Do Social Security Surpluses Pay Down Publicly Held Debt?
Evidence from Budget Data

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Abstract

Being fair to future generations requires that Social Security be reformed in a manner that effectively prefunds a significant share of future Social Security benefit payments. All serious reform plans have this property. Prefunding is attempted exclusively in the Social Security trust fund in some plans, and it is attempted partly in personal retirement accounts in others.

Many analysts believe that Social Security surpluses are offset all or in part by lower non-Social Security surpluses. If the offset is 100 percent, then running Social Security surpluses does not increase the government's capacity to pay future Social Security benefits. In this case, reforms that rely on trust fund accumulations to make Social Security fair to future generations do so at the expense of a non-Social Security policy that is less fair to future generations.

The evidence on whether or not trust fund accumulations pay down federal debt is of two general types: formal statistical analyses of historical budget data, and informal observations of budget politics. Mariger (2008) reviews the recent history of budget politics and concludes that there is a substantial probability that Social Security surpluses are in large part offset by smaller non-Social Security surpluses. To complement that study, this paper attempts to draw out statistical evidence from budget data.

It is concluded that the budget data is essentially silent on the question of whether Social Security surpluses are truly saved. The reason is that the regression model specification is necessarily approximate, Social Security surpluses show little independent year to year variation, there are only 37 years of data, and spurious correlations mask the true relationships.

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*The analysis and conclusions set forth in this paper are those of the author and do not indicate concurrence by other members of the Treasury research staff or Treasury's senior officials.

I. Introduction

Being fair to future generations requires that Social Security be reformed in a manner that effectively prefunds a significant share of future Social Security benefit payments. All serious reform plans have this property. Prefunding is attempted exclusively in the Social Security trust fund in some plans, and it is attempted partly in personal retirement accounts in others.

The consequences of prefunding Social Security in the trust fund are controversial and not well understood. The key question is whether Social Security surpluses are offset by smaller non-Social Security surpluses. If Social Security policy does not influence non-Social Security policy, then the trust fund balance at every date represents the amount by which past Social Security cash flows have reduced debt held by the public at that time. Reducing a liability in this manner is real saving that increases the government's capacity to pay future Social Security benefits.

On the other hand, many analysts believe that Social Security surpluses are offset all or in part by lower non-Social Security surpluses. If the offset is 100 percent, then running Social Security surpluses does not increase the government's capacity to pay future Social Security benefits. In this case, reforms that rely on trust fund accumulations to make Social Security fair to future generations do so at the expense of a non-Social Security policy that is less fair to future generations (Mariger, 2008). And if political constraints dictate that prefunding must be done in the trust fund, then it would be rational to compromise on benefit adequacy so as to limit trust fund accumulations in a manner that benefits future generations (Mariger, 2008).

Given that so much rides on the question of whether or not trust fund accumulations pay down federal debt, it is important to carefully consider the evidence. That evidence is of two general types: formal statistical analyses of historical budget data, and informal observations of budget politics. Mariger (2008) reviews the recent history of budget politics and concludes that there is a substantial probability that Social Security surpluses are in large part offset by smaller non-Social Security surpluses. To complement that study, this paper attempts to draw out statistical evidence from budget data.

The estimates indicate that the offset between Social Security and non-Social Security surpluses is significantly greater than the maximum theoretical value of one for one. This is taken as evidence that the estimates are biased by left out variables that are correlated with Social Security surpluses. Because the standard error on the offset estimate is about three-quarters as large as the maximum theoretical offset, and the offset estimate is sensitive to the inclusion of time trends in the regression, it is concluded that the evidence of a significant offset is weak.

These findings reflect the inherent difficulty of making inferences when the model specification is necessarily approximate, there are only 37 years of data, and Social Security surpluses show little independent year to year variation. To drive home these points, the paper reports regression estimates utilizing synthetic data generated by a plausible model of policymaker behavior that assumes Social Security surpluses are offset 100 percent by non-Social Security surpluses. It was expected that the offset estimate would be insignificant because of lags in the model that generates the synthetic data. Surprisingly, the estimated offset turns out to be significant and the ***wrong*** sign. Only when irrelevant independent variables are excluded from the regression does the offset estimate have the right sign.

