Urban Residential Construction and Steel Demand in China

Adam Baird[*]

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Abstract

Investment in Chinese urban residential real estate has been declining since 2021, and demand for steel by the sector has also slowed considerably. Despite this decline, overall demand for steel in China has been resilient due to strong growth in manufacturing and infrastructure investment, which looks likely to continue in the near term. This article provides a projection for urban residential construction in China to 2050, suggesting that construction in China has peaked and that demand for steel will decline in the longer term. This will weigh on overall steel demand in China, though there remains considerable uncertainty around the longer term outlook for demand from other sources.

Introduction

Urban residential construction has been a major contributor to Chinese economic growth since the 1990s, but has declined in recent years due to a number of factors.[1] The sector has also been one of the largest sources of steel demand in China until recently. The decline in construction and in steel demand by the sector could weigh on overall investment growth in China in the long term and could also have significant implications for countries like Australia that export iron ore to China.

This article briefly discusses the recent downturn in Chinese urban residential construction and the near-term implications of this downturn for steel demand. The article then examines the long-term outlook for urban residential construction and steel demand in China, using new data and assumptions, and a new approach to estimating demolitions, to provide a projection for urban residential construction to 2050.

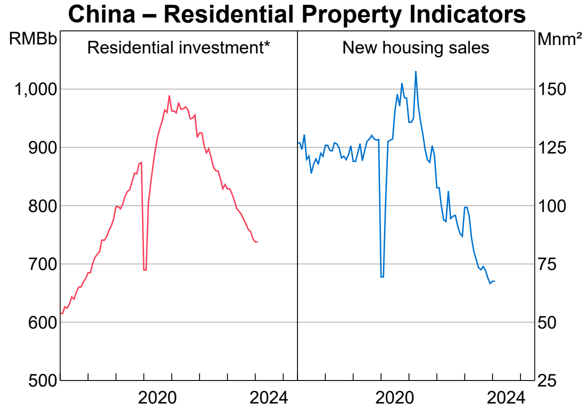
Recent developments in China's urban residential construction sector

Conditions in China's urban residential construction sector began to deteriorate in 2021, and they remain weak. This weakness, which followed a period of very rapid growth, reflects a combination of supply and demand side factors. On the supply side, authorities introduced the 'three red lines' policy in late 2020, which aimed to address financial stability risks by making it more difficult for highly leveraged developers to access credit (Hendy 2022). Authorities also introduced new demand-side tightening measures in many cities where housing prices had accelerated after the easing of China's initial COVID-19 restrictions in 2020. These measures, which included time limit restrictions on the resale of new housing and eligibility requirements for housing ownership, contributed to slowing demand for new housing. Declining revenue from new (typically in advance) housing sales and tighter access to credit, in turn, forced some developers to suspend work on their existing projects, resulting in the value of developers' residential investment in the economy decreasing by the end of 2021.

Several factors have contributed to the persistence of the downturn in investment since 2021. The suspension of existing work by developers led to rising concerns among households that homes they had purchased prior to construction would not be delivered. This concern, combined with slowing income growth and rising uncertainty around the economic outlook, has weighed on housing demand. Without income from new sales, funding challenges for developers have continued to worsen. At the end of 2023, developers' residential investment in China was around 20 per cent below its 2019 average level, and national new housing sales were almost 50 per cent lower (Graph 1).

Graph 1

China – Residential Property Indicators



* Nominal developer fixed asset investment.
Sources: CEIC Data; RBA.

Although authorities have provided material policy support for the residential construction sector since late 2021, there are few signs yet of recovery in the sector. Since 2021, authorities have guided mortgage costs for households lower, extended eligibility for home ownership in large cities, and largely removed limits on how many homes households can own. They have also repeatedly guided banks to expand their lending to developers, particularly to support the completion of unfinished housing. Despite this easing in conditions, new housing sales have declined, and most private developers continue to face considerable funding challenges. These ongoing challenges continue to pose a risk to financial stability in China (RBA 2023).

