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Houses as Collateral: Has the Link between House Prices and Consumption in the U.K. Changed?

I. Introduction

Significant attention is paid by policymakers in the United Kingdom to the relationship between house prices, the business cycle, and inflation, on account of the pronounced procyclical pattern of house prices. Are house prices a symptom of macroeconomic conditions? Or are there important feedback effects from house prices to real variables? As this paper shows, the data suggest that there is a strong comovement of house prices with consumption and with consumer durables expenditures in particular. A deeper look at the data seems to indicate that house prices are not a source of fundamental shocks, but are part of the transmission mechanism by which changes in short-term interest rates affect consumption, the output gap, and hence inflation. It is important for policymakers to study how this transmission mechanism works, and this is one objective of our paper. There have been numerous studies of the relationship between housing and consumption in the United Kingdom.[1] However, these studies have tended to be partial-equilibrium analyses, which are inappropriate for examining the monetary policy transmission mechanism in the macroeconomy.

Another important set of questions concerns the implications for monetary policy of the structural changes taking place in the United Kingdom's retail financial markets—starting in the early 1980s and still continuing today. As documented later, the market for credit cards and unsecured loans has seen a large number of new entrants. Increased competition in retail credit markets is likely to have widened the availability of credit and reduced its price. In the mortgage market, a wider range of products has become available, and it has become easier for consumers to withdraw housing equity to finance consumption. It is important for policymakers to understand whether these structural changes in retail financial markets have affected the relationship between monetary policy and housing variables.

To address these questions, we apply the financial accelerator model of Bernanke, Gertler, and Gilchrist (1999)—or BGG—to the household sector. The BGG model is a dynamic general-equilibrium model that focuses on the macroeconomic effects of imperfections in credit markets. Such imperfections generate premia on the external cost of raising funds, which in turn affect borrowing decisions. Within this framework, endogenous developments in credit markets—

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such as variations in net worth—work to amplify and propagate shocks to the macroeconomy. In our model, we show that a rise in house prices increases the value of collateral available to households. This stimulates consumption and housing investment by making it easier and cheaper for households to borrow against the value of their home. Therefore, fluctuations in house prices amplify fluctuations in consumption and housing investment over business cycles.

Because house prices affect households' borrowing decisions, structural changes in the market for retail financial services—such as those that have occurred in the United Kingdom over recent years—are likely to have affected this element of the transmission mechanism. Using our model, we simulate the impact of financial innovation in the United Kingdom. Also examined is the effect of recent improvements in households' ability to access housing collateral. We show that this increases the response of consumption to a monetary policy shock, but reduces the response of housing investment and house prices. In the second experiment, we simulate the effect of developments in unsecured consumer credit markets. Here, we demonstrate that the effects of a monetary policy shock are reversed: the responses of housing investment and house prices are larger, but the effect on consumption is dampened. Our experiments suggest that the overall change in consumption associated with a given change in house prices is likely to have risen relative to the past.

Our paper is structured as follows. In Section II, we highlight some of the main stylised facts about the business cycle, housing, and monetary policy in the United Kingdom, and discuss some of the main developments in U.K. financial markets in recent years relevant to the household sector. Section III outlines the financial accelerator modeling framework that we use to capture these stylised facts. In Section IV, we run several model simulations to show the changes in the relationship between house prices and consumption within our model triggered by two types of financial liberalisation: a reduction in transaction costs related to accessing housing equity and a general reduction in credit constraints as a result of better developed, unsecured consumer credit markets. Section V concludes.

II. The Housing Market in the United Kingdom

Stylised Facts from U.K. Data

Chart 1 presents the key housing variables—housing investment and house prices—and output.[2] House prices move strongly with output but lag slightly. Housing investment, however, clearly leads output. Housing investment and house prices also show a close comovement, and housing investment leads house prices. These comovements in the data are consistent with a neoclassical world with and without credit frictions. For instance, a q-theory of housing investment would imply a comovement of housing investment, output, and house prices.[3] To distinguish between the two theories, we look in more detail at the relationship between house prices and consumption.

House prices and consumption are depicted in the chart. Breaking down consumption into durables and nondurables, we see that the strongest relationship seems to be between house prices and consumption of durable goods. A q-theory of housing investment combined with a standard permanent income theory of consumption could generate a comovement of house prices and consumption generally.[4] However, the particular comovement between durables consumption and house prices is consistent with a credit channel, as durable goods purchases are often thought to be more likely financed by borrowing, and therefore more interest-sensitive if there are frictions in credit markets. If changes in the extent of credit frictions are in turn correlated with movements in house prices—for instance, if these proxy the availability of housing collateral—then a strong comovement between house prices and durable goods consumption might be generated.

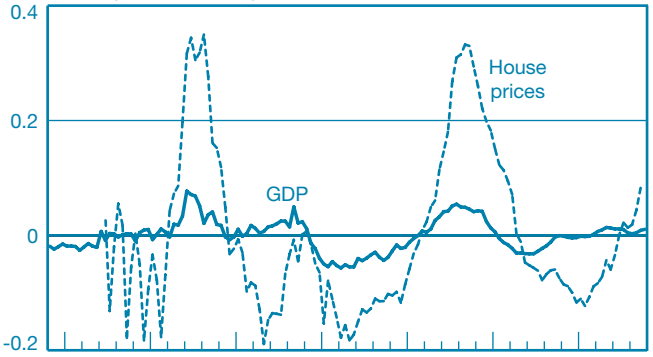
The Effect of Monetary Policy on House Prices: Some VAR Results

Because the relationship between consumption and house prices suggests that a household credit channel may be part of the monetary transmission mechanism, we investigate how house prices are affected by monetary policy. We estimate a small vector autoregression (VAR) model of quarterly output, inflation, oil prices, real broad money balances, and the short-term interest rate. Oil prices are included in this system to reduce the price puzzle.[5] Real broad money balances are

