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# The Household Sector Financial Balance, Financing Gap, Financial Markets, and Economic Cycles in the US Economy: A Structural VAR Analysis

by

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**ABSTRACT**

This paper investigates private net saving in the US economy—divided into its principal components, households and (nonfinancial) corporate financial balances—and its impact on the GDP cycle from the 1980s to the present. Furthermore, we investigate whether the financial markets (stock prices, BAA spread, and long-term interest rates) have a role in explaining the cyclical pattern of the two private financial balances. We analyze all these aspects estimating a VAR—between household and (nonfinancial) corporate financial balances (also known as the corporate financing gap), financial markets, and the economic cycle—and imposing restrictions on the matrix *A* to identify the structural shocks. We find that households and corporate balances react to financial markets as theoretically expected, and that the economic cycle reacts positively to corporate balance, in accordance with the Minskyan view of the operation of the economy that we have embraced.

**Keywords:** Household Financial Balance; Financing Gap; Business Cycle; Financial Markets; SVAR

**JEL Classifications:** C32, E12, E20

## INTRODUCTION

The starting point is the known macroeconomic identity:

$$Y = C + I + G + X - M \qquad (1)$$

where $Y$ is GDP, $C$ and $I$ indicate consumption and capital expenditure of the private sector, $G$ is government expenditure, $X$ exports, and $M$ imports. Subtracting government's taxes and transfers ($T$) from both sides and rearranging, we have the financial balances for the economy's sectors:

$$(Y - T - C - I) = (X - M) - (G - T) \qquad (2)$$

or

$$0 = (X - M) + (G - T) - (S - I) \qquad (3)$$

where $(X - M)$ is current account surplus (CAS), $(G - T)$ government deficit (GD), and $(S - I)$ private net saving (PNS).

Equations (2) and (3) above express the intrinsic constraint whereby all sectors' positions cannot be determined independently in equilibrium. Figure 1 in the appendix shows the balances dynamic of PNS, GD, and CAS since 1960. We can see from the figure how these sector financial balances have moved over time. Private sector surplus and government deficit have moved very closely. This is not surprising given they are the opposing sides of an accounting identity. The difference between them, more visible from the 1980s, is the current account balance.

So far, the perspective is one of accounting and not economics. The impact of the financial balances on the economy depends not on the sector's actual financial balance, but whether the sector is above/below its "normal" path over time (Hatzius 2003; Godley et al. 2007). The "normal" path is identified as the trend pattern historically observable in the data. The trend is a sort of ideal or desirable level of financial balance. When a sector's balance diverges from its normal level, this implies an impulse on GDP growth.

In what follows we focus on the PNS only and its impact on the GDP cycle. The reason is twofold: 1) PNS has shown a closer relationship with the economic cycle over the years; and 2) PNS comprises the two key groups of private agents in the economy: households and firms.

With regard to point 1, appendix figure 2 shows the relationship between GDP growth and the PNS cycle.

Two interpretations are possible. Figure 2 (a) shows a negative correlation with GDP growth, slightly lagging at the turning points; figure 2 (b) shows a positive and leading correlation with GDP growth. Figure 2 (a) gives a static picture of the relationship between PNS and economic cycle: a boom in economic growth corresponds to an excess of spending in the private sector (and then to a negative PNS). Due to its lagging behavior, the negative PNS seems to be a result of GDP growth and not vice versa. In this interpretation PNS is a passive variable: it is caused by the GDP cycle. Figure 2 (b), instead, gives a dynamic picture of the relationship; since the private sector historically shows a tendency towards mean reversion, the large deficit/surplus today raises the probability of an imminent reversion in the near future. This cyclical behavior can have a significant impact on future GDP growth. For example, when PNS is running at a financial deficit (total spending larger than income) this implies a future reversion (reduction of total spending) with a negative impact on the economic cycle. We concur with this dynamic interpretation, since it is the only one compatible with a view of the private sector as an "active" and leading actor in the economy.

With regard to point 2, we make a distinction in our analysis. We split the PNS into households and firms. In particular, we select households and nonfinancial corporate balances as suggested by Hatzius (2003). This is important because households and nonfinancial corporate balances reflect different decisions and may show different patterns over time (see Casadio and Paradiso [2009] on this point). Furthermore, the nonfinancial corporate balance—corporate profits minus business investments, known as the financing gap with the sign reversed—is a variable of choice for firms: other than investments, they decide on the financial imbalance. This variable summarizes Minsky's theory of financial instability and financial cycles (Minsky 1993).

