The Research Agenda: Stijn Van Nieuwerburgh on Housing and the Macroeconomy

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1. Introduction

An important part of my research focuses on the intersection of real estate, the largest financial asset for most households, asset markets, and the real economy. In the US, aggregate household residential real estate wealth is currently about $18 trillion and residential mortgage debt about $13 trillion. A common theme in my work is that housing plays a key role as collateral against which households can borrow. In several papers, I model the extent to which households use their house to insure against income shocks and study how changes in the value of housing affects interest rates and rates of return on risky assets. The main message from this research agenda is that, through its effect on risk sharing, fluctuations in housing collateral wealth can help explain puzzling features of stock returns, house prices, interest rates, and the cross-sectional dispersion in households' consumption. The research speaks to the dramatic swings in real estate markets we observed in the last fifteen years. In this overview I take the opportunity to report on some of my ongoing work in this area and to review some of the main findings of earlier research.

2. The Housing Boom and Bust: Time-Varying Risk Premia

An important challenge in the housing literature is to explain why house prices are so volatile relative to fundamentals such as rent (rental cost) and why price-to-rent ratios exhibit slow-moving boom-bust cycles all over the world. The unprecedented amplitude of the boom-bust cycle between the years 2000 and 2010 in particular begs for a coherent explanation.

In ``The Macroeconomic Effects of Housing Wealth, Housing Finance, and Limited Risk-Sharing in General Equilibrium (2010, FLVNa)," Jack Favilukis Sydney Ludvigson, and I generate booms and busts in house price-to-rent ratios that quantitatively match those observed in U.S. data in a model that accounts for the observed equity risk premium and risk-free rate behavior. A large preceding literature makes clear that this is a difficult task, especially in a model with production and realistic business cycle properties like ours (e.g., Davis and Heathcote 2005, Jermann 1998).

Specifically, FLVNa study a two-sector general equilibrium model of housing and non-housing production where heterogeneous households face limited risk-sharing opportunities as a result of incomplete financial markets. 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 non-housing consumption and who face a stochastic life-cycle earnings profile. We introduce market incompleteness by modeling heterogeneous agents who face idiosyncratic and aggregate risks against which they cannot perfectly insure, and by imposing collateralized borrowing constraints on households (standard down-payment constraints). Within this context, we focus on the macroeconomic consequences of three systemic changes in housing finance, with an emphasis on how these factors affect risk premia in housing markets, and how risk premia in turn affect home prices. First, we investigate the impact of changes in housing collateral requirements. Second, we investigate the

impact of changes in housing transactions costs. Third, we investigate the impact of an influx of foreign capital into the domestic bond market.

These changes are meant to capture important changes to the U.S. economy over the last fifteen years. Taken together, the first two factors represent the theoretical counterpart to the relaxation of credit standards in mortgage lending that took place in the real world between the late 1990s and the peak of the housing market in 2006, and the subsequent tightening of credit standards after 2006. We refer to these two changes as *financial market liberalization* (FML) and its reversal. During the boom years, the U.S. mortgage markets saw a massive increase in the use of subprime mortgages, negative amortization and teaser rate loans, and low or no-documentation loans. It also saw a massive increase in the incidence and dollar volume of second mortgages and home equity lines of credit, and with it a large rise in the fraction of borrowers with combined loan-to-value ratios above 95 or even above 100%. Finally, the transaction costs associated with mortgage borrowing, home equity extraction, and mortgage refinancing fell rapidly while borrowers' awareness of the opportunities to tap into one's home equity rose. During the housing crisis and to this day, mortgage credit constraints tightened substantially, costs of tapping into one's home equity rose and both reverted to their pre-boom levels. Favilukis, Kohn, Ludvigson, and Van Nieuwerburgh (2011) provide detailed evidence as well as references to this literature.