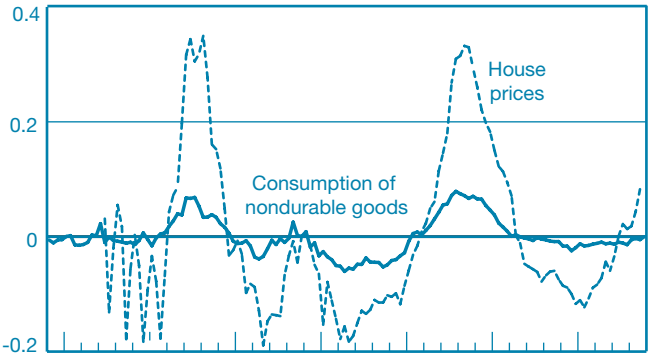
Chart 1

Key Housing Variables

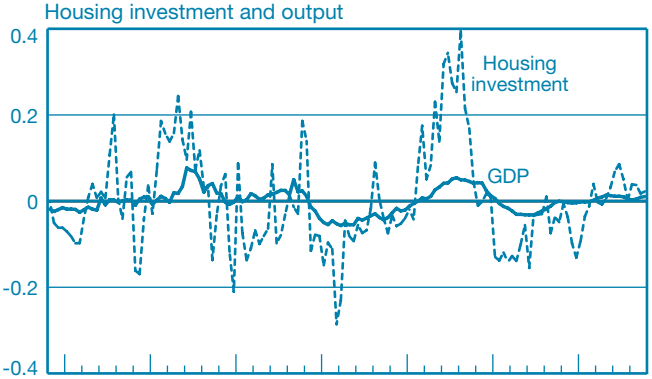
House prices and output



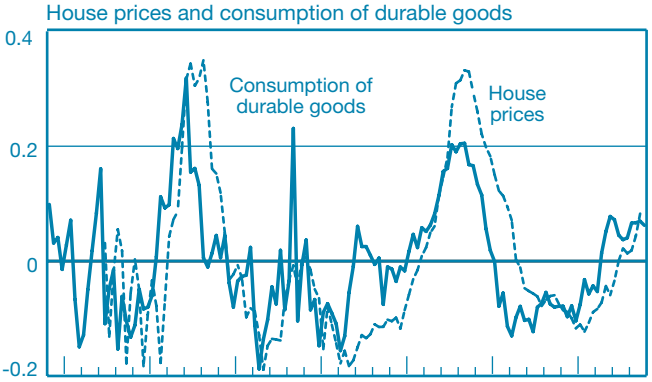
House prices and consumption of nondurable goods



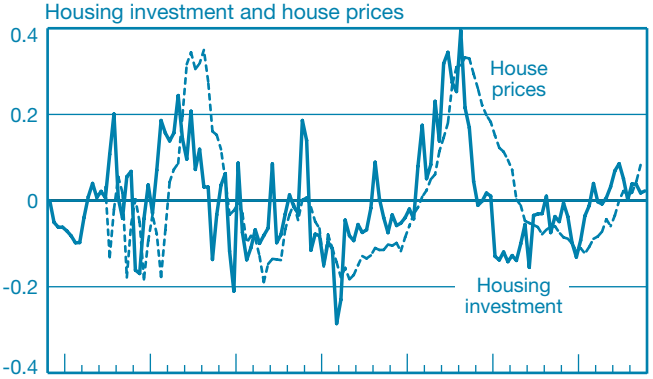
Housing investment and output



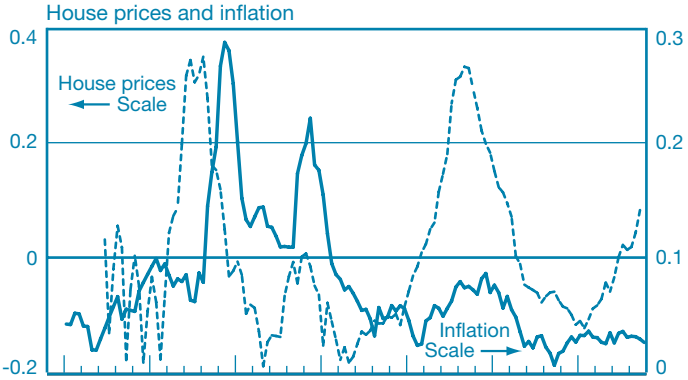
House prices and consumption of durable goods



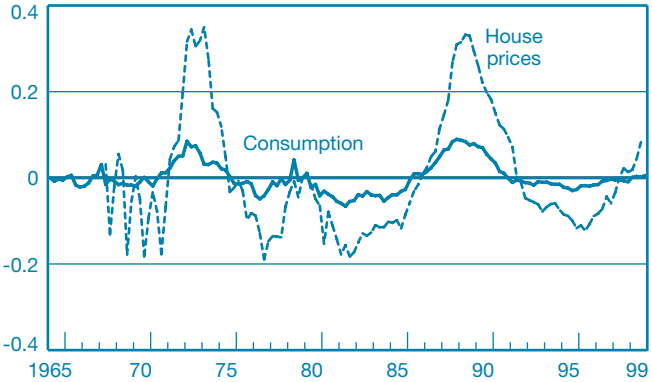
Housing investment and house prices



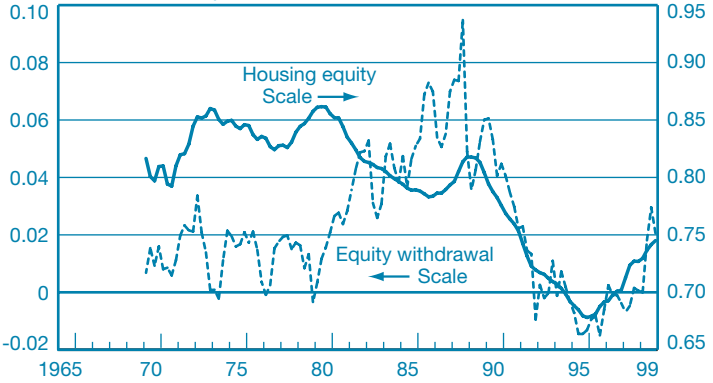
House prices and inflation



House prices and consumption



Net housing equity and mortgage equity withdrawal as a share of disposable income



included as a timely information variable for the policymaker. To this core five-variable system, which we assume adequately summarises a basic macroeconomic model, we add variables of interest: consumption, house prices, and housing investment. Consumption is broken down into durables and nondurables consumption. The sample period, after adjusting for lags, is 1975:2 to 1999:4, and six lags were used.[6] To identify the monetary policy shock, we order the policy rate last in a recursive identification structure. The implied identifying restriction is that the monetary authorities observe contemporaneous variables when setting interest rates, but all variables respond with a lag to monetary policy shocks.

