relaxing assumption (c) (whereby AB_{∞} improves in response to faster wage growth) diminishes relative to the effect of relaxing assumption (b) (whereby AB_{∞} worsens with faster wage growth). Under declining weights on wages further back in the past, a larger share of total benefits would be paid to relatively younger retirees and faster wage growth would increase benefit expenditures more quickly.

This extensive calibration exercise allows an examination of the effect of faster wage growth on AB_{∞} under demographic conditions relevant for the United States. Table 1 shows two types of actuarial balance calculations—AB_{∞} and AB_{75}—in order to compare the implications of both. The calculations are presented for alternative discount rates as well, to see if the conclusion would be sensitive to the choice of the discount rate (it is not).

What message does Table 1 convey? Panel B shows the baseline case under a 3.0 percent discount rate. It shows that increasing the wage growth assumption from 1.1 percent per year to 1.6 percent per year (these are the Social Security Administration's intermediate- and low-cost real wage growth rates respectively) *increases* (improves) AB_{75} from –1.5 percent to –1.1 percent. However, AB_{∞} *decreases* (worsens) from -3.2 percent to –4.1 percent under the same change in the wage growth rate. As confirmed by Panels A and C of Table 1, the directions of change in AB_{∞} and AB_{75} in response to faster wage growth remain opposed to each other despite changing the discount rate: AB_{∞} exhibits a worsening in Social Security's finances for a range

Social Security's financial condition worsens with faster wage growth under the long horizon measure, despite changing the discount ratio.

Table 1
Social Security's Actuarial Balance Ratios under Selected Real Wage Growth and Discount Rates

Discount Rate (percent)	Projection Horizon (years)	Real Wage Growth Rate (percent)	*AB* (percent)
		Panel A	
2.7	AB_{75}	1.1	-1.6
		1.6	-1.2
	AB_{∞}	1.1	-4.0
		1.6	-5.9
		Panel B	
3.0	AB_{75}	1.1	-1.5
		1.6	-1.1
	AB_{∞}	1.1	-3.2
		1.6	-4.1
		Panel C	
3.3	AB_{75}	1.1	-1.3
		1.6	-1.0
	AB_{∞}	1.1	-2.7
		1.6	-3.1

Source: Andrew Biggs and Jagadeesh Gokhale, "Wage Growth and the Measurement of Social Security's Financial Condition," in *Government Spending on the Elderly*, ed. Dimitri B. Papadimitriou (New York: Palgrave Macmillan, 2007).

The rate of decline in the worker-to-beneficiary ratio is a crucial parameter determining the change in Social Security's financial condition in response to faster wage growth.

of discount rates whereas AB_{75} shows an improvement.

As described earlier, the rate of decline in the worker-to-beneficiary ratio is a crucial parameter determining the behavior of AB_{∞} in response to faster wage growth. Hence, in addition to exploring that behavior under alternative discount rates, it is also important to explore it under different rates of decline in the worker-to-beneficiary ratio. The above experiments showed that AB_{∞} declines with faster wage growth (Social Security's finances worsen) under calibration to U.S. parameters. A key point, however, is that faster wage growth fails to improve Social Security's financial condition under less stringent conditions.

The experiments implemented earlier assumed that Social Security's terminal (year-75) rate of decline in the worker-to-beneficiary ratio, *b*, remained in place *forever*. Although gradually increasing longevity and a gradual but continuing decline in fertility is not inconceivable for a number of decades beyond the next 75 years, the assumption of declining worker-retiree ratios in perpetuity is difficult to defend. What would happen to AB_{∞} if that rate of decline were assumed to become zero—and the worker-to-beneficiary ratio to remain constant—after just a few years beyond the 75th year?

