



Overcoming the Nation's Daunting Housing Supply Shortage

MARCH 2021

Prepared By

Jim Parrott
Mark Zandi



Overcoming the Nation's Daunting Housing Supply Shortage

BY JIM PARROTT AND MARK ZANDI

There is not enough housing for sale or rent in communities across the country. This means families must pay more for their housing, renters have less to get by on at the end of the month, homeownership is out of reach for too many, and those of modest means are forced to live farther from decent jobs. The effects of the housing shortage are significant, both economically and socially.

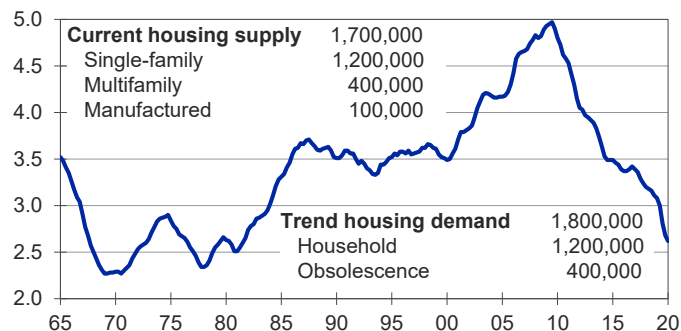
To address the problem, policymakers must tackle a host of challenges outside the traditional reach of housing policy—in trade, immigration, education, taxes and even municipal decision-making. Yet, if they succeed in taking the steps needed to close the gap between the housing we have and the housing we need, the benefits will be considerable. Housing would become more affordable, leading to more household savings, greater access to homeownership, and increased upward mobility. Difficult as the housing supply challenge is, it is worth taking on.

The toll of the shortfall in housing supply

The scale of the supply shortfall is considerable. There is less housing available for rent and sale than at any time in 30 years, and things are only getting worse. The annual supply of new housing units is running an estimated 100,000 below new housing demand, creating the largest shortfall in nearly a half century, equal to almost a year of new construction at its current pace (see Chart 1).¹

Chart 1: Plunging Vacancy Rate

Vacancy rate for homes for sale and rent, 4-qtr MA, %

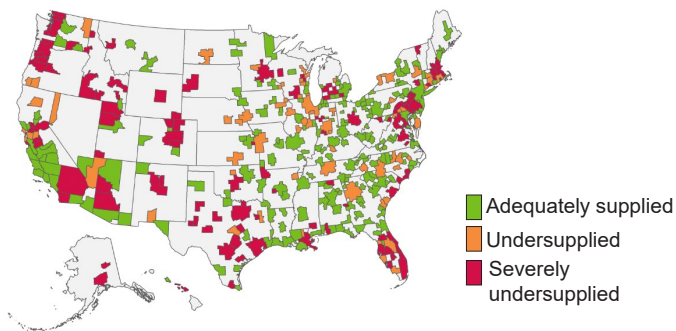


Sources: Census Bureau, Moody's Analytics

Yet even these figures understate the severity of the problem. The lion's share of the undersupply is concentrated in the lower end of the market, particularly in areas that offer significant economic opportunity, driving up house prices and rents for low- and moderate-income families precisely where they want to live (see Chart 2).² Prices for homes sold in the bottom quartile are up nearly 8% per annum over the past decade, almost double that for homes in the top quartile. And rents for those families who rent because they cannot afford to own, rather than by choice, have increased nearly 4% per annum over the past decade—a trend that has continued even during the pandemic.

The rising rents leave more and more renters with little to live on. Today, one in four renters pays over half of their monthly income toward rent, leaving barely enough to cover food, clothing and health-care, much less save for emergencies or build wealth. The typical renter saves less than \$500 a year, not enough to cover run-of-the-mill financial emergencies let alone save for a down payment on a

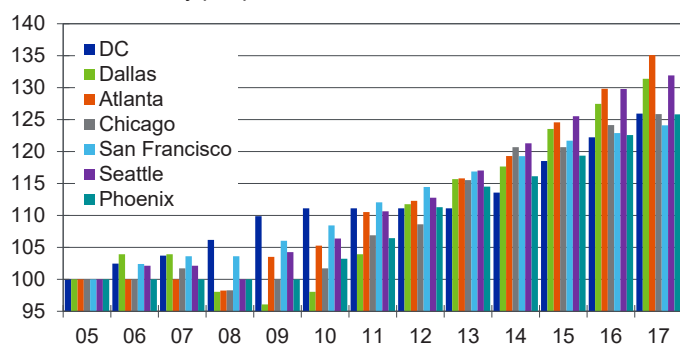
Chart 2: Shortages Plague Much of U.S.



