Supplemental Methodological Appendix

for *Journal of Politics* Referees

Methodological Notes on Study 1:

Cross-sectional Analysis

The two surveys from Princeton Survey Research Associates, conducted before and after the downturn during late-August and early-September of 1998, were used to determine whether the stock market affects privatization preferences. Since the dependent variable is a four point scale ranging from strongly oppose (=1) to strongly favor (=4), the appropriate way to model the influence of the stock market is an ordered probit specification (McKelvey and Zavoina 1975). These models are used when the choice categories are discrete but ordered in some fashion, and when the distances between the adjacent points on the dependent variable scale are not necessarily equally spaced.

As noted in the manuscript, the two surveys were stacked and a dummy variable was created that takes a value of one in the period after the stock market turbulence and zero otherwise. This dummy variable was also interacted with all other independent variables to determine whether any of the underlying relationships changed after the market dropped. The coefficient on the dummy term represents an intercept shift while the interaction terms represent slope changes (i.e., differences in the slope coefficients between the two surveys). If the dummy variable is significant, then support changes in the aggregate. If the sign on any of the interactions is significant, then the data have a structural break (Johnston and DiNardo 1997).

A structural break occurs if the parameters underlying a relationship differ from one subset of the data to another. In this study, the focus is on which characteristics influence privatization support and how they change following the stock market decline. If the overall level support drops and all else stays the same, then we can say that the stock market movement was the most likely cause of the reduction in support. But even if the net effect on the intercept

coefficient is negligible, stock market turbulence could still have an impact if the underlying slope coefficients change. Finding such structural variations in support, beyond intercept changes, is important because stock markets can affect not only what opinions people hold, but also why they hold them.

To assess whether intercept or slope coefficients changed, the data were pooled and the equation estimated was:

$$Y_i = \beta_0 + \beta_{00}d_1 + (\beta_{11} + \beta_{21}d_1)X_1 + (\beta_{12} + \beta_{22}d_1)X_2 + \ldots + (\beta_{1k} + \beta_{2k}d_1)X_k + \mu_i$$

where Y_i is the respondent's position on the Social Security privatization, d_1 is a dummy variable equal to one if the respondent was surveyed after the market decline, the X_k variables are personal characteristics of the respondent that influence preferences on the Social Security issue, and μ is a random disturbance term. The coefficients in this model are specified so they can vary between the pre-decline and post-decline samples. The β_{1k} coefficients represent the effect of X_k before the stock market decline when d_1 equals zero. The β_{2k} coefficients indicate the additional influence of X_k following the stock market decline when d_1 equals one. The effect of any independent variable, such as X_1, before the stock market decline is β_{11} and afterward it is $\beta_{11} + \beta_{21}$. If X_1 has the same influence after stock market decline as before, then β_{21} must equal zero. Conversely, if the effect of X_1 changes after the stock market decline, β_{21} must be different from zero.[1]

[1] Franklin and Kosaki (1989) employ a similar specification to model aggregate and structural changes in abortion preferences before and after the Supreme Court's *Row v. Wade* decision.

If the structure of preferences was unaffected by the stock market, we would expect all the β_{2k} coefficients to be near zero and the effects of X_k (estimated by β_{1k}) to be constant over the samples. If each of the β_{2k} coefficients is near zero while β_{00} (*stock market decline*) is large and negative (positive), then the stock market had a uniform effect of lowering (raising) support for privatization without changing the structure of support. If, in contrast β_{00} is insignificant while at least some of the β_{2k} coefficients are large, the primary effect of the market downturn was to shift the structure of the group cleavages on the issue, while producing little net effect on the aggregate balance of preferences. Finally, if both β_{00} and β_{2k} are close to zero, the stock market had no discernable influence on Social Security privatization preferences.[2]

The first empirical study tests the expectation that support for Social Security privatization should fall as stock markets decline.[3] Consequently, the stock market decline dummy variable is expected to be negative and significant. To control for other factors that likely influence support for Social Security privatization, several demographic variables—income, education, age, gender, race, marital status, and financial expertise—were also included.[4] All the

[2] Both models shown in Table 1 of the manuscript were tested against restricted models which constrained the intercept term to zero (column 1) or which set both the intercepts and slope interactions to zero (column 2). The chi-square statistics in Table 1 indicate that the addition of the dummies and interaction terms was warranted.

