Working Paper No. 576

A Financial Sector Balance Approach and the Cyclical Dynamics of the U.S. Economy

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September 2009

* The authors are grateful to Claudio Sardoni, Luigi Ventura, and Gennaro Zezza for helpful comments on a previous version of this paper. E-mail: paolo.casadio@yahoo.it; anto_paradiso@hotmail.com.

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ABSTRACT
This paper investigates the relationship between asset markets and business cycles with regard to the U.S. economy. We consider the Goldman Sachs approach (2003) developed to study the dynamics of financial balances.

By means of a small econometric model we find that asset market dynamics are fundamental to determining the long-run financial sector balance dynamics. The gap between long-run equilibrium values and the actual values of the financial balances help to explain the cyclical path of the economy. Among all financial sectors balances, the financing gap in the corporate sector shows a leading effect on business cycles, in a Minskyan spirit. The last results appear innovative with respect to Goldman Sachs's findings. Furthermore, our econometric results are robust and quite stable.

Keywords: Financial Balance; Asset Markets; Business Cycle; Financing Gap; Cointegration; DLS

JEL Classifications: C50, E12, E17, E20

INTRODUCTION

In this work we develop and estimate a small-scale macroeconomic model to study, in a reduced form, the evolution of sectors' financial balances (the difference between a sector's income and its outlays) for the U.S. economy. Our purpose is to carry out an econometric estimate and forecasting analysis. The institutional sectors considered in our analysis are the private sector—divided into households and nonprofit firms on one side, and nonfinancial firms on the other—and the external sector[1]. The partition is important in a Keynesian view because it introduces a distinction between different decisional centers and their respective uncertainty.

Our starting point is the "financial balances" approach developed by Goldman Sachs (2003) and inspired by the works of Godley. The importance we attach to focusing on sectors' financial balances is the following. In this scheme we consider a financing gap (the difference between internal funds and business investments of nonfinancial firms) a concept that allows us to consider the financial unbalance of firms and to introduce in the analysis the idea of financial fragility in capitalistic economies, originally developed by Minsky. We find that a financing gap is a leading indicator of business cycles while business investment is only a lagging variable. Inertia in investments and financial unbalances in the expansionary phase of the cycle help to explain the cyclical inversion, and then the downturn, of the economy.

We focus on the determination of equilibrium sectors' financial balances based on asset markets. We find a cointegrating relationship for all financial sectors' balances considered[2]. We, then, move on to study how these equilibrium sectors' balances have an impact on GDP cyclical growth. The idea is that discrepancies from equilibrium cause an effect on output. Finally, by means of a simulation, we ascertain whether the qualitative effect of shocks on asset markets is similar to those we find in our estimates.

The work is organized as follows. Section 1 outlines the sectors' financial accounting framework and the method used to study the U.S. economy. Section 2 presents stylized facts analysis about the sectors' balance, focusing both on the relationship between the sectors' dynamic and GDP cycle and on the study of sectors' balance drivers. Then we concentrate our analysis on explaining the particular pattern of financing gap as pointed out by stylized

1 We do not consider explicitly the financial firms and public sector balances in our work.

2 Econometrically, we estimate financial sectors' balances using DOLS method developed by Stock and Watson (1993) which overcomes the problem of no endogeneity among regressors. Additionally, we check our results with the Johansen procedure and we find very similar results.

facts analysis. Section 3 describes the financial sectors' balance model introduced by Goldman Sachs (GS) in 2003. In this section we evidence the method of analysis adopted by GS, with the relative weakness, and the fragile estimation results found by GS. Section 4 presents our sectors' balance model with the specifications and results. Finally, the main results of this work are discussed in the conclusions.

1. SECTORS' FINANCIAL BALANCE APPROACH: EVIDENCE AND METHOD OF ANALYSIS

The starting point is the known macroeconomic identity[3]:

$$Y = C + I + G + X - M \tag{1}$$

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

$$(Y - T - C - I) = (X - M) + (G - M) \tag{2}$$

or

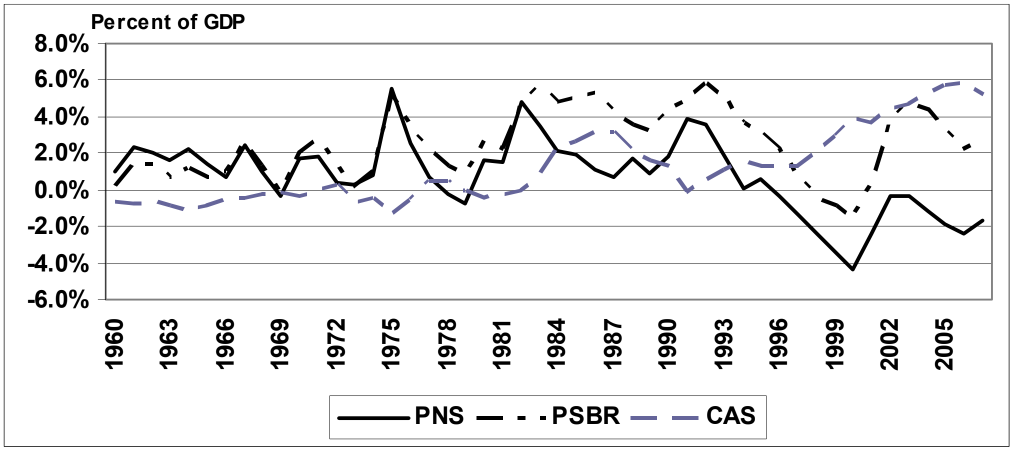
$$0 = (X - M) + (G - T) - (S - I) \tag{3}$$

where (X - M) is Current Account Surplus (CAS), (G - T) Government Deficit (PSBR) 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. The figure below shows the balances dynamics of PNS, PSBR and CAS (this last one with the reversed sign) since 1960. We can see from the figure that financial balances move together in some periods and we will see how these co-movements will be reflected in a cyclical dynamic of the whole economy.

[3] All aggregates are measured in nominal terms.

Figure 1: Sectors' Financial Balances Dynamic



Source: BEA. All series are percentages of GDP.

Our calculations are on annual data. CAS is represented with the reversed sign.

Although all the balances must equal zero, each variable has a "life of its own" and it is the change of real output that brings them into equivalence (Godley et al. 2007). For example, in the second half of the 1990s, a deficit in the private sector pushed up the GDP, which caused a reduction in CAS (through pressure on imports) and a rise in the public sector surplus (the taxes, in general, rise proportionally to output).

Methodologically we consider two analyses:

1. Determination of equilibrium sectors' financial balances on the basis of asset markets variables. By means of a long-run cointegration relationship we derive a sector's equilibrium balance reflecting the prevailing condition on financial conditions[4]. The idea is that asset markets convey information on stock variables (wealth) that influence sectors' balances. For example, a rise in house prices implies that households feel richer and tend to spend more.

2. These equilibrium sectors' balances have an impact on GDP growth. In particular, by means of ECM (Error Correction Model) we analyze how discrepancies from equilibrium cause an effect on output growth. For example, a level of PNS over equilibrium implies that, for the private sector, spending outstretches are in excess of incomes. This implies a positive impact on GDP growth[5].

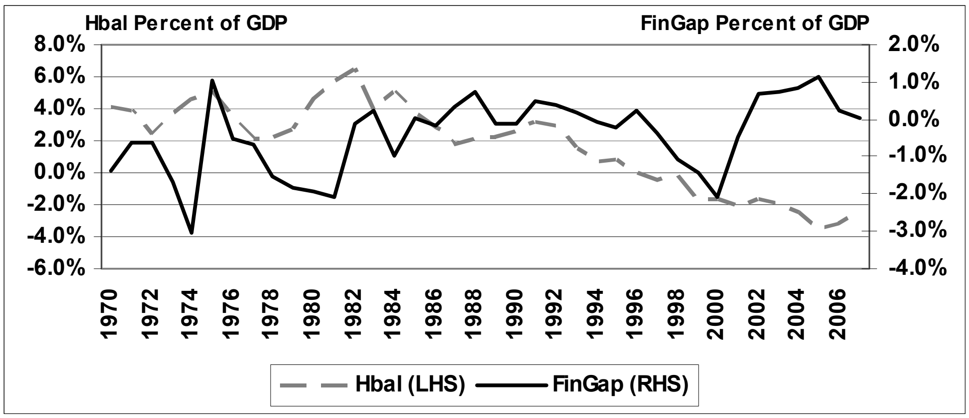
4 We make use of same definition given by Goldman Sachs (2003).

5 Sectors' balance and GDP have a double linkage. On one side, a deviation of a sector from equilibrium implies an effect on output growth. On the other side, it is GDP, through its dynamic, that brings all sectors into equivalence.

One important distinction (originally developed by GS [2003]) to be made is the splitting of PNS into households (Hbal) and nonfinancial corporate business (FinGap). It is important to analyze these sectors separately for two reasons:

1. Hbal and FinGap reflect different decisions and show different patterns over time—in particular they diverge after 2000—as shown in Figure 2. It is, therefore, important to analyze them separately.

Figure 2: Household balance vs Financing Gap



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

2. Furthermore, FinGap represents a variable of choice for firms: they decide, other than investments, the financial unbalance. This variable summarizes Minsky's theory and it is a leading indicator of the economic cycle (as we will see in details in section 2) as opposed to business investment which is lagging, according to our study of stylized facts about cycle.

We turn now to study the behavior of the sectors' balance in relation to business cycle and to identify their drivers through a stylized facts analysis.

2. SECTORS' FINANCIAL BALANCES STYLIZED FACTS

In this section we analyze the relationship between sectors' financial balances, their components and business cycle, in order to find the dynamic correlation and the timing linking those variables. We will use these findings later to identify the explanatory variables in estimating sectors' balances.

An appropriate measurement of time series and business cycle is important to establish stylized facts about cyclical movements. The main problem, highlighted by Stock and Watson (1998), is that there are some fluctuations in the series arising from temporary factors, outliers, and measurement error. For these reasons the data has to be filtered to remove the low frequency variations[6].

2.1 Financing Gap

This balance is the difference between internal funds (retained earnings after taxes and dividends) and fixed investments of nonfinancial corporate business[7] (both calculated in terms of GDP ratio). It is very important to understand the cyclical nature of the financing gap. In our analysis the financing gap plays a crucial role in anticipating and determining the business cycles phases, in a way Minsky originally put forward in his theory of financial fragility.

Table 1 summarizes three important stylized facts of the financing gap and its components:

I. the cyclical pattern of the financing gap (panel a);
II. the relationship of internal funds (share) with profits (share) and dividend policy (panel b);
III. the relationships linking the investment share to business cycles, internal funds, equity prices, and the cost of external corporate finance (panel c).

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6 In our work we "clear" our series applying a Hodrick-Prescott filter with a smoothing parameter λ= 1600. This value is the most appropriate for quarterly data (Hodrick and Prescott 1997). The HP filter decomposes a time series into a cyclical component and a trend. Applied to GDP, this HP trend is interpreted as the potential GDP. The smoothness of the trend is controlled by a parameter λ.

7 Our version of business sector balance is different from the GS version. Our work considers the financing gap with the exclusion of the inventories while GS includes them in their analysis. Our analysis of equilibrium financing gap and our interest in analyzing the leading nature of this balance leads us to exclude inventories. In appendix A, we make a comparison between our measure (without inventories) and the BEA measure (with inventories): the two series have a very similar pattern, so the information incorporated (from an econometric point of view) in the series is not so different.

Table 1: Stylized Facts Regarding the Financing Gap (Quarterly Data, 1976q1-2007q1)

(a) Business cycle properties of the financing gap		
Variable	**Correlation with GDP**	**Timing**
Financing gap	+0.3	Leading (5Q)
Internal funds share	+0.25	Leading (2Q)
Business Investment share	+0.7	Lagging (3Q)

(b) Stylized facts regarding internal funds component		
Internal funds share	**Correlation with profits**	**Timing**
	+0.51	Coincident
Dividends / Internal funds	**Correlation with yield curve**	**Timing**
	-0.56	Coincident

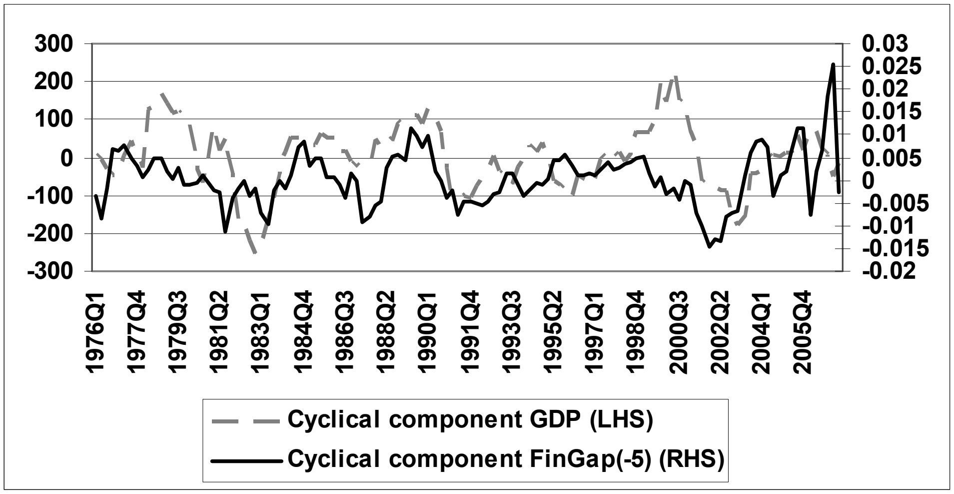
(c) Stylized facts regarding investment share component		
Investment share	**Correlation with internal funds**	**Timing**
	+0.27	Lagging (4Q)
Investment share	**Correlation with equity prices**	**Timing**
	+0.34	Lagging (4Q)
Internal funds share	**Correlation with Baa spread***	**Timing**
	-0.33	Coincident

*** Correlation calculated on annual data for period 1975-2004. Baa spread, the difference between the baa corporate yield and the ten-year government bond yield, is the cost of external corporate bond finance.**

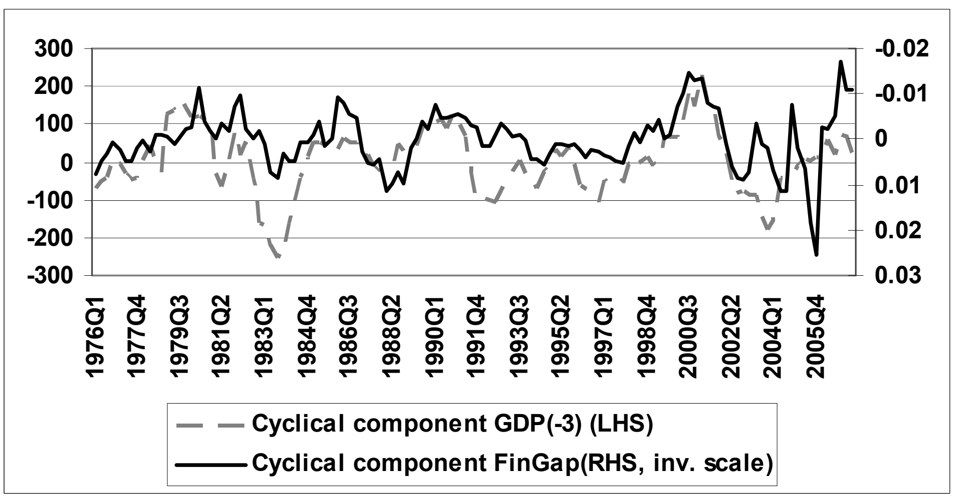
Cyclical Pattern of the Financing Gap

At an aggregated level, according to the standard cross-correlation analysis, we find that the financing gap is a lagging variable of the cycle (GDP cyclical component with an average of 3 lags) and it appears negatively correlated to it (with a correlation coefficient of -0.5), as it is shown in Figure 3b. In Figure 3a we present a graph showing that an alternative interpretation of the financing gap—as a leading indicator of the cycle and with a positive correlation with it—is also possible. By means of a closer analysis, at a disaggregated level, splitting the financing gap into its two components, we find that the latter interpretation is the correct one: the financing gap as a leading variable, with a time variable lead, an average of 5 quarters and positively correlated with the cyclical component of GDP.

Figure 3: Cyclical Component of GDP vs Cyclical Component of Financing Gap



(A) Positive relationship between cyclical component of GDP and financing gap. Financing gap leads cycle by about 5 quarters on the entire sample (but the lead varies along time). This last variable is plotted with a lag of 5 quarters to show the relationship as contemporaneous. Cross correlation = 0.3.



(B) Negative relationship between cyclical component of GDP and financing gap. Financing gap lags cycle by about 3 quarters. GDP growth is plotted with a lag of 3 quarters to show the relationship as contemporaneous. Cross correlation = 0.5.

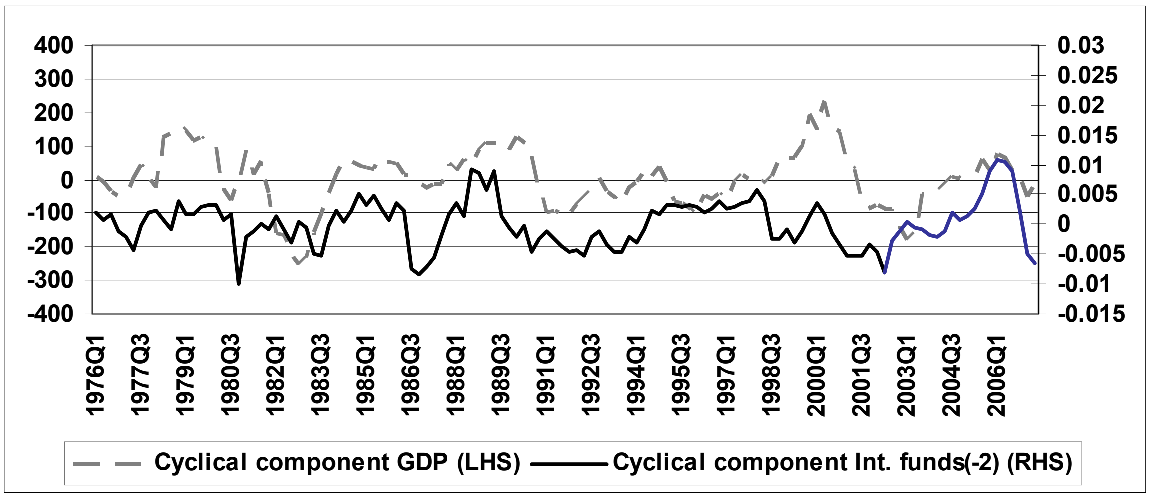
Note: Leading and lagging behavior (and the sign of correlation) is ascertained by cross correlations analysis.

Let us consider first the internal funds share. This variable is made up of the undistributed profits, so they share the same pattern. Since the business profit share tends to anticipate the cycle positively, then internal funds typically rise and decline early in a cycle as shown in

Figure 4[8]. This stylized fact is also found in other analysis of the US economy (see Zarnowitz 1992). Turning to the business investment share, we find that it lags output (Figure 4)[9].

Putting together a leading profit share and a lagging investment share, we can conclude—at disaggregated level—in favor of a leading and procyclical financing gap. The circumstance in which profits share tends to lead the cycle, while business investment share lags, is compatible with a procyclical and leading financing gap.

Figure 4: Cyclical Component of GDP vs Cyclical Component of Internal Fund Share and Investment Share



Internal funds lead cycle by about 2 quarters. Internal funds growth is plotted with a lag of 2 quarters to show the relationship as contemporaneous. Cross correlation = 0.25. Note: for period 2002 q3 - 2007q2, internal funds series is presented as a two-quarters moving average because of a huge increase in its volatility.

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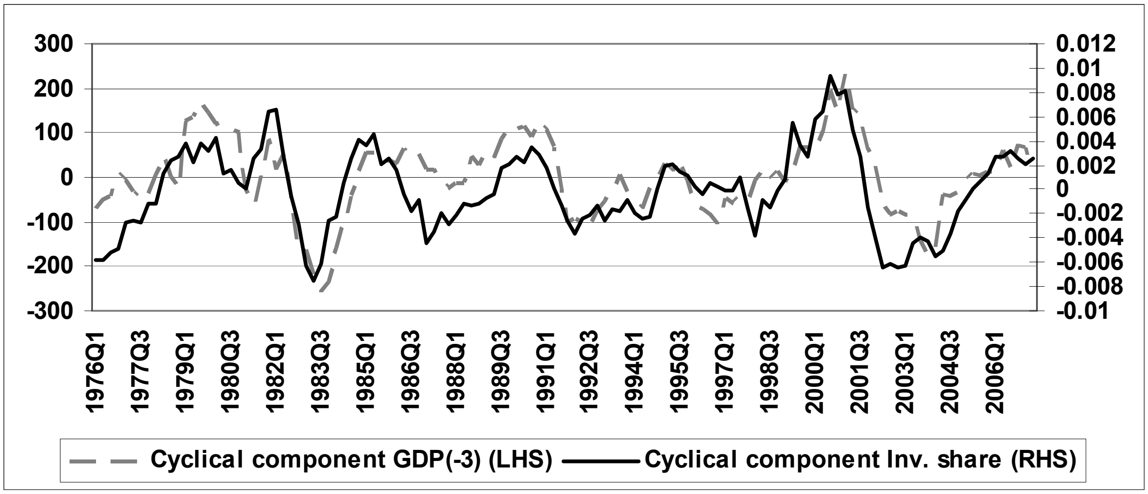
8 Since 2002q3 internal funds present a huge increase in volatility. For this reason, to facilitate the reading of evidence between internal funds and cycle, we present the last four years of internal funds as a two quarters moving average of the original cyclical series. A moving average does not alter the dynamic of a series, it reduces only the volatility of this series.

9 This fact is compatible with Kalecki's theory of business cycle (1937). In Kalecki's model, investment decisions in one period result in investment expenditures in the following period. For Kalecki, these time lags between investment decisions and the resulting investment expenditures are an important feature of reality.



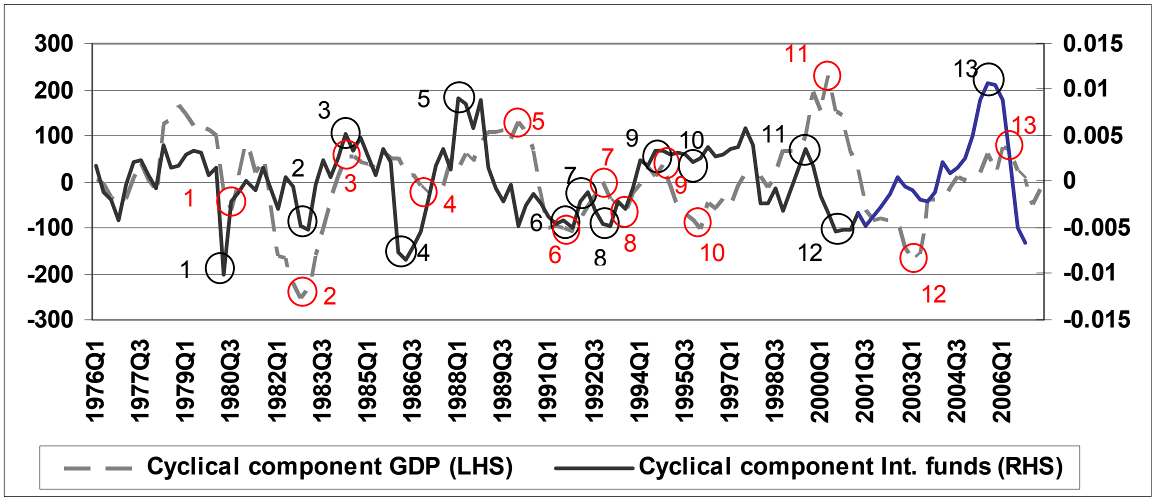
The cyclical component of GDP leads investment share by about 3 quarters on the entire sample (but the lead varies along time). GDP cycle is plotted with a lag of 3 quarters to show the relationship as contemporaneous. Cross correlation = 0.7.

Note: Leading and lagging behavior (and the sign of correlation) is ascertained by cross correlations analysis.

A leading financing gap is further demonstrated by a study of peaks and troughs of financing gap components compared to peaks and troughs of GDP cycle growth. Peaks and troughs are determined by application of a Hodrick-Prescott filter on the raw series. From the figure below, it is clear that internal funds' share tends to anticipate (9 times out of 13), or at least to coincide (4 times), in relation to the cycle. As can be seen from the graph, at the end of the 1990s the leading pattern of the financing gap is confirmed but the time lag with the GDP becomes bigger and variable, indicating a bit more loose relationship. The maximum lead corresponds to the last trough (indicated as event 12). Here internal funds anticipate a cycle of more than 2 years[10]. Business investments, instead, lag the GDP growth cycle turning points as we can see in the figure; only 1992 and 2003 (event 7 and 12) occurs simultaneously to the cycle, while all other events (peaks and troughs) are lagging.