II. Estimates

Smetters (2004) is the most recent analysis of the historical relationship between Social Security and non-Social Security budget surpluses and serves as a starting point for the current analysis. The basic relationship investigated is:

$$(3)\quad S_t^O / PGDP_t = \gamma_1 S_t^S / PGDP_t + \gamma_2 D_t^S + \gamma_3 D_t^O + \gamma_4 GDP_t / PGDP_t + \gamma_5 WS_t / GDP_t + \gamma_6\, trend + \gamma_7\, trend^2 + \gamma_8$$

where the γ's are estimated parameters, S_t^O is the non-Social Security primary surplus, $PGDP_t$ is potential GDP as estimated by the Congressional Budget Office (2007), S_t^S is the Social Security primary surplus, WS_t is wages and salaries, D_t^O is debt attributable to non-Social Security policy (debt held by the public plus the trust fund balance), D_t^S is debt attributable to Social Security policy (minus the trust fund balance), and *trend* is time in years beginning with 1 in 1949. The first two parameters are our focus: If trust fund accumulations pay down federal debt one for one, then $\gamma_1 = \gamma_2 = 0$, and if they enable larger non-Social Security deficits, γ_1 is between -1 and 0 and γ_2 is positive. The other explanatory variables in (3) control for the effects of non-Social Security debt (expect $\gamma_3 > 0$), the business cycle (expect $\gamma_4 > 0$), the effect of GDP makeup on non-Social Security receipts (expect $\gamma_5 > 0$), and other unspecified determinants of the non-Social Security primary surplus captured by the trend variables.

This specification is the same as Smetters (2004) except for the treatment of wages and salaries and debt. Smetters normalizes wages and salaries by potential GDP rather than actual GDP, which makes γ_5 hard to interpret because it reflects both business cycle effects and GDP composition effects. And instead of including debt variables in his specification, Smetters specification subtracts net interest from the dependent variable: This would be the same specification as (3) if γ_2 and γ_3 were each time-varying and equal to the effective annual government borrowing rate. Because Smetters implicitly assumes that $\gamma_2 = \gamma_3$, his specification does not permit the non-Social Security budget to be entirely independent of the Social Security budget $(i.e., \gamma_2 = 0, \gamma_3 > 0)$.

Estimates of (3) for three different time periods are reported in Table 1. For the 1949-2006 sample period, the estimates suggest that each \$1 or Social Security primary surplus causes the non-Social Security primary surplus to be smaller by \$3.63, nearly four times as large as the maximum offset consistent with theory (see regression (1)). The standard error on the estimate is rather large relative to its expected range [-1, 0], but because the magnitude of the estimate is so large, the one-tailed 95 percent confidence interval shown in the last row of the table is $\gamma_1 \leq -2.579$. The coefficient on Social Security debt is also quite large and statistically significant. The reported estimate of $\hat{\gamma}_2 = 0.190$ constrains the coefficient to equal the coefficient on non-Social Security debt ($\hat{\gamma}_3$) because the unconstrained estimates ($\hat{\gamma}_2 = 0.489$ and $\hat{\gamma}_3 = 0.171$) violate the theoretical prediction that either $(\gamma_2 = 0, \gamma_3 > 0)$ or $\gamma_2 = \gamma_3$, which implies $\gamma_3 \geq \gamma_2 \geq 0$.

The second and third columns of Table 1 verify the Smetters finding that the post-1969 data are responsible for the large estimated negative offset; the estimated one-tailed 95 percent confidence intervals are $\gamma_1 \leq 1.329$ for the 1949-69 sample period and $\gamma_1 \leq -3.329$ for the 1970-2006 sample period.

The post-1969 data suggest an implausibly large offset between non-Social Security and Social Security primary surpluses. Theory suggests that the offset is between in the range [-1,0], but the estimates indicate that the probability of γ_1 have an absolute value that small is less than one in a ten thousand. It seems likely therefore that the estimates are biased by the exclusion of explanatory variables that are correlated with the Social Security primary surplus. In that case, the error terms in the regression do not satisfy the conditions under which the sampling distributions for the estimated parameters are derived, and rigorous statistical analysis is not possible without additional assumptions.

