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Did the FED Inflate a Housing Price Bubble? A Cointegration Analysis between the 1980s and the 1990s

by

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ABSTRACT

The aim of this work is to verify if the recent episodes of expansionary policies followed by the FED contributed to the creation a housing price bubble. This study compares two different samples, both including periods of recession followed by accommodating monetary policies. The paper showed that even though the long-run relationship between inflation and the interest rate did not change along the whole sample, suggesting an unaltered behavior of the central bank with respect to changes in inflation, the reactivity of housing prices to monetary policy has considerably augmented during the 1990s compared to the 1980s. This is interpreted as evidence that prolonged accommodating monetary policies affected the US real estate market.

Keywords: Housing Price Bubble, Monetary Policy, Cointegration.

JEL Classification: E31, E41, E52.

NON-TECHNICAL SUMMARY

Following a classical text-book analysis, an expansionary monetary policy involves four steps: first, the central bank reduces the interest rate; then after some lag, the economy reacts, showing an increase in aggregate demand; next prices rise; finally the central bank raises the interest rate in order to stabilize the economy. Considering the United States, it seems that since the year 2000, this country had a different experience. After the easing of monetary policy and the positive affect in aggregate demand, an equivalent increase in price, similar to the one observed in previous periods, has not been observed. The following elements may explain the smaller reaction of inflation to the change in monetary policy; the most relevant has been the entry of China into the global economy; the manufactured goods exported by China and the other Asian countries use labor-intensive technologies, due to the low labor cost in Asia. These phenomena have reduced the wage pressure and prices of imported goods, considering moreover the de facto peg of many Asian currencies to the US dollar. In this case, central banks can prolong an accommodating policy. This does not occur without costs. In the US, there exist different imbalances. Households are hugely indebted and the current account deficit is reaching new records (among others IMF (2005)). Recently the Bank of International Settlement BIS (2005) claimed that inflation targets are set at a level considered too high. Therefore, for monetary authorities it is quite easy to reach their targets. This kind of monetary policy may be creating imbalances in the real estate market. Mortgage rates are at an historically low level and households are decreasing their savings and are buying houses. Based on the data collected it seems that during the last decade the excess of liquidity present in the economy was invested in the housing market rather than in the asset market, which is considered more stable and trustworthy. This type of investment is increasing the existing US economy imbalances; the wealth effect generated by a rising of housing prices is pushing up consumption, therefore increasing the current account deficit and the household indebtedness (see Cecchetti (2005) and the Economist (2005)). The paper showed that even though the long-run relationship between inflation and the interest rate did not change along the whole sample, suggesting an unaltered behavior of the central bank with respect to changes in inflation, the reactivity of housing prices to monetary policy has considerably augmented during the 1990s compared to the 1980s. This is interpreted as evidence that prolonged accommodating monetary policies affected the US real estate market.

LA FED HA CONTRIBUITO AD AUMENTARE LA BOLLA DEL MERCATO IMMOBILIARE STATUNITENSE? UNA ANALISI DI COINTEGRAZIONE TRA GLI ANNI '80 E '90

SINTESI

Scopo del presente lavoro è stato quello di verificare se recenti episodi di politiche monetarie accomodanti negli Stati Uniti abbiano contribuito alla creazione di bolle speculative nel mercato immobiliare statunitense. A tal fine, questo lavoro confronta due periodi differenti, entrambi caratterizzati da fasi di recessione ed espansione del ciclo economico. L'articolo mostra che, anche se la relazione di lungo periodo che lega l'iflazione al tasso di interesse sia rimasta inalterata durante tutto il campione, suggerendo un comportamento della FED immutato per quanto concerne la reazione del tasso d'interesse a variazioni dell'inflazione, la sensibilità dei prezzi delle case a cambiamenti della politica monetaria è considerevolmente aumentata negli anni '90 rispetto agli anni '80. Pertanto, sembra che prolungati periodi di politica monetaria accomodante abbiano influenzato il mercato immobiliare statunitense.

Parole chiave: Bolla speculativa nel mercato immobiliare, politica monetaria, cointegrazione.

Classificazione JEL: E31, E41, E52.

