Developing Housing Finance Systems

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1. Introduction

Housing finance systems should promote the attainment of adequate housing outcomes for all in an economy. But some are too small, unable to help ameliorate the substantial housing deficits faced in many countries. Others are quite large, apt (but not necessarily destined) to create instability and substantial volatility, as the global financial crisis has highlighted. While the financial instability of some large systems – notably that of the United States – has been the recent focus in many advanced economies, there are more countries with housing finance systems that are too small.

Our aim in this paper is to provide countries that would like to grow their housing finance systems with a simple framework that highlights factors that are all within a government's set of feasible instruments. The framework extends the Warnock and Warnock (2008) assessment of mortgage markets around the world. We gather data from many sources on the size of mortgage markets in 61 economies as of 2009 and show that there is substantial variation. Some countries, such as Australia, Denmark, Ireland, the Netherlands, New Zealand, Sweden, Switzerland, the United Kingdom and the United States, have quite sizeable mortgage markets that are greater than 80 per cent of GDP, while many others are at less than 10 per cent. We show that this variation in mortgage size can be described, to some extent, by differences in a few fundamental factors, such as the strength of legal rights for creditors and borrowers (mainly bankruptcy and collateral laws), the depth of credit information systems, the ease of registering property (as a proxy for how well the housing market works), and macroeconomic stability. Our analysis of fundamental factors that support the development of mortgage markets provides a framework for countries that want to grow their housing finance systems in a robust, sustainable manner.

An example helps underscore some of the paper's main lessons. Brazil has one of the world's largest and fastest growing economies, and has made impressive progress along a number of dimensions in the past 15 years. But Brazil has a tiny mortgage market (only 3 per cent of GDP), much smaller than a country like Malaysia (31 per cent of GDP). Why? Our analysis shows that Brazil's housing finance system is small in part because its legal system still provides little protection for borrowers and lenders (and hence loans are less likely to be made), its credit information systems are less informative than they could be (negative information is often discarded, making it difficult to create scoring models), its property registration process is onerous and time consuming, and the economy still has the remnants of past macroeconomic instability. In this environment, private

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lenders are naturally unwilling to do anything more than required by law; they are forced by the government to set aside some portion of savings to fund home loans, and they do that and nothing more, leaving Brazil with both a tiny mortgage market and a sizeable housing deficit of almost 6 million homes with about one-quarter of the population living in slums (Galindo *et al* 2012).

The paper proceeds as follows. The next section presents data on the size of mortgage markets for 61 economies. Section 3 presents a framework of housing finance that then informs reduced-form regressions that are estimated in Section 4. Some ancillary regressions are presented in Section 5. Section 6 concludes.

2. The Size of Mortgage Markets

Figure 1 shows mortgage debt as a percentage of GDP for 61 economies.[1] The panels are separated by region; each has the same scale (0 to 120 per cent) for ease of comparison across regions. There are great differences in the size of mortgage markets across regions and economies (Table 1). Within the set of emerging markets, mortgage markets in emerging Asia are moderately sized, averaging 12 per cent of GDP for the region with the largest being in Malaysia (31 per cent) and Thailand (19 per cent). In contrast, housing finance systems in Latin America tend to be quite small, with an average of mortgage debt that is 5 per cent of GDP. Chile and Panama have the largest mortgage markets in the region, with debt averaging 20 per cent of GDP, but other countries in the region have much smaller markets (Mexico, 9 per cent; Brazil, 3 per cent; Argentina, 2 per cent). Mortgage markets tend to be much larger in advanced economies, averaging roughly 60 per cent of GDP, but they vary greatly across countries. Some advanced economies (such as Denmark, the Netherlands and Switzerland) have mortgage markets that are roughly 100 per cent of GDP, while others (such as Australia, New Zealand and the United States) average around 80 per cent. Japan and Korea are much smaller at around 20 per cent of GDP.

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1   To gauge how well a housing finance system functions, other measures could be used. These might include access to housing finance (e.g. the share of households that has access to appropriate financing for shelter) and the availability of a range of financing options. But all else equal, larger housing finance markets are likely to reach a greater proportion of the population and, as a measure, size has the important advantage that it can be constructed for a wide range of countries.