The impulse-response functions, shown in Chart 2, are the estimated responses of all the variables in the system to an unexpected, one-standard-deviation increase in the short-term interest rate. The responses are plotted as percentage deviations from trend levels. They correspond broadly to our priors about the effects of monetary policy: real money balances fall in response to an unexpected monetary tightening. Output falls and the price level falls after some lag. House prices, housing investment, and consumption respond negatively to an unexpected monetary tightening. Housing investment responds more quickly than house prices and falls by more. The peak response in housing investment occurs after two quarters. The peak response to a 50-basis-point shock is estimated to be about 180 basis points. The peak response in house prices occurs later, after five quarters, but is smaller at 80 basis points. Durable goods consumption responds more strongly to a monetary tightening than nondurable goods consumption. The estimated effect of a 50-basis-point monetary policy shock on durables consumption is about 80 basis points, whereas the response of nondurables consumption is only 10 basis points.[7]

Housing Variables and the Phillips Curve

We conclude the data section by analysing the relationship between housing variables and inflation (Chart 1). Adding house prices as an explanatory variable to a Rudebusch and Svensson–style Phillips curve (see Rudebusch and Svensson [1999])—that is, inflation regressed on lagged inflation and the output gap—we find that house prices have no marginal predictive power for inflation. In a regression of output on lagged output, interest rates, inflation, and housing variables, house prices are not significant, but housing investment is. House prices do not have predictive power for consumption once lagged consumption, interest rates, and inflation are included in the regression. House prices therefore appear to affect consumption only via their effect on the transmission of monetary policy, which affects inflation through the output gap, but house prices have no marginal predictive power for inflation outside this mechanism. Details are provided in the appendix.

Structural Change in the Retail Credit Markets and Its Effect on the Pattern of Household Debt

The VAR results are informative but need to be interpreted with some care. The sample spans a period of considerable change in the U.K. financial markets that is likely to have altered the empirical relationships between the variables. A series of major institutional and legislative changes has affected retail financial markets in the United Kingdom since 1979. First were the removal of exchange controls in 1979 and the direct control of bank lending ("the corset") in 1980.[8] Restrictions on building societies (mutually owned savings and loan institutions) were also lifted in a series of measures—principally the Building Societies Act (1986)—that allowed them to fund themselves partially with wholesale deposits and hence to compete with banks on a more equal footing. The increase in competition resulting from these measures has been well documented in Muellbauer and Murphy (1997) and references therein. In addition, starting in 1989 and continuing today, building societies have attempted to remove the remaining restrictions that separate them from banks by abandoning their status as mutuals in order to become banks. Other nonbank entrants—department stores, retailers, and insurance companies—have also increasingly been able to offer selected retail financial services, such as deposit accounts, credit cards, personal loans, and mortgages.

The result was a steady intensification of competition and product innovation in retail banking. This trend has continued in recent years, as retail financial markets in the United Kingdom have been undergoing a further period of structural change. As documented in the February 2001 edition of the Bank of England Inflation Report, "Competition in retail credit markets has intensified in recent years which, together with product innovation, may have widened the availability of credit and reduced its price." The market for credit cards and unsecured loans, in particular, has seen a large number of new entrants. In the mortgage market, the prevalence of "lock-in" clauses in mortgage contracts has fallen. In addition, a wider range of mortgage products has become available, with more firms offering variable repayment mortgages and the facility for lump-sum withdrawals against net housing equity. Some lenders also have introduced "current account" mortgages,

Chart 2

Vector Autoregression Results

Response to One-Standard-Deviation Innovations Plus or Minus Two Standard Errors

Note: *Y* is log output; *RM4* is log real broad money balances; *O* is log oil price; *P* is log price level (GDP deflator); *HP* is log real house prices; *HI* is log real housing investment; *CO* is log real consumption; *R* is log (1 + interest rate); *DUR* is log durables consumption; *NONDUR* is log nondurables consumption.

where funds can be borrowed or invested at a single rate without prearrangement, subject to limits based on the loan-to-value ratio, offering even greater flexibility.

This increased competition has not led to a steady decline of the standard variable mortgage rate over the (overnight) repo rate. But temporary discounts in the variable mortgage interest rate—usually offered to new customers for the first one or two years of the mortgage—have risen, and during 2000 they stood at their highest recorded level. In addition, these discounted mortgages have risen markedly as a share of total new mortgage lending in recent years, to more than half, which has reduced the average mortgage interest rate that customers pay. Remortgaging—obtaining a new mortgage to refinance an outstanding one—has increased as a share of total mortgage lending, perhaps reflecting a reduction in the prevalence of lock-in clauses in mortgage contracts. Another notable feature has been the rapid increase in the use of flexible mortgage products, which allow the borrower to change the principal of the loan at a low or zero transaction cost. A recent survey by Market and Opinion Research International (MORI) for the Council of Mortgage Lenders showed that 16 percent of respondents now have mortgages with at least some degree of flexibility, defined as those mortgages offering underpayments, daily or monthly interest calculation, and the option of a payment holiday. The take-up of flexible mortgages is likely to increase further.

