UNITED KINGDOM

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UNITED KINGDOM

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July 8, 2014

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European Department

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CONTENTS

HOUSING AND BUSINESS CYCLES: IS THE UK DIFFERENT FROM OTHER ADVANCED ECONOMIES?[1]

In contrast to other OECD countries, housing cycles in the UK are marked by sharp movements in prices and an inelastic response of residential investment, owing notably to supply constraints. Housing cycles in the UK also tend to have a large impact on economic activity, with booms generally associated with a worsening of household balance sheets and a rise in relatively high-risk mortgages. Alleviating supply-side constraints, notably pertaining to planning restrictions, is imperative for a moderation of housing cycles in the UK, while risks to financial stability in the context of the current house price inflation could be addressed by pursuing targeted macroprudential measures.

A.   The UK Housing Market: A Historical Perspective

1.   **The housing sector plays an important role in the UK economy.** The value added of the real estate sector—related closely to the housing market as a sector—has been increasing steadily over time in the UK. While in 1990 it represented about 6 percent of GVA, in 2013 it reached 12 percent. Moreover, when all industries related to the housing market (finance, real estate, and construction, or FREC) are taken into consideration, the share rises to about 25 percent of GVA, substantially higher than the average for the OECD economies taken together and one of the highest among the G7 economies, underscoring the increasing importance of the housing sector in the UK economy.

2.   **House price increases in the UK stand out among the OECD economies.** Over the past 30 years, real house prices have increased the most in the UK when compared with other OECD economies. Indeed, over this period, annual house price increases have averaged 3 percent in real terms, compared with 1 percent for the OECD as a whole. This divergence in house price increases was particularly pronounced from the mid-1990s through the Great Recession. Furthermore, house prices in the UK have also been a lot more volatile when compared with other advanced economies.

Figure 1. Housing-related Sectors: Finance, Real-Estate, and Construction (Percent of GVA)

Source: Haver Analytics.

Figure 2. Real House Prices in OECD Economies (Index, 100 = 1980)

Sources: OECD; and ONS.
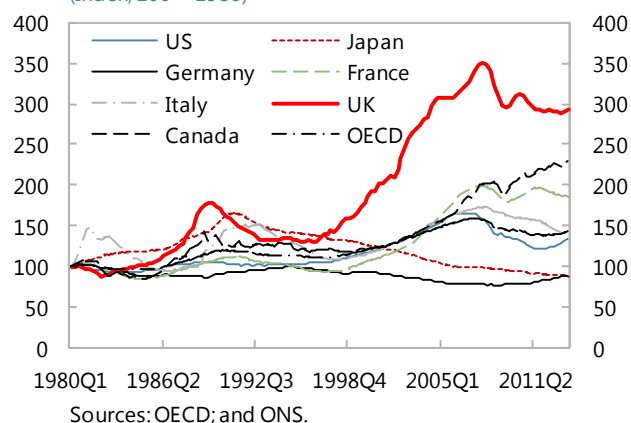
3.   **In the context of a strong demand for housing, rapid price increases reflect the impact of serious supply constraints in the UK housing market.** Residential investment in the UK as a share of GDP is among the lowest across the OECD economies. The sluggish response of residential investment to a strong demand for housing is attributed to supply-side constraints. In particular, restrictive planning regulations, in combination with inadequate incentives for local authorities to grant building permits, have resulted in a low house price elasticity of residential investment in the UK.[2] Obtaining a planning permit in the UK takes about 25 weeks, longer than in the average OECD economy (NAO, 2008).[3] There is some evidence that past attempts by the government to limit the time involved in processing planning permits have resulted in an increase in the rejection rates of permit applications, and an increase in the time spent in the appeal process (Corder, 2008 and NAO, 2008).[4]

Figure 3. OECD: Residential Investment and Planning Costs

Residential Investment in OECD Economies (Percent of GDP)

Source: Haver Analytics.

Number of Days to Required to Obtain Building Permits in OECD Countries

Sources: World Bank; DBI; and NAO.
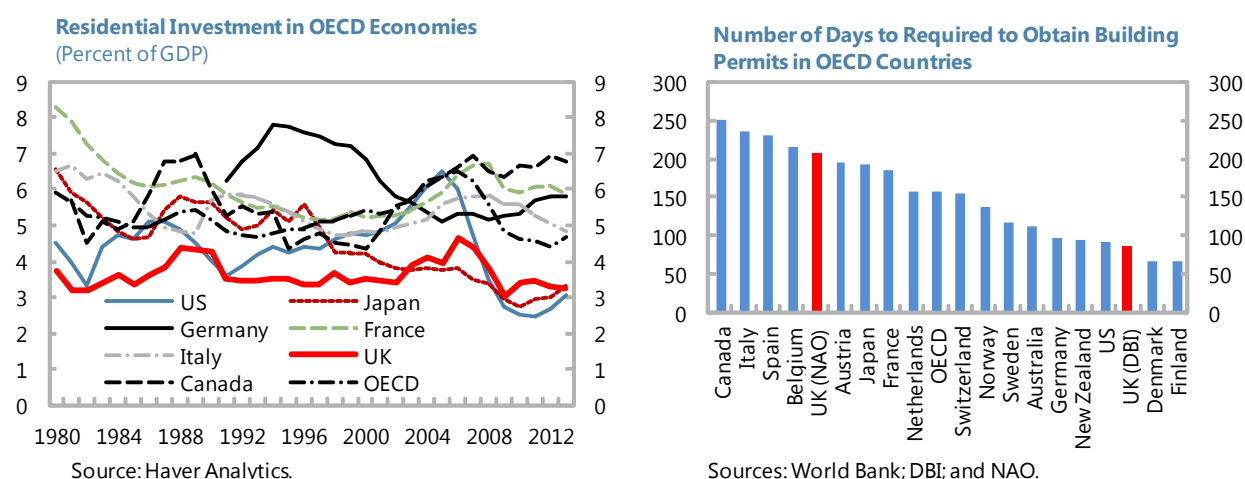
B.   Housing Booms and Busts in Advanced Economies

Does the UK Stand Out?

4.   **Housing cycles in the UK are characterized by large fluctuations in real house prices and a limited response of residential investment.**

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[2] OECD (2011) and André (2011).

[3] While the National Audit Office (NAO) estimates an average time to process planning permits of 25 weeks, the Doing Business Indicators (DBI) consider an average time of 13 weeks. The estimate of the NAO is higher than the DBI since it takes into account the time involved in the appeal process once a planning permit is rejected. In addition, the DBI database shows that the monetary cost of obtaining building permits in the UK is 66 percent of per capita income, higher than the cost in the average OECD economy (56 percent of per capita income).

[4] Corder (2008) showed that the rejection rate of major housing projects increased from 15 percent in the mid 1990's to 35 percent in 2008. One reason for the increase in the rejection rate is that the government introduced a target of 13 weeks to process planning permits. Local councils reached the target by increasing the rejection rate of permit applications.

- The UK stands out as having the largest fluctuations in real house prices among G7 economies.[5] In fact, house price volatility is even larger than in countries that have experienced pronounced housing cycles, such as the US and Canada.

- On the other hand, residential investment in the UK is less volatile than in most OECD economies. This volatility, in turn, is influenced by the elasticity of housing supply.[6]

Figure 4. The UK Housing Cycle: Volatile Prices and Subdued Residential Investment (1980−2013)

A. Increase in Real House Prices During Upturns (Annual Percentage Change)

B. Decline in Real House Prices During Downturns (Annual Percentage Change)

C. Increase in Real Residential Investment During Upturns (Annual Contribution to GDP Growth)

D. Decline in Real Residential Investment During Downturns (Annual Contribution to GDP Growth)
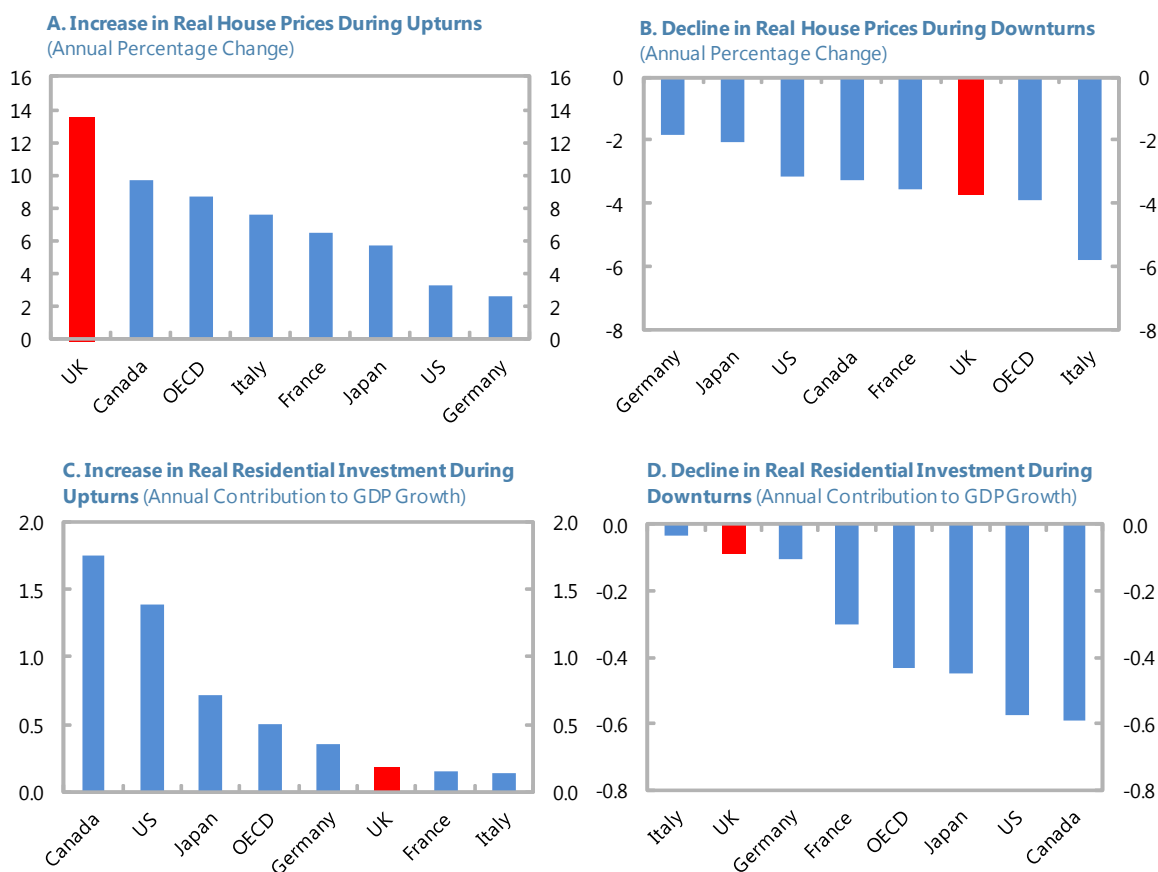
Source: Haver Analytics; and IMF Staff calculations.

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[5] We compared the average annual change in house prices and residential investment during upturns and downturns. The turning points for the upturns and downturns were defined using the BBQ algorithm from Harding and Pagan (2002). Our sample included 18 OECD countries.

[6] The elasticity of housing supply depends on policy factors (planning costs and land-use regulations) and non-policy factors (land availability and population density). See Caldera Sanchez and Johansson (2011) for an estimation of housing supply elasticities from OECD countries.

5.   **Housing cycles in the UK have become more persistent and volatile over time. The properties of the housing cycles have changed dramatically over time.**

- The duration of housing cycles has increased dramatically during upturns. While during the 1980–96 period, the average duration of upturns in the UK was 31 quarters, during 1997–2013 the average duration increased by 50 percent to 47 quarters.

- Moreover, the amplitude of the cycle—measured by the difference in real house prices between the trough and peak—during upturns increased from 98 to 170 percent.[7] This is surprising, since most macroeconomic variables across OECD economies experienced a decline in volatility over the same sample period (Blanchard and Simon, 2001).

- The volatility in the housing market has been amplified by a loosening of credit conditions prior to the crisis (Igan and Loungani, 2012).

Figure 5. The UK Housing Cycle Has Changed Over Time

A. Duration of House Price Cycles
(Number of quarters)

B. Amplitude of House Price Cycles
(Annual Percentage change)
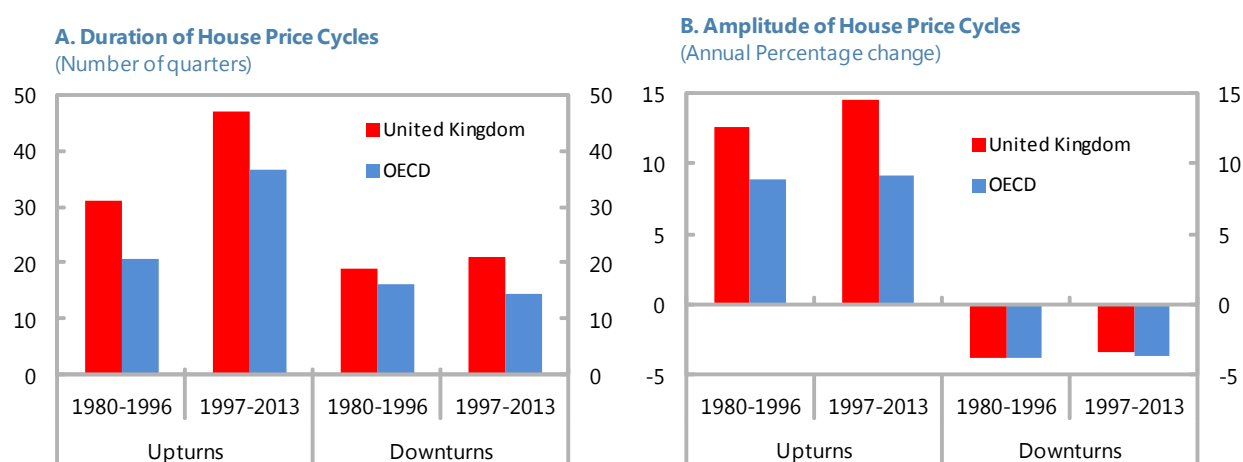
Sources: Haver Analytics; and IMF Staff calculations.

6.   **House price volatility in the UK has been influenced by restrictive planning regulations and favorable credit conditions.** The properties of the UK housing cycles can be interpreted through a simple model of demand and supply for housing. Large fluctuations in prices with a limited response in quantities are a result of large shifts in the demand curve in a market where the supply is inelastic. In fact, some key features of the UK housing market indicate that this is the case.

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[7] The amplitude is measured as the difference between the peak and trough of real house prices.

- Planning costs are relatively high compared to the average OECD economy, and tend to reduce the elasticity of residential investment to house prices.[8]

- Moreover, mortgage loans with a high loan-to-value (LTV) ratio have generally been more pervasive in the UK, and have contributed to boosting the demand for housing (IMF, 2011).

- To test the influence of these factors on house price volatility, we split the sample of OECD countries into different groups—countries with high and low planning costs, and countries with high and low LTV ratios—and compute the average annual price change in each subsample.[9] This exercise shows that house price volatility tends to be high in countries with high planning costs and high LTV ratios, suggesting that these two factors could be playing a pivotal role in influencing the UK housing cycle.

Figure 6. Planning Restrictions and LTV Ratios Influence the Housing Cycle

A. Planning Costs: Changes in Real House Prices Over the Cycle (Annual Percentage Change)

B. LTV Ratio: Changes in Real House Prices Over the Cycle (Annual Percentage Change)
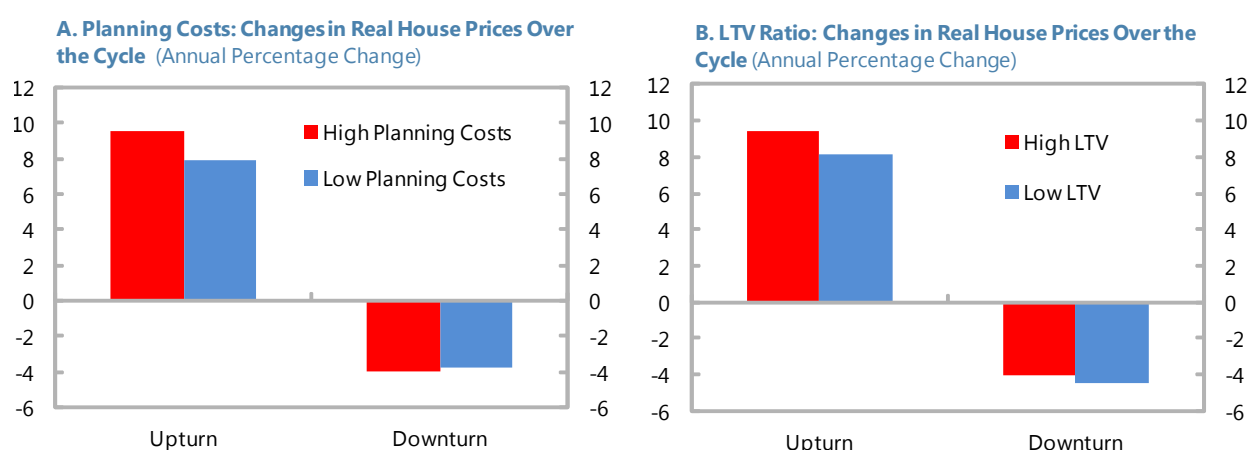
Sources: World Bank; Haver Analytics; and IMF Staff calculations.

7.   **Households' balance sheets expand dramatically during house price booms, resulting in a higher financial vulnerability of the household sector.** For instance, as a consequence of sustained increases in house prices ahead of the current crisis, housing wealth sharply increased in the decade prior to the event. The increase in housing wealth went hand in hand with higher mortgage debt. However, notwithstanding the large increase in mortgage debt, housing net worth (the difference between housing wealth and mortgage debt) reached 200 percent of GDP in 2007. But the increase in net wealth on aggregate masked an underlying vulnerability in the household sector. In particular, the mortgage market in the UK provides relatively high loan-to-value ratios for first-time buyers, making this segment of the household sector more vulnerable to swings in the housing market. This vulnerability, in turn, magnifies the impact of housing shocks on economic activity.

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[8] In addition, the sluggish supply of housing in the UK is explained by the uncertainty over planning outcomes. While in the UK a development requires permission from the local planning authorities and is subject to delays, other OECD countries rely on rule-based zoning systems (Barker, 2004 and Cheshire, 2014).

[9] The threshold for high planning costs and LTV ratios is defined by the sample median.

Figure 7. UK: Household Sector Balance Sheet

UK: Household Sector Balance Sheet
(Percent of GDP)

OECD: Maximum Loan-to-Value Ratio on New Loans (Percent)

Sources: ONS.

Source: IMF (2011).
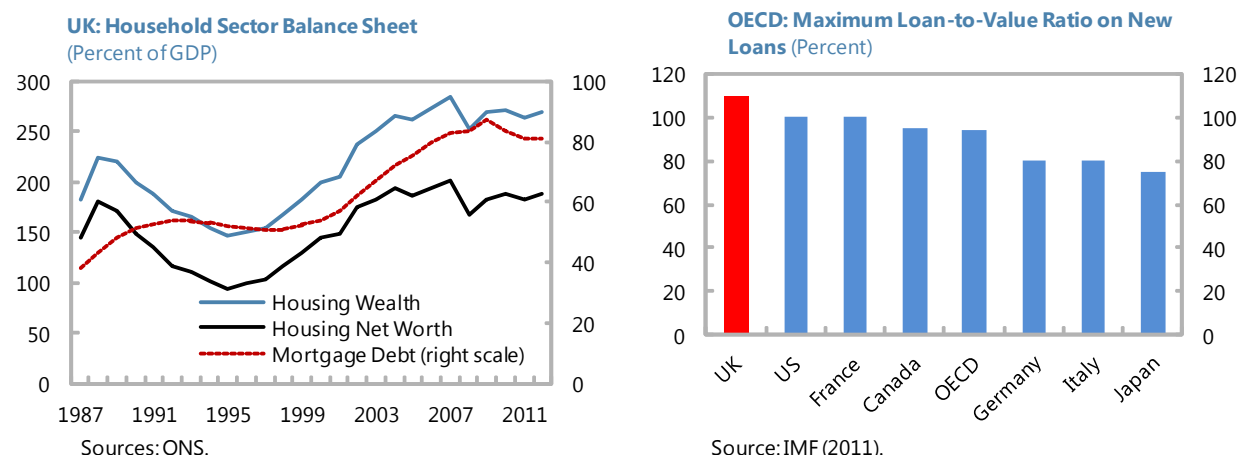
The Great Recession and its Aftermath

Impact of the crisis

8.   **Advanced countries that experienced the most pronounced housing booms before the crisis exhibited the largest decline in GDP relative to trend.** In the run-up to the crisis (1997–2007) real house prices in the UK increased by 150 percent, more than in other OECD countries, except Ireland. Post-crisis, GDP in the UK was 18 percent below the pre-crisis trend in 2012. On average, OECD economies experienced a decline in GDP relative to trend of 14 percent. Some countries, such as Switzerland or Germany, experienced a milder pre-crisis housing boom and a smaller decline in de-trended GDP. This pattern illustrates how large swings in the housing market are correlated with economic activity.[10]

Figure 8. Change in Real House Prices and GDP Deviation from Trend in OECD Countries

GDP in 2012 (Deviation from trend)

Change in real house prices (1997–2007)

Source: Haver Analytics.
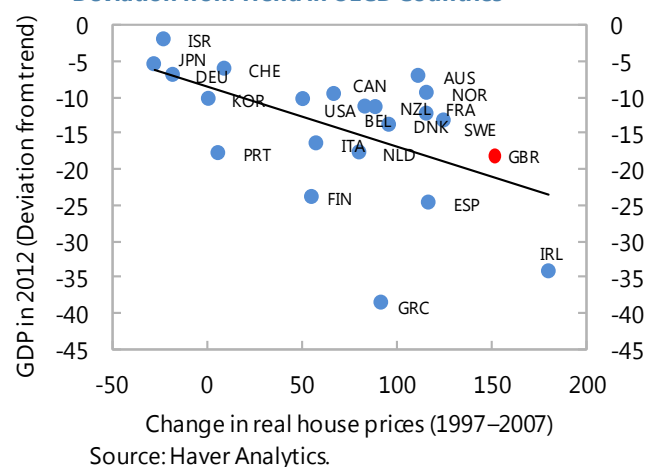
9.   **During the Great Recession (2008–10), the UK's housing bust was more severe than in most G7 economies.** Real house prices in the UK declined by 15 percent while residential investments as a share of GDP declined by 50 percent. Only the housing bust in the US was more severe. In contrast, Canada and Germany experienced a housing boom shortly after the Great Recession. More recently, UK's real house prices and residential investment have been recovering, but they remain significantly below the pre-crisis peak.