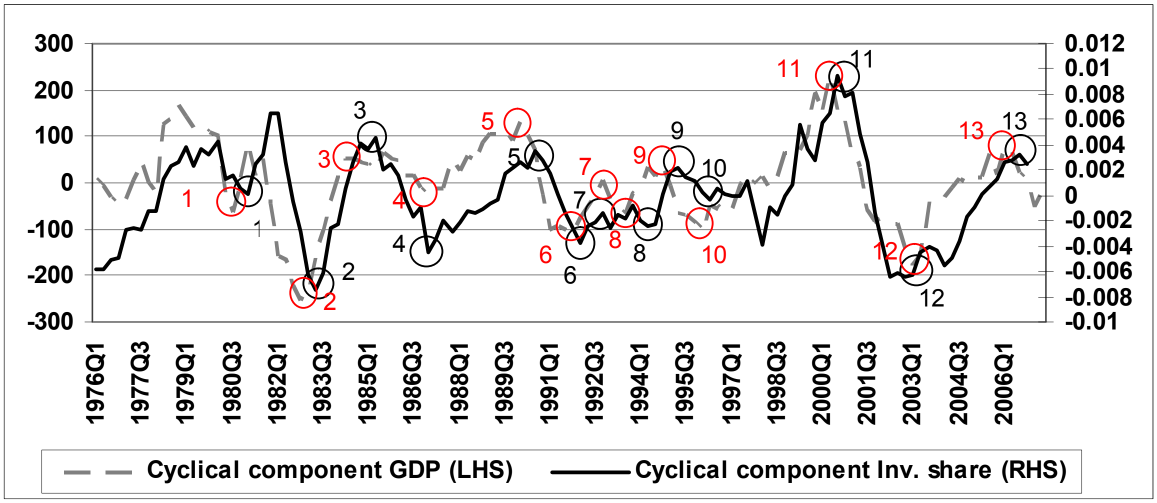
[10] Here, Hodrick and Prescott's filter tends to delay the recession of 2001.

Figure 4 A: Cyclical Component of GDP vs Cyclical Component of Internal Fund Share and Investment Share (Peaks and Troughs Analysis)



Events	Leading variable	Events	Leading variable	Events	Leading variable
1	Int. funds leading (1)	**5**	Int. funds leading (8)	**9**	Coincident
2	Coincident	**6**	Coincident	**10**	Int. funds leading (1)
3	Coincident	**7**	Int. funds leading (3)	**11**	Int. funds leading (3)
4	Int. funds leading (3)	**8**	Int. funds leading (2)	**12**	Int. funds leading (10)
				13	Int. funds leading (3)

Note: for period 2001 q3 - 2007q2, internal funds series is presented as a two-quarters moving average because of a huge increase in internal funds volatility in the last years.

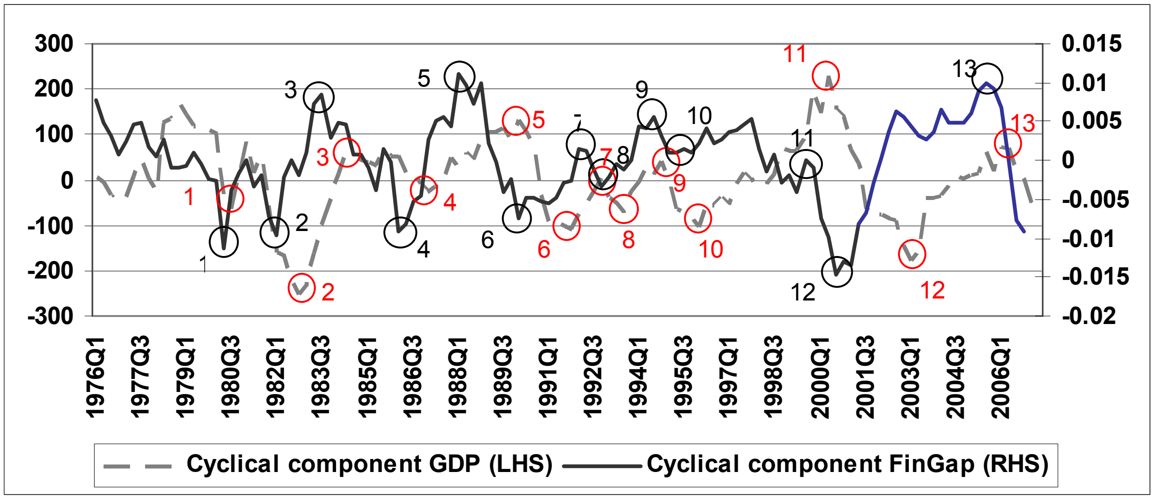


Events	Leading variable	Events	Leading variable	Events	Leading variable
1	GDP leading (2)	5	GDP leading (2)	9	GDP leading (2)
2	GDP leading (2)	6	GDP leading (1)	10	GDP leading (1)
3	GDP leading (3)	7	Coincident	11	GDP leading (1)
4	GDP leading (1)	8	GDP leading (3)	12	Coincident
				13	GDP leading (2)

Note: Red circles indicate GDP cycle growth turning points, whereas black circles indicate turning points of other variables involved in the analysis.

The result of this analysis in terms of financing gap is depicted below. Financing Gap is leading in relation to the cycle in all events. Its leading capacity in relation to output is bigger than internal funds because of a lagging pattern of investments that emphasize this behavior. In section 2.2 we explain the pattern of financing gap on the basis of a simulation model we developed in order to fit these stylized facts.

Figure 4 B: Cyclical Component of GDP vs Cyclical Component of Financing Gap (Peaks and Troughs Analysis)



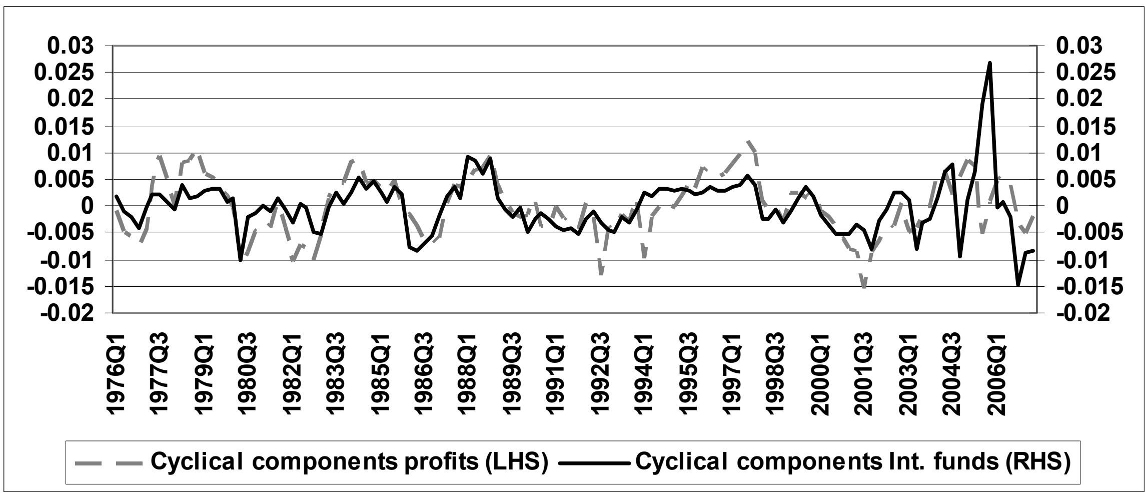
Events	Leading variable	Events	Leading variable	Events	Leading variable
1	FinGap leading (1)	5	FinGap leading (8)	9	FinGap leading (1)
2	FinGap leading (3)	6	FinGap leading (6)	10	FinGap leading (2)
3	FinGap leading (5)	7	FinGap leading (2)	11	FinGap leading (3)
4	FinGap leading (4)	8	FinGap leading (3)	12	FinGap leading (10)
				13	FinGap leading (3)

Note: for period 2001 q3 - 2007q2, internal funds series is presented as two-quarters moving average because of a huge increase in its volatility.

Stylized Facts Regarding Internal Funds

Internal funds (profits less dividends and taxes) can be seen in some regards as a variable of choice by firms. They are the result of dividend policy distribution by corporates. The first evidence is somewhat direct and simple: internal funds are basically the undistributed profits, so they share the pattern shown in Figure 5a. Additional evidence concerning internal funds regards its relationship with dividend policy. Dividend constitutes a wedge between profits and internal funds, and we find an anti-cyclical dividend internal fund ratio. Managers give defined guidance to stakeholders and declare a dividend yield target, which becomes a parameter of choice by investors. The earnings (for investors) can assume the form of dividend or stock market performance. When managers indicate dividend yield (expected) for the following period, these dividends are fixed on the basis of expected market performance. If managers expect a stronger economic cycle (and future rises in stock price, since stock price dynamic is strongly procyclical), then they will fix a lower dividend because stakeholders earnings are already guaranteed by market performance[11]. In other words if firms expect a rise in economic growth, they can satisfy a given dividend per share, detracting less sources to investment projects. So, the firm is able to put aside proportionally fewer resources to dividends' distribution. According to widespread literature and evidence, we use yield spread (CV spread) as a leading indicator of business cycle. So we present the stylized fact about dividend policy (Figure 5b) in terms of its relationship with the CV spread, showing a clear negative correlation.

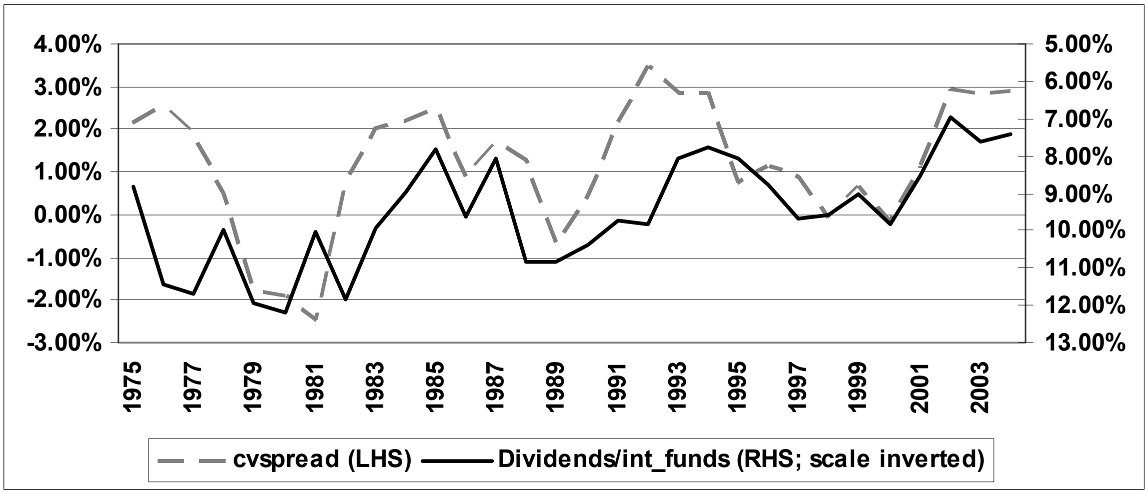
Figure 5: Stylized Facts About Internal Funds



(A)

[11] A counter cyclical dividend yield is confirmed by other studies in literature (Gordon and Bradford 1980, Pilotte 2003, and Eades, Hess, and Kim 1994).

Cyclical component of internal funds share are contemporaneous with profits share cycle. Cross correlation = 0.51.



(B)

Note: Our calculations are on annual data. We stop in 2004, because an outlier value in dividends internal funds ratio disturbs the relationship shown. CV spread and dividend internal funds ratio are contemporaneous and show a negative correlation. Cross correlation = -0.56.

Note: Leading and lagging behavior (and the sign of correlation) is ascertained by cross correlations analysis.

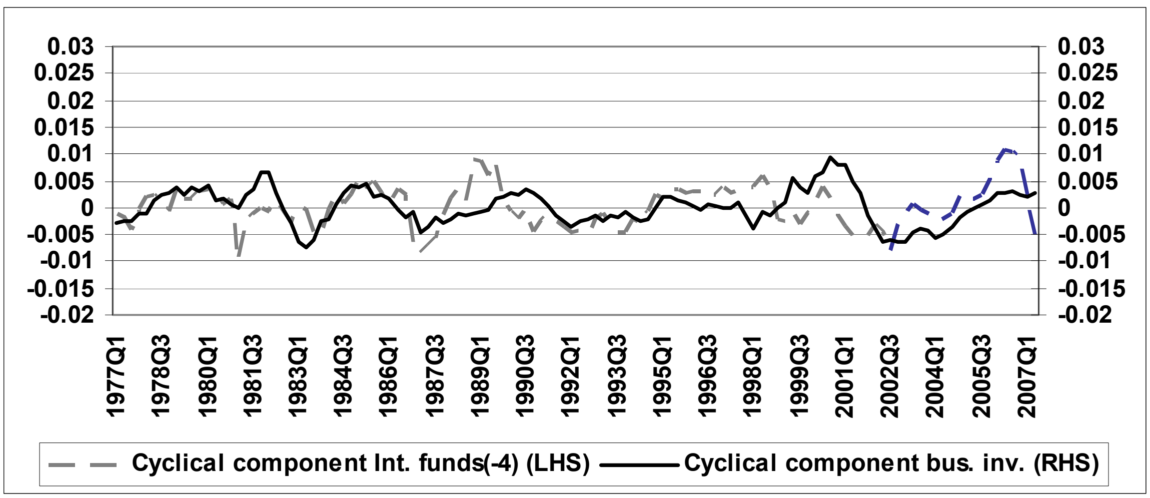
Stylized Facts Regarding Business Investments

Business investment share (the ratio of fixed investments to GDP) is positively correlated with the internal funds ratio (with a lag of 4 quarters), as Figure 6a shows. This stylized fact is largely recognized in a vaste theoretical and empirical literature, embracing post and neo Keynesian production. Internal funds allow firms to invest and represent the first source of finance in a hierarchy scale of different financial sources. Internal funds do not expose firms to the default risk connected with rising external funds and do not have extra costs due to asymmetric information about lenders on financial markets.

Equity price dynamics appears to be another variable linked to the investment share. Equity prices are positively correlated with investment share, according to the evidence reported in Figure 6b. Prices on equity markets are able to capture profits expectation about the firms. The relationship between internal funds and equity prices becomes stronger starting in the early 1990s, with the boom in stock markets. The U.S. stock index reflects wide information over the economic outlook and in particular, it discounts the expected earning per share (EPS). The higher the expected EPS in one year, the higher the index. Figure 6b shows this correlation. Therefore, bigger values of the share index usually co-move with stronger planned investments dynamics, given actual profits.

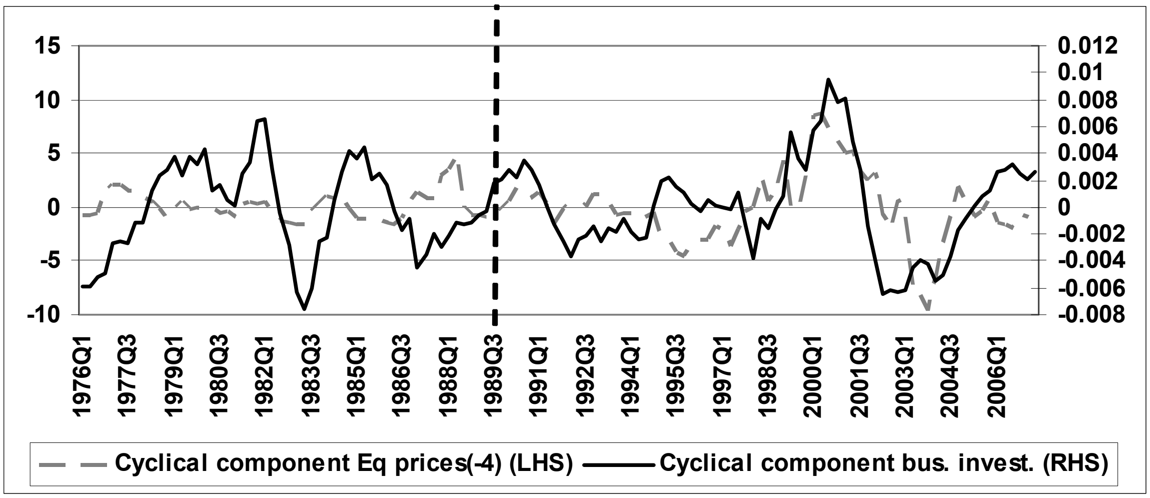
Investment expenditures also depend on the availability and the cost of external finance. It is possible to simplify the analysis taking into account that the cost of external finance is basically a function of the internal funds. This point can be shown by a simple graph—see Figure 6c below, where Baa spread is the spread between Baa corporate bond yields and 10-year Treasury bond yields—and has been explained at a theoretical level by some economists (i.e., Bernanke, Gertler, and Gilchrist 1998). Smaller internal finance or a rise in Baa spread discourage debt financed spending by firms. As we can see in Figure 6c there is a clear negative correlation between profit share and Baa spread: higher profits correspond to a lower lender's risk because of more collateral and less moral hazard by a firm. This finally translates into a lower Baa spread.

Figure 6: Stylized Facts About Business Investment



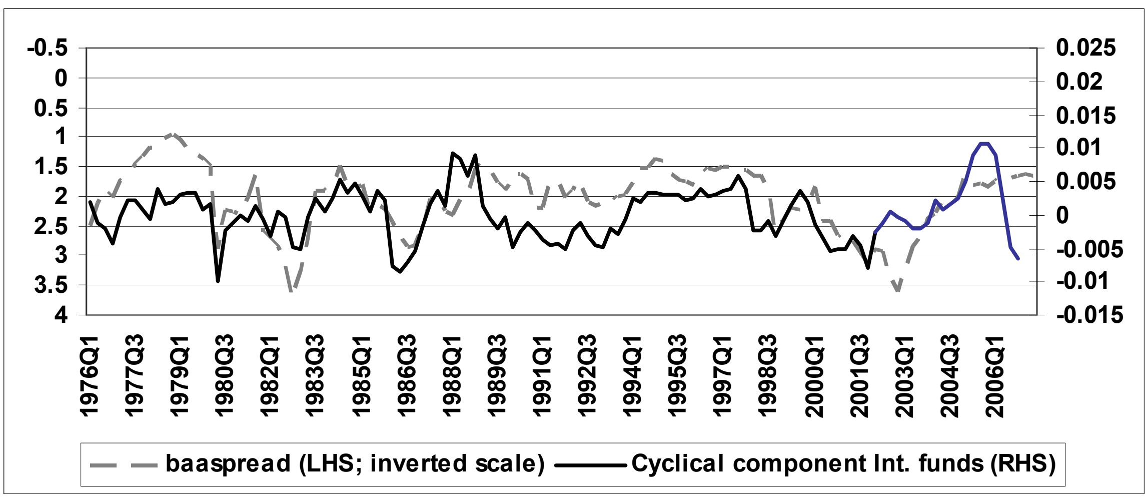
(A)

Cyclical components of internal funds share lead investment share (a) cycle for about 4 quarters for the entire sample (but the lead varies along time). The internal funds cycle is plotted with a lag of 4 quarters to show the relationship as contemporaneous. Cross correlation = 0.27. Note: for period 2002 q3 - 2007q2, internal funds series is presented as two quarters moving average because of a huge increase in internal funds volatility in the last 5 years.



(B)

Cyclical components of equity prices lead investment share by about 4 quarters (but the lead varies along time). The equity prices cycle is plotted with a lag of 4 quarters to show the relationship as contemporaneous. Cross correlation = -0.33 (over the whole period, even if there is a stronger relationship starting from the 1990s).



(C)

Baa spread and the cyclical component of internal funds share are coincident with a negative correlation. Cross correlation = -0.33. Note: for period 2001 q3 - 2007q2, internal funds series is presented as a two-quarters moving average because of a huge increase in internal funds volatility in the last years.

Note: Leading and lagging behavior (and the sign of correlation) is ascertained by cross correlations analysis.

Financing Gap Explanatory Variables

We can identify the explanatory variables of financing gap with simple but clear evidence. Internal funds are a function of profits and CV spread, both in a positive way. Business investments depend on internal funds, their expectations (captured by the U.S. stock index), and Baa spread. Since Baa spread information, from an econometric point of view, is captured by profit share, then we expect that this variable does not enter into the estimation[12]. Putting these components together, we arrive at equation 4. Profit share enters into both internal funds and investments, so we cannot ascertain the sign in this section. We anticipate here that from an econometric analysis we will find that the effect on internal funds is stronger.

Nonfinancial corporate business balance (FinGap)

Internal funds function:

$If = If\left(\left(\frac{\Pi}{Y}\right)\cdot Y, cvspread\right)$; $If_{\Pi} > 0$; $If_{Y} > 0$; $If_{cvspread} > 0$

If = Internal funds; Π = profits; Π/Y = profit share; Y = GDP; CV spread = spread between 10 years Treasury bond and the three month Treasury bill.

Business investment function:

$I_b = I_b\left(If, If^e, baaspr\right)$; $I_{b,If} > 0$; $I_{b,Ife} > 0$; $I_{b,\ baaspr} < 0$

If^e = internal funds expected; baaspr = spread between Baa corporate bond and 10-year Treasury note yields. Facts ascertained: (1) If^e is captured by equity market (eq); (2) $\frac{\Pi}{Y} \Leftrightarrow baaspr$: Baa spread information is included already in profit share (an increase in profit share corresponds to a low lender's risk).

FinGap

$FinGap = \left(If - I_b\right) = f\left(\left(\frac{\Pi}{Y}\right)\cdot Y, cvspread, eq\right)$; $FinGap_{\Pi/Y} = ?$; $FinGap_{Y} > 0$; $FinGap_{cvspread} > 0$; $FinGap_{eq} < 0$

From the theoretical point of view the sing of the elasticity of financing gap respect to profit share is uncertain in a Minskyan way: in a strong cycle environment, optimism pushes financing gap to open due to overinvestment activity beyond the intern funds; in a negative cyclical phase, pessimism brings to underinvestment activity, with firms investing less than internal funds.

From an econometrically estimated relationship, we find that profit $\left[\left(\frac{\Pi}{Y}\right)\cdot Y\right]$ effect has a positive sign on financing gap.

$$FinGap = f\left(\overset{+}{\left(\frac{\Pi}{Y}\right)\cdot Y}, \overset{+}{cvspread}, \overset{-}{eq}\right) \qquad (4)$$

[12] Our estimations about financing gap, including this variable, produce coefficients for Baa spread not statistically significant.

2.2 Households Balance

The table below shows, for period 1976 - 2007, some empirical facts regarding households balance (disposable income less consumer outlays and residential investments) and its components. The treatment follows the same scheme used for financing gap: a description of some evidences and the use of these findings to identify explanatory variables for this balance.

An analysis at aggregated level shows a counter cyclical and leading pattern of households balance. A closer analysis at disaggregated level, consumption and residential investments, shows that this behavior is due to the leading behavior of housing investments.

Consumption is a variable which moves together with equity and house prices (the two main assets of households net wealth), rather than with disposable income, according to the traditional theory of consumption.

Households residential investment presents a high positive correlation with housing prices and a negative correlation with long-term interest rates.

Table 2: Stylized Facts Regarding the Households Balance (Quarterly Data, 1976q1-2007q1)

(a) Business cycle properties of the households balance		
Variable	**Correlation with GDP**	**Timing**
Households balance	-0.51	Leading (2Q)
Consumption	+0.82	Coincident
Residential investment	+0.65	Leading (2Q)

Note: Consumption is total consumption expenditures (durables and non durables).