As a result of these changes, the balance sheet of households in the United Kingdom has changed substantially. The stock of aggregate debt as a fraction of annual household income increased from 30 percent in the late 1970s to more than 100 percent in 2000.[9] The composition of aggregate debt has also changed, with the share of unsecured debt increasing over the same period from 11 to 19 percent. In aggregate, the evidence suggests that households in the United Kingdom have become less credit-constrained. Households have access to more credit, and as banks have developed their retail credit expertise, households who previously did not qualify for credit became able to borrow. Bayoumi (1993) estimates that the share of liquidity-constrained consumers fell from 60 to 30 percent between 1974 and 1987.

Although reliable long runs of data are not available, the interest rate spreads and transaction costs associated with retail financial products appear to have been declining since at least the early 1990s. One consequence of lower transaction costs for mortgages, for example, has been that households have been better able to extract home equity when house prices rise. Chart 1 shows the relationship between aggregate net housing equity (after subtracting mortgage debt) and secured borrowing for consumption, often referred to in the United Kingdom as mortgage equity withdrawal (MEW). Prior to the mid-1980s, there was little relationship between housing equity and MEW. When the mortgage market was dominated by building societies and subject to rationing, withdrawing additional equity generally required homeowners to move, which carried a high transaction cost (Miles 1992). As new mortgage products became available that allowed refinancing or additional borrowing at ever lower transaction costs, mortgage equity withdrawal became more closely linked to movements in net housing equity. The increased use of flexible mortgages suggests that this trend is likely to continue. Such products drive to zero the transaction cost of withdrawing additional equity.[10]

The next section outlines the model we use to explore the monetary policy implications of these structural changes.

III. Modeling the Household Credit Channel

To analyse more formally the implications of financial innovations for the monetary policy transmission mechanism, we require a model. Here we sketch the intuitive outline of the model used for the analysis in the subsequent sections. Interested readers are referred to Aoki, Proudman, and Vlieghe (2001). Our hypothesis is that house prices play a role because housing is used as collateral to reduce the agency costs associated with borrowing to finance housing investment and consumption. Our model applies the Bernanke, Gertler, and Gilchrist (1999) model to the household sector. The BGG framework links the cost of firms' external finance to the quality of their balance sheet and net worth. Because there are parallels between housing investment and business investment, and between house prices and the value of business capital goods, the BGG model provides a useful platform on which to build a model where house prices, housing investment, and consumption interact in a general-equilibrium framework.

So how should we think of credit frictions in the household sector? Households are exposed to the idiosyncratic risk of fluctuations in their house prices. On its own, this is not sufficient to generate a credit channel. However, personal bankruptcy is associated with significant monitoring costs faced by lenders. Lenders therefore charge a premium over the risk-free interest rate to borrowers. Higher net worth—or lower leverage—reduces the probability of default and therefore reduces the external finance premium.

In practice, fluctuations in the external finance premium may best be thought of in the following way: When house prices fall, households that are moving have a smaller deposit (that is, net worth) available than they otherwise would for the purchase of their next home. When households have a smaller

deposit, they obtain less favourable interest rates when renegotiating their mortgage and have less scope for extracting additional equity to finance consumption. Since house prices significantly affect the collateral value of houses, fluctuation in housing prices plays a large role in the determination of households' borrowing conditions.

The main modeling issue is how to generate both consumer borrowing and lending within a general-equilibrium framework without losing tractability and comparability with benchmark macro models.[11] To avoid the complexity inherent in modeling the dynamic optimisation problem of heterogeneous consumers under liquidity constraints, we represent consumer behaviour in a rather stylised way. That is, we think of each household as being a composite of two behavioural types: homeowners and consumers. This separation makes the analysis significantly simpler, without losing the essence of the financial accelerator mechanism.

On the one hand, "homeowners" borrow funds to purchase houses from housing producers. Homeowners purchase houses and rent them to consumers. This flow of rental payments within households is captured in the United Kingdom's national accounts as imputed rents. Homeowners finance the purchase of houses partly with their net worth and partly by borrowing from financial intermediaries. When borrowing from financial intermediaries, homeowners face an external finance premium caused by information asymmetries, just as firms are assumed to do in BGG.

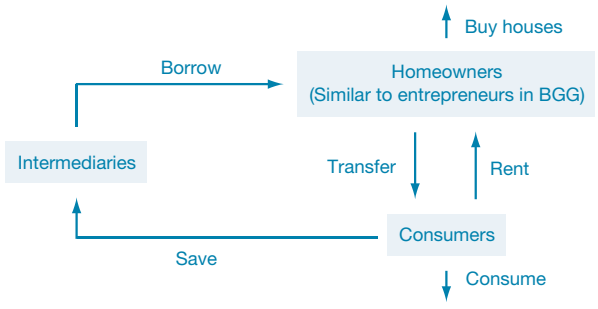
On the other hand, consumers consume goods and housing services. They also supply labour in a competitive labour market. Consumers are assumed to rent housing services from the homeowners. Consumers and homeowners are further linked by a "transfer" rule that homeowners pay to consumers. This assumption captures the fact that households use their housing equity to finance consumption as well as housing investment. When house prices increase—and therefore housing equity rises—the household faces the following decision problem: If it increases the transfer and hence consumption today, current household utility would go up. However, if transfer payments are kept constant, net worth would increase, reducing the future external finance premium. Thus, the household faces a choice between current consumption and a cheaper future finance premium. The optimal allocation—and hence transfer payment—would depend on such factors as the elasticity of intertemporal substitution, the sensitivity of the external finance premium with respect to household net worth, and future income uncertainty. In general, there exists a target level of net worth relative to debt (that is, leverage), and transfers depend on the deviation of leverage from target. Here we assume a transfer rule that captures the household's decision described above. Transfers are assumed to be increasing in the net worth of households relative to their debt.

Fluctuations in transfers described in our model can be thought of as borrowing against home equity for consumption. If we interpret transfers as MEW, then the sensitivity of transfers with respect to home equity will also depend on the transaction costs involved in MEW. Keeping all else constant, if it is less costly to withdraw mortgage equity, MEW becomes more sensitive to households' financial positions and therefore to house prices.

