Online Appendix

A simple domestic-market house price accounting exercise

Can the observed cross-country variation in housing prices be explained by factors that capture country-specific supply and demand? Consider a simple accounting identity, namely, a present value calculation for a typical household. Assume that the household allocates a fraction α of their annual income y to saving or debt repayment, and discounts future cash flows at a rate r. Then, the present value p of a typical property is given by:

$$p = \frac{\alpha y}{r}. \tag{1}$$

Here, αy captures the amount of disposable income the household is willing to allocate toward housing-related costs, which could be either mortgage or cash payments. We can also think of this as the rent that the household would be prepared to pay if they chose not to become a home-owner. The price-to-income ratio (p/y) is then equal to α/r, which implies two factors to consider as possible explanatory variables for house prices across locations and through time, namely, the rent-to-income ratio, and the discount rate.

A clear problem with this framework is that it only accounts for the valuation by a single household of a single residential unit. To extend the analysis to the broader housing market, we must somehow account for *aggregate* demand and supply. On the demand side, population growth is a significant factor. As the population increases, the number of households rises, increasing the number of potential buyers in the market. On the supply side, the rate of new construction determines the number of units available for purchase; a higher rate of new construction can mitigate upward pressure on prices associated with additional demand. A more complete accounting of housing affordability in a market might therefore include four variables: (i) the average rent-to-price ratio in the market, (ii) short- and long-term interest rates, (iii) the size of the population, and (iv) the volume of new housing construction.

How much of the observed variation of price-to-income ratios in the data can be explained by such simple supply-demand accounting in the domestic housing market? As a warm-up, the left-hand plot in Panel A of Figure A.1 shows that changes in nominal rental values have a strong correlation with changes in house prices (the R-squared in the bivariate regression stands at 70%), consistent with the prediction that the two market segments are strongly linked.

But what does this high correlation between prices and rents imply about housing affordability? To explore this question, we use a pooled panel regression which is guided by the simple accounting identity described above. The regression explains the annual level of the (indexed) house price-to-income ratio, using the annual level of the (indexed) rent to income ratio, short- and long-term interest rates (measured using 1 and 10-year government bond yields, respectively), the level of the population, and the level of new construction in each country in each year. We use cross-country comparable variables reported by the OECD, calculated for each year from 2000 to 2022.

The right-hand plot in Panel A of of Figure A.1 shows that differences in the size of the population explains 25% of the variation in price-to-income ratios, variation in short- and long-term rates, 7%, and new construction, approximately 3%. Allowing for interaction effects between the level of the population and the amount of new construction slightly increases the explanatory power of this simple model by around 5%. However, the explanatory contribution of rental market prices is negligible, once we control for income. While the rental value does capture local factors, i.e., the tenant needs to be physically present to consume housing services, a rental contract also entails a

relatively lower financial commitment over a shorter time period than an outright house purchase, and owning a house does not necessarily require the owner to consume the housing services directly. The difference between the two market segments (purchase and rental) in terms of whether physical presence is needed means that house purchase demand from overseas could have different effects on house prices and rental rates.

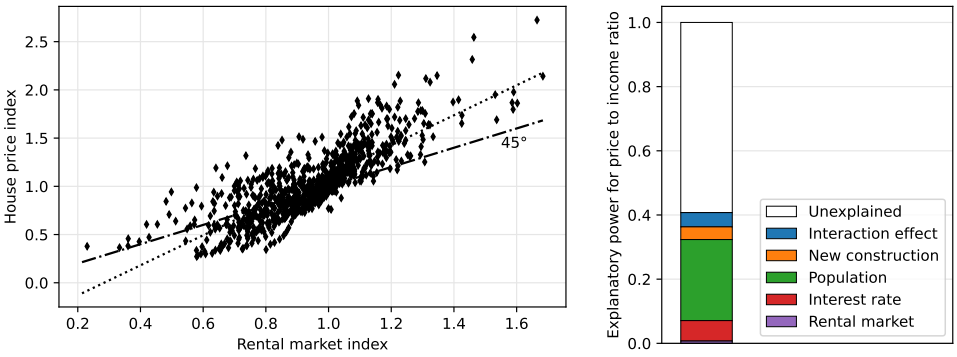
Before addressing this point in more detail, the summary of this initial "autarkic" analysis is that that plausible domestic factors explaing roughly 40% of the cross-country cross-time variation in our measure of housing affordability. Clearly, there is substantial remaining cross-country heterogeneity in movements in housing affordability (measured by the price-to-income ratio) that cannot be accounted for by these domestic factors alone. To illustrate this finding, Panel B of Figure A.1 reports the level of the price-to-income ratio for countries for which data is available between 2000 and 2022 and compares it against the predicted value implied by the "domestic factors" regression.