(b) Stylized facts regarding consumption component		
Consumption	**Correlation with equity prices**	**Timing**
	+0.42	Lagging (2Q)
Consumption	**Correlation with house prices**	**Timing**
	+0.45	Lagging (2Q)

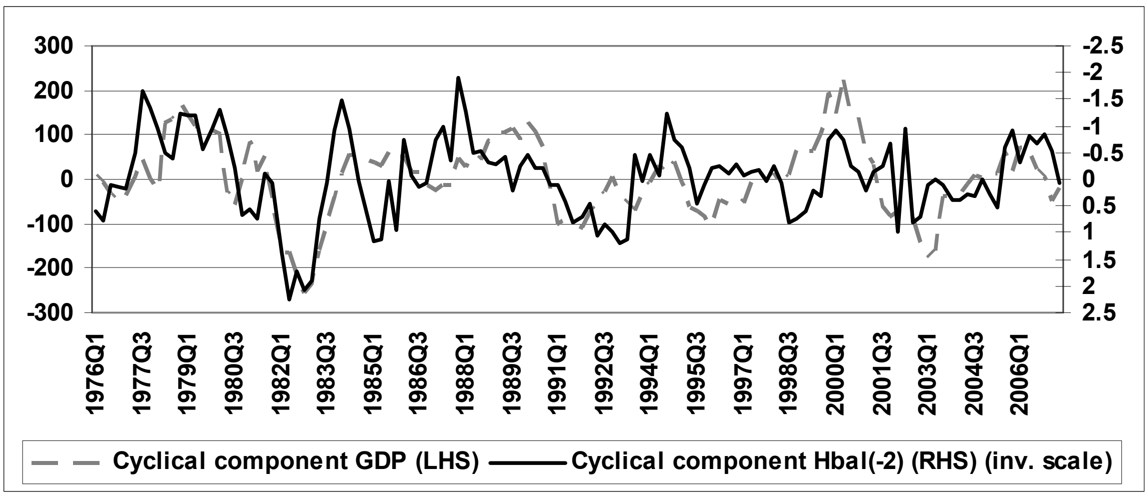
(c) Stylized facts regarding residential investment share component		
Residential investment	**Correlation with house prices**	**Timing**
	+0.69	Lagging (1Q)
Residential investment	**Correlation with 10 y. Treasury yields**	**Timing**
	-0.61	Lagging (2Q)

Business Cycle Properties of the Households Balance

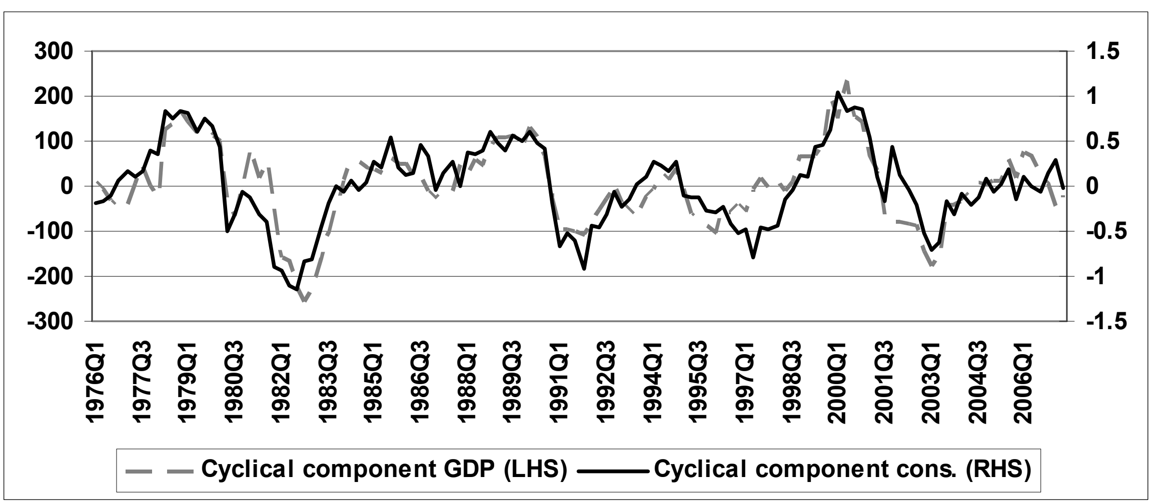
The cross correlation analysis suggests that households balance has a negative correlation with cycle and it is leading by roughly 2 quarters (even if from Figure 7 this lead seems to vary over time).

To focus on this aspect we split households balance into its components. The disposable income is contemporaneous to output variation, such as consumption expenditures, whereas housing investments are leading. These results are in accordance with other studies conducted in the literature[13]. From this evidence it follows that the leading pattern of cyclical households balance, in relation to GDP cycle growth, is explained by cyclical behavior of housing investments which tend to anticipate GDP cyclical movements, whereas consumption is contemporaneous.

Figure 7: Cyclical Component of GDP vs Cyclical Component of Households Balance

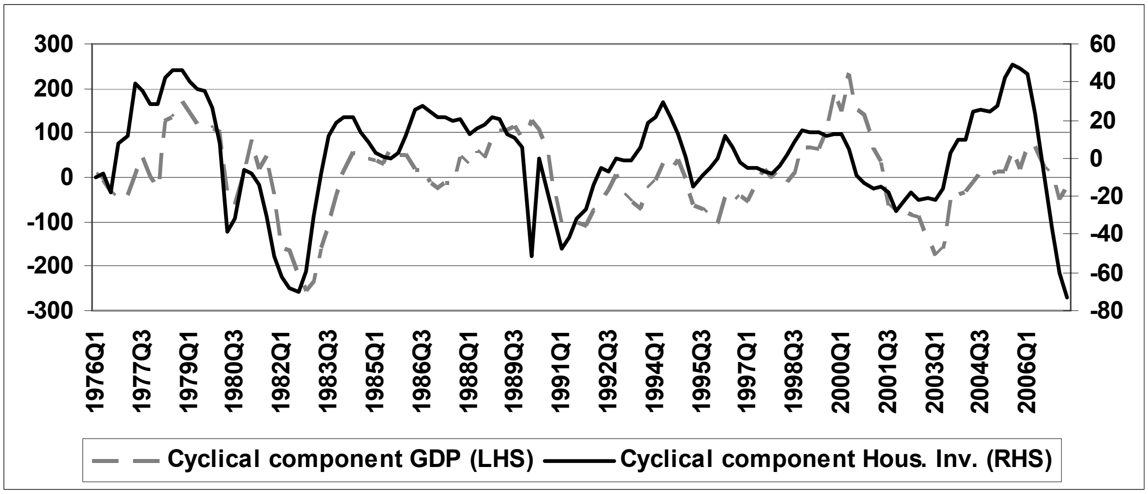


Cyclical component of households balance leads GDP cycle growth by about 2 quarters. Hbal cycle growth is plotted with a lag of 2 quarters to show relationship as contemporaneous. Cross correlation = -0.51.



Cyclical component of consumption coincides with GDP cycle growth. Cross correlation = 0.82.

[13] See Zarnowitz (1992) for example.



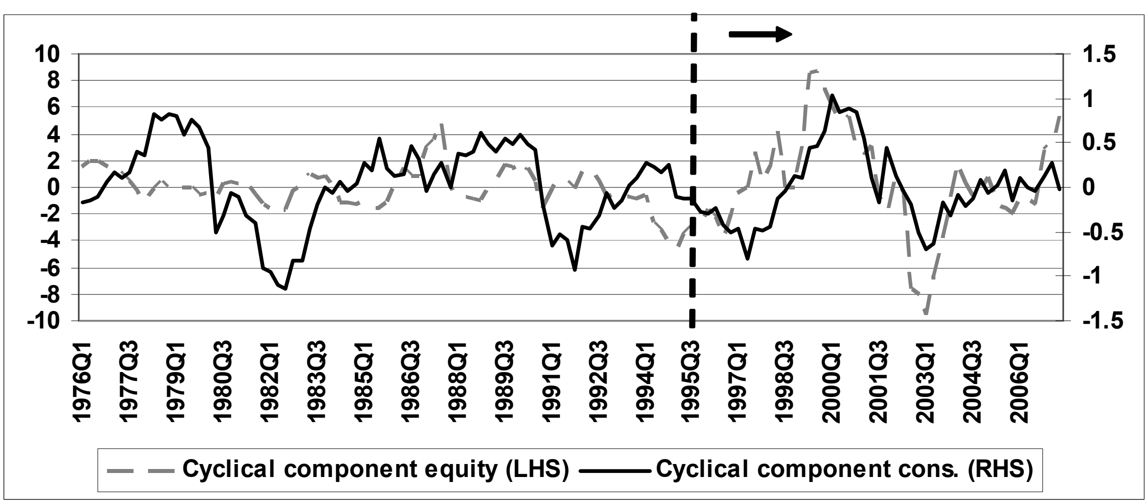
Cyclical component of households housing investments leads GDP cycle growth by about 2 quarters. Cross correlation = 0.65.

Note: Leading and lagging behavior (and the sign of correlation) is ascertained by cross correlations analysis.

Stylized Facts Regarding Consumption

Consumption expenditures move together with equity prices and house price inflation[14] (in a lagging way), but a clarification needs to be made. Until the mid 1990s (before the boom of the stock market) consumption is linked more to the house price inflation pattern; after this date, with the huge increase in stock prices, consumption follows equity prices more strictly. Only after 2006 (and then at the end of our sample), with the housing boom, there seems to be a closer link with housing markets.

Figure 8: Stylized Facts About Consumption



Cyclical component of consumption lags equity prices cycle growth by about 2 quarters. Cross correlation = 0.42.

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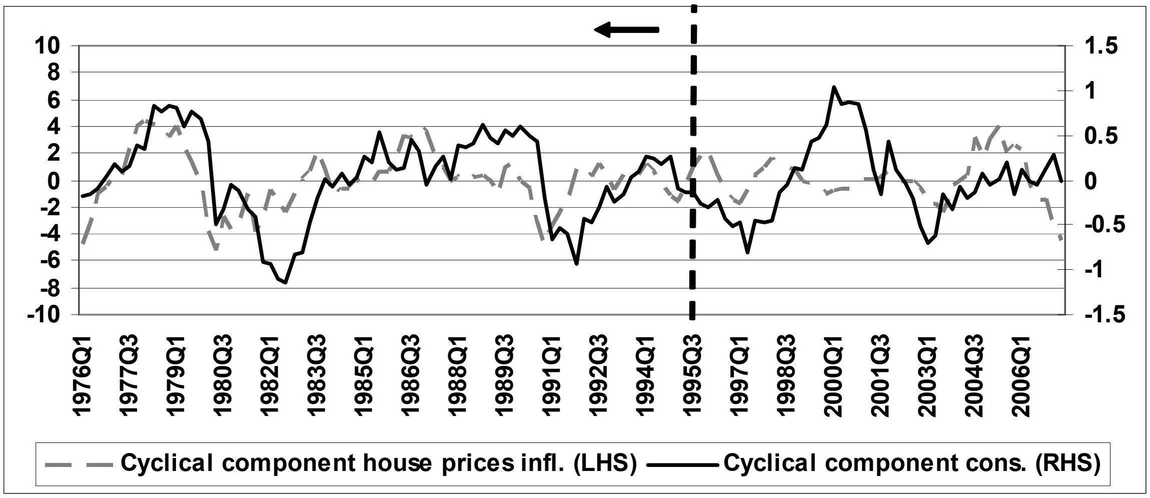
14 House price inflation is I(1) and it is more linked to consumption and, as we demonstrate below, residential investments.



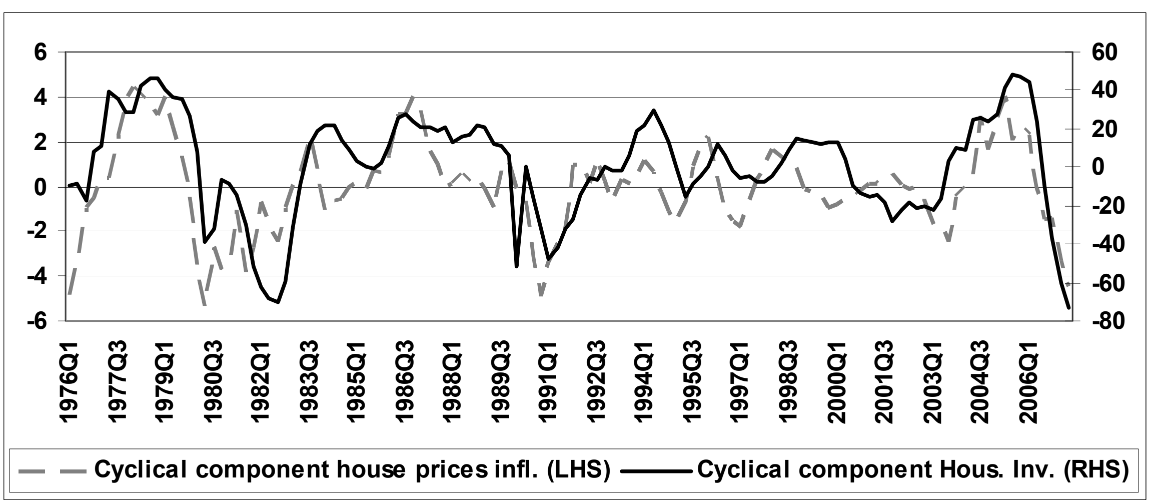
Cyclical component of consumption lags house price inflation cycle growth by about 2 quarters. Cross correlation = 0.45.

Note: Leading and lagging behavior (and the sign of correlation) is ascertained by cross correlations analysis. Consumption is considered to be total consumption expenditures (durables and non durables).

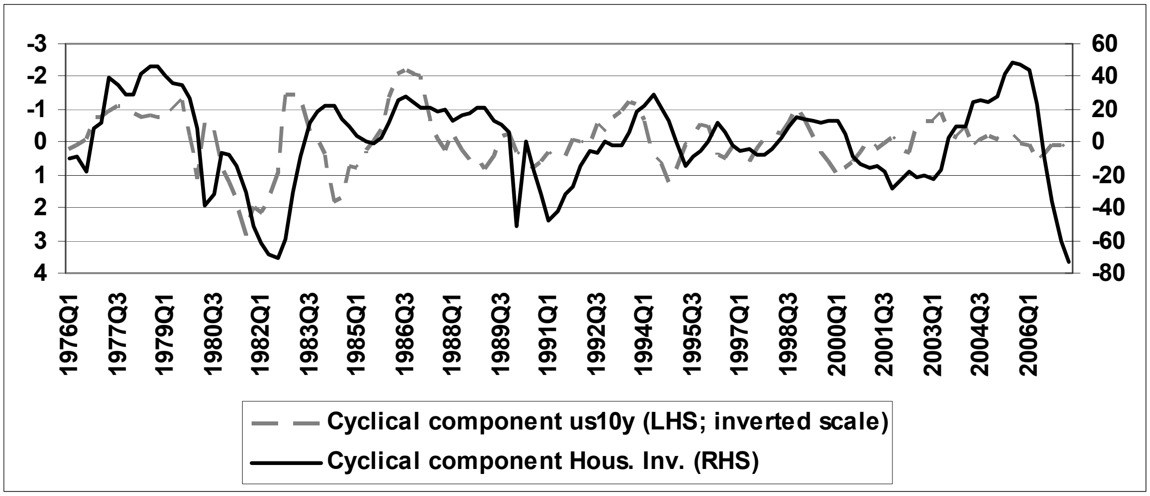
Stylized Facts Regarding Residential Investments

Household residential investments, according to stylized facts presented below, are correlated with: house price inflation (in a positive way) and long-term interest rates (in a negative manner). It tends to lag cyclical patterns of house prices (1 quarter) and 10-year Treasury yield (2 quarters).

Figure 9: Stylized Facts About Residential Investments



Cyclical component of households housing investments lags house price inflation cycle growth by about 1 quarter. Cross correlation = 0.69.



Cyclical component of households housing investments lags 10-year Treasury yields cycle by about 2 quarters. Cross correlation = 0.61.

Note: Leading and lagging behavior (and the sign of correlation) is ascertained by cross correlation analysis.

Households Balance Explanatory Variables

From the above evidence, we are now able to identify the explanatory variables for the single components of this balance: that is, saving and residential investments. The saving depends on (according to the traditional theory of consumption and our stylized facts conducted on consumption) disposable labor income, in a positive way, and net wealth, in a negative way[15]. As we have seen in stylized facts analysis, movements in net wealth are captured by housing and equity price dynamics. Residential investments follow the behavior of long run interest rates and house price inflation. The table below gathers these results, with a clarification. From stylized facts we know that the sign of income effect on overall balance is negative. This means that the income effect coming from residential investment overcomes the effect coming from saving. This assumption is not so implausible if we consider that $\frac{\partial S_t}{\partial Y_t} \cong 0.3$,

and that the majority of empirical models on housing investments, which incorporate household income term, embody long-run elasticities with respect to this last variable in the proximity of unity[16]. Putting together these aspects, we arrive at equation 5.

15

$$S_t \equiv Y_t - C_t = Y_t - (\alpha_1 Y_t + \alpha_2 NWeq_{t-1} + \alpha_3 NWhouse_{t-1}) = (1-\alpha_1)Y_t - \alpha_2 NWeq_{t-1} - \alpha_3 NWhouse_{t-1}$$

As demonstrated by various empirical studies, $\alpha_1 < 0$, and then $\frac{\partial S_t}{\partial Y_t} > 0$. See for example Hiebert (2006).

16 See for example Arcelus and Meltzer (1973), Kearl (1979), and Egebo, Richardson and Lienert (1990).

Households balance

Saving function:

$S = S(Y_L, eq, \Delta_4 ph)$; $S_{YL} > 0$; $S_{eq} < 0$; $S_{\Delta 4ph} < 0$;

S= Saving; Y_L = labor income; ph = house prices; $\Delta_4$ph = house prices inflation; eq = equity prices.

Housing investment function:

$I_h = I_h(\Delta_4 ph, i_{mtg}, Y)$; $I_{h,\Delta 4ph} > 0$; $I_{h,imtg} < 0$; $I_{h,Y} > 0$;

I_h = residential investment; Y = GDP; i_{mtg} = mortgage rates.

Households balance

$Hbal = (S - I_h) = f(Y, eq, i_{mtg}, \Delta_4 ph)$; $Hbal_Y < 0$; $Hbal_{eq} < 0$; $Hbal_{imtg} > 0$; $Hbal_{\Delta 4ph} < 0$.

Housing and equity wealth effect are captured by equity and house prices dynamic. From stylized facts: $I_{h,Y} > S_{YL} > 0$.

$$Hbal = f\left(\overset{-}{Y}, \overset{+}{i}_{mtg}, \overset{-}{\Delta_4 ph}, \overset{-}{eq}\right) \qquad (5)$$

2.3 Current Account Surplus (CAS)

The table below presents, for period 1978-2007, some basic empirical evidence for Current Account Surplus (CAS). Unlike other sector balances, we do not make an in-depth study of stylized facts about this balance because there are many studies in literature that examine this balance.[17] We limit our analysis to business cycle properties of CAS (a leading and counter cyclical pattern) and some stylized facts regarding CAS behavior with some variable considered in literature to be capable of explaining this balance (trade weighted dollar and oil price). In particular we find that CAS counter cyclical behavior is explained for the most part from households balance pattern.

[17] See for example Roubini and Setser (2004), Graf (2007), Milesi-Ferretti (2008).

Table 3: Stylized Facts Regarding the CAS (Quarterly Data, 1976q1-2007q1)

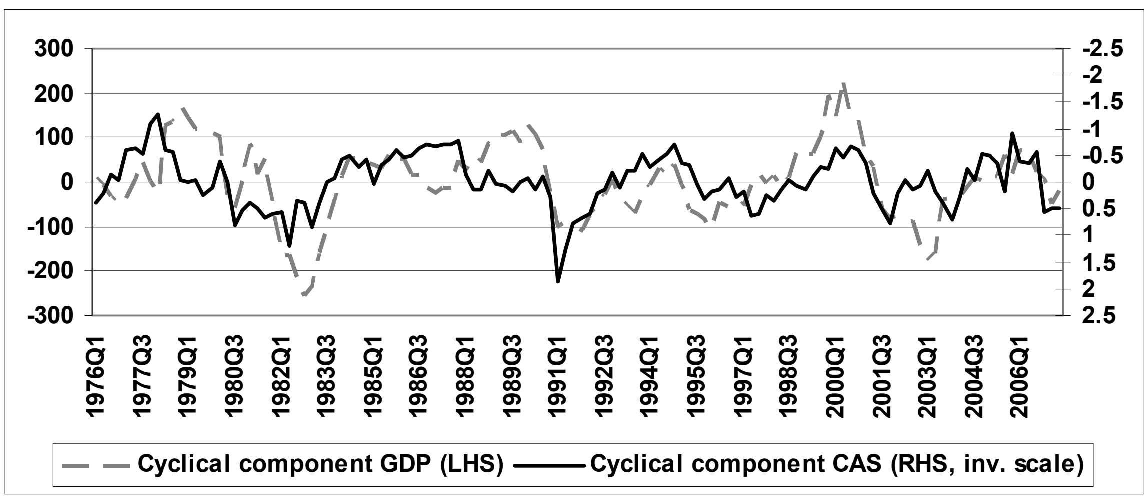
(a) Business cycle properties of the CAS		
Variable	**Correlation with GDP**	**Timing**
CAS	-0.47	Leading (1Q)

(b) Stylized facts regarding CAS		
CAS	**Correlation with Hbal**	**Timing**
	+0.51	Coincident
CAS	**Correlation with trade weight dollar**	**Timing**
	-0.5	Lagging (4Q)
CAS	**Correlation with oil price**	**Timing**
	-0.54	Coincident

Business cycle properties of the CAS

For the period 1978-2007, Current Account Surplus (CAS) growth is countercyclical, and it is leading in relation to output growth (Figure 10). An explanation of this pattern is the following: in the last few years, increasing negative net saving, driven by consumption component, coming from households balance, has supported the creation of a deficit in the current account balance[18] This aspect is shown in the next subsection.

Figure 10: Cyclical Component of GDP vs Cyclical Component of CAS



Cyclical component of households balance leads by one period in relation to GDP cycle growth. Cross correlation = -0.47.

Note: Leading and lagging behavior (and the sign of correlation) is ascertained by cross correlations analysis.

[18] This interpretation is also sustained by Summers (2004).

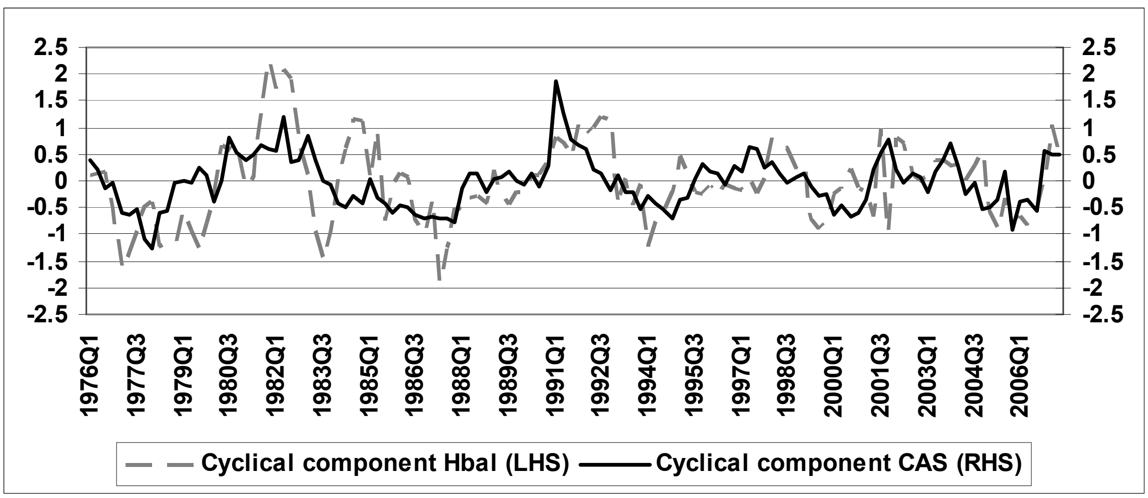
Stylized Facts Regarding CAS

CAS is correlated, positively, with households balance as shown in the figure below. Historically, internal demand has had an important influence on CAS. Foreign balance also appears to be correlated, negatively, with oil price and exchange rate.

The development of the U.S. current account balance (CAS) tracked the U.S. dollar with a time lag of about two years in the twenty years from 1975 to 1990[19]; afterwards this correlation appears to be more contemporaneous and no relationship seems to exist from the beginning of the 2000s. Other things being equal, currency depreciation makes a country's imports more expensive and exports cheaper. A significantly weaker dollar stimulates exports. Imports depend on the level of trade weight dollar, but with the opposite sign (a weaker dollar constrains imports).

Oil price is correlated negatively with CAS, as we can see from the figure below, because a rise of this variable implies an increase in the volume of imports because of low price elasticity of demand[20]. This relationship appears to be stronger after the 1990s; before that period the relationship is somewhat low.

