The Sources of House Price Change: Identifying Liquidity Shocks to the Housing Market

By

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DRAFT OF WORK IN PROGRESS

Abstract

In a previous paper (Taltavull and White, 2012) we analysed the role of money supply, migration and mortgage finance in house price evolution. Using a VECM framework we examined these variables together with income, inflation, and interest rates for both Spain and the UK. The results indicated an important role for income, mortgages and migration in UK house price movements, more so than in Spain. Financial deregulation, and increasing monetary integration have been the background against which flows of liquidity have increased. Increasing interbank flows have also linked markets in different countries providing increased liquidity that can impact the mortgage market. Traditionally, monetary policy used interest rate changes to affect GDP. However this policy tool impacts asymmetrically in Eurozone economies and is generally constrained by the highly internationally interconnected money market. In this paper we build upon our previous work and focus on the role that changes in liquidity have played in the evolution of house prices. In doing this we identify the main channels of transmission affecting the housing market. In addition we also consider how the housing market, being impacted by increased liquidity can also feedback to aggregate money supply. The models tested examine Spain and the UK and identify short run and permanent effects in the relationship between liquidity and house prices.

Keywords: House Prices, Liquidity, Mortgage Finance, Money Supply, Credit Channel

JEL Classifications: R3, E5

Introduction

The Global Financial Crisis (GFC) and the ensuing credit crunch has had asymmetric effects across different countries in the world and also within the European Union (EU). Imbalances across the EU have become evident in the years since 2008. The lack of harmonisation in, for example, the fiscal system, financial supervision and differences in state welfare programmes have been well documented. However, some market mechanisms that are central to macroeconomic equilibrium, linking the financial system and real economy at the macro level, have received comparatively less attention. Of these the housing sector is fundamental with many analysts placing housing debt at the origins of the GFC. Indeed, housing imbalances and the operation of the housing market have been at the core of wider macro-economic imbalances in several European countries. House prices have a direct impact on housing wealth (real or perceived), and hence on consumption and macroeconomic growth. House prices impact on the risk level of financial institutions through the value of the collateral for mortgages and real estate assets. House prices also affect monetary policy objectives focusing on inflation targeting, though liquidity channels.

House prices and their impact on macroeconomic equilibrium has been recognized by the European Commission (EC) through the inclusion of house price indices as one of 11 scoreboard indicators chosen as "the most relevant dimensions of macroeconomic imbalances and competitiveness losses" (EU, 2012:4[1]). Likewise, the Macroeconomic Imbalance Procedure (MIP) and the Excessive Imbalance Procedure (EIP) identify house price change as the key early warning measure alerting the possibility of macroeconomic imbalance as "… large movements in real asset markets have been traditionally associated with a number of economic crisis." (EU, 2012:16).

How the GFC transmission occurred across EU countries, its effects, the strength of the credit crunch in different countries and consequences at a social level still raises many questions. While the literature explains how the financial crisis impacted on economies, the Central Banks' reactions to avoid the worst of the effects and the recommended policies there still remains a gap in the knowledge base on how global effects contributed to macroeconomic imbalances. Earlier studies for example, of that by Shiller (2000) focused on how deregulation of the financial system at the global level contributed to large flows of liquidity. Most of the effects of financial liberalisation were transmitted via the banking system, with the increase in liquidity and credit having an impact on both private and public debt. This resulted in high levels of indebtedness of households and firms (Debelle, 2004, Iacoviello and Minetti, 2008). In the case of households, one of the effects of financial liberalisation was an increase in finance flows towards housing and real estate markets, creating the first synchronised global housing cycle (Taylor, 2007, Kim and Renaud, 2009). Indeed, a wealth of recent literature (Mishkin, 2007, Muellbauer, 2008, Iacoviello, 2005) indicates that increases in mortgage credit

[1] The number of scoreboard indicators were extent to 11 in 2013. European Economy, 2012, 'Scoreboard for the surveillance of macroeconomic imbalances, Occasional Papers 92, Brussels

resulting from monetary policy fuelled housing demand and increased house prices (Bernanke, 2010).

Real variables create an imbalance when they perform out of the long term equilibrium, for example when there is a fall in production, changes in demand (stronger or lower), exports/imports, either at unusually high or low levels, produce international imbalances. Similarly, imbalances occur with strong changes in population mobility and migration flows. Financial or monetary imbalances appear when long term inflation occurs or when financial flows change affecting investment (real). Four groups of factors emerge as being important: (1) real factors with permanent effect for any economy, such as growth/fall in demand due to changes on domestic demographic structure, income or long term economic growth determine the wealth accumulation process in the economy; (2) financial factors including funds and interest rates, which are both directly determined by the total availability of domestic funds in the economy and by private and public savings, and by the degree of integration in the international financial system allow use of extra savings from other economies. Collectively groups (1) and (2) have long term effects on the economy. (3) Short term variables affecting the macro economy equilibrium, for example movements on interest rates or inflation and (4) shocks occurring in the economy due to unexpected and unforeseeable changes in some economic and social conditions from the third and fourth groups respectively.