But what determines the cyclical movement of households and corporate balances? The answer is the cyclical pattern of financial markets. Stock prices, 10-year Treasury-Note (T-N) yields, and the spread between BAA-corporate bond yields and 10-year T-N yields (BAA-spread) are the financial variables used in our empirical study. For example, a rise in stock prices implies that households feel richer (the equity wealth effect) and corporate bodies are more optimistic about their future returns on capital. The effect is a rise in their spending. When long-term interest rates reduce, households will refinance their mortgages and corporate bodies will be more willing to borrow capital. Also in this case, the effect is a rise in their spending. BAA-spread is another measure of the cost of external finance for corporate bodies. Higher BAA-spread discourages debt-financed spending by firms, discouraging investment spending.

In this paper, we use financial variables explained above—long-term interest rates, equity price, BAA-spread—to estimate the cyclical pattern of households and nonfinancial corporate balances. We then show that the difference between the actual and trend components of the two financial balances is related positively to economic growth, confirming our view of a dynamic interpretation of the financial balances. In particular, we find that future growth is explained by the nonfinancial corporate sector according to a Minskyan view of the economy.

As all aspects in this comparison are interdependent (financial markets depend on fundamentals and influence households and corporate financial balances; a deviation of one of the two private sectors implies an effect on output, but at the same time GDP brings all the sectors into equivalence), the proper instrument to analyze these aspects is the vector autoregression (VAR). We first estimate an unrestricted VAR, and then we identify the structural shocks imposing restrictions on the matrix *A* of contemporaneous relationships. The impulse response function (IRF) points out that households and nonfinancial corporate balances react to financial markets in a correct way (in a way consistent with our theoretical expectations), and that economic cycles react positively to the financing gap (according to our interpretation).

## THE EMPIRICAL VAR MODEL

### The Data

The variables used in the empirical VAR analysis are the Standard and Poor's 500 index, expressed in the ratio of GDP *sp500*, the BAA-spread (the spread between BAA corporate bond yields and 10-year T-N yields) *baas*, the 10-year T-N yields *long10*, the log of real GDP *gdp*, the household balance (gross saving—line 10 of table F.100 in the flow of funds account [FoF]—minus capital expenditures—line 12 of table F.100 in the FoF) measured as a share of GDP *hbal*, and the corporate financial balance (internal funds with IVA minus total capital expenditures—line 54 of table F.102 with sign reversed in the FoF) measured as a share of GDP *fgap*. All the variables are expressed as cyclical component with the

Hodrick-Prescott filter. The sample uses observations from 1980q1 to 2010q2. Time series are plotted in appendix figure 3.

### Reduced Form Model

Given that, for construction, all the variables are static, we proceed to estimate the unrestricted VAR model that forms the basis of our analysis. We employ information criteria to select the lag length of the VAR specification, including only a constant. With a maximum lag order of $p_{max} = 8$, Akaike info criterion and final prediction error suggest a lag of two, whereas the Hannan-Quinn and Schwartz criterion suggest only a lag of one. After having estimated the model for the suggested lag lengths—and having excluded the insignificant parameters according to the top-down algorithm (with respect to the AIC criteria)—we conduct the usual diagnostic tests. The results are reported in table 1 in the appendix.

The results are satisfactory, except for some traces of non-normality. Because the VAR estimates are more sensitive to deviations from normality due to skewness than to excess kurtosis (Juselius 2006), we check these measures for each variable. An absolute value of unity or less for skewness is considered acceptable in the literature (Juselius 2006). Since that for $p = 1$ we find a skewness very close to one for the stock price equation, we prefer to select a VAR with two lags. Appendix table 2 reports specification tests for the single variables for the case $p = 2$. Since the skewness values are below the values suggested by the literature, we conclude that non-normality is not a serious problem in our case.

### Structural Identification and Impulse Response Analysis

Having specified the reduced form model, we now proceed to the structural analysis. A structural VAR has the following general form:

$$A_0 Y_t = A_1(L) Y_t + B\varepsilon_t \tag{4}$$

Here $Y_t$ represents $K$-vector relevant variables; $A_0$ and $B$ are $K \times K$ matrices; and $A_1(L) = \sum_{i=1}^{p} A_{i1} L^i$ represents matrices polynomial in the lag operator with $A_{i1}$ being $K \times K$ matrix. $\varepsilon_t$ is an $K$-vector of serially uncorrelated, zero mean structural shocks with an identity contemporaneous covariance matrix ($\Sigma_\varepsilon = E[\varepsilon_t \varepsilon_t'] = I$ ).