Sources: Census Bureau, Moody's Analytics

Chart 3: Increased Congestion

Hrs of traffic delay per person, 2005=100



Sources: Texas A&M, Moody's Analytics

Chart 4: Lumber Prices Surge in Pandemic

Lumber and wood producer prices, 1982=100



Sources: BLS, Moody's Analytics

home. And the rise in house prices is putting the economic opportunity of homeownership out of reach for more and more families, particularly those of color. Today the homeownership rate for Hispanics is 48% and for Blacks it is 42%, a level not seen in decades.³

The housing shortfall is not just depressing savings and increasing the wealth gap. It is also forcing those at the bottom of the economic ladder to live farther away from those at the top and, more importantly, farther from economic opportunity. The most desirable cities are becoming affordable only to the wealthy, while many of those of more modest means are forced into longer commutes, creating more traffic, more environmental strain, and greater social division (see Chart 3).

A tale of two markets

Homebuilding collapsed during the housing crash a decade ago, with builders constructing only 550,000 homes in 2009, the lowest pace on record. Construction of high-end homes and apartments recovered first, with builders responding to the quicker rebound in demand by well-to-do households and the stronger profit margins in that segment of the market. By the middle of the last decade, supply at the top end of the market began to meet demand again nationwide and has since eclipsed it in many urban areas.

However, construction of affordable housing—homes that low- and moderate-income households can afford to rent or buy—has been much slower to bounce back. Here, too, the story is one of demand and profit margins. Low- and moderate-income households were much slower to recover from the recession, only hitting their economic stride again in the year or two before the pandemic. And the margins that builders could get from building affordable housing have been too low to incent the investment, with pricing too low to adequately clear the high fixed costs of building.

The economics of building affordable housing have improved recently, with skyrocketing house prices and rents finally creating a wide enough margin to justify more investment. But the fact that the economics of building affordable housing are still precarious and appear to require pricing that is *not* affordable for many homebuyers and renters, especially as mortgage rates normalize on the other side of the pandemic, indicates the problem remains acute.⁴

What's undermining the economics of building affordable housing

The primary causes of this shortfall, from least to most important, are materials and labor, lending, and land (see Box 1). These are significant inputs into building a home, and they have all been in short supply since the financial crisis, driving up their cost and reducing builders' profit margins and thus their incentive to put up more homes, particularly lower-priced housing with lower margins.⁵

While prices of many building materials have risen in recent years, the rise in softwood lumber prices has been especially dramatic, up close to 10% per annum since the housing bust and nearly double over the past year alone⁶ (see Chart 4). The higher material costs reflect a range of factors, most recent being the disruption of global supply chains during the pandemic and the Trump administration's imposition of higher tariffs and greater trade restrictions on most major U.S. trading partners. Trade disputes with China and Canada have had the most adverse impact since China is an important source of aluminum, steel, concrete, fiberglass, plumbing fixtures and appliances, and Canada is a critical source of lumber and other wood products.

Homebuilders have also struggled in recent years to develop and maintain a consistent labor force, reflecting the difficulty that many of the trades face in attracting high school graduates into careers requiring specialized skills. Prior to the financial crisis, this labor gap was largely being filled by immigrants. But, just as housing demand began to warrant ramping up housing supply again, the Trump administration all but shut down this source of labor through restrictive immigration policies. The same problem is driving up labor costs in the transportation, distribution and supply industries that homebuilders rely on, making homebuilding still more costly and difficult. Labor cost pressures have eased a bit during the pandemic, but this appears temporary and will almost surely worsen again if there is a large federally financed infrastructure effort.⁷

As the cost of materials and labor has gone up, builders' access to financing has gone down. Bank acquisition development and construction lending is an especially important source of financing for smaller builders, which often do not have ready access to other forms of financing.⁸ Yet banks have been pulling back on these loans since the financial

Box 1: What Explains the Housing Shortage?