When variables relating to demographics, finance or income change, the macroeconomic imbalance is transmitted to the housing market through their effect on the demand side. For owner-occupiers, sudden changes in demand affect house prices generating a second imbalance with various effects due to the large number of interrelationships between house prices and other macroeconomic sectors. If local supply conditions allow the house building response, a rise in prices acts as a trigger for development which increases economic added value, with as a consequence the whole economy growing (Mueller, 1999). On the other hand, an increase in house prices increases household wealth, thereby increasing the role of housing as a collateral for loans and modifying relative price expectations, with effects on affordability. The strength of change in house prices could serve as incentive to extra investment in the housing market while a fall in house prices could have the opposite effect.

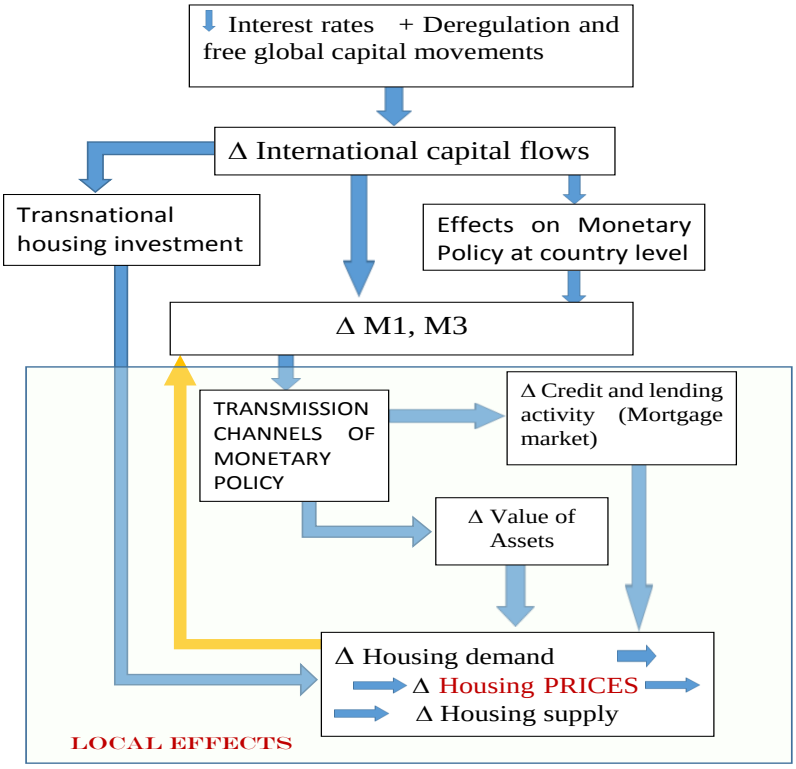
The literature discusses long run equilibrium for housing markets with a particular focus on the short run dynamics of adjustment processes. From a microeconomic perspective, house prices are the result of local short run disequilibrium due to inflexible supply and the difficulty in responding to demand change (DiPasquale and Wheaton, 1994, Ortalo-Magné and Rady, 2006). In reference to the inflexibility of supply (Muellbauer and Murphy, 2008), it means that the housing market equilibrium does not take place in the short run because of the rigidity of the supply curve. Equilibrium is eventually achieved as the curve gradually acquires more flexibility and adjustment takes place (Meen, 2002, Topel & Rosen, 1988, Quigley, 1997, De Leeuw & Ekanem, 1971, Olsen, 1987, Hanushek & Quigley, 1979, Blackley, 1999, Glaeser et al, 2005).

Levitin and Wachter (2013) suggest that housing is unusually susceptible to booms and busts because credit conditions affect demand. Homeownership requires borrowing making the housing market dependent on the credit system. Any imbalance in the credit system is transmitted through an increase/decrease of financial flows to the housing market. Most literature focuses on the credit channel of the monetary transmission framework. Liquidity affects credit generation by fuelling housing demand and thus causing house prices to rise (Lastrapes, 2002, Aron et al, 2010, Goodhart and Hofmann, 2008). As the number of loans increase, the credit multiplier increases liquidity in the economy.

Several studies have investigated the links between monetary policy and housing booms (Mishkin, 1995, 2007, Favero and Giavazzi, 1999) supporting the idea that the credit channel is not the only way to transmit the effect of house price changes. Muellbauer (2007), Setzer et al, (2010) and Greiber and Setzer, 2007, find evidence that liquidity contributes to an increase in house prices through three different channels: money demand (Setzer et al 2010, Friedman 1988), asset inflation (the role of liquidity with respect to housing finance), as well as credit channels. They conclude that housing may act as a catalyst which amplifies the effects of monetary policy reinforcing the relationship between house prices and loans and providing a house price channel. They find that "… collateral or credit channel effects which also imply a positive correlation between money and housing should be significant. This is in line with empirical estimates suggesting that house price fluctuations are a major determinant of credit cycles (ECB 2003)." (Greiber and Setzer, 2007:15).

The essence of this literature is summarised in figure 1 below and distinguishes between capital/monetary flows and financial flows. The former have indirect effects on house prices through channels of monetary transmission while the financial cycle affects housing through direct investment or financing developments.