CONTENTS

1 Introduction

Following a classical text-book analysis [1], an expansionary monetary policy involves four steps: first, the central bank reduces the interest rate [2]; then after some lag, the economy reacts, showing an increase in aggregate demand; next prices rise; finally the central bank raises the interest rate in order to stabilize the economy. Considering the United States, it seems that since the year 2000, this country had a different experience. After the easing of monetary policy and the positive affect in aggregate demand, an equivalent increase in price, similar to the one observed in previous periods, has not been observed. The following elements may explain the smaller reaction of inflation to the change in monetary policy; the most relevant has been the entry of China into the global economy; the manufactured goods exported by China and the other Asian countries use labor-intensive technologies, due to the low labor cost in Asia. These phenomena have reduced the wage pressure and prices of imported goods, considering moreover the *de facto* peg of many Asian currencies to the US dollar. In this case, central banks can prolong an accommodating policy. This does not occur without costs. In the US, there exist different imbalances. Households are hugely indebted and the current account deficit is reaching new records (among others IMF (2005)). Recently the Bank of International Settlement BIS (2005) claimed that inflation targets are set at a level considered too high. Therefore, for monetary authorities it is quite easy to reach their targets. This kind of monetary policy may be creating imbalances in the real estate market. Mortgage rates are at an historically low level and households are decreasing their savings and are buying houses.

Based on the data collected it seems that during the last decade the excess of liquidity present in the economy was invested in the housing market rather than in the asset market, which is considered more stable and trustworthy. This type of investment is increasing the existing US economy imbalances; the wealth effect generated by a rising of housing prices is pushing up consumption, therefore increasing the current account deficit and the household indebtedness (see Cecchetti (2005) and the Economist (2005))

The methodology for analyzing this issue is the following: using a cointegrated VAR, the sample was split into two sub-periods, where the second one includes the beginning of the house bubble (a similar approach can be found, among others, in Iacoviello and Minetti (2003) and McCarthy and Peach (2002)). In both subperiods three long-run relationships were found:

[1] I would like to thank Massimo Franchi, Michelle McMeel and Paolo Zanghieri and an anonymous referee for their suggestions. The views expressed in the article are those of the author and do not involve the responsibility of BNP Paribas and that of the Italian Ministry of Economy and Finance, where I was working when I wrote this article.

[2] Another possibility is that the monetary authority could increase the amount of money.

the money demand, the Fisher equation and an equation relating the housing prices to the real GDP and to the interest rate. The last equation shows how, in the second sample, housing prices are highly more sensitive to the interest rate, and hence to the monetary policy, than in the first period.

On the contrary, the relationship between inflation and the interest rate did not change along the whole sample, suggesting an unaltered behavior of the central bank with respect to changes in inflation.

These results, based on the US economy, contribute to the debate of housing prices and monetary policy, (among others Bean (2003)) attempting to quantify the effects of prolonged expansionary monetary policies on the housing market. If a central bank aims at stabilizing the economy, it has to consider, in a more appropriate way, both asset markets and housing markets, otherwise it can cause serious problems once the bubbles burst. This paper leaves for future research the way to evaluate how asset markets and housing markets have to be considered by the monetary authorities, working along the line suggested by Bernanke and Gertler (2001) and recently by Iacoviello (2005)[3].

The paper is organized in the following way: section 2 describes the data set used; section 3 describes the methodology used and presents the results; conclusions are presented in section 4.

2 The data set used

To compute this empirical analysis quarterly data from the US economy was used. A VAR, constituted by the following variables $X_t = [y; mp3; qq; i; \pi]'_t$, was considered, where y is the real GDP in logarithm, $mp3$ is the real quantity of money in logarithm, that is $\log(M3) - \log(CPI)$; qq is the logarithm of the real housing prices, deflated using the US consumer price index; i is the short term interest rate, and finally π is the inflation rate. The data for the GDP and π comes from Datastream ; $M3$ and i come from the US Federal Reserve; the housing prices are taken from the Office of Federal Housing Enterprice Oversight. [4]

[3]It can be shown that estimating by GMM a Taylor rule for the US economy, relating interest rate to expected inflation and output gap, adding to the instruments list also the housing price variable, the null hypothesis of orthogonality condition is not rejected; therefore this variable, even though it can be a valid information for the monetary authority, does not enter into this rule which seems to replicate the behavior of the interest rate quite well. The results are available upon request by the author.

