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DIALOGUES IN ARTS AND SCIENCE

REQUIEM OF A HOUSING BOOM AND BUST

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The dawn of the 21st century was marked by a dramatic boom-bust cycle in residential real estate prices, a pattern unprecedented both in amplitude and scope that affected many countries around the globe and most regions within the United States. Figure 1 illustrates this dramatic cycle by plotting a measure of the value (in aggregate) of U.S. residential house prices relative to an aggregate measure of rents, a common specification of the fundamental dividend stream provided by the housing stock. For brevity, I shall refer to the period of rapid home price appreciation from 2000 to 2006 as the boom period in the U.S., and the period 2007 to roughly the end of 2009 as the bust. Looking back now, almost 10 years after the end of the bust, what have we learned about the factors that likely did and did not contribute to this volatility?

Providing a complete answer to this question is tricky because there are many possible contributing factors, and identifying the most salient is a challenging problem located at the intersection of empirical and theoretical economics. But let us begin with two empirical aspects of this cycle, the facts of which are relatively incontrovertible. First, the period leading up to the peak of the housing boom was characterized by a widespread relaxation of underwriting standards that reduced housing financing constraints in both U.S. and

international mortgage markets. Conversely, the housing bust that followed was associated with a subsequent reversal of these standards. Second, the entire period was characterized by a sharp increase in foreign purchases of U.S. Treasury and Agency debt, and steady declines in U.S. real interest rates. Looking across countries, those nations that exhibited the largest house price increases also often exhibited very large and increasing net inflows of foreign capital that bankrolled sharply higher trade deficits.

While there is broad agreement on these historical facts, economists have debated the role each may have played in explaining these movements in house prices and asset market volatility more generally. These historical facts also leave out other possible contributing factors about which we have less objective information. A common hypothesis is that the boom was generated by an exogenous decline in interest rates. “Exogenous” just means that the model offering such a hypothesis doesn’t explain why the decline occurs. Another hypothesis is that the boom was generated by an expectation of faster growth in housing fundamentals, such as rents. Rent is a measure of the service flow or “dividend” from the housing stock. Even home buyers who intend to occupy their homes could be rationally motivated to pay higher prices if the service flow from the house is expected to grow more quickly in the future. A third hypothesis is that house price increases are positively related to a rise in the country’s net foreign inflows, either because they directly cause house price increases (perhaps by lowering real interest rates), or because other factors simultaneously drive up both house prices and capital inflows.

In a series of research studies I have been involved with, we have argued that the key causal factor in the boom/bust episode was not interest rates, not faster expected growth in housing fundamentals, and not changes in international capital flows. We have concluded instead that the key causal factor was a *financial market liberalization* and its subsequent reversal that took place in many countries largely independently of international capital flows. Financial market liberalization (FML hereafter) refers to a set of regulatory and market changes and subsequent decisions by financial intermediaries that made it easier and less costly for households to obtain mortgages, borrow against home equity, and adjust their consumption. The rest of this essay surveys the existing literature on the Great Housing Boom and Bust, and explains how we arrive at this conclusion.

Let's begin by considering the hypothesis that the vast flows of foreign capital into U.S. securities were a key driving force behind the boom/bust cycle. Consider the value of foreign holdings of U.S. assets minus U.S. holdings of foreign assets, referred to hereafter as *net foreign asset holdings* in the U.S., or alternatively, as the U.S. *net liability position*. A positive change in net foreign asset holdings indicates a capital inflow, or more borrowing from abroad. A number of studies have addressed the link between house prices and capital flows, focusing on the boom part of the cycle.