The last 15 years were also marked by a sustained depression of long-term interest rates that coincided with a vast inflow of capital into U.S. safe bond markets. While in 1997 foreigners only held $1.6 trillion in U.S. Treasury and Agency bonds, that number had grown to $5.2 trillion by June 2010, representing nearly half of the amounts outstanding. Interestingly, foreign purchases of safe U.S. securities not only rose sharply during the housing boom, but the inflows continued unabated during the housing bust. The vast bulk of these foreign purchases over this period (80%) were made by foreign official institutions, mostly Asian central banks. The increase in foreign purchases of U.S. safe assets accounts for the entire rise in the U.S. net foreign liability position in all securities, because the net position in risky securities hovers around zero.

The main impetus for rising price-rent ratios in the model in the boom period is the simultaneous occurrence of positive economic (TFP) shocks and a relaxation of credit standards, phenomena that generate an endogenous decline in risk premia on housing and equity assets. As risk premia fall, the aggregate house price index relative to aggregate rent rises. 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. First, lower collateral requirements directly increase access to credit, which acts as a buffer against unexpected income declines. Second, lower transactions costs reduce the expense of obtaining the collateral required to increase borrowing capacity and provide insurance. These factors lead to an increase in risk-sharing, or a decrease in the cross-sectional variance of marginal utility. The housing bust is caused by a reversal of the FML, negative 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 house price-rent ratio down. Thus, in contrast with the literature, housing risk premia play a crucial role in house price fluctuations.

It is important to note that the rise in price-rent ratios caused by a FML in FLVNa must be attributed to a decline in risk premia and not to a fall in interest rates. Indeed, the very changes in housing finance that accompany a FML drive the endogenous interest rate up, rather than down. It follows that, if price-rent ratios rise after a FML, it must be because the decline in risk premia more than offsets the rise in equilibrium interest rates that is attributable to the FML. This aspect of a FML underscores the

importance of accounting properly for the role of foreign capital over the housing cycle. Without an infusion of foreign capital, any period of looser collateral requirements and lower housing transactions costs (such as that which characterized the housing boom) would be accompanied by an increase in equilibrium interest rates, as households endogenously respond to the improved risk-sharing opportunities afforded by a FML by reducing precautionary saving.

To model capital inflows, the third structural change in the model, FLVNa introduce foreign demand for the domestic riskless bond into the market clearing condition. We model foreign capital inflows as driven by foreign governments who inelastically place all of their funds in U.S. riskless bonds. Krishnamurty and Vissing-Jorgensen (2012) estimate that such foreign governmental holders, such as central banks, have a zero price elasticity for U.S. Treasuries, because they are motivated by reserve currency or regulatory motives (Kohn, 2002).

The FLVNa 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 with constant risk premia, 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. There is a second offsetting general equilibrium effect. Foreign capital inflows also stimulate residential investment, raising the expected stock of future housing and lowering the expected future rental growth rate. 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 only a small positive effect on house prices.

In summary, there are two opposing forces simultaneously acting on housing risk. During the housing boom, there is both a FML and a capital inflow. 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 is far greater than the rise in risk premia resulting from the capital inflow. The decline in risk premia on housing assets is the most important contributing factor to the 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 while risk-free interest rates remain low. The rise in risk premia drives the decline in house-price rent ratios. Time variation in risk premia is the distinguishing feature that permits our model to explain not just the housing boom, but also the housing bust. Moreover, the model underscores the importance of distinguishing between interest rate changes (which are endogenous) and exogenous changes to 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 savings. Instead we observed low real interest rates, generated in the FLVNa model by foreign capital inflows, but the inflows themselves are not the key factor behind the housing boom-bust.