To explore the impact, AB_{∞} is calculated under alternative ranges of years beyond the next 75 after which the decline in the worker-to-beneficiary ratio is terminated. In other words, it is assumed that the rate of decline in the worker-to-beneficiary ratio equals that shown in figure 2 through the 75th year; it equals the year-75 value for N years after year 75, and it becomes zero after year 75+N. Table 2 shows changes in the infinite-term actuarial

Table 2
Infinite Term Actuarial Balance under Alternative Horizons For Decline in the Worker-to-Beneficiary Ratio

N	AB_{∞} Under Alternative Wage Growth Rate Assumptions	
(Number of years after the next 75)	1.1 percent	1.6 percent
10	-2.51	-2.47
20	-2.61	-2.61
30	-2.70	-2.74

Source: Andrew Biggs and Jagadeesh Gokhale, "Wage Growth and the Measurement of Social Security's Financial Condition," in *Government Spending on the Elderly*, ed. Dimitri B. Papadimitriou (New York: Palgrave Macmillan, 2007).

balance from increasing wage growth under alternative values of N. It shows that the infinite-term AB_{∞} under wage growth of 1.6 percent per year is smaller (worse) than that under wage growth of 1.1 percent per year when population aging is allowed to proceed for just a little more than 20 years beyond the next 75 (N=20 or more). Thus, although the negative impact of higher wage growth on the infinite-term actuarial balance requires the assumption of a continued decline in the worker-to-beneficiary ratio beyond the 75th year, it suffices to maintain that assumption for only a little more than 20 years beyond that conventional projection horizon.

Contrasting Annual-Balance Ratios with AB_{∞}: A Paradox?

As mentioned in the introduction, one of the measures emphasized by the Social Security Trustees is the sequence of *annual cash-balance ratios*—each year's ratio equals the difference between the *income ratio* (ratio of tax revenues to payrolls in that year) and the *cost ratio* (the ratio of benefits to payrolls in that year).[14] As it turns out, annual balance ratios perhaps provide the strongest support for the conventional view. Unlike the other measures of Social Security's finances, annual balance ratios are not subject to the short-term bias criticism because they can in principle be calculated for all future years. Faster real-wage growth increases (makes less negative) annual cash-balance ratios—that is, it reduces each years cost ratio relative to the same year's income ratio—in perpetuity. For many observers, this fact reinforces the conventional view that faster wage growth improves Social Security's financial condition.

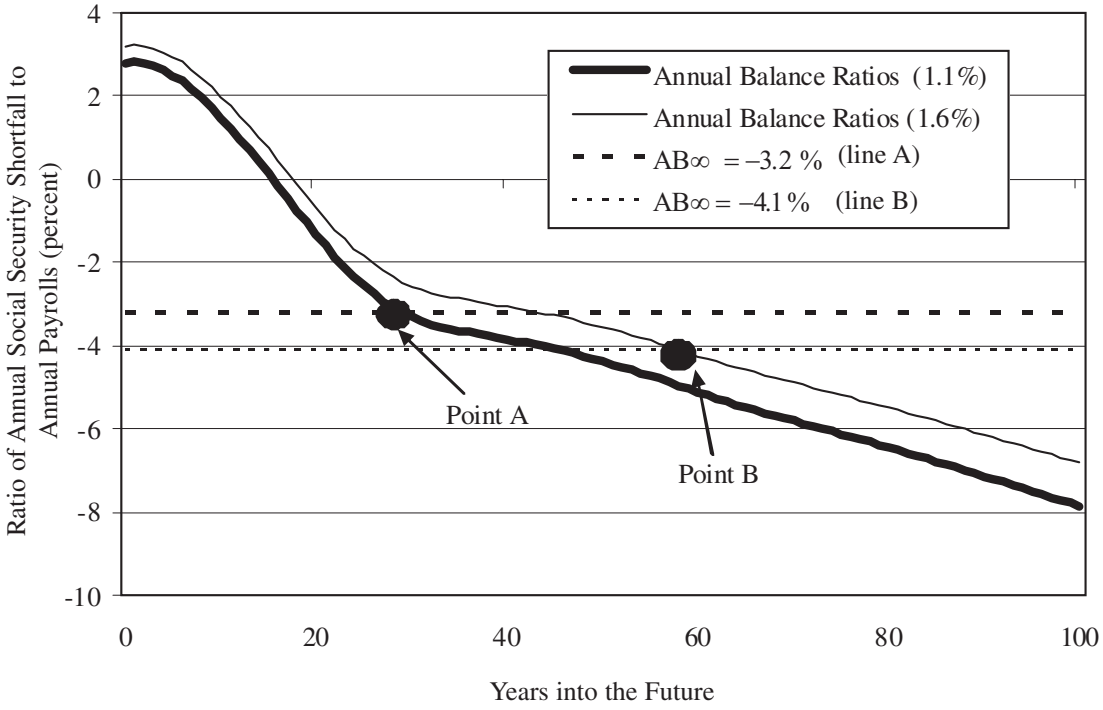
Thus, a seeming paradox arises when one compares the impact of faster wage growth on Social Security's financial condition in terms of annual balance ratios with that measured using AB_{∞}. As shown earlier, measurement of Social Security's finances using AB_{∞} under U.S. demographic and wage growth parameters indicates that faster wage growth worsens the program's financial condition. However, as stated in previous paragraphs, it is also true that under those same conditions, annual balance ratios would be larger (less negative) under faster wage growth in *all* future years. How can the conflicting signals from these two indicators be reconciled?