In this way, we can capture in a parsimonious form the idea that some elements of the household sector save while others borrow, and that this process is intermediated through financial markets with credit frictions. To emphasise the idea that consumers and homeowners form part of the same composite household, we illustrate the flow of funds within our model in the exhibit below.

We also assume two types of consumers. Some fraction of consumers has accumulated enough wealth that their consumption is well approximated by the permanent income hypothesis (PIH). Their consumption satisfies the standard optimising condition.[12] However, the consumption of a certain fraction of the population does not. If these consumers are impatient, or if they are subject to borrowing constraints, their behaviour is similar to that of rule-of-thumb (ROT) consumers—see Campbell and Mankiw (1989)—who spend their current income in each period. Their consumption in each period is equal to their labour income and transfers. There is a large literature, both theoretical and empirical, on consumer behaviour under liquidity constraints.[13] This line of research develops rigorous models of optimal household behaviour under liquidity constraints and income uncertainty. Our model should not be interpreted as an alternative

Flow of Funds



Note: BGG is Bernanke, Gertler, and Gilchrist (1999).

approach to the analysis of consumption and saving under liquidity constraints. Rather, a major challenge for this branch of the literature has been that the solution to household optimisation problems under liquidity constraints and uncertainty is very complex. As a result, the construction of a tractable general-equilibrium model is extremely difficult. Our approach offers the opportunity to capture in a simple way many of the implications of this literature for the monetary policy transmission mechanism.

The rest of our model is standard. We introduce nominal price stickiness in the consumption goods sector so that monetary policy has real effects. Specifically, we assume the Calvo (1983) staggered price setting (see, for example, Woodford [1996], Rotemberg and Woodford [1999], and McCallum and Nelson [1999]). House prices are determined by a q-theory of investment with a convex adjustment cost. Monetary policy is assumed to follow a standard Taylor-type feedback rule.

In the next section, we use the model to illustrate the implications of recent financial innovations for monetary policy.

IV. Model Simulations: Effects of Financial Innovation on the Monetary Transmission Mechanism

How does the financial accelerator work in our world? A negative shock to the economy causes a fall in housing demand, which leads to a decline in house prices and a decrease in homeowners' net worth. This causes an increase in the external finance premium, which leads to a further fall in housing demand and a fall in the transfer paid back to consumers. This fall in the transfer generates a reduction in consumption. As in Bernanke, Gertler, and Gilchrist (1999), credit market frictions amplify and propagate shocks to the economy.

In this section, we analyse the effects of an unanticipated monetary policy loosening and show how these effects are altered by the financial innovations discussed in Section II. The parameter values chosen for the model underlying the simulations are discussed in Aoki, Proudman, and Vlieghe (2001).

The steady-state annual external finance premium is assumed to be 200 basis points, and the ratio of net worth to capital is 0.7, which is the average historical leverage ratio of U.K. households. The elasticity of the transfer with respect to housing equity is set at 3. This is the estimated average elasticity of mortgage equity withdrawal with respect to the net worth ratio. In this section, we experiment with changes in this parameter. Lastly, the share of rule-of-thumb consumers is set at 0.5. There is no consensus in the literature on what this share should be for the United Kingdom, but the range appears to be 0-0.6 (Bayoumi 1993; Jappelli and Pagano 1989; Campbell and Mankiw 1989). Again, we experiment with changes in this parameter later in this section.

Better Access to Housing Equity

In Section II, we observed that the transaction costs of extracting equity from housing has fallen, and that product development is likely to reduce them further in the coming years: mortgage equity withdrawal and net housing equity have become more closely linked (Chart 1). In this section, we examine the implications of this structural change for monetary policy.

In our model, households face a trade-off when house prices rise: they can either withdraw the additional equity for consumption or they can use their stronger balance sheet to lower the rate at which they can borrow. This trade-off is captured by the adjustment parameter on the transfer stream between the house owning and consuming part of the household. When transaction costs fall, the elasticity of the transfer with respect to housing equity increases.

Chart 3 shows the responses of key variables to an unexpected monetary policy loosening when the elasticity of transfer with respect to housing equity is set to 3 and when it is increased to 10.[14] The net effect of reducing transaction costs on housing investment is to dampen the response to the policy loosening. Its effect on consumption is to heighten the response. The intuition is as follows: after the monetary policy shock, households respond to the unexpected increase in house prices. When transaction costs are lower, households use more of the increased housing equity to finance consumption. The balance-sheet improvement is therefore smaller and shorter lasting than it would otherwise have been, and this dampens the positive response of housing investment and house prices. Chart 3 captures the result that, following a fall in transaction costs, fluctuations in house prices in response to a monetary policy shock may become smaller, while fluctuations in consumption may become larger.