[3] It is not possible to detail the underlying mechanism here; but briefly, opinions are constructed based upon the considerations that come to mind immediately (Zaller 1992). Anything that reminds respondents of the risks of Social Security privatization, such as a market downturn, should reduce support for Social Security privatization.

[4] The coding for the variables is as follows: income (1-7, 7=$100,000 or more in family income), education (1-4; 4=college degree or higher), age dummy variables (0-1; 1=age group listed on table), female (0-1; 1=woman), black (0-1; 1=black), married (0-1; 1=married), financial expertise (1-4; 4=respondent would do an excellent job

control variables are expected to work in a manner consistent with previous research (Page 2000; Cook and Jacobs 2001). So, for example, older respondents, women, and minorities rely on Social Security more (Gramlich 1998); all else equal, they should not favor the proposal to create worker accounts since this options is risky and may threaten the guaranteed benefit system. More wealthy, educated, married, and financially sophisticated respondents have the ability to withstand market downturns and they might do well by moving to a privatized system, so members of these groups should favor privatization.

Missing data for demographic variables in the form of "don't know" and refusal related item nonresponse were recovered via the EMis algorithm (Expectation Maximization with importance sampling) in the AMELIA computer software program in GAUSS developed by Gary King and his associates (King et al. 2001). Missing data plagues many studies (Little and Rubin 1987). This procedure reduces the potential for selection bias while still acknowledging the uncertainty inherent in the multiple imputation procedure. Recovering the missing responses was particularly important in this study because 12 percent of the sample failed to provide their income. Analyzing the data without these respondents could bias the results. The difference in the number of cases between the estimation sample (N=2,684) and the complete dataset with both surveys stacked (N=3,013) is due to nonresponse for Social Security privatization attitudes (the dependent variable), which was not imputed.

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investing). Dummy variables for partisanship (i.e., Democrat or Republican) appeared in early models but were always insignificant so they were excluded.

Methodological Notes on Study 2:

Time Series Analysis

The 96 survey questions in Study 2 were identified in a search of the *iPoll* database from Roper Center for Public Opinion Research accessed via Lexis-Nexis Academic Universe. Since the words "Social Security" yielded hundreds of questions, the search was further refined to include the word "stock" or "invest." Detailed information on the questions is available from the Roper Center.

Scholars have shown how variations in question wording, interviewing techniques, and other idiosyncratic measurement styles can affect substantive responses (Schuman and Presser 1996). It is possible to use surveys from multiple sources when the same questions over time are not available (Mondak and Smithey 1997; Stimson 1999). However, prior to doing so it is important to determine whether some forms of question wording, format, or interviewing techniques lead to more or less support for Social Security privatization than others.

Table A-1 presents the results of the auxiliary analyses mentioned in footnote 5 of the manuscript. The dependent variable is the proportion favoring privatization in each of the 96 times that such a question has appeared since 1996. Even though the polls varied in (1) the style of question—e.g., some warned of Social Security's impending bankruptcy while others mentioned the possible gains for investors—(2) their format—e.g., two or four answer choices, the number of respondents, or days in the field, etc.—or (3) by which firm conducted the poll, only questions which mentioned the risks or gains associated with privatization significantly affected support. According to the estimates presented in Table A-1, support for privatization was lower by approximately 8 percentage points for questions that mentioned the possible risks

or gains.[5] As indicated in footnote 8 of the paper, dummy variables capturing quarters with risks/gains questions in the time series models were always insignificant.

Insert Table A-1 here

Identification of the Time Series Data

As noted on page 13 of the manuscript, the Dow, S&P, Nasdaq, and an average of all three markets appear to be positively related to support for Social Security preferences in ordinary least squares regression models. Those estimates, which appear in Table A-2, are considered spurious regressions because the data are non-stationary. The Augmented Dickey-Fuller tests in Table A-2 for the undifferenced data series indicate that the Dow, the S&P, the Nasdaq, and the three market average are all non-stationary or integrated, I(1), variables. Although not shown in Table A-2, the undifferenced Social Security privatization series is also non-stationary according to augmented Dickey-Fuller tests (ADF=-2.4, $p > .10$), while the differenced privatization series is stationary (ADF=-4.5, $p \leq .01$).