Provided that $A_0$ is nonsingular, solving for $Y_t$ yields the reduced form of VAR representation:

$$Y_t = A_0^{-1} A_1(L) Y_t + A_0^{-1} B \varepsilon_t \tag{5}$$

or

$$Y_t = C(L) Y_t + u_t \tag{6}$$

where

$$C(L) = A_0^{-1} A_1(L) \tag{7}$$

and

$$u_t = A_0^{-1} B \varepsilon_t \tag{8}$$

or

$$A_0 u_t = B \varepsilon_t \tag{9}$$

Equation (4) is the structural model of the VAR, whereas (5) is the reduced form. The technique involved consists of estimating equation (5) and recovering the parameters and the structural shocks $\varepsilon_t$ in (4) from these estimates. Equation (9) relates the reduced form disturbances $u_t$ to the underlying structural shocks $\varepsilon_t$ . To identify the structural form parameters, we must place $2K^2 - K(K+1)/2$ restrictions on the *A* and *B* matrices. In our case, where K = 6, the number of necessary restrictions is 51. We impose the following restrictions:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ * & 1 & * & * & * & * \\ * & 0 & 1 & * & 0 & 0 \\ * & * & 0 & 1 & 0 & 0 \\ * & * & 0 & * & 1 & 0 \\ * & * & * & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_t^{gdp} \\ u_t^{sp500} \\ u_t^{baas} \\ u_t^{long10} \\ u_t^{hbal} \\ u_t^{fgap} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{gdp} \\ \varepsilon_t^{sp500} \\ \varepsilon_t^{baas} \\ \varepsilon_t^{long10} \\ \varepsilon_t^{hbal} \\ \varepsilon_t^{fgap} \end{bmatrix}$$

where * indicates a parameter that is freely estimated in the system. *gdp* is presumed to adjust slowly to shocks of other variables in the system as assumed by Rotemberg and Woodford (1999), for example. Equity price, instead, is allowed to react instantaneously to all types of shock according to the theory that financial markets reflect all the information in the system. BAA-spread is supposed to react immediately to shocks in output and long-term interest rates, whereas long-term interest rates are supposed to react instantaneously to *gdp* and *sp500*. Household financial balance and the financing gap are assumed to respond without delay to the assumed dependent variables (*gdp*, *sp500*, *long10* for *hbal*; *gdp*, *sp500*, *baas* for *fgap*).

The results of IRF are reported in figure 4 in appendix. We focus here on the key results. First of all, households and corporate balances react to financial markets as we expected: *hbal* and *fgap* respond negatively to a rise in stock prices; *fgap* falls after a rise in BAA-spread; and *hbal* rises in the presence of a rise in long-term interest rates. Secondly, a rise in the economic cycle does raise the household balance positively, but causes a fall in the corporate balance. This occurs because higher income means higher savings (for households), whereas higher *gdp* means higher business investments (for corporate bodies). More importantly, the effect of the two financial balances on GDP growth are positive, as we expected, even if only the financing gap response is statistically significant. This result brings an important message: the financing gap is a leading component of the cycle as suggested by Casadio and Paradiso (2009) and accordingly to Minsky's theory of financial instability (Minsky 1993).

Other results of the IRF confirm the goodness of the SVAR estimation. A positive shock in BAA-spread, in general, makes outside borrowing more costly, reduces firms' spending and production, and consequently hampers real activity. This reason explains the negative response of *gdp* and *sp500* to a positive shock in BAA-spread. Instead, a positive shock in the economic cycle makes future expectations of economic activity more optimistic and reduces the risk premia tightening the spread. Long-term interest rates depress economic activity according to the well-known theory, whereas a positive shock on the *gdp* cycle raises long-term interest rates (as long-term interest rates are the average of expected future short-term rates, and a rise in *gdp* implies that there will be expectations of an increase in short-term interest rates).