Faster wage growth increases each year's *income ratio* in about the same proportion but not that year's *cost ratio* because benefits depend on wage growth in earlier periods. Figure 4 shows the change in future annual balance ratios in response to increasing wage growth from 1.1 percent per year to 1.6 percent per year. This case corresponds to the one of Panel B of Table 1. The thick line shows annual balance ratios under a lower rate of annual wage growth (1.1 percent), and the thin line shows those ratios under a faster rate of annual wage growth rate per year (1.6 percent).

Each year's annual balance ratio (multiplied by –1) reflects the share of payrolls that

A seeming paradox arises when one compares the impact of faster wage growth on Social Security's financial condition in terms of annual balance ratios versus the perpetuity measure.

Figure 4
Annual Balance Ratios Under Alternative Wage Growth Rates (1.1% and 1.6%)—U.S. Calibration



Source: Author's calculations.

would have to be *additionally* devoted (either by way of a cut in benefits or increase in taxes) toward closing the gap between the program's revenues and expenditures in that year. Figure 4 shows that the amount would be negative during the first few years because Social Security taxes are currently in surplus.[15] Note that today's Social Security expenditures are predetermined based on past wage outcomes, but today's Social Security revenues depend on current payrolls. If wages were to grow faster starting today, today's revenues would increase by a lot because the *entire* work force's payrolls would now be larger and would generate more taxes immediately. However, benefits would increase only after another year, and then only because the benefits of those retiring in that year would increase on account of the previous year's faster wage growth. It would take many years before today's faster wage growth became fully incorporated in proportionally higher benefit payments. But again, during the intervening years, revenue increases would continue to accrue as faster wage growth (that commenced this year) is sustained in future years. It is not surprising, then, that the gap between revenues and benefits (the annual balance ratio) would become larger in all future years. This explains why the annual balance ratio curve under wage growth of 1.6 percent per year lies above that under 1.1 percent wage growth in all future years (although Figure 4 shows the shift only for the first 100 years).

Most observers stop the analysis at this point and conclude that Social Security's finances are improved as a result of faster wage growth.

Most observers stop the analysis at this point and conclude that Social Security's finances are improved as a result of faster wage growth. As it turns out, however, this is only a part of the story. Notice that the increase in annual balance ratios in all future years as shown in Figure 4 is consistent with the result of the earlier section. That is, AB_{∞} is *smaller*—is a larger negative percentage—under the faster annual wage growth rate of 1.6 percent

compared to 1.1 percent. That provides a hint that the previous paragraph's analysis is not complete and that drawing the conventional conclusion is not yet warranted.

The values of AB_{∞} under Table 1's two rates of wage growth are shown in Figure 4: "Line A" refers to the AB_{∞} rate of –3.2 percent corresponding to a 1.1 percent wage growth rate, and "Line B" refers to the AB_{∞} rate of –4.1 percent under a 1.6 percent wage growth rate. Both AB_{∞} levels are taken from Panel B of Table 2—under a discount rate of 3.0 percent.

To reiterate, the paradox is that the AB_{∞} measure suggests that faster wage growth worsens Social Security's finances. That is, a larger negative value of AB_{∞} under faster wage growth implies that the share of payrolls that must immediately and permanently be devoted to make the system sustainable is larger. However, the sequence of annual balance ratios suggests that the system's finances are improved because those ratios are larger in all future years—that is, annual balance ratios are either larger positive numbers during years of surplus revenues or smaller negative numbers during years of deficits as shown in Figure 4.