Insert Table A-2 here

Shocks to integrated data series are permanent in the sense that they never return to pre-intervention levels (i.e., the labels "permanent memory," "nonstationary," "random walk," or "unit root"). In contrast, short-memoried ("stationary") processes are those where data series are

[5] An example of a question with risks or gains wording is the following from *Yankelovich* on April 8, 2000: "Some people have suggested that workers should have the option of taking some of their Social Security taxes and putting them in investments such as the stock market. People who did this would get more money when they retired if those investments did well, but less money if those investments did poorly. Do you think the government should or should not allow Americans to invest a portion of their Social Security taxes in investments such as the stock market?"

interrupted by shocks only briefly before returning to an underlying mean. Because all of the original series are integrated but the errors from the cointegrating regressions are stationary, error correction models are an appropriate choice (Charemza and Deadman 1997). In addition to avoiding the spurious regression problem (Granger and Newbold 1974), these models are attractive because they estimate short-term effects (Δstock market series$_t$), long-term effects (stock market series$_{t-1}$), and the rate at which the series return to equilibrium.

The one-step error correction models which appear in the manuscript are akin to the specification that Durr (1993) uses—i.e., without lagging the differenced independent variables— but the substantive findings are unchanged in models with lagged and differenced independent variables. Following Durr's exposition, the general form of the bivariate error correction model is written as follows:

$$\Delta Y_t = \beta_1 \Delta X_t - \beta_2 (Y_{t-1} - \beta_3 X_{t-1} - \gamma) + \varepsilon_t$$

The β_1 coefficient estimates the short-term quarter to quarter changes of X on Y, β_3 measures the long-term (or lagged) effect of X on Y, and β_2 is the error correction component, which measures the rate at which disequilibria are corrected. The γ term represents the unknown and inestimable constant "spread" between the variables in their equilibrium state, which is the constant from the cointegrating regression. The error correction estimates in Table 2 of the manuscript have been reproduced with additional stationary and diagnostic tests in Table A-3.

Insert Table A-3 here

The estimates in the first column for the Dow imply the following:

$$\Delta Priv.\ Support_t = .10 + .02*\Delta Dow_t - .48*Priv.\ Support_{t-1} + .02*Dow_{t-1} + e_t$$

where *Priv. Support* is the percentage favoring Social Security privatization and *Dow* is the quarterly Dow Jones Industrial Average value. Rewriting this estimated equation in error correction form produces the following:

$$\Delta Priv.\ Support_t = .10 + .02*\Delta Dow_t - .48(Priv.\ Support_{t-1} + .04*Dow_{t-1}) + e_t$$

where the part of the equation in parentheses represents the error correction component. The main difference between the raw estimates and re-writing them in error correction form is that the coefficient on the lagged market series goes from .02 to .04 (.02 / .48).

According to the model, support for Social Security privatization will be in an equilibrium relationship with the Dow Jones Industrial Average when this expression equals zero. Any shock to this relationship will be corrected by changes in privatization support at a rate of 48% per quarter, beginning one quarter after the shock is experienced. This implies that privatization support responds to equilibrium errors fairly quickly, leaving only 52% of the disequilibrating shock after two quarters, 16% after three, 5% after four, and so on.[6]

Interpretating the coefficients helps illustrate the effects. Starting in equilibrium and holding all else constant, suppose the Dow experiences a 1,550 point increase (or 1.55 units, since the data have been divided by 1000), which is a one standard deviation gain based on the variance of the series during the time period under observation. Since only the long-term (Dow_{t-1}) coefficients are significant (i.e., there is no short-term effect that shows up in the same quarter), the total effect is a nearly 7 percentage point increase in support for Social Security privatization (.042 * 1.550 = .065; all of the examples here are reported at three decimal places

[6] The higher the estimate of rho, ρ, the cointegrating coefficient, the faster the series return to equilibrium.

