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VAR Estimates of the Housing and Stock Wealth Effects: Cross-country Evidence [*]

Sheng Guo [†]   Umut Unal [‡]

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Abstract

We estimate the wealth effects of housing and stock market wealth using time-series data for eight developed countries. In estimation we employ the structural vector-autoregressive regressions (SVAR), which articulate the dynamic interactions of shocks to housing prices, stock values, and disposable incomes. Our results show that for these countries the initial consumption response to housing price shocks is greater than to stock market capitalization shocks, but the long-run consumption response to the latter is more persistent than to the former.

JEL Classification: E21, E44, D12, D14, G12, R31

Key Words: wealth effect, consumption, housing, stock market

1 Introduction

The wealth effect, defined as the change in consumption expenditure induced by an exogenous change in wealth, has profound implications for measurement, diagnosis, and forecast of economic activity. For countries including the United States consumption expenditure comprises the bulk of GDP. The analysis of wealth effects thus has garnered attention from market practitioners, policy makers, and academic researchers. There are various components of wealth, thus various wealth effects associated with each of them. Yet a large body of literature examines and compares the magnitude of wealth effects from housing and stock market wealth, presumably two of the most significant components of wealth for households in developed countries.

Several reasons exist for us to expect a larger wealth effect coming out of housing than out of stock market wealth. First, the volatility of stock markets is much higher than that of housing markets.[1] *Ceteris paribus*, with higher volatility, gains and losses are less permanent, and households may accordingly exhibit a smaller propensity to consume out of stock wealth. Secondly, housing wealth is more evenly distributed among households than is stock wealth. For that reason, even if a household responds in the same way to both wealth shocks, in aggregate we may still observe a larger magnitude for housing wealth. Finally, in most economies, housing assets can be easily pledged as collateral to borrow funds, through mortgages or home equity loans. This is less the case for stock assets. The increased use of homes as collateral has strengthened the positive effect of rising housing wealth on consumption as well as on the rest of the economy via household borrowing —the "financial accelerator" effect (Aoki et al., 2002; Cardarelli et al., 2008).

Yet a couple of factors point to the opposite direction. First, as Poterba (2000) points out, the rise of house prices increases the implicit "user cost" of living in a house, which may undercut the boost to nonhousing consumption induced by rising wealth due to higher house value. Secondly, housing wealth is measured less precisely, which may lead a household's reaction to wealth change more lukewarm. Finally, transaction costs related to housing eat into a larger percentage of the housing value appreciation, discouraging homeowners from cashing out the increased equity.

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[1]See Figure 1 and Figure 2 for demonstration of this point for countries in our sample.

Thus which set of factors dominate the other is an empirical question.

We re-examine the housing and stock wealth effects by employing the vector autoregressive (VAR) framework which incorporates the dynamic, interactive structure of variables with each other. Using macro time series for a group of developed countries, we estimate the VAR model with specified structural error terms. The model stipulates that the shocks specific to housing wealth precede those specific to stock market and to income, and that the shocks specific to stock market precede those to income. We shall discuss the justification of this recursive ordering after presenting the empirical specification, but we note here that the results obtained with other orderings are very similar.

Our findings can be summarized as follows: for all the countries in our sample except Australia, we find a larger initial wealth effect of housing than that of stock wealth. The on impact value of consumption to a 10% housing wealth shock ranges from 0.60% (Finland) to 6.42% (Sweden). Yet the long-run effects on consumption from housing and stock wealth vary considerably across countries. Yet, despite the greater initial housing wealth effects, over time stock market wealth effects catch up and are mostly persistent, whereas housing wealth effects level off and may decline eventually.

The remainder of this paper proceeds as follows. Section 2 briefly reviews the relevant literature. Section 3 introduces the exact empirical specification we use under the structural VAR framework. Section 4 presents data. Section 5 discusses estimation results, and Section 6 concludes.

2 Literature Review

Regarding the relative magnitude of wealth effects of housing and of stock wealth, empirical evidence is mixed. Previous works have found a larger wealth effect for housing from macro-level aggregate data for the U.S. (Benjamin et al., 2004; Case et al., 2005; Carroll et al., 2011), and from micro-level survey data for the U.S. (Bostic et al., 2009), and for Spain (Bover, 2005). From these works, the marginal propensity to consume (MPC) from housing wealth is around 0.03~0.10, while that from financial wealth is around 0.02~0.08. However, Dvornak and Kohler (2007) find

3

the opposite for Australia.

Fewer studies have compared both wealth effects from a cross-country perspective. Indeed, due to cultural, institutional, and market-related differences, a cross-country comparison might shed light on what may be the driving force behind the differences in wealth effects. Slacalek (2009, Figure 1) shows that there is a great deal of heterogeneity in MPC between countries. He incorporates the sluggishness of consumption in estimating MPC in a two-step empirical procedure. For the 16 countries in his sample, some countries (such as U.S. and U.K.) have substantially larger housing wealth effect than financial wealth effect while the rest (such as Canada and Japan) do not, even though these estimates are imprecise. Ludwig and Sløk (2004) find a significantly positive relationship between stock prices and consumption for OECD countries in a pooled mean group analysis, but the relationship is insignificant between house prices and consumption. Edison and Sløk (2002) focus on the stock wealth effects for eight countries and find that the wealth effect of the information technology stock market sector is smaller than that of other sectors.

As regards methodology, a strand of literature has used sophisticated models other than VAR in estimating wealth effects. Some studies have invoked panel data techniques in their estimation (Dvornak and Kohler, 2007; Slacalek, 2009). More closely related to our VAR approach is error-correction models that aim to capture long-run equilibrium effects. Case et al. (2005) employ an error-correction model in which only consumption and income have equilibrium errors while housing and stock wealth do not. Benjamin et al. (2004) carefully examines unit-root and co-integration issues in U.S. aggregate data (and differ from Case et al. (2005) in terms of sources and measurements) and arrive at the same conclusion. Ludwig and Sløk (2004) and Cardarelli et al. (2008, Table 3.6) expand the accommodation of equilibrium errors to the housing and stock price variables, while still maintaining that consumption is the sole dependent variable responsive to changes in other variables. The closest in methodology to our paper is Edison and Sløk (2002), though their research question, their employed variables and their Cholesky ordering are different.

Were co-integration an issue, our VAR model could be revised into the form of vector error-correction model (VECM), which would allow for equilibrium errors of the kind assumed by

4

the aforementioned literature. Carroll et al. (2011) argue against the use of co-integrating/VECM models in estimating wealth effects, for neither theory nor evidence implies the existence of a stable co-integrating vector. Whatever the case may be, there is no need to do so in our analysis, for co-integration is not a serious concern for the majority of countries in our data set.

3   Empirical Specification

The simplest specification for estimating various wealth effects takes the form

$$C_t = \alpha + \beta_h H_t + \beta_s S_t + \beta_y Y_t + \varepsilon_t \tag{3.1}$$

where C_t stands for consumption of goods and services, H_t for housing wealth, S_t for stock wealth, and Y_t for personal disposable income. This specification can be derived from the Life-Cycle/Permanent Income Hypothesis (LC-PIH) consumption theories, as is shown in Benjamin et al. (2004), Dvornak and Kohler (2007), and other studies. As such, estimated coefficients of β_h and β_s measure the MPC out of housing wealth, and of stock wealth, respectively.

We extend the content contained in (3.1) into the VAR framework. One substantial advantage of the VAR is to bring forth the dynamic structure between variables. The reduced-form VAR is specified by the following equation:

$$\boldsymbol{Y}_t = \boldsymbol{B}_0 + \sum_{k=1}^{K} \boldsymbol{B}_k \boldsymbol{Y}_{t-k} + \boldsymbol{U}_t \tag{3.2}$$

where $\boldsymbol{Y}_t$ is the vector of variables (H_t, S_t, Y_t, C_t), $\boldsymbol{B}_k$ is the matrix of coefficients for the k-th lag of $\boldsymbol{Y}_t$, and $\boldsymbol{U}_t$ is the vector of reduced form innovations. The value of K, the number of lags included in (3.2), is to be determined by the Akaike Information Criteria (AIC) and the Final Prediction Error (FPE).