Our assessment of the importance of the factors explaining the housing shortage is based in part on conversations with homebuilders, land developers, housing researchers and consulting firms. While there was strong uniformity of views regarding the factors behind the supply shortage, there were meaningful disparities in the ordering of the importance of these factors. So, we did a statistical analysis to assess the relative impact of the factors.

Our statistical analysis confirmed that the factors identified in these conversations were indeed important, and that land availability (proxied by the land share of house prices) is the most critical factor explaining the shortage followed closely by the availability of financing (proxied by the Federal Reserve's senior loan officer survey results for acquisition development and construction loan underwriting standards). Labor (measured by annual pay from the Quarterly Census of Employment and Wages) and material costs (which we proxy for with the producer price index for softwood lumber) are somewhat less important, with their relative importance depending on market conditions. Labor was more important prior to the pandemic because of the extraordinarily tight job market, and material costs have become more important during the pandemic because of the supply chain disruptions and ongoing trade conflicts.

The statistical analysis includes the simple correlation of the various factors with the difference between the housing vacancy rate and the average of the vacancy rate over the period for which historical data are available, or vacancy gap, across metro areas. The average vacancy rate is a proxy for the equilibrium vacancy rate, or that vacancy consistent with house prices and rents growing at the pace of household incomes and construction costs. Each of the factors is meaningfully negatively correlated with the vacancy rate, though the correlation coefficients for labor and lumber are lower than for the land share and AD&C underwriting standards (see Table 1).

We also performed univariate (each factor is regressed separately on the vacancy gap) panel regressions across metro areas over the period for which historical data are available. The coefficients are interpreted as the change in the vacancy gap for a given one standard deviation change in the factor. Land availability and financing stand out as very important factors explaining the housing shortage—labor and lumber costs much less so.

Finally, we ran a multivariate (all the factors are regressed collectively on the vacancy gap) panel regression across metro areas over the period for which historical data are available. All the factors are appropriately signed and statistically significant, although land share stands out. A one standard deviation increase in the land share increases construction enough to reduce the vacancy gap by 2.5 percentage points. This suggests much of the housing shortage that has developed since the financial crisis is due to land constraints. Labor costs are the least important factor driving the vacancy rate in the multivariate regression, though this may reflect the soft job market in the years immediately after the financial crisis.

Table 1: What Explains the Housing Shortage?

Explaining the vacancy gap – the difference between the actual and equilibrium housing vacancy rate

	Correlation Coefficient	Univariate panel regressions Coefficient	Univariate panel regressions T-statistic	Multivariate panel regression Coefficient	Multivariate panel regression T-statistic
Land share of house price	-0.08	-0.50	-12.9	-2.52	-15.9
AD&C loan standards	-0.20	-0.38	-25.7	-0.40	-12.0
Construction labor compensation growth	-0.05	-0.04	-1.6	-0.02	-0.8
Lumber price growth	-0.05	-0.07	-4.1	-0.18	-7.1

Notes:

Correlations based on metro area data over the available historical period.

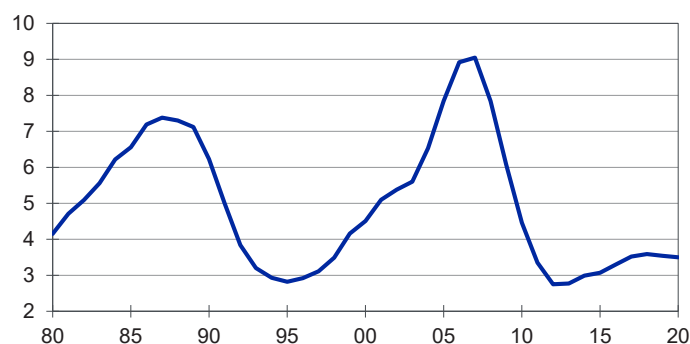
Regressions are panel regressions for metro areas and census divisions over the available historical period.