Figure 1: Mortgage Debt
Per cent of GDP, 2009
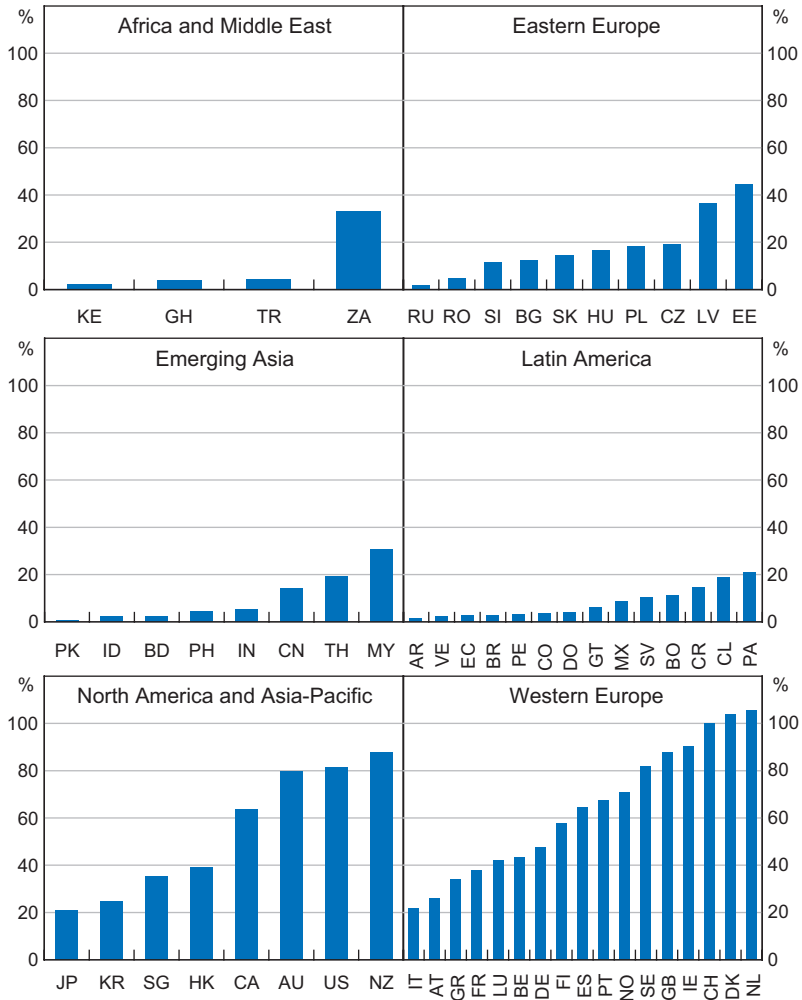
Note: See Glossary for a listing of country codes

Sources: Bank of Ghana; European Mortgage Federation; Swiss National Bank; Titularizadora Colombiana; UN-Habitat; national sources

Table 1: Summary Statistics
GDP-weighted means

	Advanced economies	Emerging market economies	Latin America	Emerging Asia	Eastern Europe
Mortgage Debt Outstanding	61.4	9.4	5.4	12.4	8.3
Legal Rights for Borrowers and Lenders	7.2	5.5	4.0	6.3	5.1
Credit Information	5.6	4.5	5.2	4.2	4.8
Ease of Registering Property	7.4	6.2	4.4	6.6	7.1
Inflation Volatility	1.14	3.34	4.1	2.3	4.4

Note: See Appendix A for variable definitions and sources

3.   Sustainable Housing Finance Systems: Basic Infrastructure

In this section we present a model of the size of a country's mortgage market that will inform our reduced-form regressions. The model is similar to the one in Warnock and Warnock (2008, henceforth WW) which, using cross-sectional data from around 2005, studied 62 economies to examine the extent to which markets enable the provision of housing finance. The study found that, after controlling for country size, economies with stronger legal rights for borrowers and lenders (through collateral and bankruptcy laws), deeper credit information systems, and a more stable macroeconomic environment have deeper housing finance systems. Not surprisingly, many factors associated with well-functioning housing finance systems are those that enable the provision of long-term finance (Burger and Warnock 2006; Chan, Davies and Gyntelberg 2006; Davies, Gyntelberg and Chan 2007; Burger, Warnock and Warnock 2012). The results and policy implications of the WW analysis have important lessons for emerging market economies looking to grow their mortgage sectors, showing empirically some fundamental preconditions that are necessary to develop mortgage markets. We enhance and update that analysis below.

Our underlying framework is the supply of and demand for housing finance. Demand for housing finance is derived from the demand for owner-occupied homes, which in turn depends on demographic, financial and institutional factors such as the rate of household formation, income levels, affordability and the ease of purchasing (and registering) property. On the supply side, one way to think about the provision of housing finance is to split it into two components: (i) the provision of housing finance by a lender that has ample funds at hand; and (ii) the mobilisation of funds within an economy so that lending institutions have access to funds.

In addition, housing finance should be longer-term in nature (as housing costs are typically a multiple of annual income). For lenders with adequate funds to choose to allocate some portion to long-term housing finance, a number of preconditions should be in place:

- *Information on the borrower.* To adequately price a loan, a lender must have information on the creditworthiness of prospective borrowers that enables a determination of the probability of default. The information could be produced by a standardised and accurate source of credit history, such as public credit registries or private credit bureaus. It is best if the source has wide coverage of the population, and the most informative source would include negative as well as positive transactions. Absent standardised information on credit histories, standard banking relationships, in which a bank spends considerable resources acquiring information on potential borrowers, would work but they would be limited (at least geographically, if not in other ways) in the capacity of the lenders and of the housing finance system as a whole to create loans.

- *Ability to value the property.* There should be an ability to determine the market value of the property. This is a natural outcome of a well-functioning housing market in which detailed information on housing transactions is maintained in a systematic way. For example, if data on the sale price and relevant features of the home (location, size, age, etc) are maintained in a mandatory property registry, appraisers can more accurately value prospective homes for lenders and borrowers.[2]

- *Ability to secure collateral.* The lender should to be able to secure collateral against the loan in case of default. The property itself is an obvious candidate for that collateral, providing that, in the case of default, the lender can seize the property. This requires that there is something resembling clear title and that the legal system allows the lender to seize collateral.

- *Macroeconomic stability.* The macroeconomic environment should be stable. If inflation is volatile, the lender would incur substantial interest rate risk if it lends at a fixed rate. In an unstable environment, lenders will typically pass on this risk to the borrowers – who are less likely to fully understand it – by only offering variable-rate loans. Substantial interest rate risk, no matter who bears it, will retard the development of the housing finance system, as either lenders will go out of business (e.g. the United States savings and loans crisis in the 1980s) or borrowers will be unable to repay their loans (or both).