for additional clarity). The error correction term means that total effect appears gradually, with support for privatization increasing roughly 3 percentage points the quarter after the initial increase in the Dow (.065 * .475 = .031 at t+1), another 2 points two quarters later (.034 * .475 = .016), 1 additional percentage point three quarters later (.018 * .475 = .009), and so on with roughly half (.475) of the remaining percentage point appearing in each following quarter until the entire total effect has been experienced.[7]

Footnote 8 of the manuscript refers readers to this appendix for stationarity tests and diagnostic statistics for the error correction models. The original coefficients and the full set of diagnostics appear in Table A-3. As the battery of tests in Table A-3 There are no problems to report (i.e., no multicollinarity, outliers, autocorrelation, omitted variables, etc.) with the exception of one of the heteroskedasticity tests for the Nasdaq model (White's test for heteroskedasticity = 23.3, $p < .05$). Robust standard errors were calculated, but the statistic for White's test was still significant.

One possibility is that the Nasdaq series is fractionally (Box-Steffensmeier and Smith 1998) or nearly-integrated (De Boef 2000; De Boef and Granato 1997) rather than a unit root. To assess this, a differencing parameter, *d,* was estimated, and all models in the paper were re-run using fractionally intergrated one-step error correction models (De Boef 2001). The results of these analyses were similar with respect to the direction and size of the estimated cointegrating relationship.[8]

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[7] The long-term effects of the S&P 500 and the three market average are also felt gradually over several quarters. Even though the Nasdaq error correction term was significant, the coefficient on $Nasdaq_{t-1}$ was insignificant so there is no long-term effect that will gradually appear in a co-integrating relationship.

[8] For the Dow, the d estimate was .84 and the cointegrating parameter was -.56, for the S&P 500 d=.96 and ρ=-.52, for the Nasdaq d=1.02 and ρ=-.39 (n.s.), and finally for the market average d=.87 and ρ=-.55.

Footnote 8 also mentions Granger causality tests. Although unlikely, it could be that the privatization series causes the stock market indicators rather than the opposite.[9] With only one exception, again on the Nasdaq, the stock market indices always granger cause support for Social Security privatization ($p \leq .10$, two-lags estimated). Due to the lack of causal clarity as well as the poor diagnostic tests in the case of the Nasdaq, a vector error correction specification (Johansen 1988; Stock and Watson 1988) was employed. The result was a small (.03) estimated cointegration term, indicating once again that the relationship between the stock market and privatization is weakest on the Nasdaq.

Two final points deserve mention. First, all three financial market series are correlated highly (ranging from .73 for the Dow and the Nasdaq to .92 for the Dow and the S&P, all $p <$ .01), so the models must be run separately. Second, a privatization poll appeared in virtually every quarter; missing values were interpolated when no privatization surveys were conducted during a quarter. While it would increase the total number of data points, privatization polls were not conducted frequently enough to create a monthly series.

[9] Such a scenario might be the case if, for instance, Social Security privatization looked imminent. Investors, anticipating the huge influx of money through private investment accounts, might start buying stocks, which would send the market indices higher. While the relative odds for Social Security privatization might increase when political control of the government shifts to the Republicans (who largely favor privatization), no privatization proposal has gather enough momentum in Congress to the point where its passage looks imminent.

References

Box-Steffensmeier, Janet M., and Renée M. Smith. 1998. "Investigating Political Dynamics Using Fractional Integration Methods." *American Journal of Political Science* 42 (2): 661-689.

Charemza, Wojciech W., and Derek F. Deadman. 1997. *New Directions in Econometric Practice: General to Specific Modelling, Cointegration, and Vector Autoregression* 2nd ed. Lyme, NH: Edward Elgar Publishing,

Cook, Fay Lomax, and Lawrence R. Jacobs. 2001. "Americans' Attitudes Toward Social Security: Popular Claims Meet Hard Data." *Social Security Brief No. 10*. Washington D.C.: National Academy of Social Insurance.

De Boef, Suzanna. 2000. "Persistence and Aggregations of Survey Data Over Time: From Microfoundations to Macropersistence." *Electoral Studies* 19: 9-29.

De Boef, Suzanna. 2001. "Modeling Equilibrium Relationships: Error Correction Models with Strongly Autoregressive Data." *Political Analysis* 9: 78-94.