Coefficients on the explanatory variables represent the change in the vacancy rate gap for a 1 standard deviation in the explanatory variable

Sources: Engineering News Record, FHFA, CoreLogic, BLS, Federal Reserve, CoreLogic, Moody's Analytics

Chart 5: Construction Financing Still Tight

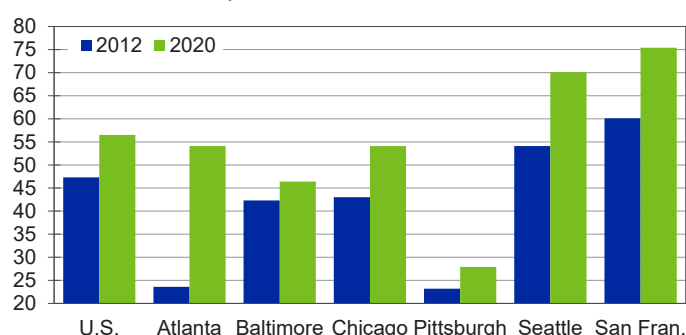
Construction and land development loans, % of total loans



Sources: FDIC, Federal Reserve, Moody's Analytics

Chart 6: Land Costs Soar

Land share of house price, %



Sources: CoreLogic, Engineering News Record, Moody's Analytics

crisis and show little signs of expanding them again. Typically, AD&C loans account for about 5% of bank loans outstanding, but today they account for only 3% (see Chart 5). The retreat has been strongest for smaller banks that cater to smaller builders. This hurts supply at the lower end of the housing market, where smaller builders often focus.

However, the most significant impediment to building more affordable housing is the availability and cost of land. There simply is not enough buildable land to meet the demand in many areas, and the costs associated with securing and developing the land that is available too often push builders' total costs above what they could get from the sale of an affordable property. The cost of land has soared to an estimated 55% of the total price of the median-priced home nationwide, and upwards of 70% in high opportunity areas such as Seattle and San Francisco (see Chart 6).⁹

What policymakers should do

The good news is that there is no single, prohibitive problem standing in the way of building more affordable housing, only a host of smaller ones. This of course leads to the bad news, which is that there is no one policy step that can be taken to deal effectively with the issue. Policymakers will need to take many.

Since the costs and constraints of developing land pose the biggest challenge, addressing them would have the biggest impact. The sheer number of local impediments here suggests that federal policymakers would do well to take a top-down approach. From zoning that restricts multifamily development or dense single-family development, to prohibitive permitting and developing fees, there are so many decisions made at the local level that can impede the development of affordable housing that federal policymakers should push communities to reorganize their approach to development from the ground up.

Policymakers can do this by conditioning some of the considerable federal aid they provide to local governments on a commitment to make their communities more hospitable to the construction of affordable housing. One logical funding stream to tie to such commitments would be the community development block grants issued by the Department of Housing and Urban Development. These grants, which currently run about \$6 billion a year, are intended to help communities address their housing and development needs, so it makes sense to make them contingent on local decision-making that helps facilitate private investment that would do the same (see Table 2). Another candidate is transportation funding. One of the costs of

Table 2: Federal Support of Housing Supply and Infrastructure

Cost estimate by fiscal yr, \$ bil

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2021-2031
Total	98.3	101.8	103.8	106.2	108.6	102.1	110.2	115.2	118.0	120.4	123.1	1,207.6
Transportation funds to state and local governments	71.0	73.5	74.8	76.8	78.5	81.3	83.5	85.1	87.0	88.7	90.5	890.5
Low-Income Housing Tax Credit	10.4	10.9	11.4	11.6	12.0	12.5	12.9	13.4	13.9	14.4	15.0	138.5
Section 142 tax-exempt bonds	8.0	8.0	8.0	8.0	8.1	8.2	8.2	8.3	8.4	8.5	8.6	90.4
Community Development Fund	5.9	6.2	6.2	6.4	6.6	6.6	6.7	6.9	7.2	7.4	7.6	73.7
New Markets Tax Credit	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.8	10.7
Housing Trust Fund	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4.2
Capital Magnet Fund	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2.1
Opportunity Zones	1.5	1.6	1.7	1.7	1.8	-8.1	-2.7	na	na	na	na	-2.5

Sources: CBO, JCT, OMB, Moody's Analytics

Overcoming the Nation's Daunting Housing Supply Shortage

local decisions that limit affordable housing is that it forces those of modest means to commute longer distances, putting a strain on roads and highways; it makes sense to reward those communities with policies that make it easier for people to live near where they work. The considerable sums involved—each year the Department of Transportation sends over \$70 billion to states and municipalities—would make this a particularly powerful incentive.