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[10] Although it is challenging to identify the direction of causality between house prices and economic activity in the data, in section III we estimate a VAR model to quantify the impact of house price shocks on GDP.

Figure 9. G7: Housing Market During the Great Recession

A. Real House Prices
(Index, 100 = 2007)

Legend: US, Japan, Germany, France, Italy, UK

B. Residential Investment -to-GDP
(Index, 100 = 2007)

C. GDP
(Index, 100 = 2007)

Legend: US, Japan, Germany, France, Italy, UK, Canada

D. Private Consumption
(Index, 100 = 2007)

E. Unemployment Rate
(Index, 100 = 2007)

F. Household Debt / Disposable Income
(Index, 100 = 2007)
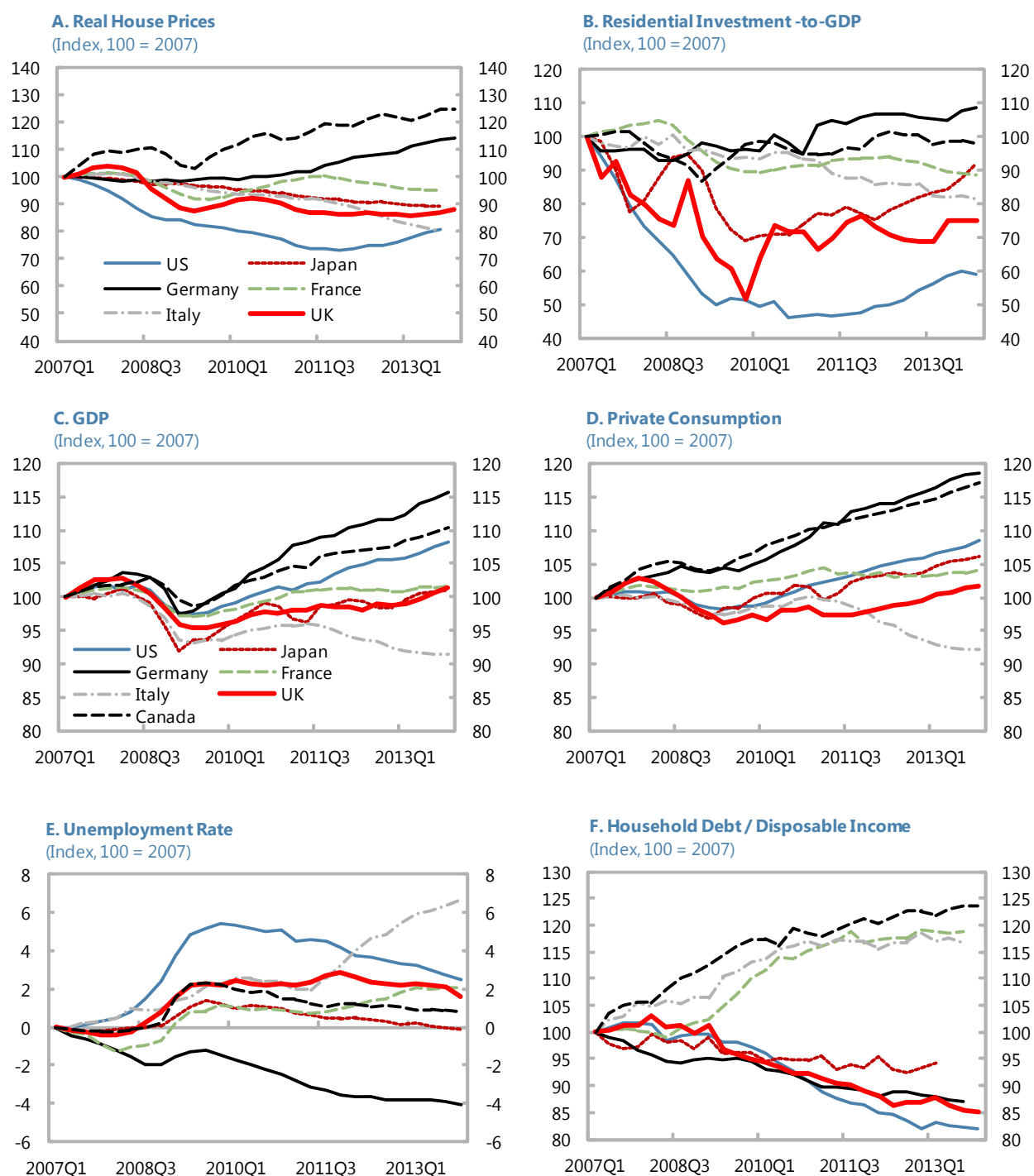
Sources: Haver Analytics; ONS; and OECD.

10.   **The housing bust had a significant macroeconomic impact in the UK, particularly on private consumption and household debt.** The UK exhibited the largest decline in private consumption and one of the largest reductions in household debt ratios among G7 economies, which possibly reflects not only wealth effects from lower house prices, but also the prevalence of tight credit conditions in the aftermath of the crisis. On average, countries that experienced a large housing bust (Italy, Japan, and the UK) also experienced a deep recession. On the contrary, countries that experienced a housing boom (Canada and Germany) exhibited a shallow recession. The US experienced a different boom-bust pattern as its economy was able to grow at a relatively fast pace after a housing bust, owing to a pick-up in investment and exports and a fast rebound in productivity.

Post-crisis Recovery

11.   **Price-to-Income and Price-to-Rent ratios suggest an overshooting in house prices.** Standard valuation ratios indicate that house prices remain high relative to income and rents, suggesting an overshooting of house prices. The extent of overshooting can be estimated by calculating the difference between current housing valuation ratios and a benchmark long-term valuation ratio. An assessment based on two benchmarks, the average of the ratios over the past 15 and 30 years, shows that the overshooting is in the range of 10–30 percent.[11]

Figure 10. UK: Price-to-Income and Price-to-Rent Ratios (Index, 100 = 2010)

Source: OECD.
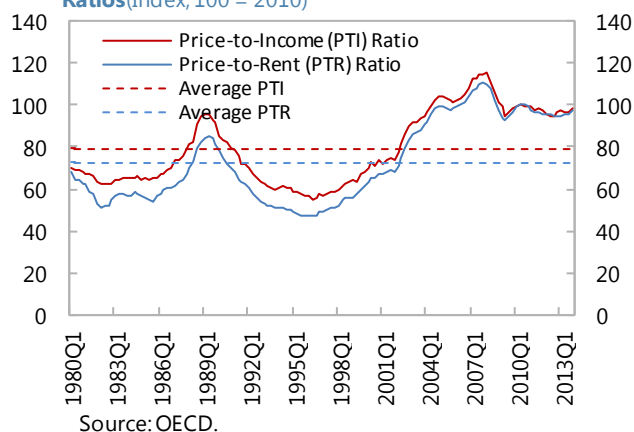
12.   **The current UK housing recovery occurred in the presence of weak credit growth, suggesting a greater role of cash transactions.** The current housing recovery is comparable with previous historical episodes. Real house prices in this recovery are close to the average of the previous two recoveries, and residential investment has been increasing at the same pace as in previous episodes. However, it is puzzling that housing recovery is taking place in a context in which GDP growth is weaker than in the past, and the ratio of credit to the private sector to GDP (measured by M4 and M4LXex lending) is declining. The increase in house prices in a context of weak credit growth suggests that cash transactions, in particular by foreigners, are playing an increasingly important role in the housing recovery.[12]

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[11] The high price-to-rent and price-to-income ratios in the UK reflect in part the historically low long-term rates.

[12] M4LXex is a measure of credit to the private sector excluding the effects of securitizations and loan transfers.

**Figure 11. The UK is Experiencing a Strong Housing Recovery
Compared to Past Episodes**

A. Real House Prices
(Index = 100 at trough of the cycle; *x*-axis in quarters)

B. Residential Investment
(Index = 100 at trough of the cycle; *x*-axis in quarters)

C. Real GDP
(Index = 100 at trough of the cycle; *x*-axis in quarters)

D. Credit to the Private Sector / GDP
(Index = 100 at trough of the cycle; *x*-axis in quarters)
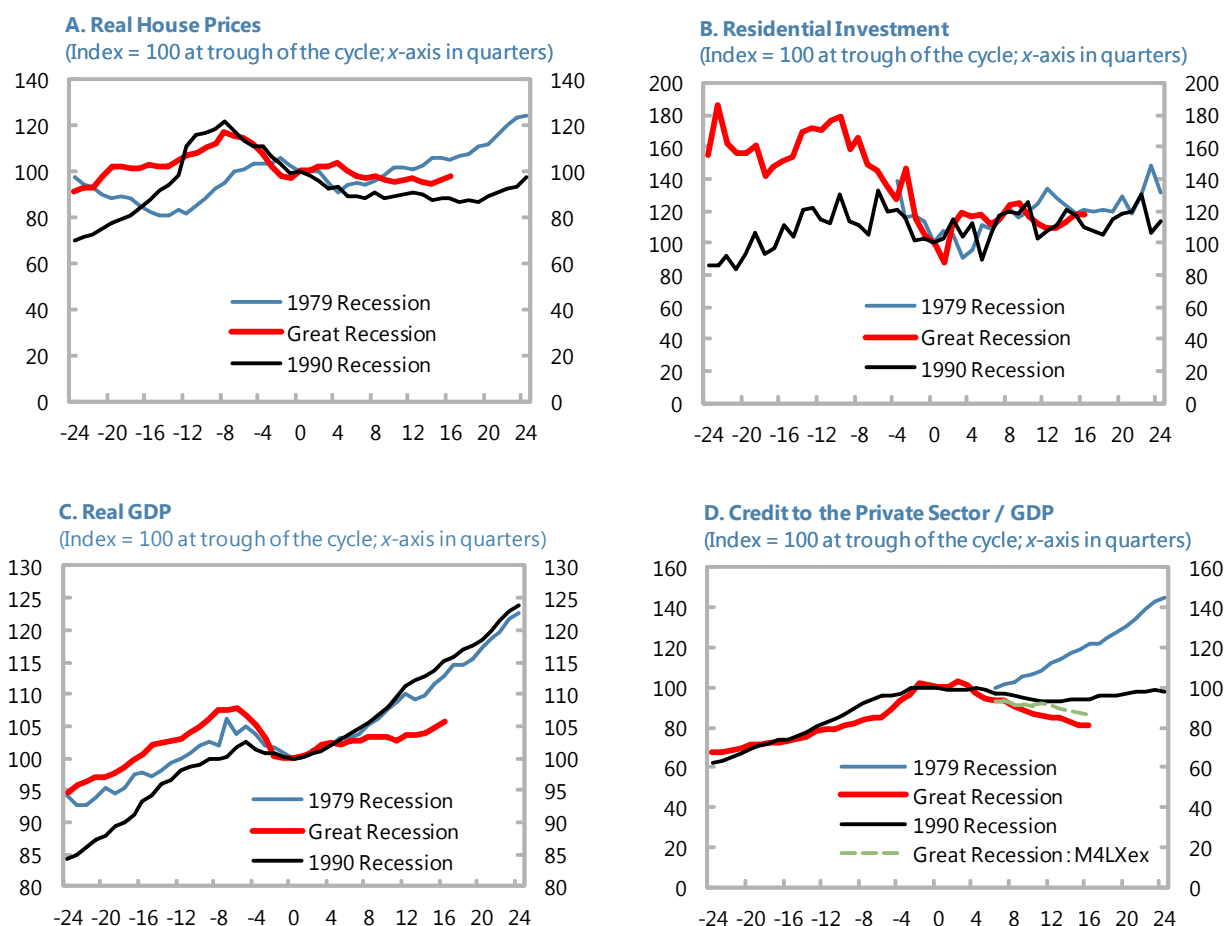
Sources: ONS; and IMF staff calculations.

13.   **The UK housing recovery remains unbalanced. Demand is outpacing supply, particularly in the London market.** There is a large disparity among regional house price indices. While real house prices in London have already reached their pre-crisis peak, house prices in other regions have not yet recovered. The differences in house prices might in part reflect regional disparities in the UK recovery. Furthermore, there is an increasing imbalance between demand and supply. While residential investment is recovering at a sustained pace, housing transactions have been growing in recent quarters resulting in an acceleration of house price inflation. This imbalance is likely to be more acute in the London property market, where prices are growing faster than anywhere else.

Figure12a. UK: Real House Prices.
(Index, 100 = 2007Q1)

Source: ONS.
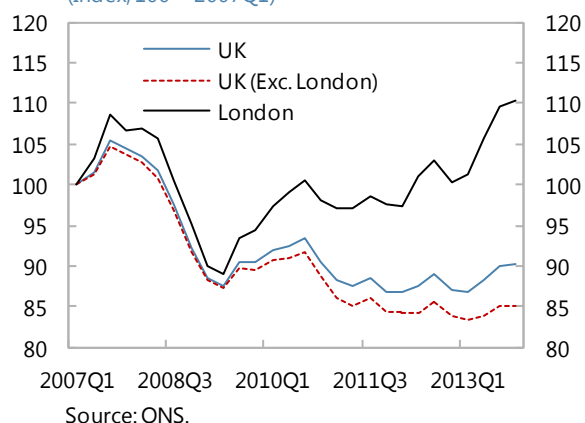
Figure 12b. House Transactions and Residential Investment (Index, 100 = 2007Q1)

Source: RICS; ONS.
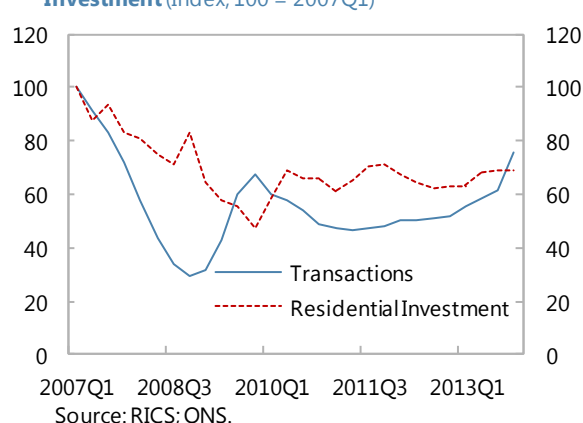
C.   Housing and the Business Cycle

14.   **House price shocks in the UK have a strong impact on consumption and household debt.** A Vector Autoregression (VAR) model was estimated to assess the impact of house price shocks on the UK economy.[13] In response to a 10 percent increase in house prices, private consumption responds strongly, increasing up to 2 percent in 5 quarters. The household debt ratio reaches a peak response of 10 percentage points of disposable income after 12 quarters. The increase in private consumption can be explained by wealth and collateral effects. In particular, the existence of mortgage equity withdrawal in the UK allows households with positive equity to extract part of their housing wealth to finance consumption expenditures (Benito et al., 2006). Furthermore, the high elasticity of household debt to house prices captures the fact that mortgage credit expands rapidly during housing booms, resulting in a higher household debt leverage ratio.

Figure 13a. UK: Consumption Response to a House Price Shock (Percent)

Source: IMF staff calculations.
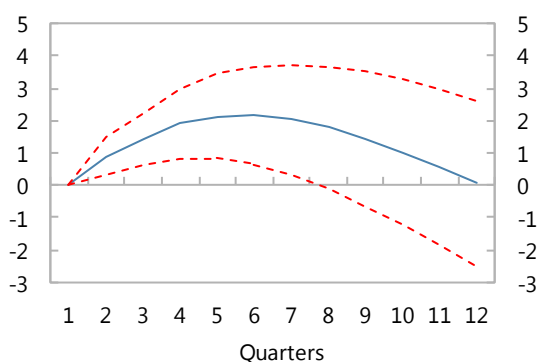
Figure 13b. UK: Household Debt Response to a House Price Shock
(Percent of disposable income)

Source: IMF staff calculations.
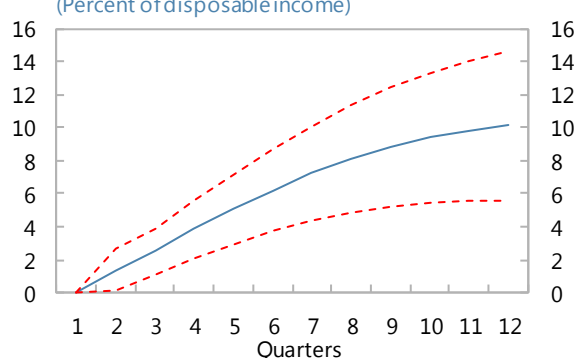
15.   **In the UK, residential investment is less responsive to house prices and household debt is more elastic to house prices than in most OECD countries.** A cross-country comparison of the transmission of house price shocks shows that the UK is different from other OECD economies. The

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[13] See appendix for details on the estimation of the VAR model.

response of residential investment in the UK is half of the median response for OECD economies. On the other hand, the response of household debt is more than twice as high as the response in the median OECD economy. This cross-country comparison highlights two key facts about the UK economy. First, housing supply constraints seem to be more binding in the UK resulting in a low elasticity of residential investment to house prices. Second, household debt is highly elastic, reflecting the fact that mortgage credit expands rapidly during housing booms.

16.   **The housing bust in the UK was responsible for a third of the decline in GDP during the Great Recession.** Using a historical decomposition analysis of the VAR model, we simulate the impact of housing shocks on GDP.[14] The simulation shows that housing shocks reduced GDP by 3 percent, about a third of the fall in output experienced during the Great Recession. More importantly, the simulation suggests that the effects of housing busts are persistent and account for the weak recovery in the aftermath of the crisis.

Figure 14. UK: Real GDP During the Great Recession
(Index, 100 = 2008)
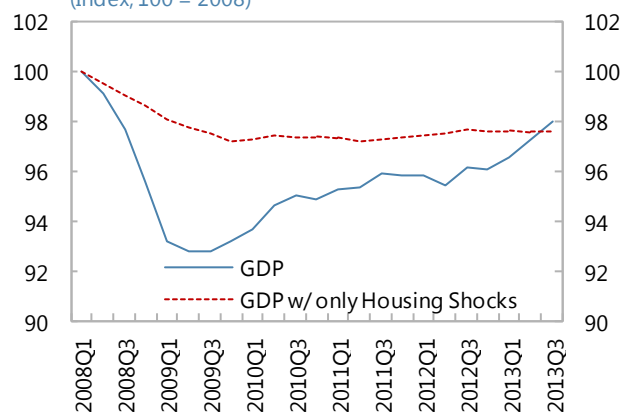
Source: IMF staff calculations.

17.   **In the early 1990's, the UK economy experienced a fast recovery from a housing bust due to a rapid increase in exports and investment.** The historical decomposition analysis shows that the impact of the early-1990s housing bust on GDP was 2 percent. However, the recession was short-lived and the GDP recovery was robust. The negative impact of the housing bust on GDP was compensated by a rapid expansion in exports and investment during the first four years of the recovery. This episode illustrates how the rebalancing of the UK economy towards investment and exports can play an important role in ensuring a fast recovery in the aftermath of a housing bust.

Figure 15. UK: Real GDP During the 1990 Recession
(Index, 100 = 1990)
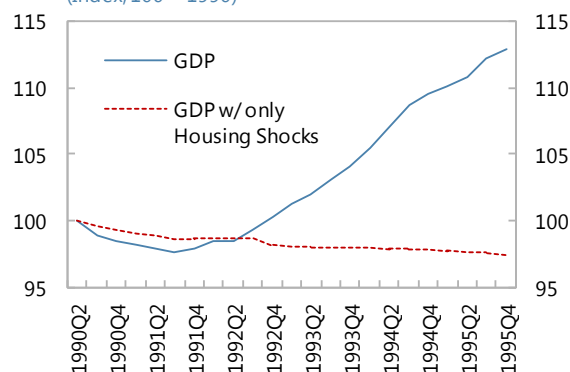
Source: IMF staff calculations.

Figure 16. Average Growth of GDP Components, 1992–95 (Percent)
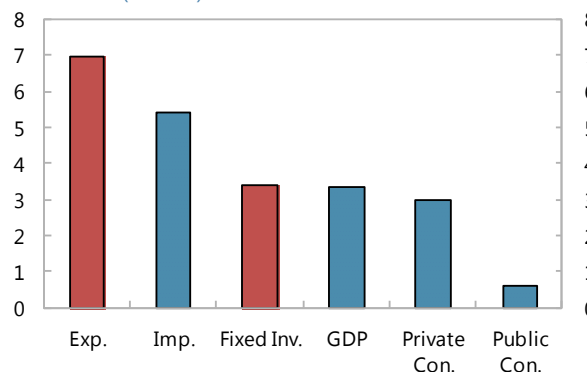
Source: ONS.

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[14] The simulation includes shocks to both house prices and residential investment to fully capture the extent of the downturn in the housing market.

D.   Conclusions and Policy Implications

18.   **The UK housing cycle is highly volatile as a result of tight housing supply constraints and fluctuations in credit conditions.** The UK is characterized by having one of the largest fluctuations in house prices and one of the smallest volatilities of residential investment among OECD economies. These properties of the UK housing cycle are a result of both housing supply constraints and fluctuations in credit conditions. This volatility in the housing market, in turn, contributes to a more pronounced business cycle in the UK, as shown during the recent financial crisis. A more stable housing market requires policies that address both supply constraints and excessive fluctuations in mortgage credit.

19.   **Housing supply-side constraints can be alleviated through changes to the planning system and tax reforms.** The new National Planning Policy Framework introduced by the government is creating the incentives for local councils to increase available land for construction. There are early signs that this change in the planning system is contributing to the recovery in housing construction. However, key inefficiencies remain in the way property and land are taxed. The current tax regime discourages institutional investment in rental accommodation, and undeveloped land is exempted from business taxes, which incentivize land hoarding. A reform of property and land taxation could improve the efficiency in the use of land and encourage an expansion in housing supply.

20.   **Targeted macroprudential policies could address financial stability risks stemming from the housing market.** Although mortgage credit as a share of GDP has been declining in the current housing recovery, there are signs that there is a buildup of financial risks: loan-to-income ratios are increasing in London and among first time buyers.[15] Macroprudential policies are the first line of defense against systemic financial risks. Given the uncertainty of the transmission of mechanism of macroprudential policies, there are merits in adopting macroprudential policy measures early and gradually.[16] These policies would not only increase the resilience of the banks' balance sheets, but would also reduce the volatility of the housing cycle.

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[15] See the Selected Issues Paper "Macroprudential Policy: Lessons from Advanced Economies."

[16] The Financial Policy Committee (FPC) has recently recommended a macroprudential policy measure: a cap on mortgages with high loan-to-income ratios. The new macroprudential policy measure states that no more than 15 percent of new mortgages could have a loan-to-income ratio of 4.5 or higher. This measure will be effective from October 1, 2014.