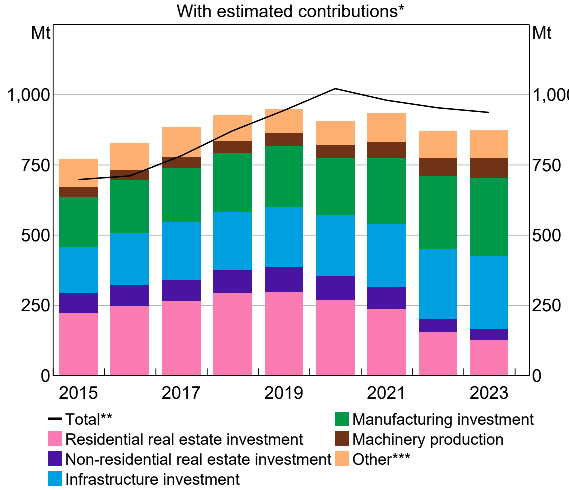
Urban residential construction's contribution to overall steel demand in China

The downturn in urban residential construction has reduced the sector's demand for steel. Urban residential construction consumed an estimated 296 million tonnes of steel at its peak in 2019 – 31 per cent of all steel used domestically in China (Graph 2; see Box A for details on the steel demand estimates). In 2023, the sector is estimated to have used less than half of that amount. Despite this, overall demand for steel in China has remained resilient, due mainly to strong growth in both infrastructure and manufacturing investment.

Graph 2

China – Steel Demand

With estimated contributions*



* Contributions are estimated from measures of sector output and assumptions about the steel intensity of production.

** Total is estimated from steel production less net exports and less the change in inventories.

*** Other includes the production of cars, ships, whitegoods, rolling stock and shipping containers.

Sources: CEIC Data; RBA.

In the near term, it is likely that infrastructure and manufacturing investment will continue to grow, with the support of fiscal and preferential lending policy measures. But in the longer term, headwinds to investment growth in these sectors from high levels of government debt, a declining population and a slowing rate of industrialisation mean that demand for steel from these sectors may grow more slowly or even decline. As a result, the longer term outlook for urban residential construction in China remains important to the outlook for Chinese steel demand and, in turn, Australian exports of iron ore to China.[2]

Projecting urban residential construction to 2050

To assess the longer term outlook for urban residential construction, and therefore its longer term contribution to steel demand, I project underlying demand for urban residential construction to 2050 following the approach of Berkelmans and Wang (2012). The projection is produced using new data and assumptions, as well as a new approach to estimating demolitions.

The projection is produced in two steps:

1. I estimate the future size of the urban housing stock in each year using projections of total population, the share of the population living in urban areas, and urban housing floor area per capita. In equation form:

$$urban\ housing\ stock_t = total\ population_t \times urban\ population\ share_t \times urban\ housing\ floor\ area\ per\ capita_t$$

2. I estimate demand for new construction in any given year as the difference between the housing stock in consecutive periods plus an estimate of housing that will be demolished. In equation form:

$$urban\ residential\ construction_t = urban\ housing\ stock_t - urban\ housing\ stock_{t-1} + demolitions_t$$

The assumptions for the key variables are:

- a decrease in total population to 1.3 billion people by 2050 and an increase in the urban share of the population to 80 per cent, consistent with United Nations (UN) projections
- an increase in urban housing floor area per capita to 43 square metres; by comparison, this is midway between the current levels in Japan and Germany
- a demolition rate of 1.5 per cent in 2015 falling to 0.5 per cent in 2050 based on demolition estimates from Chinese census data. These rates are considerably lower than those assumed in Berkelmans and Wang (2012).

Details on how these assumptions were determined are given in Appendix A.

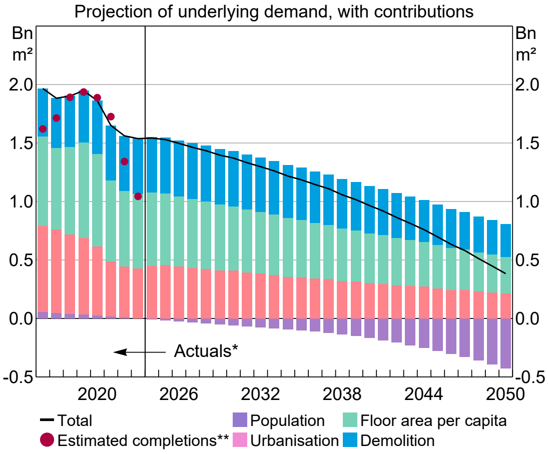
Projection results

Based on the projection results, urban residential construction in China has already peaked, and construction will decline over the medium-to-long term. These results are similar to those found by Berkelmans and Wang (2012), with higher assumed growth in floor area per capita offsetting a lower assumed demolition rate (Graph 3).

Graph 3

China – Urban Residential Construction

Projection of underlying demand, with contributions



* Actuals are used up to 2023 for the urban share, and up to 2020 for population and floor area per capita. Projections are used thereafter. Demolitions are projected for all years.