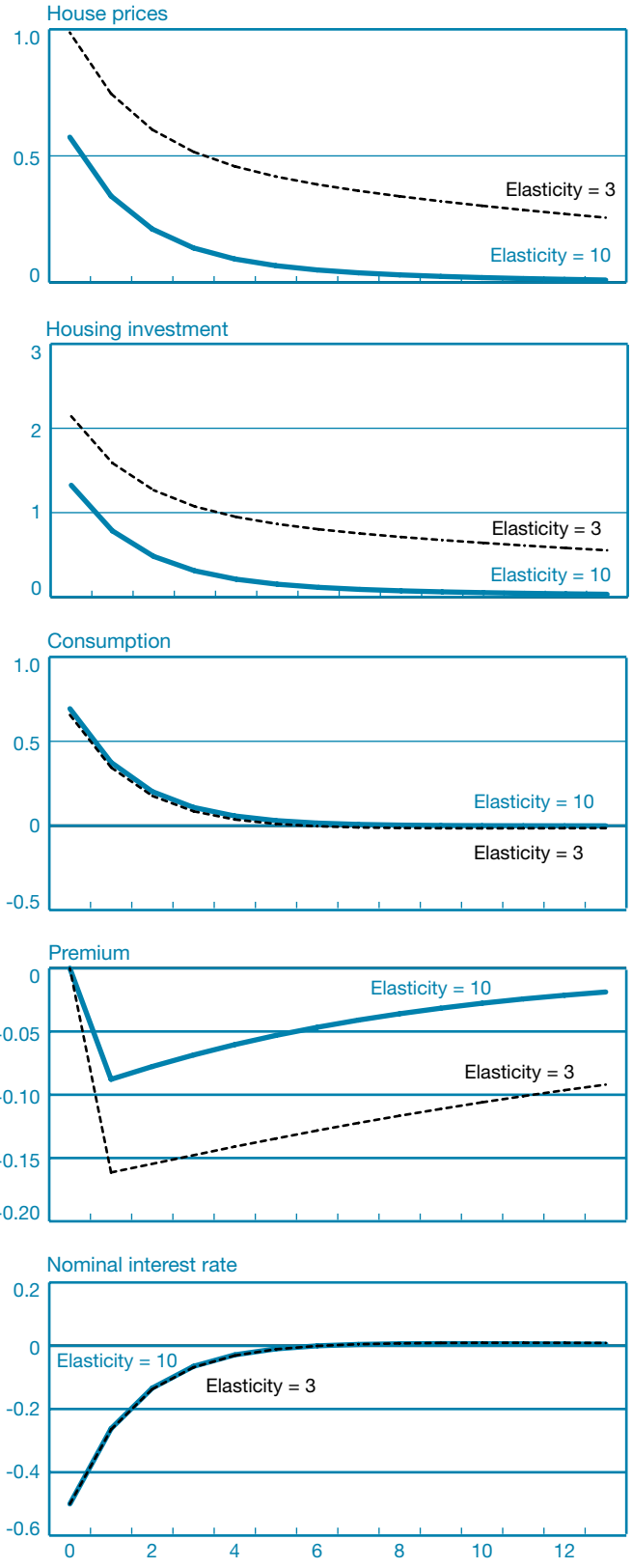
Other Sources of Lower Liquidity Constraints

The second development in U.K. retail credit markets that we explore is the increased availability of unsecured consumer credit. This may have lowered liquidity constraints independently of house price fluctuations. As Bayoumi (1993)

Chart 3

Response to a 50-Basis-Point Monetary Policy Tightening

Varying the Elasticity of the Transfer with Respect to Housing Equity



finds, the share of liquidity-constrained consumers fell significantly during the 1980s. It is likely that households now have better access to credit regardless of the state of the economy's cycle. We proxy these developments by varying the share of rule-of-thumb consumers.[15]

Chart 4 shows the response of key variables to an interest rate cut when the share of ROT consumers is lowered from 0.5 to 0.2. When there are fewer of these consumers, the responses of investment and house price are larger, while the consumption response is dampened. The intuition is as follows: rule-of-thumb consumers react more strongly than PIH consumers to changes in income, causing exaggerated movements in demand over and above those generated by the movement in real interest rates. When there are fewer of these consumers, a given monetary policy shock will have a smaller effect on consumption demand and therefore a smaller effect on inflation. If there is less inflation to react to, the nominal interest rate will not revert to trend as quickly, and the overall real interest rate response will be larger. The response of investment is therefore larger.

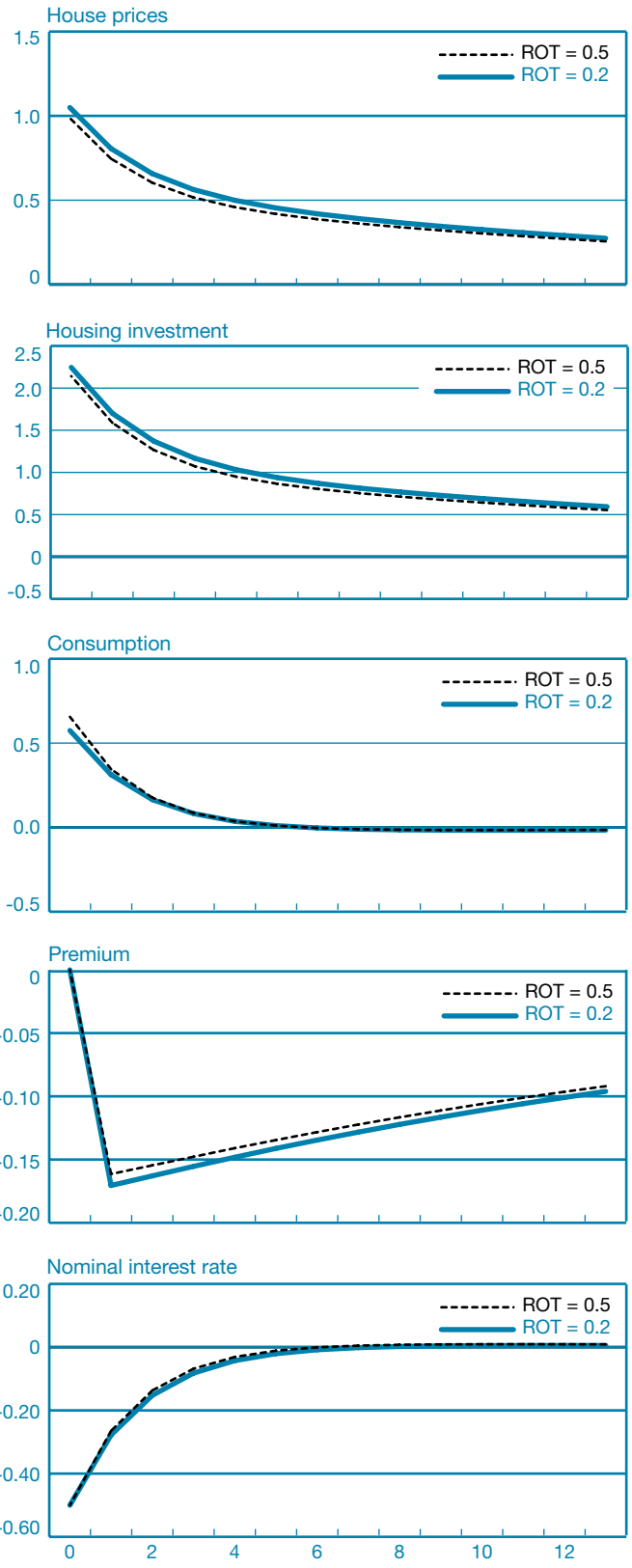
The two structural changes in the U.K. economy that we have discussed therefore have opposite effects. As people become less liquidity-constrained, they are better able to smooth consumption. However, increased access to housing collateral has linked consumption more closely to house prices, making it respond more strongly to monetary policy shocks. For housing investment, the response is the opposite. More rapid extraction of mortgage equity means that the balance sheet of homeowners changes less following a change in house prices. This lessens the financial accelerator effect. Fewer liquidity constraints, however, mean that the inflationary impact of a monetary policy shock is smaller, and a feedback rule dictates that monetary policy should revert to trend more slowly, causing a larger real interest rate change, which causes a larger investment response.