The *global savings glut* hypothesis put forth by a number of prominent researchers, including former Federal Reserve Chair Ben Bernanke, contends

that a number of possible events (the Asian financial crisis in the late 1990s being one frequently cited) led to an increase in savings in developing countries, notably China and emerging Asia, which sought safe, high-quality financial assets that their own economies could not provide. Because of the depth, breadth, and safety of U.S. Treasury and Agency markets, those savings predominantly found their way to the United States. To the extent that saving in developed nations remained roughly unchanged by these events, the increase in savings in developing nations would cause an increase in world-wide savings, hence the global savings glut. Many researchers proposed a direct link between these capital flow patterns and higher U.S. home prices in the boom, arguing that low interest rates (driven in part by the capital inflow) were a key determinant of higher house prices during the boom. But some researchers criticized the global savings glut hypothesis by noting that an increase in world-wide savings should have led to an investment boom in countries that were large importers of capital, notably the U.S. Instead, the U.S. experienced a consumption boom that accompanied the housing boom, suggesting that saving world-wide was not unusually high. Economists at Harvard suggested an alternative interpretation of the correlation between home values and capital flows during the boom based on asset bubbles. Assuming a bubble in the housing market, they argued that the rise in housing wealth generated by the bubble led to higher consumption, which in turn led to greater borrowing from abroad and a substantial net capital inflow to the U.S.

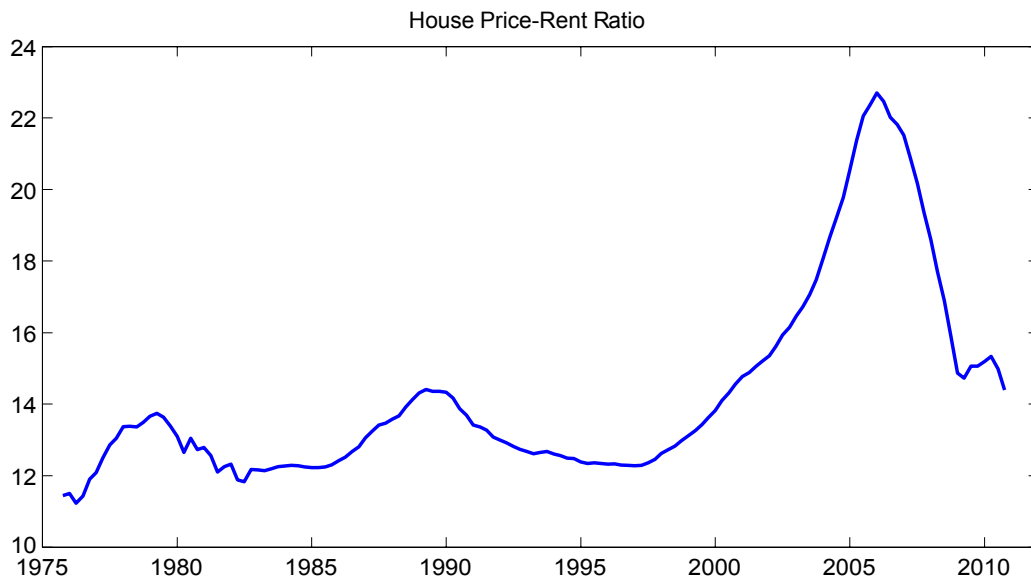


Figure 1: Price-Rent Ratio in the United States. The figure plots an aggregate price-rent ratio index for the United States from 1975:Q4-2010:Q4. Rent is rent for primary residence, constructed from the Shelter component of the Consumer Price Index for all urban consumers, SA, last month of each quarter. Data available from the Bureau of Economic Analysis of the U.S. Department of Commerce. Price is the Core Logic National House Price Index (SA, Jan.2000=100). The price-rent ratio has been normalized to equal the level, in 1975:Q4, of the quarterly Price-Rent ratio constructed from the flow of funds housing wealth and National Income and Products data on housing consumption.

Others have argued that so-called preference shocks and a desire for smooth (across goods) consumption can generate a positive correlation between house prices and capital inflows. Suppose the U.S. economy experiences an exogenous increase in its preference for housing. This would lead to a reallocation of productive inputs in the U.S. toward housing production and away from other sectors, so that housing consumption can rise. This would also lead to a concomitant increase in house prices, as long as the housing supply is not infinitely elastic. But with a preference for smooth consumption across goods, non-housing goods would then need to be increasingly imported from abroad, leading to capital inflows to the U.S.