** Weighted average of new commodity housing starts for the current and previous three years plus estimated social housing completions.

Sources: CEIC Data; NBS; RBA; United Nations Population Division.

That said, the projection implies that construction should eventually recover from its current low levels, as estimated completions have significantly undershot estimates of underlying housing demand.[3] However, the timing of this recovery will depend on how quickly developers can resolve their debt and funding challenges, and when demand for housing recovers.

Scenario analysis

I test the sensitivity of the projection to two assumptions. The downside scenario assumes a portion of the existing vacant stock of housing becomes occupied, thus reducing the need for new construction even further. And the upside scenario assumes a higher average demolition rate, given the uncertainty around estimating this variable.

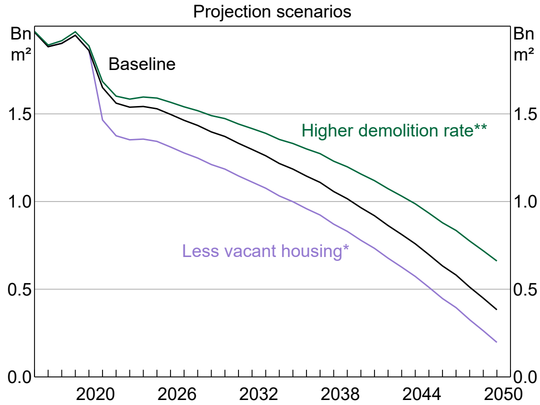
The main downside risk to the baseline projection, which assumes that the stock of vacant housing is unchanged, comes from the possibility of a large reduction in vacant housing. Developers in China hold large stocks of finished-but-unsold housing, and many households own unoccupied housing (Glaeser *et al* 2017). Since the baseline projection relies on estimates of occupied rather than total housing, a drawdown of developer inventory, or sales of unoccupied housing to owner-occupiers, would imply less construction than in the baseline projection for an equivalent level of demand.[4]

Based on estimates of the owned-but-unoccupied stock and developer inventory, the vacancy rate for 2022 was around one-quarter of the total housing stock.[5] Assuming that the vacancy rate instead declines to 10 per cent of the housing stock by 2050 – which is comparable with current vacancy rates for many advanced countries – results in a material reduction in the projected volume of new construction by 2050 ('less vacant housing' line in Graph 4). This is because a larger share of future demand for housing would be met by existing stock in such a scenario.[6]

Graph 4

China – Urban Residential Construction

Projection scenarios



* Combined developer and owned-but-unoccupied stock assumed to fall gradually from 26 to 10 per cent of total stock.

** Demolition rate assumed to fall from 1.5 to only 1 per cent over the horizon.

Sources: CEIC Data; NBS; RBA; United Nations Population Division.

I also test the sensitivity of the projection to the assumed demolition rate, as this is the least certain of the assumptions. In this upside scenario, the demolition rate is assumed to fall from 1.5 per cent to only 1 per cent by 2050. Relative to the baseline, there is little difference in the near term. But by the end of the horizon there is a more pronounced difference, with projected construction significantly higher at almost 700 million square meters in 2050 ('higher demolition rate' line in Graph 4).

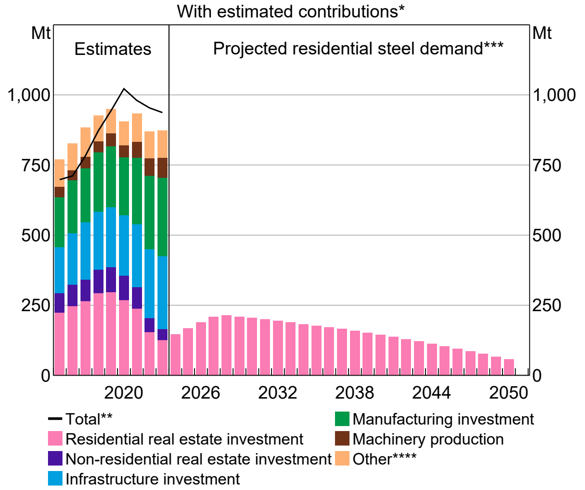
Implications for steel demand in China

Liaison conducted by the RBA's Beijing Office suggests that urban residential property construction in China uses an average of 1.5 tonnes of steel per 10 square metres built. The baseline scenario therefore implies that annual steel demand from residential construction in China will decline to 58 million tons in 2050 (though this figure could be as low as 30 million tons under the lower vacancy rate scenario or as high as 99 million tons assuming a higher demolition rate) compared with 296 million tons in 2019 (Graph 5).