A logical next question is what the combined result would be of both structural changes. The short but uninteresting answer is that it depends on the chosen parameters. Perhaps a more fruitful approach is to examine plausible ranges for the parameters and to see under what conditions one effect dominates the other. The natural range for the share of rule-of-thumb consumers is 0 to 1. The transfer adjustment is more difficult to parameterise. Estimating the elasticity of mortgage equity withdrawal over the whole sample period gives a result of approximately 3, which we use in our benchmark model. Estimating the elasticity over a more recent period (1986-99) gives a much higher elasticity of 20. We are cautious about the precision of such estimates over short sample periods. Yet a precise estimate is not required for this particular exercise, and we use 20 as the upper bound of the plausible range of values for the elasticity of transfer with respect to net housing equity.

Chart 4

Response to a 50-Basis-Point Monetary Policy Tightening

Varying the Share of Rule-of-Thumb (ROT) Consumers



The table shows the initial consumption, housing investment, and house price responses for the range of parameters we posited as plausible. Some intuitively appealing facts emerge. Moving from a very constrained to a slightly less constrained model results in the biggest changes. Further relaxations of constraints cause relatively smaller changes thereafter. Across the plausible range, the result that house prices and housing investment will move less when credit constraints are relaxed probably holds more generally. The result for consumption is more sensitive to the particular parameter choice. However, the difference in the consumption response with tighter or looser constraints is generally smaller than the difference in the housing investment and house price response. We tentatively conclude that the covariance between housing and consumption is likely to have fallen, as has the sensitivity of house prices to monetary policy shocks. This has important implications for the information content of house price movements in order to evaluate the magnitude of the shocks hitting the economy. In other words, the elasticity of consumption with respect to housing wealth has risen, which means that the estimated coefficient on house prices in reduced-form consumption functions over long sample periods will be biased downward.

Sensitivity Test

Percentage Deviations from Trend

	Rule-of-Thumb Share				
Initial Response of Consumption					
Elasticity	0.9	0.7	0.5	0.3	0.1
1	-1.03	-0.73	-0.61	-0.55	-0.51
5	-1.10	-0.79	-0.67	-0.61	-0.57
10	-1.14	-0.82	-0.69	-0.62	-0.58
15	-1.19	-0.85	-0.71	-0.63	-0.58
20	-1.23	-0.88	-0.72	-0.64	-0.59
Initial Response of Housing Investment					
Elasticity	0.9	0.7	0.5	0.3	0.1
1	-3.19	-3.76	-4.01	-4.15	-4.24
5	-1.33	-1.57	-1.68	-1.74	-1.78
10	-1.04	-1.23	-1.32	-1.38	-1.42
15	-0.93	-1.12	-1.21	-1.27	-1.31
20	-0.88	-1.06	-1.15	-1.21	-1.25
Initial Response of House Prices					
Elasticity	0.9	0.7	0.5	0.3	0.1
1	-1.47	-1.79	-1.93	-2.00	-2.05
5	-0.53	-0.68	-0.75	-0.79	-0.82
10	-0.37	-0.51	-0.57	-0.61	-0.64
15	-0.32	-0.45	-0.51	-0.55	-0.58
20	-0.28	-0.42	-0.48	-0.52	-0.55

V. Conclusion

In this paper, we suggest that the link between house prices and consumption may have changed. We use a financial accelerator model of the household sector to simulate the impact of two kinds of the financial innovation that have occurred in the United Kingdom.

First, we examine the effect of recent developments in mortgage markets. We show that these developments increase the response of consumption to a monetary policy shock, but reduce the response of housing investment and prices. In the second experiment, we simulate the effect of developments in unsecured lending on consumption, proxied by a reduction in the number of rule-of-thumb consumers in the economy. Here it is shown that the effects are reversed: the response of housing investment and prices is larger, but the effect on consumption is dampened. For a wide range of parameter choices, the aggregate effect of the financial innovations combined is that the magnitude of house price responses has declined relative to consumption responses. This finding has important implications for the information content of house prices and the stability of reduced-form consumption functions that include housing prices or the housing stock. As a result of financial innovations, house prices are likely to move less than they did before to the same economic shocks. Therefore, we could not conclude that shocks have become smaller if house price movements have become smaller. Moreover, the responses of consumption and housing investment may also have changed. After the financial innovations, our model predicts that consumption should move by relatively more in response to a shock, but housing variables should move less.

Appendix: Housing in the Phillips Curve

We report some simple reduced-form regressions here to investigate whether house prices help explain output, consumption, and inflation.

Our sample period is 1974:1-1999:4 and generally four lags of each variable are used.[16] The gap term is an output gap estimated using the Hodrick-Prescott filter on quarterly GDP data. Inflation (π) is the log first difference of the GDP deflator, house price (hp) is the Department of the Environment, Transport, and the Regions house price index deflated by the GDP deflator, and the interest rate (R) is the Bank of England's repo rate. All variables are in logs, except interest rates, which are entered as *log (1+ interest rate)*. Standard errors are reported in parentheses.