[4]The data for m and i can be found at http://www.federalreserve.gov/ and for the housing prices at http://www.ofheo.gov/HPI.asp

The data set runs from the first quarter of 1975 until the fourth quarter of 2005; quarterly data was used due to the absence of monthly data for housing prices.

The sample is split into two parts where each part includes periods of recession followed by expansionary monetary policies. Due to the lack of sufficient information in the second sample we fixed the break point at the beginning of 1991. [5]

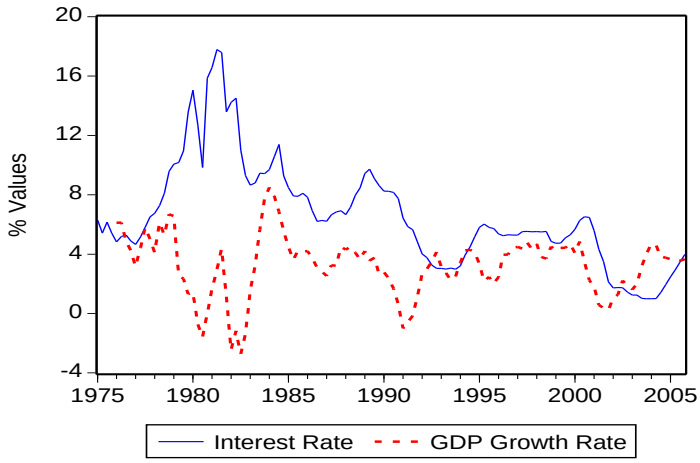

Figure 1: GDP Growth rate and Interest Rate.

Figure 1 shows the behavior of the GDP growth rate and of the interest rate. At the end of the 1970s the oil supply shocks dropped the GDP and increased the interest rate. After a period of expansion, the economic activity decreased during the second half of the 1980s with a negative peak corresponding to the the First Gulf War. The second half of 1990s showed the expansion of the US stock market followed by a recession which began in the year 2000. The interest rate, if we exclude the turbulence related to the oil supply shocks, followed the path of the GDP growth rate.

Consumer price inflation and housing inflation had a similar path from the beginning of the sample until the first half of the 1990s; from this point they seem to diverge. As shown in Figure (2) during the 1970s and the 1980s the inflation and the growth rate of M3 followed a similar path. Since the 1990s this strong correlation has disappeared. Figure 2 shows how, from the beginning of 1990s, the growth rate of money and the housing inflation had similar

[5] I tried different end points for the first sample, making it longer. The results did not change substantially. However the longer the first period, the smaller the second one, making the obtained results less reliable. Some commercial banks, for instance "IXIS Corporate and Investment Bank" (Artus (2003)), analyzing similar phenomena, split the sample in the same way.

behaviors rather than inflation and growth rate of money, which are variables that normally behave in a similar way.

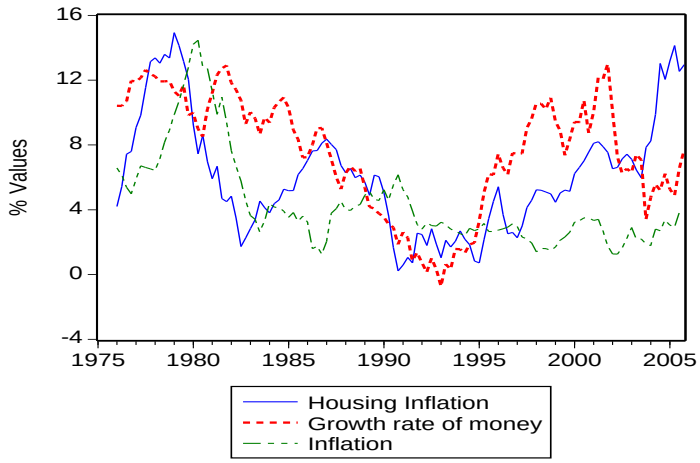

Figure 2: Expansionary monetary policies, Housing Inflation and Inflation.