Policymakers could provide additional incentives by offering competitive local housing innovation grants to state and local governments that make their land-use policies friendly for building affordable housing. The funds could then go toward activities that further support the effort: purchasing blighted properties, renovation and conservation, modernizing schools and other public infrastructure, promoting green development, and so forth.

Lowering the cost of financing would also promote more supply, particularly at the low end of the market, where it is difficult for builders to earn a return even without the impediments mentioned above. In particular, policymakers should send more funds to the Housing Trust Fund and the Capital Magnet Fund, which provide grants to preserve and produce affordable housing for low- and very low-income households,¹⁰ and expand the Low-Income Housing Tax Credit, section 142 tax-exempt bonds for the development of rental housing, and the New Market Tax Credit, each of which has proven effective in promoting development in underserved communities. Opportunity Zones have had more mixed results but could become more effective if targeted and expanded for those that develop affordable housing at the low end of the market. These tax credits together run currently about \$21 billion a year.

Policymakers may also want to consider expanding the range of funding sources. A secondary market for AD&C loans, perhaps established by Fannie Mae and Freddie Mac, would allow more capital to flow to the smaller businesses engaged in land development and construction. And financial incentives to expand the use of infrastructure districts to help finance the cost of land development could jump-start more construction.¹¹ Infrastructure districts operate in several states today, but federal tax incentives to facilitate their broader use would allow more communities to develop areas where municipal services are not currently available.¹²

The labor shortage is more challenging, because it implicates issues well outside of housing policy. But it is worth attention given the significant strain it is creating across a wide range of trades. To address the problem over the long term, policymakers need to develop a more robust training and apprenticeship infrastructure for high school graduates to move into a career in the trades. These sectors offer well-paying jobs, but new college graduates often prefer to

avoid manual labor and high school graduates often lack awareness or interest in the additional training needed. Developing an effective education pipeline into the trades will take time, so over the near term the Department of Labor should scale up the number of H-2B visas available to foreign workers who commit to working in these sectors.

Addressing the rising cost of building materials will also take policymakers well outside of the housing space. Most pressing is settling the ongoing trade dispute with Canada over softwood lumber. This dispute has persisted for decades, leading to a significant underinvestment in capacity by Canadian producers. If the U.S. were to signal a clear and lasting end to the tariffs and the trade dispute, investment would increase quickly, capacity would soon follow, and prices would eventually moderate. An easing in the trade tensions with China would also help ease the cost of other critical building materials.

It is important that the steps outlined here be taken in concert. Providing additional subsidy without addressing the impediments we describe will result in more spending without significantly better results. And addressing the impediments without additional subsidy will leave the nation without much additional supply where it is needed most—at the bottom end of the market.

However, an aggressive combination of these steps would be of considerable benefit (see Box 2). Closing the gap between housing supply and demand would finally ease the upward pressure on house prices and rents, particularly in metro areas where the shortage is driving prices up most dramatically. This would allow more families to buy a home, more renters to save, and more families of modest means to live near good jobs. All of this will create more upward mobility in the economy and reduce the economic and social distance between those at the bottom and the top of the economic ladder.

Conclusion

The shortage in the supply of affordable housing is daunting in its scale, its impact, and the range of policy issues it raises. But it is not going to sort itself out, at least not soon. Meanwhile, the longer it is allowed to go on, the deeper the economic damage it will do. Policymakers should respond to the challenge soon and aggressively, easing the trade, labor, financing and land-use headwinds that are undermining the basic economics of building affordable housing, and providing the additional subsidy needed to create more housing at the bottom end of the market, where it is needed most. If they do, policymakers will help align supply and demand in the market, converting housing from a source of increasing financial and social instability for millions of families to a source of stability.

Box 2: Assessing the Macroeconomic Benefit

To assess the macroeconomic benefit of federal fiscal policies designed to address the affordable housing shortage, we use the [Moody's Analytics model of the U.S. economy](#) to consider a hypothetical federal program that incents localities to ease regulations and other building restrictions in return for \$50 billion in per annum funding via the Housing Trust Fund and Capital Magnet Fund to support the construction of more affordable housing. While this is only one of the tools we recommend policymakers use to address the housing shortage, it is representative of the economic benefits.