All of these hypotheses fall into two broad categories: those that rely on higher domestic demand to simultaneously drive both house prices and capital inflows in the same direction, and those that rely on capital inflow-driven low interest rates to drive up house prices. While these papers were motivated by observations on housing and capital flows during the housing *boom*, they also have implications for the housing bust. The former imply that the housing bust should be associated with a reversal of domestic demand, leading to a capital outflow. The latter imply that the housing bust should be associated with a rise in real interest rates, driven by a capital outflow.

Our research indicates that the data pose a number of challenges to these theories. First, while it is true that real interest rates were low throughout the boom period, they have remained low and even fallen further in the bust period. Second, while capital certainly flowed into countries like the U.S. during the boom period, there is no evidence of a clear reversal in this trend during the bust period. From 1994 to 2010, only the change in net foreign holdings of U.S. *securities* (equities, corporate bonds, U.S. Agency and Treasury bills and bonds) shows any discernible upward trend. Moreover, among securities, the upward trend has been driven entirely by an increase in net foreign holdings of U.S. assets considered to be safe stores-of-value, specifically U.S. Treasury and Agency debt, (referred to hereafter simply as U.S. “safe” assets). Yet inflows into these securities, rather than declining during the housing bust, have on average continued to increase. Importantly, foreign demand for U.S. safe assets is domi-

nated by Foreign Official Institutions, namely government entities that have specific regulatory and reserve currency motives for holding U.S. Treasuries and other U.S.-backed assets, and that face both legal and political restrictions on the type of assets that can be held. Such entities take extremely inelastic positions, implying that when these holders receive funds to invest, they buy U.S. Treasuries regardless of price. These observations suggest that net capital flows into the United States over both the boom and the bust period in housing have followed a path largely independent of the forces that moved home prices, driven to great extent by foreign governments' regulatory, reserve currency, and economic policy motives.

This is not to say that there is no evidence of a positive correlation between capital inflows and the housing boom. While the notion of a global savings glut is controversial, recent data clearly suggest a reallocation of savings away from the developed world, and toward the developing world, the so-called *global imbalances* phenomenon. Unlike any prior period, global financial integration allowed for the channeling of one country's excess savings towards another country's real estate boom. Such financing occurred directly, for example by German banks' purchases of U.S. subprime securities, but also indirectly through the U.S. Treasury and Agency bond markets. As the world's sole supplier of a global reserve currency, the U.S. experienced a surge in foreign ownership of U.S. Treasuries and Agency bonds. (Agency bonds refers to the debt of the two government-sponsored enterprises (GSEs) Freddie Mac and

Fannie Mae, as well as to the mortgage-backed securities that they issue and guarantee. Due to their ambivalent private-public structure and their history as agencies of the federal government, private market investors (including foreign investors) have always assumed that the debt of Freddie Mac and Fannie Mae was implicitly backed by the U.S. Treasury. That implicit backing became an explicit backing in September 2008 when Freddie Mac and Fannie Mae were taken into government conservatorship.) But to acknowledge that these flows partly financed the housing boom does not imply that they *caused* the boom. Any such causal relationship should have worked in reverse in the bust, or we require a much more complex theoretical model that could accommodate significant asymmetries in the dynamic causal relationship between house prices and foreign capital flows.

What about the relationship of foreign capital flows to interest rates? The data show a long term upward trend in net foreign holdings of U.S. securities since 1994 that is the consequence of an upward trend in net foreign holdings of U.S. safe securities. The rise in net holdings by foreigners over time has coincided with a downward trend in real interest rates. The real annual interest rate on the 10-year Treasury bond fell from 3.78% at the start of 2000 to 1.97% by the end of 2005, while the 10-year Treasury Inflation Protected (TIPS) rate fell from 4.32% to 2.12% over this period. Real rates fell further to all time lows during the housing bust. The real 10-year Treasury bond rate declined from 2.22% to -0.42% from 2006:Q1 to 2011:Q3, while the TIPS rate declined from 2.20% to 0.08%.