It is well known that a reduced form VAR like (3.2) does not allow correlations among variables to be interpreted casually (see, e.g., Stock and Watson, 2001). We need a structural VAR

representation with "identifying assumptions" for that purpose:

$$A(I - \sum_{k=1}^{K} B_k L^k)Y_t = AB_0 + AU_t = AB_0 + Be_t \tag{3.3}$$

where the vector of structural shocks $e_t \sim N(0, I_4)$ and $E[e_t e_s'] = 0$ for all $s \neq t$. The matrix A describes the contemporaneous relation between the variables and the reduced form residuals U_t. The matrix B specifies the linear relation between the orthogonal structural shocks and the reduced form residuals (Heppke-Falk et al., 2010). One version of the so-called Cholesky restrictions to achieve identification on the system is that A is a lower triangular matrix with ones on the diagonal, and B a triangular matrix.

By adopting this version of Cholesky restrictions, we assume that the components of Y_t enter in the order of (H_t, S_t, Y_t, C_t). This, coupled with the lower triangular matrix A, implies that the current shock to the housing wealth H_t precedes all other contemporaneous shocks, the shock to Y_t is affected by contemporaneous shocks to H_t and S_t, and the shock to C_t is affected by contemporaneous shocks to all the rest.

Our justification of the recursive ordering of shocks in the model, especially the contemporaneous housing shock being exogenous to other shocks, draws on recent literature on housing, business cycles, and the macro economy. Leamer (2007) argues that the housing sector cycle is one of the most important precursors of the U.S. business cycle. He demonstrates that in the U.S., eight out of ten recessions are preceded by substantial problems in housing, and the residential investment contribution to the U.S. recessions and recoveries (measured in the year before the business cycle peaks and in the subsequent two years) is substantial. Ghent and Owyang (2010) find no consistent statistical relationship between local housing and local business cycles by examining the Metropolitan Statistical Areas data for U.S. cities. Yet, they also find that national housing building permits are a leading indicator for local employment. Helbling and Terrones (2003, Figure 2.1) show that, even though both housing and equity prices have generally coincided or overlapped with recessions, half of all housing price busts in the post-war period overlapped with equity price crashes, while only one-third of all equity price busts overlapped with housing

price busts. Additionally, during 1970–2002, the negative output effects associated with housing price busts were about twice as large as those of equity price busts.

Still, to guard against the possibility that our results hinge critically on this particular Choleski ordering, we also experiment with other alternative orderings. The results obtained with these alternative orderings are very similar.

4 The Data

We use quarterly data with different time coverage for the following countries: Australia, Belgium, Canada, Finland, the United Kingdom, the United States, Sweden, and Switzerland.[2] The data include following variables: housing price index, stock market capitalization, consumption expenditure, and household disposable income. We obtain the stock market capitalization from Thomson Reuters Datastream as the measure of stock wealth. Consumption is the measure of private final consumption expenditure as is defined in the System of National Account used by OECD, including goods and services.[3]

Conceptually, a natural candidate for measuring housing wealth is home value. Practically, we can obtain the value of real estate owned by households only for the U.S. For other countries, the relevant data available is the housing price index, and we use it as a proxy for housing wealth for these countries. This follows the practice of existing literature in this field.[4] Yet by using housing prices we fail to pick up the change in the size or quality of the housing capital stock per capita caused by the change in housing prices. However, Cardarelli et al. (2008) argue that monetary policy now transmits more through the price of houses than through residential investments.

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[2]Table 4 summarizes the time coverage as well as the number of observations for analysis for each country in our data. In Organisation for Economic Co-operation and Development (OECD) countries, quarterly house price index is available only for the countries in our sample, plus New Zealand. However, disposable income (or industrial production as its proxy) is not available for New Zealand. Therefore we do not include New Zealand in our analysis. Ludwig and Sløk (2004) include more countries than ours due to the fact that they interpolate quarterly housing prices via annual observations.

[3]The consumption measure includes both durable and non-durable components. Mehra (2001) points out that the total consumption is indeed the variable of interest in estimation of the long-term consumption-wealth relationship.

[4]Exceptions exist. Case et al. (2005) adjust the housing price index by the homeownership rate and the number of households for a country. Slacalek (2009) constructs a measure of housing wealth from a combination of first and secondary data sources.

Thus, omitting the change in the housing capital stock due to residential investments may not be as damaging as it sounds.

Meanwhile, both housing value and housing price index are available for the U.S. We compare the results of estimated impulse response functions by separately employing these two data series for the U.S., and find quantitatively small differences between these two. In particular, for the U.S., the comparison between the values of impulse response functions for housing and for stock value does not change, whichever data series we use for the housing value. Appendix B contains further detail about data sources and the time coverage for each country.

All variables are adjusted to real terms according to the respective Consumer Price Index (CPI) for each country. Except for the housing price index, all variables are on a per capita basis. If not already so in the original data, they are seasonally adjusted by the X12-ARIMA method. Finally, we use the natural logarithm of these variables in estimation, for it would be inappropriate to put housing price indexes with other values on the same footing in levels. Accordingly, our interpretation of the estimates would be in elasticities, rather than in MPC. Later we convert estimates of elasticities back into MPC for comparison with the existing literature.

If VAR contains non-stationary variables, VECM is needed to specify a linear combination of integrated variables that is stationary. We employ the maximum eigenvalue test and the Johansen trace test to detect co-integrating relationships between the variables. Lütkepohl et al. (2001) provide evidence that these two tests may end up with different results for short samples. This is indeed the case for Belgium in our data set: according to the maximum eigenvalue test, there is no co-integrating relationship; according to the Johansen trace test, we find a maximum of two co-integrating relationships. For Finland and Australia, both maximum eigenvalue and trace tests suggest that a maximum of one co-integrating relationship exists. No significant results surfaced for other countries. Even so, as in Edison and Sløk (2002), our sample period is not long enough to impose robust long-run relationships between the variables.[5] Thus we still apply the same structural VAR analysis to these countries.

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[5]The longest time coverage in our data set is from 1973 to 2009 for U.S., whereas the comparable coverage in Edison and Sløk (2002) is from 1990 to 2000. However, ours are quarterly data and theirs are monthly, therefore our effective sample period is not effectively longer.

Furthermore, we run stability tests to see whether the estimated VAR is stable, in the sense that the variables are covariance stationary. The results show that the eigenvalue stability condition is satisfied for all countries except Australia. One approach to address non-stationarity is to difference the data. However, Sims (1980) and Sims et al. (1990) caution against differencing, as differencing throws away information concerning the co-movements in the data. Thus we choose not to difference the Australia data before estimation.

5 Estimation Results

We determine the lag structure, namely, the value of K in (3.2), for each country based on AIC and FPE criteria. Our examination of the data reveals that the second-order lag structure is adequate for Australia, Sweden and the U.K., that third-order is adequate for Canada, Finland and Switzerland, and that fourth-order is adequate for Belgium and the U.S.

Figure 3 and Figure 4 depict consumption responses to housing price shocks for the eight different countries in our data set. The horizontal axis indicates the time that has passed, in quarters, after a 10% exogenous shock to housing prices initially. The vertical axis indicates the corresponding changes to consumption in percentages. Dashed and dotted lines indicate, respectively, 1.645 and one standard deviation confidence bands (or, 90% and 68% confidence intervals). For all countries except Finland, we observe that the initial consumption response to a housing price shock (i.e., on impact response) is positive and statistically significant at a 10% level. Sweden exhibits the largest on impact consumption response, at 6.42% to a 10% shock, and Finland exhibits the least, at 0.6% which is not statistically significant.

However, housing price has only a transitory effect on consumption, as is revealed by Figure 3 and 4. Consumption multipliers of housing price shocks level off over time and decline eventually: for the majority of these countries, after 12 quarters, the consumption multiplier declines to a value that is less than the response on impact. Furthermore, there is a great deal of heterogeneity in the shape of the impulse-response function over time: for Canada, U.K., and Sweden it peaks very soon and then trends down swiftly, whereas for Belgium and Switzerland the trends are visible

but almost flat.

Figure 5 and Figure 6 depict consumption responses to stock market capitalization shocks for the same countries. The responses on impact for all countries, except Finland, are positive and statistically significant at a 10% level. Canada leads in the consumption response on impact at 2.27% to a 10% shock, and Finland again ranks as the last, at a statistically insignificant 0.15%. Yet, in contrast to the pattern of responses to housing price shocks, the consumption multipliers of five countries (except U.S., Belgium, and Switzerland) keep increasing over time. After 8 quarters, all countries have a larger consumption multiplier than the consumption response on impact . Edison and Sløk (2002, Figure 4) also obtain a persistent consumption response to stock valuation shocks for their selected countries. Their sample includes U.S., Canada, U.K., which are also included in our sample; however, their estimated effects are much smaller in comparison to ours.