Despite the fact that $\hat{\gamma}_1$ in regression (3) is almost certainly biased, one must conclude that the data supports values of γ_1 closer to -1 than to 0. As all empirical specifications are approximations undoubtedly subject to bias, it would be illogical to dismiss the Table 1 estimates in their entirety simply because they are too strong. But the bias in $\hat{\gamma}_1$ is a reminder that there are many untested assumptions underlying regression analysis, and that empirical estimates based on aggregative time series data are notoriously unreliable. On this score, it is troubling that the offset estimate is insignificantly positive when the time trend variables are excluded from the regression (see regression 4).

The next section further illustrates the unreliability of the estimates.

III. The Unreliability of Estimates Based on Aggregate Time Series Data

This section considers this question: If post-1969 non-Social Security primary surpluses offset Social Security primary surpluses in precise accordance with a plausible model of policymaker behavior that implies the offsets are essentially 100 percent, would time series regressions like those in Table 1 give accurate estimates of the offset? Despite the fact that the model generating the synthetic data is certainly much simpler than the real world, the answer turns out to be an emphatic no. The reason is that the linear regression model is an approximate specification, there are only 37 years of data, and spurious correlations mask the true relationships.

The Simulation Model for Non-Social Security Primary Surpluses

The model of policymaker behavior is taken from Mariger (2008). The model was developed to help quantify the consequences for intergenerational fairness of not truly saving Social Security surpluses.

The model has at its core a simple model that is modified to incorporate real world complexities. The simple core model assumes that the non-Social Security primary surplus share of GDP in each year t is set to the level that would be permanently sustainable if Social Security primary surplus share of GDP were to equal actual levels for the succeeding N years (years t through to year t+N-1), and were to stay constant at the year t+N-1 level in all later years. In the simple case were the real government borrowing rate and the growth rate of real GDP are forever constant at r and η, respectively, the core model is:

(2) $$\tilde{s}_t^O = (\beta - 1)[d_{t-1} - \sum_{i=t}^{t+N-1} s_i^S \beta^{t-1-i}] - s_{t+N-1}^S \beta^{-N}$$
$$d_t = \beta\, d_{t-1} - \tilde{s}_t^O - s_t^S$$

where $\beta = (1+r)/(1+\eta)$ and, for year j, $\tilde{s}_j^O$ is the planned non-Social Security primary surplus share of GDP, s_j^S is the actual Social Security primary surplus share of GDP, and d_j is the end-of-year ratio of publicly held debt to GDP.

The core model is premised on the notion that the optimal non-Social Security fiscal policy keeps the non-Social Security primary surplus forever constant as a share of GDP, but that the actual non-Social Security surplus share of GDP deviates from that ideal because of political constraints that make it difficult to run unified surpluses in anticipation of the need to finance future unified deficits. Those constraints are modeled as inaccurate forecasts of Social Security primary surpluses beyond N years, but the problem is not inaccurate forecasts as much as inability to plan in accordance with those forecasts.

The core model is such that the non-Social Security primary surplus rises or falls in accordance with whether the projections on which choices are based worsen ($s_{t+N-1}^S < s_{t+N-2}^S$) or improve ($s_{t+N-2}^S > s_{t+N-2}^S$). In a prefunded system, Social Security primary surpluses ultimately fall and the news is on balance negative. As a result, non-Social Security primary surpluses are too low initially and gradually rise over time in response to bad news.