The model of FLVNa is silent on the origins of the relaxation of credit constraints and its subsequent tightening, but it is worthwhile to briefly digress and consider some possibilities. A first possibility is that mortgage lenders were confronted with exogenous changes in technology that affected mortgage finance. The boom period witnessed the birth of private-label securitization, collateralized debt obligations, credit default swaps, as well as automated underwriting and new credit scoring techniques employed in that underwriting (Poon, 2009). These innovations have been linked to the boom in mortgage credit and house price growth by Mian and Sufi (2009) and Keys, Seru, Piskorski, and Vig (2012). Second, there was substantial legislative action that gave banks much more leeway to relax lending standards: Mian, Sufi, and Trebbi (2010) mention 700 housing-related legislative initiatives that Congress voted on between 1993 and 2008 while Boz and Mendoza (2010) highlight the 1999 Gramm-Leach-Bliley and the 2000 Commodity Futures Modernization Acts. Third, in this period, regulatory oversight over investment banks and mortgage lenders weakened substantially (Acharya and Richardson, 2009). For example, the regulatory treatment of AA or better rated private label residential mortgage-backed securities (MBS) was lowered in 2002 to the same low regulatory capital level as that applied to MBS issued by the Agencies since 1988. Also, since 2004 investment banks were allowed to use their internal models to assess the risk of the MBS and capital requirements fell even further. Regulatory capital rules were relaxed on guarantees that banks extended to the special purpose vehicles they set up and that housed a good fraction of mortgage credit (Acharya, Schnabel, and Suarez, 2012). These changes took place in an environment where private sector mortgage lenders where engaged in a race to the bottom with the government-sponsored enterprises, who themselves were substantially affected by regulatory changes and implicit government guarantees (Acharya, Richardson, Van Nieuwerburgh, and White, 2011). Faced with such changes in their economic environment, mortgage lenders formed expectations of higher future house price growth, justifying more and riskier mortgages as in the optimal contracting framework of Piskorski and Tchystyi (2010). The bust saw a tightening of regulatory oversight and the Dodd-Frank Act (Acharya, Cooley, Richardson, and Walter, 2011), to which lenders responded by cutting back on credit.

3. International Evidence and the Role of Capital Flows in the Housing Boom and Bust

In follow-up empirical work, Favilukis, Kohn , Ludvigson, and Van Nieuwerburgh (2011) study the empirical relationship between house prices, foreign capital flows, and a direct measure of credit standards for a cross-section of countries. Across countries, we find a positive correlation between house price growth and foreign capital inflows (current account deficits) during the boom period, but a negative correlation during the bust. For a smaller subset of countries we have a direct measure of the tightness of credit constraints from senior loan officers' surveys on banks' standards of supplying mortgage credit to households. In a panel regression for 11 countries for a sample that spans the boom and bust, we find a strong positive association between the fraction of banks that eases credit standards and house price growth. Over the same sample, such a relationship is absent between current account deficits and house price growth. These results are robust to alternative measures of capital flows. Longer time series evidence for the U.S. suggests that more than 50% of variability in house price growth is accounted for by changes in credit standards, and very little by the dynamics of the current account. Our measure of credit standards is positively related to the ratio of non-conforming to conforming mortgage originations. In sum, the time series and cross-country data seem supportive of the notion that changes in international capital flows played, at most, a small role in driving house prices during this time, both in the U.S. and around the world.

4. Foreign Holdings of U.S. Safe Assets: Welfare Effects for U.S. Households

In "Foreign Ownership of U.S. Safe Assets: Good or Bad? (2012, FLVNb)", we use a similarly rich framework to evaluate the implications of the dramatic rise on foreign holdings of U.S. safe assets for the welfare of U.S. households. Despite a vigorous academic debate on the question of whether global imbalances are a fundamentally benign or detrimental phenomenon (see Gourinchas (2006) Mendoza, Quadrini, and Rios-Rull (2007), Caballero, Fahri, and Gourinchas (2008a), Caballero, Fahri, and Gourinchas (2008b), Obstfeld and Rogoff (2009), and Caballero (2009)), little is known about the potential welfare consequences of these changes in international capital flows, or of foreign ownership of U.S. safe assets in particular. We argue in this paper that a complete understanding of the welfare implications requires a model with realistic heterogeneity, life-cycle dynamics, and plausible financial markets. The model has a special role for housing as a collateral asset.