To compare the consumption multipliers to house price shocks with those to stock market capitalization shocks, we tabulate the two-year impact effects in Table 1. The consumption response is to a 10% initial shock to housing prices, or to stock market capitalization. Seven countries (Australia excluded) exhibit a larger initial response to housing price shocks than to stock market capitalization shocks, sometimes substantially (e.g., 6.42% versus 2.14% in the case of Sweden).[6] By the end of two years, however, four of these countries display a larger consumption multiplier in response to a stock market capitalization shock than to a housing price shock.

Could the differences in wealth effects of housing and stocks be attributable to the use of housing prices instead of home values? We investigate this by replacing household real estate values with the housing price index for the U.S. Figure 7 demonstrates the dynamic wealth effects of consumption to housing price shocks by separately using these two data series for housing wealth. The basic pattern that the consumption multiplier levels off and eventually falls does not change, yet the consumption multiplier estimated from housing price series drops off more precipitously. Figure 8 shows that the impact on estimates of consumption multipliers to stock value shocks is minimal when switching to housing value series.[7]

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[6]Our results for Australia are consistent with the findings in Dvornak and Kohler (2007). Based on state-level data for Australia, they find that the MPC out of housing wealth (0.02 ~ 0.05) is lower than that out of stock wealth (0.08 ~ 0.12).

[7]Likewise, Edison and Sløk (2002) find that, by the substitution of stock prices for stock market capitalization as a

After analyzing the wealth effects separately for each country, we are now at a position where we can gauge the average effects by examining the mean group estimates. This estimator has been applied in Dvornak and Kohler (2007), Edison and Sløk (2002), Slacalek (2009), to name a few. In essence, it is equivalent to pooling the data and imposing the identical-slopes restriction for all countries.[8] We show the results in Table 2. For all countries as a whole, the initial consumption response to a 10% housing price shock is 2.79%, in contrast to the (statistically insignificant) 1.31% to a 10% stock market value shock. Still, by the end of two years, the stock wealth effect overshadows the housing, consistent with the pattern for the majority of countries observed above, even though these mean group estimates are not statistically significant after 8 quarters. We divide the eight countries into two groups: Anglo-Saxon countries (Australia, Canada, U.K., and U.S.) versus Continental Europe countries (Belgium, Finland, Sweden, and Switzerland). The rationale is that the former group has a more robust housing and stock market system than the latter. From Table 2 we observe that the wealth effects on consumption for the former group are generally greater than those for the latter group.

All the estimates listed so far are expressed in terms of elasticities. It is straightforward to multiply the elasticity by the consumption-wealth ratio to obtain MPCs that can be compared with the existing estimates of MPCs in the literature. Since the housing and stock wealth values are both available only for the U.S., we select the U.S. to carry out this exercise. Note that the consumption-wealth ratio itself varies over time. We choose two different three-year time periods for the calculation of the MPCs: one is from 2003q1 to 2005q1, representative of the booming period for both housing and stock markets; the other is from 2006q1 to 2008q1, representative of the bust period.

Table 3 presents the MPCs calculated for these two time periods. For the boom years, the computed MPC out of housing wealth is 0.093 in the initial period, which means for the U.S. a dollar increase in housing prices leads to an immediate 9.3 cents rise in consumption. This

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measure of wealth for the U.S., none of their VAR estimates of stock wealth effects changes.

[8]Pesaran and Smith (1995) show that mean group estimators can provide consistent estimates in dynamic models with heterogeneous coefficients across groups (countries). Strictly speaking, the number of countries in our sample is small, thus the criteria of large N for applying the mean group estimator is not satisfied. The results reported below should be treated with caution.

compares with a 0.060 MPC out of stock wealth initially. By the end of two years, the MPC out of housing wealth is 0.24, whereas the MPC out of stock wealth is 0.136. For the bust period, initially, the housing and stock wealth MPCs are both lower than those in the boom years (0.08 and 0.051 now). Yet due to the decline in both housing and stock wealth values and the fact that consumption cannot decline indefinitely, by the end of two years, the MPCs become substantially greater those in the boom period. The initial MPCs for housing and/or stock wealth are within the range of those reported in the literature for the U.S. (Benjamin et al., 2004; Cardarelli et al., 2008; Slacalek, 2009) , lending support to the estimates obtained here.[9] Nevertheless, the crucial additional insight from our study is that the two-year MPCs turn out to be much greater due to the dynamic effects of one variable on the others. In particular, this finding of continuing stock wealth effects boosting consumption for a few quarters is consistent with that in Dynan and Maki (2001), who use Consumer Expenditure Survey micro data in their analysis. Our estimated magnitude also agrees with what they obtain.

Empirically teasing out the causes behind the differences in housing and stock wealth effects is a difficult task. Here we just navigate on one key difference between housing and stock assets: housing assets can be used for collateralized borrowing, while it is less common for households to post stock shares to borrow. We explore the relationship between estimated housing wealth effects and country values of Mortgage Market Index (MMI) constructed by Cardarelli et al. (2008). MMI is constructed from a variety of indicators, including mortgage equity withdrawal, refinancing easiness, typical loan-to-value ratio, mortgage-backed security issues, et cetera, and measures the maturity and development of mortgage market of a country. A higher value of MMI indicates easier household access to mortgage credit. Table 1 lists the values of MMI for our sample of countries except Switzerland, for which the data is not available. Figure 9 plots the on impact, 1-year, and 2-year consumption elasticities to a 10% housing price shock against the Mortgage Market Index (MMI) constructed by Cardarelli et al. (2008). The trendlines of these scatter plots help visualize the fact that those countries with higher MMIs are associated with greater housing

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[9]Our estimated initial MPCs of housing and stock wealth are close to the "eventual" MPCs obtained in Carroll et al. (2011), whose approach exploits the sluggishness in consumption response to shocks.

wealth effects.

6   Conclusion

This paper employs the structural VAR model to analyze the relationship between consumption, income, and stock and housing wealth. We apply this model to time series data of eight developed countries. Our main finding is that for a majority of countries in our data housing wealth exerts a larger and statistically significant response of consumption on impact than stock wealth does, yet the long-run effects of a housing wealth shock are not as persistent as those of a stock capitalization shock. For the U.S., our estimates imply an immediate MPC of 8 ~ 9 cents out of a dollar increase in housing wealth, in contrast to a MPC of 5 ~ 6 cents for stock wealth. Our identification strategy is based on the particular Cholesky recursive ordering but our results are robust to other orderings as well.

Due to data availability, we can only use housing prices as a proxy for house values. For the U.S., however, we do have data for both housing prices and household owned real estate values, and we find that our results are not sensitive to which measure in use. We find a larger housing wealth effect is associated with easier access to mortgage credit for these countries.

Our finding that the stock wealth effect is more persistent than the housing wealth effect probably runs opposite to conventional wisdom. It is unclear how we can generalize this finding, however, since there are only eight countries in our sample. Nevertheless, the results are firm and robust for the U.S. This has important implications for public policy, even though they are at best suggestive at this point. Policy makers may still deem it a priority to monitor the economic performance of housing sector to detect signs of transitions in business cycles. However, a buoyant stock market, even though its immediate impact on the economy through consumption boosting is weaker, would make its economic contribution persistently over time.

References

Aoki, Kosuke, James Proudman, and Gertjan Vlieghe, "Houses as collateral: Has the link between house prices and consumption in the UK changed?," *Federal Reserve Bank New York Economic Policy Review*, 2002, *8*, pp. 163–178.

Benjamin, John D., Peter Chinloy, and G. Donald Jud, "Real Estate Versus Financial Wealth in Consumption," *Journal of Real Estate Finance and Economics*, 2004, *29* (3), pp. 341–354.

Bostic, Raphael, Stuart Gabriel, and Gary Painter, "Housing Wealth, Financial Wealth, and Consumption: New Evidence from Micro Data," *Regional Science and Urban Economics*, May 2009, *39* (1), pp. 79–89.