## CONCLUSIONS

We investigated the PNS, split into the two main components—household and nonfinancial corporate balances—for the US economy for the period 1980q1–2010q2. We tested whether: 1) financial markets have a role to explain the cyclical dynamic of the two private balances; and 2) the two balances explain the economic cycle. We estimated a structural VAR, imposing restriction on the contemporaneous effects matrix, to test these points. IRF shows that household and corporate balances react to financial markets as we expected, and that positive shocks in nonfinancial corporate balances do raise the GDP cycle according to our interpretation and Minsky financial cycles.

## REFERENCES


Casadio, P., and A. Paradiso. 2009. "A Financial Sector Balance Approach and the Cyclical Dynamics of the U.S. Economy." Working Paper 576. Annandale-on-Hudson, NY: Levy Economics Institute of Bard College.

Godley, W., D.B. Papadimitriou, G. Hanngsen, and G. Zezza. 2007. "The U.S. Economy: Is There a Way out of the Woods?" Strategic Analysis (April). Annandale-on-Hudson, NY: Levy Economics Institute of Bard College.

Hatzius, J. 2003. "The private sector deficit meets the GSFCI: A financial balances model of the US economy." Global Economics Paper No. 98. New York: Goldman Sachs.

Juselius, K. 2006. *The cointegrated VAR model: Methodology and applications*. Oxford, UK: Oxford University Press.

Lutkepohl, H., and M. Kratzig. 2004. *Applied Time Series Econometrics.* Cambridge, UK: Cambridge University Press.

Minsky, H.P. 1993. "The financial instability hypothesis." in P. Arestis and M. Sawyer (eds.), *Handbook of Radical Political Economy*. Aldershot: Edward Elgar.

Rotemberg, J.J., and M. Woodford. 1999. "Interest rule in an estimated sticky-price model." in J.B. Taylor (ed.), *Monetary Policy Rules.* Chicago: University of Chicago.

## APPENDIX TABLES AND FIGURES

### Table 1: Diagnostic Tests for VAR(p) Specifications

| | $Q_{16}$ | $Q^{*}_{16}$ | $LM_5$ | $LJB^{L}_{5}$ | $MARCH_{LM}(5)$ |
|---|---|---|---|---|---|
| $\rho = 2$ | 507.73 [0.84] | 550.81 [0.36] | 196.02 [0.19] | 67.93 [0.00] | 2285.45 [0.11] |
| $\rho = 1$ | 523.57 [0.83] | 564.86 [0.39] | 191.74 [0.26] | 129.49 [0.00] | 2278.62 [0.13] |

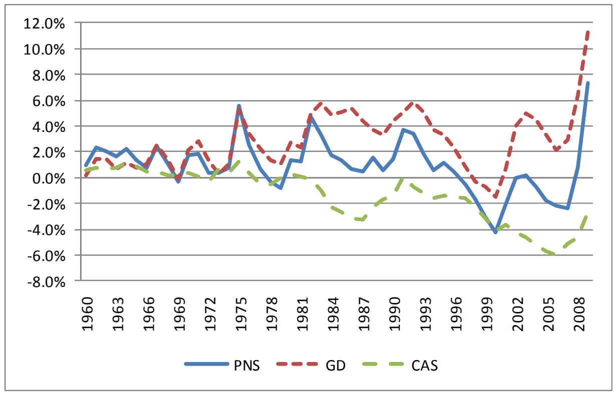
**Note:** p-values in brackets. $Q_p$ = multivariate Ljiung-Box portmentau test tested up to the $p$th lag; $LM_p$ = LM (Breusch-Godfrey) test for autocorrelation up to the $p$th lag; $LJB^{L}_{p}$ = multivariate Lomnicki-Jarque-Bera test for non-normality from Lutkepohl and Kratzig (2004) with *p* variables in the system; $MARCH_{LM}(q)$ = multivariate LM test for ARCH up to the $p$th lag. An impulse dummy variable for period 2008q4 is considered because a strong outlier in baa-spread series.