If the conditions for long-term lending are in place, lenders must also have ample access to funds in order to lend:

- *Sources of funds.* In the primary market, deposit-taking institutions, such as banks, can fund mortgages through deposits. However, because deposits are short term, if this is the only source of funds, housing loans will tend to be short term or at variable rates.[3] Short-term loans, given that housing is expensive, are insufficient to fund home purchases.[4] Potential

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2   The property registry and appraisal system will also enhance the efficiency of the overall housing market, as consumers will have better information to judge the relative value of various properties.

3   More generally, a well-developed housing finance system will typically have a diversity of lenders in the primary market (such as non-depository mortgage specialists, non-government organisations, microfinance institutions, and contractual savings systems) and greater specialisation within the origination process. See Follain and Zorn (1990) on the unbundling of the mortgage finance business.

4   Short-term funds can be usefully employed to fund incremental housing, as is common with housing microlenders in developing countries.

borrowers might find variable-rate loans attractive, but they are not likely to be able to gauge the substantial interest rate risk they are bearing (CGFS 2006). In addition, a reliance on deposits implies that funding sources are limited geographically, which increases risk. An important additional source of funds for the housing finance system is the secondary market, which buys loans from the primary market and finds many ways to raise funds.[5] Participants in the secondary market include mortgage securitisers, who bundle and repackage mortgages (or parts of mortgages) to create new securities, and investors in these mortgage securities. The securitisers can be public (such as Cagamas Berhad in Malaysia, or Fannie Mae, Freddie Mac or Ginnie Mae in the United States) or private (such as GE Capital); the investors can be domestic or foreign institutions or individuals. Notwithstanding recent events in markets for mortgage securities, secondary mortgage markets can be an important component of a country's broader capital markets.

- *Additional sources of liquidity*. Whatever the usual sources of funds, it can be important to have a backstop, such as a governmental liquidity window, in case of temporary liquidity crunches.

In summary, a basic infrastructure that can enable a well-functioning housing finance system includes factors that promote long-term lending (the ability to value property and to seize it in the case of default, information on the creditworthiness of potential borrowers, macroeconomic stability) and factors that promote the mobilisation of funds (be it through savings and deposits, capital markets, a governmental liquidity window or secondary markets).[6]

We next use the above framework to inform reduced-form regressions.

4. Empirical Determinants of the Size of Mortgage Markets[7]

We model the size of the housing finance sector as measured by the ratio of residential mortgage debt outstanding to GDP as of a point in time, 2009. Analysis of the evolution of housing finance systems is not as easy as one might wish because, for many countries, data through time are not available. Once the decision is made to explain cross-country differences in the size of mortgage markets, the simple supply and demand framework discussed in the previous subsection readily informs reduced-form regressions. Many factors influencing housing finance supply and demand are available from the World Bank's Doing Business reports.[8] *Legal Rights for Borrowers and Lenders* is an index that ranges from 0 to 10, with higher scores indicating that collateral and bankruptcy laws are better designed to expand access to credit; for a mortgage lender to be comfortable lending long-term, it needs to be able to secure collateral against the loan, and this ability hinges on being able to seize the collateral (the property) in the case of default. The lack of legal protection for creditors has been identified as the single most important regulatory limitation for

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5   For example, the development of Fannie Mae in the United States stemmed from market illiquidity. See Davies *et al* (2007) for a discussion of housing finance agencies in Asia.

6   These factors can also be recast in terms of risk mitigation (Van Order 2005). Another important factor is the regulatory and supervisory environment.

7   Our focus on the size of the mortgage market is determined more by current data limitations than a belief that size is the most relevant characteristic. Policymakers should not infer from our analysis that bigger mortgage markets are always and everywhere better, an inference that would overlook important notions of unsustainable debt levels and financial sector stability.

8   Many of the explanatory variables are available through the Getting Credit portion of the World Bank's Doing Business database; see <http://www.doingbusiness.org/methodology/getting-credit> for a complete description.

the development of credit markets in some emerging markets. Regarding housing finance, crucial weaknesses in many emerging markets include the duration of legal proceedings in protecting creditor rights, which can take more than three or four years; the excessive number of appeals allowed on behalf of the debtor during the process; and the lack of political will to protect such rights (Galindo *et al* 2012). *Credit Information* is an index that ranges between 0 to 6 and measures the depth of lenders' access to standardised and informative sources of credit information on potential borrowers, with higher values indicating greater availability of credit information.[9] *Ease of Registering Property* is a variable that measures the ease with which property can be registered for use after purchase, which is crucial for the assets that back mortgages to be used as collateral. An adequate property registry allows potential lenders to evaluate the track record and the liens that rely on the properties they would finance, and hence, by increasing transparency, enhance the value of the mortgage-backed assets. Doing Business ranks countries using three component indicators: the number of procedures, the time and the official costs necessary for a buyer to purchase a property and to transfer the property title so that it can be used, sold, or posted as collateral. We recast the World Bank's ranking into the variable, *Ease of Registering Property*, that ranges from 0 (very difficult and costly) to 10 (easy). The final measure is *Inflation Volatility*, which is related to interest rate risk that can impede long-term lending; we use the standard deviation of quarterly CPI inflation rates over the period 2000 to 2009. *Inflation Volatility* might seem like a simple variable, and it is, but it is vital: countries with high inflation volatility tend not to have functioning bond markets (Burger *et al* 2012), nor will they have mortgage markets of any size.