To add realism to the core model, it is assumed that politics precludes full upward adjustments to the non-Social Security primary surplus. Specifically, the plan is modified to include two regimes given by (2) when (2) calls for an unchanging or declining non-Social Security primary surplus share of GDP, (3a) $\hat{s}_t^O = \tilde{s}_t^O \;\; if \;\; \tilde{s}_t^O \leq s_{t-1}^O,$

and which otherwise reverts to a damped version of (2):

(3b) $\hat{s}_t^O = s_{t-1}^O + \lambda(\tilde{s}_t^O - s_{t-1}^O) \;\; if \;\; \tilde{s}_t^O > s_{t-1}^O,$

where $\hat{s}_t^O$ is the modified plan**,** $\tilde{s}_t^O$ refers to the core one-regime plan, and $\lambda \in [0,1]$ is a parameter reflecting resistance to rises in the non-Social Security primary surplus share of GDP. The debt to GDP ratio evolves according to:

(4) $d_t = \beta\, d_{t-1} - \hat{s}_t^O - s_t^S$

To simulate synthetic post-1969 data for non-Social Security surpluses, the model is generalized to allow the real government borrowing rate and the real GDP growth rate to accord with actual historical values through to 2006, and values projected in the 2005 Social Security Trustee Report in later years. (Details are in Mariger (2008).)

Two model simulations for the non-Social Security primary surplus share of GDP are shown in Figure 1 along with actual values. The synthetic data simulation assumes that $\lambda = 0.5$ and $N = 5$. The optimal time profile for the non-Social Security primary surplus share of GDP is also shown in the figure; it corresponds to a simulation with $N = \infty$ and $\lambda = 1$ and implies a non-Social Security surplus share of GDP that is forever flat at 0.26 percent of GDP. The optimal primary surplus is just sufficient to service outstanding debt in 1969 that was attributable to non-Social Security policy, which was 33.8 percent of GDP.[1] (Publicly held debt was 30.2 percent of GDP and the trust fund balance was 3.6 percent of GDP.) The fact that the actual non-Social Security primary surplus share of GDP is generally lower than the optimal path implies that publicly held debt attributable to non-Social Security policy has grown faster than under the optimal plan; indeed, starting from 2006 initial conditions, the optimal path for the non-Social Security primary surplus share of GDP is constant at 0.68 percent, a full 0.42 percentage points higher than the optimal path starting from 1969 initial conditions.

[1] If $N = \infty$, $\lambda = 1$, and the Social Security system abides by its budget constraint, then (3b) and (4) reduce to $\tilde{s}_t^O = (\beta - 1)[d_{t-1} + f_{t-1}]$**,** $d_t = \beta\, d_{t-1} - \tilde{s}_t^O - s_t^S$, and $f_t = \beta\, f_{t-1} + s_t^S$, where $f_j = -\sum_{i=j+1}^{\infty} s_i^S \beta^{j-i}$ is the Social Security trust fund balance share of GDP at the end of year j. It is easily verified that these equations imply that the optimal non-Social Security surplus share of GDP is forever constant at $(\beta - 1)[d_{t-1} + f_{t-1}]$.

Estimates Utilizing Simulated Non-Social Security Primary Surpluses

Five regressions utilizing simulated data are reported in Table 2. The regressions utilize the simulated 1970-2006 time path for non-Social Security surpluses and non-Social Security publicly held debt, and actual values for the other independent variables. Regression (1) is the most general specification, the same as regression (3) in Table 1 except that the debt variable coefficients are not forced to be equal. The estimated coefficients on the budget variables, the only explanatory variables that are "relevant" in the sense that they enter the simulation model generating the dependent variable, are all the ***wrong*** sign and achieve at least 1 percent statistical significance (one-tailed test). Among the other explanatory variables (the "irrelevant" explanatory variables), all but the business cycle coefficient achieves at least 5 percent statistical significance.

Regressions (2)-(4) in Table 2 drop the irrelevant explanatory variables from the regression one at a time in the order of lowest to highest statistical significance. Only after all irrelevant explanatory variables are purged from the specification do any of the coefficients on the relevant explanatory variables become the right sign; in that case (regression (4)), the one-tailed 95 percent confidence intervals are ($\leq$ -0.551) for the Social Security primary surplus, ($\geq$ -0.005) for non-Social Security debt, and ($\geq$ 0.014) for Social Security debt.

This exercise suggests that including irrelevant variables in a regression can be as perilous as leaving out relevant variables when the sample size is small.