### Table 2: Specification Tests for VAR(2) Model

| Univariate normality test for | *gdp* | *sp500* | *baas* | *long10* | *hbal* | *fgap* |
|---|---|---|---|---|---|---|
| Norm(2) | 9.93 [0.01] | 23.25 [0.00] | 4.98 [0.08] | 20.21 [0.00] | 0.62 [0.73] | 35.67 [0.00] |
| Skewness | 0.39 | -0.57 | 0.08 | 0.04 | -0.09 | 0.62 |
| Excess kurtosis | 4.16 | 4.83 | 3.98 | 5.00 | 3.30 | 5.36 |

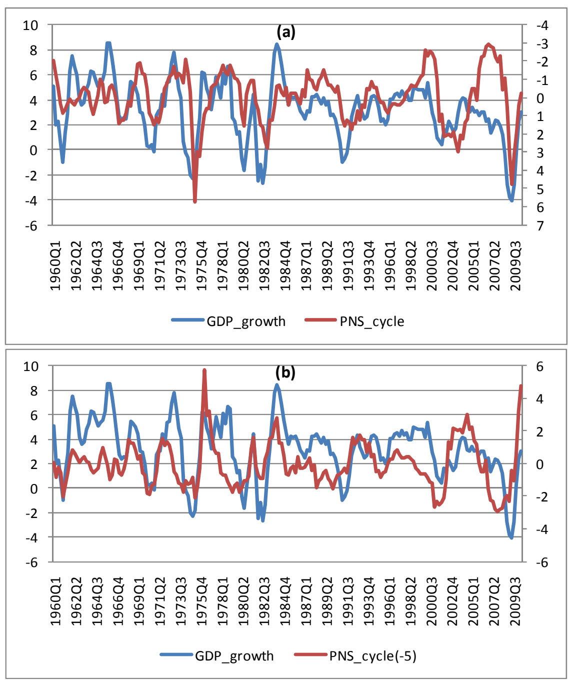
**Note:** p-values in brackets.