Figures 2 to 5 show each economy's score on these four dimensions; regional GDP-weighted means for these variables are provided in Table 1.

The depth of credit information (Figure 2) does not vary much across economies. While the Philippines scores 3 out of 6, most economies score 5 or 6. The lack of variation across economies limits this variable's usefulness in cross-sectional regressions, but in reality there is much more variation in the quality of economies' credit information systems than this measure is picking up. A further issue with *Credit Information* is that it does not take into account the percentage of the adult population that is covered. For example, Brazil rates very well, scoring 5 out of 6, but only 27 per cent of adults are included in its public credit registry and, while the private credit registry covers a broader set of the population (54 per cent of adults), it does not maintain both positive and negative information about borrowers, making it very difficult to create an informative credit score.

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9   While credit information is market enhancing, over-reliance on externally generated credit scores can lead to instability (Ellis 2008).

Figure 2: Strength of Credit Information Systems
0 = poor credit information to 6 = strong credit information, 2009

Note: See Glossary for a listing of country codes
Source: World Bank and IFC (2010)

There is much more variation in *Legal Rights for Borrowers and Lenders* (Figure 3), with many countries in Latin America, for example, scoring 5 or below (out of 10) and many economies in other regions scoring much better. While advanced economies tend to score better than emerging markets on this measure, this is not true in every case: three euro area countries – Greece, Italy and Portugal – score at Brazil's level.

Figure 3: Strength of Legal Right for Borrowers and Lenders
0 = poor legal rights to 10 = strong legal rights, 2009
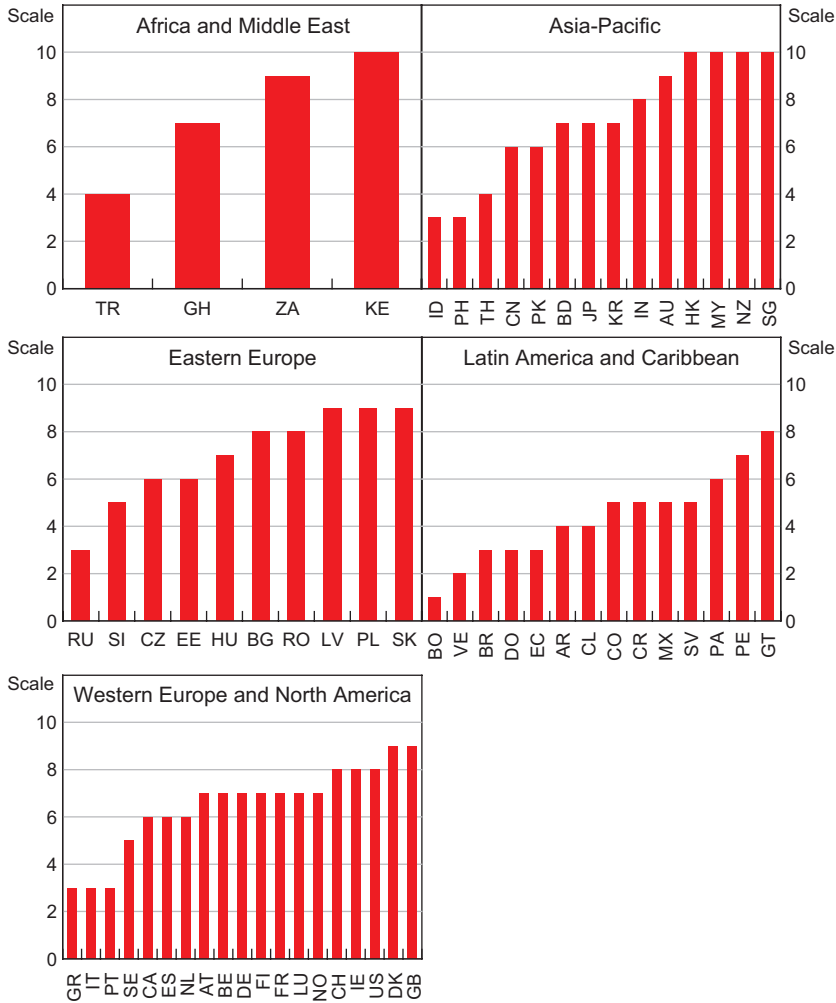
Note: See Glossary for a listing of country codes
Source: World Bank and IFC (2010)

Substantial variation across economies is also evident for *Ease of Registering Property* (Figure 4). For example, in Latin America, Brazil scores only 3 out of 10, but Chile scores 8 and Peru scores 9; in emerging Asia, the Philippines scores 4 while Thailand scores 10; and among developed countries, Greece scores 4 while Sweden scores 9 out of 10. Other interesting observations are that France scores as poorly as anywhere in the developing world; Italy is no better than the typical Latin American country; and there are many well-scoring Latin American countries as well as relatively high scores for Ghana and Turkey.