Of course, the remaining unexplained variation could also come from the fact that we have chosen imperfect proxies for the key determinants in our simple domestic supply-and-demand accounting exercise. In other words, the measures we are using to represent rent, interest rates, population growth, and new construction may not fully capture the underlying economic dynamics. To address this issue, we expand the model by incorporating two additional factors: home-ownership rates and the share of mortgages in the housing market. The rationale for including home-ownership rates is that house prices could be higher in countries or at times when a larger segment of the population owns homes. There is considerable variation in these home-ownership rates; famously, Germany has a far lower rate of homeownership than Southern and Eastern European countries. Similarly, the share of mortgages in the housing sector can provide insight into the degree of financialization in the housing market. A higher mortgage share may be associated with higher housing prices, as greater access to credit should expand accessibility of the housing market to a larger number of households.

Figure A.1. Domestic-market accounting cannot fully explain the data

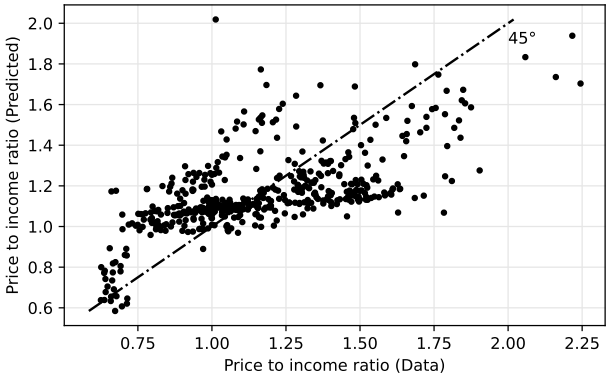
Panel A

Explanatory power



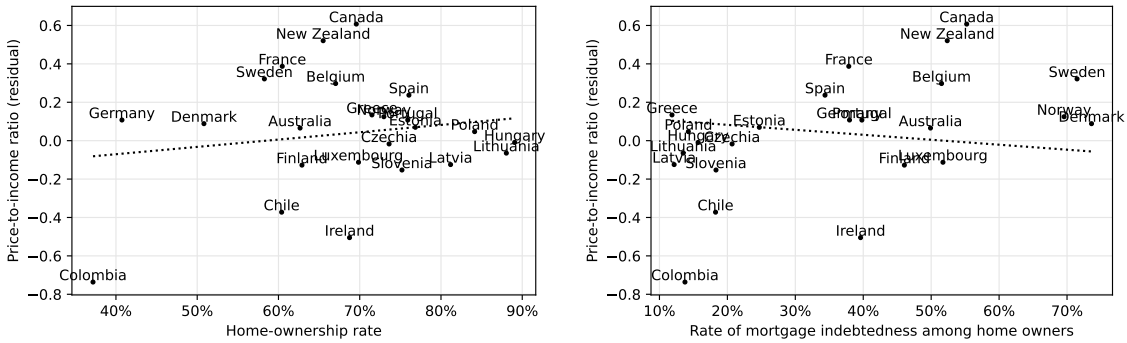
Panel B

Unexplained variation



Note: The left-hand plot in Panel A reports the correlation between the nominal house price index and rental index, in an unbalanced panel of countries and years. Panel B reports the marginal R-squared for respective variables from a pooled panel regression of the price-to-income ratio on the rental market index, the income index, the short term and long term interest rate (measured by the 10-year government bond yield), the level of the population, and the level of new construction in each country in a given year, calculated relative to respective values for 2015. All data are obtained from the OECD, and cover the period between 2000-2022. Panel B compares the level of the price-to-income ratio with the predicted value implied by the regression above.

Figure A.2. Housing affordability, homeownership rates and mortgage debt



Note: The vertical axes of the plots show residuals from a regression of the price-to-income ratio on the rental market index, the income index, the short term and long term interest rate (measured by the 10-year government bond yield), the level of the population, and the level of new construction in each country in a given year, calculated relative to respective values for 2015, for the period between 2000-2022. The residuals are measured for the year 2022. The horizontal axes show home ownership rates (left-hand plot) and fractions of home-owners that have purchased their property with a mortgage contract (right-hand plot). All data are obtained from the OECD.