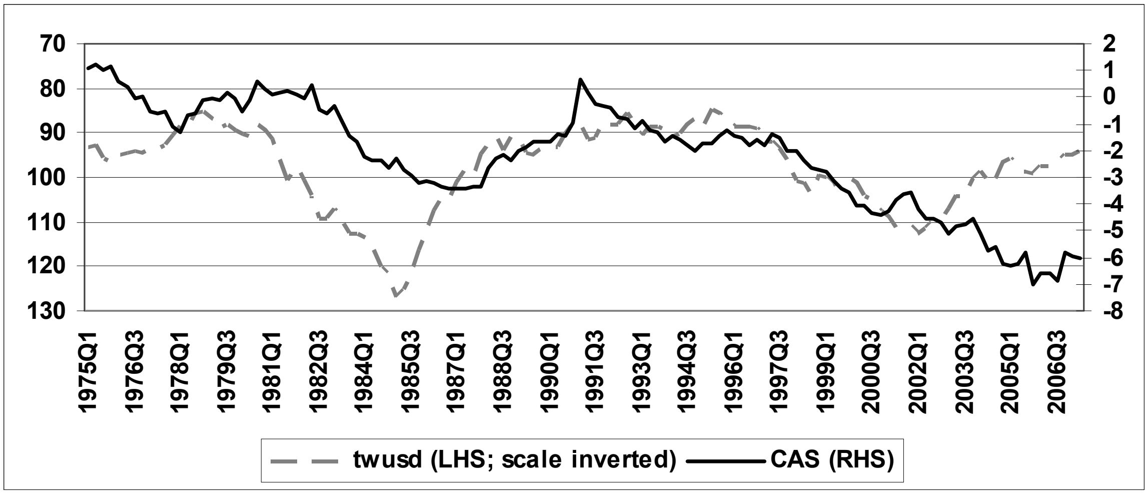
Figure 11: Cyclical Component of Households Balance vs Cyclical Component of CAS



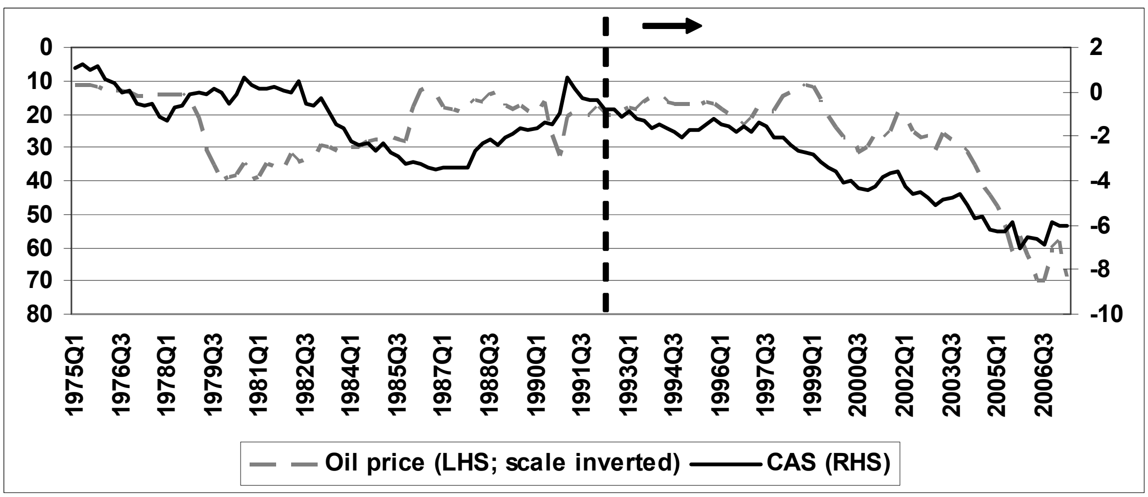
Cyclical component of households balance is roughly contemporaneous to households balance cycle growth. Cross correlation = 0.51.

19 Numerous factors (such as partial pass-through of devaluation in import prices or J-curve lags on export responses) make response to a weaker dollar not immediate. See for example the study of Graf (2007).

20 In general, the U.S. current account balance is also driven by world trade, because if the world economy accelerates, imports rise resulting in a current account deficit. Our stylized facts analysis does not capture an evident relationship between CAS and world trade. This is confirmed by our estimates, in which the inclusion of this variable is not statistically significant.



Trade weight dollar is leading by 4 quarters in relation to CAS and it is correlated negatively. Cross correlation = -0.5.



Oil price coincides with CAS and it is correlated negatively. Cross correlation = -0.54.

Note: Leading and lagging behavior (and the sign of correlation) is ascertained by cross correlations analysis.

Foreign Balance Explanatory Variables

From the evidences about CAS, we can identify the explanatory variables for the foreign balance.

CAS

<u>Exports:</u>

$X = X(\lambda)$; $X_\lambda < 0$

X= exports; λ = real broad trade weight dollar.

<u>Imports:</u>

$M = M(Y, \lambda, oil)$; $M_Y > 0$; $M_\lambda > 0$; $M_{oil} > 0$;

M = imports; oil = oil price.

<u>CAS</u>

$Fbal = CAS = f(Y, \lambda_{-i}, Hbal)$; $CAS_Y < 0$; $CAS_{\lambda\text{-}i} < 0$; $CAS_{Hbal} > 0$.

$$CAS = f\left(\overset{-}{Y}, \overset{-}{\lambda}_{-i}, \overset{-}{oil}\right) \qquad (6)$$

Financing Gap: The Intuition Behind Stylized Facts Analysis

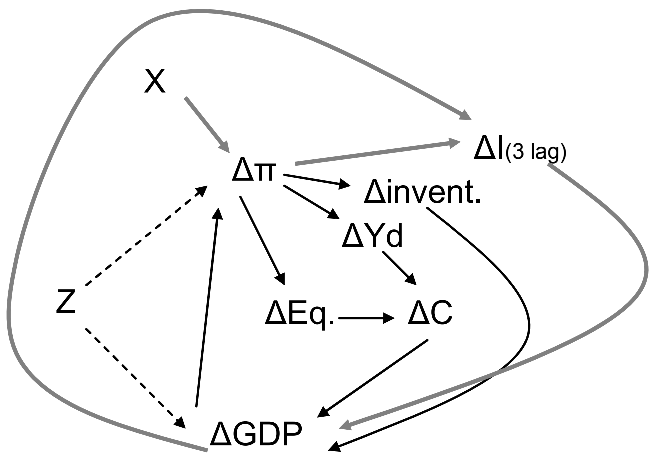
The above results help to explain the underlying forces driving sectors' balance and the correlation of various sectors balance with output. In this section we focus on explaining the intuition behind the pattern of the most interesting sector: financing gap.

In general, profits and output have a common dynamic and are driven by common factors (summarized by a variable denoted by Z in the Figure 12). In this part of the analysis we can, however, consider profit share as having an independent dynamic (that is, it is not determined by the quantity side of the economy). Suppose profit share rises, because a positive shock occurs (X). This can produce a first impulse on GDP growth via consumption and inventory changes. In particular, consumption could be stimulated by disposable income (in the component of proprietors' income) and net wealth effect coming from equity prices[21]. As we have seen, business investments move with a lag (roughly 3 quarters from stylized facts analysis) in relation to information coming from profits and GDP cycle, because they wait for a confirmation and in general investments' expenditures lag investments' decisions.

[21] In fact, the dynamic of equity prices is strongly linked to the profits pattern.

After profit share rises, and output gives positive signals, business investment augments, fueling output growth. Consequently, output growth stimulates the profits positively. This positive scenario pushes the corporate business to increase business investment beyond profits. So, in the first phase, the financing gap is positive because corporates wait to invest; while in the second phase, as GDP growth is fuelled by business investments and optimism spreads, corporates push investment beyond internal funds leading to a financial unbalance (and then to a negative financing gap) in a Minskyan way.

Figure 12: Explanation of GDP cycle and financing gap dynamic



To confirm this, we have run a simulation focusing only on the relationship between profits, investments, and GDP (the external part marked in grey in Figure 12). To simplify, we exclude a possible influence from profits to inventories and consumption (through disposable income and equity prices), and then to GDP growth [22]. We also exclude any influence between output and profits; in other words, in this formulation we consider profits as having an independent dynamic. Details on this simulation model are in appendix (D). Here we only say that it embodies all characteristics emerging from stylized facts analysis: 1) profits enter with a lag (of 5 periods) in investments; 2) GDP lag (of 3 periods) influences investments; 3) GDP growth is mainly driven by investments dynamic. In formal terms:

[22] This interaction is not essential to the main mechanism driving the cycle. It intercepts only a first impulse on GDP growth coming from other variables. The main force driving the cycle comes from business investment.

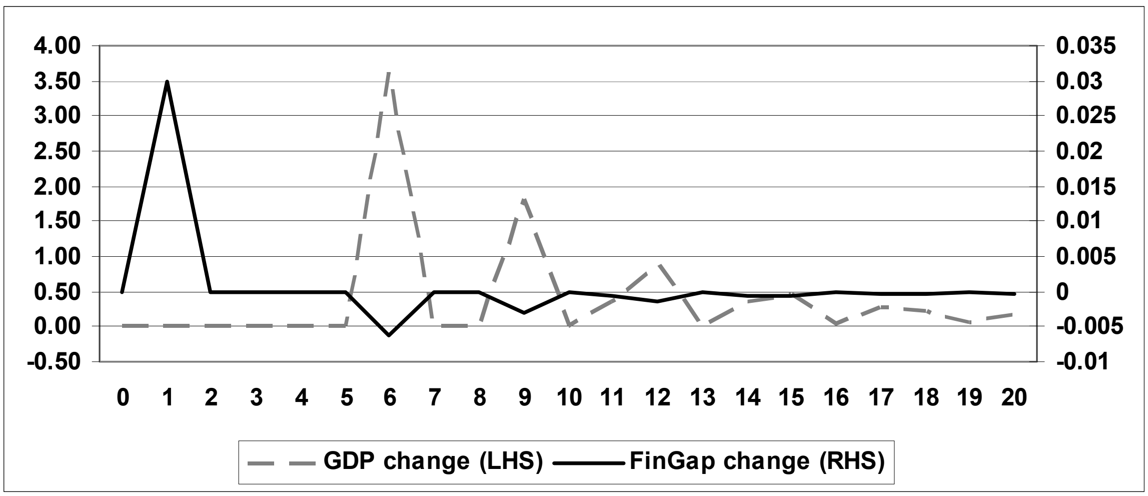
$$I_t = f\left(\overset{+}{\Pi}_{t-5}, \overset{+}{Y}_{t-3}\right)$$

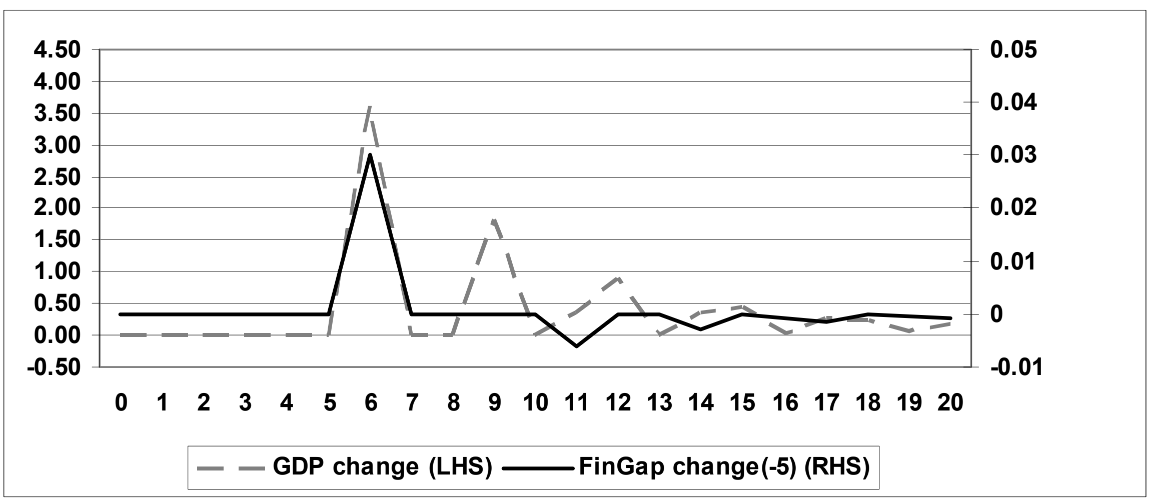
$$Y_t = D_t + I_t$$

where D is the demand component (consumption and government spending) which remains constant in our simulation analysis.

We have run two kinds of simulations. First, a permanent shock occurs in profit share (considered exogenous at this stage of the analysis). The results are reported below.

Figure 13: Simulation of FinGap and GDP Change Coming from Permanent Shock to Profit Share

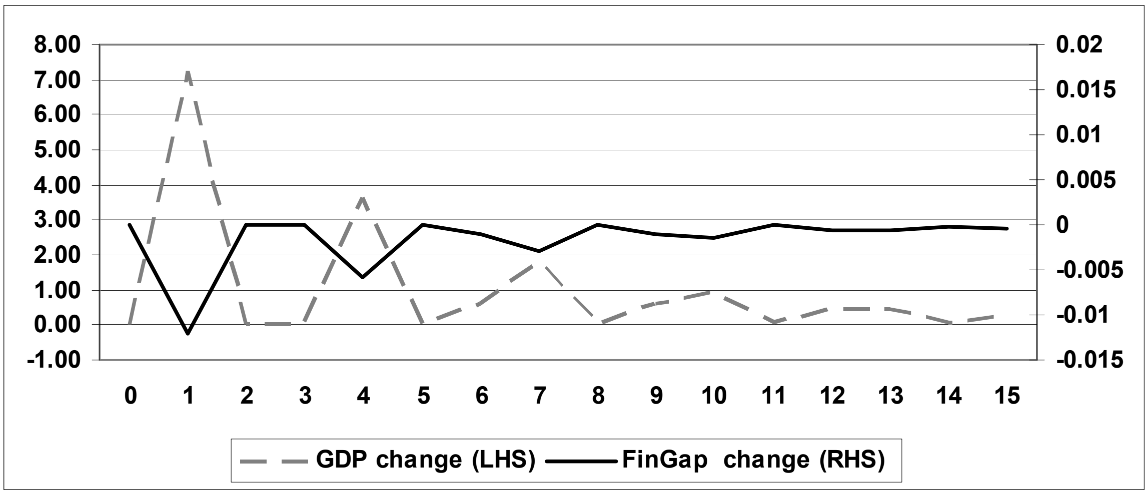




Financing gap change is leading by 5 periods in relation to GDP variation. After the first impulse, the leading period changes because GDP Variation enters into the process which influences investment (and then financing gap) after 3 periods.

The second kind of simulation regards a permanent shock in an autonomous component of business investment. In this case a shock to investment implies a rise in GDP and the relationship is negative and contemporaneous (Figure 14). Historically, from the data the first relationship appears more clearly (from profit share to financing gap) because it was, probably, the most frequent.

Figure 14: Simulation of FinGap and GDP Change Coming from Permanent Shock to Autonomous Component of Investment



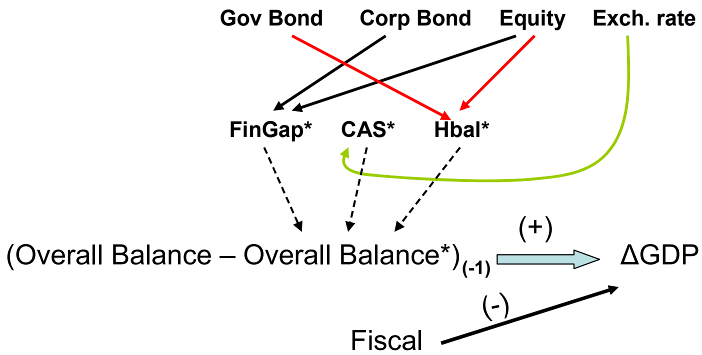
In appendix D we present another simulation model in which profits' shares are endogenized (they depend on cycle); we demonstrate that with endogenous profits' share the results remain the same: change in financing gap leads GDP change by 5 periods.

3. GOLDMAN SACHS (GS) MODEL

The GS financial sectors' balance model of the U.S. economy (2003) makes use of financial conditions - interest rates, equity prices, and trade-weighted dollar—to estimate equilibrium balances for the households, corporate business, and the foreign sector. The model has the same general features as our model discussed in section 1. It differs mainly in the logical solution method applied, and in the cyclical growth estimation as a function of all three sectors together.

The logic scheme of the model presented by GS can be summarized graphically in the figure below.

Figure 15: Logic Scheme of GS Model



Notes: * denotes equilibrium levels; Overall Balance = FinGap + Hbal – CAS; Fiscal is change in the standardized budget balance (coming from CBO).

From the figure we see that financial markets (governmental bonds, corporate bonds, stock prices, and exchange rate) determine the sectors' financial balance equilibrium.

The financing gap depends on the equity market cap/GDP ratio and the level of Baa spread (the spread between Baa corporate bond yields and 10-year Treasury note yields). The stock price term acts as a proxy for expected returns on investment. When stock prices are high, both financial market investors and corporate executives typically have optimistic expectations about future returns on capital. For given levels of cash flow and credit availability, they will, therefore, be more inclined to run a larger financial deficit in order to expand productive capacity. Baa spreads is considered by GS as a proxy for the availability of capital. A rise in Baa spreads indicates less availability of capital and less investment spending.

The household balance (disposable income less consumer outlays and residential investment) depends on the equity market cap/GDP ratio and the 10-year Treasury bond yield, the latter measured in relation to its trailing two-year average. The first term is a conventional equity wealth effect: a rise in equity price implies that households are able and willing to spend more relative to their income. 10-year Treasury bond yield (relative to its average over the prior two years) captures the mortgage refinancing mechanism coming from a reduction in interest rates[23].

[23] GS considers that this variable, in addition, is able to capture the dynamic of house price inflation, because a reduction in interest rates tends to lower house price inflation. We do not find any evidence in this sense, and in our Hbal estimation house price inflation enters as explanatory variable together with US10y. This means that US10y does not contain information about house price inflation behavior.

Finally, the foreign balance (the current account balance) depends on the level of the trade-weighted dollar (as measured by the Federal Reserve Board's real broad trade-weighted dollar index), and a linear time trend. A significantly weaker dollar is a stimulant for net external demand (X-M), because it makes exports cheaper and imports more expensive. For GS the time trend takes the place of the relative demand variables that are often included in foreign trade equations. Explaining it in this way "...it is much simpler, as foreign demand data are often unreliable and subject to big revisions" (GS 2003).

The three equations that describe equilibrium financial balances for households, nonfinancial corporate business, and foreigners, are combined to obtain an expression for the overall equilibrium financial balance. The difference between actual and equilibrium balances (gap), in addition to an exogenous variable (fiscal) which captures the change in the public sector pattern, captures the cyclical output growth (ΔGDP). The Gap enters lagged by 1 period, because, for example, a negative deviation from equilibrium in households balance, financing gap or current account deficit (CAS with sign reversed), is interpreted as a signal that agents will reduce their spending in order to close the gap with equilibrium. A negative variation in a financial balance today implies that tomorrow agents will cut their spending, with a negative impact on GDP growth; then, a negative gap today (negative deviation from equilibrium) means reduction in cyclical output growth tomorrow (positive relation).

The underlying box summarizes the relationship described above between sectors' balance and financial markets, together with the relative signs.

Relationship among sectors' financial balances and financial variables advanced by GS

$$FinGap = f\left(\overset{-}{\left(\frac{Eq}{GDP}\right)}, \overset{+}{baaspr}\right)$$

$$Hbal = f\left(\overset{-}{\left(\frac{Eq}{GDP}\right)}, \overset{+}{us10yma}\right)$$

$$CAS = f\left(\overset{-}{twusd}, \overset{-}{trend}\right)$$

$$\Delta GDP = \left(\overset{+}{gap_{-1}}, \overset{-}{fiscal}\right)$$

In the following sub-section we present the GS estimations together with our estimations.

3.1 GS Estimation Results

The GS model, with the structure described above, is presented in 2003. After this date, this version is no longer available, and other studies with private sector balance appear (that is, Hbal and FinGap in a unique block). The estimation strategy is the following: 1) we consider the original GS results; 2) we replicate these results by means of two different estimation methods (a direct ECM estimates by OLS and DOLS[24]) referring to the same sample and an extended up-to-date sample; 3) we consider all the diagnostic tests needed by this analysis.

The analysis of GS results ends with an analysis of estimation of cyclical growth. GS combines all three balance equations to obtain an expression for the combined equilibrium financial balances of all three sectors; then it builds the deviations of the overall balance obtained from equilibrium to explain deviation of real GDP from potential growth. In this estimation the change in standardized budget balance is included.

We first present the results of sectors' balance estimations in this order: financing gap, households balance, and foreign sector. All these variables are expressed as percent of GDP in their estimations. In this section we show only a summary of the results; for details on these estimations' results and cointegration test, see appendix C. Finally, we present the estimation of cyclical growth.

Financing Gap (FinGap)

Our estimates of GS result are reported in Table 4. They are obtained with the same technique used by GS (ECM estimated by OLS) and DOLS method. Independently from the method used, it emerges that no cointegration exists for GS FinGap equation.

In the first row of Table 1, the GS original estimate for the period 1970 - 2003 is reported. All variables have the expected signs and are statistically significant, but diagnostic tests required by estimation to validate the cointegrating relationship are not reported. Our estimate of the GS equation, both with GS technique and DOLS method, considering the same sample as well as a longer sample up to 2007, produces a coefficient for equity GDP ratio not statistically significant[25]. Since one or more explanatory variables are not

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[24] The first method replicates the same technique used by GS in estimations. This approach is similar to the LSE (London School of Economics) method developed by Hendry (1995) (which incorporates both the long and short run effects in OLS estimate), but it differs as it considers only the error correction term in OLS. A series of diagnostic tests are however required for valuating the estimation obtained (heteroscedasticity, normality and serial correlation of residuals, etc.). DOLS stands for Dynamic Ordinary Least Squares developed by Stock and Watson (1993). This method consists of estimating the long -run relationship together with the leads and lags of first difference of regressors. The leads and lags correct for presence of regressors endogeneity.

[25] The equity GDP ratio, in DOLS version, is even positive in the period 1975-2007.

statistically significant, it makes no sense to apply diagnostic tests on estimation equations and we can directly conclude that a cointegration does not exist in the GS financing gap version. All details on these estimations presented in Table 4 are reported in appendix C.

Households Balance (Hbal)

The households balance estimations are reported in Table 5. From the estimations it emerges that there is not a cointegrating relationship for the GS households balance equation.
With the GS approach, we find coefficients with expected signs and all are statistically significant. However, these estimations fail to pass the diagnostic tests required. The DOLS estimations produce better results up to 2003 q1 giving a cointegrating relationship: until this date, the equation obtained has the variable with expected signs, all statistically significant, and it passes the residuals test at the 10 percent level of significance. However, an upgrade of this estimation up to 2007 q2, produces a result that no longer passes the cointegration test. Details on these results are in appendix C.

Foreign Balance (CAS)

In Table 6 we report the results of CAS estimation in the GS version. All estimations, GS technique and DOLS approach, do not pass cointegrating tests; therefore, we can conclude that there is no cointegrating relationship in CAS equation advanced by GS.

All estimations, independent of the technique used, produce coefficients with expected signs and are statistically significant. But, as we show in more detail in appendix C, they do not pass the required cointegrating test.