Figure 4: Ease of Registering Property
0 = difficult to 10 = easy, 2009
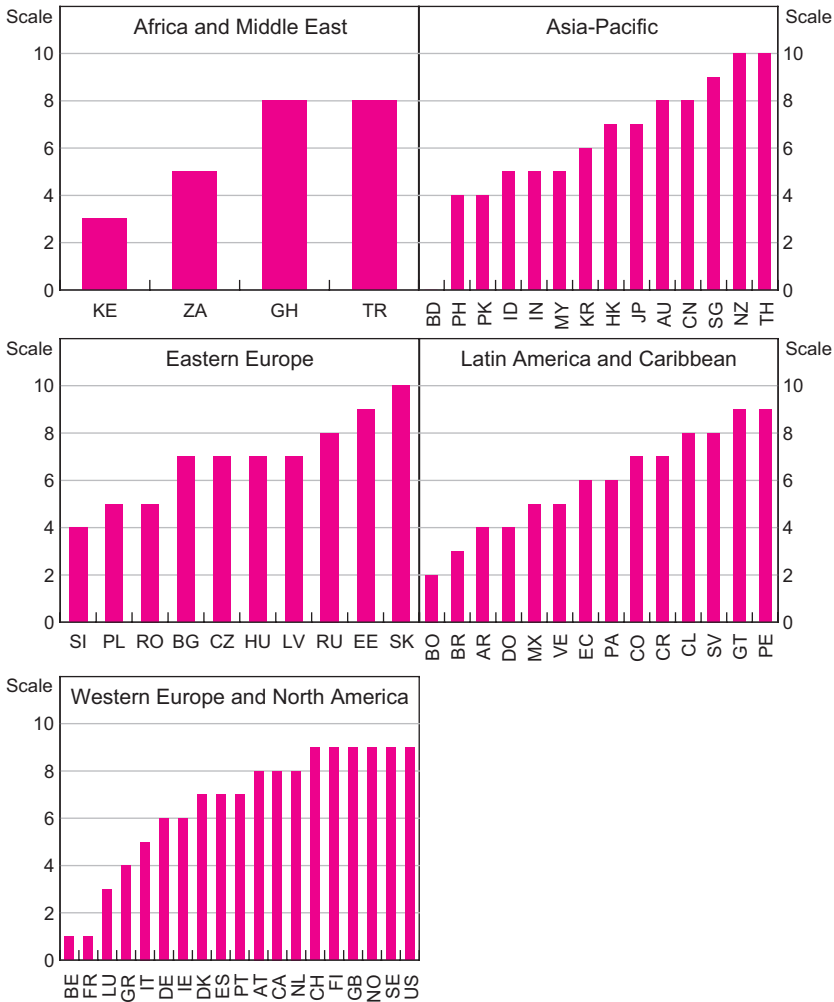
Note: See Glossary for a listing of country codes
Source: World Bank and IFC (2010)

Reasonably low inflation volatility is evident across most regions, although countries like Ecuador, Turkey and Romania still have substantial macroeconomic instability (Figure 5).[10]

Figure 5: Inflation Volatility
2000–2009
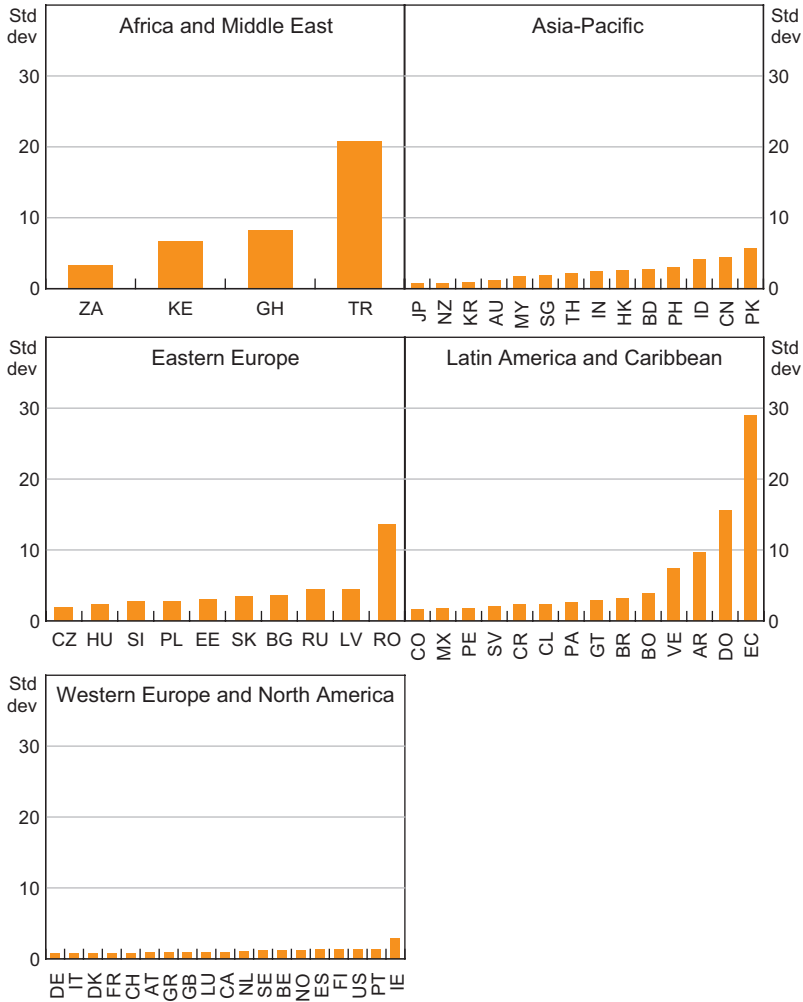
Notes: Standard deviation of 2000:Q1–2009:Q4 annual inflation rates; see Glossary for a listing of country codes

Sources: IMF, International Financial Statistics; authors' calculations

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10 We calculate inflation volatility over a 10-year period, so even if a country improves significantly in terms of macroeconomic stability, the sins of the past do not quickly disappear. We feel this is appropriate: it takes years to cleanse an economy of macroeconomic instability.