The contradictory conclusions from the two measures are reconciled, however, when one realizes that the AB_{∞} is simply a *weighted average of annual balance ratios* where the average is computed over all future years. If a tax increase equal to (the negative of) this average ratio were levied on all future payrolls and the additional funds were devoted to Social Security, it would fully plug Social Security's financial gap. What are the weights used in computing this average? The weight applicable to each future year's annual balance ratio is the share of that year's payrolls in total future payrolls.[16]

This prepares us for the second (and usually neglected) part of the analysis: Although faster wage growth increases each future year's applicable cash-balance ratio (thus reducing the pay-as-you-go tax increase required in each future year to close each year's shortfall), it also *increases* the shares of annual payrolls (in total future payrolls) that accrue in the distant future relative to the shares of annual payrolls in years closer to today. Note that Figure 4 shows that under U.S. conditions, the *levels* of annual balance ratios under a given wage growth rate *declines* (becomes more negative) over time. In Figure 4, annual balance ratios decline over time under each of the two assumptions regarding the growth rate of wages—1.1 percent growth and 1.6 percent growth. Because under faster wage growth, the payroll weights applicable to the (algebraically smaller) annual balance ratios in distant future years increase, the *average* annual balance ratio declines (becomes more negative) notwithstanding the fact that annual balance ratios themselves are larger (less negative) in each future year under faster wage growth.

That this is the case under U.S. conditions is shown by the fact that in Figure 4, the level of AB_{∞} under 1.6 percent wage growth per year lies below the level of AB_{∞} under wage growth of 1.1 percent per year. Notice that the former level corresponds to an annual cash balance ratio further out into the future (marked as Point B in Figure 4) because the larger weighting by payrolls occurring in the distant future pulls the "average point" in the right-ward direction compared to that corresponding to level of AB_{∞} under the lower wage growth of 1.1 percent per year (Point A).

Policy Implications

This resolution of the paradox described above can be understood in terms of alternative policy approaches to closing Social Security's shortfall. Under any given rate of wage growth, a "pre-funding" policy would be to apply the average actuarial-balance ratio (AB_{∞}) to each future year's payrolls. From the results above, the required average tax increase would be larger under faster wage growth (AB_{∞} is a larger negative number under faster wage growth as shown in Table 1 and Figure 4). On the other hand, a "pay-as-you-go" policy would levy each future year's annual balance ratio (as shown by the curves in Figure 4) as a tax increase on that year's payrolls.[17] Indeed, in the first few years of payroll-tax surpluses, it would involve a tax reduction. Figure 4 also shows that the pay-as-you-go tax

Although faster wage growth increases each future year's applicable cash-balance ratio, it also increases the shares of annual payrolls that accrue in the distant future.

Those who appear to principally support the pay-as-you go policy approach to fixing Social Security's financial problems tend to emphasize annual balance ratios as their preferred measure of the program's financial condition.

increases would grow larger over time under both wage-growth assumptions (both the thin and thick curves in Figure 4 decrease over time). However, in every future year (extending in perpetuity), the applicable pay-as-you-go tax increase would be smaller under the faster wage growth rate (the thin annual balance ratio line lies above the thick annual balance ratio line in Figure 4).

Adopting the pay-as-you-go approach to closing future Social Security shortfalls is supported by the conventional view, which suggests that faster wage growth improves Social Security's financial condition. One could reverse this argument to claim that those who appear to principally support the pay-as-you-go policy approach to fixing Social Security's financial problems tend to emphasize annual balance ratios as their preferred measure of the program's financial condition. The conventional view based on annual balance ratios, however, is an illusion created by ignoring the fact that a larger share of total future payrolls would be subjected to higher future tax increases under the pay-as-you-go policy compared to the pre-funding policy.[18]

The AB_{∞} measure shows that adopting the pay-as-you-go policy is equivalent to imposing a larger tax rate, on average, on all future payrolls when the comparison is based on an evaluation of the fiscal treatment under Social Security of all future payrolls (in present value terms). In the U.S. case, that larger tax results from the particular configuration of the existing population age-structure, prospective population aging, and the range of relevant wage growth rates.