References

André, Cristophe, 2011. "Improving the Functioning of the Housing Market in the United Kingdom," *OECD Economics Department Working Papers*, No. 867.

Barker, Kate, 2004. "Review of Housing Supply: Final Report," HMT.

Benito, Andrew, Jamie Thompson, Matt Waldron and Rob Wood, 2006. "House prices and Consumer Spending," *Bank of England Quarterly Bulletin*, pp. 142–154.

Blanchard, Olivier and John Simon, 2001. "The Long and Large Decline in U.S. Output Volatility," *Brookings Papers on Economic Activity*, No. 1, pp. 135–174.

Caldera Sanchez, A., and A. G. Johansson, A. G., 2011 ."The Price Responsiveness of Housing Supply on OECD Countries," *OECD Economics Department Working Paper,* No. 837.

Cheshire, Paul, 2014. "Turning Houses into Gold: the Failure of British Planning," *Centrepiece*, Vol. 19, No. 1, pp. 14–18.

Corder, Matthew and Nyssa Roberts, 2008. "Understanding Dwellings Investment," *Bank of England Quarterly Bulletin*.

Giuliodori, Massimo, 2005. "The Role of House Prices in the Monetary Transmission Mechanism Across European Countries," *Scottish Journal of Political Economy*, Vol. 52, No. (4), pp. 519–543.

Harding, Dan and Adrian Pagan, 2002., "Dissecting the Cycle: A Methodological Investigation," *Journal of Monetary Economics*, Vol. 49, No. (4), pp. 365–381.

Hilber, Christian, and Wouter Vermeulen, 2012. "The Impact of Supply Constraints on House Prices in England," London School of Economics, *SERC Discussion Paper* 119.

Igan, Deniz, and Prakash Loungani, Prakash, 2012. "Global Housing Cycles," *IMF Working Paper* No. 12–217.

Musso, Alberto, Stefano Neri, and Livio Stracca, 2011. "Housing, consumption and monetary policy: How different are the US and the euro area?" *Journal of Banking & Finance*, Vol. 35, pp. 3019–3041

OECD, 2011. "Housing and the Economy: Policies for Renovation," *Economic Policy Reforms: Going for Growth*.

Sá, Filipa, Pascal Towbin and Tomasz Wieladek, 2011. "Low Interest Rates and Housing Booms: The Role of Capital Inflows, Monetary Policy and Financial Innovation." Working Paper No. 411. Bank of England.

Appendix 1. The VAR Model

1.   **A seven-variable macroeconomic VAR model is estimated to evaluate the impact of housing shocks on economic activity.** The VAR model for the UK is estimated with quarterly data for the 1987–2013 sample period. The VAR includes the following variables: CPI inflation rate, residential investment, private consumption, GDP, interest rate, the ratio household debt to income, and house price. Data for the UK and other OECD countries were obtained from the Office of National Statistics (ONS) and Haver Analytics. All variables, except for the inflation rate and the interest rate, are expressed in logarithms.[1] The system is identified following the standard recursive ordering (Cholesky decomposition), with the order following the listing of the variables mentioned above. We follow the Akaike criterion for lag selection, and estimate the model with 2 lags.[2]

2.   **The VAR model is related to an extensive literature on housing and business cycles.** Several studies have estimated the impact of house price shocks on economic activity, and the role of monetary policy in stabilizing the housing cycle. Igan and Loungani (2012) estimate a VAR model for a sample of OECD economies, and find that house price shocks tend to have a larger impact on output in countries where mortgage credit is more accessible. Musso et al. (2011) compare the impact of housing shocks in the Euro Area and the US, and find that in the latter housing shocks have larger effects on consumption. In addition, house prices in the US are more sensitive to changes in the monetary policy rate. Giuliodori (2005) estimates the effects of the monetary policy shocks on house prices across European countries and finds that the housing market channel of monetary policy tends to be stronger in countries with more developed mortgage markets. Sa et al. (2011) find that in a sample of OECD countries, the effects of capital inflows on house prices is amplified in countries with more developed mortgage markets.

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[1] Sims, Stock and Watson (1990) show that if variables are cointegrated, the VAR model can be consistently estimated in levels.

[2] We conducted a sensitivity analysis and estimated two alternative version of the VAR model: (i) a model where variables are de-trended and shocks are identified using a Cholesky decomposition; and (ii) a model in levels where the shocks are identified using generalized impulse response analysis. Both versions of the model provide similar results to the baseline model used in the paper.

GROWTH PROSPECTS IN THE UK: THE ROLE OF BUSINESS INVESTMENT[1]

Is the current uptick in business investment durable? This is the focus of this chapter. Investment models based on firm level data suggest that weak demand, financial market frictions, and heighted uncertainty largely explain the underperformance of business investment in the UK over the past few years. With these key investment determinants improving, business investment is now recovering. However, to sustain the momentum and anchor durable growth, recovery in productivity is imperative. To this end, the efficiency of the capital allocation mechanism needs to be restored, and the banking system should take a more active role.

A. Introduction

1. **After a prolonged period of weakness, business investment in the UK is recovering**. Business investment was hit hard by the global financial crisis, falling by 20 percent in 2008–09. The pace of investment recovery thereafter was weak compared to many other advanced economies and previous UK recessions. More recently, however, business investment has begun to grow, up 10 percent year on year in the first quarter of 2014.

Figure 1. Business Investment
(Index, 2009Q1 = 100)

Source: Haver Analytics.

2. **A durable recovery in business investment is critical to anchor sustainable economic growth**. Beyond boosting demand, investment will enhance the productive capacity of the economy and contribute to rebalancing away from consumption and towards external demand (McCafferty, 2014, and IMF, 2014). The focus of this chapter is to assess whether the recent uptick in investment indicates a turnaround in the trend and to discuss the role of business investment in the UK's growth prospects.

Figure 2. UK: Business Investment
(Indices, pre-recession peak = 100)
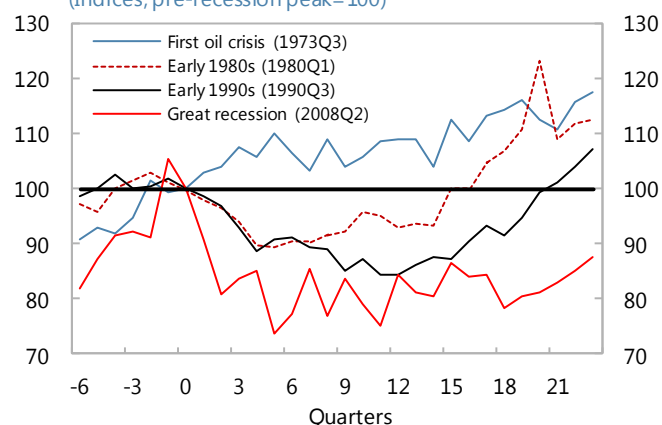
Sources: Haver Analytics; and IMF staff calculations.

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[1] Prepared by Kotaro Ishi, Stephanie Denis (both EUR), and Carolina Osorio Buitron (RES). The analysis in this chapter is based on the data available as of end-June 2014.

B. UK Investment Trends and Economic Performance—the Long-Run View

Before the crisis, growth in the UK was strong and broad-based

3.   **Business investment played an important role in boosting the UK's pre-crisis growth.** In the decade leading to the global financial crisis, business investment grew 4 percent a year on average, with the capital-to-labor ratio rising faster than in many other economies. Alongside, capital productivity (measured as output divided by net capital stock) grew faster than in many other advanced economies, reaching the highest level just before the global financial crisis erupted.

4.   **Supply-side growth accounting confirms that growth in the UK was broad-based in the pre-crisis years (1997–2007).**

- Capital was the most important driver of overall growth. Moreover the large accumulation of capital in information and communication technology (ICT) boosted growth directly and indirectly (through its contribution to higher productivity growth).

- Total factor productivity explained about 20 percent of growth. Labor also grew strongly and accounted for about one third of overall growth.

- The even contributions of factor accumulation and productivity growth in the pre-crisis era suggest that growth in the UK was broad-based. While a similar pattern was observed in the U.S., other major advanced economies grew at lower rates, with uneven sources of growth. Germany experienced robust total factor productivity growth, but the contribution of labor and capital was relatively weaker. In France and Japan, total factor productivity growth was particularly weak.

Figure 3. UK: Real Growth and Business Investment
(Average; percentage points)
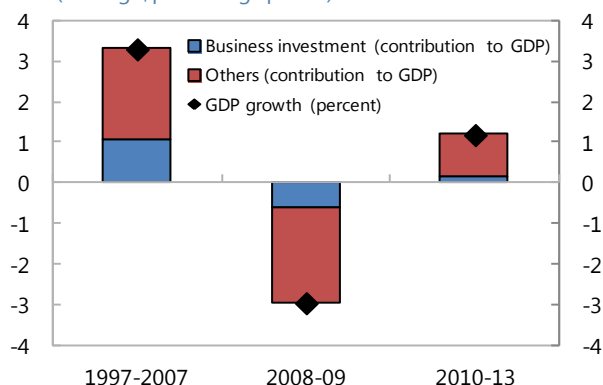
Source: Haver Analytics.

Figure 4. Capital Productivity
(GDP divided by net capital stock)
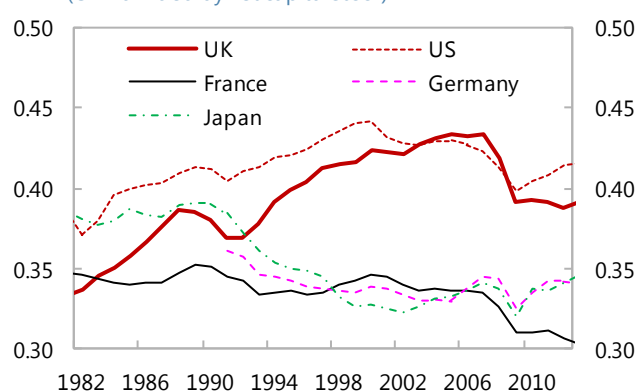
Sources: Annual macro-economic database; and IMF staff calculations.

Selected Countries: Growth Accounting
(Annual percent change)

| | | | Contributions to GDP growth | | | |
| | | | | Of which: | | |
	GDP growth	Labor	Capital services	ICT	Non ICT	TFP
			1997–2007 average			
UK(ONS) 1/	**3.2**	**0.9**	**1.3**	**0.7**	**0.6**	**1.0**
US	3.1	0.9	1.5	0.8	0.7	0.7
Germany	1.7	0.0	0.6	0.3	0.3	1.0
France	2.3	0.6	1.2	0.4	0.8	0.5
Japan	1.0	0.0	0.7	0.3	0.5	0.3

Sources: UK ONS; and The Confederation Board, Total Economy Database.
1/ The composition of ICT and Non ICT is estimated using Confederation Board Data.

5.   **The UK's strong growth performance was also supported by an efficient allocation of resources**. If resource allocation mechanisms are efficient, a sector with higher profitability, or better growth prospects, should attract more factors of production, such as capital. There is evidence that before the crisis, the UK's fast growing industries with higher total factor productivity growth—such as information, communication, professional, and technical services—attracted more capital. Hence, the shift in capital appears to have been efficient in the pre-crisis periods, contributing to increases in total factor productivity and output at the aggregate level.

But the crisis appears to have broken the UK's positive growth pattern

6.   **As elsewhere, the crisis hit the UK economy hard as investment and productivity collapsed**. Between 2008 and 2010, GDP growth averaged minus 1.5 percent, among the deepest contractions in advanced economies. This was largely accounted for by a sharp decline in total factor productivity, and to a lesser extent, by reduced labor inputs and slower capital accumulation.[2]

7.   **More recently, the economy has rebounded, driven mainly by strong labor growth**. Employment growth rebounded strongly in 2011–12, while capital accumulation has remained weak, and total factor productivity has continued to be a drag on growth.

Figure 5.UK: Growth of Gross Value Added, Capital, and Productivity
(Average growth in 1995-2007, percent) 1/
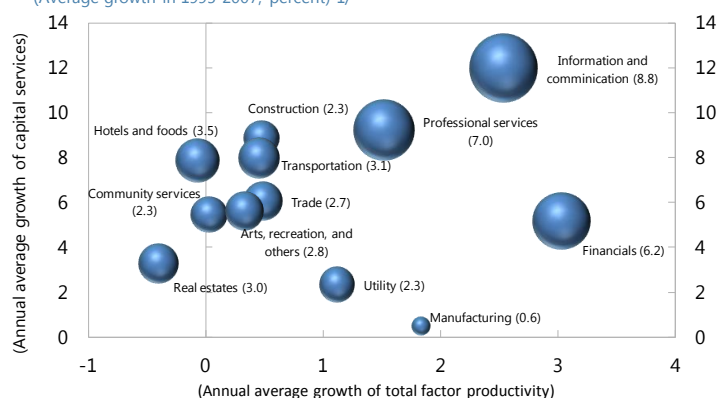
Sources: EU KLEMS database; and IMF staff calculations.
1/ The size of the bubble indicates the annual average growth rate of real gross value added, with the growth rates in the parenthesis.

Selected Countries: Growth Accounting

(Annual percent change)

	GDP growth	Labor	Capital services	ICT	Non ICT	TFP
			Contributions to GDP growth			
				Of which:		
	2008–10 average					
UK(ONS) 1/	**-1.5**	**0.2**	**0.7**	**0.1**	**0.6**	**-2.4**
US	-0.2	-1.0	0.7	0.4	0.3	0.1
Germany	-0.1	0.2	0.5	0.3	0.2	-0.8
France	-0.5	-0.1	0.8	0.1	0.7	-1.3
Japan	-0.7	-0.8	0.3	0.2	0.0	-0.2
	2011–12 average					
UK(ONS)	**0.8**	**1.6**	**0.2**	**...**	**...**	**-1.1**
US	2.3	1.1	0.6	0.4	0.2	0.6
Germany	2.0	0.7	0.6	0.5	0.2	0.7
France	1.0	0.3	0.7	0.1	0.6	0.0
Japan	0.7	0.2	0.2	0.3	-0.1	0.2

Sources: UK ONS; and The Confederation Board, Total Economy Database.
1/ The composition of ICT and Non ICT is estimated using Confederation Board Data.

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[2] The positive contribution from capital services to growth in 2008–10 may seem inconsistent with very weak investment after 2008. This is primarily because by construction, estimates of capital services reflect investments over multiple years (especially for long-lived buildings and structures) and do not account for the premature scrapping of assets.

8. **Furthermore, there is evidence that capital allocation mechanisms have weakened**.
Capital productivity, which fell sharply at the onset of the crisis, remains well below pre-crisis levels,
apparently reflecting possible impairments in capital allocation mechanisms (see also Barnett *et.al*,
2014; and Broadbent, 2014).[3] The decomposition of capital productivity suggests that in the pre-
crisis years, capital productivity growth was supported by positive allocational effects (i.e., shifts of
capital from lower to higher productivity sectors) offsetting negative direct effects (i.e., decreases in
sectoral capital productivity). By contrast, after the crisis, aggregate capital productivity fell sharply,
as sectoral productivity dropped and the reallocation effect weakened.

Figure 6. UK: Capital Productivity
(Real GDP divided by net capital stock; 2000=100)
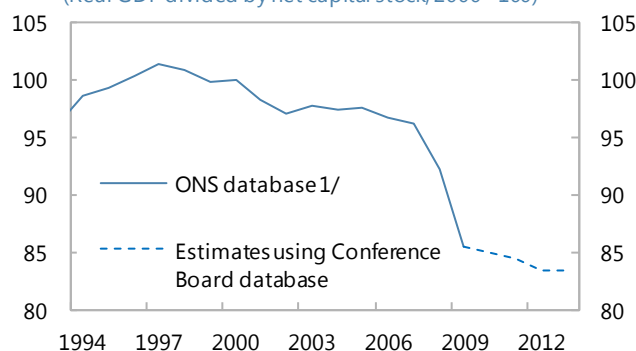
Sources: ONS; The Conference Board Total Economy
Database; and Haver Analytics.
1/ Excluding the dwelling sector.

Figure 7. UK: Decomposition of Capital Productivity
Growth 1/ (Percentage points)
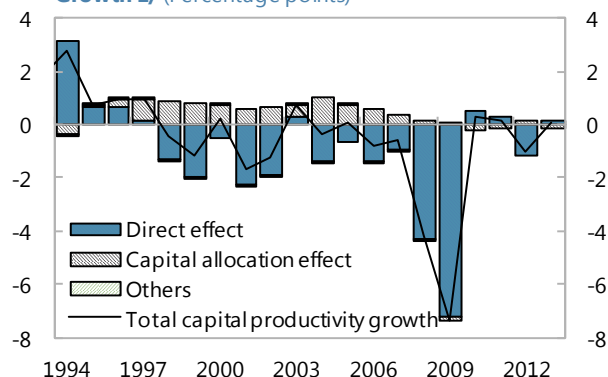
Sources: ONS; Haver Analytics; and IMF staff calculations.
1/ Data for 2010 and beyond are estimated with
investment figures.

C. Diagnostic: Explaining Business Investment Performance in the UK

9. **Weak demand prospects, financial market frictions, and heightened uncertainty
largely explain the UK business investment trend of the past few years.** Using firm-level panel
data on listed non-financial firms, investment models are estimated (Appendix I).[4]

Main regression results (Appendix Table 1 Model 1)

10. **Demand for investment is considered to be positively associated with sales levels and
profitability and negatively with the cost of capital.**

- A firm's specific demand is captured by its Sales Gap (defined as a firm's de-trended sales). The
  coefficient on this variable is positive and statistically significant, validating the narrative of
  recent investment developments: in the aftermath of the global financial crisis, firms faced a

[3] This mirrors the weakening of labor productivity since the beginning of the crisis.

[4] The data are from the Worldscope database, including about 5,000 firms, for the period of 1997–2012 (annual
frequency). The dataset includes all non-financial industry, except oil and gas extractions, public administration, and
defense.

large negative demand shock and cut back investment, whereas more recently, however, prospects for final demand have risen, and so have firms' intentions to invest. Furthermore, as expected, the coefficient on firms' profitability (Return on Assets) is positive and statistically significant.

Figure 8. UK: Cost of Debt and Policy Rate
(Median, percent, interest divided by total debt)
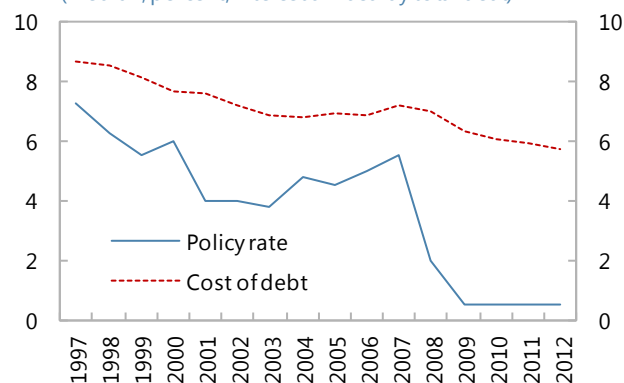
Sources: Datastream; and IMF staff calculations.

- The coefficient on Cost of Debt (a proxy variable for the cost of capital) is negative and statistically significant, providing evidence that higher borrowing costs are negatively associated with firms' desired stock of capital. To support demand, the policy interest rate was reduced to near the zero-lower bound. However, borrowers' risk premium rose, and the cost of debt did not fall as much.[5]

11.   **The state of a firm's balance sheet would also matter for investment, particularly as financial market imperfections prevail.**

- As the cost of financing increases with asymmetric information, a firm would prefer internal financing first, then debt, and lastly equity financing (Pecking Order Theory). Indeed, UK firms rely on internal funds for at least 60 percent of business investment, and the reliance on internal funds has apparently increased since the onset of the crisis (McCafferty, 2014). Consistent with the theory and stylized facts, the empirical results suggest that a firm's retained earnings (Retained Earnings) are positively associated with investment.

- This said, external financing remains important. The coefficient on Long-Term Debt is positive and statistically significant, suggesting that UK firms would invest more if they had more access to external finance.

- A firm's profit distribution policy could also affect investment. The coefficient on Cash Dividend Payments (as a share of operating profits) is negative and statistically significant, suggesting that a firm's owners might discount future profits excessively and prioritize near-term outcomes over longer term investment opportunities (short-termism).[6]

12.   **Many investment projects can be considered as irreversible.** As *Policy Uncertainty* rose, firms might have postponed investment projects, as these are long-term and largely irreversible in nature. The empirical results support this hypothesis, with the coefficient on the *Policy Uncertainty* variable negative and significant. Given that this recession was particularly deep and prolonged, the

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[5] See IMF, 2013, "United Kingdom: Staff Report for the 2013 Article IV Consultation, Annex 4, The Monetary Policy Transmission Mechanism, Credit and Recovery" for discussions about the evidence of credit supply problems.

[6] Haldane and Davies (2011) argues that short-termism had adverse effects on investment even before the crisis.

policy uncertainty channel appears to have played a substantial role in weakening investment (Baker, Bloom, and Davis, 2013).[7]

Is there any evidence of weakened efficiency in the capital allocation mechanisms?

13.   **If resource allocation mechanisms are efficient, firms with higher profitability would attract more capital**, as evidenced by the positive coefficients on profitability variables in Model 1. To examine a possible structural shift leading to a disruption in the capital allocation mechanism, pre-crisis dummy variables (1 for observations up to 2007, and zero thereafter) are included and interacted with the profitability and constant terms (Model 2).

14.   **Evidence is found that the efficiency of capital allocation has weakened.[8]** The coefficient on the profitability variable interacting with the pre-crisis dummy is positive (0.058) and significant. This suggests that business investment was more sensitive to profitability in the pre-crisis periods than in the post-crisis periods—evidence that the allocation of capital was more efficient before the crisis. Furthermore, the long-run elasticity of investment to profitability fell from 0.17 in the pre-crisis period to 0.08 in the post-crisis period.[9]

Is investment recovery important for external rebalancing?

15.   **There is evidence that exporters tend to invest more than domestically oriented firms do, all else equal.** The exporter dummy variable is significant and positive, suggesting that demand for investment in the export sector is higher on average (Model 3). This also indicates that stronger investment could be associated with stronger exports.