Graph 5

China – Steel Demand

With estimated contributions*



* Contributions are estimated from measures of sector output and assumptions about the steel intensity of production.

** Total is estimated from steel production less net exports and less the change in inventories.

*** Assuming construction levels converge to the baseline projection over five years from 2024.

**** Other includes the production of cars, ships, whitegoods, rolling stock and shipping containers.

Sources: CEIC Data; RBA.

The weak long-term outlook for steel demand from urban residential construction is consistent with the RBA's previous assessment that growth in overall Chinese steel demand is likely to slow in the future and may be near its peak (RBA 2017). This outlook factors in slowing steel demand from residential construction, as well as headwinds to the longer term outlook for manufacturing and infrastructure investment, which are other important sources of steel demand. Slowing overall steel demand in China could weigh on global demand for iron ore and, all else equal, its price.

Conclusion

Weakness in the Chinese urban residential construction sector has persisted since 2021, and has significantly reduced the sector's demand for steel. However, overall demand for steel has remained resilient due to recent growth in infrastructure and manufacturing investment. Investment growth in these sectors looks set to continue in the near term, but there is considerable uncertainty around the long-term outlook for such investment. This uncertainty means the outlook for urban residential investment remains a key risk to the outlook for Chinese steel demand.

Projections to 2050 indicate that demand for urban residential construction in China has likely peaked. While some recovery in construction activity is likely in the near term (as current levels of construction have fallen below those estimates of demand), urban residential construction will likely continue to weigh on overall demand for steel in China.

Box A: Chinese steel demand estimates

By Tekla Bastian*

The steel demand estimates shown in Graph 2 are based on estimates of output and assumptions about how steel-intensive production is for a range of sectors in China. The estimates of steel demand currently incorporate data and assumptions for 13 infrastructure sectors, manufacturing investment, residential and non-residential real estate investment, and the production of 34 industrial outputs including ships, cars, whitegoods, rolling stock and heavy machinery.

The assumptions of steel intensity used to produce the estimates depend on how outputs are measured:

- For sectors where the outputs are measured as *volumes produced* (e.g. the number of cars), the average weight of the product and the steel share by weight are assumed. Together, these give an estimate of how much steel is used per unit produced, and when multiplied by the number of units produced, this gives an estimate of the steel required to produce that output. These assumptions are more exact for some products than others (mainly depending on how uniform the produced outputs are).
- For sectors where *expenditure* is measured, assumptions are made about the share of steel in that spending. For example, 20 tonnes of steel is assumed to be used for every million yuan of spending on highway investment. This corresponds to around 8 per cent of spending. These assumptions are based on estimates from industry liaison, but are likely to be less precise than assumptions for production-based estimates of steel demand given how broad the categories of expenditure are.
- For real estate investment, 1.5 tonnes of steel is assumed to be used for every 10 square metres of construction. This is also based on industry estimates.

Since 2015, these estimates of steel demand have been comparable to an alternative estimate of Chinese steel demand ('total' line in Graph 2), which is calculated by subtracting net exports and the change in steel inventories from Chinese steel production. Remaining data gaps include the defence sector and machinery production where data are limited, and imperfect assumptions about steel intensity are a likely source of error in both directions.

**Tekla Bastian undertook the work behind the steel demand model used in these estimates while in Economic Analysis Department. If referencing this steel demand model, please use the following attribution:*
Bastian T (2024), 'Box A: Chinese Steel Demand Estimates', RBA Bulletin, April.

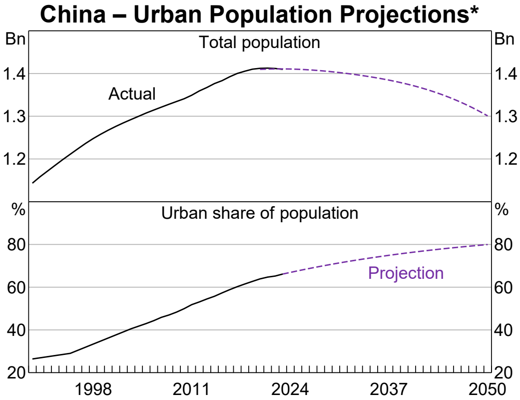
Appendix A: Urban residential construction projection assumptions

Urban population

The projection for China's population is based on the UN's medium scenario projection from its World Population Prospects (2022), while the projection for the urban share of the population is based on the projection from the UN's World Urbanization Prospects (UN 2018; UN 2022) (Graph A1). Both measures have been adjusted slightly to align with official population estimates from China's National Bureau of Statistics (NBS) up to 2023, which have been slightly lower than the UN's projections in recent years.