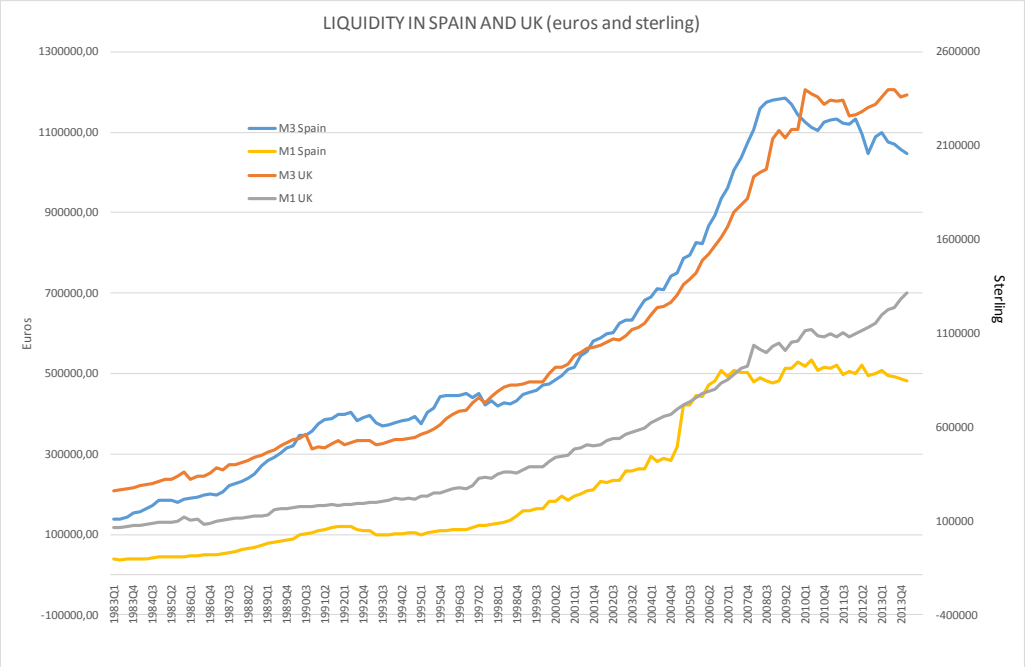
Figure 1: Representation of Housing Market and Financial Market Interlinkages



The figure shows several transmissions between changes on flow of capitals and housing market. On the one hand, an increase on money or credit availability (for instance, coming from high housing market liquidity or savings) in presence of low interest rates could increase the international housing demand. Capital and monetary liquidity flows (with an enlarging interbank market) affect the credit channel and/or the asset channel with the effect of extend the housing demand through higher availability of mortgages or price incentives to invest on housing. On the other hand, the accumulation of demand in housing market could evolve in a further increase on the total liquidity (for instance, when demanders comes from other region or due to the need of cash when credit increase). Those creates a circle between liquidity and housing demand which could fuel housing supply at different rates. The circle has different effect at local level and it is possible that it does not work in some regions while strong in others. The described phenomena remains unanalysed.

In Europe, due to successive changes in financial framework (both international and European), liquidity has increase dramatically last two decades. Policies of deregulation in Europe began with the UK in the early 1980s. Subsequent developments in the EU saw monetary union with the creation of the Eurozone with the Euro beginning to circulate in 2001. During this process liquidity increased. Interbank lending increased that fed into economies via capital flows through the banking system. Increases have been identified in monetary aggregates, namely M1 and M3. Figure 2 shows how these changed for both Spain and the United Kingdom.

Figure 2: Evolution of Liquidity (M1 and M3) in Spain and the UK, 1983q1 – 2013q4



The figure clearly shows the increase in both liquidity measures in each country that is almost continual until 2007/8. Also notable is the increasing gap between the monetary measures and the particularly rapid increase in M3 in both countries in the 5 years or more before the GFC.

The European Central Bank (ECB) suggested that most liquidity went into the housing and commercial real estate markets and provided funds for household mortgages putting upward pressure on house prices. Thus a strong and possibly strengthening channel between monetary indicators and house prices could exist. Monetary stimuluses' could therefore be transmitted to the housing market in many different ways though various channels. Because of this both MIP and EIP see house price change as having a major destabilising impact on macroeconomies.

Aim, Objectives and Model

In light of the above, the aim of this paper is to examine the role of monetary liquidity in house price evolution through examining the *asset (housing) inflation channel*. In relation to our supporting objectives, we attempt to identify the main channels of transmission affecting house prices testing from monetary supply channels to house price change. We examine the asset price channel and specifically in this paper we focus on the role of M1 and examine its impact in Spain and the UK. These countries have had significant house price inflation until the start of the GFC. Since then, Spain has witnessed significant reductions in house prices while in the UK, although house prices have fallen, more recently prices have begun to increase across the country albeit by significantly more in London.

Monetary policy instruments transmit their influence via, for example, interest rates that in turn impact on liquidity and thus changes in GDP. Financial market deregulation and EMU creation modify the capacity of monetary policy to control

inflation. It is also difficult to control M3. With EMU, liquidity increased by more than had been expected, with varying spatial distribution. Researchers have become increasingly interested to know how house price change could impact on monetary aggregates and hence monetary policy.