16.   **Moreover, exporters are more sensitive to productivity, while non-exporters care more about domestic policy settings.**

Figure 9. Volatility of External and Domestic Demand
(5-year rolling standard deviation of GDP growth, in percent)
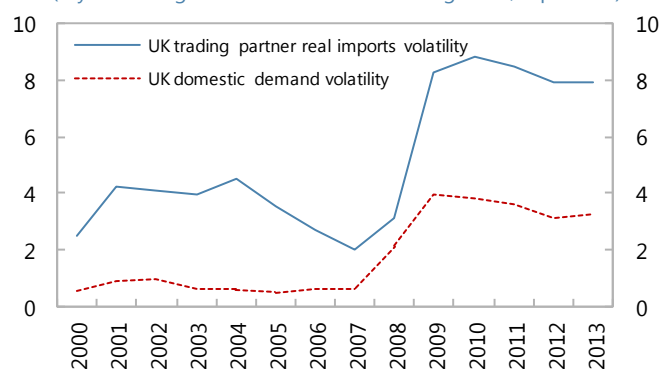
Sources: Office for National Statistics; and Haver Analytics.

- For average exporters, the coefficient on Return on Assets is higher than that for non-exporters, which may reflect their greater exposures to competitive global markets (Models 4 and 6).

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[7] The increase in "policy uncertainty" does not necessarily mean that policymakers exogenously introduced greater policy uncertainty. Instead, this likely reflects difficult policy environment: following the collapse of the great moderation, a broad consensus emerged about the needs to review the pre-crisis policy framework, but with less clarity about how exactly the policy framework should be modified.

[8] Our finding is largely consistent with Barnett, Broadbent, Franklin, and Miller (2014).

[9] The long-run elasticity is calculated as "coefficient on lagged return on assets" divided by "1 minus coefficient on lagged investment to capital."

Furthermore, the coefficient on Sales gap for exporters is smaller than for non-exporters—thus exporters are more cautious in increasing capital stock given particular demand than non-exporters—, which likely reflects the fact that external demand has been more volatile than domestic demand (and increasingly so in recent years). Alongside, the regression results indicate that long-term debt for average exporters is positive and significant. All these results suggest that exporters are constrained more by demand prospects and less by financing.

- For non-exporters, investment is more sensitive to the interest rate and policy uncertainty, as coefficients on Effective Interest Rate and Policy Uncertainty are negative and relatively large.

- Resource allocation efficiency problem appears to be more evident for exporters: the coefficient on the profitability variable interacting with the pre-crisis dummy is positive and significant (Model 5), suggesting that investment in the export sector has become less sensitive to profitability since the great recession. For non-exporters, such evidence is weaker, as the coefficient of the interaction term is not statistically significant (Model 7).

Are investment determinants in the UK different from those in other advanced economies?

17.   **While investment determinants for firms in the U.S., France, and Germany are broadly similar to those in the UK, some differences are noticeable (Appendix Table 2).** In particular:

- There is no clear evidence of capital allocation mechanisms becoming less efficient since the crisis in the other three countries. The coefficients on return on assets interacting with the pre-crisis dummy variable are negative and insignificant for the U.S., France, and Germany.

- For French firms, the coefficient on the demand variable interacting with the pre-crisis dummy is negative and significant, suggesting that French firms have become more cautious in investment following the crisis, similar to UK firms.[10]

- To analyze similarities among these countries, an investment model is estimated by pooling data for all countries and adding country dummy variables (Model 12). The results suggest similarities between UK and US firms, as the size of the coefficient on the UK dummy is much smaller than that on Germany and France dummies.

D.   Discussion

Regression results anticipate a pick-up in business investment in the near-term

18.   **The regression results indicate that the undergoing recovery in business investment reflects improvements in investment determinants.** UK firms have been increasingly confident about turnover, and Bloom's policy uncertainty index—which rose sharply at the onset of the crisis and stayed high thereafter—has fallen significantly in recent months, while firms' profitability has returned to its pre-crisis level. These recent indicators suggest that an upturn in business investment would be durable.

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[10] For UK firms, the coefficient is negative (0.445) and significant (Model 3), suggesting that business investment was more sensitive to demand prospects in pre-crisis periods than in post-crisis periods.

Figure 10. BCC Survey: Turnover Confidence: Next 12 Months
(Balance in percent)
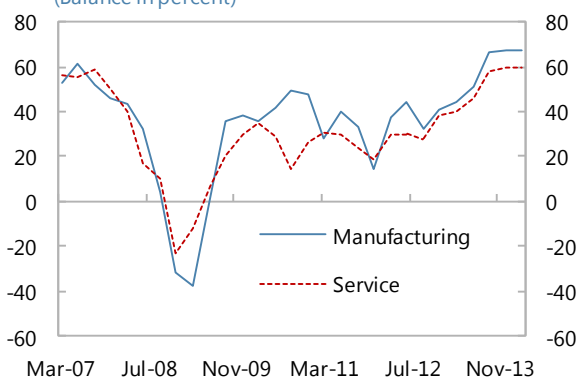
Figure 11. UK: Bloom's Policy Uncertainty
(Index)

Source: Haver Analytics.
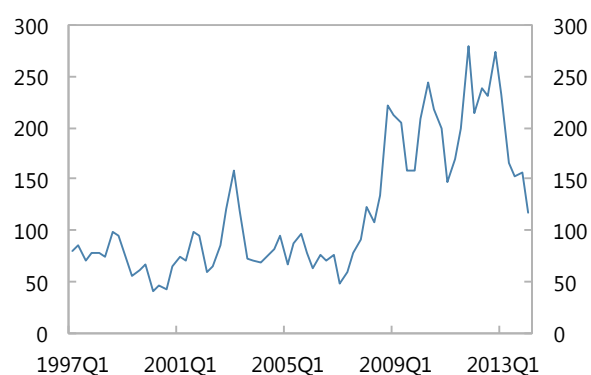
Source: Economic Policy Uncertainty website,
http://www.policyuncertainty.com/europe_monthly.html

But capital allocation mechanisms continue to be weak

19.   **There is no clear consensus on why the efficiency of capital allocation mechanisms remains weak.** One possible explanation is a weakness in financial intermediation. The banking system in the UK was hit hard by the global financial crisis. To a variable extent, firms rely on bank financing to expand, renovate, and restructure their business models to bolster their activity and productivity. Hence, banking sector weaknesses could affect firm productivity because firms would face higher interest rates or difficulty in securing bank financing. In fact, although real lending rates for large firms have dropped to around zero percent, those for smaller firms—some of them may be facing the problem of lack of sufficient collateral or good credit records— have remained at relatively elevated levels.

Figure 12. UK: Real Lending Rates by Size of Loans
(Percent, new fixed rate loans, deflated by CPI inflation)
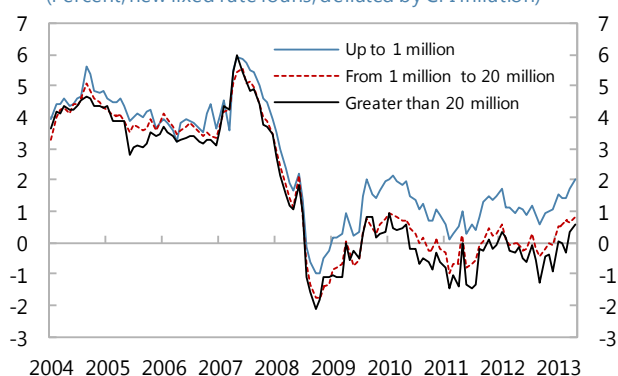
Source: Haver Analytics.

20.   **There is also evidence that banks are less active in allocating credit across business sectors, thus hindering the efficient allocation of capital.** A simple measure of sector credit shift is calculated as the dispersion of growth rate of bank loans across sectors (Text Figure). The degree of credit shifts can be considered to reflect either the size of sectoral shocks or the efficiency of financial intermediation. As seen in the figure, the size of sectoral credit shifts has decreased since the great recession, which, together with stagnant growth in aggregate loans, would evidence weakened financial intermediation channels.

Figure 13. UK: Sectoral Credit Shift Indicator

$$Indicator = \left[\sum_{i=1}^{N} \frac{l_{it}}{L_t} \left(\Delta l_{it} - \Delta L_t \right)^2 \right]^{1/2}$$
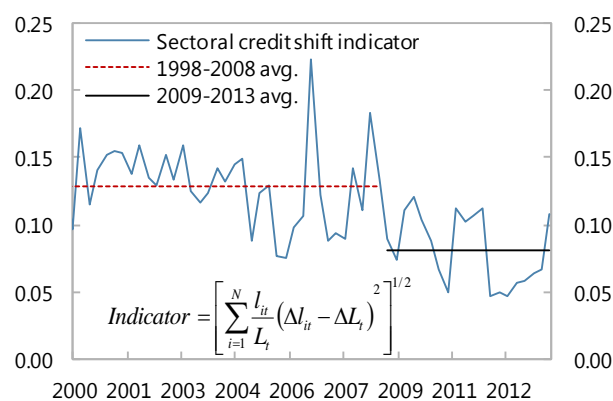
Sources: Haver Analytics; and IMF staff calculations.

E. Concluding Remarks and Policy Recommendations

21.   **The empirical results suggest that the current pick-up in business investment is likely to be sustained.** Facing a large negative demand shock in the aftermath of the global financial crisis, firms held back investment. Firms' profitability also dropped sharply, further dampening their incentives to invest. To support demand, the policy interest rate has been reduced to the zero-lower bound, but the cost of capital has not fallen as much, as the risk premium for firms' borrowing rose. Furthermore, policy uncertainty rose, particularly severely this time due to the depth and scale of the recession following the crisis. However, more recently, key investment determinants—including demand prospects, firms' profitability, and policy uncertainty indicators—are improving, hence supporting a recovery in business investment.

22.   **For sustainable and solid growth, business investment is critical, but is not enough by itself.** If business investment continues to grow, this would help rebalance the economy away from consumption, but also strengthen the productive capacity of the economy. Notwithstanding these positive developments, restoring the allocational efficiency of capital is essential for productivity recovery.

23.   **A challenge is to formulate appropriate policy prescription.** Over the past few years, the government has rightly taken various measures to stimulate investment and enhance long-run growth potential, including boosting capital expenditures, expanding financial incentives to stimulate private investment, establishing new institutions (such as Business Bank), and strengthening the banking system. But more could be done.

- First, efforts should continue to improve financial intermediation, especially aimed at ensuring adequate access to finance for business innovation and restructuring.

- Second, infrastructure should continue to be improved, especially in the areas of transport, energy, and housing.

- Third, as recommended by LSE Growth Commission (2013), corporate governance structure could be reviewed to address "short-termism" and encourage firms to invest more.

- Finally, policies should continue to support human capital development, including through enhancing vocational training and apprenticeship programs to help bolster productivity. In this regard, the UK should not halt efforts to attract foreign talents.

References

Arellano, M. and S. Bond, 1991, "Some Test of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies, vol. 58*, pp. 277–297

Arellano, M. and O. Bover, 1995, "Another Look at the Instrumental-Variable Estimation of Error-Components Models", *Journal of Econometrics*, vol. 69, pp. 29–52

Baker, S.R., N. Bloom, and S. J. Davis, 2013, "Measuring Economic Policy Uncertainty," unpublished working paper, Stanford University and University of Chicago.

Barnett, Alina, B. Broadbent, A. Chiu, J. Franklin, and H. Miller, 2014, "Impaired Capital Reallocation and Productivity," *Journal of the National Economic Institute and Social Research*, May 2014; 228 (1), pp. R35-R48.

Blundell, R.W. and S. Bond, 1998, "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics*, vol. 87, 115–143.

Broadbent, Ben, 2014, "The Balance of Growth," speech at The London School of Economics, London, on January 17, 2014

Haldane, Andrew G. and R. Davies, 2011, "The Short Long," speech at 29th Société Universitaire Européene de Recherches Financières Colloquium: New Paradigms in Money and Finance?, Brussels, in May 2011

International Monetary Fund, 2013, "United Kingdom: Staff Report for the 2013 Article IV Consultation, Annex 1, The Productivity Puzzle in the UK."

LSE Growth Commission, 2013, "Investing for Prosperity," LSE Center for Economic Performance

McCafferty, Ian, 2014, "Achieving a sustainable recovery: where next for business investment?" speech at The Nottingham Business School on January 22, 2014.

Appendix 1. Regression Model Specification and Data

Using an annual firm-level panel dataset of listed non-financial companies, the following investment model is estimated.

$$\left(\frac{I_{it}}{K_{i,t-1}}\right) = \alpha_0 + \alpha_1\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \beta_1 \sum_{j=0}^{1} D_{i,t-j} + \beta_Z \sum_{j=0}^{1} Z_{i,t-j} + d_t + \eta_i + v_{it}$$

where i denotes a company, I_{it} is fixed investment, K_{it} fixed capital stock, d_t time fixed effect, η_i firm fixed effect, and v_{it} idiosyncratic shock. D_{it} is a vector of determinants of investment, including annual sales gap (reflecting demand prospects relative to historical averages), return on assets (reflecting profitability), the effective interest rate on debt (reflecting cost of borrowing), and Bloom's policy uncertainty index (reflecting uncertainty). Z_{it} is a vector of additional variables, including retained earnings and long-term debt (reflecting financial constraints); and cash dividend payments (reflecting allocation of internal funds).

In addition to the variables mentioned above, a lagged dependent variable is included to incorporate the dynamic effects of the capital stock. The dynamic effects capture the high persistence of investment on past realizations.

The sample dataset is unbalanced. The estimation method consists of the GMM-System estimator proposed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). The use of the GMM-System estimator is warranted as it addresses potential endogeneity problems and measurement errors in autoregressive models with high persistence in the data. The lagged levels of the explanatory variables are used as instruments.

The period covered in the regression analysis is from 1997 to 2012. All nonfinancial firms are included, except for firms in the oil and gas sector and public administration and defense sector. Firms with data outside of 1–99 percent of sample distributions are excluded as outliers.

Variable definitions

The data are from the Worldscope database (except for the uncertainty variable).

Variable	Definition	World scope codes
Investment to capital (logarithm)	Capital expenditures as the ratio of lagged net capital stock (property, plant, and equipment)	WC04601/WC02501
Sales gap	Net sales or revenues minus a firm's historical mean.	WC01001
Retained earnings to capital (logarithm)	Retained earnings as the ratio of lagged net capital stock	WC03495/WC02501
Cash dividends payments (logarithm)	Cash dividends paid as the ratio of operating income	WC04551/WC01250
Long-term debt (logarithm)	Long-term debt as the ratio of lagged net capital stock	WC03251/WC02501
Effective interest rate (logarithm)	Interest expense as the ratio of total debt	WC01251/WC03255
Return on assets (logarithm)	Return on assets	WC08326
Exporter dummy	Firms with foreign Sales for at least three consecutive years	WC08731
Uncertainty (logarithm)	Bloom's policy uncertainty measure	http://www.policyuncertainty.com/europe_monthly.html

Appendix Table 1. UK: Determinants of Business Investment 1/

	All Firms			Type of firms			
				Exporters		Domestic	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Lagged investment to capital	0.331***	0.333***	0.331***	0.358***	0.360***	0.323***	0.323***
	(0.044)	(0.043)	(0.043)	(0.058)	(0.058)	(0.067)	(0.067)
Sales gap (difference from historical linear trends)	0.416***	0.415***	0.772***	0.448***	0.446***	0.543***	0.543***
	(0.076)	(0.076)	(0.169)	(0.081)	(0.081)	(0.137)	(0.137)
Lagged return on assets	0.092***	0.091***	0.054*	0.092***	0.045	0.087**	0.066
	(0.017)	(0.017)	(0.031)	(0.018)	(0.032)	(0.041)	(0.098)
Effective interest rate	-0.072***	-0.072***	-0.073***	-0.007	-0.008	-0.158***	-0.159***
	(0.020)	(0.020)	(0.020)	(0.023)	(0.023)	(0.044)	(0.044)
Retained earnings to capital	0.211***	0.208***	0.210***	0.180***	0.179***	0.219***	0.219***
	(0.016)	(0.016)	(0.016)	(0.015)	(0.015)	(0.029)	(0.029)
Long-term debt to capital	0.038***	0.037***	0.039***	0.050***	0.050***	0.000	0.000
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.018)	(0.018)
Cash dividends payment to total profit	-0.062***	-0.063***	-0.060**	-0.021	-0.021	-0.141***	-0.141***
	(0.024)	(0.024)	(0.024)	(0.025)	(0.024)	(0.048)	(0.048)
Bloom's policy uncertainty 2/	-0.106***	-0.120***	...	-0.090**	...	-0.251**	-0.387
	(0.036)	(0.037)		(0.036)		(0.119)	(0.292)
Pre-crisis period dummy			0.219**				
			(0.111)				
Lagged return on assets x pre-crisis period dummy			0.058*		0.070**		0.0284
			(0.033)		(0.033)		(0.101)
Sales gap x pre-crisis period dummy			-0.445**				
			(0.185)				
Exporter dummy		0.122***					
		(0.035)					
Small firm dummy		-0.032					
		(0.236)					
Constant	-0.664***	-0.679***	-1.461***	-0.418***	-1.148***	-0.41	0.039
	(0.165)	(0.166)	(0.137)	(0.158)	(0.134)	(0.495)	(1.248)
Number of instruments	61	63	63	61	62	61	62
AR(2) test p-value	0.246	0.251	0.295	0.401	0.406	0.232	0.231
Hansen test p-value	0.221	0.197	0.200	0.525	0.512	0.701	0.699
Number of observations	5,216	5,216	5,216	2,967	2,967	1,821	1,821
Number of firms	1,038	1,038	1,038	608	608	487	487

1/ System GMM specifications, with lagged values of repressors used as instruments. Robust standard errors in parentheses, with ***, **, * indicating significance level at 1 percent, 5 percent and 10 percent level respectively.

2/ ... indicates that variable is dropped due to collinearity.

Appendix Table 2. Selected Advanced Countries: Determinants of Business Investment 1/

	UK Model 8	US Model 9	Germany Model 10	France Model 11	All countries Model 12
Lagged investment to capital	0.331***	0.370***	0.252***	0.303***	0.335***
	(0.043)	(0.028)	(0.083)	(0.071)	(0.029)
Sales gap (difference from historical linear trends)	0.772***	0.366***	0.311	0.706***	0.482***
	(0.169)	(0.086)	(0.356)	(0.186)	(0.075)
Lagged return on assets	0.054*	0.155***	0.108***	0.0335	0.127***
	(0.031)	(0.018)	(0.040)	(0.036)	(0.015)
Effective interest rate	-0.073***	-0.0272*	0.04	0.007	-0.015
	(0.020)	(0.015)	(0.031)	(0.027)	(0.010)
Retained earnings to capital	0.210***	0.0842***	0.268***	0.202***	0.164***
	(0.016)	(0.008)	(0.038)	(0.018)	(0.008)
Long-term debt to capital	0.039***	0.034***	0.108***	0.143***	0.062***
	(0.009)	(0.008)	(0.024)	(0.019)	(0.007)
Cash dividends payment to total profit	-0.060**	-0.032***	0.005	0.024	-0.025***
	(0.024)	(0.008)	(0.018)	(0.019)	(0.008)
Bloom's policy uncertainty 2/	...	...	...	-0.393***	-0.0592
				(0.141)	(0.038)
Lagged return on assets x pre-crisis period dummy	0.058*	-0.009	-0.059	-0.02	0.011
	(0.033)	(0.019)	(0.066)	(0.040)	(0.016)
Sales gap x pre-crisis period dummy	-0.445**	0.194*	0.429	-0.469**	-0.019
	(0.185)	(0.104)	(0.498)	(0.216)	(0.096)
Pre-crisis period dummy	0.219**	...	...	...	...
	(0.111)				
UK dummy					0.048**
					(0.020)
Germany dummy					0.235***
					(0.028)
France dummy					0.504***
					(0.028)
Lagged return of assets x UK dummy x pre-crisis period dummy					
Constant	-1.461***	-0.905***	-0.902***	1.268**	-0.735***
	(0.137)	(0.082)	(0.219)	(0.615)	(0.203)
Number of instruments	63	63	63	63	67
AR(2) test p-value	0.295	0.682	0.857	0.488	0.793
Hansen test p-value	0.200	0.011	0.422	0.020	0.027
Number of observations	5,216	10,034	2,507	3,617	21,374
Number of firms	1,038	1,359	476	617	3,490

1/ System GMM specifications, with lagged values of repressors used as instruments. Robust standard errors in parentheses, with ***, **, * indicating significance level at 1 percent, 5 percent and 10 percent level respectively.
2/ ... indicates that variable is dropped due to collinearity.

MACROPRUDENTIAL POLICY: LESSONS FROM ADVANCED ECONOMIES[1]

The UK is experiencing a rapid increase in house prices, particularly in London, and greater numbers of new mortgages with high loan-to-income ratios could represent risks to financial stability. Macroprudential policy is the first line of defense against those risks. Empirical evidence from a sample of advanced economies suggests that caps on debt-to-income (DTI) and on loan-to-value (LTV) ratios are potent tools to dampen mortgage credit growth and to mitigate financial stability risks. The effectiveness of these tools is enhanced when they are used simultaneously with additional macroprudential measures. In addition, countries tend to implement macroprudential policies gradually, possibly as a result of the uncertainty of the transmission mechanism of those policies.

A. Macroprudential Policy and Financial Stability Risks

1. **High loan-to-income mortgages are rising in the UK, resulting in an increase in financial stability risks.** Although mortgage lending is growing at a slow pace and financial risks have not materialized yet, the loan-to-income ratio of first-time buyers and of those households living in London have been increasing in the last 12 months. If this trend continues, banks' and households' balance sheets will become more vulnerable to income, interest rate, and house price shocks.

Figure 1. Loan-to-Income Ratio

A. Loan-to-Income Ratio: UK and London (Percent of gross disposable income)

B. Loan-to-Income Ratio: First-time Buyers and Movers (Percent of gross disposable income)
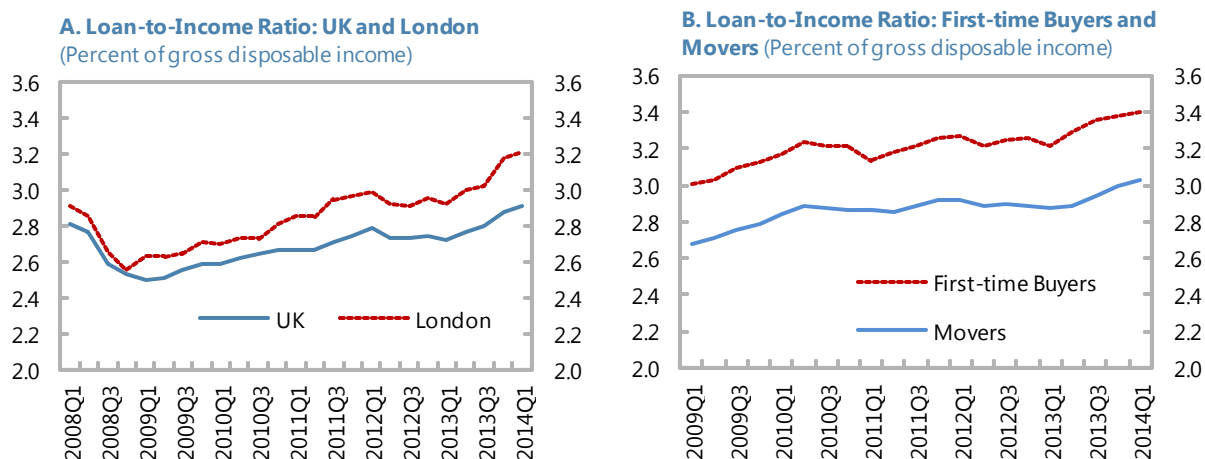
Sources: Haver Analytics; ONS; RICS; and IMF Staff Calculations.