Many factors can explain the behavior of these variables. As reported by international organizations and research institutes (BIS (2005), IMF (2005), IMF (2006), the Economist (2005)) the entry of China into the global economy, with its large quantity of labor force, is pushing down the cost of labor and the costs of manufacturing goods that make use of labor-intensive technologies. Moreover thanks to the so called "Bretton Woods II system" of exchange rates (see for instance Rubin and Setser (2004), or Eichengreen (2004)), the major Asian currencies are *de facto* pegged to the US dollar and hence, even if the dollar depreciated against the most important currencies, the prices of imported goods would substantially rest unchanged. Indeed, a rise of the share of Asian imported goods of the total US importation was observed and foreign firms preferred to reduce their margins to maintain their market quotas; both are elements which stabilized the prices of imported goods.

These elements could have modified how the economy reacts to changes of monetary policy. The data seems to show that in order to escape from a recession, an accommodating policy can be prolonged given the smaller reaction of inflation. Our goal is to determine if this policy created imbalances in the economy, and in particular, on the real estate sector .[6]

[6]Many reports of international organizations, research Institutes (Baker (2005), the Economist (2005)) show the negative effects of a burst of housing bubbles. Moreover, notice that the wealth effect generated by an increase in housing prices, is postponing the needed adjustment of the US twin deficits.

3 Econometric specification and mis-specification tests

To test if a prolonged expansionary monetary policy inflates an housing price bubble, the following VAR(5) was specified and estimated:[7]

$$X_t = C + A_1 X_{t-1} + A_2 X_{t-2} + A_3 X_{t-3} + \ldots + A_n X_{t-n} + \epsilon_t \tag{3.1}$$

The unobservable terms ϵ_t are independent Gaussian with mean zero and variance Ω; the vector of observed variables , that is $X_t = [y; mp3; qq; i; \pi]'_t$, is constituted by log of real GDP, real money balances, real housing prices, the short term interest rate and inflation. The samples run from the first quarter of 1975 to the last first of 1991 and from the second quarter of 1991 to the last quarter of 2005. Sequential Modified Likelihood ratio test Lutkëpohol (1991), indicated 5 lags in the first sample and 3 in the second one. In both samples the normality of the errors and absence of autocorrelation were tested, supporting our dynamic specification of the system. Let X_t^I be the VAR related to the first sample and X_t^{II}, the one related to the second sample. Table 1 reports the joint test for autocorrelation for both samples and table 2 reports the Jarque-Bera normality test which gives satisfactory results in all cases [8].

LM Test for Autocorrelation				
	First Sample		Second Sample	
Lags	LM-Stat	Prob	LM-Stat	Prob
1	23.820	0.529	36.020	0.071
2	25.291	0.446	29.928	0.227
3	37.133	0.056	27.206	0.345
4	47.025	0.005	31.221	0.182
5	33.009	0.131	37.250	0.055
6	34.132	0.105	31.002	0.189

Table 1: Null hypothesis, absence of autocorrelation up to lag $h = 6$ Prob $\chi(25)$ Degree of Freedom k^2, with k number of variables, see Johansen (1996). First Sample 1975:1 1991:1, Second Sample 1991:2 2005:1

Standard ADF unit-root test indicated that all the variables can be treated as $I(1)$ with the exception of inflation in the second sample. The presence of long-run relationships among the variables was tested using the Johansen (1996) trace test.

With five variables in the VAR three cointegrated relationships were expected:

[7] Iacoviello and Minetti (2003) and Iacoviello (2002) used a specification similar to the one adopted in the paper.

[8] The autocorrelation tests for each variable are available from the author upon request.

Normality: Jarque-Bera Test					
	Res. y	Res. $mp3$	Res. qq	Res. i	Res. π
J-B First sample $\chi(2)$ prob [ ]	0.007 [0.99]	1.275 [0.52]	0.616 [0.73]	0.928 [0.63]	0.179 [0.91]
J-B Second sample $\chi(2)$ prob [ ]	0.497 [0.78]	0.946 [0.62]	0.793 [0.67]	0.278 [0.87]	0.108 [0.95]

Table 2: Jarque-Bera test for the null hypothesis of normality

Output, Real housing prices, Interest Rate Housing price models show that (among others Higgins and Osler (1998),Kalra, Mihaljek, and Duenwald (2000) and Filardo (2004)), due to the constraint represented by the supply factors, values of real estates tend to rise. The GDP takes into account this constraint; indeed it can be seen as the output of the production function, which represents the frontier of the production possibilities given the available factors (Iacoviello (2002)). At the same time the financial sector is a key element in explaining the housing prices, particularly in a period of profound deregulation in the housing finance system (McCarthy and Peach (2002)) where changes of monetary policy affect the mortgage market and hence the housing prices. A similar long-run relationship was found by Honjo, Hunt, Koeva, and Schule (2005), studying the UK real estate market.