Conclusion

The impact of faster wage growth on Social Security finances is theoretically ambiguous. Under calibrations consistent with U.S. demographic and economic conditions, however, faster wage growth worsens Social Security's financial condition when it is measured comprehensively. This result contradicts that obtained under traditional measures of Social Security's financial status—such as annual balance ratios, truncated actuarial deficits, crossover dates, and trust fund–exhaustion dates.

The perpetuity measure of AB_{∞} employed here is generally de-emphasized by Social Security's trustees, but it constitutes a more comprehensive and financially more sensible measure of the program's finances. Indeed, the Social Security trustees give prominence only to measures with a short-term bias, all of which have promoted the now-conventional view that faster wage growth would improve Social Security's financial condition. This mistaken conclusion appears to be driving the public debate on Social Security reform and appears to provide ammunition for a "do nothing" policy.

The conventional view is incorrect—at least in the U.S. case. Adopting a "do nothing" policy because we expect future wage growth to be faster than that assumed by the Social Security trustees in their financial projections would be precisely wrong and opposite relative to the policy prescription suggested under a more comprehensive, long-term measure—the infinite-horizon actuarial balance—AB_{∞}.

Some readers may wonder if the result that faster wage growth worsens Social Security's financial condition implies another perverse policy prescription: to reduce future productivity and wage growth via, say, higher taxes. However, the analysis here only to evaluates whether faster wage growth would improve or worsen Social Security's financial condition under the program's current rules of operation. Even if Social Security's finances are worsened under faster wage growth, the latter remains desirable because it would provide more resources to allocate to the population's needs.

Conservative commentators sometimes use the conventional view—that faster wage growth would improve Social Security's finances—to argue against tax increases because those would also worsen Social Security's finances. The demonstration that the conventional view is incorrect under the AB_{∞} metric means that conservatives' arguments against tax increases stand or fall according to their impact on eco-

nomic growth. The further impact on Social Security's finances should not be adduced to support the case against tax hikes.

Lastly, there is the issue of choosing between annual balance ratios and AB_{∞} as a metric for basing judgment about the impact of faster wage growth. Many commentators vested in the "do nothing" policy would likely reject AB_{∞} in favor of annual cash balances. If the seriousness of Social Security's financial condition is judged by the additional share of future payrolls that must be devoted to cover the gap between its revenues and outlays, that share is clearly larger on average under faster wage growth. As such, adopting a pay-as-you-go approach because of faster expected wage growth is inconsistent with fiscal conservatism that seeks to reduce the overall size and influence of the government on people's economic lives throughout the future.[19] This perspective is communicated more clearly through the AB_{∞} measure under a fuller and financially proper accounting of the implications of faster wage growth for the program's financial condition.

Notes

This paper draws from "Wage Growth and the Measurement of Social Security's Financial Condition," by Andrew Biggs and Jagadeesh Gokhale, in *Government Spending on the Elderly*, ed. Dimitri B. Papadimitriou (New York: Palgrave Macmillan, 2007).

1. The liberal position is well known. For the conservative position, see "Don't Know Much About History . . . " *Wall Street Journal*, June 12, 2006, p. A12.

2. Technically, annual balance ratios could be calculated for all future years, but it is impractical to show how those ratios evolve in perpetuity. The standard practice is to calculate them through the next 75 years.

3. The two series of output per hour and compensation per hour shown in Figure 1 have a correlation coefficient of 0.52 for the entire time period 1948–2006. For the three separate periods of 1948–73, 1974–95 and 1996–2006, the correlation coefficients are also positive: 0.19, 0.59, and 0.41 respectively.

4. For a contrary view, see Charles P. Balhous III, "Have the Social Security Trustees Been Too Conservative?" Presentation to the American Enterprise Institute, September 7, 2007.

5. See Robert J. Gordon, "Exploding Productivity Growth: Context, Causes, and Implications," *Brookings Papers on Economic Activity*, No. 2, 2003, pp. 207–98, http://faculty-web.at.northwestern.edu/economics/gordon/Productivity-Brookings.pdf.