2. **Macroprudential policy is the best tool for addressing financial stability risks associated with the housing market.** By introducing financial regulations, such as caps on loan-to-value (LTV) and debt-to-income (DTI) ratios of mortgage loans, macroprudential policies can mitigate systemic risks in the financial system. By adopting macroprudential policies, government

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[1] Prepared by Ruy Lama (EUR) and Mohamed Norat (MCM).

authorities not only are able to reduce the supply of mortgages and dampen credit growth, but can also reduce the leverage ratio of marginal borrowers and improve the resilience of the financial system to negative shocks.

3.   **Macroprudential policies are becoming more common among advanced economies.** Macroprudential policies are being used intensively in advanced economies, in particular since 2004.[2] Caps on LTV/DTI ratios are the most common macroprudential measures used to address financial stability risks. Other measures, such as changes in the property taxes and risk weights (RW) of banks assets, have also gained popularity but are used less intensively than caps on LTV/DTI ratios (See Figure 2 and Appendix 2).

Figure 2. Number of Macroprudential Policy Measures in Advanced Economies.
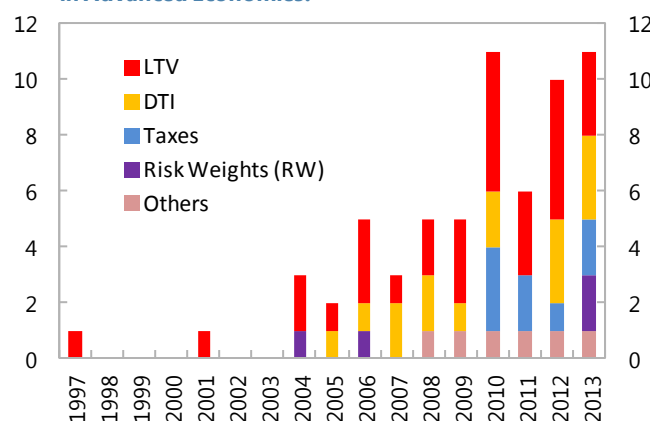
Sources: BIS; and IMF staff estimates.

4.   **This note analyzes the recent experience of macroprudential policies in advanced economies and draws some policy lessons for the UK.** Using the macroprudential policy actions database from the BIS (2013), we analyze quantitatively and qualitatively the implementation of macroprudential policies in advanced economies.[3] There are three main results: (i) the use of caps on the DTI ratio is the most effective tool to reduce mortgage credit growth and contain financial stability risks;[4] (ii) the impact of macroprudential measures is maximized when several instruments are used simultaneously; and (iii) macroprudential measures are typically implemented in a gradual fashion, possibly as a result of implementation lags and uncertainty about the transmission mechanism of these policies. These results suggest that the recent cap on high loan-to-income ratio mortgages recommended by the Financial Policy Committee (FPC) is appropriate for addressing financial risks.[5] Going forward, it is likely that the factors that lead to a gradual implementation of macroprudential policy measures in other advanced economies also hold in the UK. A gradual approach would call for an early adoption of macroprudential policies, so UK authorities would have the flexibility to properly calibrate these policies over the cycle.

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[2] We analyze a sample of 7 advanced economies: Australia, Canada, Hong Kong, Korea, New Zealand, Singapore, and Sweden. Many of these countries have important financial centers and their experience with macroprudential policies can provide valuable lessons for the UK.

[3] The classification of macroprudential policy measures follows the work of Shim et al. (2013) and Krznar and Morsink (2014).

[4] Caps on LTV ratios also have an important impact on credit growth, but they are not as effective as caps on DTI.

[5] See Bank of England's Financial Stability Report (2014).

B.   International Evidence on the Effectiveness of Macroprudential Policies

The Effectiveness of Macroprudential Policy in Advanced Economies

5.   **The effectiveness of macroprudential policy tools is quantified through an event study analysis.** We quantify the impact of macroprudential policies as the difference between: (i) the growth rate of mortgage credit and house prices 6 months after the introduction of a macroprudential measure; and (ii) the growth rate of the same variables 6 months before the measure. The difference in growth rates quantifies the slowdown (or acceleration) in credit and house prices after the implementation of macroprudential policies. The empirical evidence shows that macroprudential policies have quantitatively important effects on mortgage credit and house prices.[6]

6.   **Macroprudential policies, in particular caps on DTI ratios, are highly effective in containing financial risks stemming from the housing market.** The empirical evidence from a sample of advanced economies shows that credit and house price growth rates decline after a tightening of macroprudential policies (Figure 3). The most effective instrument to contain credit growth is a cap on DTI ratio, which reduces nominal mortgage credit growth by 1.4 percent and house price inflation by 1.8 percent. A cap on the LTV ratio is also effective, since it reduces credit growth by 0.8 percent and house price inflation by 1.9 percent. The most effective tool for reducing house price inflation is tax policy, an instrument widely used in Asian economies. On average, house price inflation is reduced by almost 4 percent after the implementation of tax measures. Other measures such as changes in risk weights and provisioning have a limited impact on mortgage credit and house prices.

Figure 3. Impact of Macroprudential Tools on Mortgage Credit and House Prices

A. Reduction in Mortgage Credit Growth in Response to Macroprudential Measures (Percentage change)

B. Reduction in House Price Inflation in Response to Macroprudential Measures (Percentage change)
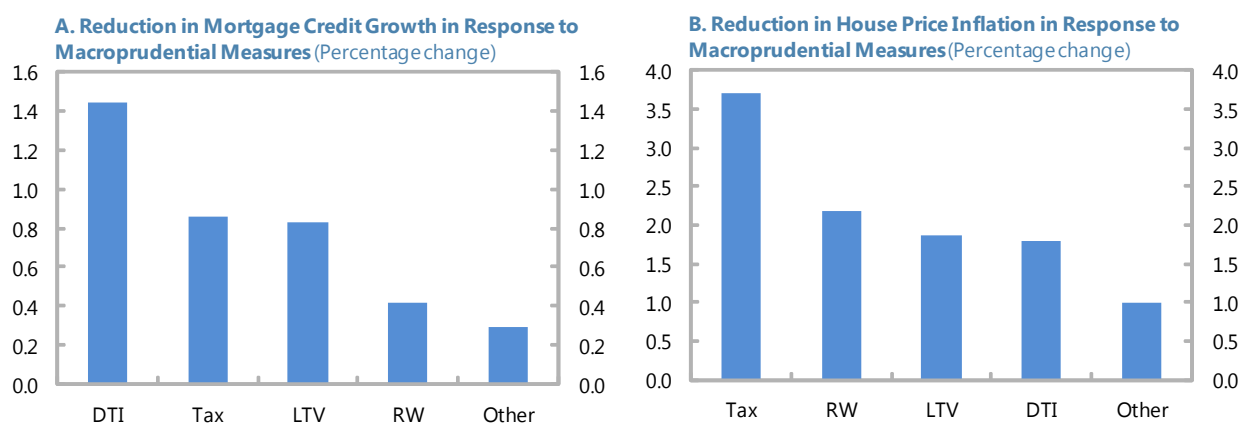
Source: IMF staff estimates.

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[6] Data on house prices and mortgage credit was obtained from Haver Analytics for the 1997–2013 period.

7.   **The effect of macroprudential policy is maximized when several instruments are used simultaneously.** In the sample of advanced economies macroprudential policies are typically implemented in a gradual fashion. Furthermore, over time as macroprudential policies are widely tested, authorities tend to use several macroprudential tools simultaneously.[7] The empirical evidence shows that macroprudential policy is much more powerful when several instruments are used at the same time (Figure 4). While, on average, a single instrument can reduce mortgage credit growth by 0.4 percentage points, the combined effect is 5 times more powerful, and several instruments combined are capable of reducing mortgage credit growth by 2 percentage points. For instance Hong Kong used four different macroprudential tools in the first quarter of 2013, resulting in a reduction in house price inflation and credit growth of 11 and 3 percent, respectively.

Figure 4. Impact of Individual and Combined Macroprudential Policies

A. Reduction in Mortgage Credit Growth in Response to Macroprudential Measures (Percentage Change)

B. Reduction in House Price Inflation in Response to Macroprudential Measures (Percentage Change)
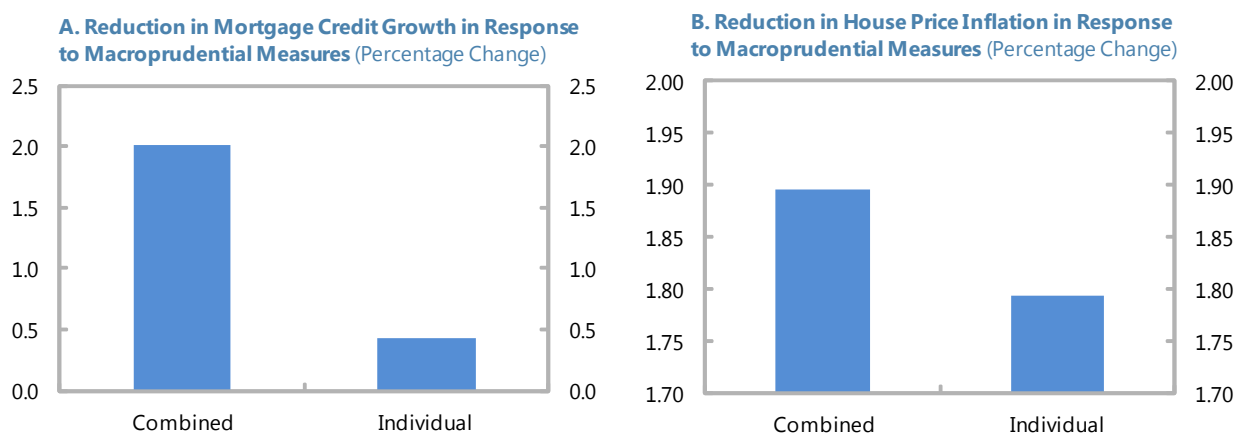
Source: IMF staff estimates.

8.   **Other studies also find similar effects of macroprudential tools in dampening credit growth and house price inflation.** Kuttner and Shim (2013) find that caps on the DTI have the maximum effect on containing credit growth, while tax measures are effective at reducing house price inflation. Krznar and Morsink (2014) find that in Canada a cap on the LTV ratio is a powerful tool for reducing mortgage credit growth. In addition, in a cross-country econometric estimation, they find that changes in risk weights and caps on DTI ratios are effective at containing credit growth. In Asia, there is evidence that caps on LTV ratios and taxes on housing transactions have a strong impact on credit growth, house price inflation, and bank leverage (REO, 2014).

B. Case Studies of Macroprudential Policies in Advanced Economies.

9.   **We analyze the implementation of macroprudential policies in Korea, Canada, and New Zealand.** From each case study we draw some lessons for the UK: (i) macroprudential policies are effective at containing regional housing booms; (ii) macroprudential policy measures are

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[7] Most of the simultaneous macroprudential measures were adopted after 2008. Before 2008, countries had a tendency to implement individual macroprudential measures.

implemented gradually; and (iii) the macroprudential policy toolkit should include instruments that target directly mortgage credit flows (i.e., caps on LTV and DTI ratios that directly affect the supply of mortgage credit). Next, we analyze in detail the experiences in Korea, Canada, and New Zealand.

Korea: The role of regional macroprudential policies

10.   **Korea experienced pronounced housing cycles in the early 2000s.** In the aftermath of the Asian crisis Korea experienced two major housing cycles. The first one in the 2001–05 period, and the second one during 2005–13. By 2002 house prices were growing at 18 percent in the country, and 32 percent in the prestigious Gangnam districts. Moreover, household credit was growing at an annual rate of 36 percent.

11.   **In response to high house price inflation in specific markets, government authorities introduced regional macroprudential measures in 2003.** In response to house price inflation in the prime areas in Seoul, the government adopted macroprudential policies tailored specifically to "speculative zones". A geographical area was designed a speculative zone, if the following criteria were satisfied:

- Monthly nominal house price index increase of 30 percent more than the CPI inflation rate during the previous month.

- Either (i) The average house price inflation in the previous two months increase 30 percent more than the national house price inflation in the previous two months; or (ii) the average monthly house price inflation over the previous year was higher than the average monthly national house price inflation over the previous three years.

12.   **Empirical evidence suggests that regional macroprudential policies were effective, but it required frequent adjustments.** In May 2003 the authorities reduced the LTV threshold on mortgage loans with a maturity of less than three years from 60 to 50 percent. In October 2003 the LTV restrictions on mortgage loans with a maturity shorter than 10 years and properties located in speculative zones were reduced even further to 40 percent . After this measure was adopted, real house prices declined by 5 percent. In June 2005, once the house prices started increasing again, the government reduced the LTV to 40 percent on properties priced above 600 million won. Moreover, in August 2005 the government increased the capital gains tax for homeowner with three or more properties in the speculative zones. Data on house prices and mortgage credit indicate that these policies were effective at stabilizing the housing and mortgage market (Chang, 2010 and Miller, 2013). Furthermore, the policy was effective at curbing expectations on house price increases and discouraging speculative incentives (Igan and Kang, 2011).

Canada: The role of mortgage insurance and gradual implementation of macroprudential policies

13.   **Canada's housing boom was a major risk to financial stability.** House prices, residential mortgage credit, and consumer credit (including Home Equity Lines of Credit or HELOCs) all grew rapidly in the 2000s. Most indicators of house price valuation, such as the house price to income ratio and the house prices to rent ratio, increased sharply (IMF, 2014). Household debt as a share of disposable income rose from about 110 percent in 2000 to 165 percent in 2013. Mortgages and consumer loans secured by real estate (mostly HELOCs) are estimated to account for 80 percent of household debt and to represent the single largest exposure for Canadian banks (about 35 percent of their assets).

14.   **The Canadian authorities have exceptional power to affect housing finance through government-backed mortgage insurance.** Specifically, the combination of the requirement that most lenders have insurance for high loan-to-value (LTV) mortgage loans and the central role of the government in providing such insurance gives the government great power to influence housing finance. In other words, the rules governing mortgage insurance are de facto important macroprudential tools. In addition, the authorities can also influence credit and house price growth through microprudential measures, such as prudential guidelines on mortgage lending, and structural measures, such as the oversight of the government-owned Canadian Mortgage and Housing Corporation (CMHC).

15.   **The tightening of mortgage insurance in Canada along with other macroprudential tools was most effective after several rounds of combined measures.** Krznar and Morsink (2014) find that the initial macroprudential measures were not effective in limiting mortgage credit growth. However, after the implementation of three further rounds of mortgage insurance tightening (2010, 2011 and 2012) and successive increases in LTV and DTI caps, there was a slowdown in mortgage credit and house price growth.

New Zealand: The need of a comprehensive macroprudential toolkit

16.   **New Zealand adopted a macroprudential policy framework in 2013 to address systemic financial risks.** New Zealand has a history of boom and bust cycles in the housing market. In the pre-crisis period, house prices were growing at double digits. By the end of 2012, house prices in New Zealand were growing at an annual rate of 7 percent while mortgage credit was expanding at 4 percent per year. The rate of mortgage credit growth appeared to be low compared to previous housing booms as a result of high debt repayments. However, new mortgage loans were growing in excess of 30 percent, similar to pre-crisis rates. In this context the Reserve Bank adopted a new macroprudential policy framework in May 2013 to deal with financial vulnerabilities arising in the housing market.

17.   **The macroprudential toolkit of the Reserve Bank of New Zealand included four instruments.** The instruments were: (i) countercyclical capital buffer (CCB); (ii) sectoral capital requirements (SCR); (iii) adjustments to the minimum core funding ratio (CFR); and (iv) restrictions

on high LTVs. The first two instruments are designed to build capital buffers against negative shocks. The third instrument builds resilience in the financial system against liquidity shocks by ensuring a stable source of funding. Only the fourth instrument, a cap on LTVs, has a more direct effect of reducing the risk of mortgage loans and the supply of credit.

18.   **In October 2013 the Reserve Bank imposed caps on the proportion of new loans with high LTV ratios.** The Bank limited the share of high LTV loans (80 percent or higher) to 10 percent of the new mortgage lending.[8] As opposed to outright LTV caps, a partial limit on LTV loans provides banks with some flexibility to manage the risk of their mortgage portfolio. In order to reduce incentives for regulatory arbitrage, the measure was announced to be temporary, and there was a commitment to remove the cap once the housing market stabilized.[9]

19.   **The cap on high LTV loans was effective at containing financial risks.** As a result of implementing the cap on loan-to-value ratios, the share of high LTV loans declined from 25 percent of new mortgage lending in September 2013, to 5.6 percent at the end of March 2014. In addition, national house sales dropped by 23 percent between September 2013 and March 2014 across regions (RBNZ, 2014). Although the policy achieved the objective of reducing the risk exposure of banks, constant monitoring is required to prevent regulatory arbitrage. An assessment on the impact of this macroprudential policy is published twice a year in the Financial Stability Report.

C.   Policy Implications for the UK

20.   **The experience of macroprudential policies in other advanced economies provide three important policy lessons which could have implications for the UK:**

- **Macroprudential policies have been implemented gradually.** The experience from Canada and other advanced economies shows that macroprudential policies are implemented in a gradual fashion. Since there is uncertainty about the transmission mechanism and possibly some implementation lags, macroprudential policy measures are enacted in several rounds. Under a gradual approach, the authorities have time to assess the impact of macroprudential measures and, if necessary, they can recalibrate the policies accordingly. Large and discrete changes of macroprudential policy could disrupt the financial system, have a negative effect on economic activity and lead to financial disintermediation.

- **Macroprudential policies that rely on caps on LTV/DTI ratios to deal with risks in the housing market have been shown to be successful.** The experience from New Zealand shows that the macroprudential authority should rely on caps on LTV/DTI ratios to deal with financial stability risks arising from the housing market. The Reserve Bank of New Zealand had some macroprudential instruments in common with the FPC, namely countercyclical capital buffer

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[8] New mortgage lending was defined for a window of six months.

[9] However, there was no formal definition of stability in the housing market.

(CCB) and sectoral capital requirement (SCR). However, the first macroprudential instrument used by the Reserve Bank was a cap on the proportion of high loan-to-value mortgage lending. The Reserve Bank of New Zealand chose that instrument since it was considered the most targeted and effective at mitigating risks from the housing market (Spencer, 2013).

- **Regional macroprudential policies can be effective in containing financial risks**. House price dynamics in the UK are not uniform across regions. While house price inflation in London has reached the same levels as in the pre-crisis period (19 percent), in the rest of the country it still remains at single digits (7 percent). In this context, there are merits of implementing macroprudential policies targeted at specific regions following the Korean example. By introducing limits on high LTV and DTI mortgages issued in London, the macroprudential authority could directly address the source of systemic financial risk. However, as the Korean experience suggests, several rounds of regional macroprudential policies are required to mitigate financial risks.

D.   Concluding Remarks

21.   **Cross-country evidence indicates that macroprudential policies are effective at containing risks from the housing market.** Macroprudential policy is becoming an increasingly important tool in advanced economies, in particular, in countries that experience rapid surge in house prices. Relying on an event study analysis, we find that the caps on high DTI and LTV ratios are highly effective at reducing both mortgage credit growth and house price inflation. Moreover, the effectiveness of macroprudential policies is maximized when several tools are used simultaneously. However, as a result of the uncertainty about the lags and effectiveness of the transmission mechanism, authorities in advanced economies implement macroprudential policies gradually.

22.   **The cap on high loan-to-income mortgages in the UK is a step in the right direction.** The FPC has recently recommended a cap on mortgages with high loan-to-income ratios which is due to take effect from October 1, 2014. The new macroprudential policy measure states that no more than 15 percent of new mortgages could have a loan-to-income ratio of 4.5 or higher. As the experience in the Reserve Bank of New Zealand indicates, this new macroprudential tool could be extremely powerful at reducing the households' leverage ratio. In addition, evidence from other advanced economies suggests that this macroprudential measure could be adjusted gradually over the business cycle.

References

Bank of England, 2014. *Financial Stability Report*, June 2014.

Chang, Soo-taek, 2010. "Mortgage Lending in Korea. An Example of a Countercyclical Macroprudential Approach," *World Bank Policy Research Working Paper* No. 5505.

Igan, Deniz, and Prakash Loungani, Prakash, 2011,. "Do Loan-to-Value and Debt-to-Income Limits Work? Evidence from Korea," *IMF Working Paper No*. 11–297.

International Monetary Fund, 2014. "Macroprudential Policy and Capital Flow Measures in Asia: Use and Effectiveness," *Regional Economic Outlook: Asia and Pacific*.

IMF. (2014). Canada 2013 Article IV Consultation. IMF Country Report No. 14/27

Krzna, Ivo and James Morsink, 2014. "With Great Power Comes Great Responsibility: Taming Canada's Housing Boom." Forthcoming IMF Working Paper.

Kuttner, Kenneth N. and Ilhyock Shim, 2013. "Can Non-interest Rate Policies Stabilize Housing Markets? Evidence from a Panel of 57 Economies," *BIS Working Paper* No. 433.

Miller, Josh, 2013. "Is it time for a second nominal Anchor in the UK? Managing House Price Inflation with Macroprudential Tools," *RICS Economic Research*.

Reserve Bank of New Zealand, 2014. *Financial Stability Report*.

Shim, I, B Bogdanova, J Shek and A Subelyte, 2013. "Database for policy actions on housing markets", *BIS Quarterly Review*, September, pp 83–95.