Money Balances, Output and Interest Rate At least two possible explanations suggest a stationary relationship among these variables. The first one is the money demand function which relates, positively, real money balances with the GDP and negatively real money balances with the interest rate (Coenen and Vega (1999)); alternatively, as noticed by Galí (1992), the desire of monetary authorities to stabilize the economy can cause instabilities of the nominal variables, suggesting a co-movement among output, money and the interest rate.

Interest Rate and Inflation There are a lot of studies that suggest a stationary relationship between the nominal interest rate and inflation. This can be considered as a sort of the classical *Fisher Equation* where current inflation rather than expected inflation is used.

Given the vector $X_t = [y; mp3; qq; i; \pi]'_t$ the three expected cointegrated vectors can be represented in the following way:

$$\begin{aligned} \beta_1 &= [-\beta_{1y}; 0; 1; \beta_{1i}; 0]' \\ \beta_2 &= [-\beta_{2y}; 1; 0; \beta_{2i}; 0]' \\ \beta_3 &= [0; 0; 0; 1; -\beta_{3\pi}]' \end{aligned} \tag{3.2}$$

where the first one $qq = \beta_{1y}y - \beta_{1i}i$ describes the long-run housing price equation, the second one $mp3 = \beta_{2y}y - \beta_{2i}i$ identifies a long-run money demand schedule and the third one $i = \beta_{3\pi}\pi$ implies a stationary real interest rate.

To check these hypothesis, the equation (3.1) was rewritten in the error correction representation (Johansen, 1996), that is

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{h} \Gamma_i \Delta X_{t-i} + \epsilon_t \tag{3.3}$$

with $h = 4$ in the first sample and $h = 2$ in the second and:

$$\begin{aligned} \Delta X_t &= X_t - X_{t-1} \\ \Pi &= \sum_{i=1}^{n} A_i - I \\ \Gamma_i &= -\sum_{j=i+1}^{n} A_j \end{aligned}$$

where the number of lags (or n) is five in the first sample and three in the second one.

Under the assumption that $X_t \sim I(1)$, the equation (3.3) was rewritten as a reduced rank regression:

$$\Delta X_t = \alpha\beta' X_{t-1} + \sum_{i=1}^{h} \Gamma_i \Delta X_{t-i} + \epsilon_t \tag{3.4}$$

where α and β are the $p \times r$ matrices of full rank r that define the adjustment space $sp(\alpha)$ and the cointegration space $sp(\beta)$.

Under the the Johansen (1996) LR , the null hypothesis of an r dimensional cointegration space was tested against the alternative that X_t is a vector of stationary variables:

$$\begin{cases} H(r): \ rank(\Pi) = r \\ H(p): \ rank(\Pi) = p \end{cases}$$

Under the null hypothesis $H(r)$, the LR statistic $-2lnQ(H(r)|H(p))$, has a non standard distribution and critical values have to be computed numerically (Johansen, 1996).

The results are reported in the next two tables.

I(1)-ANALYSIS First Sample 1975:1 1991:1					
p-r	r	Eig.Value	Trace	Frac95	P-Value
5	0	0.604	122.647	59.961	0.000
4	1	0.487	67.048	40.095	0.000
3	2	0.244	27.044	24.214	0.021
2	3	0.118	10.247	12.282	0.109
1	4	0.044	2.726	4.071	0.115

Table 3: Johansen LR test for the null hypothesis of r against p cointegrating relations . Frac95 corresponds to the critical values $C_{.95}$ as in CATS, new version.