The model economy implies that foreign purchases (or sales) of the safe asset have quantitatively large distributional consequences, reflecting sizable tradeoffs between generations, and between economic groups distinguished by wealth and income. Indeed, the results suggest that a sell-off of foreign government holdings of U.S. safe assets could be tremendously costly for some individuals, while the possible benefits to others are many times smaller in magnitude. To answer the question posed in the title, this type of foreign capital inflow is good (by a lot) for some, and bad (by much less) for others.

Welfare outcomes are influenced by the endogenous response of asset markets to fluctuations in foreign holdings of the safe asset. Foreign purchases of the safe asset act like a positive economic shock and have an economically important downward impact on the risk-free interest rate, consistent with empirical evidence. Although lower interest rates boost output, equity and home prices relative to measures of fundamental value, foreign purchases of the domestic riskless bond also reduce the effective supply of the safe asset, thereby exposing domestic savers to greater systematic risk in equity and housing markets. In response, risk premia on housing and equity assets rise, substantially (but not fully) offsetting the stimulatory impact of lower interest rates on home and equity prices. These factors imply that the young and the old generations experience welfare gains from a capital inflow, while middle-aged savers suffer. The young benefit from higher wages and from lower interest rates, which reduce the costs of home ownership and of borrowing in anticipation of higher expected future income. On the other hand, middle-aged savers are hurt because they are crowded out of the safe bond market and exposed to greater systematic risk in equity and housing markets. Although they are partially compensated for this in equilibrium by higher risk premia, they still suffer from lower expected rates of return on their savings. By contrast, retired individuals suffer less from lower expected rates of return, since they are drawing down assets at the end of life. They also receive social security income that is less sensitive to the current aggregate state than is labor income, making them more insulated from systematic risk. Taken together, these factors imply that the oldest retirees experience a significant net gain even from modest increases in asset values that may accompany a capital inflow.

The magnitude of these effects for some individuals is potentially quite large. For example, in the highest quintile of the external leverage distribution, the youngest working-age households would be willing to give up over 2% of life time consumption in order to avoid just one year of a typical annual decline in foreign holdings of the safe asset (which amounts to about 2% of U.S. trend GDP). This effect could be several times larger for a greater-than-typical decline, and many times larger for a series of annual declines in succession or spaced over the remainder of the household's lifetime. By contrast, the absolute value of the equivalent variation welfare measure we study is often one-tenth of the size (and in general of the opposite sign) for sixty year-olds than it is for the youngest or oldest households. Thus,

middle-aged households often stand to gain from an outflow, but their gain is much smaller in magnitude than are the losses for the youngest and oldest.

We also compute welfare consequences for groups that vary according to total wealth, housing wealth, and income, as well as an ex-ante measure for agents just being born. The latter provides one way of summarizing the expected welfare effects over the life cycle, as experienced by a newborn whose stochastic path of future earnings and foreign capital inflows is unknown. Under the veil of ignorance, newborns benefit from foreign purchases of the safe asset and would be willing to forgo up to 18% of lifetime consumption in order to avoid a large capital outflow.

Our study focuses on the effect of a reserve-driven upward trend in the U.S. net foreign debtor position over time on the macroeconomy and welfare. Our model is silent on the economic implications of gross flows, and we do not study cyclical fluctuations in the value of net foreign holdings of other securities which, unlike net foreign holdings of U.S. safe assets, show no upward trend (Favilukis, Kohn, Ludvigson, and Van Nieuwerburgh (2011)). By contrast, Gourinchas and Rey (2007) and Maggiori (2011) investigate how the net foreign asset position of the U.S. invested in risky securities varies cyclically across normal and crisis times, as well as how gross flows are affected. On the other hand, these papers are silent on the reasons for the large and growing net foreign debtor position of the U.S. in good times, and on its upward trend over time. We view these studies as complementary to our study. Integrating both aspects of foreign flows in one model seems like a priority for future research.