When considering the channels of monetary policy transmission, money supply change can lead to GDP change thus impacting housing demand and house prices, being the opposite causality to the above. Credit, balance sheet, and asset inflation channels may also be considered. For example, Mishkin 2007; Lastrapes, 2002; and Weber et al., (2011) examine the credit and balance sheet channels. Lastrapes (2002), analysed the response of house prices to money supply shocks. He employed a VAR framework and found that monetary shocks have real impacts on the housing market, affecting both prices and transactions volumes which rise in the short-run in response to positive money supply shocks.

Belke et al (2008) examine liquidity effects via asset inflation. Greiber and Setzer (2007) suggest that liquidity contributes to house price inflation and consider how money demand, asset inflation, and credit channels transmit liquidity effects.

Starting with the effects from housing price changes, as mentioned earlier, changes in house prices can affect changes in monetary aggregates. We consider the money demand channel. Here the wealth effects happen due to the existence of the credit channel. This has been defined as a housing collateral effect by Muellbauer (2007):

$\Delta P_h \implies \Delta$Hwealth $\implies \Delta$(portfolio composition) $\implies \Delta$property demand $\implies \Delta$consumption

In the substitution effect:

$\Delta P_h \implies$ change in the attractiveness of different assets $\implies \Delta$housing demand and Δmoney demand $\implies \Delta$%property in portfolio

In the transactions effect:

$\Delta transact_h \implies \Delta(P_h + numbT) \implies \Delta$M1(demand for payments)
$\forall$ higher in boom periods $\implies$ need deposits and liquidity (M3 + M1)

In the collateral effect changes in house prices affect housing wealth and asset allocation within portfolios further impacting property demand and consumers expenditure. In the substitution effect change in house prices affect the relative attractiveness of different assets that impacts housing demand, money demand and property portfolio weightings. Finally in the transactions effect, changes in the volume of transactions change both house prices and future transactions numbers leading to changes in money demand.

In the *asset inflation channel*, changes in money supply lead to changes in inflation or asset prices:

$\Delta M1 \Longrightarrow \Delta CPI$ or ΔAsset Price

Here, the final effect depends on price elasticity (of Goods and assets). When goods are Supply elastic, then the change in prices will tend to zero due to competition in the market. When supply elasticity of assets < 1 there will be positive asset price inflation as the housing market has restricted supply at least in the short run. Thus:

$\Delta M1 \Longrightarrow \Delta P_h$ depending on the elasticity value,
$\Delta P_h > 0$ if J ϵHsupply<1

In the *credit, or lending, channel*, changes in house prices lead to changes in lending. Higher collateral improves lending conditions and liquidity rises.

$\Delta P_h \Longrightarrow \Delta$collateral value $\Longrightarrow \Delta$lending conditions $\Longrightarrow \Delta$Debt $\Longrightarrow \Delta$liquidity of housing wealth

Further:

ΔPh $\Longrightarrow \Delta$collateral value $\Longrightarrow \Delta$lending conditions $\Longrightarrow \Delta$loans $\Longrightarrow \Delta M1$

As this channel has two direction it is identified as an *accelerator* (Greiber and Setzer, 2007).

So changes in house prices have several effects leading to changes in collateral values and to changes in housing wealth, changes in consumption and changes in M1 demand. Changes in collateral value can also lead to changes in debt, changes in the liquidity of housing wealth and to changes in demand for money. Changing collateral value leads to changes in housing asset demand and demand for money via the transactions motive. In addition, Elbourne (2008) suggests that housing wealth affects consumption while Setzer et al (2010) suggest that housing wealth also determines money holdings.

The model

We approach the *asset inflation channel* in two steps. In the first step we estimate the elasticity of supply:

$$E\sup_t = \Gamma[Ph_t, rir_t, R_t] + \mu_t \qquad (1)$$

Where the supply elasticity is written as a function of house prices, real interest rates, and specific unobservable differences in each housing market (like developer structure, availability of land or regulation, represented by R_t[2]).

[22] As construction costs are not fully available for both countries, they are not included into the model. We support this decisions due to the low significancy in their results in previous work (Taltavull and White, 2012) due to the extreme stable evolution during the analysed period where they are remain almost constant.

In the second step a house price model is estimated of the form:

$$Ph^r{}_t = \Phi_2[Inc^r{}_t, Migr^r{}_t, \inf l^r{}_t, M1^r{}_t, controls] + \mu_t \qquad (2)$$

Where the real house price is regressed on income (Inc), the demographic demand (Migr), inflation (infl), the measure of liquidity in the economy M_1 and a set of control variables. The model is run at national level for Spain and the UK. M_1 is used to approach monetary liquidity rather than M_3 because the latter includes the effect of the bank multiplier in deposits. M_1 contains the money in circulation (M_0) and the primary and liquid deposits whose changes constitute the first effect of liquidity changes in the economy, and which is the effect this paper is seeking for.