I(1)-ANALYSIS Second Sample 1991:2 2005:1					
p-r	r	Eig.Value	Trace	Frac95	P-Value
5	0	0.567	108.393	59.961	0.000
4	1	0.464	63.980	40.095	0.000
3	2	0.323	30.914	24.214	0.006
2	3	0.175	10.236	12.282	0.109
1	4	0.000	0.013	4.071	0.947

Table 4: Johansen LR test for the null hypothesis of r against p cointegrating relations . Frac95 corresponds to the critical values $C_{.95}$ as in CATS, new version.

In both samples the LR statistics showed that at 95% level of confidence the null hypothesis of 3 cointegrated relationships cannot be rejected.

Therefore in both samples $r = 3$ was chosen. Equation (3.4) is estimated following the Johansen (1996) procedure.

The economy, described by equations (3.2), represents an over-identified structure which can be tested. A LR test (Johansen (1996)) was computed to analyze if the economic specification adopted belongs to the $sp(\beta)$ or not. Table 5 reports the values of the LR statistics and the point estimations. Table 6 reports the estimations of the loading factors.

Data support our identification in both samples (see table (5). The null hypothesis, refereing to this economic specification, cannot be rejected in both samples ($\chi(2) = 5.073$ with

β' For the First Sample					
	y	$mp3$	qq	i	π
Beta(1)	-0.004 $[-1.652]$	0.000 $[NA]$	1.000 $[NA]$	0.010 $[4.829]$	0.000 $[NA]$
Beta(2)	-0.471 $[-195.569]$	1.000 $[NA]$	0.000 $[NA]$	0.033 $[16.534]$	0.000 $[NA]$
Beta(3)	0.000 $[NA]$	0.000 $[NA]$	0.000 $[NA]$	1.000 $[NA]$	-1.000 $[NA]$
β' For the Second Sample					
Beta(1)	-0.036 $[-3.941]$	0.000 $[NA]$	1.000 $[NA]$	0.169 $[11.204]$	0.000 $[NA]$
Beta(2)	-0.858 $[-10.684]$	1.000 $[NA]$	0.000 $[NA]$	1.585 $[11.974]$	0.000 $[NA]$
Beta(3)	0.000 $[NA]$	0.000 $[NA]$	0.000 $[NA]$	1.000 $[NA]$	-1.000 $[NA]$

Table 5: Restricted β. t statistic in square brackets. TEST OF RESTRICTED MODEL : First Sample $\chi(2)$ = 5.073 Prob. = [0.079]; Second Sample $\chi(2)$ =2.847 Prob. = [0.241]

Loading Factors						
	First Sample			Second Sample		
	Alpha(1)	Alpha(2)	Alpha(3)	Alpha(1)	Alpha(2)	Alpha(3)
Δy	-0.122 $[-2.407]$	0.023 $[0.518]$	0.000 $[0.019]$	0.015 $[0.741]$	-0.002 $[-0.795]$	0.001 $[0.652]$
$\Delta mp3$	-0.171 $[-4.088]$	-0.074 $[-2.053]$	0.004 $[2.946]$	0.128 $[2.840]$	-0.014 $[-2.736]$	0.009 $[3.037]$
Δqq	-0.090 $[-1.608]$	-0.022 $[-0.453]$	0.001 $[0.406]$	0.148 $[5.858]$	-0.015 $[-5.075]$	0.001 $[0.608]$
Δi	3.350 $[0.542]$	18.811 $[3.525]$	-0.879 $[-4.488]$	-3.203 $[-3.285]$	0.271 $[2.420]$	-0.083 $[-1.232]$
$\Delta \pi$	8.989 $[3.120]$	-2.331 $[-0.936]$	-0.022 $[-0.237]$	0.409 $[0.295]$	-0.214 $[-1.344]$	0.312 $[3.245]$

Table 6: Loading factors α.

$prob.[0.079]$ for the first sample and $\chi(2) = 2.847$ with $prob.[0.241]$ for the second one[9]). Therefore, with a certain level of confidence, the imposed restrictions describe the behavior of this economy for the whole sample[10].