Researchers have found evidence for lower Treasury yields around periods of Japanese purchases of U.S. Treasuries in the 2000-2004 period, and estimates suggest that 12-month flows equal to one percent of GDP are associated with a 19 basis point reduction in long term interest rates, such as those on U.S. mortgage assets. The effects are large. Had the twelve months ending in May 2005 seen zero foreign official purchases of U.S. Treasury and agency bonds, these results suggest that, *ceteris paribus*, U.S. long rates would have been about 80 basis points higher.

However, while there is little doubt that inflows of foreign capital into U.S. Treasury and Agency markets are associated with lower long-term real interest rates, there is no direct evidence that low interest rates have played an important role in raising house prices during the boom. Our own evidence suggests that they did not, as I discuss below. What then accounts for the dramatic rise in U.S. house prices during the boom if not foreign capital flows and/or low interest rates? A key missing element in this scenario is the shift in credit standards and housing transactions costs, summarized above as a FML and its reversal. A growing body of empirical evidence directly links measures that identify changes in credit *supply* (as opposed to changes in demand) to movements in asset prices.

Many different aspects of mortgage lending over the 2000-2010 period are consistent with a relaxation of credit standards. It may seem that an obvious way to measure relaxation of credit standards is to study loan-to-value (LTV)

ratios. But several studies have observed that average or median loan-to-value ratios did not increase much over time during the boom. There are at least three problems with using average LTV ratios as an indicator of tightness of credit constraints. First, average loan-to-value ratio measures usually mix in mortgages for house purchases with those for refinancing. The latter category of mortgages have much lower LTV ratios because the borrowers often have accumulated substantial amounts of home equity already. These refinancings are quantitatively important because, during the housing boom, mortgage interest rates came down persistently, leading to a massive refinancing boom. Second, the average loan-to-value ratio is typically based only on the first lien on the house. But often, new borrowers would take out an 80% LTV first lien and then a second (and possibly third) lien (closed-end second or home equity line of credit). By the end of 2006 households were routinely able to buy homes with 100% or higher financing using a piggyback second mortgage or home equity loan. The fraction of households with second liens rose dramatically during the boom. For subprime loans, that fraction rose from 3% in 2002 to 30%; for Alt-A loans it rose from 3% to 44%. In addition, second or third liens were a common way in which existing home owners tapped into their home equity, often several quarters after they took out the original mortgage. This equity extraction through second liens is in addition to extraction via cash-out refinancing, another innovation of the boom which became increasingly prevalent.

What this evidence suggests is that we should look at combined LTVs

(CLTVs), combining all liens on a property, at the time of purchase. And to gauge how credit constraints affected the marginal household, we should look at the right tail of that CLTV distribution. What has been found is that the average LTV at purchase for properties *with one lien* stayed rather constant over the boom, and if anything it declined a bit. Likewise, the share of purchases with one mortgage with an LTV greater or equal to 95% also stays constant. By contrast, the share of purchases *with multiple mortgages* with a CLTV greater or equal to 95% rose dramatically during the boom in every region of the U.S. The nationwide increase was from about a 25% share to about a 60% share. At the peak, about two-thirds of purchase mortgages with a second lien had a CLTV of 95% or more.