5. Housing Collateral, Financial Market Puzzles, and Measures of Risk Sharing

My earlier work explores the role of housing as a collateral asset in models of limited commitment, along the lines of Krueger (1999), Alvarez and Jermann (2000), and Chien and Lustig (2010). Two of these papers provide empirical support for the mechanism operating in these models. ``Housing Collateral, Consumption Insurance, and Risk Premia: an Empirical Investigation" (2005) with Hanno Lustig, predicts that households are less keen to take on financial risks, and therefore demand a higher return for bearing these risks, when housing collateral is scarce. In U.S. aggregate data, we show that a decrease in housing collateral is followed by higher future stock returns, in excess of the risk-free rate and that this relationship is statistically significant. The cross-sectional prediction of the model is that assets whose returns covary more positively with the value of housing must offer their investors higher returns relative to other assets. In contrast, assets whose value increases when housing collateral is scarce are a valuable hedge against the risk of being borrowing-constrained. This additional benefit induces the holders of these assets to accept lower returns. In the data, this mechanism explains more than 80% of the cross-sectional difference between average returns on value (high book-to-market ratio) and growth stocks (low book-to-market ratio). Its pricing errors compare favorably to those of competing asset pricing models.

The model upon which these empirical results are based, spelled out in Lustig and Van Nieuwerburgh (2007), also provides an explanation for why short-duration assets, whose risky cash flows accrue in the near future, have higher risk premia than long-duration assets, an empirical fact highlighted by Binsbergen, Brandt, and Koijen (2011).

The second piece of evidence on the housing collateral and risk sharing mechanism comes from quantity data for U.S. metropolitan areas. ``How Much Does Housing Collateral Constrain Regional Risk Sharing?" with Hanno Lustig (2010) measures the degree of risk sharing as the cross-sectional variance of consumption relative to the cross-sectional variance of income. The model aggregates heterogeneous,

borrowing-constrained households into regions characterized by a common housing market and solves for the equilibrium consumption dynamics. It generates a lower degree of risk sharing when housing collateral is scarce to an extent similar to what we find in the data.

6. Regional Variation in Housing Prices

My interest in regional variations across housing markets led to a project that explores why house prices differ across regions and over time. The spatial location model in ``Why Has House Price Dispersion Gone Up?" with Pierre-Olivier Weill (2010) is one of the first dynamic versions of the seminal Rosen (1979) and Roback (1982) model in urban economics. Regions differ in their productivity levels and therefore the wages paid to their resident workers. Since workers are free to move across regions, house prices must adjust to make them indifferent between living in any region. Regions which experience fast wage growth attract new households who bid up house prices. Housing supply regulation constrains the number of new units that can be built per period in each area; muting the response of quantities amplifies price changes. By feeding realized regional wages into a calibrated version of the model, we can explain the magnitude of the increase in average house prices and the increase in the dispersion of house prices across regions over the 1975-2005 period. Interestingly, a tightening in housing supply regulation by itself -an alternative candidate explanation for the observed changes in the house price distribution- does not generate much of an increase in the price level or its dispersion in the model because households can relocate.

While the paper produces rich patterns for house prices across time and space and matches important features of the data over the sample period of study, it would fall short in accounting for house prices over the recent boom and bust period described above. This is because the model does not generate time variation in risk premia associated with relaxing and tightening credit constraints. An important research challenge going forward is to enrich the spatial housing models so that they imply richer asset pricing dynamics. This would allow us to understand better the heterogeneous house price experience of U.S. metropolitan areas over the last decade.

7. Conclusion

In light of the recent events, there has never been a more relevant time to work on housing and its implications for macroeconomics and asset markets at large. There is a flurry of exciting research in progress by established and young researchers alike, studying a range of interesting questions. How can we account for the magnitude and dynamics of mortgage foreclosures and how do they affect the macro-economy? How successful are the government's mortgage modification programs in getting the U.S. economy back on track? What are the macro-economic implications of the credit crunch that is currently taking place in mortgage markets in the U.S.? What should the future architecture of the U.S. housing finance system look like and what can we learn from other countries? Finally, commercial real estate remains a largely unexplored asset class in the macro-finance literature despite its size and importance to the macroeconomy. These are some of the questions I hope the profession will continue to make progress on going forward.

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