At the bottom of the table, we report the result from a Wald test that the house price terms are jointly insignificant as well as the probability associated with the null hypothesis of joint insignificance.

Housing in the Phillips Curve

Variable	Equation 1 y_t	Equation 2 c_t	Equation 3 π_t
constant	0.39	0.12	0.0049
	(0.17)	(0.20)	(0.0018)
gap_{t-1}	—		0.35
			(0.08)
c_{t-1}	—	0.72	—
		(0.11)	
c_{t-2}	—	0.23	—
		(0.14)	
c_{t-2}	—	0.21	—
		(0.14)	
c_{t-2}	—	-0.16	—
		(0.11)	
y_{t-1}	0.74	—	—
	(0.10)		
y_{t-2}	0.20	—	—
	(0.13)		
y_{t-3}	0.24	—	—
	(0.14)		
y_{t-4}	-0.22	—	—
	(0.10)		
π_{t-1}	-0.26	-0.14	0.22
	(0.09)	(0.13)	(0.09)
π_{t-2}	-0.17	-0.01	0.39
	(0.10)	(0.13)	(0.09)
π_{t-3}	0.15	-0.07	0.18
	(0.09)	(0.12)	(0.09)
π_{t-4}	0.01	0.09	-0.07
	(0.08)	(0.12)	(0.09)
R_{t-1}	-0.0004	-0.0021	—
	(0.001)	(0.0011)	
R_{t-2}	-0.0015	0.0003	—
	(0.001)	(0.002)	
R_{t-3}	0.0007	0.0006	—
	(0.001)	(0.002)	
R_{t-4}	0.00002	0.0007	—
	(0.001)	(0.001)	
hp_{t-1}	0.018	0.076	-0.051
	(0.030)	(0.041)	(0.032)
hp_{t-2}	0.0017	-0.021	0.027
	(0.04)	(0.058)	(0.045)
hp_{t-3}	0.0078	0.0049	-0.035
	(0.04)	(0.06)	(0.044)
hp_{t-4}	-0.023	-0.063	0.048
	(0.028)	(0.039)	(0.031)
$\bar{R}^2$	0.997	0.997	0.71
F-stat $hp_{t-i} = 0$ (prob)	0.47	1.96	1.66
	(0.76)	(0.11)	(0.17)

Endnotes

1. See, for example, Miles (1992).

2. For ease of visual interpretation, data in this section are detrended by taking logs and regressing them on a constant and a quadratic time trend.

3. The q-theory of investment assumes that there are costs of adjusting the capital stock to its desired level. In the case we consider here, there are costs of adjusting the stock of housing to its desired level. Whenever the expected future return to housing increases, households will want to increase housing investment now to avoid the costs of adjusting the housing stock all at once in the future. The value of the housing stock will therefore rise immediately. This mechanism therefore causes a comovement between house prices and housing investment. If the returns to housing are driven by the same factors that drive the return to other types of capital, house prices will be positively correlated with aggregate output as well.

4. The permanent income hypothesis states that consumption decisions are based on expected total lifetime income, not period-by-period anticipated variations in income. As with housing investment decisions, consumers are therefore forward-looking and will vary consumption today when there are unexpected changes in future income. If unexpected changes in future income are correlated with unexpected changes in future returns to housing, then consumption and housing investment will be correlated. Alternatively, the correlation between housing investment and consumption can be generated if consumption is subject to preference shocks over both consumption goods and housing.

5. The price puzzle is the finding that for certain specifications of VAR models, the price level rises following a monetary policy tightening. For a discussion of the price puzzle, see, for example, Sims (1992).

6. We started with eight lags and tested down using likelihood ratio tests. The null hypothesis of five lags against an alternative hypothesis of six lags was rejected at the 1 percent confidence interval.

7. The standard error bands on these impulse response functions are large, because by incorporating all variables at once we have sacrificed degrees of freedom. Introducing variables one by one, as in Christiano, Eichenbaum, and Evans (1996), reduces the standard error bands but leaves patterns of the responses broadly unchanged. We report only the more conservative results, based on the full system.

8. See, for example, Goodhart (1989).

9. The increase in home ownership has also contributed to the rise in the aggregate stock of household debt.

10. Several lenders offer products in which the transaction cost is already zero: the customer merely requests an additional loan by telephone or the Internet and no fee is charged. The interest rate on the loan is the same interest rate as on the original mortgage borrowing. See, for example, recent editions of *Moneyfacts*, a U.K. consumer finance publication.

11. Many models of household saving behaviour assume the overlapping-generations framework to ensure that both borrowing and lending occur in equilibrium. See, for example, Gourinchas (2000) and Gertler (1999).

12. The standard optimising condition in this case (also known as the Euler equation) states that the optimal path of consumption will satisfy the following condition: the marginal rate at which consumers are willing to substitute consumption in one period for consumption in the next period should be equal to the real interest rate—that is, the marginal rate at which consumption in one period can be transformed into consumption in the next period.

13. See, for example, Deaton (1991, 1992), Carroll (1997), and Gourinchas (2000). Although much of the literature focuses on nondurables consumption, Carroll and Dunn (1997) consider the effects of household balance sheets on consumption of both nondurable goods and housing.

14. Here we set a monetary policy shock as a 50-basis-point (annualised) fall in nominal interest rates. This corresponds approximately to a one-standard-deviation monetary policy shock from the estimated VAR.

15. However, it should be noted that factors other than liquidity constraints are also important for justifying a high marginal propensity to consume out of current income, such as the impatience of consumers. If consumers are sufficiently impatient, relaxing liquidity constraints reduces marginal propensity to consume only temporarily (that is, only in the transition to a new steady state). Alternatively, it is possible to interpret ROT behaviour as a result of near rationality.

16. We also experimented with different lag structures and sample periods. The results are largely unchanged, except for the consumption equation, where house prices have marginal significance for some lag structures, but this result is highly sensitive to the choice of sample period.

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