Table 4: GS FinGap Estimation

$$FinGap = f\left(\left(\overset{-}{\frac{Eq}{GDP}}\right), \overset{+}{baaspr}\right)$$

Version	Estimation technique	Period estimation	LR relationship	Cointegr. Tests⊥
GS estimate	ECM estimated by OLS#	1970q1 2003q1	$FinGap_t = -3.83^{***} + 1.63 baaspr_t^{***} - 1.11\left(\frac{Eq_t}{GDP_t}\right)^{***}$	
Our estimate	ECM estimated by OLS	1975q1 2003q1	$FinGap_t = -8.58^{***} + 1.66 baaspr_t^{***} - 0.77\left(\frac{Eq_t}{GDP_t}\right)$	
	ECM estimated by OLS	1975q1 2007q2	$FinGap_t = -6.25^{*} + 1.39 baaspr_t^{***} - 0.45\left(\frac{Eq_t}{GDP_t}\right)$	
Our estimate	DOLS	1975q1 2003q1	$FinGap_t = -3.8^{\pm} + 0.38 baaspr_t^{*} - 0.34\left(\frac{Eq_t}{GDP_t}\right)$	
	DOLS	1975q1 2007q2	$FinGap_t = -1.61 + 0.32 baaspr_t^{\pm} + 0.01\left(\frac{Eq_t}{GDP_t}\right)$	

Note: Details on GS results and our estimation are shown in the appendix. DOLS stands for Dynamic Ordinary Least Squares developed by Stock and Watson (1993). Levels of significance: *** $p-value \leq 0.01$; ** $p-value \leq 0.05$; * $p-value \leq 0.1$; $\pm$ $p-value \leq 0.15$. **# GS directly estimates an Error Correction Model by OLS. The implied coefficient for long run relationship are inferred from ECM estimation by assuming that $\Delta FinGap_t$ in equilibrium is zero. ⊥ Cointegration tests are not applied because not all variables in long term relationships are statistically significant, and for this reason we can directly conclude that a cointegration does not exist.**

Table 5: GS Hbal Estimation

$$Hbal = f\left(\overset{-}{\left(\frac{Eq}{GDP}\right)}, \overset{+}{us10yma}\right)$$

Version	Estimation technique	Period estimation	LR relationship	Cointegr. Tests
GS estimate	ECM estimated by OLS#	1960q1 2003q1	$Hbal_t = 5.86^{***} + 1.02us10yma_t^{***} - 4.2\left(\frac{Eq_t}{GDP_t}\right)^{***}$	–
Our estimate	ECM estimated by OLS	1975q1 2003q1	$Hbal_t = -14.64^{***} + 0.6us10yma_t^{***} - 2.17\left(\frac{Eq_t}{GDP_t}\right)^{**}$	**No**
	ECM estimated by OLS	1975q1 2007q2	$Hbal_t = -13.98^{***} + 0.76us10yma_t^{***} - 1.77\left(\frac{Eq_t}{GDP_t}\right)^{\pm}$	**No**
Our estimate	DOLS	1975q1 2003q1	$Hbal_t = -18^{***} + 0.39us10yma_t^{***} - 3.13\left(\frac{Eq_t}{GDP_t}\right)^{***}$	**Yes**
	DOLS	1975q1 2007q2	$Hbal_t = -17.5^{***} + 0.55us10yma_t^{***} - 2.76\left(\frac{Eq_t}{GDP_t}\right)^{***}$	**No**

Note: Details on GS results and our estimation are shown in the appendix. DOLS stands for Dynamic Ordinary Least Squares developed by Stock and Watson (1993). Levels of significance: *** $p-value \leq 0.01$; ** $p-value \leq 0.05$; * $p-value \leq 0.1$; $\pm$ $p-value \leq 0.15$. **# GS directly estimates an Error Correction Model by OLS. The implied coefficient for long run relationship are inferred from ECM estimation by assuming that $\Delta Hbal_t$ in equilibrium is zero.**

Table 6: GS Estimation of CAS

$$CAS = f\left(\overset{-}{twusd}, \overset{-}{trend}\right)$$

Version	Estimation technique	Period estimation	LR relationship	Cointegr. Tests
GS estimate	ECM estimated by OLS#	1975q1 2003q1	$CAS_t = 58.51^{***} - 0.04trend_t^{***} - 12.8twusd_t^{***}$	–
Our estimate	ECM estimated by OLS	1975q1 2003q1	$CAS_t = 54.76^{***} - 0.03trend_t^{***} - 11.89twusd_t^{***}$	**No**
	ECM estimated by OLS	1975q1 2007q2	$CAS_t = 62.98^{***} - 0.04trend_t^{***} - 13.58twusd_t^{***}$	**No**
Our estimate	DOLS	1975q1 2003q1	$CAS_t = 37.41^{***} - 0.03trend_t^{***} - 8.03twusd_t^{***}$	**No**
	DOLS	1975q1 2007q2	$CAS_t = 35.63^{***} - 0.04trend_t^{***} - 7.51twusd_t^{***}$	**No**

Note: Details on GS results and our estimation are shown in the appendix. DOLS stands for Dynamic Ordinary Least Squares developed by Stock and Watson (1993). Levels of significance: *** $p-value \leq 0.01$; ** $p-value \leq 0.05$; * $p-value \leq 0.1$; ± $p-value \leq 0.15$. **# GS directly estimates an Error Correction Model by OLS. The implied coefficient for long run relationship are inferred from ECM estimation by assuming that ΔCAS_t in equilibrium is zero.**

Criticism About GS Sectors Balances Estimates

Why such a failure? Two critiques emerge from GS analysis:

1. Estimation procedure. As shown in the discussion above (and in Figure 15) sectors' equilibrium balance is solved without considering the output. Output plays an important role in the equilibrium process: if the level of real output has to bring sectors' balance into equilibrium, then output has to be considered in each sectors' balance[26]. This is an important problem from a logical point of view.
2. Omitted relevant variables. There is no cointegration for the sectors' balance equations discussed above[27]. This arises in part from not considering output in estimation, and in part from not considering other important variables in the analysis (profit share in financing gap, house price inflation in hbal, and oil price in CAS).

GS Cyclical Growth Estimation

GS combines the long-run relationship estimated to construct the equilibrium financial balance for all three sectors together (that is, FinGap + Hbal - CAS). Then, it makes use of deviations between actual and equilibrium balance to explain the cyclical growth of real GDP. In this estimation GS also includes a variable that explains the public sectors: the change in standardized budget balance (as measured by Congressional Budget Office). The underlying idea is that a negative deviation from equilibrium in the overall balance today implies a cut in spending to close the gap with equilibrium. This implies a reduction in GDP cyclical growth tomorrow, and then a positive relationship between the gap today and cyclical growth tomorrow[28]. The equation estimated by GS is presented below.

[26] As we will see in Section 4, another way to analyze this problem, without considering output in sectors' equation, is to solve each balance as a function of others.

[27] In some cases, such as for FinGap, the coefficients for some explanatory variables are not statistically significant, while in other cases the cointegrating relationships do not pass the cointegration test.

[28] The reason is specular if it is conducted in the reverse way.

Table 7: GS cyclical Growth Estimation

$$cyc_t = \beta_0 + \beta_1 gap_{t-1} + \beta_2 fiscal_t + \beta_3 du9093 + \varepsilon_t$$

GS version				
Sample period	β_0	β_1	β_2	β_3
1973q1 2003q1	0.44 (1.5)	0.95 (6)	-1.17 (3.4)	-2.7 (3.2)
R^2	0.28			
DW	1.72			

Note: cyc indicates deviations of year on year real GDP growth from potential; gap is the deviation in the overall balance from equilibrium; fiscal is the change in the standardized budget balance (as measured by Congressional Budget Office); du9093 is an impulse dummy variable for period 1990-1993.

This estimation suffers from two problems: (1) All sectors are combined in a unique overall sector and this leads to a loss of information; (2) GS assumes that all sectors' balances have the same effect on cycle, that is, a negative deviation from equilibrium in corporate, households, and current account deficit (CAS with reversed sign), produce a reduction in GDP cyclical growth tomorrow with the same temporal lag. As we have seen in Section 2, the relation between households balance and GDP growth runs in the opposite way (a reduction in households balance cyclical growth —because consumption or housing investment are rising— implies a rise in cyclical growth); in addition, time lags in the relationship between sectors' balance and GDP growth are not equal for all (and in specific cases, as advanced by GS, equal to one).

Below we present GS cyclical growth estimation together with our three different versions. First, we present an estimate that makes use (in the overall balance) of the same long-run relationship founded by GS. We find that overall balance (gap) is not very statistically significant. Second, we make an estimation with explicit single sectors' balance (FinGap, Hbal, CAS) (we make use, also in this case, of the same long-run relationship founded by GS). We find that the main information is captured by the financing gap, while the foreign variable has the wrong sign and is not statistically significant. Also households balance has the opposite sign compared to GS expectations. Therefore, considering all sectors together implies a loss of information, strong restrictions—in assuming that all sectors behave in the same way—and it is not statistically significant. Third, we run a different cyclical growth version based on acyclical pattern of sectors' balance and different time lags for each sector, such as resulting from stylized facts analysis (with the estimation period until 2007 q2). Hbal and FinGap enter with time lags ascertained and with expected signs; CAS does not enter because its dynamic is partly captured by Hbal, and partly by oil and world trade patterns. The estimation passes the following diagnostic tests: correct specification (Reset test) and normality distribution of residuals estimate. The presence of heteroskedasticity and serial correlation is corrected with the Newey-West HAC Estimator.

Table 8: Our Version GS Cyclical Growth Estimation

$$cyc_t = \beta_0 + \beta_1 gap_{t-1} + \beta_2 fiscal_t + \beta_3 du9093 + \varepsilon_t$$

Our version				
Sample period	β_0	β_1	β_2	β_3
1976q1 2003q1	3.41 (10.6)	0.19 (1.1)	-1.02 (1.4)	-1.9 (2.5)
R^2	0.18			
DW	0.37*			

Note: cyc indicates year-on-year change in the real GDP (a very similar pattern to GS measure); gap is the deviation in the overall balance (standardized) from equilibrium; du9093 is an impulse dummy variable for period 1990-1993. * The reported t-statistics (in parenthesis) are corrected for bias stemming from serial correlation and heteroskedasticity by the Newey-West procedure.

$$cyc_t = \beta_0 + \beta_1 \varepsilon^{fg}{}_{t-1} + \beta_2 \varepsilon^{hb}{}_{t-1} + \beta_3 \varepsilon^{fb}{}_{t-1} + \beta_4 fiscal_t + \beta_5 du91 + \varepsilon_t$$

Our version						
Sample period	β_0	β_1	β_2	β_3	β_4	β_5
1976q1 2003q1	3.3 (11.6)	1.09 (5.4)	-0.44 (1.1)	-0.26 (0.8)	-0.92 (1.2)	3.3 (5.9)
R^2	0.4					
DW	0.45*					

Note: cyc indicates year on year change in the real GDP (a very similar pattern to GS measure); ε^{fg} is the difference between effective financing gap and its long run relationship; ε^{hb} the difference between effective households balance and its long-run relationship; ε^{fb} the gap between effective CAS and its long run relationship; du91 is an impulse dummy variable for all periods of 1991. * The reported t-statistics (in parenthesis) are corrected for bias stemming from serial correlation and heteroskedasticity by the Newey-West procedure. ε^{fg}; ε^{hb}; ε^{fb} are standardized before being inserted into the equation.

$$cyc_t = \beta_0 + \beta_1 fingap\_cycle_{t-4} + \beta_2 hbal\_cycle_{t-4} + \beta_3 wt\_cycle_{t-4} + \beta_4 oil\_cycle_{t-2} + \beta_5 du82 + \varepsilon_t$$

Our version based on cyclical pattern of sectors' balance					
Sample period	β_1	β_2	β_3	β_4	β_5
1976q1 2007q2	0.0045 (2.5)	-0.0062 (3.4)	5.98E-08 (5.6)	-0.0009 (3.2)	-0.0214 (6.1)
R^2 adj.	0.53				

Test Statistics

Serial Correlation	Newey – West Correction			
Functional Form	Log likelihood ratio 0.33	Prob. 0.57	F – Statistic 0.31	Prob. 0.58
Normality	Jarque – Bera 0.62	Prob. 0.63	-	-
Heteroskedasticity	Newey – West Correction			

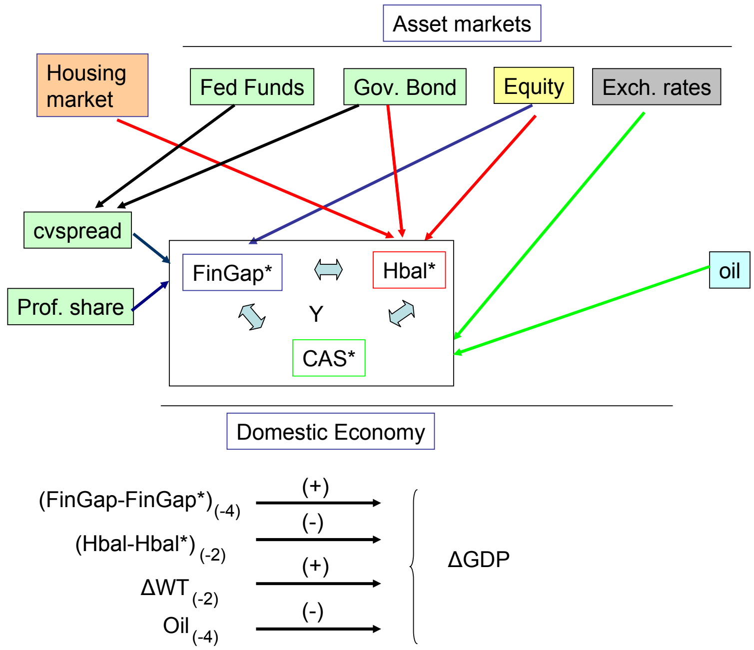
Note: cyc indicates real GDP growth cycle; du82 is an impulse dummy variable for period 1982q1 - 1982q4. Newey-West (1987) corrected t-statistics for serial autocorrelation and heteroskedasticity are applied in regression and appear in parenthesis.

To conclude, we can say that the GS sectors' financial balance model suffers from many problems. First, there is no cointegrating relation in the sectors' balance relation advanced by GS. Second, cyclical growth estimation is not statistically (and economically) significant, because it summarizes erroneous relationship between sectors' balance and output both in terms of sign (it is the case of Hbal) and in terms of time lags. A simple relationship between cyclical sectors' balance pattern and cyclical growth, based on our stylized facts analysis conducted in Section 2, produces statistically significant results confirming our view.

4. SECTORS' FINANCIAL BALANCES MODEL

The main features of our sectors' balance model are described in Section 1. In this section we describe the logic scheme behind our estimated sectors' balance model. This aspect is summarized in the figure below.

Figure 16: Logical-based model



In our analysis we focus on the goods market only. The equilibrium on the goods market at sectors' balance level depends on asset markets, namely equity markets, bonds, housing, and commodities markets. The logic is simple: sectors' balance long run relationships are a function of asset markets and GDP. Sectors' balance and GDP have a double link. On one side, a deviation of a sector from equilibrium implies an effect on output growth. On the other side, it is GDP, through its dynamics, which brings all sectors into equivalence. For this last aspect, it is important (from a logical point of view) to consider output in each sectors' equation. Another way of solving the problem, without considering output in the equation, is to solve each balance as a function of others. Since that output is influenced by sectors' balance dynamics and since these are linked to each other, we can omit output from equations and insert residual sectors' balance in each sector's equation. In each estimation we start with a wider model (sector's balance as a function of others) and we exclude the variables that are not statistically significant. We find that FinGap is the most independent sector, as we expected from our analysis. Hbal is explained in part by the FinGap dynamic (it enters as an indicator of future economic conditions, and then with negative sign), while in CAS it enters as an explanatory variable Hbal as we expected from Section 2.

The long-run relationships so obtained are used to have a cyclical growth estimation. Sectors' balance deviations from equilibrium make an impulse on GDP cycle. As we have said in the stylized facts analysis section, and we find a confirmation in our version of GS cyclical growth estimation in Table 5, we expect that lagged deviations in FinGap and Hbal (with a lag of 4 and 2 periods respectively) have an impact on output cycle. A positive FinGap deviation from equilibrium (internal funds bigger than investments) implies that there are internal funds sufficient to stimulate investment decisions and output in the near future. Instead, a positive Hbal deviation from long-run relationship (saving bigger than consumption and housing investments) implies a reduction in the demand components that produce a reduction in GDP cycle in the next two quarters. Foreign balance does not enter into GDP cyclical estimation because its dynamic is explained, from an econometric point of view, in part by Hbal (as we said in Section 2) and in part by world trade and oil price cyclical patterns.

The model we estimate is summarized in the table below.

$$FinGap = f\left(\left(\overset{+}{\frac{\Pi}{GDP}}\right), \overset{+}{cvspread}, \overset{-}{eq}\right)$$

$$Hbal = f\left(\overset{-}{i_{mtg}}, \Delta_4 \overset{-}{ph}, \overset{-}{eq}, \overset{-}{FinGap}\right)$$

$$CAS = f\left(\overset{-}{oil}, \overset{-}{\lambda_{-i}}, \overset{+}{Hbal}\right)$$

$$\Delta GDP = \left(\overset{+}{(fingap - fingap^*)_{-4}}, \overset{-}{(Hbal - Hbal^*)_{-2}}, \overset{+}{WT\_cycle_{-2}}, \overset{-}{Oil\_cycle_{-4}}\right)$$

5. ESTIMATIONS AND SIMULATIONS

This section proceeds as follows. First, we present an overview of the data and the technical estimations used. Then, we present our estimation of sector balances. Consequently, we present the estimation of GDP with sectors' balances deviations from equilibrium as explanatory variables. Finally, we run an impulse response analysis building a model based on the estimations obtained.

5.1 Data and Technical Estimations

The data used are taken from Flow of Funds (FoF) in quarterly time series. All financial sectors' balance is measured in percent of nominal GDP. A detailed description of data is in Appendix A. The estimation technique used is the Dynamic Ordinary Least Squares (DOLS) technique of Saikkonen (1991) and Stock and Watson (1993). This procedure has two advantages: (1) it is used to correct for endogeneity among the regressors; (2) it allows variables integrated with different orders to be combined with I(1) variables in the cointegrating relationship. The first aspect arises because of the possibility of "reverse casuality" between a sector's balance and output[29]. The second aspect arises because an I(0) variable enters into a cointegrating relationship (the corporate sector). For further details on these characteristics about DOLS see Appendix B.

We use also the Johansen procedure to have a confirmation about the existence of long-run relationship[30]. When the results of these two tests produce similar outcomes, we become sure of the existence of a cointegrating relationship.

The results of the estimations are used to run a simulation in the context of impulse response analysis of exogenous variables (asset markets variables). We further investigate these effects on GDP cyclical growth through an estimation of the latter as a function of sectors' balance gap (that is, deviation from equilibrium).

5.2 Estimation Results

In this section we present estimation of sectors' balance. The estimations obtained are used to build a simulation model of GDP cyclical growth as a function of sectors' deviations from equilibrium. This model is used to run an impulse response analysis.

Financing Gap

The table below presents FinGap estimation with DOLS technique. All of the coefficient estimates are statistically significant (at 1 percent level) and take the expected signs. ADF t statistic of residuals derived from DOLS regression is -4.65. The residuals are I(0) and then a cointegration relationship exists.

[29] We remember that a sector's balance movement causes a GDP variation. But it is GDP, through its subsequent movement, that brings all the balances into equivalence.

[30] As we will see in Appendix (B), the Johansen procedure admits I(0) variables in some circumstances.

Table 9: DOLS Estimates of FinGap

$$FinGap_t = \beta_0 + \beta_1\left(\frac{\Pi_t}{Y_t}\right) + \beta_2 Eq_t + \beta_3 cvspread_t + \sum_{j=-4}^{4}\beta_{1,j}\Delta\left(\frac{\Pi_{t+j}}{Y_{t+j}}\right) + \sum_{j=-4}^{4}\beta_{2,j}\Delta Eq_{t+j} + \varepsilon_t$$

Long run relationship: $FinGap_t = \beta_0 + \beta_1\left(\frac{\Pi_t}{Y_t}\right) + \beta_2 Eq_t + \beta_3 cvspread_t + u_t$

Sample period	β_0	β_1	β_2	β_3
1975q1 2007q2	-2.89 (5.2)	0.38 (5.3)	-0.03 (6.9)	0.1 (3)
Residual ADF t-test	-4.65***			

Symbols *, **, * represent, respectively, significance level of 10%, 5% and 1% of residuals ADF t – test. For the residuals ADF t-test, the lag length is chosen by SIC criteria. Critical values for test are suggested by MacKinnon (1991). The reported t-statistics (in parenthesis) are corrected for bias stemming from serial correlation and heteroskedasticity by the Newey-West procedure. The method of estimation is DOLS [Stock and Watson 1993]. Regression includes an intercept, contemporaneous plus four leading and four lagging values of each explanatory variable, and three dummies (2005 q3, 2005 q4, 1987 q1 - 1988 q4).**

The residuals from the equilibrium regression are used to estimate the Error Correction Model (ECM). The error term (u) enters with expected sign (negative) and it is statistically significant. In addition, Table 10 presents the results of the various diagnostic tests of ECM. The test for normality using the Jarque-Bera method, indicates that the residuals from the ECMs are normally distributed. Ramsey's Reset test against a quadratic form was used to test for mis-specification in the ECM. At the 1% level the null hypothesis of misspecification can be rejected. To test the presence of serial correlation, the Breush-Godfrey Lagrange multiplier test was used, with the F-statistics from the test. The result of the Breush-Godfrey test suggests that serial correlation is not present (for order three). The presence of heteroskedasticity is corrected with Newey-West HAC consistent estimates.

Table 10: Error Correction Estimates of FinGap (1975q1 - 2007q2)

$$ECM = FinGap - \left(-2.89 + 0.38\left(\frac{\Pi}{Y}\right) - 0.03Eq + 0.1cvspread \right)$$

	Coefficient
u_{t-1}	-0.32^{***}
$\Delta FinGap_{t-3}$	0.2^{*}
ΔEq_{t-5}	-0.05^{*}
$CV\ spread_{t-2}$	0.1^{***}
$CV\ spread_{t-5}$	-0.04^{**}
du87q1_88q4	0.45^{***}
du2005q3	1.82^{***}
du2005q4	1.32^{***}
du2006q1	-1.92^{***}
du2006q4	-1.54^{***}
Adj. R^2	0.55
DW	1.7

Source: authors' calculations. Levels of significance: *** $p - value \leq 0.01$; ** $p - value \leq 0.05$; * $p - value \leq 0.1$; $^{\pm}$ $p - value \leq 0.15$. **Note: the equation is significant also without the last two dummies and overcomes all the diagnostic tests, at 0.05 level of significance, reported below (except Heteroskedasticity corrected with Newey-West), but adj. R2 is low (≈ 0:3):**

Test Statistics

Serial Correlation	**Obs*R – Squared** 6.4	**Prob.** 0.09	**F – Statistic** 2	**Prob.** 0.12
Functional Form	**Log likelihood ratio** 1.67	**Prob.** 0.2	**F – Statistic** 1.51	**Prob.** 0.22
Normality	**Jarque – Bera** 0.17	**Prob.** 0.92	**-**	**-**
Heteroskedasticity	**Newey – West Correction**			

Note: The functional form test (Ramsey Reset Test) is conducted assuming a quadratic form. The serial correlation test is conducted assuming a lag = 3.

The cointegrating relationship estimated with the DOLS method is also verified with the Johansen procedure. With a lag of three, Trace test confirms the existence of one cointegrating relationship (probability Trace-Test = 0.02). The long-run relationship suggested by the Johansen procedure exhibits similar values, for equity and profit share coefficients, to DOLS result. Furthermore, the adjustment paramenter (α) also appears to be very similar. The Johansen approach confirms that the long-run relationship enters only in FinGap variable (probability restriction = 0.5). The Trace test suggests the existence of one cointegrating relationship with a result (in terms of coefficients values) similar to the one presented.

Table 11: FinGap, Profit share, Equity, CV spread – Johansen Procedure

DOLS ECM = $FinGap - \left(-2.89 + 0.38\left(\frac{\Pi}{Y}\right) - 0.03Eq + 0.1cvspread \right)$

DOLS α_c = -0.32

Lag = 3

Period	Prob. Trace	Prob. L - Max	Restrictions	Coint. vector
1975q1 2007q2	0.02	0.15	LR relationship enters only in FinGap equation	β=(1, 1.53, -0.2, 0.03, -0.25)
			Prob. restrictions = 0.5	α_c = -0.31

Note: The Trace test indicates the existence of one cointegrating relationship. The test is conducted considering the same dummies used in ECM estimations. Trace and L-Max tests accept the existence of one cointegrating relationship, with 4 lags, at 0.01 percent, but a test for binding restrictions does not accept them.

Households Balance

The households balance estimate with DOLS method produces a cointegration and coefficients with expected signs. The coefficients of the variables are statistically significant at 1 per cent level. The residuals from cointegrating relationship appear to be stationary, passing the ADF test for cointegration.

Table 12: DOLS Estimates of Hbal

$$Hbal_t = \beta_0 + \beta_1 Fingap_t + \beta_2 Eq_t + \beta_3 \Delta_4 p_t^{\,h} + \beta_4 us10y_t + \sum_{j=-2}^{2} \beta_{1,j} \Delta Fingap_{t+j} + \sum_{j=-2}^{2} \beta_{2,j} \Delta Eq_{t+j}$$

$$+ \sum_{j=-2}^{2} \beta_{3,j} \Delta\left(\Delta_4 p_t^{\,h}\right) + \sum_{j=-2}^{2} \beta_{4,j} \Delta\left(us10y_{t+j}\right) + \varepsilon_t$$

Long run relationship: $Hbal_t = \beta_0 + \beta_1 Fingap_t + \beta_2 Eq_t + \beta_3 \Delta_4 p^h{}_t + \beta_4 us10y_t + u_t$

Sample period	β_0	β_1	β_2	β_3	β_4
1975q1 2007q2	1.37 (1.72)	-0.43 (3.2)	-0.1 (10.2)	-0.1 (2.6)	0.35 (5.2)
Residual ADF t-test	-5.43***				

Symbols *, **, * represent, respectively, significance level of 10%, 5% and 1% of residuals ADF t – test. For the residuals ADF t-test, the lag length is chosen by SIC criteria. Critical values for the test are suggested by MacKinnon (1991). The reported t-statistics (in parenthesis) are corrected for bias stemming from serial correlation and heteroskedasticity by the Newey-West procedure. The method of estimation is DOLS [Stock and Watson 1993]. Regression includes an intercept, contemporaneous plus two leading and two lagging values of each explanatory variable.**

In Table 13 the ECM estimate is presented using the residuals of long-run relationship (u). The speed of adjustment has a negative sign and the error term u is statistically significant at 1 percent level. Diagnostic tests to check the correct specification of ECM are reported below in Table 13 . The ECM estimate passes all diagnostic tests: Jarque-Bera test for normality, Reset test, Breush-Godfrey test for serial correlation. The presence of heteroskedasticity is corrected with Newey-West HAC Estimator.