Bover, Olympia, "Wealth Effects on Consumption: Microeconometric Estimates from the Spanish Survey of Household Finances," 2005. Working Paper No. 0522, BANCO DE ESPAñA.

Cardarelli, Roberto, Deniz Igan, and Alessandro Rebucci, "The Changing Housing Cycle and the Implications for Monetary Policy," April 2008. World Economic Outlook, Chapter 3.

Carroll, Christopher D., Misuzu Otsuka, and Jiri Slacalek, "How Large Are Housing and Financial Wealth Effects? A New Approach," *Journal of Money, Credit and Banking*, 2011, *43* (1), pp. 55–79.

Case, Karl E., John M. Quigley, and Robert J. Shiller, "Comparing Wealth Effects: The Stock Market versus the Housing Market," *Advances in Macroeconomics*, 2005, *5* (1), pp. 1–32.

Dvornak, Nikola and Marion Kohler, "Housing Wealth, Stock Market Wealth and Consumption: A Panel Analysis for Australia," *Economic Record*, 2007, *83* (261), pp. 117–130.

Dynan, Karen E. and Dean M. Maki, "Does Stock Market Wealth Matter for Consumption?," May 2001. Finance and Economics Discussion Series 2001-23, Board of Governors of the Federal Reserve System.

Edison, Hali and Torsten Sløk, "Stock Market Wealth Effects and the New Economy: A Cross-Country Study," *International Finance*, 2002, *5* (1), pp. 1–22.

Ghent, Andra C. and Michael T. Owyang, "Is housing the business cycle? Evidence from US cities," *Journal of Urban Economics*, 2010, *67* (3), pp. 336–351.

Helbling, Thomas and Marco Terrones, "When Bubbles Burst," April 2003. World Economic Outlook, Chapter 2.

Heppke-Falk, Kirsten H., Jörn Tenhofen, and Guntram B. Wolff, "The Macroeconomic Effects of Exogenous Fiscal Policy Shocks in Germany: A Disaggregated SVAR Analysis," *Journal of Economics and Statistics (Jahrbuecher fuer Nationaloekonomie und Statistik)*, 2010, *230* (3), pp. 328–355.

Leamer, Edward, "Housing *is* the Business Cycle," in "Housing, Housing Finance and Monetary Policy, A Symposium," Federal Reserve of Kansas City, August 2007.

Ludwig, Alexander and Torsten Sløk, "The Relationship between Stock Prices, House Prices and Consumption in OECD Countries," *Topics in Macroeconomics*, 2004, *4* (1), pp. 1–26.

Lütkepohl, Helmut, Pentti Saikkonen, and Carsten Trenkler, "Maximum eigenvalue versus trace tests for the cointegrating rank of a VAR process," *Econometrics Journal*, 2001, *4* (2), pp. 287–310.

Mehra, Yash P., "The Wealth Effect in Empirical Life-Cycle Aggregate Consumption Equations," *Federal Reserve Bank of Richmond Economic Quarterly*, 2001, *87* (2), pp. 45–67.

Pesaran, M. Hashem and Ron Smith, "Estimating Long-run Relationships from Dynamic Heterogeneous Panels," *Journal of Econometrics*, 1995, *68* (1), pp. 79–113.

Poterba, James M., "Stock Market Wealth and Consumption," *The Journal of Economic Perspectives*, 2000, *14* (2), pp. 99–118.

**Sims, Christopher A.**, "Macroeconomics and Reality," *Econometrica*, 1980, *48* (1), pp. 1–48.

— , **James H. Stock, and Mark W. Watson**, "Inference in Linear Time Series Models with some Unit Roots," *Econometrica*, 1990, *58* (1), pp. 113–144.

Slacalek, Jiri, "What Drives Personal Consumption? The Role of Housing and Financial Wealth," *The B.E. Journal of Macroeconomics: Topics*, 2009, *9* (1), pp. 1–35.

Stock, James H. and Mark W. Watson, "Vector Autoregressions," *The Journal of Economic Perspectives*, 2001, *15* (4), pp. 101–115.
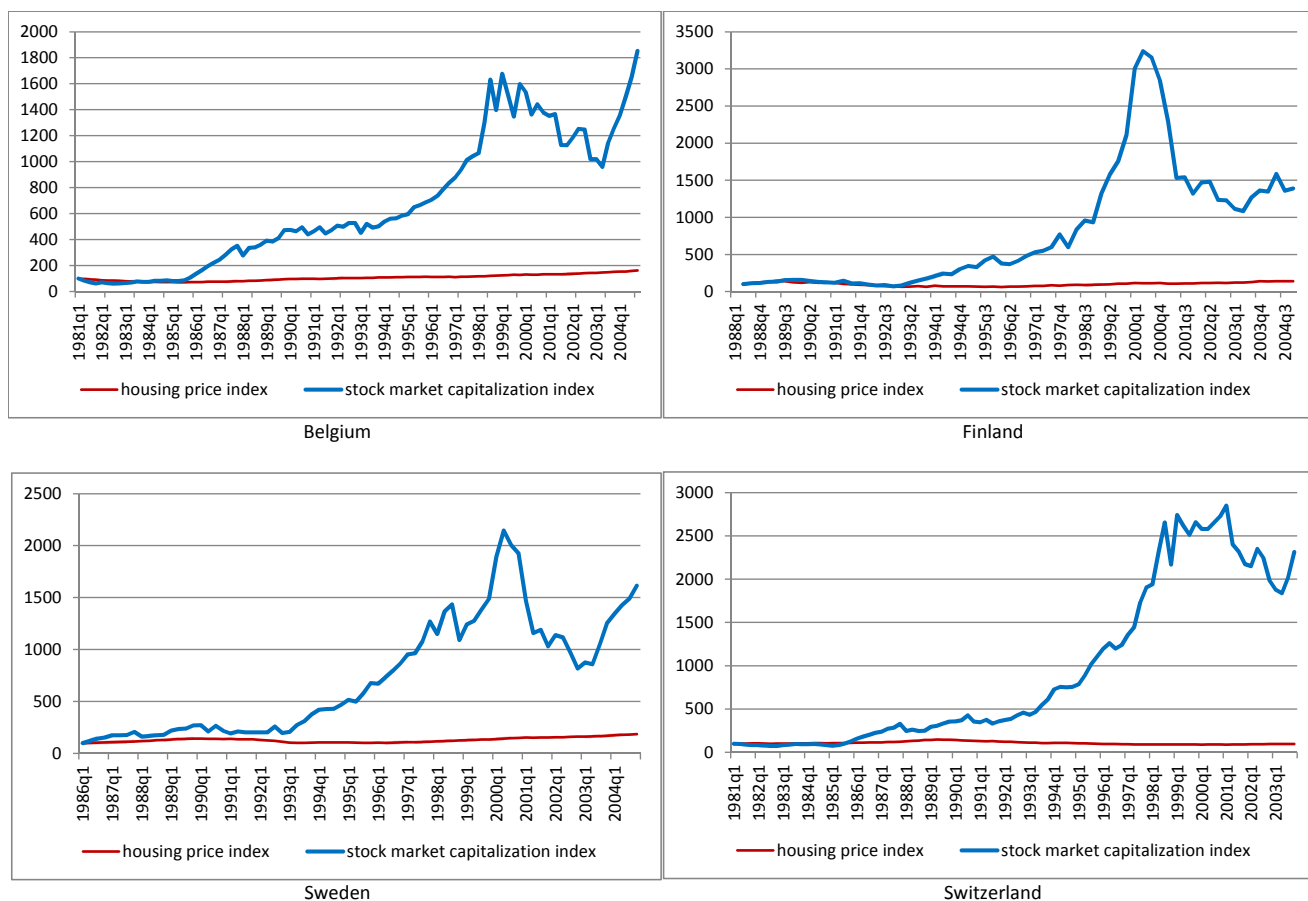
A   Tables and Figures