De Boef, Suzanna, and Jim Granato. 1997. "Near-integrated Data and the Analysis of Political Relationships." *American Journal of Political Science* 41 (2): 619-640.

Durr, Robert H. 1993. "What Moves Policy Sentiment?" *American Political Science Review* 87 (1): 158-70.

Franklin, Charles, and Liane Kosaki. 1989. "The Republican Schoolmaster: The Supreme Court, Public Opinion, and Abortion." *American Political Science Review* 83: 751-71.

Gramlich, Edward M. 2000. *Is It Time To Reform Social Security?* Ann Arbor: University of Michigan Press.

Granger, Clive W. J., and Paul Newbold. 1974. "Spurious Regressions in Econometrics." *Journal of Econometrics* 2: 111-20.

Johansen, Soren. 1988. "Statistical Analysis of Cointegration Vectors." *Journal of Economic Dynamics and Control* 12: 231-54.

Johnston, Jack, and John DiNardo. 1997. *Econometric Methods* 4th edition. New York: McGraw-Hill.

King, Gary, James Honaker, Anne Joseph, and Kenneth Scheve. 2001. ``Analyzing Incomplete Political Science Data: An Alternative Algorithm for Multiple Imputation." *American Political Science Review* 95: 49-69.

Little, Roderick J.A., and Donald B. Rubin. 1987. *Statistical Analysis with Missing Data*. New York: Wiley.

McKelvey, Richard D., and William Zavonia. 1975. "A Statistical Model for the Analysis of Ordinal Level Dependent Variables." *Journal of Mathematical Sociology* 4 (Summer):103-20.

Mondak, Jeffery J., and Shannon Ishiyama Smithey. 1997. "The Dynamics of Public Support for the Supreme Court." *Journal of Politics* 59 (4): 1114-42.

Page, Benjamin I. 2000. "How Public Opinion Affects Reform: Is Social Security Reform Ready for the American Public?" In *Social Security and Medicare: Individual versus Collective Risk and Responsibility*, eds. Shelia Burke, Eric Kingson, and Uwe Reinhardt. Washington, D.C.: National Academy of Social Insurance.

Schuman, Howard, and Stanley J. Presser. 1996. *Questions and Answers in Attitude Surveys: Experiments on Question Form, Wording, and Context*. Thousand Oaks, CA: Sage.

Stimson, James A. 1999. *Public Opinion in America: Moods, Cycles, and Swings.* Boulder, CO: Westview.

Stock, James, and Mark Watson. 1988. "Testing for Common Trends." *Journal of the American Statistical Association* 83: 1097-1107.

Zaller, John, R. 1992. The Nature and Origins of Mass Opinion. New York: Cambridge.

Table A-1. Ordinary Least Squares Analysis of Social Security Privatization Questions

Variable	Coefficient	*t* -statistic
Question wording/format		
Risks/gains mentioned	-0.08	-3.17 **
Bush mentioned	-0.01	-0.41
Financial problems mentioned	0.03	0.65
Four point format	0.04	1.09
Voter poll	0.06	1.64
Days in field	0.00	-0.24
Number of respondents	0.00	1.52
Survey organization		
ABC News / Washington Post	0.02	0.22
American Viewpoint	0.01	0.05
CBS News / New York Times	0.11	1.14
Chilton Research	0.12	1.10
Fox News / Opinion Dynamics	-0.01	-0.10
Gallup Organization	0.11	1.27
Greenberg Quinlan Research	-0.08	-0.78
Harris Interactive	0.02	0.19
Hart-Teeter	0.00	0.05
ICR Survey Research Group	0.11	1.15
Los Angeles Times	-0.05	-0.51
Matthew Greenwald & Associates	0.13	1.05
Penn, Schoen, and Berland Associates	0.06	0.51
Princeton Survey Research Associates	0.03	0.31
Public Opinion Strategies	0.10	0.78
Yankelovich	0.03	0.33
Constant	0.45	4.93 **
Adjusted R-squared	0.31	
Root M.S.E	0.08	
N	96	

Note : Roper Starch World Wide is the omitted baseline category for the survey organization dummy variables.
* $p < .05$; ** $p < .01$ (two-tailed).