**Figure 1: Sectors' Financial Balances Dynamic as a Percent of GDP**



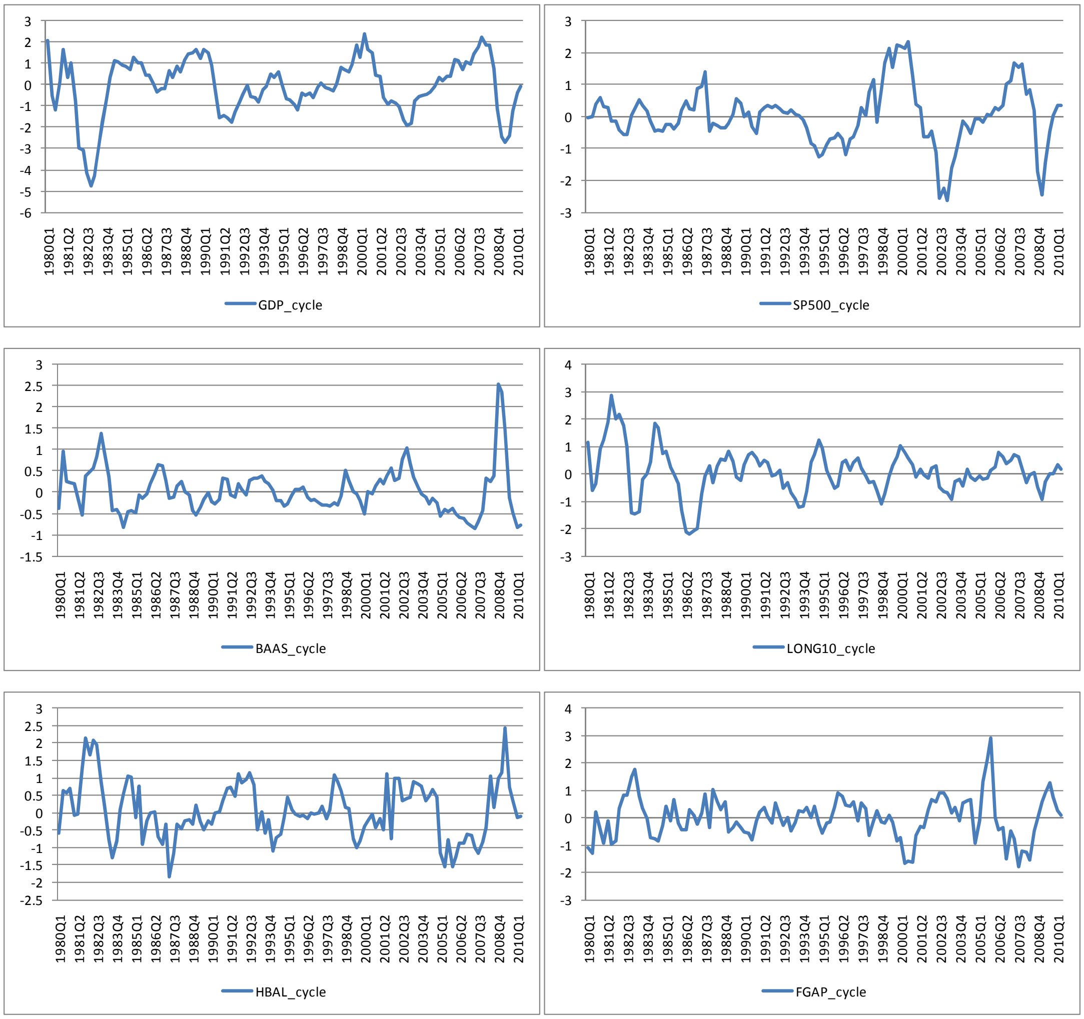

**Source:** BEA. All series are percentages of GDP.
**Notes:** Our calculations are on annual data.

**Figure 2: Cyclical Component of PNS versus GDP Growth**

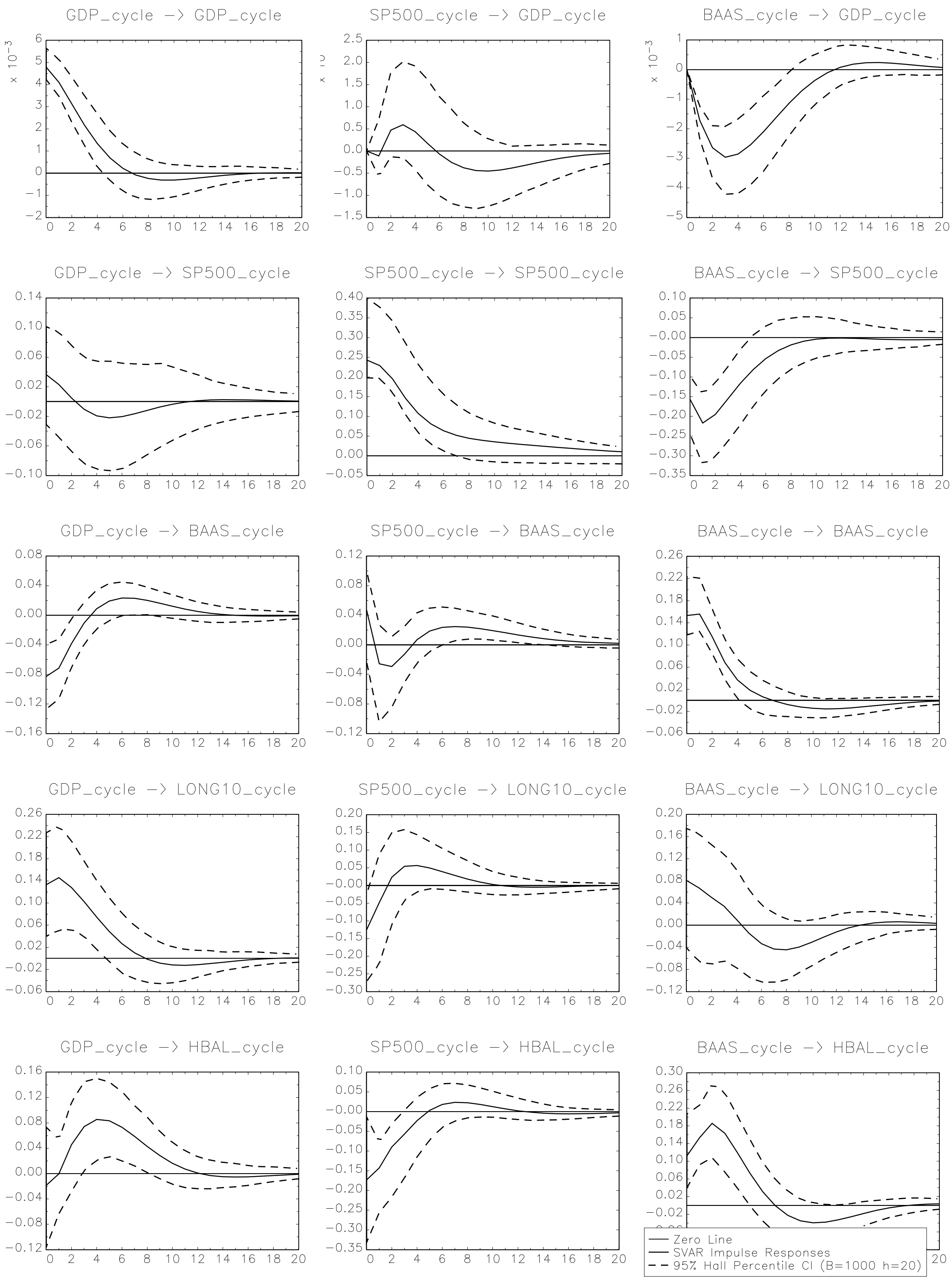