- **M_1 and M_3 evidence**

Given the relevance of liquidity in our study, an analysis of its statistical characteristics is undertaken in order to examine the time evolution of liquidity and whether or not it might reflects some shocks during the whole period. In order to do that, we have analysed and compared both M_1 and M_3 in both countries and included the same variables for the whole EMU.

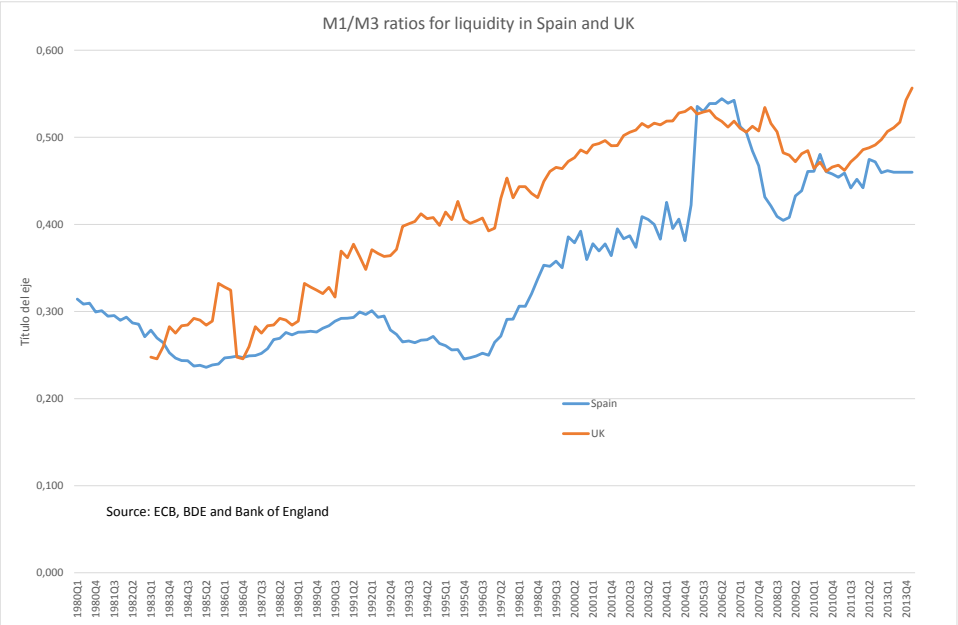
We have obtained data for liquidity in M_1 (basic money plus deposits) and M_3 (M1 plus other liabilities) from three sources: Bank of England, Bank of Spain and European Central Bank. In all cases, the data since 1997 is the one prepared to follow EMU objectives and it is linked to the historical series' in each country. The available period for liquidity data covers pre and post EMU periods, and data from 1980 is available at monthly and quarterly frequency.

In order to test the statistical proprieties of different measures of liquidity, unit-root tests have been checked and found that all series (for Spain and UK , both M_1 and M_3) are non-stationary and PP and ADF tests confirm that all are I(1). Tests for non-stationary structural change is needed and two tests have been applied, the Zivot-Andrew (Z-A) and Perron Unit Roots with structural Change test in order to identify the breaks in the series (Table 1). The null is rejected when p-value is lower than 5% and it means that data give enough evidence to reject the existence of a unit root with structural break. Results show how both tests reject the existence of structural change in the trend but no in intercept in M_1 and M_3 series, being strong enough to also be detected by the test with both breaks in some cases. Results are quite consistent and identify a break in intercept (shift in the statistical serie) during 2005, just for Spain in M_1 but for Spain and UK in M_3 although only through Z-A test. These suggest that the models have to control by such breaks. As M_1 is used, the model for Spain control for a break in intercept in 2005 with no other break points.

The lack of structural break in trend could be interpreted that the increase on liquidity follow a long term pattern during the period which is consistent with the monetary theory of liquidity and the appearance of an structural change in intercept suggest the sudden increase on primary liquidity happened during 2005.

Relationships between M_1 and M_3 is analysed using the ratio between both which could be assumed as a measure of multiplier as M_3 account of the different types of liabilities created based on primary deposits. It can be seen that it varies over time (Figure 3).

Figure 3: M1/M3 Ratios, UK and Spain



The larger value of this ratio means less propensity to keep money or in short run deposits. The ratios suggest that in UK, households use to keep more liquid money than in Spain until mid 2000's or, that bank activity retains a larger part of the money in circulation in form of medium or long term deposits, reducing liquidity. It suggest some change in the propensity to hold liquid money in population, that is, changing in the monetary pattern.

This also suggests that both countries have experienced an increase in liquidity in households during the whole period until 2005 but with a stronger impact in Spain (which could have had a severe shock in liquidity) than in UK.

Data and econometric strategy

The data used is of quarterly frequency from 1995q1(in estimation) to 2013q2. The variables are listed in Table 2 and the basic statistics in Table 3.

We test for unit roots and cointegration. In addition we test for presence of structural breaks in cointegrated relationships. Our empirical steps proceed with supply elasticity estimation where we also test for structural breaks and then re-estimate as necessary. In the price equation we include liquidity as an endogenous

determinant and control by supply elasticity. Again structural break tests are applied and re-estimation as necessary is undertaken.