6. See Jack E. Triplett and Barry P. Bosworth, "Productivity Measurement Issues in Service Industries: "Baumol's Disease" Has Been Cured," Federal Reserve Bank of New York, *Economic Policy Review* 9, no. 3 (September 2003): 23–33.

7. For example, see the description of Senator Kerry's position on Social Security, http://www.centristpolicynetwork.org/archives/000071.html.

8. Social Security's financial condition under the alternative measure of the annual cash-balance ratio—that is, the difference between annual revenues and expenditures taken as a share of the same year's payrolls—is discussed later in the text.

9. One could simply measure the size of Social Security's shortfall in terms of present-value dollars. However, that does not tell us whether a change in the shortfall in response to faster wage growth would increase compared to our capacity to cover it. Taking the present-value shortfall as a share of the present-value of future payrolls or GDP enables such a comparison. If this share increases with faster wage growth, it means that a larger fraction of future payrolls (or GDP) would have to be devoted to covering the shortfall.

10. See the 2007 annual report of the Social Security trustees, chapter IV.B.5. Total unfunded obligations (not including the program's trust fund) equal $15.6 trillion and the present value of future payrolls is estimate to be $388.4 trillion. The ratio of those two numbers equals 4.0 percent.

11. The value of Social Security's trust-fund securities ($2.0 trillion) is relatively small compared to the present value of its financial shortfall ($15.6 trillion). Moreover, paying off the trust fund's securities requires increasing other federal (non-Social Security) revenues and/or imposing cuts in other federal spending.

12. If both terms in the numerator of equation (1) grow by x percent, their difference would also grow by x percent. Since the denominator also grows by x percent, the ratio would remain unchanged.

13. Revenues from taxing benefits are ignored as they constitute a very small share of total Social

Security revenues—just 3 percent in 2007 for the Old Age and Survivors Insurance program.

14. For example, the current (2007) ratio of Social Security's taxes to payrolls (the income ratio) equals 0.128, or 12.8 percent, and the current ratio of benefit expenditures to payrolls equals 0.112 or 11.2 percent. That makes the 2007 annual balance ratio 0.128-0.112=0.016 or 1.6 percent. See single year data on income and cost rates in the 2007 annual report of the Social Security trustees available at: http://www.ssa.gov/OACT/TR/TR07/lr4B1.html#foot1.

15. The annual balance ratios shown in Figure 4 do not match official estimates of the "crossover date" because the model does not include auxiliary benefits such as spousal, survivor, mother/father, divorcee, and children's dependent and survivor benefits. These exclusions are responsible for crossover dates much further out in time in Figure 4 compared to official measures. However, including such auxiliary benefits is unlikely to overturn the results of this paper because all such benefits are determined based on the primary worker's wage history. They would not eliminate the conflict described above, namely, the different conclusions regarding the system's financial condition under annual cash-balance ratios versus the infinite horizon actuarial balance measure.

16. Technically, the future payrolls in the numerator and total of all payrolls in the denominator—that are used for computing each year's share (to be used as the weight for that year's annual balance ratio in computing the average)—are both in terms of present discounted values. Note that the sum of such annual weights in perpetuity would add up to one as required in calculating the average annual balance ratio over all future years.

17. As mentioned in the introduction, neither of these two tax-increase policy approaches should be considered to be approaches that this paper recommends. The description is used here only for clarifying the difference in the two measures of Social Security's financial condition.

18. Some observers suggest that adopting a pay-as-you-go approach and imposing higher surtaxes on future cohorts is justified because they will be more productive and richer than today's population. However, imposing ever-higher tax rates (and not just on account of Social Security, but also to make other entitlements such as Medicare and Medicaid financially sustainable) may reduce future generations' incentives to work and save as much—which potentially overturns the prior assumption about rising prosperity of future generations.

19. The perspective that Social Security enables better risk sharing with future generations argues for allowing the government to help reduce earnings risks across all generations. That asserts a positive role for government intervention in achieving retirement security for citizens. The benefits from such risk sharing, however, could potentially be offset by welfare losses from lower saving and capital crowding out—as suggested by Dirk Krueger and Felix Kubler in "Pareto-Improving Social Security Reform when Financial Markets are Incomplete," *American Economic Review* 96, no. 3 (June 2006): 737–55.

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