Spencer, Grant, 2013. "Macro-prudential policy and the New Zealand housing market," Reserve Bank of New Zealand. Accessible via:
(http://www.rbnz.govt.nz/research_and_publications/speeches/2013/5335449.pdf)

Appendix 1. Event Study Analysis

1.   **The event study analysis relied on the BIS (2013) database of macroprudential policy actions.** The database, compiled by Shim et al. (2013) from the BIS, describes in detail the macroprudential policies implemented in advanced and emerging economies since 1990. From this database we obtained the list of macroprudential policy actions for a sample of seven advanced economies: Australia, Canada, Hong Kong, Korea, New Zealand, Singapore, and Sweden. In addition, for each country we obtained data on mortgage credit in domestic currency and a house price index from Haver Analytics. These two variables were used as an input to estimate the impact of macroprudential policies.

2.   **The impact of each macroprudential policy tool was calculated as follows:**

- For each macroprudential policy measure in each country we computed the slowdown of mortgage credit and house price growth. This is calculated as the difference between the growth rate of the variable of interest 6 months after and 6 months before the measure was implemented. For instance, if mortgage credit grew by 12 percent 6 months before a macroprudential measure was implemented and grew by 9 percent 6 months after the implementation, the estimated impact was -3 percent (9–12 percent).

- For each macroprudential tool (in each country) we calculated the simple average of the impact of the correspondent macroprudential policy measure. For instance, Singapore adopted four measures under the category of LTV caps. The effect of LTV caps in Singapore is calculated as the simple average of the impact of these four measures.

- The final impact presented in figures 3 and 4 was calculated as the simple average of the effect of macroprudential tools across countries. For instance, the average impact of caps on LTV ratios is calculated as the simple average of the effect in each country.

- We followed the same steps to estimate the effects of combined and individual macroprudential policies.

Appendix 2. Macroprudential Measures to Deal with Housing Booms in Advanced Economies

Instruments	Loan-to-value	Debt Service-to-Income	Risk weights	Provisioning	Tax	Other
Australia			Risk weights for uninsured residential mortgage loans were raised in 2004.			Restrictions on foreign ownership of real estate property were established in 2010.
Canada	Reduction of LTVs from 95 to 80 percent between 2008 and 2012	A maximum debt service ratio of 45 percent of disposable income was introduced in 2008.				Tightening of underwriting standards and government-backed insurance between 2008 and 2012.
Hong Kong	In 1991, the government adopted a cap on LTV ratios of 70 percent. In 1997 the LTV on luxury properties (exceeding HK$ 12 million) was lowered to 60 percent. During the Asian crisis the LTV was raised to 90 percent in order to promote home ownership.	In 1997, the debt service ratio was set at the range of 50–60 percent (the upper limit corresponds to high-income households).	In 2013, a risk weight floor of 15 percent was introduced on all residential mortgages for banks using the internal ratings-based approach.		To reduce incentives for speculation, in 2010 the stamp duty was raised to 15 percent for properties resold within the first 6 months of purchase	In 2010, Banks were required to stress-test mortgage applicants to an increase in interest rates of at least 2 percentage points. In 2012 the maximum maturity of mortgage loans was capped at 30 years.
Korea	Between 2002 and 2012, the LTV was capped between 40 and 70 percent according to: (i) geographical location; (ii) maturity of the mortgage loan; (iii)	Between 2005 and 2012, the debt-to-income ratio was capped between 40 and 60 according to the geographical location, size of the housing unit, lending amount,	In 2012, the risk weighting for mortgage loans related to capital requirement was raised from 50 percent to between 60 percent	The financial supervisory authority raised the minimum loan loss reserve ratios for banks' household		

Instruments	Loan-to-value	Debt Service-to-Income	Risk weights	Provisioning	Tax	Other
	property value; and (iv) type of property (apartment vs. house).	borrower's credit rating, repayment method, interest rate, and evidence of income.	and 70 percent	and corporate loans that were classified as normal and precautionary in 2002 and 2006.		
New Zealand	In 2013, banks were required to restrict new residential mortgage lending at LTV of over 80 percent to no more than 10 percent of the dollar value of their new residential mortgage lending.					
Singapore	Between 2005 and 2013, the LTV ratio was capped between 90 and 40 percent according to: (i) total level of indebtedness; (ii) entities (corporations vs. households); (iii) number of properties.	In 2013, the debt service-to-income ratio threshold for all property loans was set at 60 percent.			In 2010, the government introduced a seller's stamp duty on all private properties sold within one year of purchase. In 2011 a buyer's stamp duty tax was imposed on foreigners.	In 2001, the authorities introduced caps on banks' loan exposures to the property sector (excluding residential mortgages for owner occupation) at 35 percent of total non-bank exposure. In 2010 the government released public land for property developers.
Sweden	In 2010, the government imposed an 85 percent LTV cap on mortgage loans.		In 2013, authorities introduced a risk weight floor of 15 percent.			

Source: Krznar and Morsink (2014) and Shim et al. (2013).

OUTWARD FINANCIAL SPILLOVERS FROM GLOBAL LIQUIDITY SHOCKS: TWO THOUGHT EXPERIMENTS FOR THE UK

The UK is a global hub for cross-border liquidity generation and distribution and is, thus, a natural propagator and potential amplifier of financial shocks. In that context, we study the UK's role in intermediating two potentially large global financial shocks that could materialize in the future—namely, stress from global shadow banks spilling over to global banks via repo markets in the context of a disorderly renormalization of monetary policy in advanced economies; and China's anticipated integration into the global financial system. The paper finds a significant potential role for the UK in either case, offers a rough quantification of the spillover impacts (both negative and positive), and points to some policy implications: the need to ensure effective oversight of shadow banking activity and institutions, including through engagement with other regulators and international bodies; and maintain the UK as a reliable and resilient center for international finance.

A. Introduction

1.   **This paper comprises two distinct thoughts experiments to study outward spillovers that may be generated via the UK's systemic and globally-interconnected financial system.** In section B, which has a nearer-term focus, we study the repo market channel for stress transmission from global shadow banks to UK banks in the aftermath of a world interest-rate "snapback", while quantifying possible adverse outward credit spillovers, and highlighting some policy implications. Section C, which clearly has a longer-term focus, examines the UK's potential contribution to the process of internationalization of the renminbi, and to the global distribution of China's large banking sector cross-border claims in the context of prospective capital account liberalization.

B. Contagion and Spillover from Shadow Banking Stress in World Repo Markets Following Global Interest-Rate Snapback[1]

2.   **The current global environment of low interest rates, asset price inflation, and tight bank regulation offers fertile ground for the build-up of risks in the nonbank, or shadow banking, sector.** The exceptional monetary stimulus provided by major central banks since the Global Financial Crisis (GFC) has helped stave off full-blown depression, but is also generating new vulnerabilities. For instance, negative real interest rates on safe assets are pushing investors in search of yield into riskier territories. The prevailing record-low implied volatilities in a range of markets (see Figure 1) seem at odds with observable economic vulnerabilities (such as in China and other emerging economies, Japan, and the euro area) and non-trivial geo-political tensions (e.g. crises in

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[1] This section was prepared by S. Ali Abbas (EUR), with contributions from Miguel Segoviano and Shehryar Malik (MCM), and Mathieu Vital and Robert Hills (Bank of England).

Ukraine and in Iraq). In other cases, investors are using cheap, abundant liquidity to leverage up and boost returns on equity, while pushing up asset prices. Against the backdrop of tight bank regulation, a significant amount of this risk-taking is likely occurring in the shadow banking system.[2]

Figure 1. A Global Under Pricing of Risk

US Implied Volatility
(VIX Index)

UK Implied Volatilities

GBP Short-Rate Option-Implied Volatility
FTSE 100 Option-Implied Volatility (right scale)

Source: Bloomberg.

Source: Bloomberg.
1/ Short-rate volatilities represent the 3-month option-implied volatilities of 1-year swaps.
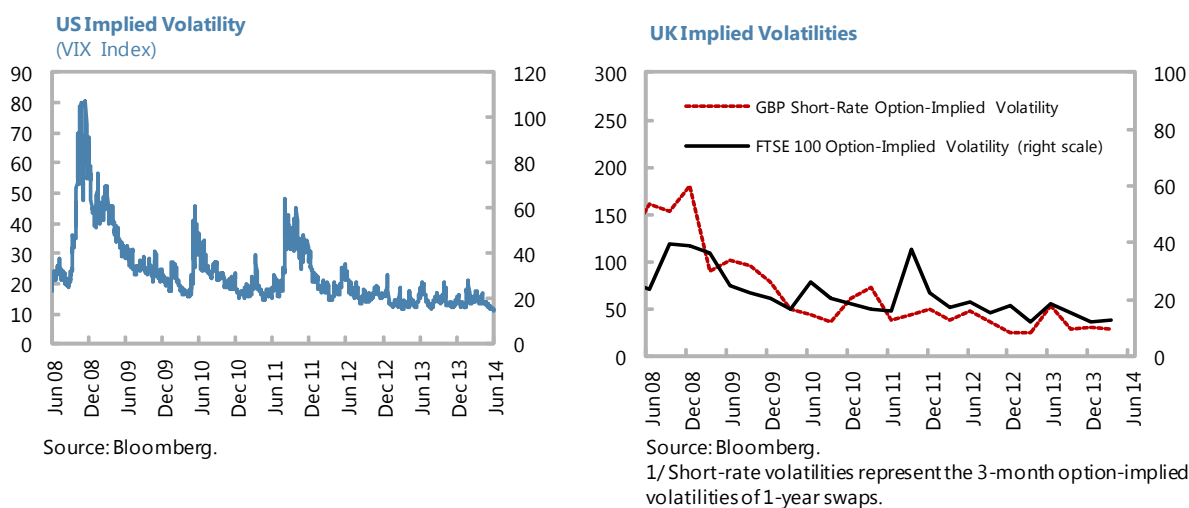
3. **In the UK, the rising sectoral contribution of the "fund sector" to systemic risk, and to bank contagion, seems to lend preliminary support to this concern.[3]** Although around two-third of overall systemic risk in the UK financial system can be attributed to major UK banks (left panel, Figure 2a), the contribution to this risk from pension, equity, bond and hedge funds has risen notably since end-2012: for instance, as shown in the right panel of Figure 2a, for equity funds, the contribution has increased by one-fourth, albeit from a relatively small level, i.e. from (from 3.2 to 4 percent). The contribution of the "fund sector" to banking sector distress-dependence has been relatively small compared with insurers over the last year (left panel, Figure 2b plots the evolution of percentage contributions over time). However, it is important to note the disproportionate share within this contribution of bond and hedge funds (right panel Figure 2b). Together, they account for three-fifth of the fund sector's contribution to banking sector distress dependence, despite being one-fifth of the size of pension funds in the sample.

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[2] In concept, shadow banks are all nonbank institutions capable of liquidity and maturity transformation and the creation of leverage. For the purposes of this section, the focus is primarily on the "fund sector", notably bond and equity funds, hedge funds and mortgage real-estate investment trusts.

[3] This part of the analysis considers the financial system to be a high-dimensional portfolio of bank and nonbank institutions (Segoviano et al (2014)). Under this assumption a joint distribution of portfolio losses can be constructed from which, in turn, a measure of systemic (tail-) risk is derived. For the purpose of this analysis the system's "expected short fall" (ES) is chosen as the measure of systemic risk in the financial system. The systemic ES takes into account the size of each institution in the system and interconnectedness among institutions. The marginal contribution to systemic risk (MCSR) by any institution or sector can be computed as the percentage contributed to the systemic ES. The MCSR is based on the (shapley-value based) risk attribution methodology proposed by Tarashev, Borio and Tsatsaronis (BIS, 2010).

Figure 2a.The Contribution of Nonbanks to UK Systemic Risk

Marginal Contribution to UK Systemic Risk-
as at End-March 2014

Change in Contribution to UK
Systemic Risk Since End-2012
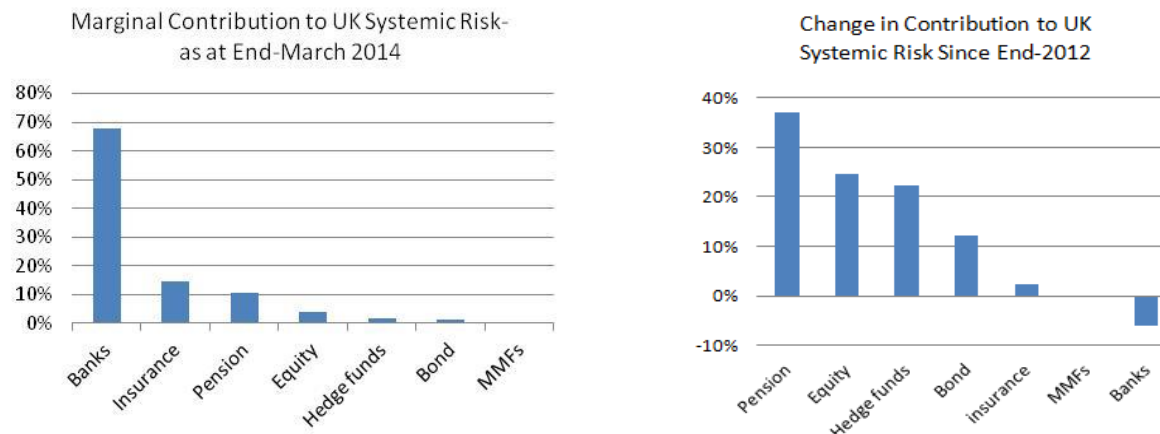
Figure 2b – The Contribution of Nonbanks to UK Banking Sector Distress Dependence

Percentage Contribution to Bank Distress Dependence
Within the Fund Sector- as at End-March 2014
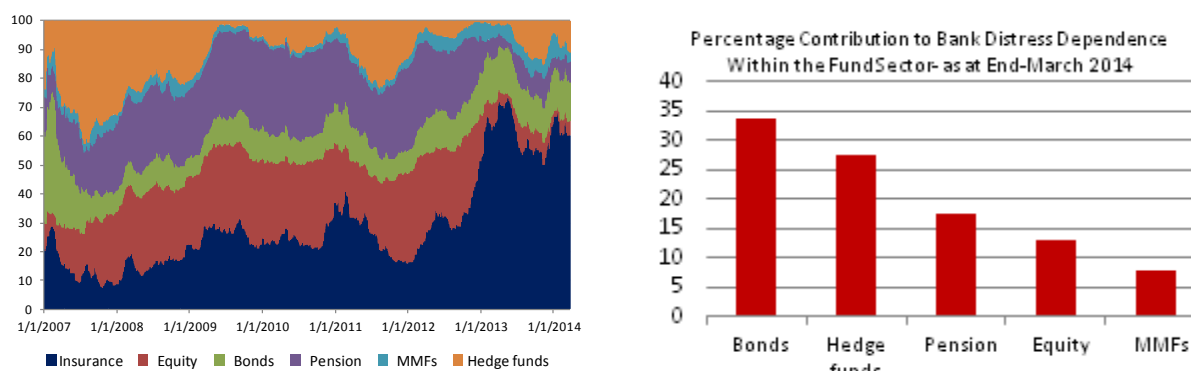
Source: IMF staff estimates

4.   **As a global financial center, the UK is also vulnerable to risks arising from "non-UK" (or global) shadow banks, especially via interactions in world repo markets.** For example, several global hedge funds incorporated in tax havens have their fund managers based in the UK. These hedge funds – alongside, inter alia, exchange-traded funds and US-based mortgage real-estate investment trusts (mREITs) – borrow cash in world repo markets from US money market funds (MMFs) through G14 dealer banks (see Figure 3). Some of these shadow entities have achieved highly leveraged positions in the past few years, by using the cash obtained initially to buy new assets, posting the latter as collateral to borrow more cash, and so on (mREITs had amassed leverage of 7.3 times). Importantly, many of the G14 dealers intermediating this borrowing are either UK-headquartered G-SIBs (RBS, HSBC and Barclays); or the UK subsidiaries and branches of foreign banks (such as Citibank, UK). The estimated share of UK-resident dealers in this repo chain is c. 30-40 percent.

Figure 3. End-2012 Map of Repo Chain Linking US MMFs to Shadow Banks via G14 Dealers
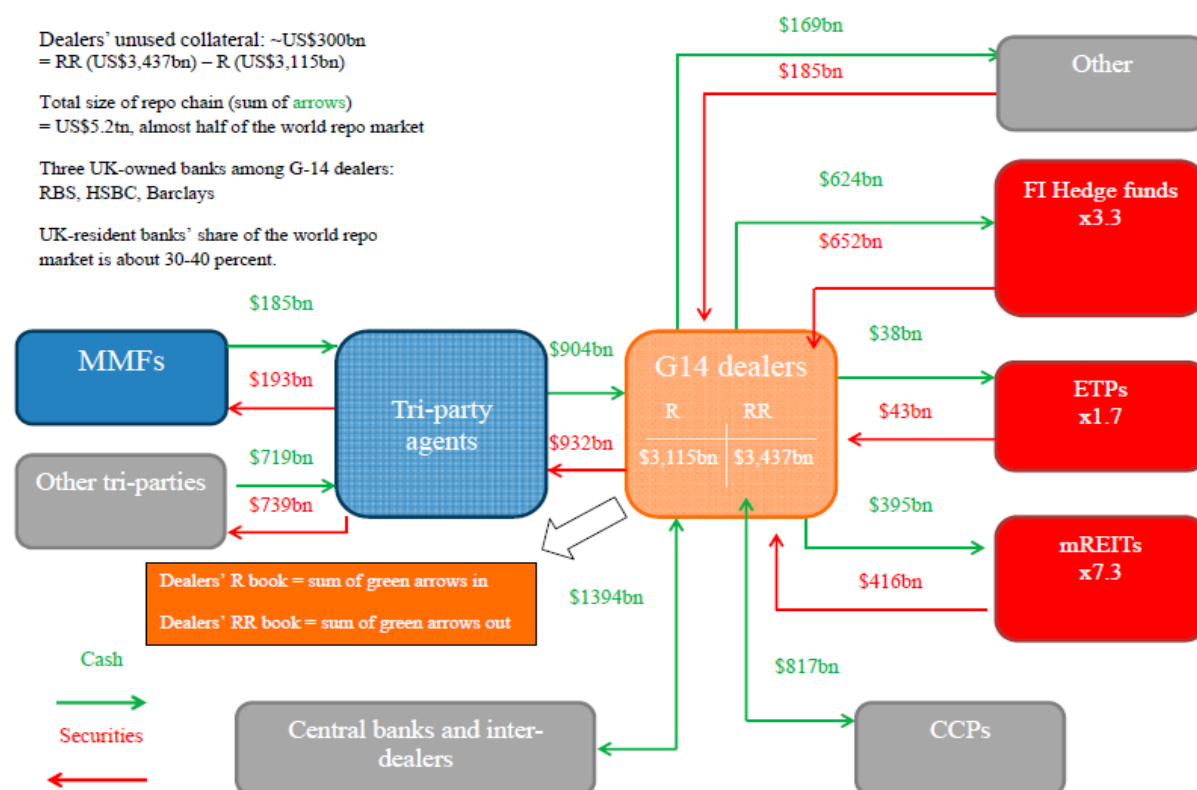
Source: Bank of England staff estimates

5.   **Against this backdrop, we study the possibility of contagion from global shadow banks to UK banks following a world interest-rate snapback, and the resulting outward spillovers.**[4] Focusing on the US$5 trillion segment of the world repo market described above, we analyze how a snapback can generate stress in leveraged global shadow banks. Specifically, we look at the ability of these shadow banks to meet variation margin calls triggered by the sudden loss in value of "repoed" collateral that results from the interest rate shock. We identify "limit points" at which the shadow banks run out of usable collateral to meet margin calls, necessitating an unwind of their repo positions and possibly fire sales of assets. This opens general and specific channels of contagion to the intermediating G14 dealers, many of which are UK-resident banks, including the possibility of intra-day freezes in the repo market. Given that banks' banking and trading books

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[4] The snapback is modeled as a symmetric instantaneous upward shift in the yield curves for the dollar, euro and sterling. A steepening of the yield curve (rise only in long rates alone) is perhaps more reasonable for the euro area, but in the particular context of the question we pose, the benefits to assuming this are inconsequential. Also, we abstract from the reasons for the snapback. We abstract from the "cause" of the snapback, noting only that even if the cause were a good one (say, stronger growth expectations in advanced economies), a sudden rise in rates could be disruptive.

would already be under stress due to the snapback,[5] this liquidity shock in the secured lending market could easily spill over into the unsecured (LIBOR) market, reminiscent of the developments around the GFC. Banks could end up deleveraging, especially abroad, generating outward financial spillovers.

6.   **We estimate that variation margin flows following an interest-rate snapback could be sizable and possibly difficult-to-meet for some highly leveraged shadow banks, such as mREITs.** As shown in Figure 4, for a 100 basis point rise in the interest rate, the implied variation margin flows for "unchanged" collateral haircuts, would be c. US$550 billion. For 200 basis points, the figure is US$1 trillion. This compares with the G14 dealers' own collateral "cushion" of ~US$300bn (= Reverse Repo book *minus* Repo book, in Figure 3), suggesting that inability of leveraged shadow banks (such as exchange traded funds, fixed income hedge funds and mREITs) to meet their margin calls could create stress in the repo market. Figure 4 shows the automatic build-up in shadow bank leverage that will follow from depressed asset prices following the snapback, and the point at which leverage must stabilize or unwind due to the exhaustion of usable assets to post as collateral. For mREITs, this "limit point" is reached with a 200 basis point interest-rate shock.

Figure 4. Variation Margin Flows in Global Repo Market Triggered by Interest Rate Snapback
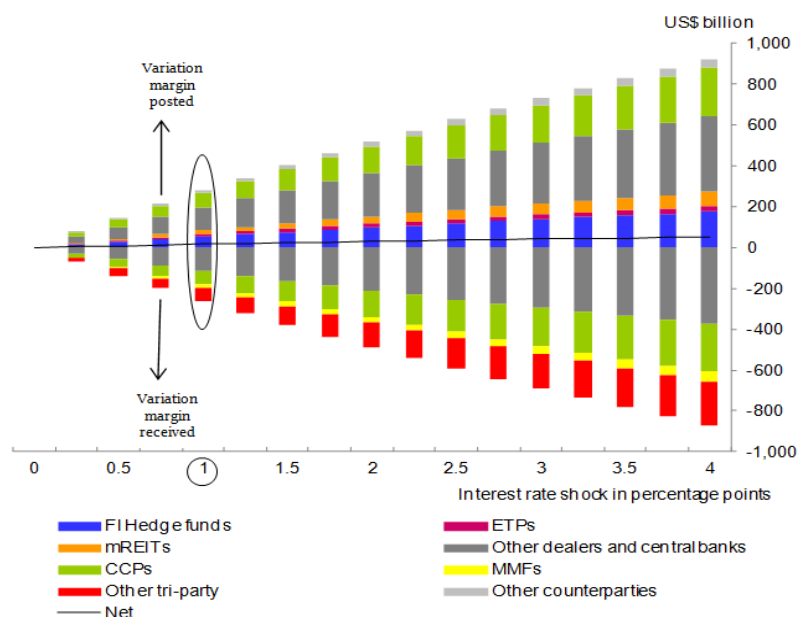
Source: Bank of England staff estimates

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[5] UK banks could be affected by a sudden rise in world interest rates due to a number of reasons, e.g.: banks' funding costs rise, directly from the increase in the risk-free rate, and indirectly from stress in the banks' counterparties; default rates rise by firms and households vulnerable to the interest-rate shock; and mark-to-market losses depress banks' own asset values (in both banking and trading book), so that market valuation of equity falls (leverage rises) with knock on effects on banks' CDS spreads and funding costs.