Looking carefully at the results it emerges:

$\beta(1)'$ **= Housing prices equation** The GDP appears to be positively related with housing prices, showing a positive relationship between investment in real estate (considered a constant fraction of GDP) and housing prices. The high level of investment registered in the second sample explains the higher value of the GDP coefficient of this equation in the second sample. The coefficient of the interest rate in this equation considerably rose between the first and the second sample. Therefore, the effect of a reduction of the interest rate in the second sample has undoubtedly a stronger effect on housing prices. The lower the interest rate, the lower the cost of financing the purchase of a house, and due to the characteristic of the mortgage market in US, which is more flexible and developed with respect to the corresponding European market (see the Economist (2005)), the house-purchase demand increases. This is an evidence of how prolonged accommodating monetary polices affected the real estate market, inflating the housing prices [11]. The expansionary monetary policy, started during the 2000s, was a reaction to the collapse of the the stock exchange and an attempt at avoiding the same errors made by the bank of Japan. However, after the easing of monetary policies, prices did not increase as they did in previous periods. The smaller reaction of inflation to the monetary policy can be explained by many factors. Among them, the low cost of Asian imported goods and the *peg* of Asian currencies to the US dollar, are the most relevant. Those

[9]See Juselius (2003). The degrees of freedom are equal to:$\sum_{i=1}^{r}(s_i - (r-1))$ where s_i is the number of restrictions in each cointegrated vector and r is the number of cointegrated vectors.

[10]An analysis of parameter constancy was conducted using the tests described by Juselius (2003). In particular, considering the first sample as reference period for the β estimation, a recursive estimations of the cointegrated relationships were computed until the forth quarter of 2005. The tests (Eigenvalue Fluctuation Tests, Recursively calculated Trace tests, and tests of Fixed Beta) did not accept the hypothesis of parameter constancy. These results are consistent with the existence of a structural break in the whole sample. Once split the whole sample in two sup-periods, recursive estimations showed coefficient stability separately in both samples.

[11]To confirm these results an out of sample analysis was computed. In particular a structural econometric model, derived from the previous VAR system, was estimated using a Full Information Method (3SLS, see Favero (2001) or Gardini, Cavaliere, Fanelli, and Paruolo (2000)) for the first sample. Dealing with housing inflation, it emerged that the actual series is constantly above the generated series, confirming a kind of over-evaluation of housing prices. A similar mechanism was used by Honjo, Hunt, Koeva, and Schule (2005) to analyze the UK real estete market. Although those results are suggestive, many factors, as incorrect marginalization, omitted variables, lack of super-exogeneity (see Chong and Hendry (1986)) could be at the base of the observed behavior.

elements stabilized the prices of imported goods and reduced the changes in inflation. These phenomena allow central banks to prolong expansionary monetary polices (Artus (2003)). The current expansionary monetary policy could worsen the US economic conditions where there exists an external deficit and a public deficit. The investment in real estate, stimulated by an accommodating monetary policy, is expanding a wealth effect that increases these imbalances of the US economy. The cost of households in covering their debts can be painful if a housing price bubble bursts (see Cecchetti (2005) or Krugman (2001)) or if monetary policy begins to tighten.

$\beta(2)'$ **= Money demand** : In both samples the signs of the variables are the ones expected: in particular the higher the real GDP, the higher real money balances. This can be seen as the classical transactional demand for money. Money demand is inversely related to the interest rate, highlighting that the higher the interest rate, the higher the cost of holding money. In the second sample, the coefficient of the interest rate is much higher than the one in the first sample. This means that a lower variation of the interest rate is needed to re-balance the money market once, for instance, the GDP changes. This is consistent with the impact of globalization on inflation, previously described. Considering, for instance, the following case: if GDP falls, then the central bank reacts by decreasing the interest rate. The aggregate demand, stimulated by lower interest rates, increases, but prices, due to the effect of globalization on inflation, react less strongly (see on this point IMF (2006)). Therefore, a central bank that aims to stabilize the economy needs to use smaller interest rate variations. The analysis of the loading factors (see table (6), column 2) confirms this interpretation. Interest rates adjust with a greater extent to a disequilibrium in the money market in the first sample than in the second one. Consistently, inflation reacts with a higher pace in the first sample than in the second one, although the coefficients do not appear to be significant.