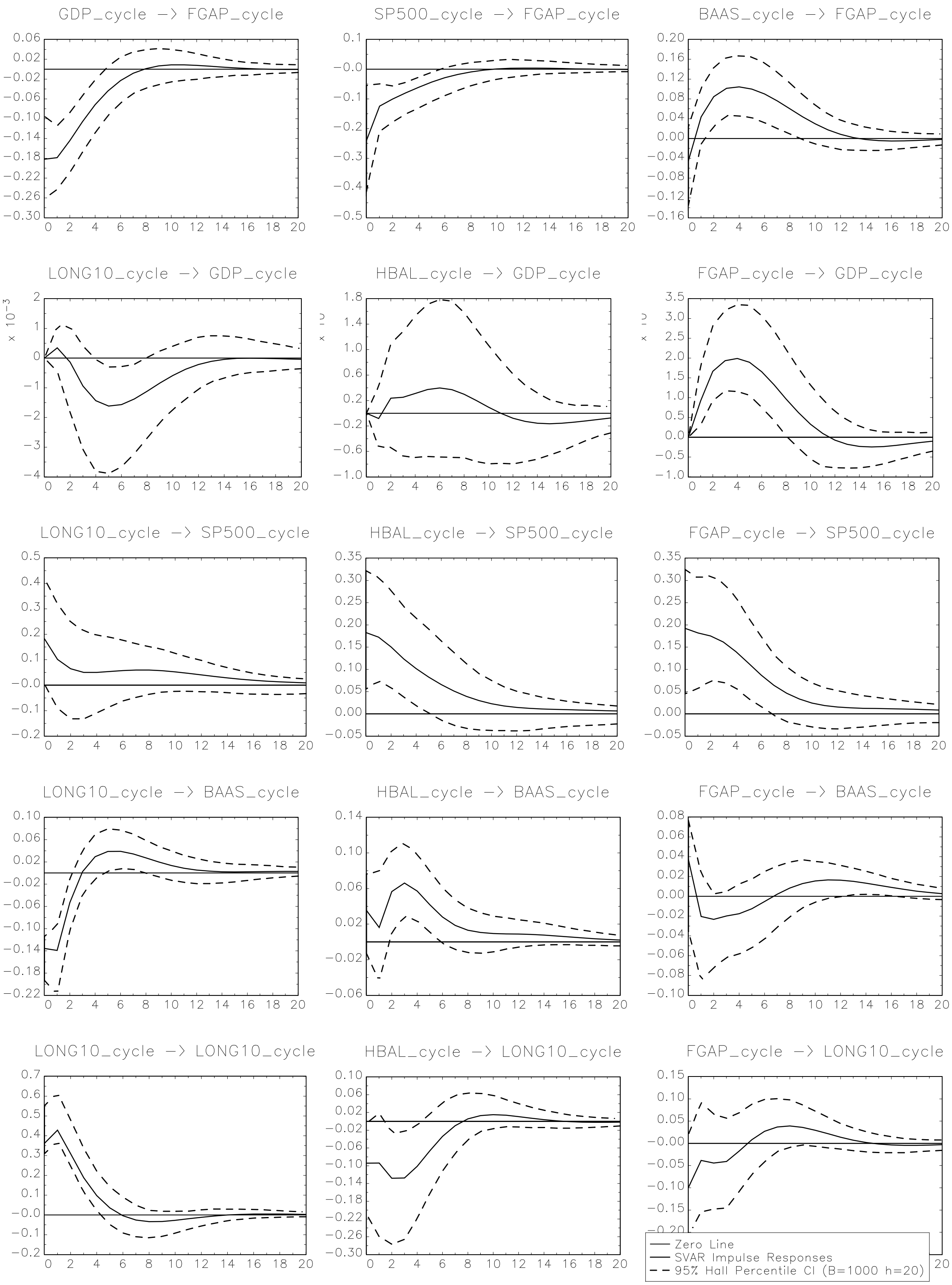

**Note:** The cycle component of PNS (PNS_cycle) is obtained through the Hodrick-Prescott filter applied to the ratio of private sector balance to GDP. GDP_growth is the GDP year-on-year growth rate (the level of GDP in one quarter is compared to the level of GDP in the same quarter of the previous year).