Figure 5. Limit Points for Selected Shadow Banks Assuming Unchanged Collateral Haircuts
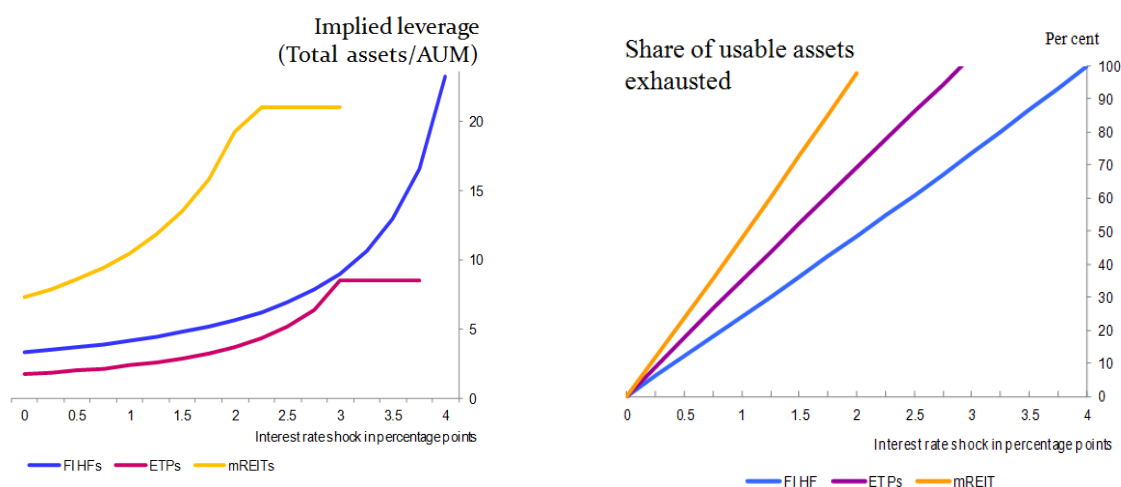
Source: Bank of England staff estimates

7. **In practice, the lenders to the repo chain could raise collateral haircuts as borrower leverage increases, causing "limit points" to be reached earlier or with smaller interest-rate shocks.** The estimates in Figures 4 and 5 are based on the assumption that lenders do not change the required haircuts on the collateral against which they lend. This is a generous assumption as it is likely that haircuts would rise (sharply and unpredictably) with borrower leverage; in some cases lenders may refuse some types of collateral or counterparties altogether: during the GFC, US MMFs suddenly became extremely risk averse and pulled back their funding from major US and EU banks, triggering fire sales of assets, general panic and a surge in counterparty risk. A repeat of such behavior – which forces borrowers in the repo chain to unwind their positions by selling assets in a short period of time – cannot be ruled out.

8. **The impact on financial markets and stability would depend critically on the speed with which interest rates rise and on borrowers' repo maturities.** For reasons of tractability, the simulations above assume that interest rates jump instantaneously, but this is too alarmist. Any surge is likely to take some time. This time, coupled with the length of repo maturities, represents the breathing space that vulnerable shadow banks will have to space out their asset sales and meet their repo obligations. Illustratively, at 20 percent, the share of mREITs' repo borrowing with maturity of less than 30 days, is not trivial. The mere expectation that asset sales may need to occur fast (i.e. anticipation of fire sales) could become self-fulfilling.

9. **Stress in any point of the repo funding chain could contaminate the G14 dealer intermediaries, and trigger broader market discontinuities, such as intra-day trading freeze.** Such a scenario would be more likely if variation margin flows were large in relation to dealers' own collateral cushions; asset fire sales had a significant impact on dealers' trading books and banking books (via higher defaults by debtors); and if dealers' "own" borrowing from lenders to the repo chain (US MMFs) got cut down or became costlier. The combination of these stresses would typically manifest in higher credit default swap premia for dealers, in turn activating credit valuation adjustments on derivatives exposures. With counterparty risk rising, the cost of borrowing in unsecured markets (measured by the LIBOR-OIS spread) would escalate. Given the complex

interconnectedness of financial assets, markets and players, it is impossible to say what the systemic implications would be in such a scenario, except that a major liquidity shock could not be ruled out.

10.   **If affected dealer banks respond by reducing cross-border lending, outward credit spillovers would result.** A shock to the G14 dealer banks, given their size and global interconnectedness, would clearly ripple through world markets, affecting a range of counterparties, and ultimately firms and households. One channel which we quantify is external deleveraging by major UK banks, mirroring their response to the liquidity crunch during the GFC: from end-Sep 2007 to end-Dec 2009, the 3-month UK LIBOR-OIS remained (on average) 80 basis points above its "normal" level of 10 basis points, and was accompanied by an 11 percent decline in UK banks' foreign claims.[6] **For illustrative purposes, we assume a shock half that size and duration so that the implied external deleveraging by UK banks is c. 3 percent (US$120 billion, given US$4trn in foreign claims)**.[7]

11.   **The distribution of outward spillovers would depend on how banks allocate the required deleveraging across jurisdictions.** In the simplest possible setting, one could assume banks apportion the US$120 billion in line with the share of foreign claims in each jurisdiction. In this case, Hong Kong would face the largest impact, with its domestic credit falling by 2 percent, followed by Mauritius and Bahamas (1.5 percent) and Luxembourg, Ireland, Singapore and South Africa (1 percent). The distribution of spillovers would be quite different if UK banks deleveraged "strategically", i.e. fully protected the largest (core) jurisdictions, while fully exiting others. In this case, a number of emerging and low-income economies (such as Panama, Djibouti, Pakistan, Mozambique, Philippines, Uruguay) could see credit reducing by 10 percent or more.[8] Whether these spillovers would be deemed favorable or unfavorable by the recipient economies would depend, inter alia, on which stage of the economic and credit cycle they were at: i.e. whether the withdrawal of UK bank credit from their jurisdictions eased over-heating pressures, or exacerbated slowdown.

12.   **Recent Bank of England efforts to strengthen bank balance sheets and liquidity backstops should reduce the likelihood and intensity of a snapback-induced crisis.** One important difference from the GFC is that banks, both in the UK and in the US are more resilient, both in terms of capital and funding, and thus less vulnerable to stress in the shadow banking system. Moreover, changes to the Sterling Monetary Framework announced in October 2013 mean that banks deemed healthy ex-ante by the Prudential Regulation Authority (PRA) would be assured access to the Bank's permanent liquidity facilities at lower cost and longer maturities, against a

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[6] See paper by Hills et al (forthcoming) for more granular evidence.

[7] End-December-2013 consolidated banking claims on ultimate risk-basis (Bank of International Settlements).

[8] Another possible scenario could be generated by taking the actual cross-country distribution of UK banks' deleveraging during the GFC and imposing it on UK banks' cross-border assets today. A caveat with this approach would be, however, that UK banks' cross-country exposures have substantially changed since the GFC (for some banks, jurisdictions exposures have been unwound to almost zero), so that earlier deleveraging may only offer limited insights into how UK banks might behave today.

broader range of collateral, and with less stigma. The decision to extend liquidity supports to central counterparties and major broker-dealers is also timely and appropriate, given the systemic importance of these entities. In both cases, however, stronger backstops will need to be accompanied by commensurately strengthened supervision to ensure beneficiaries do not end up taking more risks.

13.   **A key policy priority going forward will be ensuring adequate oversight of the nebulous shadow banking system, including global shadow banking activity.** To this end, there are already efforts underway at both the Financial Conduct Authority (FCA) and the PRA.[9] These efforts are critical given the size and complexity of the shadow banking system (in the UK and globally) and the vulnerabilities and channels of contagion to banks documented in this paper. Any additional budgetary resources, regulatory perimeter adjustments, and international coordination initiatives (in relation to "global" shadow banking), required to support these efforts should be prioritized.

Figure 6 - UK Banks' External Deleveraging–Possible Impact on Recipient Economies
(Percent of recipient economy bank credit)

Proportional Deleveraging
(in proportion to 2012 country share in claims)

Strategic Deleveraging
(bottom jurisdictions exited until aggregate 3% of total claims deleveraging met)

Sources: BIS Quarterly Review: March 2013; and IMF staff calculations.

Sources: BIS Quarterly Review: March 2013; and IMF staff calculations.

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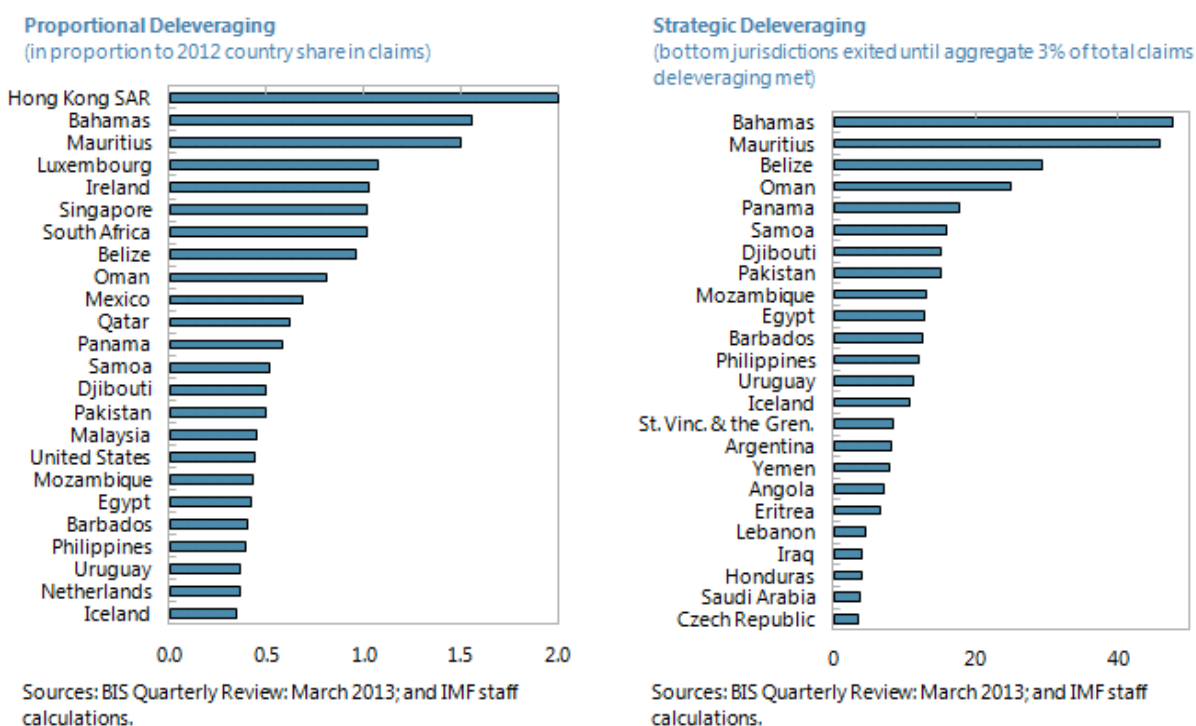
[9] These include (i) joint work with the FSB and IOSCO to identify global systemically important finance companies, insurers, investment funds, hedge funds; (ii) Bank of England work on monitoring systemic linkages between US money market funds and UK banks, including through funding channels; (iii) initiatives to enhance the transparency of repo and securities lending markets, with a view to reducing their pro-cyclicality; and (iv) regular reviews by the FPC of the adequacy of the regulatory perimeter for UK financial institutions and activities. For further details, the June 2014 Financial Stability Report (Box 9).

C.   Spillovers from UK Contribution to the Internationalization of Chinese Banking Liquidity and the Renminbi[10]

14.   **China's capital account is relatively closed, both de jure and de facto, so that the country's *financial* integration in the world far undershoots its *economic* weight.** As noted in Hooley (2013), China's share of world trade and GDP has risen dramatically from 2 percent at the start of the 1990s to over 10 percent today (Figure 7, left panel). The corresponding increase in China's global financial integration has been modest – from c. 0.5 percent to c. 2 percent, reflecting the country's (well-enforced) restrictions on capital account convertibility (Figure 7, right panel).

Figure 7. China's Financial and Economic Weight/Integration in the World
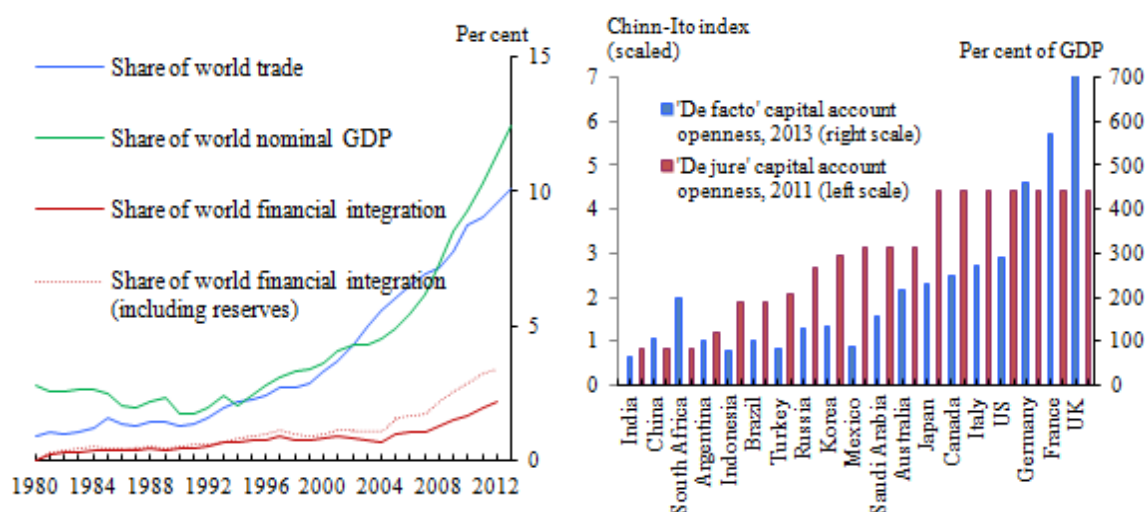
Source: Hooley (2013)

15.   **China's large banking system assets are almost entirely domestically-invested.** A simple comparison of the size of the US banking system with China's reveals just how big the latter is. At about US$ 22 trillion, Chinese banking assets were over 40 percent larger than those of US banks. However, almost all of this was domestically-invested, whereas one-fifth of US banking assets are invested abroad.

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[10] This section was prepared by S. Ali Abbas (EUR), John Hooley (AFR) and Carsten Jung (Bank of England), with contributions from Matthew Cowie (HM Treasury) and Glenn Hoggarth (Bank of England).

Figure 8. Size and External Orientation of China- and US-Resident Banking Systems[11]

Banking System Assets and Liabilities
(Billions US Dollars)

Source: Hooley (2013).
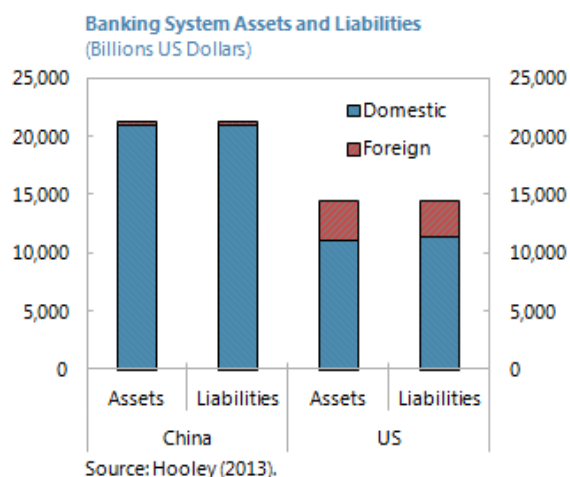
16.   **An opening of the Chinese capital account would have major implications for global finance.** In the 13th 5-year plan (2011–15), the Chinese authorities envisaged the start of what is expected to be a long and gradual process of capital account liberalization. Economists have attempted to estimate the implications of this move in various ways. Bayoumi and Ohnsorge (2013) project a net increase of Chinese international assets of US$ 1.6–2.7 trillion[12] over the next 15 years or so;[13] while Hooley (2013) shows that China's gross international investment position could increase from 5 percent to 30 percent of world GDP by 2025 under a full liberalization scenario. **Should greater capital account openness be accompanied by a similar-to-US external orientation of Chinese banks, gross cross-border claims of almost US$ 5 trillion could be accumulated by Chinese residents.**

Figure 9. Cross-border Liquidity Generated in Major Jurisdictions by Subsidiaries and Branches of Foreign Banks Resident in those Jurisdictions (Average of quarterly stock over 2005–13, US dollars billions)
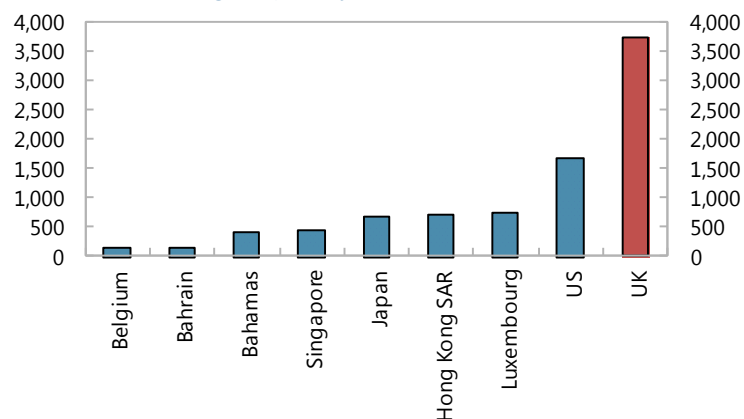
Sources: BIS *International Locational and Consolidated Banking Statistics;* and IMF Staff estimates.

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[11] Consists of local operations of domestically-owned banks, foreign subsidiaries and foreign branches, end-2012.

[12] This is imputed using the percent of GDP range estimated by the authors.

[13] This could have the effect of reducing interest rates for a number of recipient economies. For instance, Benelli (2011) argues that, ceteris paribus, every US$ 0.5 trillion diverted from advanced markets into EM sovereign bonds lowers the yields on those bonds by 240 bps.

17.   **As a global financial center, the UK could play an important intermediation role in distributing any released Chinese bank claims across jurisdictions.** The UK is the world's leading hub for international banking, where global banks distribute cross-border claims. Over 2005–13, for instance, branches and subsidiaries of foreign-owned banks based in the UK generated over US$ 3.7 trillion in cross-border claims (Figure 9, red column).[14] **The fact that Chinese banks' share of these foreign-owned bank assets in the UK is negligible – despite the rapid growth in China's weight in the world real economy – suggests there is a sizable potential for the UK's intermediation role.**

18.   **A crude thought experiment provides us with a ballpark of the size of possible "long-term" spillovers from such a UK intermediation role, focusing on gross outflows from China.** For this experiment, it is assumed that:

(i)   Chinese banks' cross-border/total asset ratio rises to one-quarter (akin to the average share of US and Japanese banks), implying a release of c. US$ 4.9 trillion in cross-border bank claims of China vis-à-vis the rest of the world.

(ii) 21 percent [US$ 1,029 billion] of these US$ 4.9 trillion cross-border assets are held in the UK, assuming Chinese banks mimic the average of US and Japanese banks' international asset allocation.

(iii) 43 percent [US$442 billion] of the US$ 1,029 billion is received by UK nonbanks and is thus assumed to "end" in the UK. This mimics the current recipient share of cross-border bank claims of the US and Japan vis-à-vis the UK.

(iv) Of the remaining US$ 587 billion received by UK-resident banking entities, a third is assumed to be "recycled back" to China (broadly consistent with the pattern observed for banking flows into the UK from the US and Japan).

(v) **Thus, US$ 391 billion remains as the China-originated gross cross-border bank claims available for global distribution from the UK.**[15]

19.   **The cross-country allocation of these funds would depend on the final purpose they are intended to serve, as well as the particular competency of the UK.** Table 1 shows the cross-

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[14] The UK's contribution to cross-border liquidity provision was obtained by subtracting the consolidated cross-border claims of UK-headquartered banks from the locational cross-border claims of all banks and branches located in the UK. This difference provides a proxy for the global claims originated from the UK by the subsidiaries and branches of banks headquartered outside the UK.

[15] Somewhat higher numbers obtain with top-down calculations, i.e. assuming China's share of the red bar in Figure 9 approaches China's long-term share in world GDP.

country distribution of funds that would obtain if Chinese banks simply followed the pattern of cross-border claim allocation by UK-resident banks today. However, given the Chinese economy's strong trade focus, it is also possible that parent Chinese banks use the funds as a source of trade finance for importers of Chinese goods in Europe, Middle East and Africa (Hong Kong SAR would likely be the preferred hub for distribution of trade finance to Asia and the Americas). In this case, the US$ 391 billion could conceivably get distributed in proportion to the importing economies' share in the US$ 580 billion total Chinese exports thereto—see Table 2.

Table 1. Illustrative Distribution via-UK Chinese Credit In Line with Current Pattern of Cross-Border Claims Allocation by UK-Resident Banks

Chinese-originated / UK-intermediated credit flows
(In percent of recipient economy GDP avg. 2014-18)

Luxembourg	13.59	Hungary	0.28
The Bahamas	11.60	Croatia	0.27
Liberia	10.01	Oman	0.25
Ireland	7.16	Russia	0.25
Netherlands	3.45	Canada	0.25
Bahrain	3.28	Serbia	0.23
Switzerland	2.57	Jamaica	0.23
Singapore	2.47	Albania	0.23
Hong Kong SAR	1.88	Kenya	0.21
Iceland	1.56	Zambia	0.20
France	1.48	New Zealand	0.19
Portugal	1.01	Jordan	0.18
Qatar	0.95	Czech Republic	0.18
Finland	0.90	Bulgaria	0.16
Denmark	0.87	India	0.16
Greece	0.87	Lebanon	0.16
Belgium	0.83	Nigeria	0.15
Germany	0.83	Israel	0.15
Spain	0.77	Romania	0.15
Sweden	0.73	Korea	0.15
United States	0.58	Brazil	0.14
Panama	0.55	Saudi Arabia	0.14
Norway	0.53	Kuwait	0.14
Italy	0.52	Poland	0.13
Australia	0.49	Ukraine	0.11
Turkey	0.46	Tanzania	0.11
South Africa	0.39	Malaysia	0.11
Austria	0.35	Slovenia	0.10

Source: Bank for International Settlements; Bank of England; and IMF staff estimates.