The behavior of CLTV ratios in the boom and bust does not do full justice to several aspects of the increased availability of mortgage credit during and preceding the boom. New mortgage products became available to borrowers that were previously unable to obtain mortgage credit. The share of subprime mortgage originations (to borrowers with low FICO credit scores) went from less than 10% of originations in 2002 to 40% of originations by 2006, growing from \$120 billion in originations in 2001 to \$600 billion in 2006. Likewise, the fraction of mortgages made to households with debt-to-income ratios above 40% rose from 33% to 50% over the same period. The Alt-A market, which grew from \$60 billion in originations in 2002 to \$400 billion in 2006, predominantly served households with low or no documentation (asset and income verifica-

tion). The fraction of Alt-A loans with full documentation declined from 41% in 2002 to 19% in 2006. So-called complex mortgages, defined as mortgages with low initial payments, grew from about 2% of originations in 2002 to 30% of total originations in 2006. Complex mortgages are non-fully amortizing loans, including the interest-only mortgages, option ARMs (pick-a-payment mortgages), negative amortization loans, loans with teaser rates, and loans with balloon payments. Complex mortgages often went to households with higher than average incomes, living in higher than average expensive housing markets. In addition to making house purchases available to some households that would otherwise not have been able to own a home, complex mortgages may also have allowed other households to buy a larger house than what they otherwise would have been able to afford.

In the aftermath of the credit crisis that began in 2007, evidence suggests that the erosion in credit standards and transactions costs was sharply reversed. For example, one measure of credit availability is based on quarterly bank lending surveys for countries in the Euro area and the U.S. For the U.S., the Senior Loan Officer Opinion Survey on Bank Lending Practices (SLOOS) is collected by the Federal Reserve. An important aspect of this survey is that it asks banks to explicitly distinguish between changes in the *supply* of credit as distinct from the *demand* for credit, on bank loans to businesses and households over the past three months. Thus in principle, answers to the appropriate questions are able to identify a movement in supply separately from a movement in demand. Data

for other countries are from bank lending surveys conducted by national central banks, and the European Central Bank. The survey questions are modeled after the U.S. Survey of Senior Loan Officers. We focus on questions related to *mortgage* credit supply to *households*. The detailed information is considered highly reliable because the surveys are carried out by central banks which are also bank regulators with access to a large amount of information about a bank's operations, including those reflected in loan applications and balance sheet data. For the U.S. SLOOS survey, banks indicate easing, tightening, or no change in lending standards compared to the previous three months. According to this measure, there was a significant easing of standards from 2002-2006, and a very sharp tightening afterwards.

What these features of the FML entail are changes in credit *supply* (as opposed to changes in demand) that may have driven movements in house prices. But what is the evidence that they did drive house prices any more than interest rates or foreign capital flows?

The first evidence is empirical. Using observations on credit standards, capital flows, and interest rates for the U.S. and for a panel of 11 countries, my collaborators and I investigated how measures of credit supply, interest rates and foreign flows are related to real house price movements in recent data. Our main measure of credit supply were the bank surveys of senior loan officers, carried out by national central banks as part of their regulatory oversight. We consider this a summary indicator of fluctuations in the variables associated

with a FML. We found for the U.S. that this measure of credit supply, by itself, explains 53 percent of the quarterly variation in house price growth over the period 1992-2010, while it explains 66 percent over the period since 2000. By contrast, controlling for credit supply, various measures of capital flows, real interest rates, and aggregate economic activity-collectively-add less than 5% to the fraction of variation explained for these same movements in home values. Credit supply retains its strong marginal explanatory power for house price movements over the period 2002-2010 in a panel of international data, while capital flows have no explanatory power. Moreover, credit standards continues to be the most important variable related to future home price fluctuations even when it has been rendered statistically orthogonal to banks' perceptions of credit demand, and even when controlling for expected future economic growth and expected future real interest rates. Taken together, these findings suggest that a stark shift in bank lending practices-conspicuous in the FML and its reversal-was at the root of the housing boom and subsequent crisis.