Table A-2. Cointegrating Regressions and Stationarity Tests

	Regression Coefficients (standard errors in parethenses)			
	Model 1	Model 2	Model 3	Model 4
Dow Jones Industrial Average	0.02 *	--	--	
	(0.01)			
Standard & Poor's 500	--	0.16 **	--	
		(0.05)		
Nasdaq	--	--	0.04 *	
			(0.02)	
Three Market Average	--	--	--	0.039 *
				(0.016)
Constant	0.37 **	0.37 **	0.47 **	0.38 **
	(0.08)	(0.06)	(0.03)	(0.06)
Stationarity Tests				
Original data series[a]	-2.64	-2.34	-1.79	-2.30
Differenced data series[b]	-3.29 **	-2.52 *	-2.56 *	-2.66 **
Cointegrating OLS residuals[b]	-3.17 **	-3.50 **	-3.01 **	-3.25 **
Adjusted R-squared	0.11	0.19	0.12	0.14
Root MSE	0.07	0.07	0.07	0.07
N	33	33	33	33

Note : All stock market data were divided by 1,000 so each slope coefficient represents a 1000-point change in the market index. The stationarity tests were conducted using Augmented Dickey-Fuller statistics with a lag but without a constant because the constant terms were insignificant.

[a] MacKinnon critical values of -3.71, -2.98, -2.62 for 1%, 5%, and 10% thresholds.

[b] MacKinnon critical values of -2.65, -1.95, -1.60 for 1%, 5%, and 10% thresholds.

* $p < .05$; ** $p < .01$ (two-tailed).

Table A-3. Time Series Analysis of Stock Market Performance and Support for Social Security Privatization

	Error Correction Model Coefficients							
	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.
Short-term effects								
Δ Dow Jones Industrial Ave.	0.02	0.99	--	--	--	--	--	--
Δ Standard & Poor's 500	--	--	0.13	0.80	--	--	--	--
Δ Nasdaq	--	--	--	--	0.00	0.10	--	--
Δ Three market average	--	--	--	--	--	--	0.03	0.72
Long-term effects								
Dow Jones Industrial Ave. $_{t-1}$	0.02	2.31 *	--	--	--	--	--	--
Standard & Poor's 500 $_{t-1}$	--	--	0.12	2.37 *	--	--	--	--
Nasdaq $_{t-1}$	--	--	--	--	0.02	1.05	--	--
Three market average $_{t-1}$	--	--	--	--	--	--	0.03	2.03 *
Rate of return to equilibrium								
Error correction term $_{t-1}$	-0.48	-3.46 **	-0.53	-3.63 **	-0.43	-2.72 **	-0.49	-3.39 **
Constant	0.10	1.19	0.15	2.02 *	0.20	2.57 **	0.14	1.87
Stationarity tests								
Augmented Dickey-Fuller	-3.59 **		-3.58 **		-3.42 **		-3.46 **	
Box-Ljung Q-test	16.23		19.60		18.66		18.37	
Diagnostic tests								
Ramsey RESET/omitted vars	0.42		0.68		0.67		0.40	
Breusch-Pagan het. test	0.22		1.35		0.23		0.45	
White's Test of het.	7.13		15.98		23.33 *		11.13	
LaGrange Multiplier ARCH	0.01		0.00		0.07		0.01	
Durbin's *h*	0.14		0.29		1.60		0.45	
Breusch-Godfrey LM	0.17		0.34		1.79		0.53	
Mean VIF	1.23		1.31		1.31		1.28	
Adjusted R-squared	0.25		0.26		0.14		0.22	
Root MSE	0.06		0.06		0.06		0.06	
N	32		32		32		32	

Note: All stock market data were divided by 1,000 so each slope coefficient represents the effect on privatization support for a 1,000-point change in the market index. The Augmented Dickey-Fuller tests on the residuals for every model include a lag and are estimated without constants because those terms were insignificant. MacKinnon critical values of -2.66, -1.95, -1.6 for 1%, 5%, and 10% thresholds respectively were used to conduct the significance tests.

* $p < .05$; ** $p < .01$ (two-tailed).