Table 2. Illustrative Distribution via-UK Chinese Credit for Trade Finance Purposes

Chinese-originated / UK-intermediated credit
(In percent of recipient economy nominal GDP avg. over 2014-18)

Liberia	57.7	Pakistan	2.7	Israel	1.5
Kyrgyz Republic	39.5	Cyprus	2.7	Oman	1.5
Djibouti	36.1	Hungary	2.6	Croatia	1.4
Togo	27.2	Uzbekistan	2.4	Poland	1.4
Benin	18.0	Bahrain	2.3	Turkey	1.4
Malta	14.9	Latvia	2.3	Finland	1.3
Tajikistan	11.5	Sudan	2.3	Bulgaria	1.2
Mongolia	11.5	Slovenia	2.3	Turkmenistan	1.2
Mauritania	7.6	Estonia	2.3	Germany	1.1
Guinea	7.4	I.R. of Iran	2.2	Dominican Rep.	1.0
Ghana	6.0	Nigeria	2.2	Denmark	1.0
Jordan	5.5	Czech Republic	2.2	Kuwait	0.9
United Arab Emirates	5.0	Ethiopia	2.0	Spain	0.8
Tanzania	4.7	Lithuania	2.0	Romania	0.8
Netherlands	4.4	Libya	1.9	Greece	0.8
Mozambique	3.7	Angola	1.8	Italy	0.7
Kazakhstan	3.3	Belgium	1.8	Sweden	0.7
Lebanon	3.3	Slovak Republic	1.8	Portugal	0.7
Senegal	3.3	Algeria	1.7	Belarus	0.7
Kenya	3.2	Tunisia	1.7	Ireland	0.7
Madagascar	3.1	Morocco	1.6	Azerbaijan	0.6
Republic of Congo	3.1	Iraq	1.6	France	0.6
Yemen	3.1	Zambia	1.6	Qatar	0.5
Georgia	3.0	DRC Congo	1.6	Norway	0.3
Mauritius	3.0	Côte d'Ivoire	1.6	Austria	0.3
South Africa	2.9	Saudi Arabia	1.5		
Jamaica	2.8	Egypt	1.5		
Cameroon	2.8	Russia	1.5		

Source: Direction of Trade Statistics; and IMF staff estimates.

20.   **Given that Chinese capital account liberalization is likely to be a gradual process, a number of qualifications around the foregoing are warranted when taking a nearer view.**

(i)   Chinese banks' cross-border/total assets ratio may initially only rise to levels seen banks in advanced economies with moderate financial integration. The total increase in cross-border bank claims to the rest of the world in this case would be closer to US$ 1.2 trillion, i.e. less than one-quarter of that assumed above. By extension, the amount remaining as China-originated bank claims available for global distribution from the UK would approach c. US$ 100 billion (and not c. US$ 400 billion).

(ii) Capital account liberalization will have a scale effect by which all types of cross-border assets and liabilities will likely increase; but it will also have a composition effect: currently China's external assets are predominantly held in low-yielding government bonds. In the future, they are likely to shift towards more FDI and partly portfolio debt and equity investment, as private sector outflows are liberalized. And while currently most of China's external liabilities are FDI, they can also be expected to shift toward more portfolio investment. This is in line with international experience suggesting that, with capital account liberalization, countries tend to rely relatively less on external FDI liabilities (He et al, 2012).

(iii) Chinese-owned banks still have limited international banking experience and capacity; and, until this changes, Chinese capital account liberalization and the bulk of capital flows will likely

largely be facilitated by the world's big investment banks, many of them operating out of London.

(iv) The UK's facilitator role over the medium-term will likely center around the following: (a) Chinese institutional investors investing in world capital markets, including via the major investment banks based in London; (b) Chinese corporations issuing debt and equity in London, taking advantage of its deep capital markets in search of lower borrowing costs. This will become especially relevant if future credit conditions tighten in China; (c) taking advantage of London as the world's leading centre for foreign exchange and derivatives trading, Chinese corporations and banks purchasing derivatives in order to insure against currency and interest rate risks;

(v) While London is likely to play a key role in many of these transactions, the domicile of these transactions may often be located outside of the UK. For example, a lot of the assets that are traded via London-based investment banks are not actually held in London, but are domiciled in jurisdictions such as Luxembourg and Ireland, for tax or regulatory reasons. That said, even though they may remain centers for the listing of other-currency bonds by Chinese entities, the legal, design, sales, marketing and execution work will be carried out in London.

Due to the complexity of the 'global financial supply chain' it is difficult to judge what impact policies in the UK will have on other countries, including China. From the perspective of UK regulators, managing and mitigating adverse outward "risk" spillovers from increased Chinese banking activity in the UK will clearly be important.

21.   **In conjunction with the UK's role as a cross-border hub for Chinese banking activity, the UK can also facilitate the internationalization of the renminbi.** With China's rising weight in the world economy, the renminbi's use as a vehicle or reserve currency of the world will inevitably grow. There are already signs of this: with the renminbi now the second most used currency for trade finance after the dollar, overtaking the euro. According to SWIFT, the renminbi is the second most used currency for cross border payments with China and Hong Kong[16], and for the Middle East and Central and Latin America, the renminbi is the most used currency for payments with China and Hong Kong. However, while the renminbi has risen to the seventh most used payments currency globally by value, this only puts it at 1.47 percent of global payments. And although the percent of Chinese exports settling in renminbi is projected to rise from below 10 percent in 2011 to about 20 percent in 2014[17] this is still comparatively small – the share of US exports settled in US dollars is close to 90 percent. Given the large pool of international investors active in London, an increase of renminbi FX and derivatives liquidity there could make a big contribution to the adoption of the currency for trade and financial transactions. This would bring the world closer to a more diversified multi-currency system.

22.   **The speed of renmbinbi internationalization partly depends on the pace of Chinese capital account liberalization and on how quickly a Euro-renminbi market develops.** Unlike the large Eurodollar market – i.e. the market for short-term dollar deposits outside the US – renminbi

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[16] Renminbi tracker, SWIFT, June 2014.

[17] Deutsche Bank, 2014.

deposits are scarce outside China and Hong Kong. Such markets bring both benefits and risks: for instance, they help separate currency from country risk, while facilitating off-shore investment banking (which can helpfully support corporate activity). But they also make it easier for financial institutions to arbitrage across regulatory and tax regimes.

23.   **The UK played a pre-eminent role in the development of the Eurodollar market, which could offer some lessons for the prospective development of a Euro-renminbi market in the future.** Box 1 summarizes the various stages of the US dollar's internationalization, the central role played by the UK in this process, and the lessons that could be drawn from that experience for renminbi internationalization. These are: (i) national policy can play a role in making certain currencies more widely used, but fundamentals matter most; (ii) a multi-currency system is possible; (iii) although the offshore internationalization of a currency is possible even with a relatively closed capital account, it ultimately depends on supply and demand factors; (iv) a large Euro-currency market may make capital controls onshore less effective; and (v) the precise use of Euro-currency markets is highly complex, involving transactions between non-residents; round-tripping transactions by residents (including for potential regulatory arbitrage purposes); and net flows out of and into the home country.

24.   **Although Hong Kong SAR is likely to play a dominant role in renminbi internationalization, the UK is emerging as the major renminbi hub outside of China and Hong Kong SAR.** The UK already has the strongest financial links with China among all major advanced economies (Figure 12). Moreover, renminbi activity levels in London which are the largest outside of China and Hong Kong SAR, are picking up, albeit from a small base (Table 2), and, by the end of 2013, almost two-third of renminbi trading outside China and Hong Kong SAR was taking place in London. This corresponds with London's position as the world's leading financial center for FX trading (40 percent share) and OTC derivatives trading (50 percent share), which is vital if agents are to take positions and conduct transactions in renminbi outside of China.

Figure 10 – UK Banks have Relatively Outsized Claims on China
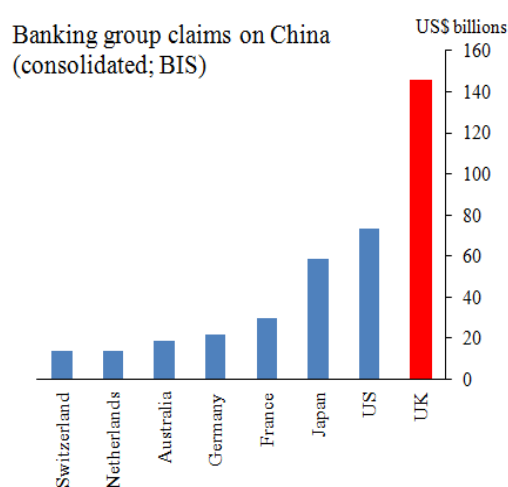
Source: Hooley (2013)

Table 3 – Renminbi Activity Levels in UK are Rising

Renminbi activity in London

RMB billions

	2011	2012	2013
Foreign exchange trading	**10.6**	**16.8**	**22.3**
o/w deliverable	2.5	7.7	15.6
o/w non-deliverable	8.1	9.1	6.8
Bond issuance	**7.0**	**12.4**	**N/A**
Deposits	**15.1**	**11.9**	**14.6**
o/w retail	0.3	0.2	0.1
o/w private banking	3.6	2.8	2.0
o/w corporate	2.9	2.1	1.1
o/w interbank	8.3	6.8	11.4
Trade finance	**8.6**	**24.9**	**27.9**
o/w letters of credit	0.2	1.0	3.3
o/w import financing	6.8	19.2	20.3
o/w export financing	1.7	4.7	4.3

25.   **Recent policy developments have been supportive of a more prominent role for the UK, both as a cross-border hub for Chinese banking activity and for renminbi internationalization.** In June 2013, the Bank of England and the People's Bank of China established a sterling-renminbi swap line to better backstop offshore currency needs. In October 2013, the PRA outlined its position in relation to non-EEA wholesale branches in the UK, paving the way for Chinese wholesale branches to be set up in the UK. China has allocated a quota of RMB 80 billion for UK-based asset managers to invest directly into Chinese onshore securities. And, in June 2014, the People's Bank of China appointed China Construction Bank as clearing bank for offshore renminbi in London, allowing onshore settlement of offshore transactions.

26.   **In sum, there is a long way to go with regard to China's capital account liberalization and the renminbi's internationalization, and the UK's contribution thereto, together with associated outward spillovers, will evolve accordingly.** In the near term, Chinese residents will increase their foreign direct investment (FDI) while the renminbi will become more important for trade invoicing. Most activity via the UK will thus be centered on FDI and trade finance. The major spillover will be the signaling effect of renminbi usage in London. In the next stage, Chinese institutional investors may start to buy and sell global cross-border assets on a large scale via the London capital market, traded by major banks; and Chinese corporations will likely start issuing offshore bonds on a large scale, facilitated by the UK financial infrastructure. The spillover effects of these developments could be a major increase in global equity and bond market assets and liabilities, requiring a smooth functioning of UK capital, FX and derivatives markets.[18] Only in the final stage will Chinese-owned banks – including through their operations in the UK – likely become major global players and facilitators of China's capital account liberalization. Effective supervision by UK and Chinese authorities will be needed to safeguard their expansion into global markets, ensuring global financial stability.

Box 1. The Development of the Eurodollar Market

1870–1925: The rise of the dollar a currency for invoicing international trade

The US dollar was initially a dominant currency for trade invoicing and settlement and only became used in global finance much later. By 1870 the US had overtaken the UK as the world's largest economy and by 1912 it had become the world's largest exporter. Thirteen years later, in 1925, the dollar overtook sterling as the major currency for foreign trade acceptances. Just as then, even though China is currently the world's largest exporter only a small fraction of world trade is actually invoiced in renminbi.

There was some role of policy in internationalizing the dollar at the initial stage. Although the US dominated global trade (as China does today), the market for dollar trade and trade credits was still illiquid, partly due to financial institutions being unfamiliar with the asset class. In 1913 the Fed was established, it allowed branches abroad and became the market maker in the nascent market for US$-denominated trade credit. In 1920 the Fed started purchased trade acceptances, stabilizing and lowering the interest rate on trade

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[18] Bayoumi & Ohnesorge (2013) estimate that the increase in Chinese residents' cross-border portfolio assets could account for up to 3 percent of global bond and equity markets

acceptance credit; by the second half of the 1920s half of all existing dollar trade credits were on the Fed's balance sheet (Eichengreen & Flandreau, 2010). In addition, (i) WWI brought about a scarcity of trade credit in London; (ii) UK trade fell relative to the US and (iii) sterling had become increasingly volatile from 1915 onwards. This all made using the dollar more attractive. This may be the phase most resembling the stage of renminbi internationalization at the moment, as China is trying to promote the liquidity of markets for trade finance and other renminbi financial products. For example, the PBoC has set up renminbi swap lines with various other central banks and established clearing banks. Thus far, many of these markets are still relatively illiquid compared to those in other currencies.

After the initial rise of the dollar a de facto multi-currency system existed. Though data is sparse, denomination of trade was split mainly between the dollar and sterling until after World War II (Eichengreen et al. 2014). But the rise of the dollar was not linear. The Great Depression in the US was deeper and longer than in the UK. This caused the role of the dollar to decline temporarily. But after WWII it had become the main international currency again. For today, this means that we are likely to see a multi-polar currency system in the medium-term, with a gradual rise of the renminbi, absent a major crisis in either China or the US.

1955–65: The development of the Eurodollar market

The Eurodollar market developed in London in the mid-1950s–1960s due to market forces in a context of highly constrained international capital flows. There were several demand factors encouraging the use of offshore dollars: (i) the dollar was already the leading world trade currency, making it an important means of invoicing; (ii) the dollar was seen as a store of value, even though there were concerns about credibility of its peg to gold throughout the 1960s; (iii) higher relative interest rates on offshore dollar deposits and bonds – due to regulatory arbitrage of US banks avoiding deposit caps at home – made Eurodollar instruments an attractive investment opportunity (Schenk, 1998; see Figure 1, first row). On the supply side, loopholes in capital controls permitted further offshore accumulation of dollars once current account restrictions were lifted from the mid-1950s onwards (Eichengreen, 2008). At the same time – while restricting convertibility of sterling for non-trade use – the UK authorities chose not to impose restrictions on cross-border banking in dollars. Other countries did restrict Eurodollar banking which encouraged the growth of London as the major centre. And the US tolerated the existence of the Eurodollar market by allowing onshore settlement of offshore transactions (He & McCauley, 2010).

Once the US started to run a current account deficit, the US authorities imposed stricter capital controls, but they never attempted to restrain Eurodollar banking via restrictions on settlement. This episode shows that offshore use of a currency is possible in the presence of significant capital controls. But there still needed to be channels allowing onshore settlement and at least some degree of convertibility for purely financial transactions. China seems to be moving to fulfilling these supply side conditions. But the demand-side factors may remain unachieved for several years to come. Last, the episode also shows that London's singular role in the internationalization of the dollar was due to its more open regulatory framework – a comparative advantage that it does not have to the same extent today.

1965–80: Increasing pressure on the Bretton Woods System, but continuation of Eurodollar use

Once the US began running current account deficits, it started to impose stricter capital controls which increased the use of the Eurodollar market. By the early 1960s, both the US and the UK were running current

account deficits, which led to the so-called Triffin Dilemma: once the offshore stock of dollars was larger than US gold reserves, the credibility of the peg to gold declined. This prompted the US to impose stricter capital controls, eg the introduction of a tax on offshore capital gains. This, in turn, further increased the incentives for conducting cross-border investments via the Eurodollar market, where the tax did not apply (Duffy & Giddy, 1994). During this period, the Euro-bond market in dollars was established: the offshore issuance of dollar-denominated debt. And the Eurodollar market became heavily used for transactions between non-US-residents (Figure 1, second row). But attempts to prevent fears of devaluation proved futile and, eventually, Britain was forced to devalue in 1967 and the US devalued in 1968. This finally led to the break-down of the Bretton Woods system of fixed exchange rates in 1971. Subsequently capital controls were lifted and financial systems were liberalized. The arbitrage advantages of using dollar offshore disappeared. But the Eurodollar market did not decline – in fact it more than doubled in size over the next 20 years. While the role of the Eurodollar market in the breakdown of Bretton Woods was certainly not central, it may have been a contributing factor by weakening the impact of capital controls that were aimed at preventing it.

1980-today: Evolution of the Eurodollar market

Even though many arbitrage opportunities disappeared the Eurodollar market continued to grow from about 10 percent of total dollar intermediation in the 1970s to about one-quarter in 2011. The UK has the largest share of Eurodollar banking at 20% of the total Eurodollar market (He & McCauley, 2010). And according to some estimates, 70% of all Eurobonds are traded in London. While US-residents were at first net creditors on the Eurodollar market, they became net debtors by the mid-1990s. The use of Eurodollars is manifold: (i) 60 percent are claims of non-US residents on other non-US residents (pure offshore); (ii) one-third are claims of US residents vis-à-vis non-US residents that are offset by claims of non-US residents against US-residents (round-tripping) and (iii) roughly ten percent are net flows from non-US to US-residents (Box Figure 1, third row) (He & McCauley, 2011). This highlights the complex and manifold uses of a global currency: If the renminbi is to become a dominant currency it will need to be used for transactions between non-residents; it will be used by residents for round-tripping transactions, including for potential regulatory arbitrage purposes and it will also comprise net renminbi flows out of and into mainland China.

Box Figure 1.The Development of the Eurodollar Market
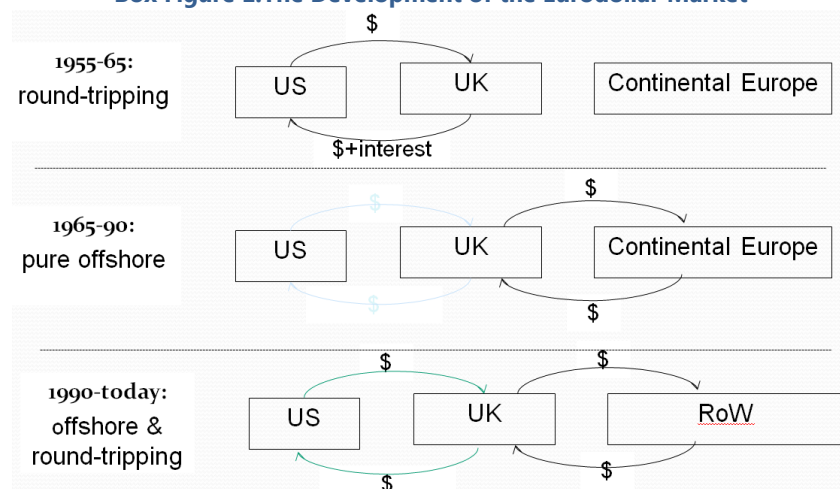
D. Concluding Remarks

27.   **The foregoing analysis shows that the UK's systemic and globally inter-connected financial system can be a potential source of outward spillovers, negative and positive.** The two thought experiments discussed in this paper—repo market stress spilling over from global shadow banks to UK banks (and then to the rest of the world), following an interest-rate snapback; and the UK's medium-to-long-term role in the internationalization of Chinese banking activity and the renmbinbi—lay out possible transmission mechanisms and quantifications for these spillovers. They also point to the appropriate policy implications for the UK authorities, namely: ensuring effective oversight of shadow banking activity and institutions, including through engagement with other regulators and international bodies; and positioning the UK financial system for China's rising global financial integration, including through maintaining the UK as a reliable and resilient center for international finance.

References

Benelli, R, 2011. "Potential Impact on Global Bond Markets of Reallocating Reserves,'' China: Spillover Report for the 2011 Article IV Consultation and Selected Issues, (Washington: International Monetary Fund).

Chitu, Eichengreen & Mehl, 2014. "Network effects, homogenous good and international currency choice—new evidence on oil markets from an older area," *ECB Working Paper Series,* No 1651; March.

Dufey, G., and I. Giddy, 1994, *The International Money Market,* Prentice Hall International.

Eichengreen, B, 2001. "Capital Account Liberalization: What Do Cross-Country Studies Tell Us?" World Bank Economic Review, Vol. 15, No. 3, pp. 341–65, (Washington).

Eichengreen, 2008. "Globalizing capital—a history of the international monetary system," Princeton University Press.

Eichengreen, B., M. Flandrea, 2010. "The Federal Reserve, the Bank of England, and the Rise of the Dollar as an International Currency, 1914–1939," IHEID Working Papers 16–2010, Economics Section, The Graduate Institute of International Studies.

He, D., L. Cheung, W. Zhang and T. Wu, 2012. "How Would Capital Account Liberalization Affect China's Capital Flows and the Renminbi Real Exchange Rates?" China and the World Economy, Vol. 20, No. 6, pp. 29–54.

He, D. And R. McCauley, 2012, "Eurodollar banking and currency internationalisation," *BIS Quarterly Review,* June.

He, D. and R. McCauley, 2010. "Offshore Markets for the Domestic Currency: Monetary and Financial Stability Issues," BIS Working Paper No. 320, September.

Hills, R., J. Hooley, Y. Korniyenko and T. Wieladek (forthcoming). "The International and Domestic Transmission of Bank Liquidity Shocks: Evidence from the UK," mimeo, Bank of England.

Hooley, J, 2013. "Bringing Down the Great Wall? Global Implications of Capital Account Liberalization in China," *Quarterly Bulletin* Q4 2013, Bank of England.

Schenk, C., 1998, "The Origins of the Eurodollar Market in London: 1955–1963"; *Explorations in Economic History*, vol. 35, 221–238

Segoviano, M, 2006. "Consistent Information Multivariate Density Optimizing Methodology," London School of Economics .*Financial Markets Group,* Discussion Paper 557.

Segoviano, M. and C. Goodhart, 2009. "Banking Stability Measures," IMF Working Paper 09/4

Segoviano, M., S. Malik, A. Bouveret and P. Lindner, 2014. "Financial System Stability Measures: Systemic Risk and Interconnectedness including Banks and non-Banks," IMF WP forthcoming.

Tamim, B. and F. Ohnsorge, 2013. "Do Inflows or Outflows Dominate? Global Implications of Capital Account Liberalization in China," IMF Working Paper 13/189, Washington, DC.

Tarashev, N., C. Borio, K. Tsatsaronis, 2010. "Attributing Systemic Risk to Individual Institutions," *BIS Working Paper,* No. 308.