While these empirical results are suggestive, to understand how and why they make sense in economic terms, we need a theoretical model of the economy that features a housing market. In work with Jack Favilukis of the University of British Columbia Stijn Van Nieuwerburgh of Columbia University, we endeavored to understand these issues theoretically by studying a two-sector model of housing and non-housing production where heterogeneous households face various types of risk, both idiosyncratic and aggregate, and have limited

opportunities to insure against such risks. A house in the model is a residential durable asset that provides utility to the household, is illiquid (expensive to trade), and can be used as collateral in debt obligations. The model economy is populated by a large number of overlapping generations of households who receive utility from both housing and nonhousing consumption and who face a stochastic life-cycle earnings profile. Households also face collateralized borrowing constraints. In the case of housing, this simply means that they must put some money down in order to buy a home.

Within the context of this model, we focus on the macroeconomic consequences of three systemic changes in housing finance that characterize the Great Housing Boom and Bust: changes in housing collateral requirements, changes in housing transactions costs, and changes in foreign capital flows into the domestic safe-asset market. We lump the first two together to get a model-implied FML and subsequent reversal.

In the model, the main impetus for rising price-rent ratio (akin to the variable in U.S. data plotted in Figure 1) in the boom period is the simultaneous occurrence of positive economic shocks and the FML. The housing bust is caused by a reversal of the FML and of the positive economic shocks and an endogenous decrease in borrowing capacity as collateral values fall. What is the channel by which these outcomes occur in equilibrium? The main mechanism involves changing *risk premia* on both housing and equity assets, which fluctuate with the business cycle and with economy-wide collateralized borrowing constraints.

Consider the expected future return you could earn on an asset such as a house. For example, if you expect the home to appreciate, that would be one reason you might expect a higher future return on the asset. The expected return on any asset can be tautologically decomposed into the sum of two components: the expected return in excess of an interest rate, plus the expected interest rate. The first component we'll call the risk premium, and the second component we'll call the expected interest rate. One reason that house prices relative to measures of fundamental value in the housing market (such as rent) can rise is if expected future housing fundamentals (e.g., growth in rents) are discounted back to the present at a lower rate. Both the risk premium and the expected interest rate directly affect this discount rate. Thus a decline in either housing risk premia or expected interest rates could lead to a boom in house price-rent ratios because they affect the discount rate, while an increase in either of these could lead to a decline in such ratios. We show theoretically that a relaxation of borrowing constraints leads to a decline in housing risk premia, which is the mechanism behind the rise in house price-rent ratios.

Why do risk premia fall? A FML reduces risk premia for two reasons, both of which are related to the ability of heterogeneous households to insure against aggregate and idiosyncratic risks they face. First, lower collateral requirements directly increase access to credit, which acts as a buffer against unexpected income declines. This is a type of implicit insurance against bad outcomes. Second, lower transactions costs reduce the expense of obtaining the

collateral required to increase borrowing capacity and provide this insurance. These factors lead to an increase in risk-sharing/insurance opportunities. The housing bust is caused by a reversal of the FML and of the positive economic shocks and an endogenous decrease in borrowing capacity as collateral values fall. These factors lead to an accompanying rise in housing risk premia, driving the aggregate house price-rent ratio lower.

But what of the role of declining interest rates and foreign capital flows in the boom and bust? The theoretical framework is useful because it shows that, in the general equilibrium of the model, the *only* way to generate a housing boom from a relaxation in financing constraints is through a decline in the housing risk premium. Specifically, the boom can't be explained by a decline in interest rates; nor can it be explained by an expectation of faster growth in housing fundamentals. The reason is that the increase in aggregate housing demand that results from a financial market liberalization leads to an endogenous increase in residential investment and thus an expected *decline* in rent growth. And although lower collateral requirements generate a housing boom, they also cause households to endogenously respond to their improved insurance opportunities by reducing saving they would normally do for precautionary reasons. This reduction in savings by itself would lead to an *increase* in the equilibrium real interest rate. Both of these adjustments have the effect of reducing the aggregate house price-rent ratio rather than increasing it. It follows that the only way the price-rent ratio can rise in response to a relaxation of financing

constraints is if the decrease in the housing risk premium more than offsets the combined effects of lower expected rent growth and a higher real interest rate.