Table 2 shows results for regressions of the size of mortgage markets as a percentage of GDP on these underlying factors. Across all 61 economies in our sample, economies with stronger legal rights for borrowers and lenders, greater ease in registering property, and less inflation volatility have larger mortgage markets. In emerging markets, the factors are similar except that economies with deeper credit information systems have larger markets, while the property registration variable is (marginally) insignificant. Among advanced economies, the sample size is quite small at only 25 observations, and ease of registering property comes through as the only significant variable.[11]

Table 2: Cross-country Analysis of the Size of Mortgage Markets
Dependent variable = *Mortgage Debt Outstanding as a Per Cent of GDP*

	(1) All economies	(2) Emerging market economies	(3) Advanced economies
Legal Rights for	3.30**	1.31*	1.48
Borrowers and Lenders	(1.39)	(0.69)	(2.31)
Credit Information	1.44	1.71**	−2.65
	(1.88)	(0.76)	(6.84)
Ease of Registering	3.50**	1.00	5.71**
Property	(1.34)	(0.66)	(2.20)
Inflation Volatility	−1.84***	−0.47***	−1.31
	(0.67)	(0.15)	(13.19)
Country Size	1.49	−1.73	−1.37
	(2.05)	(1.13)	(5.89)
Observations	61	36	25
R-squared	0.34	0.40	0.28

Notes: OLS estimation; constants are included but not reported; robust standard errors are in parentheses; ***, **, and * indicate siginificance at the 1, 5 and 10 per cent levels, respectively; see Appendix A for variable definitions and sources

The point estimates imply substantial economic significance for some of the factors. For example, the point estimates in column (1) suggest that changing the value of the *Legal Rights for Borrowers and Lenders*, *Ease of Registering Property* and *Inflation Volatility* variables from the mean values for emerging markets to the mean values for advanced economies (listed in Table 1) would be associated with increases in mortgage debt-to-GDP ratio of 5.6, 4.2 and 4.0 percentage points, respectively. While we caution that these are simple regressions that cannot imply causation,

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11 Across economies, mortgage terms also vary. WW note that as at 2005, no emerging market economy had widespread availability of long-term fixed-rate mortgages. Only a few – Malaysia, Thailand and some transition economies in Eastern Europe – had typical maturities of 30 years, and another, non-overlapping subset tended to have fixed-rate mortgages. In contrast, many advanced economies had mortgages with terms of 25 years or greater, and roughly half had predominantly fixed-rate products. While data on such characteristics were not complete or reliable enough to be included in the WW empirical analysis, they note that it is not clear *a priori* whether the prevalence of fixed- or variable-rate mortgages in any economy owes to lender or borrower preferences. It appeared to be the case that within the set of developed countries, those with more stable inflation tend to have a greater share of fixed-rate mortgages.

such increases would be sizeable given that average mortgage debt is 9.4 per cent of GDP in emerging markets.

The regression results in Table 2 show a clear path for countries to take to enable the development of their housing finance systems. Attaining macroeconomic stability is of vital importance. That might seem difficult in a world of substantial international shocks, but many countries have implemented monetary and fiscal policies that increase the probability of achieving low and stable inflation. Somewhat easier, at least if one leaves politics aside, is to enact laws that allow for the creation of meaningful credit information systems and enable better protections of legal rights for borrowers and lenders by strengthening bankruptcy and collateral laws.[12] Based on our regression results, if the Philippines improved their scores for *Legal Rights for Borrowers and Lenders* and *Credit Information* to match those of Malaysia, this would enable a quadrupling of the Philippine housing finance system from just 4.5 per cent of GDP to 18 per cent. Given a housing deficit of between 3 and 5 million units in the Philippines (Monsod 2011), such an increase in the size of the Philippine mortgage market, were it enabled by improvements in the underlying infrastructure, would seem to almost surely be welfare improving.[13]

5. Additional Regression Analysis

Countries with deeper financial systems, as measured by private credit as a per cent of GDP (Figure 6), are likely to have larger mortgage markets, in part because the two measures share a number of underlying determinants.

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12 An interesting question to ask is whether it could be shown, were times series data on mortgage debt available, that changes in legal rights lead to changes in the size of the mortgage market. Djankov, McLiesh and Schleifer (2007) investigated this question for private credit in a large sample (129 countries) using 25 years of data. They acknowledged that tackling this question would be difficult, as in their sample there were only 32 episodes of changes in creditor rights, many of which were in former communist countries. Thus, it is not surprising that in our smaller, shorter sample legal rights did not change for most countries. Two countries with substantial improvements in the legal rights index are Guatemala (+5) and Peru (+4). While our cross-sectional mortgage debt data do not allow a formal analysis of such changes, a micro investigation would be worthwhile.

13 It should be noted that *The Republic Act No 9510*, or *Credit Information System Act*, which will establish the Central Credit Information Corporation (CIC) that will pool credit information from financial institutions, was signed into Philippine law in 2008. The CIC is expected to launch operations in 2013. See Agcaoili (2012).