Graph A1

China – Urban Population Projections*



* UN projections adjusted to align with NBS estimates of total population and the urban share up to 2023.

Sources: CEIC Data; RBA; United Nations Population Division.

A material share of measured urbanisation in China in recent years has come from reclassifying communities on the periphery of major cities as urban rather than rural. This means residents of these communities are already housed when they are reclassified as urban residents. However, since most of these households live in low quality rural housing, they will still contribute to demand for new improved housing (Gan *et al* 2019).

Housing floor area per capita

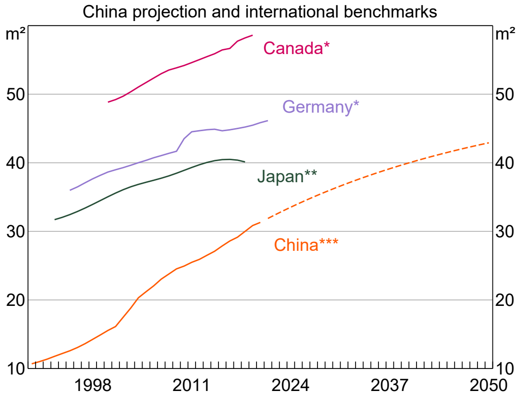
Housing floor area per capita is an indicator of housing consumption, and it typically increases with household income (Berkelmans and Wang 2012). Floor area per capita could increase as a result of households either growing smaller and/or living in larger homes.

I project floor area per capita by comparing current estimates for China against those for a selection of other countries at a more advanced stage of development. By applying judgement and taking into account differences across measures for different countries, I assume that urban floor area per capita for China in 2050 will reach 43 square metres per person.[7] This is between the current levels in Japan (where housing is small due to severe geographical constraints) and Germany (where housing is larger due to a more dispersed population, but not as large as in Canada where most households live in detached houses) (Graph A2).

Graph A2

Housing Floor Area per Capita

China projection and international benchmarks



* Total area of housing stock divided by population.

** Average dwelling size divided by average household size.

*** Usable floor area assumed as 80 per cent of gross (including shared space) for comparability. Dashed line is projection.

Sources: CEIC Data; RBA; Statistics Bureau of Japan; Statistisches Bundesamt.

The Chinese data on floor area per capita measure only lived-in housing. As a result, the projections are sensitive to the quantity of vacant housing in China, and how much of it is sold to satisfy demand in the future. The baseline projection for residential construction demand assumes the stock of vacant housing does not change over the forecast period. But I also consider a scenario where the estimated share of vacant housing declines over time to levels that are similar to advanced economies today.

Demolitions

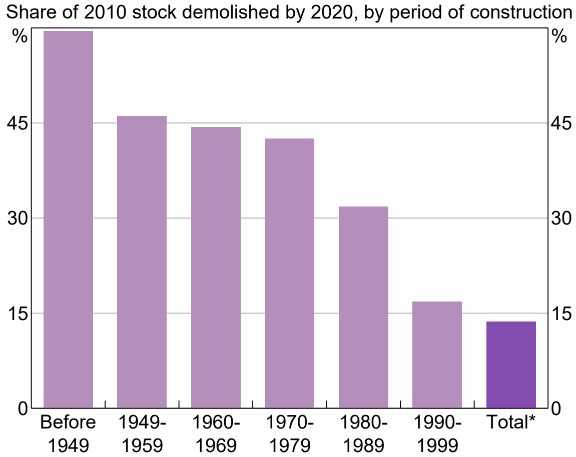
Some percentage of the housing stock is demolished every year, which will add to the construction that would otherwise be required to meet overall housing demand. Previous attempts to estimate demolitions have produced a wide range of results. For example, Berkelmans and Wang (2012) assumed a demolition rate that fell from 4.5 per cent in 2010 to 2 per cent by 2030, while Rogoff and Yang (2022) assumed a rate averaging 1.4 per cent.[8]

The work presented in this article uses a novel approach: inferring demolition from changes in the age distribution of the housing stock from census data. More specifically, I start by observing the stock of occupied housing that was constructed in different year ranges in both 2010 and 2020. For all year ranges prior to 2000, I assume that any declines in the occupier housing stock over that period measure the number of dwellings demolished. Older housing in China tends to be lower quality and have a relatively short lifespan, so I assume that most are demolished rather than simply vacated and, for example, held as an investment. This assumption is consistent with estimates of building lifespan in China that are as low as 25 years (Wang, Zhang and Wang 2018). This approach suggests around 14 per cent of 2010's occupied urban housing stock was demolished by 2020 (Graph A3). In annual terms, this averages around 1.5 per cent each year.