Of course, as we've seen, the housing boom that occurred in the first part of the 21st century was characterized by both lower collateral requirements *and* lower rather than higher real interest rates. The model thus shows that a relaxation of financing constraints cannot by itself generate lower equilibrium interest rates (indeed it generates the opposite). This implies that some other factor must have been at work to explain the decline in observed interest rates over this period. Enter stage right: foreign capital flows move into the model. Once we allow for a quantitatively plausible influx of foreign capital into the domestic safe asset market, the model generates a large decline in the equilibrium real interest rate even in an economy with lower collateral requirements. The model implies that a rise in foreign purchases of domestic bonds, equal in magnitude to those observed in the data from 2000-2010, leads to a quantitatively large decline in the equilibrium real interest rate.

Were this decline not accompanied by other general equilibrium effects, it would lead to a significant housing boom in the model. But the general equilibrium effects imply that a capital inflow is unlikely to have a large effect on house prices *even if* it has a large effect on interest rates. One reason for this involves the central role of time-varying housing risk premia. In models where risk premia are presumed fixed over time, a decline in the interest rate of this magnitude would be sufficient-by itself-to explain the rise in price-rent ratios

observed from 2000-2006 under reasonable calibrations. But with time-varying housing risk premia, the result can be quite different. Foreign purchases of U.S. bonds crowd domestic savers out of the safe bond market, exposing them to greater systematic risk in equity and housing markets. In response, risk premia on housing and equity assets rise, substantially offsetting the effect of lower interest rates and limiting the impact of foreign capital inflows on home prices. The second offsetting general equilibrium effect, mentioned above, is that foreign capital inflows also stimulate residential investment, raising the expected stock of future housing and lowering expected future rental growth. Like risk premia, these expectations are reflected immediately in house prices (pushing down the national house price-rent ratio), further limiting the impact of foreign capital inflows on home prices. The net effect of all of these factors is that a large capital inflow into safe securities has at most a small positive effect on house prices.

To summarize, there are two opposing forces simultaneously acting on housing risk premia in the model economy. During the housing boom, there is both a FML and a capital inflow. As explained, the FML *lowers* risk premia, while foreign purchases of domestic safe assets *raise* risk premia. Under the calibration of the model, the decline in risk premia resulting from the FML during the boom period is far greater than the rise in risk premia resulting from the capital inflow. On the whole, therefore, risk premia on housing assets fall, and this is the most important contributing factor to the an increase in price-rent

ratios during the boom. During the bust, modeled as a reversal of the FML but not the capital inflows, risk premia unambiguously rise even as interest rates remain low. The rise in risk premia drives the decline in house-price rent ratios.

These features of the model represent significant departures from other theories of capital flows and house prices. They permit the model to explain not just the housing boom, but also the housing bust, in which house price-rent ratios fell dramatically even though interest rates remained low and there has been no clear reversal in the trend toward capital inflows into the U.S. safe asset markets. Moreover, they underscore the importance of distinguishing between interest rate changes (which are endogenous) and credit supply. In the absence of a capital inflow, an expansion of credit supply in the form of lower collateral requirements and lower transactions costs should lead, in equilibrium, to higher interest rates, rather than lower, as households respond to the improved risk-sharing/insurance opportunities by reducing precautionary saving. Instead we observed low real interest rates, generated in the model by foreign capital inflows, but the inflows themselves are not the key factor behind the housing boom-bust.

It is worthwhile isolating the equilibrium relationship between capital inflows and housing risk premia in the theoretical environment. As we've noted, higher capital inflows into the safe bond market, by themselves, raise risk premia on housing assets as well as other risky securities such as equity. This runs contrary to the argument made by some policymakers in the years leading up to the housing crisis, that the free flow of capital across borders should be

associated with a reduction in risk premia. Here, foreign purchases of the safe asset make both equity and housing assets *more risky*, for two reasons. First, the increase in foreign money forces domestic residents as a whole to take a levered position in the risky assets. This by itself increases the volatility of asset and housing returns, translating into higher risk premia. Second, domestic savers are crowded out of the bond market by deep-pocketed foreign governmental holders who are willing to hold the safe asset at any price. As a result, domestic investors become more exposed to systematic risk in the equity and housing markets. In equilibrium, domestic savers must be compensated by higher risk premia as they shift the composition of their financial wealth towards risky securities.