Figure 6: Private Credit
Per cent of GDP, 2009
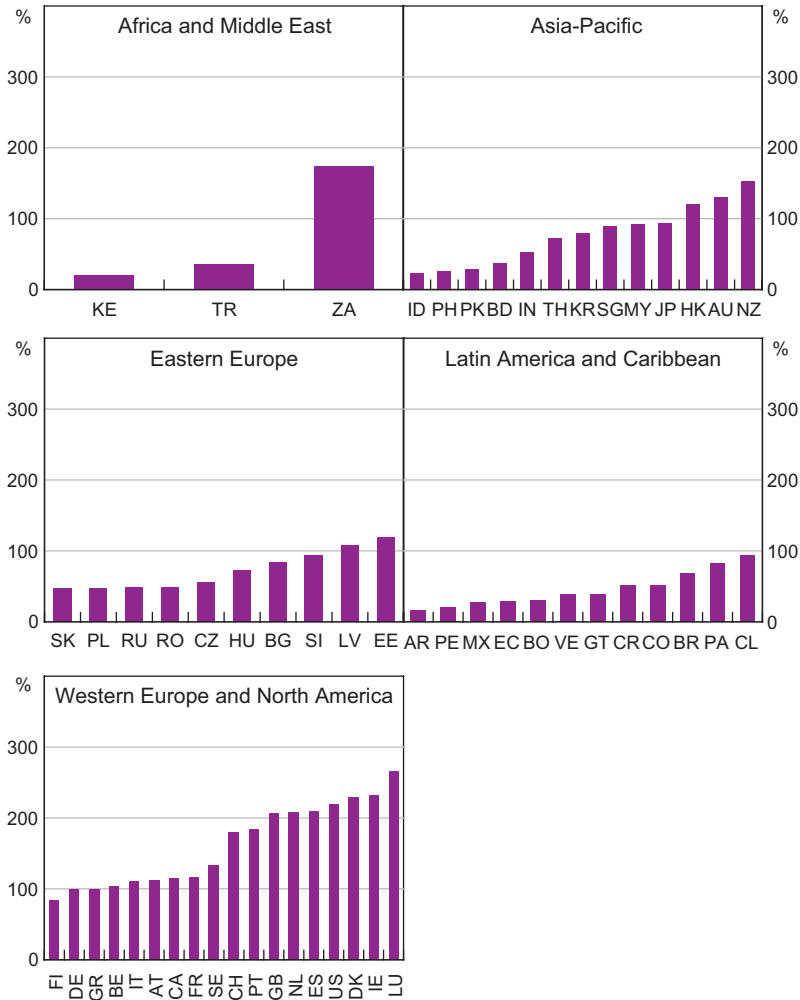
Note: See Glossary for a listing of country codes
Sources: Financial Structure Dataset (Beck, Demirgüç-Kunt and Levine (2000), revised November 2010);
           authors' calculations

But some of these shared factors seem to explain the size of the mortgage debt market above and beyond their effect on private credit. Columns (1) to (3) of Table 3 show that many of the factors that explain mortgage market size as a per cent of GDP – *Legal Rights for Borrowers and Lenders*, *Credit Information*, *Ease of Registering Property*, and *Inflation Volatility* – also explain mortgage debt outstanding as a per cent of private credit.

Table 3: Additional Analysis of the Size of Mortgage Markets

Dependent variable	Mortgage debt as a per cent of private credit[a]			Mortgage debt as a per cent of GDP (4)
	(1) All economies	(2) Emerging market economies	(3) Advanced economies	
Legal Rights for Borrowers and Lenders	1.29*	0.39	0.75	
	(0.73)	(0.75)	(1.24)	
Credit Information	2.51**	2.56**	2.90	
	(1.15)	(0.97)	(4.77)	
Ease of Registering Property	1.74*	0.62	2.15	2.79**
	(0.92)	(0.68)	(1.62)	(1.31)
Inflation Volatility	−1.10***	−0.53***	−3.58	
	(0.32)	(0.17)	(3.96)	
Country Size	−0.66	−2.78**	−3.53	
	(1.15)	(1.17)	(3.38)	
Housing Price Volatility				−89.58*
				(45.90)
Private Credit (instrumented)[b]				49.43***
				(7.64)
Observations	58	34	24	37
R-squared	0.37	0.42	0.31	0.80

Notes: Constants are included but not reported; robust standard errors are in parentheses; ***, **, and * indicate siginificance at the 1, 5 and 10 per cent levels, respectively; see Appendix A for variable definitions and sources
(a) OLS estimation
(b) Private credit is instrumented using *Legal Rights for Borrowers and Lenders*, *Credit Information*, *Inflation Volatility*, *Country Size* and *Contract Enforcement*

Two additional considerations are addressed in column (4). First, it could be that for a given amount of funds, the decision by lenders to dedicate a portion to housing finance could be influenced by the volatility of housing collateral. To capture this potential effect, we calculate the volatility of housing prices using the four-quarter-ended percentage change in quarterly housing prices over the 2000 to 2009 period and include it as an explanatory variable. The underlying housing price measure, from Cesa-Bianchi (2012), is available for a smaller sample of 38 countries, a mixed sample of mostly advanced economies but with some emerging markets.[14] Second, the results in column (4) are estimated using instrumental variables. Private credit is instrumented using variables similar to those used in Djankov *et al* (2007) – *Legal Rights for Borrowers and Lenders*, *Credit Information*, *Inflation Volatility*, *Country Size* and *Contract Enforcement*. Two housing-specific variables (*Ease of Registering Property* and *Housing Price Volatility*) also enter the regression separately. As expected, private credit (and its underlying determinants) is of primary importance in explaining the amount of mortgage debt outstanding. In addition, larger mortgage markets are seen in countries with

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14 The Cesa-Bianchi housing price series bring together prices from various sources, including the BIS property price database (available at <http://www.bis.org/statistics/pp.htm>).

less volatile housing collateral (i.e. lower house price volatility) and lower costs to registering property.