IV. Conclusion

The budget data is essentially silent on the question of whether Social Security surpluses are truly saved. The reason is that the regression model specification is necessarily approximate, Social Security surpluses show little independent year to year variation, there are only 37 years of data, and spurious correlations mask the true relationships.

But the budget data is not the only source of information. Observations of recent budget politics do not submit to formal statistical tests, but they do nevertheless provide compelling evidence. Mariger (2008) reviews that evidence and concludes that there is a substantial probability that Social Security surpluses are in large part offset by smaller non-Social Security surpluses.

Table 1
Regression Equations Explaining the On-Budget Primary Surplus Share of Potential GDP*

Estimated Coefficient and Standard Error for:	Regresssion Number And Estimation Period			
	(1)	(2)	(3)	(4)
	1949-2006	1949-1969	1970-2006	1970-2006
SS Primary Surplus /Pot. GDP	-3.652 (0.64)	-0.36 (0.954)	-4.632 (0.768)	0.159 (0.736)
Lagged Debt Due to SS/ Pot. GDP	0.190** (0.026)	0.264 (0.715)	0.126** (0.029)	0.085 (0.034)
Lagged Debt Due to Non-SS/ Pot. GDP		0.672 (0.125)		
GDP/Pot. GDP	0.277 (0.061)	0.107 (0.081)	0.465 (0.085)	0.434 (0.123)
Wages and Salaries /GDP	1.214 (0.169)	0.658 (0.358)	1.615 (0.169)	0.301 (0.119)
Time	0.003 (0.001)	0.028 (0.006)	0.009 (0.002)	--------
Time Squared	-0.00001 (0.00001)	-0.001 (0.0002)	-0.0001 (0.00002)	--------
Constant	-1.018 (0.108)	-1.011 (0.264)	-1.51 (0.132)	-0.61 (0.112)
Other Statistics				
R2	0.669	0.715	0.856	0.56009
95% Confident SS Coefficient is less than:	-2.579	1.329	-3.329	1.408