I close this requiem by noting that other models of the housing boom/bust studied by other researchers predict that a relaxation of financing constraints can have only small effects on house prices, while movements in real interest rates have large effects. These implications contrast sharply with the implications of our model. Why? Our analysis indicates that the crucial discrepancies are three-fold. First, such models are partial equilibrium analyses where the risk-free real interest rate is an exogenous parameter rather than an equilibrium variable. Second, these models have no quantitatively important sources of aggregate risk, so risk premia are negligible. Third, the models have no mechanism for matching the wealth distribution that we observe in the data. The first and second of these differences are directly related to the question of whether lower interest rates can theoretically lead to large housing booms. If the

interest rate is exogenous and risk premia are negligible, decreasing the interest rate parameter can lead to a large housing boom because doing so does not elicit an offsetting adjustment of the housing risk premium as explained above. In the general equilibrium model we studied, it is not possible to hold the housing risk premium fixed when interest rates change due to an exogenous impetus (such as an influx of foreign capital). Of course, the question of whether falling interest rates cause housing booms is ultimately an empirical one. The econometric evidence discussed above suggests that declining real interest rates do not provide a plausible explanation for the housing boom. The model we study, which generates the boom from a decline in risk premia rather than interest rates, provides a theoretical rationale for these findings.

The second and third differences are of paramount importance for the question of whether economy-wide changes in financing constraints (such as the minimum amount of collateral required to take out a mortgage) have large or small effects on house prices. We find that both aggregate business cycle risk and a realistic wealth distribution are important here. When we shut off business cycle risk in our model, we find a smaller increase in the price-rent ratio in response to a decline in collateral requirements as compared to the benchmark case that includes such risk. Business cycle risk amplifies the effects of time-variation in collateral requirements. When we shut off mechanisms required to generate a plausible wealth distribution, we find that a reduction in collateral requirements leads to a relatively small increase in house prices

and the price-rent ratio. This is because an economy-wide decrease in collateral requirements can be an important source of aggregate risk only if constrained households account for a sufficiently large component of aggregate housing demand. In standard specifications that do not match the wealth distribution, constrained households are simply too small a fraction for this to occur.

These findings illustrate two fundamental principles. First, an economy-wide shift in financing constraints is itself an important source of aggregate risk that can have sizable effects on housing risk premia. The housing risk premium is an equilibrium quantity that responds both to business cycle shocks and to the tightness of financing constraints, as these two driving forces alter the landscape for risk-sharing and insurance. Second, the model's implications for the wealth distribution are of critical importance for the questions addressed here. In specifications that deliver too little inequality, too few households operate near binding constraints, so changing those constraints has little influence on national home values. The bottom line is that financing constraints matter.

Future research is need to understand *why* credit market conditions changed so markedly during this housing cycle. It is widely understood that the financial market liberalization we study was preceded by a number of revolutionary changes in housing finance, notably by the rise in securitization. These changes initially decreased the risk of individual home mortgages and home equity loans, allowing for a more efficient allocation of risk and,

some have argued, making it optimal for lending contracts to feature lower collateral requirements and lower housing transactions fees. At the same time, these initially risk-reducing changes in housing finance were accompanied by government deregulation of financial institutions that ultimately increased risk, by permitting such institutions to alter the composition of their assets towards more high-risk securities, by permitting higher leverage ratios, and by presiding over the spread of complex financial holding companies that replaced the long-standing separation between investment bank, commercial bank and insurance company. More work is needed to understand the long-term implications of these regulatory decisions.