6. Conclusion

We present a road map that countries with small housing finance systems can use to grow their markets. Countries with stronger bankruptcy and collateral laws, deeper credit information systems, greater ease of registering property (a proxy for how well the secondary housing market works), and less macroeconomic instability have larger mortgage markets.

We note that bigger is not always and everywhere better. For a variety of reasons, size (as measured by mortgage debt outstanding scaled by GDP) is not an optimal measure of how well a housing finance system functions. Mortgage market size can be heavily influenced by price dynamics, allowable loan-to-value (LTV) ratios, and tax considerations – favourable tax treatments in countries such as the Netherlands, Switzerland and the United States tend to result in a larger stock of mortgage debt. In addition, mortgage markets that are too large or growing too quickly might contribute to macroeconomic instability (a housing bubble requires, all else equal, a larger housing finance market).

An important recent focus in the literature that we do not address in this paper is the impact of credit conditions on housing price dynamics (see, for example, Crowe *et al* (2011); Duca, Muellbauer and Murphy (2011); Muellbauer and Williams (2011)). We have done preliminary but untabulated analysis that indicates that countries with higher LTV ratios have larger mortgage markets (without materially affecting the significance of other variables). We do not include LTV ratios in our reported regressions because our primary goal is to identify fundamental factors that determine sustainable mortgage markets. We view differences in LTV ratios more as distortions, rather like differences in mortgage interest deductibility.

Much more work on the relationship between housing finance and financial stability is warranted. Indeed, there are many questions yet to answer. Are smaller mortgage markets less prone to bubbles? As countries develop their mortgage sector infrastructure, how should they include monitoring and oversight to detect inappropriate lending, pricing and risk management? Are bank-based financial systems less prone to instability? What lessons can we learn from the failure of the government-sponsored enterprises in the United States, and what is the proper role of the government?

Finally, more analysis of mortgage markets should be conducted once a broad panel dataset of mortgage market size and characteristics becomes available. For some countries such a dataset is already available, and the time dimension could lead to interesting analysis of changes in housing finance systems. For example, in Europe data are now available on the evolution of the size of 27 mortgage markets from 2001 to 2009. The European data indicate that Ireland's mortgage market was 33 per cent of GDP in 2001, 52 per cent by 2004 and 70 per cent by 2006. The doubling in size in just five years was likely to have been a precursor of future problems. If time series can be obtained for other regions, a fuller analysis of the time dimension would be feasible, adding to our understanding of mortgage markets.

Appendix A: Data

Contract Enforcement

Description: Contract enforcement measures the ease (in terms of time, costs and number of procedures) of enforcing contracts. The raw 0 to 181 country ranking is transformed into an index ranging from 0 to 10, with a higher score indicating greater ease in enforcing contracts.

Source: World Bank and IFC (2010)

Country Size

Description: Country size is measured as the log of the 2000–2009 average of GDP (in PPP terms).

Source: http://www.doingbusiness.org/

Credit Information

Description: Credit information is the average of the 2006, 2007 and 2008 indices of the depth of lenders' access to standardised and informative sources of credit information on potential borrowers. The index ranges from 0 to 6, with a higher score indicating a greater availability of credit information (from either a public registry or a private bureau). This variable is lagged in the regressions because changes in credit information systems are likely to affect mortgage origination with a lag.

Source: World Bank and IFC (2010)

Ease of Registering Property

Description: Ease of registering property is an index of the ease (in terms of time and cost) with which newly purchased property can be registered for use (directly or as collateral) or sold. The index ranges from 0 to 10, with a higher score indicating relative ease in registering a property for use after purchase. The index is calculated by averaging three indices measuring: the number of procedures, the time and the official costs of registering property.

Source: World Bank and IFC (2010)

Housing Price Volatility

Description: Housing price volatility is the average of four-quarter-ended housing price growth; calculated using quarterly data over 2000–2009.

Source: Cesa-Bianchi (2012)

Inflation Volatility

Description: Inflation volatility is the standard deviation of quarterly CPI inflation rates, calculated over 2000–2009.

Source: IMF, International Financial Statistics database

Legal Rights for Borrowers and Lenders

Description: Legal rights for borrowers and lenders is the average of the 2007, 2008 and 2009 indices of the strength of legal rights. The index ranges from 0 to 10, with a higher score indicating that collateral and bankruptcy laws are better designed to expand access to credit.

Source: World Bank and IFC (2010)

Mortgage Debt Outstanding

Description: The ratio of mortgage debt outstanding to GDP in 2009, or latest year available.

Sources: Bank of Ghana; European Mortgage Federation; Swiss National Bank; Titularizadora Colombiana; UN-Habitat; national sources

Private Credit

Description: Private credit is defined as claims on the private sector by deposit money banks and other financial institutions as a per cent of GDP.

Source: Financial Structure Dataset (Beck, Demirgüç-Kunt and Levine (2000), revised November 2010)

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