Figure 1: Housing price and stock market index: Australia, Canada, United Kingdom, United States
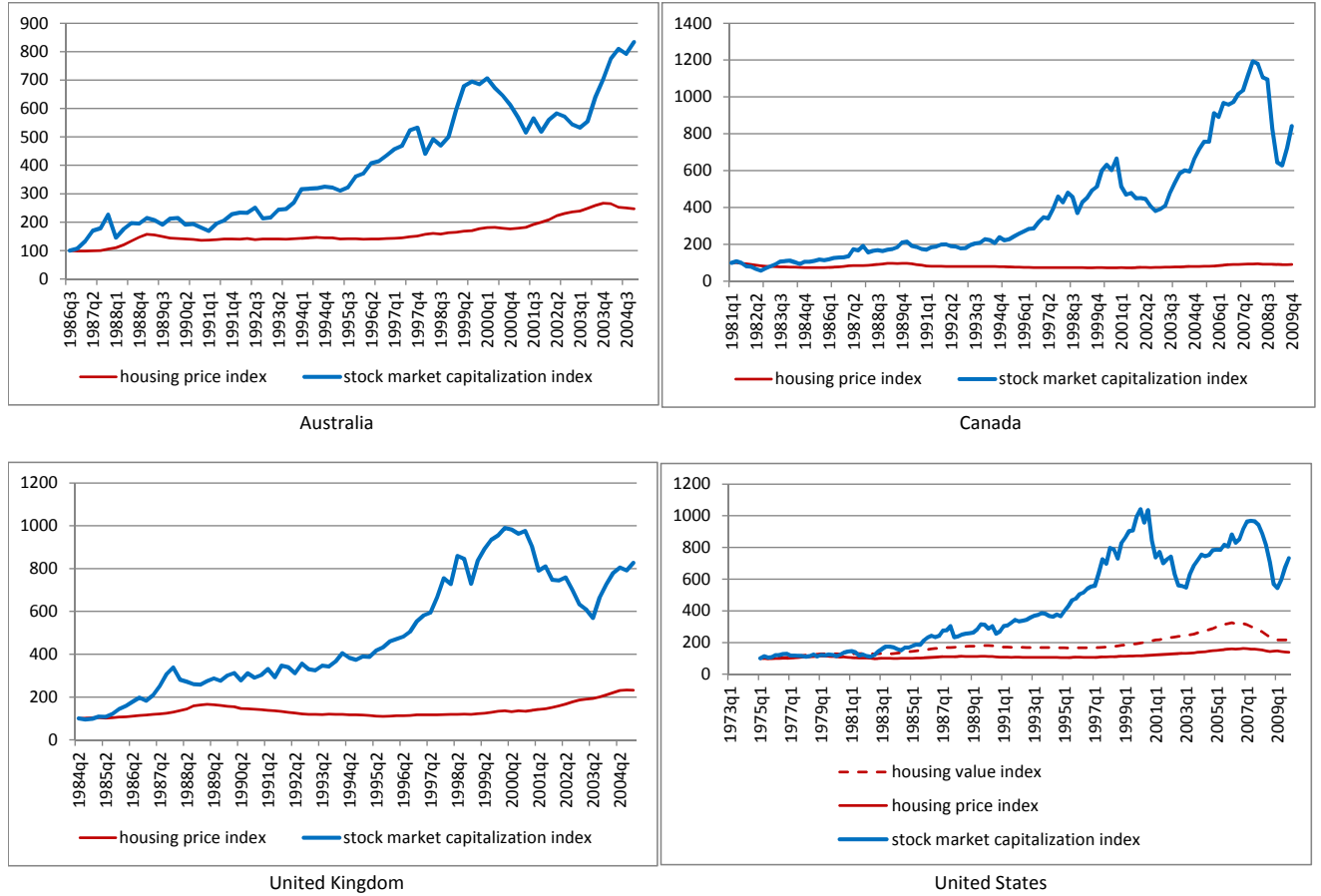
Notes: index = 100 for both housing price and stock market capitalization at the beginning of data time series for each country. For the United States, the series of market value of household owned real estate is also included.

Figure 2: Housing price and stock market index: Belgium, Finland, Sweden, Switzerland


Notes: index = 100 for both housing price and stock market capitalization at the beginning of data time series for each country.

Figure 3: Impulse response functions of consumption given a 10% increase to housing prices: Australia, Canada, United Kingdom, United States
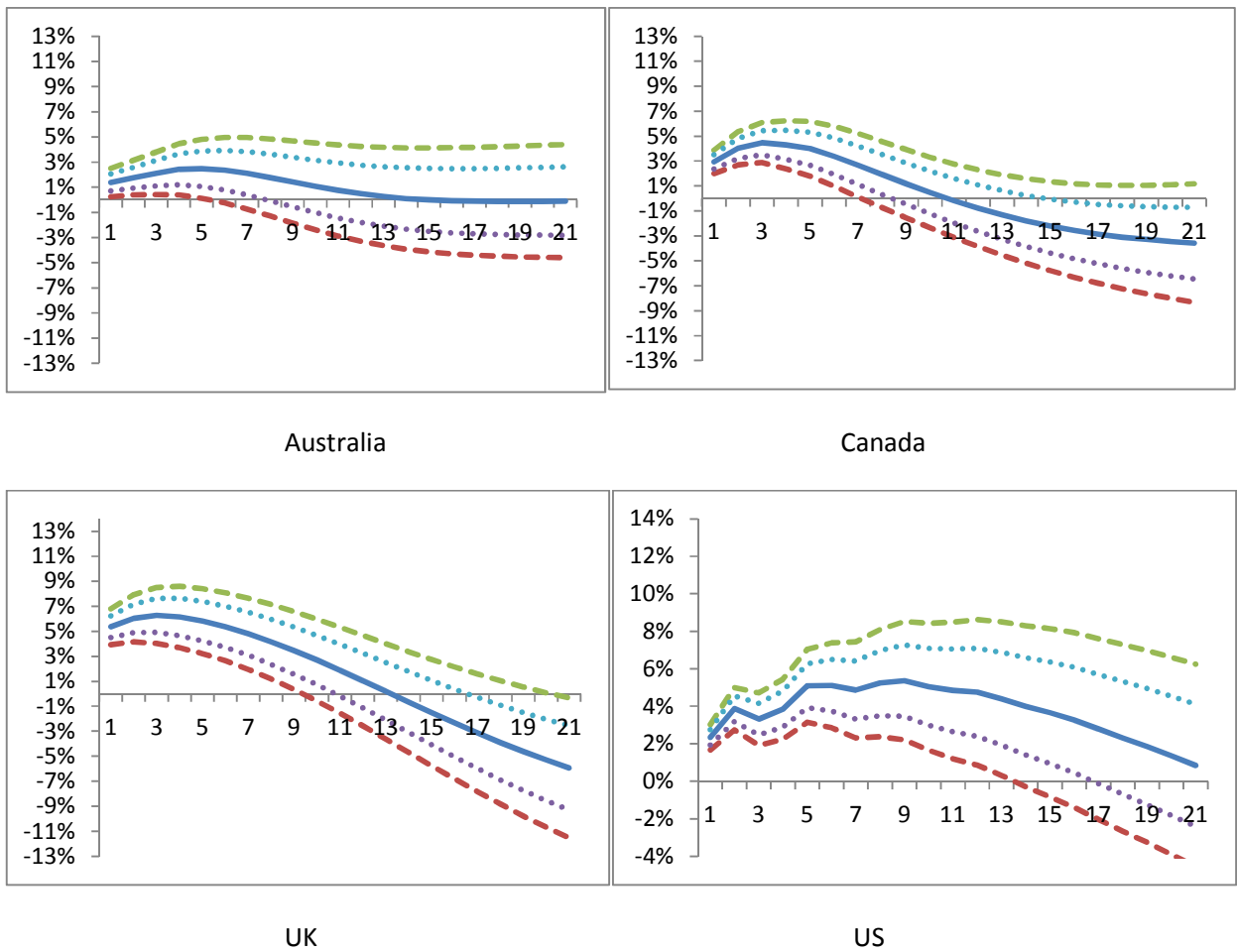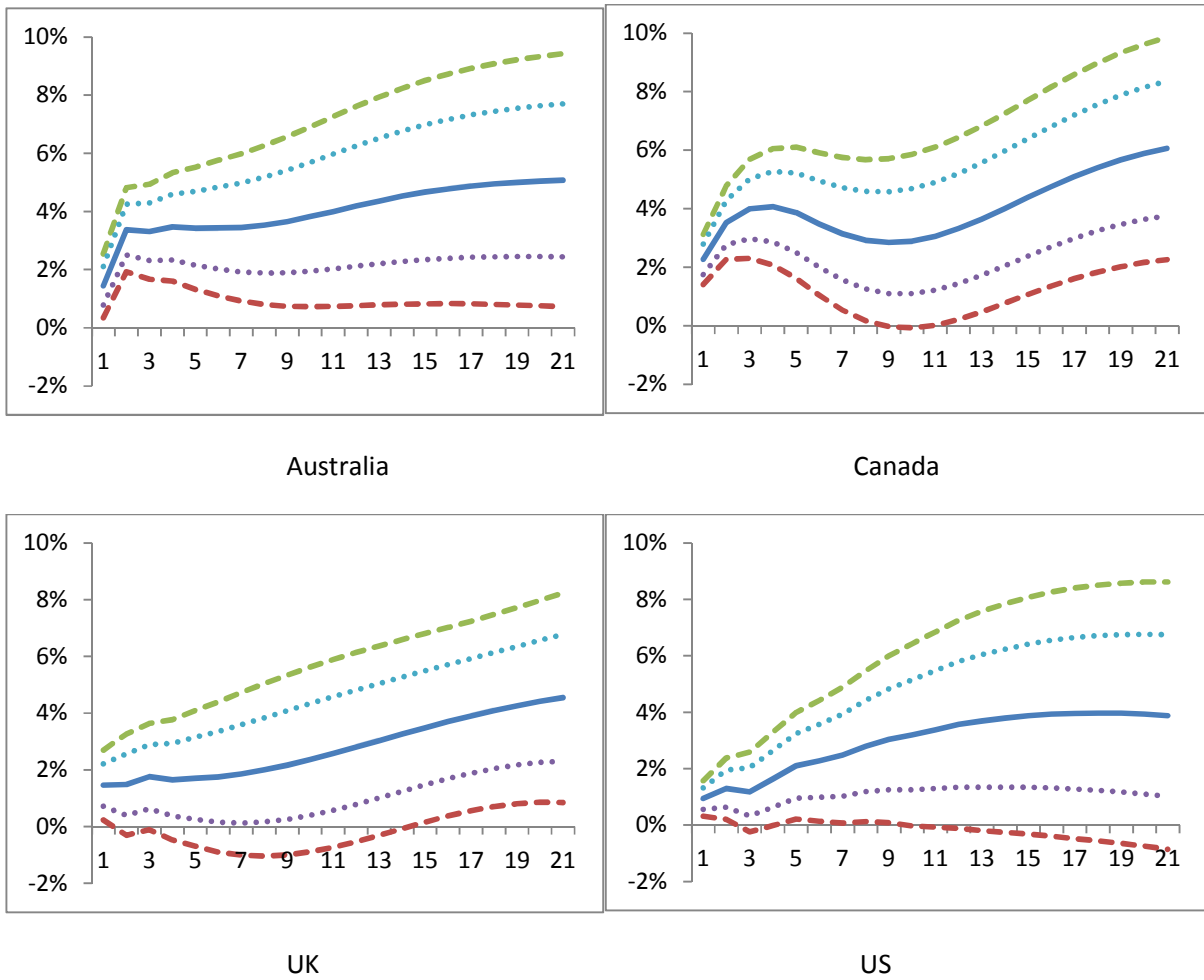