Table 13: Error Correction Estimates of Hbal (1975q1 - 2007q3)

$$ECM = Hbal - \left(1.37 - 0.43FinGap - 0.1Eq - 0.1\Delta_4 p^h + 0.35us10y\right)$$

	Coefficient
u_{t-1}	-0.44^{***}
ΔEq_{t-3}	0.04^{*}
du2001q3	1.46^{***}
du2001q4	-1.58^{***}
du2002q1	1.21^{***}
Adj. R^2	0.44
DW	1.98

Source: authors' calculations. Levels of significance: *** $p - value \le 0.01$; ** $p - value \le 0.05$; * $p - value \le 0.1$; $^{\pm}$ $p - value \le 0.15$.

Test Statistics

Serial Correlation	Obs*R – Squared 0.36	Prob. 0.95	F – Statistic 0.11	Prob. 0.95
Functional Form	**Log likelihood ratio** 0.8	**Prob.** 0.37	**F – Statistic** 0.76	**Prob.** 0.38
Normality	**Jarque – Bera** 3.85	**Prob.** 0.15	-	-
Heteroskedasticity	**Newey – West Correction**			

Note: Functional form test (Ramsey Reset Test) is conducted assuming a quadratic form. The serial correlation test is conducted assuming a lag = 3.

The Johansen procedure exhibits very similar results to DOLS estimate, confirming the validity of the long run estimation obtained. With a lag equal to 1, the Trace test (for lag equal to 1 and 3) and L-Max test (for lag equal to 1, and for lag equal to 2 but at 10 percent significance) confirms the existence of 1 cointegrating relationship. The restrictions on other variables (namely, long-run relationship enters only in Hbal) are accepted. With a lag equal to two or three, at least one of the two tests (Trace and L-Max) accept the existence of one long run relationship. The restrictions on other variables pass the test, and the cointegrating relationships obtained are very similar to DOLS result.

Table 14: Household Balance, FinGap, Equity, House Price Inflation, 10-Year Treasury Yields – Johansen

$$\textbf{DOLS ECM = } Hbal - \left(1.37 - 0.43FinGap - 0.1Eq - 0.1\Delta_4 p^h + 0.35us10y\right)$$

DOLS α_c = -0.44

Lag = 1

Period	Prob. Trace	Prob. L - Max	Restrictions	Coint. vector
1975q1 2007q2	0.00	0.00	LR relationship enters only in FinGap equation	β=(1, -0.7, 0.31, 0.08, 0.13, -0.42)
			Prob. restrictions = 0.22	α_c = -0.45

Lag = 2

Period	Prob. Trace	Prob. L - Max	Restrictions	Coint. vector
1975q1 2007q2	0.1	0.06	LR relationship enters only in FinGap equation	β=(1, -0.78, 0.39, 0.09, 0.11, -0.41)
			Prob. restrictions = 0.57	α_c = -0.45

Lag = 3

Period	Prob. Trace	Prob. L - Max	Restrictions	Coint. vector
1975q1 2007q2	0.03	0.1	LR relationship enters only in FinGap equation	β=(1, -1.26, 0.44, 0.1, 0.11, -0.37)
			Prob. restrictions = 0.08	α_c = -0.44

Note: Trace test and L-Max test indicates the existence of one cointegrating relationship. The test is conducted considering the same dummies used in ECM estimations.

CAS

The estimate of CAS with DOLS technique exhibits coefficients, for all three explanatory variables, statistically significant at 1 per cent and with the expected signs. ADF test on residuals is significant at the 1 percent level, confirming the existence of a cointegrating relationship.

Table 15: DOLS Estimates of CAS

$$CAS_t = \beta_0 + \beta_1 Hbal_t + \beta_2 twusd_{t-3} + \beta_3 oil_t + \sum_{j=-2}^{2} \beta_{1,j} \Delta Hbal_{t+j} + \sum_{j=-2}^{2} \beta_{2,j} \Delta twusd_{t-3+j} + \sum_{j=-2}^{2} \beta_{3,j} \Delta oil_{t+j} + \varepsilon_t$$

Long run relationship: $CAS_t = \beta_0 + \beta_1 Hbal_t + \beta_2 twusd_{t-3} + \beta_3 oil_t + u_t$

Sample period	**β_0**	**β_1**	**β_2**	**β_3**
1975q1 2007q2	7.38 (6.5)	0.51 (15.9)	-0.09 (12.3)	-0.04 (6.9)
Residual ADF t-test	-4.83***			

Symbols *, **, * represent, respectively, significance level of 10%, 5% and 1% of residuals ADF t – test. For the residuals ADF t-test, the lag length is chosen by SIC criteria. Critical values for the test are suggested by MacKinnon (1991). The reported t-statistics (in parenthesis) are corrected for bias stemming from serial correlation and heteroskedasticity by the Newey-West procedure. The method of estimation is DOLS [Stock and Watson 1993]. Regression includes an intercept, contemporaneous plus two leading and two lagging values of each explanatory variable, and one dummy (1991 q1).**

The residuals of long-run relationship enter into the ECM estimation with the expected sign and are statistically significant at 1 percent. The ECM passes all the diagnostic tests. The tests indicate: no residuals serial autocorrelation, residuals normally distributed, no mis-specification error in the ECM. The heteroskedasticity is treated with Newey-West HAC Estimator.

Table 16: Error Correction Estimates of CAS (1975q1 - 2007q3)

$$ECM = CAS - \left(7.38 + 0.51Hbal - 0.09twusd_{-3} - 0.04oil\right)$$

	Coefficient
u_{t-1}	-0.22^{***}
ΔCAS_{t-3}	0.14^{**}
Δoil_{t-2}	0.02^{*}
Δoil_{t-3}	0.01^{*}
du1991q1	1.63^{***}
du2005q4	-1.17^{***}
Adj. R^2	0.39
DW	1.98

Source: authors' calculations. Levels of significance: *** $p - value \leq 0.01$; ** $p - value \leq 0.05$; * $p - value \leq 0.1$; $^{\pm}$ $p - value \leq 0.15$.

Test Statistics

Serial Correlation	**Obs*R – Squared** 0.4	**Prob.** 0.94	**F – Statistic** 0.13	**Prob.** 0.95
Functional Form	**Log likelihood ratio** 0.1	**Prob.** 0.75	**F – Statistic** 0.09	**Prob.** 0.76
Normality	**Jarque – Bera** 4	**Prob.** 0.13	**-**	**-**
Heteroskedasticity	**Newey – West Correction**			

Note: The functional form test (Ramsey Reset Test) is conducted assuming a quadratic form. The serial correlation test is conducted assuming a lag = 3.

The Johansen procedure exhibits results very close to DOLS estimate. For lag up to order four, both Trace and L-Max test confirm the existence of one long run relationship. All the restrictions on long run relationship applied to other variables are binding. The factor loading obtained (α) is very similar to DOLS estimate.

Table 17: Foreign Balance, Household Balance, Trade-Weight Dollar, Oil Price - Johansen Procedure

DOLS ECM = $CAS - \left(7.38 + 0.51 Hbal - 0.09 twusd_{-3} - 0.04 oil\right)$

DOLS α_c = -0.22

Lag = 1

Period	Prob. Trace	Prob. L - Max	Restrictions	Coint. vector
1975q1 2007q2	0.00	0.00	LR relationship enters only in FinGap equation	β=(1, -8.9, -0.46, 0.11, 0.03)
			Prob. restrictions = 0.31	α_c = -0.23

Lag = 2

Period	Prob. Trace	Prob. L - Max	Restrictions	Coint. vector
1975q1 2007q2	0.01	0.04	LR relationship enters only in FinGap equation	β=(1, -8.74, -0.47, 0.11, 0.03)
			Prob. restrictions = 0.26	α_c = -0.23

Lag = 3

Period	Prob. Trace	Prob. L - Max	Restrictions	Coint. vector
1975q1 2007q2	0.03	0.04	LR relationship enters only in FinGap equation	β=(1, -8.1, -0.46, 0.1, 0.04)
			Prob. restrictions = 0.17	α_c = -0.25

Note: The Trace test and L-Max test indicates the existence of one cointegrating relationship. The test is conducted considering the same dummies used in ECM estimations.

5.5 GDP Cycle Estimation

We use the error correction estimations found, and the results obtained in the stylized facts analysis about business cycle, to estimate the cyclical pattern of GDP. As we have already checked in Table 8, with an estimation of output cyclical growth with sectors' balance cyclical pattern as explanatory variables, we expect that the FinGap deviation from equilibrium enters with a lag of 4 periods, whereas Hbal gap from equilibrium enters with a lag of two. The estimation result is presented in the table below. All variables enter with the expected signs and are statistically significant. The diagnostic tests indicate a normal distribution of residuals and a correct specification of equation. Serial correlation and heteroskedasticity are corrected with Newey-West HAC consistent estimates.

Table 18: GDP Cycle Estimation Based on Stylized Facts Information

$$cyc_t = \beta_0 + \beta_1 u_{t-4}^{fg} + \beta_2 u_{t-2}^{hb} + \beta wt\_cycle_{t-1} + \beta_4 oil\_cycle_{t-2} + \beta_5 du82 + \varepsilon_t$$

Our version					
Sample period	β_1	β_2	β_3	β_4	β_5
1976q1 **2007q2**	0.0032 (2.4)	-0.0035 (2.5)	7.06E-08 (7)	-0.0013 (4.7)	-0.0321 (8.6)
R^2 Adj.	0.42				

Test Statistics

Serial Correlation	**Newey – West Correction**			
Functional Form	**Log likelihood ratio** 0.6	**Prob.** 0.44	**F – Statistic** 0.57	**Prob.** 0.45
Normality	**Jarque – Bera** 5.3	**Prob.** 0.07	**-**	**-**
Heteroskedasticity	**Newey – West Correction**			

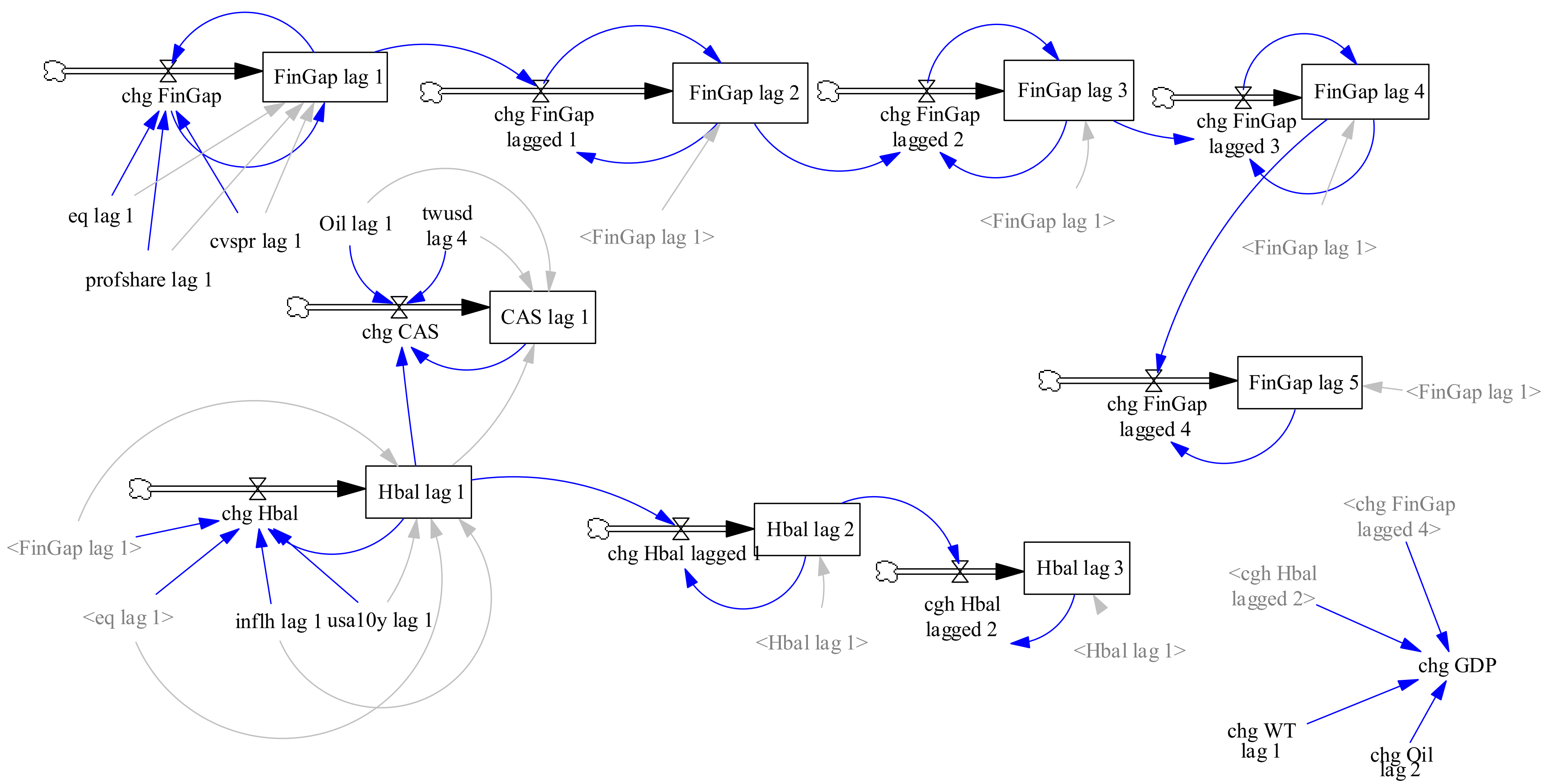
Note: cyc indicates real GDP growth cycle; u^{fg} is the error term of DOLS estimation for financing gap; u^{hb} is the error of DOLS estimation for households balance; du82 is an impulse dummy variable for period 1982q1 - 1982q4. Newey-West (1987) corrected t-statistics for serial autocorrelation and heteroskedasticity are applied in regression and appear in parenthesis.

5.6 Simulations

In this section we run an analysis of the dynamic response of the sectors' balance and GDP growth cycle to impulses in exogenous variables. To implement these predictions we use system dynamics models[31]. Using the results obtained in our estimations, we construct a system dynamic model in Vensim language.

31 De-Toledo, Marquez and Nunez (2008) focused on the relation between econometric sand system dynamic models. System dynamic models are systems of difference equations. The theory of difference equations underlies all the time series methods.

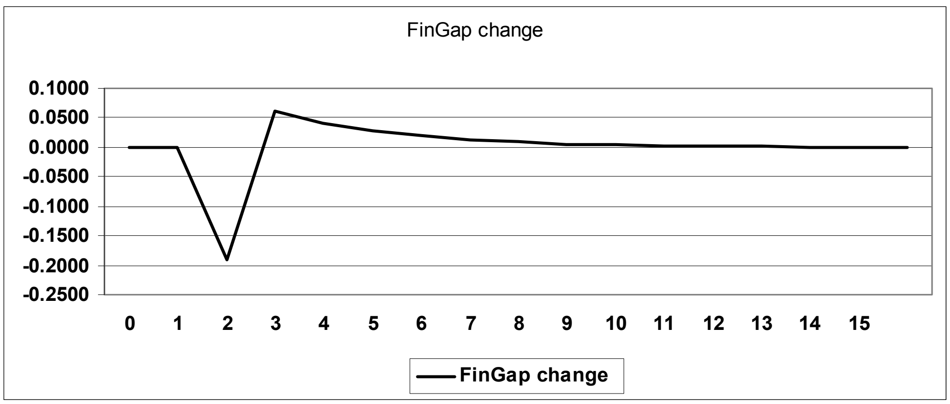
Figure 17: The Design of Equations Estimation in Vensim to Implement Impulse Responses Analysis

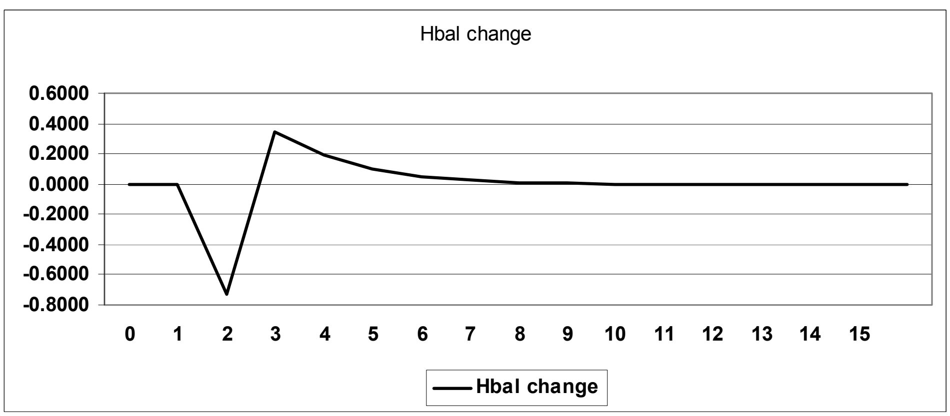


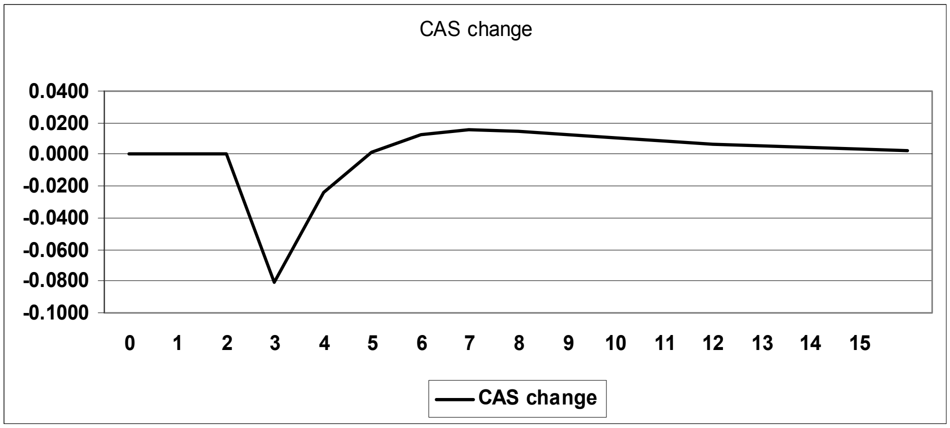
Plots of the generalized impulse response functions for one standard shock in exogenous variables (equity prices, yield spread, profits share, house prices inflation, and 10-year T-bond yield) are shown in the figures below. The hypothesis is that a positive shock takes place and comes back in one period.

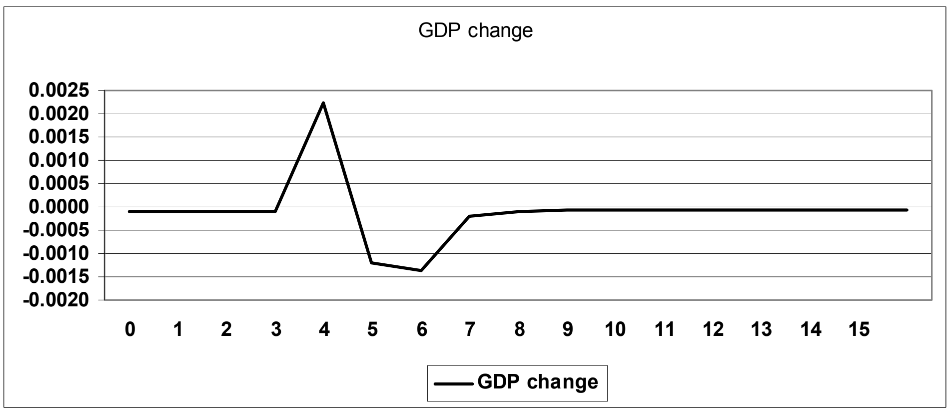
A shock in equity prices corresponds to a shock in business investments components. As we expect, the impact on financing gap and households balance is negative, while the impact on GDP is positive. The effect on CAS is also negative, because high consumption pushes up imports.

Figure 18: Simulated Impact of Transitory 1-std-dev. Improvement in Equity Prices





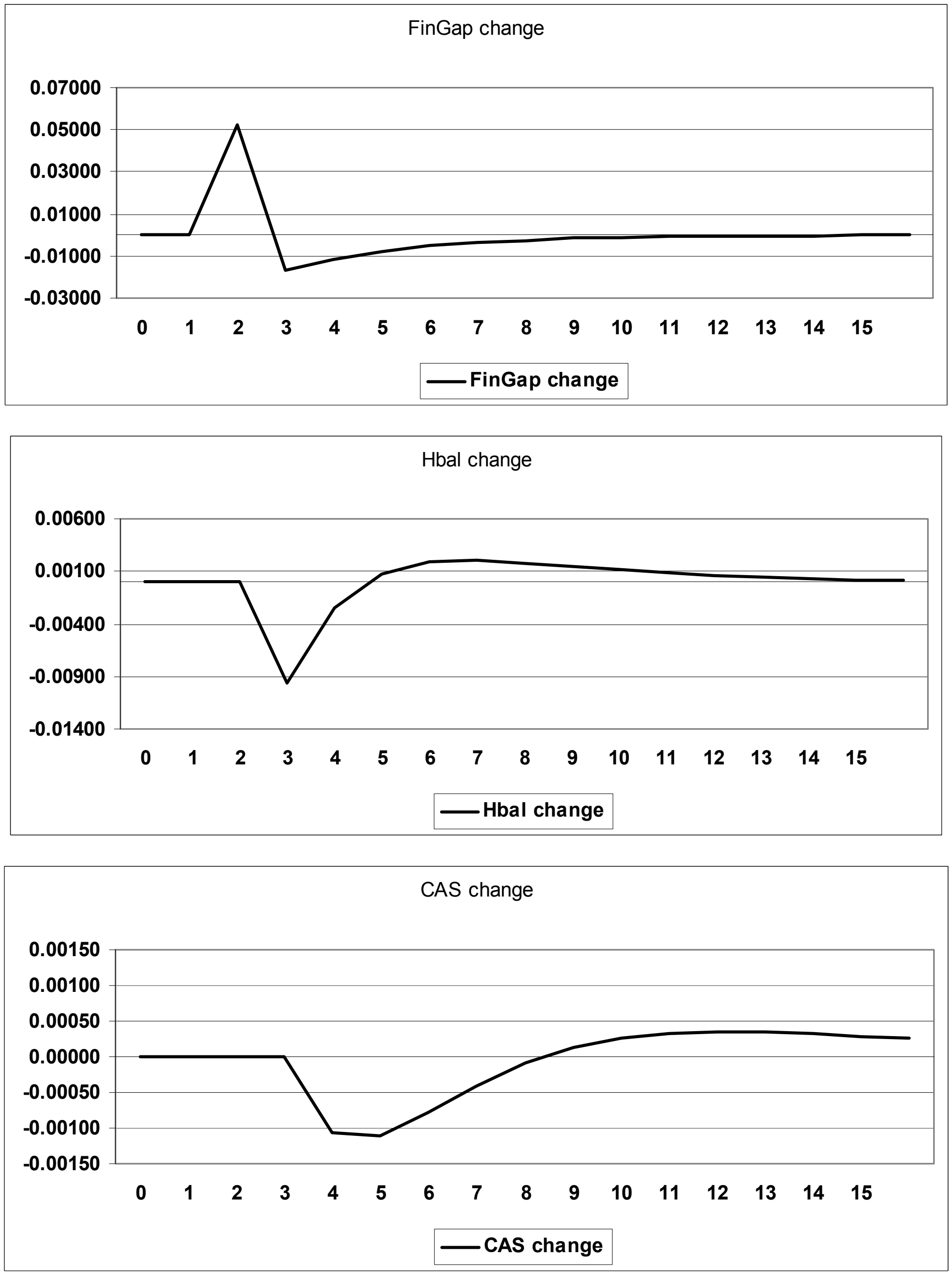


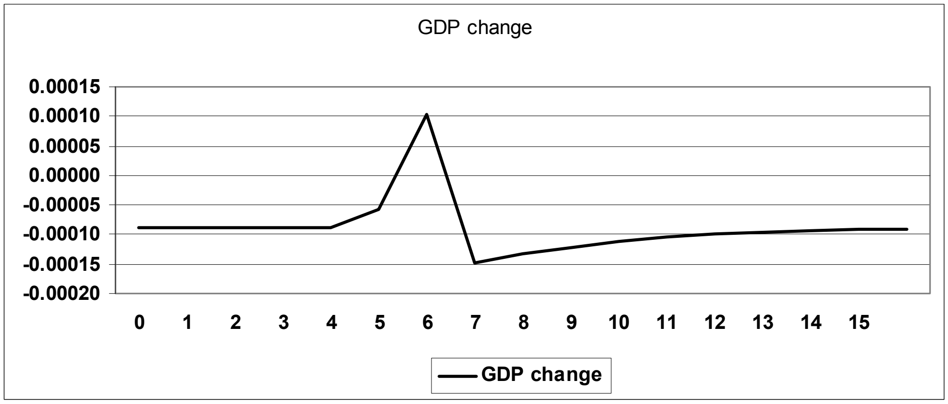


Source: Authors' calculations. Note: The periods on x axes indicates quarters from shock.