The supply equation in logs is written as:

$$D(stock)_t = \alpha + \beta_1 Ph1_t + \beta_2 Rir_t + \mu_t \quad (3)$$

Where the change in stock is written as a semilog function of logged house prices and the real interest rate in levels. The house price log-log equation:

$$Ph_t | @\varepsilon sup = \alpha + \gamma_1 Inc_t + \gamma_2 Migr_t + \gamma_3 inf_t + \gamma_4 M_{1t} + \mu_t \quad (4)$$

Here supply elasticity is included along with liquidity captured by M_1. The definition for M_1 includes the money (notes and coins) in circulation plus primary deposits. This definition is selected because it is closer to the basis from which the credit creation process in the economy begins and, at the same time, is the closest measure of the amount of money households holds to cover short term payments.

We find cointegration between the change in stock and M_1 and house prices. In the supply (elasticity) model we find one cointegrating relationship in each country. In Spain there are 3 lags with an intercept and trend. In the UK there are 4 lags, no intercept or trend. Test for structural change in cointegration are not statistically significant[3].

Table 4 shows the supply relationships in Spain and the UK. House prices and interest rates are significant in both countries. There also seem to be quite high adjustment speeds in each country. Next equation (4) is estimated with evidence of cointegration relationships. In the UK there are two cointegrating vectors and an intercept and trend in the cointegrating equation. In Spain, there are 3 cointegrating equations and again an intercept and trend in the CE. There were no statistically significant structural breaks in relationships in each country.

In addition to model (4) we also test the following equation for M_1:

$$M1_t = a + d_1 Inc_t + d_2 Migr_t + d_3 inf_t + d_4 (Ph_t | @\varepsilon sup) + \mu_t \quad (5)$$

Where money supply depends upon income, migration, inflation, and house price conditional on the elasticity of supply. Hence (4) and (5) together represent a system of simultaneous equations for price and liquidity. Then:

[3] We have tested for structural change in the cointegration relationship through generating the relationship and then estimating the Z-a and Perron test statistics. No significant results have been reach suggesting that the null of existence a structural break can be rejected.

$$\Delta Ph_t = \alpha + \phi_1 [Ph_{t-1} + \gamma_1 Inc_{t-1} + \gamma_2 Mig_{t-1} + \gamma_3 M1_{t-1} + \gamma_4 inf + \gamma_4 Trend] + \Sigma_j \varphi_1 \Delta X_{t-j} + \varphi_2 @\varepsilon supp_t + \mu_t \quad (6)$$

$$\Delta M1_t = \alpha + \phi_1 [Ph_{t-1} + \gamma_1 Inc_{t-1} + \gamma_2 Mig_{t-1} + \gamma_3 M1_{t-1} + \gamma_4 inf + \gamma_4 Trend] + \Sigma_j \varphi_1 \Delta X_{t-j} + \varphi_2 @\varepsilon supp_t + \mu_t \quad (7)$$

Where X_t is a matrix of endogenous variables including housing prices, migration flows, real income and inflation. Table 5 presents the long term results for each country. Liquidity is significant for determining house price change in both the UK and Spain. The error correction models are then presented in Table 6.

The results show evidence of convergence in house prices for both countries although not for liquidity. The supply elasticity term is significant in only one country, the UK.

Next we examine impulse responses for changes in house prices and liquidity on each other for each country. These are shown in figures 4 and 5 below.

Figure 4: House Price Response to Liquidity Shock

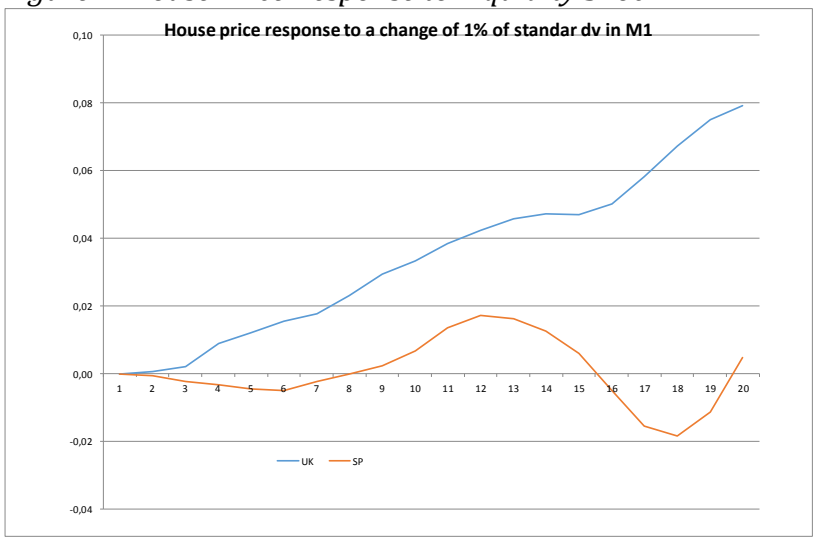


Figure 4 shows the response of house prices to a 1% change in M_1. These results are quite different for each country with the response being much greater and wholly positive in the case of the UK. In contrast the impact is smaller in Spain and varies with both positive and negative values.