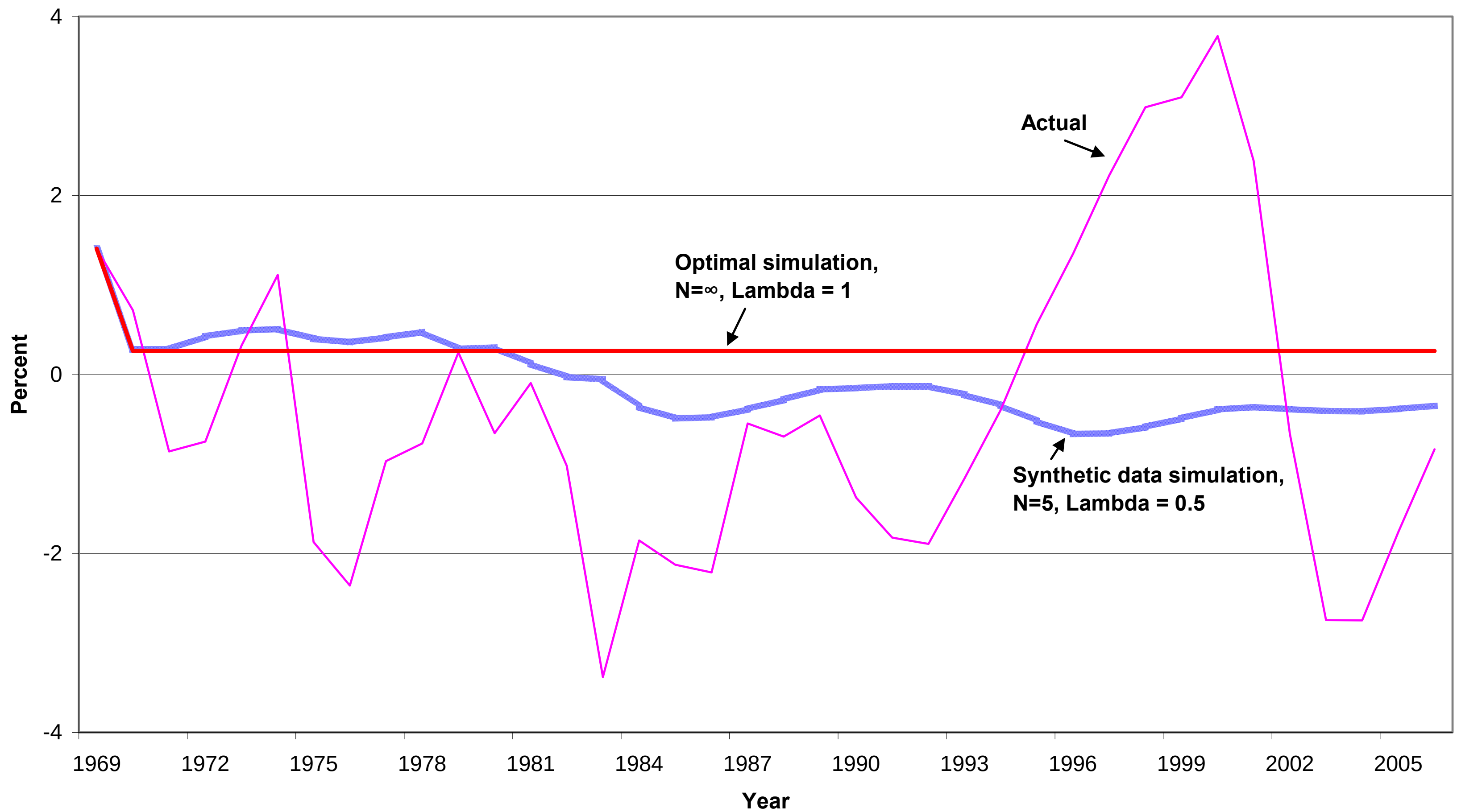
*The dependent variable and all independent variables other than the constant and time variables are normalized by potential GDP. Robust standard errors are reported in parentheses.
**Coefficients on debt due to SS and due to Non-SS constrained to be equal. For regressions 1 and 3, the reason is that the unconstrained estimates violate the theoretical prediction that that the SS coefficient is no larger than the non-SS coefficient. Regression 5 is constrained to be consistent with myopic unified budget planning.

Table 2
Regression Equations Explaining the Simulated Suboptimal 1970-2006 On-Budget Primary Surplus Share of GDP Shown in Figure 2*

Estimated Coefficient and Standard Error for:	Regresssion Number			
	(1)	(2)	(3)	(4)
SS Primary Surplus /Pot. GDP	0.646	0.664	0.451	-0.812
	(0.144)	(0.135)	(0.12)	(0.135)
Lagged Debt Due to SS/ Pot. GDP	-0.314	-0.313	-0.275	0.023
	(0.039)	(0.039)	(0.037)	(0.017)
Lagged Debt Due to Non-SS/ Pot. GDP	-0.085	-0.084	-0.075	0.04
	(0.011)	(0.012)	(0.011)	(0.015)
GDP/Pot. GDP	0.008	--	--	--
	(0.01)			
Wages and Salaries /GDP	-0.063	-0.062	--	--
	(0.017)	(0.017)		
Time	0.001	0.001	0.001	--
	(0.0004)	(0.0004)	(0.0005)	
Time Squared	-0.00003	-0.00003	-0.00003	--
	(0.00001)	(0.00001)	(0.00001)	
Constant	0.035	0.042	0.006	-0.009
	(0.017)	(0.014)	(0.009)	(0.004)
Other Statistics				
R2	0.942	0.941	0.931	0.557
95% Confident SS Coefficient is less than:	0.891	0.893	0.655	-0.584

* Robust standard errors are reported in parentheses. If noise orthogonol to the right-hand-side variables is added to the dependent variable so as to lower the regression (1) R2 to the same level as for a regression using actual data (0.876), all standard errors in all regressions would be higher by 82 percent.

Figure 1
Simulated Non-Social Security Primary Surplus Share of GDP Starting From 1969 Initial Conditions



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