Yield spread and profits share shock produce a positive impact on financing gap and GDP after some lags (4 periods as we expect). The effect on households balance and CAS is negative. In the first case this is because FinGap enters as explanatory variable with negative sign; in the second case this happens because of reductions first in Hbal influences imports and then in CAS in the same direction.

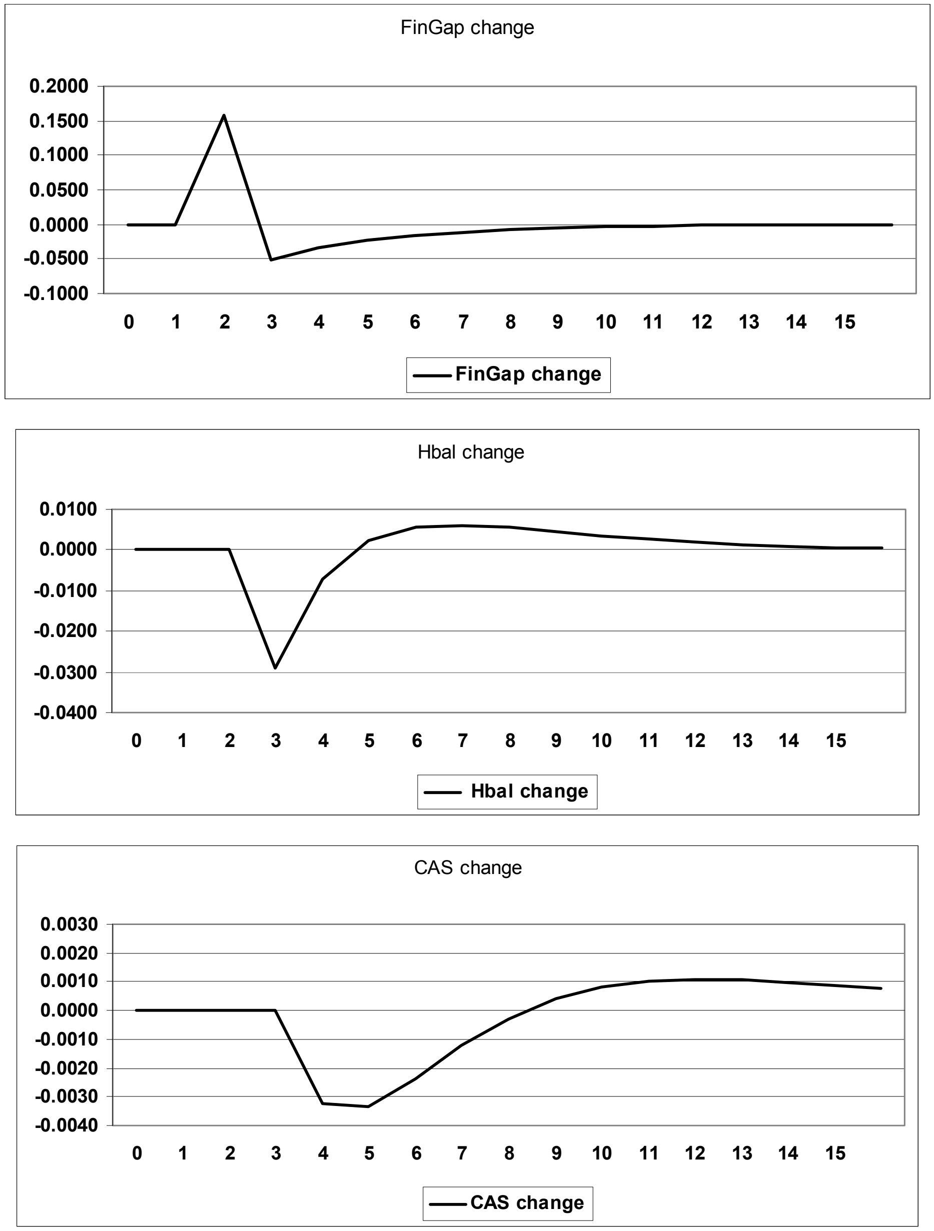
Figure 19: Simulated Impact of Transitory 1-std-dev. Improvement in Yield Spread (CV Spread)

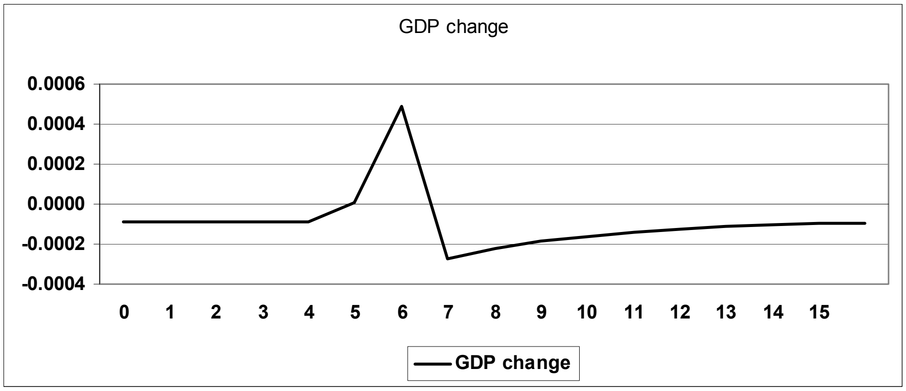




Source: Authors' calculations. Note: The periods on x axes indicates quarters from shock.

Figure 20: Simulated Impact of Transitory 1-std-dev. Improvement in Profits Share

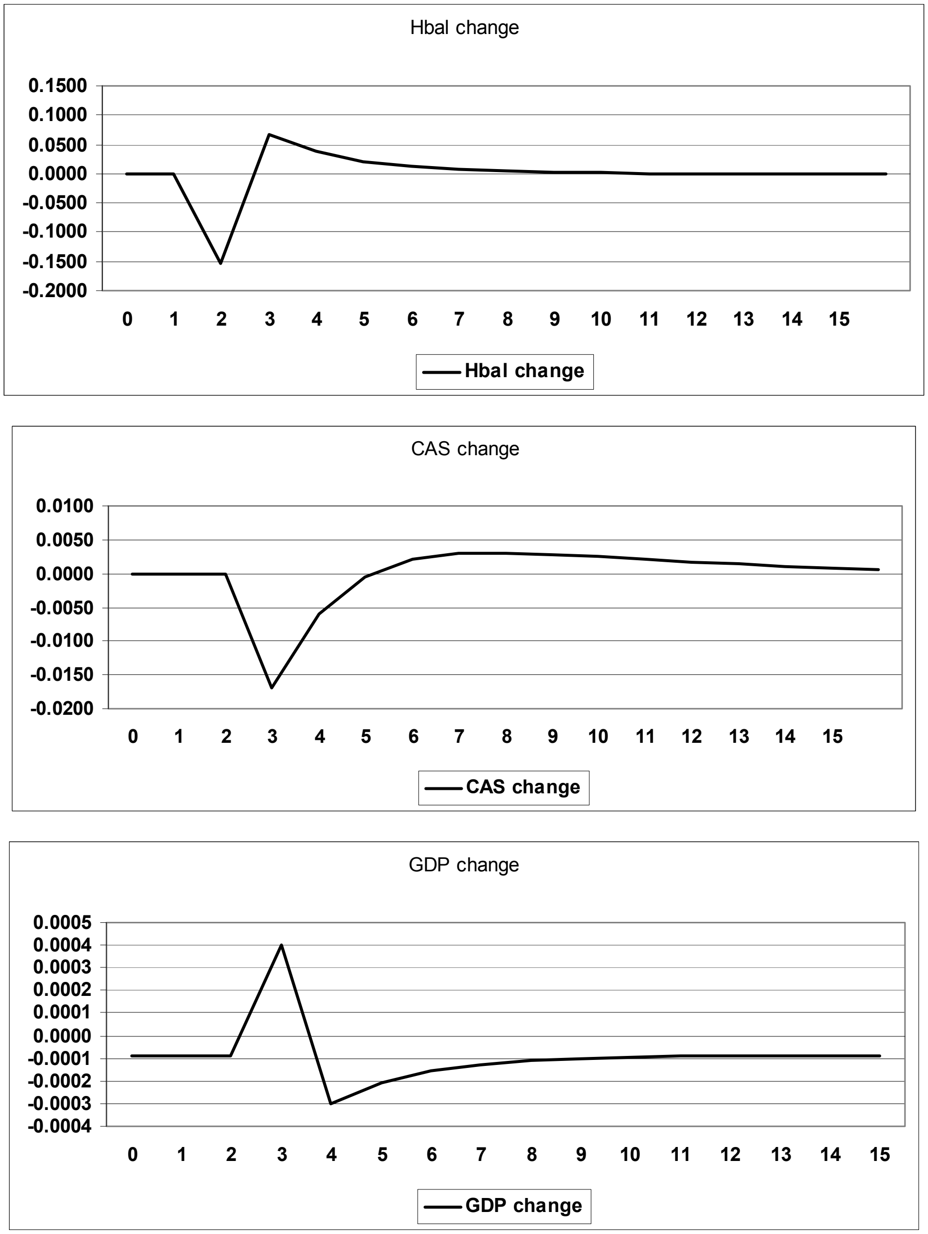




Source: Authors' calculations. Note: The periods on x axes indicates quarters from shock.

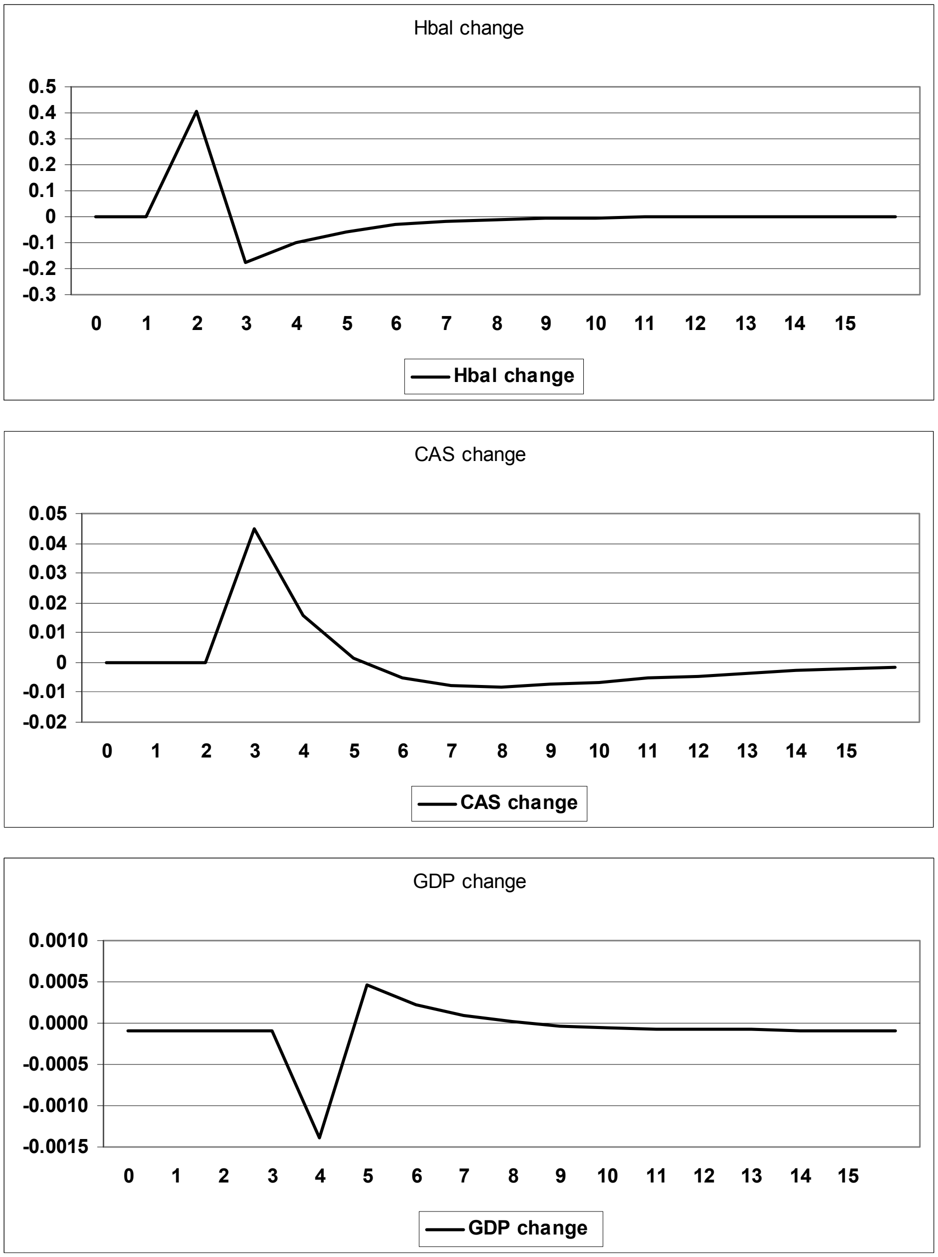
House prices inflation and 10-year T-note yield are shocks which only influence households balance. The effect of these shocks on CAS go in the same direction as Hbal, while the effect on GDP growth goes in the opposite direction

Figure 21: Simulated Impact of Transitory 1-std-dev. Improvement in House Prices Inflation



Source: Authors' calculations. Note: The periods on x axes indicate quarters from shock.

Figure 22: Simulated Impact of Transitory 1-std-dev. Improvement in 10-year T-note Yield



Source: Authors' calculations. Note: The periods on x axes indicates quarters from shock.

CONCLUSIONS

We have studied a model of the U.S. economy based on the financial sectors' balances approach developed by GS and inspired by the works of Godley. The main conclusions of this work are the following:

- Financing gap, a variable which captures the financial instability hypothesis by Minsky, is a leading indicator of the cycle accordingly to stylized facts analysis, econometric estimates, and the simulations conducted. A positive shock on the investment side causes an immediate rise in GDP and the relationship between FinGap and GDP is, obviously, negative. A positive shock on the internal fund side, instead, causes a rise in GDP with a lag of 4-5 quarters because business investments start with a lag (firms wait confirmations coming from profits and GDP cycle, this being previously stimulated by inventories change and consumption). The relationship between FinGap and GDP is positive. Historically, the second effect is dominant.

- All equilibrium sectors' balances depend on assets market variables. Financing gap is influenced by equity prices and yield spread; households balance depends on equity and housing prices, and 10 year T-note yield; foreign balance depends on trade weight dollar and oil price. The long run relationships found are all statistically significant.

- The sectors' balances discrepancies from equilibrium cause an effect on output cyclical growth. In particular, a negative discrepancy in the financing gap balance implies a negative effect on future cyclical growth because firms will cut their investments, with a negative effect on GDP, in order to close the gap with long-run equilibrium. A negative discrepancy in the households balance produces, instead, a positive effect on cyclical growth because an increase in consumption or residential investment expenditures has a more immediate (positive) impact on GDP growth. Foreign balance does not enter into the GDP cyclical growth equation because its dynamic, from an econometric point of view, is captured by households balance and oil price dynamics. An impulse and response analysis confirms the results obtained in our econometric estimates and stylized facts analysis conducted.

APPENDIX A

Data Descriptions

All data used in our estimations are taken from Flow of Funds Accounts (FoF):

Household financial balance = gross saving (line 10 of table F.100 in the FoF)– capital expenditures (line 12 of table F.100 in the FoF);

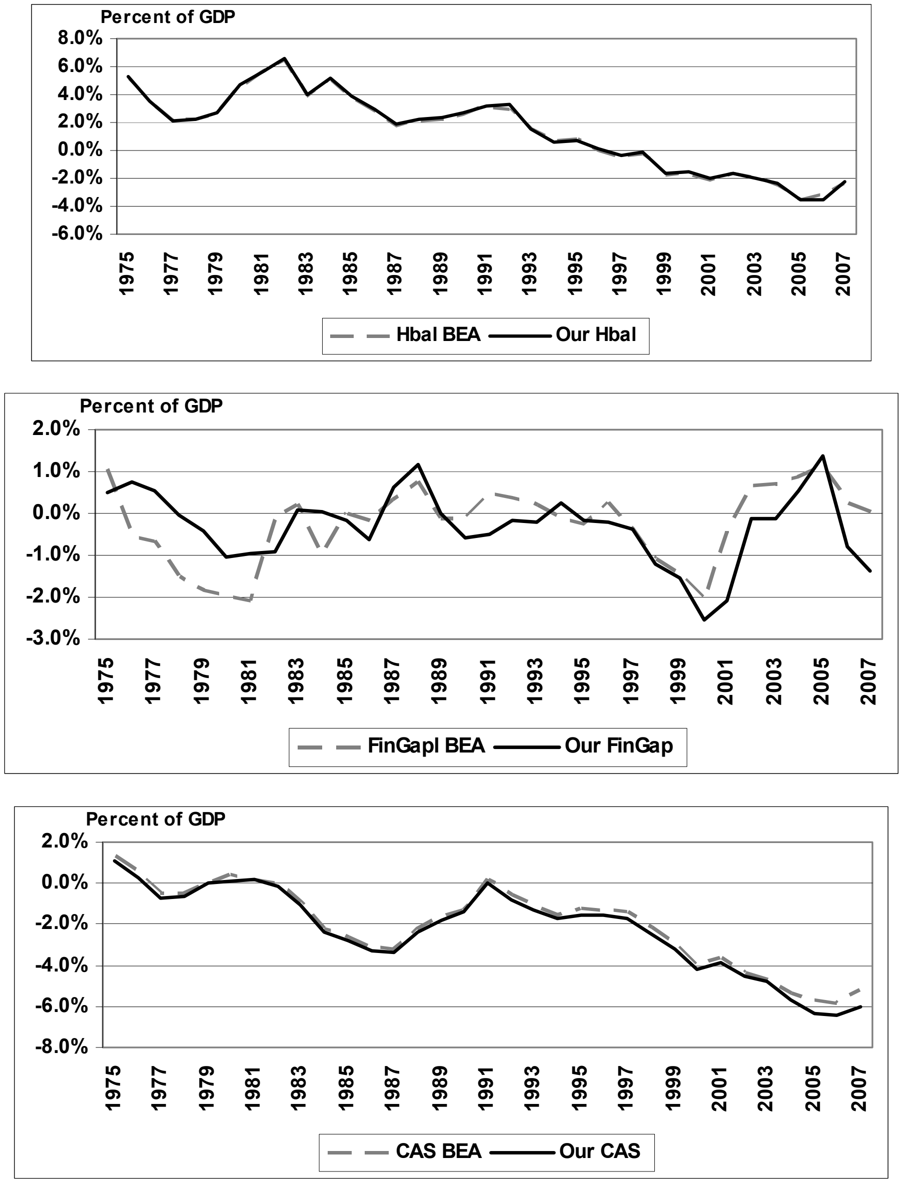
Corporate financial balance = U.S. internal funds (line 5 of table F.102 in the FoF)– fixed investment (line 12 of table F.102 in the FoF);

Current Account Balance (line 62 of table F.107 in the FoF).

All balances are normalized for nominal GDP.

BEA releases selected aggregates series for sectors of the economy (that is, corporate business, households, and nonprofit institutions, Federal government and State and local government, rest of the world) in annual series. We make a comparison between our data and the BEA series. From the figure below, we can see that our series for households and the foreign sector are equivalent to BEA version, while our measure of financing gap (non financial corporate business sector without considering inventories accumulation) is different in value but contains the same information since the dynamic of the two series is similar.

Figure A 1: BEA Sectors Balance vs Our sectors' Balance Measures



Other data used in this work are the following:

US10y = 10-Year Treasury Constant Maturity Rate (Board of Governors of the Federal Reserve System);

US10yma = 10-Year Treasury Constant Maturity Rate relative to its average over the prior two years;

GDP = Y = Nominal GDP (Federal Reserve System, Flow of Funds Accounts of the United States);

Eq = U.S. Share Price Index (DATASTREAM, code USQ62...F);

Eq/GDP = U.S. Share Price Index normalized for nominal GDP;

Fed Funds = Federal Funds Rate (Board of Governors of the Federal Reserve System);

CV spread = US10y – Fed Funds;

Baa yield = Moody's Seasoned Baa Corporate Bond Yield (Board of Governors of the Federal Reserve System);

Baa spread = Baa yield - US10y;

Profits (Π) = US Nonfinancial Corporate Profits (with inventory valuation and capital consumption adjustments) (Bureau of Economic Analysis);

Profits/GDP = (Π/Y);

P^h = OFHEO House Price Index (Office of Federal Housing Enterprise Oversight);

$\Delta_4 p^h$ = p^h inflation;

Oil = Price of West Texas Intermediate Crude;

Twusd = Real broad trade weighted dollar index (Board of Governors of the Federal Reserve System);

In estimations Eq and p^h are deflated using Consumer Price Index (Bureau of Labor Statistics).

Unit Root test

In this section of the appendix we present unit root tests for variables considered in the analysis. All series are I(1), except CV spread and Baa spread. The table below presents the results in detail.

Table A 1: Dickey - Fuller Tests for Unit Roots (1975q1 - 2007q2)

	Dickey Fuller t - Statistics		Critical values	
			-3.44	-3.15
FinGap*	-3.25		-3.44	-3.15
Hbal	-2.97		-3.44	-3.15
CAS	-1.73		-3.44	-3.15
Eq	-2.13		-3.44	-3.15
Eq/GDP	-2.31		-3.44	-3.15
CV spread*	-2.88		-2.88	-2.58
Baa spread*	-3.3		-2.88	-2.58
$\Delta_4 p^h$	-2.43		-3.44	-3.15
Π/Y	-1.9		-3.44	-3.15
Us10y	-1.01		-2.88	-2.58
Us10yma	-0.57		-2.88	-2.58
Oil	-0.37		-3.44	-3.15
twusd	-2.53		-3.44	-3.15

Source: authors' calculations. Values, except for fed fund, are in real per capita terms. The series includes a time trend except for us10y, us10yma, cvspr and Baa spr which includes only an intercept term. Lag length based on AIC criteria. Critical values suggested by MacKinnon (1991). * Phillips-Perron test confirms that Baa spread and CV spreads are I(0), while FinGap is I(1).

APPENDIX B

DOLS and Johansen Approach

One method of extracting the long-run coefficients is proposed by Stock and Watson (1993). This method has two important properties which are relevant in our case: (1) it takes into account and corrects the presence of endogeneity among regressors (if this is present); (2) it allows for cointegrated variables which are an integration of mixed I(0) and I(1) (or also higher order).

The Stock-Watson method is a robust single equation approach that corrects for regressor endogeneity by the inclusion of leads and lags of first differences of the regressors. Hayashi (2000, pp. 654 - 657) gives a complete description of this aspect.

The DOLS estimation doesn't require that each variable is I(1). The DOLS method, in the version developed by Stock and Watson (1993), allows variables integrated from different orders to be combined with I(1) variables in the cointegrating relationship. The DOLS procedure of estimating the long-run relationship basically involves regressing any I(1) variables on other I(1) variables, on any I(0) variables and leads and lags of the first difference of any I(1) variables. As we can see in Table A 1, CV spread is I(0). Consequently, in our estimation of financing gap, CV spread enters only in levels.

The Johansen-Juselius cointegration procedure requires that variables are I(1). It is, however, possible to have a mixture of different order series when there are three or more series under consideration (Charemza and Deadman (1992); Pesaran and Pesaran (1997); Masih and Masih (2000); Pesaran et al. (2001, p. 315, footnote 39)). In particular, the Johansen procedure can admit both I(1) only or a mixture of I(1) and I(0) processes in the system with at least two explanatory variables integrated of I(1).