Australia

Canada

UK

US

Notes: dashed lines indicate 90% confidence interval; dotted lines indicate 68% confidence interval.

Figure 4: Impulse response functions of consumption given a 10% increase to housing prices: Belgium, Finland, Sweden, Switzerland
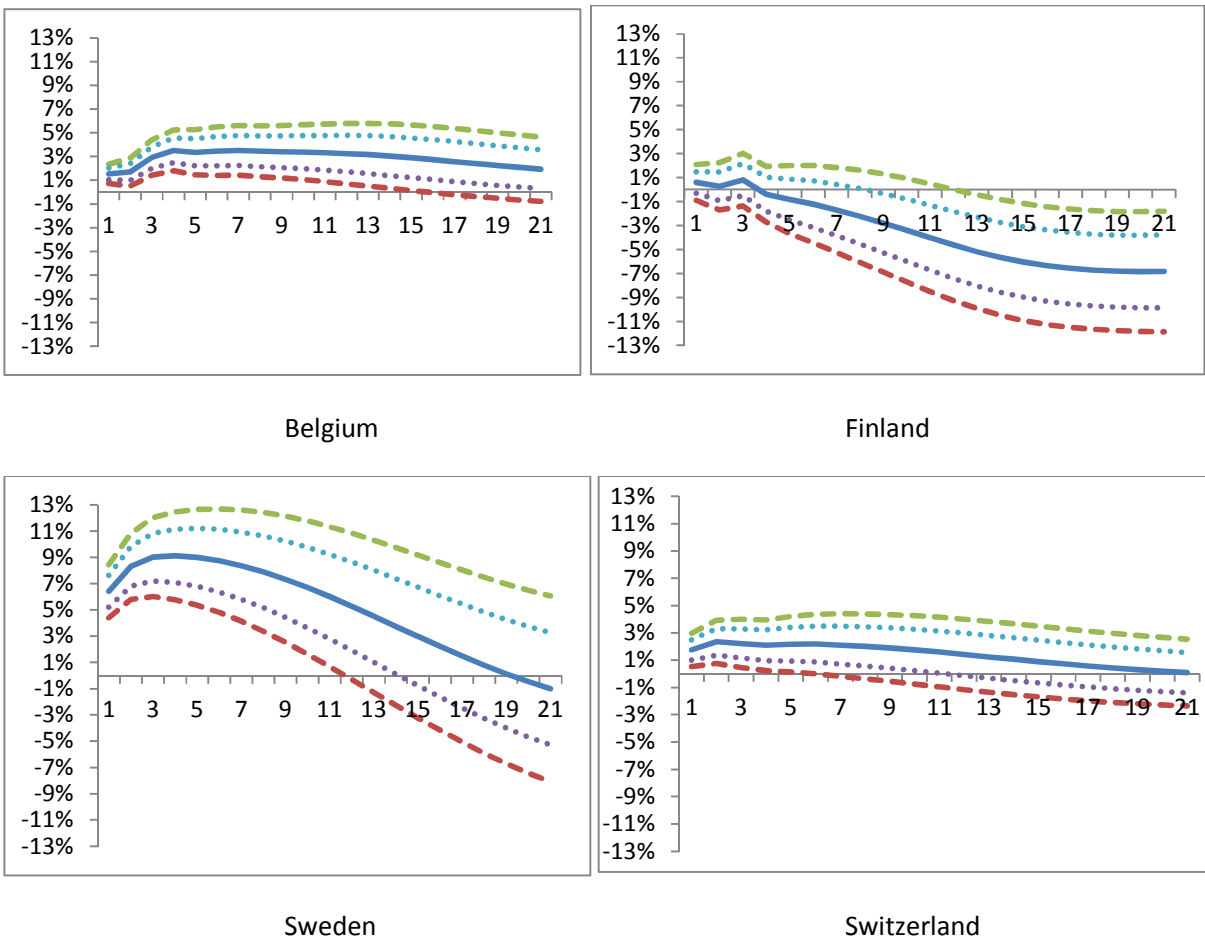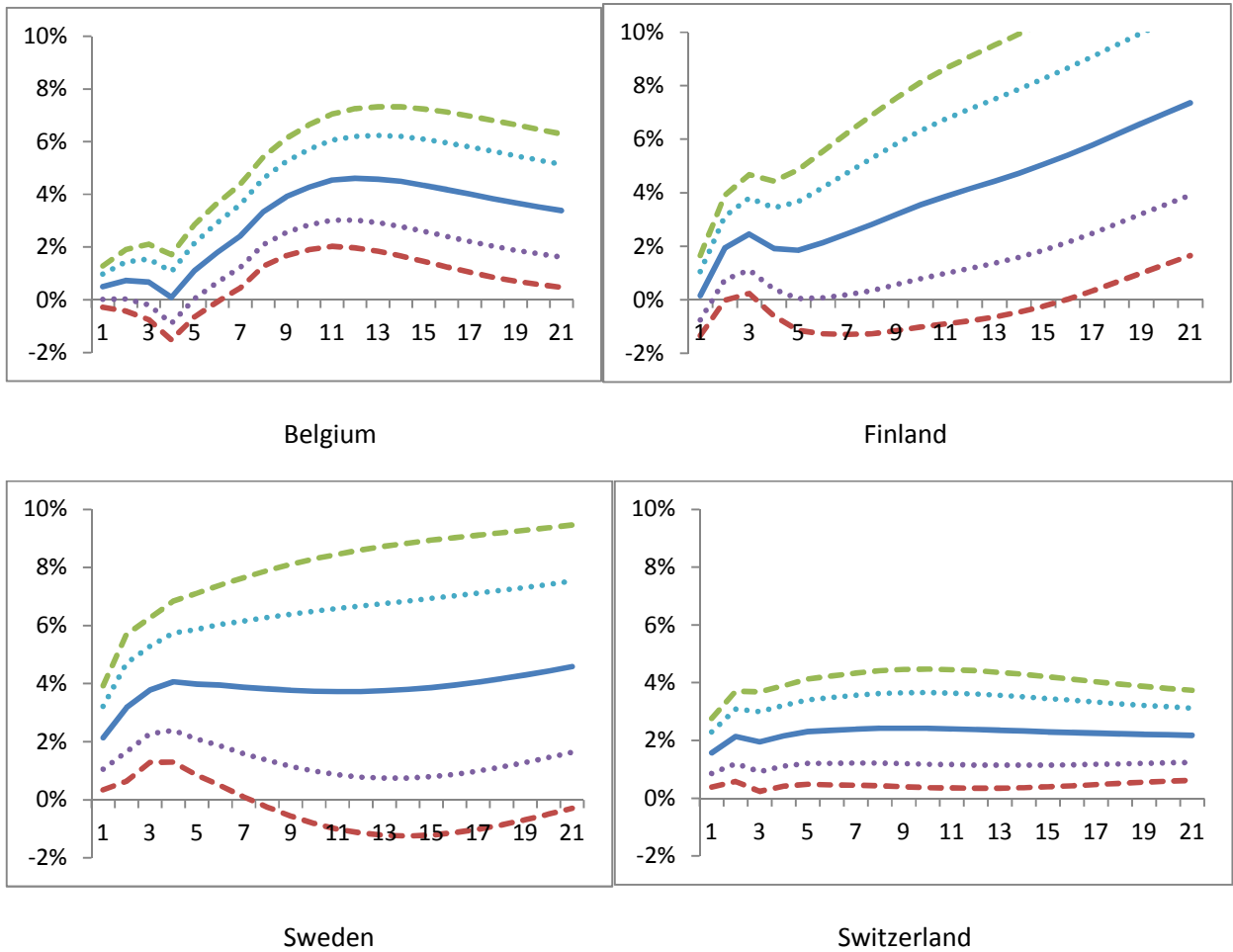