We test in the opposite direction in figure 5. In the case of a house price shock to liquidity, again results are quite different by country. In this scenario, there is virtually no response in liquidity to a house price shock in the case of the UK. In

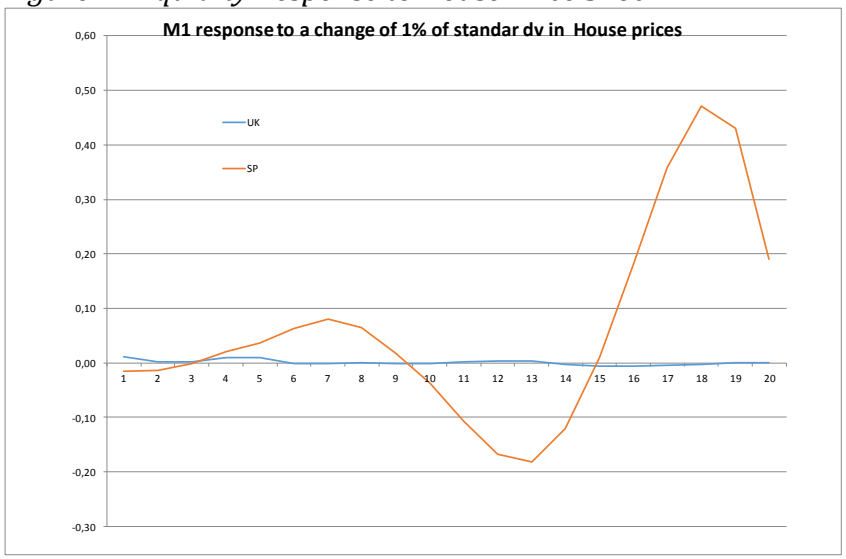
Spain however the response seems to increase as the number of periods rises with a larger amplitude of fluctuation.

Discussion and conclusions

This paper presents a preliminary discussion and set of results as a basis for further development. Our initial results confirm the relationship between monetary aggregates (M_1) and mortgage generation in Spain suggesting a long term permanent relationship. Mortgages respond temporarily to a shock in liquidity but liquidity experiences a permanent effect from mortgage finance innovations. An increase in mortgage flows raises liquidity in the economy supporting the collateral channel hypothesis. The results support other studies evidencing asymmetry in the mortgage-liquidity relationship.

The results add empirical evidence on how an increase in mortgages is transmitted to an increase in house prices. The relationship is symmetric with permanent effects. In addition the results also support a direct effect on house prices from changes in liquidity as captured by M_1, through the asset inflation channel.

Figure 5: Liquidity Response to House Price Shock



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TABLES

Table 1: Structural breaks in Liquidity time series.

M1						
	Intercept		Trend		intercept and trend	
4 lags	Zivot-Andrews	Perron	Zivot-Andrews	Perron	Zivot-Andrews	Perron
Spain	-7,5***	-7.82***	-2,51	-2.35	-11.3***	-11.5***
break point	2005Q2	2005Q1	2009q4	2009Q4	2005q2	2005Q1
UK	-2,6	-2.67	-2,64	-2.71	-2,76	-2.74
break point	2005q1	2004Q4	1999Q1	2001Q2	2004q1	2003Q4
M3						
Spain	-43.44***	-3.37	-2.61	-2.43	-3.28***	-3.19
break point	2004q4	2004q3	2009q4	1995Q2	2006q2	2006Q2
UK	-3,46***	-3.49	-1.98	-2.01	-2,07	-2.07
break point	2006q1	2005q4	1999q1	1997Q4	1997q3	1997q2

Table 2: Data Definitions and Sources

Variables	Definition	Source	Period
lRPH	Real House prices (logs)	Ministry of Fomento-Spain	1991q1-2014q1 (1989q1 Spain)
		HBOS	1983q1-2012q1
LMIG	Migration. Net increase on population (logs)	INE. Spain	1988q1-2013q4
		Government Statistics - UK	1983q1-2009q2
LRINC	Income (logs)	INE. Spain	1990Q1-2014Q1
		Regional Statistics - UK	1990q4-2012q4
RIR	Real mortgage interest rate	Bank of Spain	1990q1-2014q1
		Bank of England	1983q1-2014q1
INF	Inflation	INE. Spain	1992q1-2014q1
		Government Statistics - UK	1983q1-2014q1
LRMORTG	Flow of real mortgage credits to finance housing purchases (logs)	INE. Spain	1990Q1-2014Q1
		Council of Mortgage Lenders - UK	1983q1-2012q1
LM1	Liquidity in the economy-M1 (logs)	Bank of Spain	1990q1-2013Q4
		Bank of England	1983q1-2013Q4