Graph A3

China – Housing Demolitions

Share of 2010 stock demolished by 2020, by period of construction



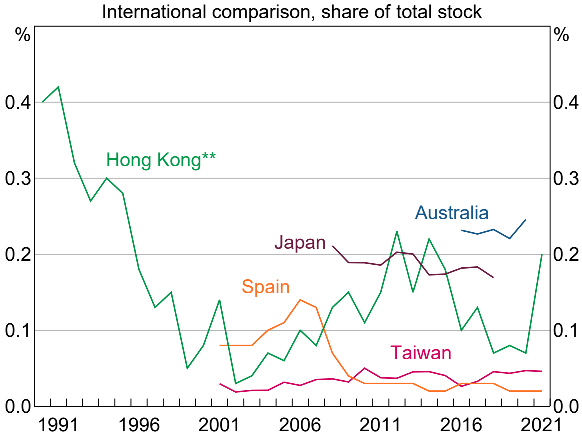
* Estimated by dividing all demolished dwellings by the total stock in 2010 (including housing built after 1999).

Sources: NBS; RBA.

Graph A4

Housing Demolition Rates*

International comparison, share of total stock



* Number of dwelling demolitions or approved demolitions divided by estimated stock.

** Estimates for market sector housing only.

Sources: Australian Bureau of Statistics; CEIC Data; RBA; Statistics Bureau of Japan.

The estimates are lower than those used in previous work, but closer to the rates observed in other countries (Graph A4). Indeed, demolition rates in advanced economies are even lower than the estimate for China, though this is to be expected given the higher average quality of housing in advanced economies.

I assume the demolition rate falls from 1.5 per cent in 2015 to 0.5 per cent by 2050 as the share of new higher quality housing increases. This is roughly equivalent to the demolition rate for Hong Kong in 1990. I also consider an upside scenario where the assumed demolition rate falls to only 1 per cent by 2050.

Endnotes

[*] The author is from Economic Analysis Department. He would like to acknowledge Tekla Bastian's role developing the steel demand model used for this work, including the methodology given in Box A.

[1] I estimate the direct contribution of residential investment to GDP at 11.3 per cent in 2022, down from a peak of 17.2 per cent in 2013. Kemp, Suthakar and Williams (2020) estimated the combined direct and indirect contribution at 18 per cent in 2020, down from a peak of 20 per cent in 2016.

[2] The volume of Australian iron ore exports and the price received for these exports will depend on how global steel and iron ore demand evolves, including in countries outside China. In 2022, China's share of world steel demand was 51 per cent and its share of world iron ore imports was 66 per cent.

[3] I estimate urban housing completions as a weighted average of current and lagged new commodity housing starts plus an estimate of social housing completions from official sources.

[4] This process is partly underway; developers' inventory of unsold housing has declined since 2020. While existing home sales by households have been resilient relative to new housing sales, they have not yet grown by much since 2021.

[5] The occupied stock of housing is estimated from data in the 2020 Chinese census. Adding to this the stock of housing that is owned, but unoccupied by households (based on the China Household Finance Survey in 2019) gives the household-owned stock of housing. Developers' unsold inventory is estimated as the cumulative difference between new housing starts and sales since 1995. Adding this to the household-owned stock gives an estimate of the total housing stock. Subtracting the occupied stock from this gives an estimate of the total vacant stock.

[6] Assuming Chinese floor area per capita rises only to Japan's current levels by 2050 reduces projected new housing and steel demand by a similar magnitude to the scenario where the vacancy rate falls to 10 per cent.

[7] Official measures for China include shared space in apartment buildings (Rogoff and Yang 2022). These are multiplied by 0.8 to produce comparable estimates with other countries, where this space is not included. Estimates from some other countries also capture vacant housing. This is not adjusted for, but was considered when, comparing the estimates.

[8] The demolition rate estimate used by Berkelmans and Wang (2012) was based on government reports and depreciation estimates from the national accounts. The rate used by Rogoff and Yang (2022) applies assumed building lifespans to a distribution of housing by period of construction.

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