Belgium

Finland

Sweden

Switzerland

Notes: dashed lines indicate 90% confidence interval; dotted lines indicate 68% confidence interval.

Figure 5: Impulse response functions of consumption given a 10% increase to stock market capitalization: Australia, Canada, United Kingdom, United States
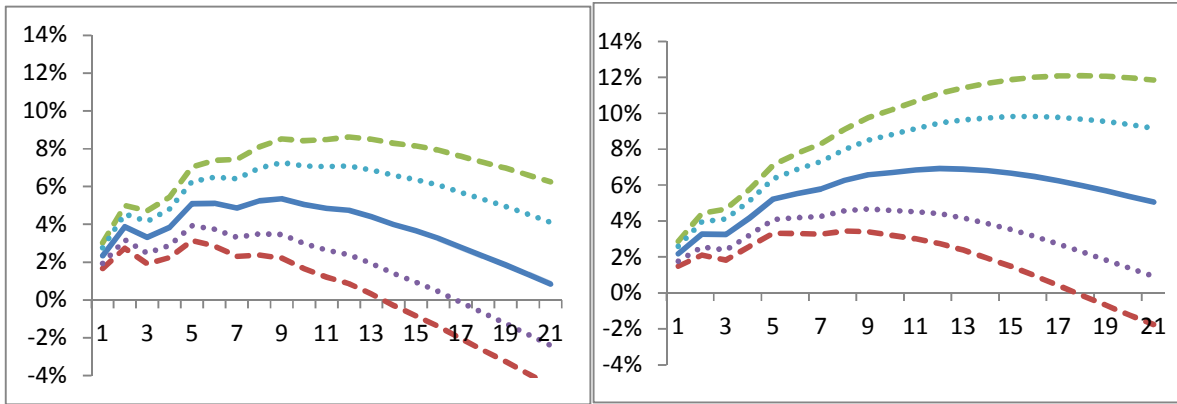

Australia

Canada

UK

US

Notes: dashed lines indicate 90% confidence interval; dotted lines indicate 68% confidence interval.

Figure 6: Impulse response functions of consumption given a 10% increase to stock market capitalization: Belgium, Finland, Sweden, Switzerland

Belgium

Finland

Sweden

Switzerland

Notes: dashed lines indicate 90% confidence interval; dotted lines indicate 68% confidence interval.

Figure 7: Impulse response functions of consumption given a 10% increase to housing value or housing price: United States

US (estimated with housing price index)   US (estimated with housing value)

Notes: housing variables are measured by housing value or housing price index; dashed lines indicate 90% confidence interval; dotted lines indicate 68% confidence interval.

Figure 8: Impulse response functions of consumption given a 10% increase to stock market capitalization: United States
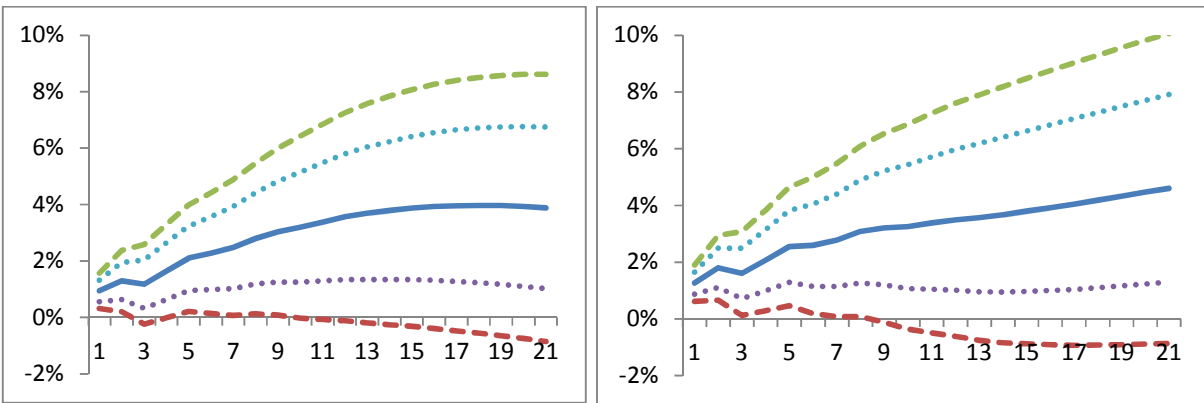

US (estimated with housing price index)   US (estimated with housing value)

Notes: housing variables are measured by housing value or housing price index; dashed lines indicate 90% confidence interval; dotted lines indicate 68% confidence interval.

23

Table 1: The dynamic percentage change of consumption to a 10% shock to housing prices and to stock market capitalization for eight countries

| | | Consumption response to a 10% | | | | | |
| | | house price shcok | | | stock market value shock | | |
Country	Mortgage market index[a]	Initial	1-year	2-year	Initial	1-year	2-year
Australia	0.69	1.38%**	2.47%**	1.42%	1.45%**	3.43%**	3.66%**
Canada	0.57	2.93%**	4.00%**	1.19%	2.27%**	3.86%**	2.84%*
UK	0.58	5.37%**	5.81%**	3.45%**	1.46%**	1.70%*	2.17%*
US (housing price)	0.98	2.35%**	5.09%**	5.37%**	0.94%**	2.1%**	3.04%**
US (housing value)		2.18%**	5.22%**	6.58%**	1.26%**	2.55%**	3.21%*
Belgium	0.34	1.54%**	3.36%**	3.40%**	0.50%*	1.11%*	3.90%**
Finland	0.49	0.60%	-0.83%	-2.79%*	0.15%	1.85%*	3.20%*
Sweden	0.66	6.42%**	9.00%**	7.33%*	2.14%**	3.98%**	3.77%*
Switzerland	—	1.75%**	2.17%**	1.89%*	1.58%**	2.31%**	2.43%**

Notes: Consumption percentage change in response to a 10% exogenous shock to housing prices and to stock market capitalization for each country. All calculations are based upon the impulse-response functions implied by our SVAR estimates. Initial elasticity is the elasticity in the initial period. ** and * indicate statistical significance levels of 0.1 and 0.32, respectively. (a) Mortgage market index is an index of the maturity and development of mortgage market of a country (higher value indicating easier household access to mortgage credit), constructed from indicators of mortgage equity withdrawal, refinancing easiness, typical loan-to-value ratio, mortgage-backed security issues, et cetera. See Cardarelli et al. (2008) for further detail.