Table 3. Descriptive statistics

		Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Obser-vations
LRPH	UK	6,58	6,54	6,96	6,28	0,21	0,35	1,89	96
	SP	7,23	7,18	7,69	6,89	0,28	0,33	1,57	97
LMIG	UK	4,13	4,04	4,63	3,55	0,38	0,05	1,59	58
	SP	12,70	12,72	13,59	11,03	0,60	-0,27	2,03	84
LRINC	UK	9,22	9,21	9,31	9,13	0,04	0,12	2,41	78
	SP	7,47	7,46	7,61	7,35	0,05	0,20	2,48	97
RIRM	UK	4,36	4,71	9,06	-1,17	2,06	-0,60	2,95	97
	SP	3,62	2,42	11,26	-0,53	3,30	0,84	2,60	97
INF	UK	2,68	2,30	8,38	0,63	1,74	1,67	5,31	97
	SP	3,31	3,23	6,98	-1,02	1,66	-0,07	3,15	97
LRMORT	UK	17,26	17,22	17,93	16,36	0,32	-0,61	3,54	85
	SP	16,33	16,30	17,84	15,10	0,82	0,24	1,89	96
LM1	UK	13,15	13,20	14,09	12,10	0,64	-0,19	1,65	93
	SP	12,36	12,26	13,19	11,49	0,65	0,08	1,34	93
D(Stock)	SP	97,47	91,48	208,55	12,99	46,10	0,21	2,11	95
	UK	47,33	48,00	62,00	32,00	6,99	0,22	2,96	85

Table 4: Model Results – Supply Equation

	SPAIN	UK
Long term		
D(stock)(-1)	1	1,00
RPh (-1)	-4,6***	-0,54***
rir_m(-1)	1,61***	-0.07***
Trend	0,23***	
Error correction		
Convergence parameter	-0,05***	-0,14
t-stat	-3,42	-1,67
Dep variable	Δ(Dstock)	Δ(Dstock)
Δ(Dstock (-1))	-0,71***	
Δ(Dstock (-2))	-0,31***	
Δ(Dstock (-3))	-0,26***	
Δ(Dstock (-4))		0,32***
Δ(rPh (-1))		-0,84***
Δ(rPh (-2))		0,99***
Δ(rir_mort (-3))	0,10***	
C		
Ad R2	0,438	0,17
Σe2	3.632	0.208
F	8,02	2,39
Log Likelihood	151,15	124,52

*** p-value<0.01
** p-value <0.05

Table 5: Long Term Results

	SPAIN			UK	
Dep variable	∆(Ph)			∆(Ph)	
Long term					
RPh (-1)	1	0	0	1	0
INC (-1)	0	1	0	0	1
MIG(-1)	0	0	1	-0,29***	-0,03
M1 (-1)	-0,84***	0,03***	-0,93**	3,01***	0,60***
Infl(-1)	-0,01	0,01***	0,19***	-0,07	0,01
Trend	0,01	0,00	0,01	-0,09	-0,02
C	2,64	-7,73	-2,22	-4,6	16,29

Table 6: Error Correction Model Results

Error correction	Δ(Ph)	Δ(M1)	Δ(Ph)	Δ(M1)
Converg 1	-0,10***	0,59	-0,33***	-0,13
t-stat	-2,54	3,30	-2,73	-0,62
Converg 2	-0,82	-21,28	2,16	0,10
t-stat	-0,68	-5,29	3,70	0,10
Converg 3	0	0,04		
t-stat	1	0,59		
Δ(Ph (-1))	0,23	-1,67**	0,49***	-0,15
Δ(Ph (-2))	-0,37	-0,87	0,08	0,36
Δ(Ph (-3))	-0,06	-1,73***	0,16	0,20
Δ(Ph (-4))	0,46***	-1,23**	0,08	0,25
Δ(Ph (-5))	-0,41***	1		
Δ(INC (-1))	0,16	17,5***	-1,07***	-0,74
Δ(INC (-2))	0,42	14,71***	-2,03***	0,62
Δ(INC (-3))	0,30	0,09***	-1,35***	0,27
Δ(INC (-4))	0.00	3,36	-1,18	-0,98
Δ(INC (-5))	0,50	1,80		
Δ(MIG (-1))	-0,02	-0,21	-0,03	-0,11
Δ(MIG (-2))	-0.03	0	0,00	0,00
Δ(MIG (-3))	0.01	-0,05	0,08**	0,04
Δ(MIG (-4))	-0,03	-0,05	0,02	0,10
Δ(MIG (-5))	0	-0,15		
Δ(M1 (-1))	0	-0,15	-0,30	-0,06
Δ(M1 (-2))	-0.09	0,47**	-0,28	-0,29
Δ(M1 (-3))	-0,1**	0	-0,08	0,25
Δ(M1 (-4))	-0,05	0	-0,11	0,53**
Δ(M1 (-5))	-0,04	0		
Δ(inf (-1))	-0,02	0,2***	-0,04***	-0,02
Δ(inf (-2))	0	0,16***	-0,03***	-0,02
Δ(inf (-3))	-0,01	0,12***	-0,01	-0,03
Δ(inf (-4))	-0,01	0,10***	-0,02**	-0,01
Δ(inf (-5))	-0,01	0		
c	0	0,21***	0,08***	-0,01
Trend	0	0,003***	0,001***	0,00
@ESUPP	-0,01***	0	-0,02	0,00