APPENDIX C

GS estimation results

Table C1: GS Estimation of Financing Gap (FinGap) (ECM Estimated by OLS)

$$\Delta FinGap_t = \beta_0 + \beta_1 FinGap_{t-1} + \beta_2 baaspread_{t-1} + \beta_3 \ln\left(\frac{Eq_{t-1}}{GDP_{t-1}}\right) + \varepsilon_t$$

GS version⊥				
Sample period	β0	β1	β2	β3
1970q1 2003q1	-1 (4.6)	-0.27 (5.4)	0.43 (4.8)	-0.29 (2.1)
R^2	0.24			
DW	2.02			

Long-run relationship: $FinGap_t = -3.83 + 1.63 baaspread_t - 1.11\left(\frac{Eq_t}{GDP_t}\right)$

⊥ **GS directly estimates an Error Correction Model by OLS. The implied coefficient for long-run relationship are inferred from ECM estimation by assuming that $\Delta FinGap_t$ in equilibrium is zero.**

Our version				
Sample period	β0	β1	β2	β3
1975q1 2003q1	-1.69 (2.4)	-0.2 (4.1)	0.33 (4.4)	-0.15 (1.2)
R^2	0.19			
DW	2.1			

Long-run relationship: $FinGap_t = -8.58 + 1.66 baaspread_t - 0.77\left(\frac{Eq_t}{GDP_t}\right)$

Our version				
Sample period	β0	β1	β2	β3
1975q1 2007q2	-1.35 (1.8)	-0.22 (4)	0.3 (3.8)	-0.1 (0.7)
R^2	0.17			
DW	2			

Long-run relationship: $FinGap_t = -6.25 + 1.39 baaspread_t - 0.45\left(\frac{Eq_t}{GDP_t}\right)$

Note: t statistics in parenthesis.

Table C2: DOLS[⊥] Estimation of GS Financing Gap (FinGap)

$$FinGap_t = \gamma_0 + \gamma_1 baaspread_t + \gamma_2 \ln\left(\frac{Eq_t}{GDP_t}\right) + \sum_{j=-3}^{3}\gamma_{2,j}\Delta\ln\left(\frac{Eq_{t+j}}{GDP_{t+j}}\right) + \varepsilon_t$$

Long-run relationship: $FinGap_t = \gamma_0 + \gamma_1 baaspread_t + \gamma_2 \ln\left(\frac{Eq_t}{GDP_t}\right) + u_t$

Sample period	γ_0	γ_1	γ_2
1975q1 2003q1	-3.8 (1.5)	0.38 (1.8)	-0.34 (0.7)

Sample period	γ_0	γ_1	γ_2
1975q1 2007q2	-1.61 (0.6)	0.32 (1.5)	0.01 (0.03)

The reported t-statistics (in parenthesis) are corrected for bias stemming from serial correlation and heteroskedasticity by the Newey-West procedure. The method of estimation is DOLS [Stock andWatson 1993]. Regression includes an intercept, contemporaneous plus three leading and three lagging values of equity GDP ratio. Baa spread is expressed only in levels because it is I(0) (see appendix B for details). **[⊥] Cointegration tests are not applied because not all variables in long term relationships are statistically significant, and for this reason we can directly conclude that a cointegration does not exist.**

Table C3: GS Estimation of Household Balance (Hbal) (ECM Estimated by OLS)

$$\Delta Hbal_t = \beta_0 + \beta_1 Hbal_{t-1} + \beta_2 us10yma_{t-1} + \beta_3 \ln\left(\frac{Eq_{t-1}}{GDP_{t-1}}\right) + \varepsilon_t$$

GS version[⊥]				
Sample period	β_0	β_1	β_2	β_3
1960q1 2003q1	1.2 (4.3)	-0.2 (4.9)	0.2 (4.7)	-0.83 (3.8)
R^2	0.2			
DW	2.44			

Long-run relationship: $Hbal_t = 5.86 + 1.02us10yma_t - 4.2\left(\frac{Eq_t}{GDP_t}\right)$

[⊥] GS directly estimates an Error Correction Model by OLS. The implied coefficient for long-run relationship is inferred from ECM estimation by assuming that $\Delta Hbal_t$ in equilibrium is zero.

Our version				
Sample period	β0	β1	β2	β3
1975q1 2003q1	-4.93 (3.1)	-0.34 (5.5)	0.2 (3.9)	-0.73 (2.3)
R^2	0.24			
DW	2.2			

Long-run relationship: $Hbal_t = -14.64 + 0.6us10yma_t - 2.17\left(\frac{Eq_t}{GDP_t}\right)$

Diagnostic Tests

Serial Correlation	**Obs* R-Squared** 3.7	**Prob.** 0.29	**F – Statistic** 1.2	**Prob.** 0.31
Functional Form	**Log likelihood ratio** 15.5	**Prob.** 0	**F – Statistic** 16	**Prob.** 0
Normality	**Jarque – Bera** 8	**Prob.** 0		
Heteroskedasticity	**Obs* R-Squared** 7.3	**Prob.** 0.3	**F – Statistic** 1.2	**Prob.** 0.3

Our version				
Sample period	β0	β1	β2	β3
1975q1 2007q2	-3.68 (2.7)	-0.26 (5.4)	0.2 (4)	-0.47 (1.6)
R^2	0.21			
DW	2.2			

Long-run relationship: $Hbal_t = -13.98 + 0.76us10yma_t - 1.77\left(\frac{Eq_t}{GDP_t}\right)$

Diagnostic Tests

Serial Correlation	**Obs* R-Squared** 4	**Prob.** 0.27	**F – Statistic** 1.29	**Prob.** 0.29
Functional Form	**Log likelihood ratio** 4.2	**Prob.** 0.05	**F – Statistic** 4.1	**Prob.** 0.05
Normality	**Jarque – Bera** 10	**Prob.** 0		
Heteroskedasticity	**Obs* R-Squared** 6.7	**Prob.** 0.35	**F – Statistic** 1.1	**Prob.** 0.36

Note: A functional form test (Ramsey Reset Test) is conducted assuming a quadratic form. A serial correlation test is conducted assuming a lag = 3. t statistics appear in parentheses.

Table C4: DOLS Estimation of Households Balance (Hbal)

$$Hbal_t = \gamma_0 + \gamma_1 us10yma_t + \gamma_2 \ln\left(\frac{Eq_t}{GDP_t}\right) + \sum_{j=-2}^{2} \gamma_{1,j} \Delta us10yma_{t+j} + \sum_{j=-2}^{2} \gamma_{2,j} \Delta \ln\left(\frac{Eq_{t+j}}{GDP_{t+j}}\right) + \varepsilon_t$$

Long-run relationship: $Hbal_t = \gamma_0 + \gamma_1 us10yma_t + \gamma_2 \ln\left(\frac{Eq_t}{GDP_t}\right) + u_t$

Sample period	γ_0	γ_1	γ_2
1975q1 2003q1	-18 (6.1)	0.39 (3.2)	-3.13 (4.3)
Residual ADF t - test	-3.63*		

Sample period	γ_0	γ_1	γ_2
1975q1 2007q2	-17.5 (5.3)	0.55 (3.8)	-2.76 (3.4)
Residual ADF t - test	-3.14		

Symbols *, **, * represent, respectively, the significance level of 10%, 5% and 1% of residuals ADF t- test. For the residuals ADF t-test, the lag length is chosen by SIC criteria. Critical values for the test are suggested by MacKinnon (1991). The reported t-statistics (in parenthesis) are corrected for bias stemming from serial correlation and heteroskedasticity by the Newey-West procedure. The method of estimation is DOLS [Stock and Watson 1993]. Regression includes an intercept, contemporaneous plus two leading and two lagging values of each explanatory variable.**

Table C5: GS Estimation of Foreign Balance (CAS) (ECM Estimated by OLS)

$$\Delta CAS_t = \beta_0 + \beta_1 Fbal_{t-1} + \beta_2 trend + \beta_3 \ln(twusd_{t-1}) + \varepsilon_t$$

GS version$^{\perp}$				
Sample period	β_0	β_1	β_2	β_3
1980q1 2003q1	10.4 (4.6)	-0.18 (4.1)	-0.007 (3.6)	-2.28 (4.5)
R^2	0.2			
DW	1.98			

Long-run relationship: $CAS_t = 58.51 - 0.04 trend - 12.8 \ln(twusd_t)$

$^{\perp}$ **GS directly estimates an Error Correction Model by OLS. The implied coefficient for a long-run relationship is inferred from ECM estimation by assuming that ΔCAS_t in equilibrium is zero.**

Our version				
Sample period	β_0	β_1	β_2	β_3
1975q1 2003q1	8.69 (5.5)	-0.16 (6.1)	-0.005 (4.2)	-1.89 (5.6)
R^2	0.19			
DW	2			

Long-run relationship: $CAS_t = 54.76 - 0.03trend - 11.89\ln(twusd_t)$

Diagnostic Tests

Serial Correlation	**Obs* R-Squared** 1.92	**Prob.** 0.59	**F – Statistic** 0.61	**Prob.** 0.61
Functional Form	**Log likelihood ratio** 0.07	**Prob.** 0.8	**F – Statistic** 0.07	**Prob.** 0.8
Normality	**Jarque – Bera** 175.6	**Prob.** 0		
Heteroskedasticity	**Obs* R-Squared** 1.23	**Prob.** 0.98	**F – Statistic** 0.19	**Prob.** 0.98

Our version				
Sample period	β_0	β_1	β_2	β_3
1975q1 2007q2	6.84 (4.4)	-0.11 (4.7)	-0.004 (3.9)	-1.47 (4.4)
R^2	0.12			
DW	2.16			

Long-run relationship: $CAS_t = 62.98 - 0.041trend - 13.58\ln(twusd_t)$

Diagnostic Tests

Serial Correlation	**Obs* R-Squared** 4.1	**Prob.** 0.25	**F – Statistic** 1.33	**Prob.** 0.26
Functional Form	**Log likelihood ratio** 0.02	**Prob.** 0.65	**F – Statistic** 0.2	**Prob.** 0.66
Normality	**Jarque – Bera** 95.4	**Prob.** 0		
Heteroskedasticity	**Obs* R-Squared** 3.49	**Prob.** 0.74	**F – Statistic** 0.57	**Prob.** 0.76

Note: The functional form test (Ramsey Reset Test) is conducted assuming a quadratic form. A serial correlation test is conducted assuming a lag = 3. t statistics appear in parentheses.

Table C6: DOLS Estimation of Foreign Balance (CAS)

$$CAS_t = \gamma_0 + \gamma_1 trend + \gamma_2 \ln(twusd_t) + \sum_{j=-2}^{2} \gamma_{2,j} \Delta \ln(twusd_{t+j}) + \varepsilon_t$$

Long-run relationship: $CAS_t = \gamma_0 + \gamma_1 trend + \gamma_2 \ln(twusd_t) + u_t$

Sample period	γ_0	γ_1	γ_2
1975q1 2003q1	37.41 (8)	-0.031 (10.3)	-8.03 (7.9)
Residual ADF t - test	-2.47		

Sample period	γ_0	γ_1	γ_2
1975q1 2007q2	35.63 (5.6)	-0.041 (8.8)	-7.51 (5.4)
Residual ADF t - test	-2.03		

Symbols *, **, * represent, respectively, a significance level of 10%, 5% and 1% of residuals ADF t- test. For the residuals ADF t-test, the lag length is chosen by SIC criteria. Critical values for the test are suggested by MacKinnon (1991). The reported t-statistics (in parenthesis) are corrected for bias stemming from serial correlation and heteroskedasticity by the Newey-West procedure. The method of estimation is DOLS [Stock and Watson 1993]. Regression includes an intercept, contemporaneous plus two leading and two lagging values of each explanatory variable.**

APPENDIX D

Equation of the Simulation Model Based on Stylized Facts About Financing Gap

The model is non-linear and it is characterized by the following equations.

$X \equiv$ profit share = 0.17

Profits = X * GDP

chg profits = (X * GDP) – profits lag 1

GDP = AD + Invest

Invest = exog + profits lag 5 * 0.5 + GDP lag 3 * 0.5

exog = autonomous investment component = 0

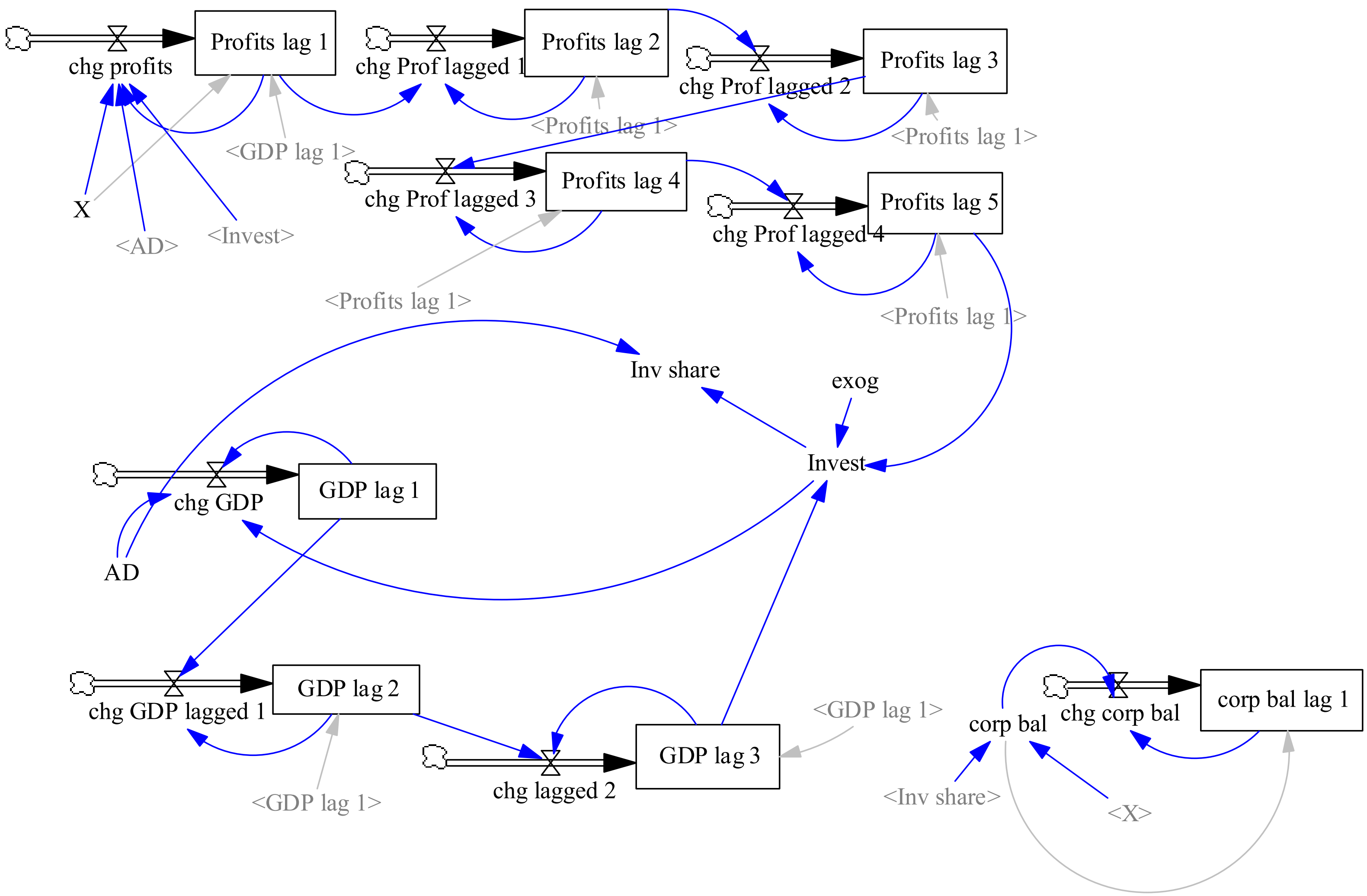
Inv share = $\frac{Invest}{(AD + Invest)}$

Corp bal =X – Inv share

chg corp bal = corp bal – corp bal lag 1

In Figure D 1 there is a formalization in the system dynamics language (Vensim) of the model. In the numerical simulation, the parameter and initial values (for AD) chosen are somewhat plausible and reasonable.

Figure D1: Simulation Model with Exogenous Profits Share

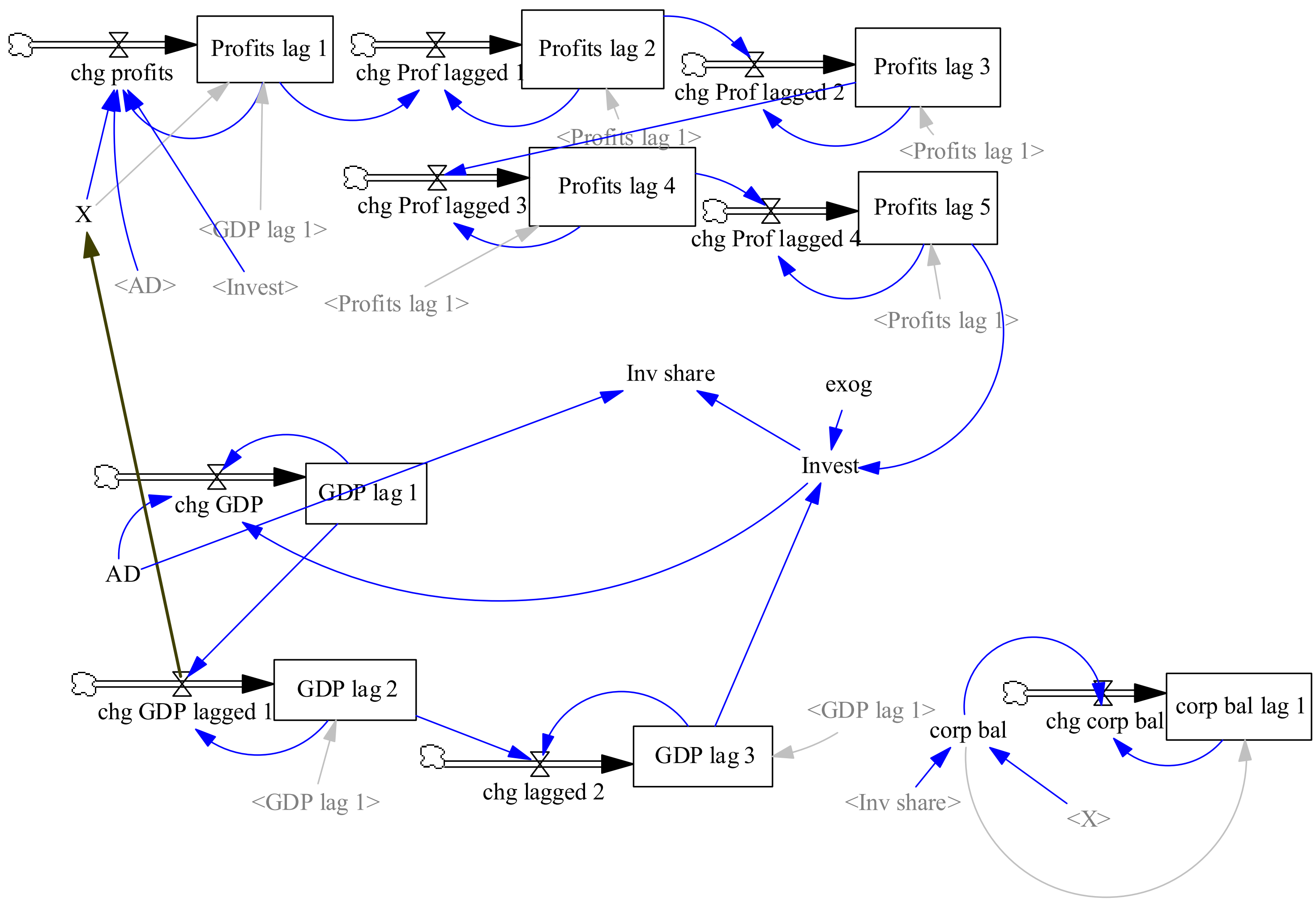


In the model with endogenous profits' share, the only change to the previous model is in the equation of profits' share that includes a lagged GDP variation in addition to an autonomous component denoted by fixed parameter 0.17:

X = profit share = 0:17 + chg GDP lagged1 * 0:0013

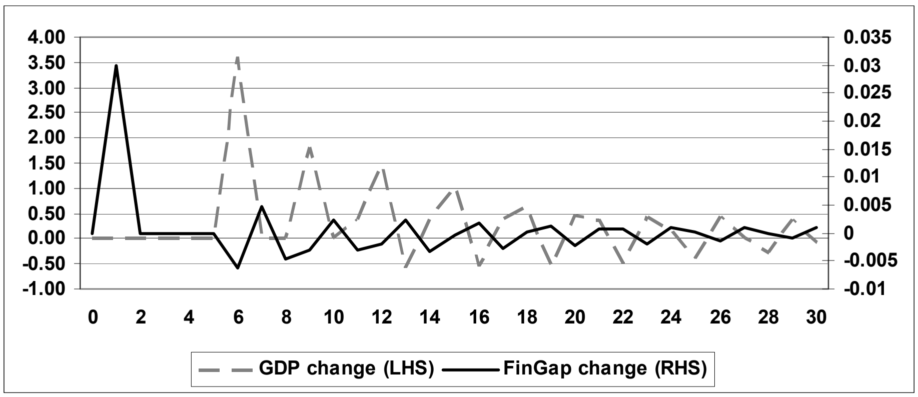
The idea is that profits' share incorporates the change in economic condition with a lag, because behind the profits' share there are wages bargaining which take a period to incorporate these changes.

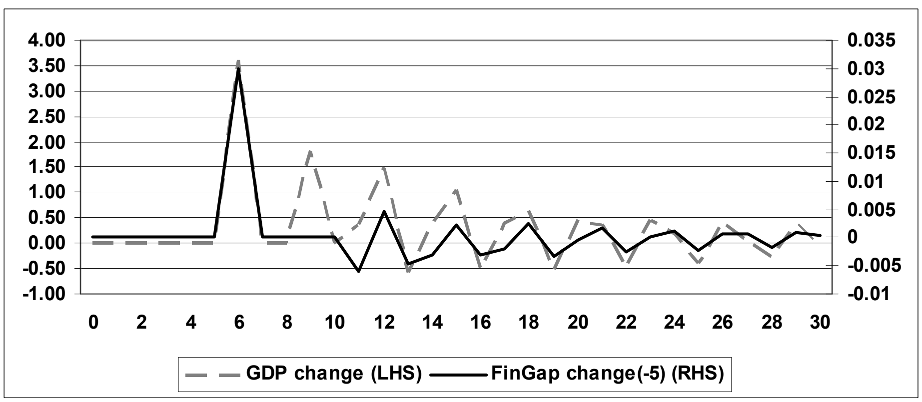
Figure D2: Simulation Model with Endogenous Profits' Share



A shock to the exogenous parameter in the profits' share equation generates an oscillation in financing gap (chg corp bal) and GDP change which tend to decrease over time. The relationship, caused by this shock, between financing gap and GDP is positive with a lead of 5 periods (quarters) by financing gap.

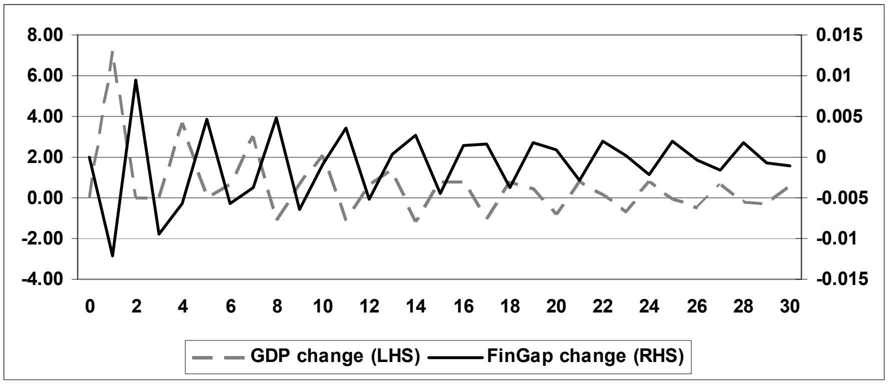
Figure D3: Simulation Result of a Profits' Share Shock in Model with Endogenous Profits' Share





A shock to the exogenous parameter in the investment equation generates an oscillation in financing gap (chg corp bal 1) and GDP change with a negative relation as we expected. The peaks and troughs in financing gap change correspond to troughs and peaks in GDP change.

Figure D4: Simulation Result of Investment Shock in Model with Endogenous Profits Share



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