Table 2: The mean group estimators of consumption to a 10% shock to housing prices and to stock market capitalization

| | Consumption response to a 10% | | | | | |
| | house price shock | | | stock market value shock | | |
Region	Initial	1-year	2-year	Initial	1-year	2-year
Anglo-Saxon countries	3.01%***	4.34%*	2.86%	1.53%*	2.77%*	2.93%
Continental Europe	2.58%*	3.43%*	2.46%	1.09%	2.31%	3.33%
All	2.79%*	3.88%	2.66%	1.31%	2.54%	3.13%

Notes: Consumption percentage change in response to a 10% exogenous shock to housing prices and to stock market capitalization for each region. Reported here are the unweighted mean group estimators for each region. The standard error of each mean group estimator is calculated assuming the estimates for each country are independent. All calculations are based upon the impulse-response functions implied by our VAR estimates. Initial elasticity is the elasticity in the initial period. ***, ** and * indicate statistical significance levels of 0.05, 0.1 and 0.32, respectively. Anglo-Saxon Countries include Australia, Canada, UK, and US; Continental Europe countries include Belgium, Finland, Sweden, and Switzerland.

Table 3: The Marginal Propensity to Consume for the United States

	U.S. Marginal Propensity to Consume (MPC) of					
	housing wealth			stock wealth		
starting period	Initial	1-year	2-year	Initial	1-year	2-year
2003q1	0.093	0.209	0.240	0.060	0.112	0.136
2007q1	0.080	0.224	0.345	0.051	0.107	0.214

Notes: MPC is calculated as the elasticity of consumption to wealth multiplied by consumption-wealth ratio of the corresponding period. The elasticities are obtained from the impulse-response functions implied by our SVAR estimates. We choose U.S. because it has both household house value and stock market capitalization value in data.

Figure 9: Scatter plots of consumption responses to a 10% housing price shock
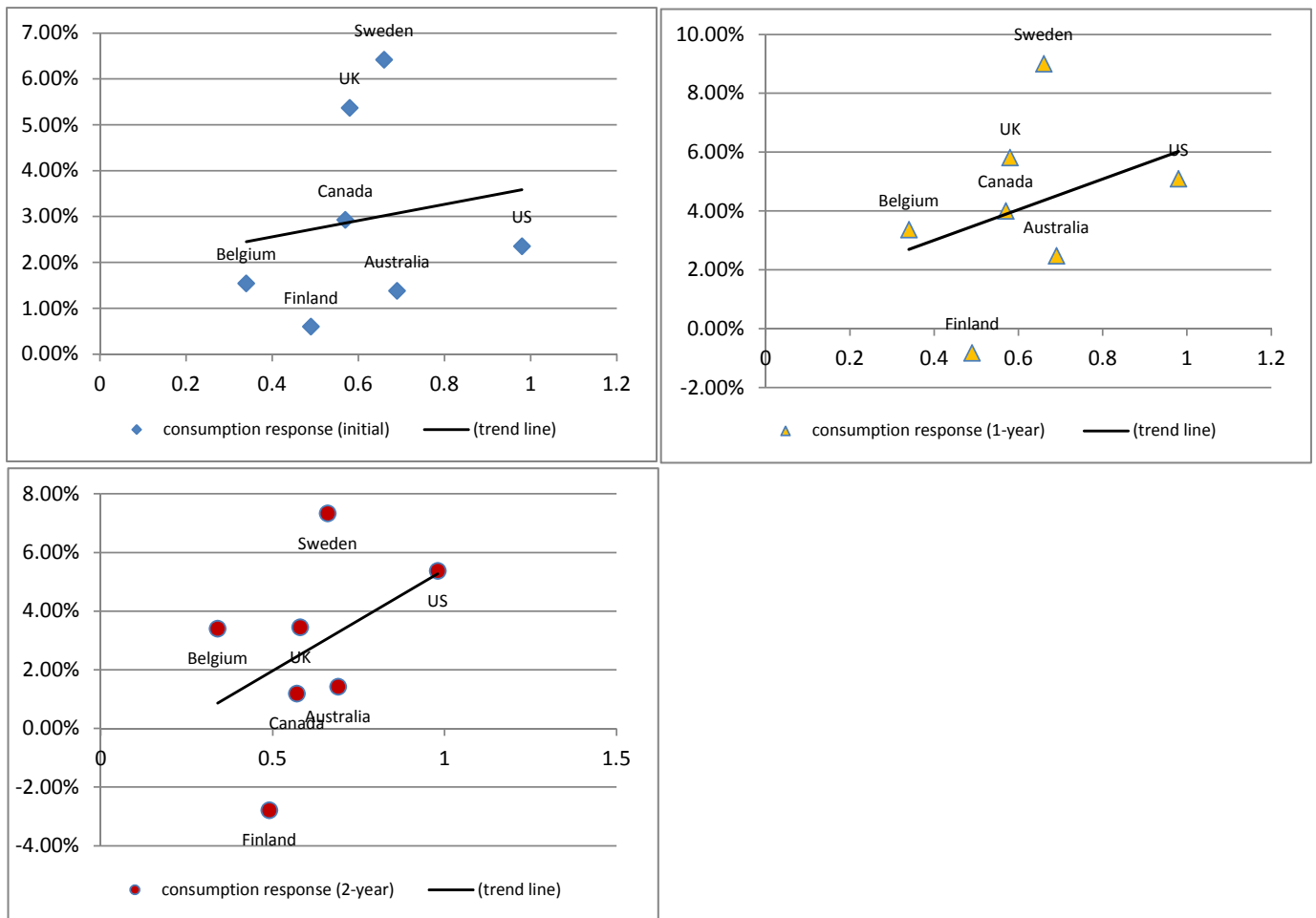
B Data Sources

Consumption: For all the countries except the U.S., consumption data come from OCED Economic Outlook (`http://www.oecd.org`). For the U.S., the data is obtained from Bureau of Economic Analysis (`http://www.bea.gov`).

Stock Market Capitalization: For all the countries, stock market capitalization data come from Datastream by Thomson Reuters. The retrieval code is TOTMXX(MV) where XX is the corresponding country code.

Disposable Income: For all the countries except the U.S., income data come from OECD Economic Outlook (`http://www.oecd.org`). For the U.S., the data is obtained from Bureau of Economic Analysis (`http://www.bea.gov`).

Housing Price Index: For all the countries except the U.S., housing price index data come from the property price statistics by Bank for International Settlements. For the U.S., the market value of household owned real estate (including vacant land and mobile homes) is obtained from Federal Reserve Board Z1 data releases B.100 (FL155035015.Q), and the housing price index is the housing all-transactions index obtained from Federal Housing Finance Agency (`http://www.fhfa.gov`).

Consumer Price Index: For the countries except the U.S., consumer price index data come from OECD Economic Outlook (`http://www.oecd.org`). For the U.S., the data is obtained from Bureau of Economic Analysis (`http://www.bea.gov`).

Population: For Canada, the population data is obtained from Statistics Canada (`http://www.statcan.gc.ca`). For the U.S., the population data is obtained from Bureau of Economic Analysis (`http://www.bea.gov`). For the other countries, the data come from OECD Economic Outlook (`http://www.oecd.org`).

Table 4: Summary of period of coverage and number of observations for countries

Country	Period of coverage	Number of observations
Australia	1986q3—2004q4	74
Belgium	1981q1—2004q4	96
Canada	1981q1—2009q4	116
Finland	1988q2—2004q4	67
Sweden	1986q1—2004q4	76
Switzerland	1981q1—2003q4	92
United Kingdom	1984q2—2004q4	83
United States	1973q1—2009q4	148