$\beta(3)'$ **= Fisher Equation** The Fisher equation seems to be confirmed by the data. The coefficient of inflation was almost the same in both samples. Moreover, the LR could not reject to fix it equal to the value of one. This suggests an unaltered behavior of the central bank with respect to changes in inflation. As the adjustments of the interest rate to real money balance dis-equilibrium, positive deviations from the long-run equilibrium with inflation cause a stronger error correction adjustment of the interest rate, (see table 6, Alpha(3) columns) in the first sample than in the second one (in this case the coefficient has the expected sign but not significant). By contrast, inflation tends to

revert to its equilibrium in the first sample (although the coefficient is not significant), but not in the second one. The interest rate's reaction does not seem to be adeguate to reduce inflation.

The estimated loading factors (table 6), show that deviations from the equilibrium relationship of money demand (Alpha(2) columns of table 6), cause an error-correcting movements of real money balances in both samples, an upward pressure on output in the first sample and an almost nil reaction in the second sample [12]. Finally positive deviations from the long-run equilibrium in the house market cause different error-correcting adjustments in the two periods (Alpha(1) columns). In the first sample a dis-equilibrium in the real estate market causes an adjustment towards the equilibrium of the real housing prices. The interest rate rises to reduce the excess in the real estate market, although the coefficient does not appear to be significant. Real money balances decrease as well as output. By contrast, inflation increases. In this case it seems that when prices in the housing market rise, then the property's value increases, pushing up consumption and thus prices. In the second sample things are different. When bubbles affect asset or real estate markets, then their prices' movements do not appear to be related to their fundamentals. In this case, if for some reason, prices deviate from their long-run equilibrium, then they continue to grow, pointing to an explosive scenario, closer to an economy characterized by the existence of price bubble.

4 Remarks and Conclusions

This work studied the effects of prolonged accommodating monetary policies on the real estate market. The global economy, the so called "New Bretton Woods System", and the low-cost of Asian goods, modified the reaction of inflation with respect to monetary policies. For instance, a weak US dollar did not cause an increase in the prices of imported goods as was expected in previous periods. Due to this new "configuration" of the economy, central banks can prolonged expansionary monetary policies. This is what was observed in the US economy. What are the effects of this behavior? I answered this question by analyzing two different samples, both characterized by periods of recession followed by expansionary monetary policies. Using a cointegrated approach I studied the behavior of housing prices during the 1980s and 1990s. The reactivity of housing prices with respect to the interest rate is much stronger in the second sample than in the first one, while the reactivity of the interest rate

[12] However, the last two coefficients do not appear to be significant.

with respect to inflation did not change for the whole sample. The underlying economic interpretation is the following: the central bank maintained the same behavior with respect to changes in inflation; the FED, since the year 2000, has been conducting an expansionary monetary policy. It could prolong its policy given the smaller reaction of inflation to monetary policy that seems to exist in the current configuration of the global economy. Its behavior stimulated investment in the housing market, inflating the housing prices and increasing the already existing imbalances of the US economy. The opinions in the debate on which elements a central bank has to consider and take into account in conducting the monetary policy are far from reaching a convergence (Bean (2003)); the current FED chairman, Bernanke, seems not to follow an aggressive policy against changes of asset prices and housing prices (Bernanke and Gertler (2001) and Bernanke and Gertler (1999)). To be more precise, quoting Bernanke and Gertler "...central bank should not respond to changes in asset prices expect insofar as they signal changes in expected inflation". This approach can be defined as 'conventional strategy' (Donald (2006)), as opposed to an 'extra action approach' which is closer to the ECB behavior (ECB (2005)). In different speeches by Otmar Issing and ECB chairman Trichet (2005) , it emerges that a central bank should occasionally consider the 'leaning against the wind' of an incipient bubble (see also Cecchetti, Genber, Lipsky, and Wadhwani (2000)). The wealth effect generated by housing investment (higher than that in the asset market (Cecchetti (2005))), stimulates consumption [13] and increases the external imbalance of the United States. By contrast, the two-pillar strategy followed by the ECB, seems to assess more accurately the asset market and the housing market. One pillar of the ECB strategy is related to the growth rate of money supply; therefore, for instance, monetary authorities can evaluate if excess in the credit market can be a driving force behind over-valuation in the real estate market. An interesting experiment could be to replicate this analysis on countries of the Euro area. This analysis could confirm, or not, if the ECB policy is inflating a housing price bubble, as it seems that the FED's policy is doing.

[13] Asset prices and housing prices affect the value of collateral and thus the provision of credit, thereby influencing aggregate spending.

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