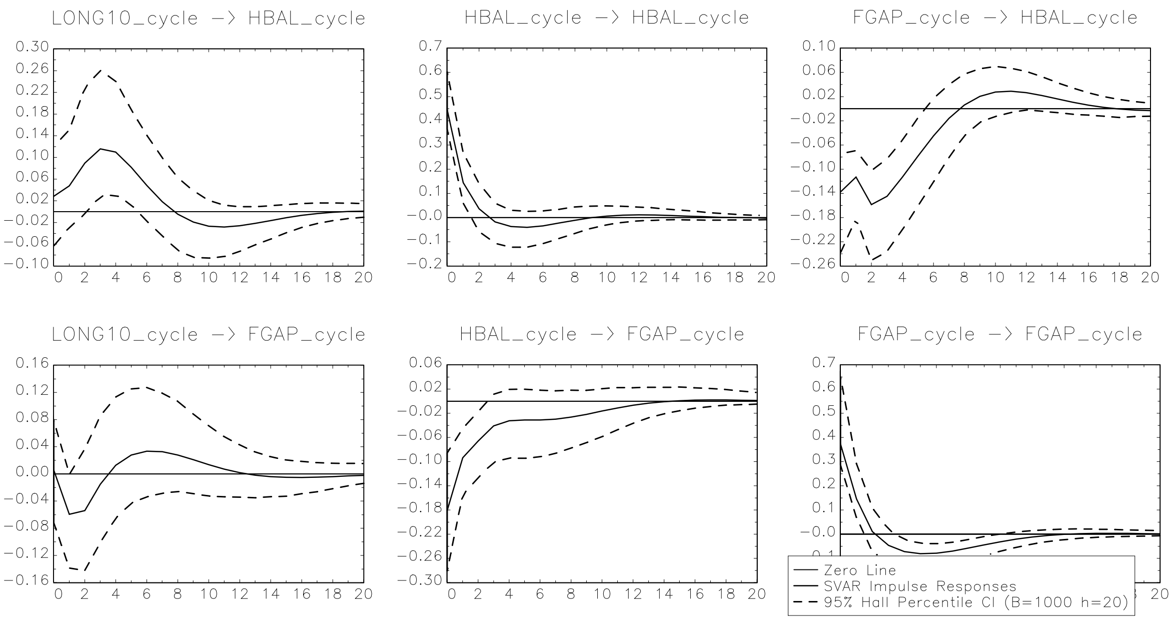
## Figure 3: Time Series Used in VAR Estimation, 1980q1–2010q2



# Figure 4: Impulse Responses, Structural VAR




GDP_cycle -> FGAP_cycle
SP500_cycle -> FGAP_cycle
BAAS_cycle -> FGAP_cycle
LONG10_cycle -> GDP_cycle
HBAL_cycle -> GDP_cycle
FGAP_cycle -> GDP_cycle
LONG10_cycle -> SP500_cycle
HBAL_cycle -> SP500_cycle
FGAP_cycle -> SP500_cycle
LONG10_cycle -> BAAS_cycle
HBAL_cycle -> BAAS_cycle
FGAP_cycle -> BAAS_cycle
LONG10_cycle -> LONG10_cycle
HBAL_cycle -> LONG10_cycle
FGAP_cycle -> LONG10_cycle
Zero Line
SVAR Impulse Responses
95% Hall Percentile CI (B=1000 h=20)


LONG10_cycle -> HBAL_cycle
HBAL_cycle -> HBAL_cycle
FGAP_cycle -> HBAL_cycle
LONG10_cycle -> FGAP_cycle
HBAL_cycle -> FGAP_cycle
FGAP_cycle -> FGAP_cycle
Zero Line
SVAR Impulse Responses
95% Hall Percentile CI (B=1000 h=20)