Our simulation is based on several assumptions, including that the legislation becomes law later this year and is effective in calendar year 2022. Given the magnitude of the increase in funding, we assume it will take several years to get a program or mix of programs like this up to full speed. Even if policymakers leverage existing programs, it will take time to expand the needed infrastructure to disburse this amount of funding effectively.

Another important assumption is that it will cost close to \$200,000 to produce a typical affordable housing unit in 2022. This is consistent with the cost to produce a unit in a Low-Income Housing Tax Credit project. We expect that cost to increase by over 3% per annum, given the strong economy and higher tariffs on imported homebuilding materials, and to moderate closer to 2% growth by the mid-2020s, consistent with overall price inflation.

Finally, we make the highly stylized assumption that the program is largely paid for with higher estate taxes and is thus deficit neutral on a dynamic basis with no resulting impact on interest rates.

Under the new legislation, our model shows that affordable housing construction increases by 275,000 units per annum over the 10-year budget horizon (see Table 3). This would alleviate the affordable housing shortage by the second half of this decade. Since housing supply is significantly increased, it will have the added benefit of improving housing affordability particularly for affordable rental homes. Without the legislation, rents are expected to increase by over 4% per annum. With the legislation, rent growth will be closer to 3% per annum. A decade from now, affordable rents will be approximately 10% lower than they are today, or about \$100 per month in today's dollars.

More housing construction will increase the economy's growth rate and the number of jobs as activity increases. The increased housing construction will lift employment by approximately 250,000 jobs in 2022 and by just over 400,000 jobs at the peak of the impact in the mid-2020s.

There are a range of other factors that we did not consider, but whose macroeconomic impacts likely offset each other. We understate the economic benefit of the legislation, because it does not consider that the measure will facilitate the ability of low-income households to move closer to their employment or potential jobs. Affordability is also forcing low-income workers to live farther away from their work, requiring long and costly commutes and reducing productivity. There is also the possibility the program is not fully paid for, which would add to the nation's deficits, resulting in higher interest rates that would limit the benefits to the economy.

Table 3: Macroeconomic Impact of Federal Programs Promoting Housing Supply

	Annual spending, \$ bil			Additional affordable housing units			Additional jobs
	Housing Trust Fund	Capital Magnet Fund	Total	Housing Trust Fund	Capital Magnet Fund	Total	
2022	34.5	0.4	34.9	170,593	13,845	184,438	249,098
2023	40.0	0.9	40.9	192,402	30,303	222,705	300,780
2024	45.0	1.7	46.7	211,173	55,843	267,016	360,625
2025	46.5	2.5	49.0	213,306	80,276	293,582	396,505
2026	46.5	3.2	49.7	208,714	102,113	310,827	419,795
2027	46.5	3.2	49.7	204,421	100,013	304,434	411,160
2028	46.5	3.2	49.7	200,217	97,955	298,172	402,704
2029	46.5	3.2	49.7	196,291	96,035	292,326	394,808
2030	46.5	3.2	49.7	192,442	94,152	286,594	387,066
2031	46.5	3.2	49.7	188,669	92,306	280,974	379,477
2022-2031	445.0	25.0	470.0	1,978,226	762,841	2,741,067	

Source: Moody's Analytics

Endnotes

- 1 Total supply equals new single- and multifamily housing starts and manufactured-home placements, and trend housing demand equals household formations, new homes needed to replace those that become obsolete, and second and vacation homes. Trend demand abstracts from the near-term temporary impacts on demand from the ups and downs in the business cycle.
- 2 See "[Housing Constraints and Spatial Misallocation](#)," Hsieh and Moretti, American Economic Journal: Macroeconomics 2019.
- 3 These homeownership rates are for 2019 from the Census Bureau's Housing Vacancy Survey. The HVS for 2020 has significant measurement problems due to the pandemic.
- 4 In an economy operating at full employment and with inflation at the Federal Reserve's 2% target, fixed mortgage rates will be near 5.5%.
- 5 The [National Association of Home Builder's 2019 Construction Cost Survey](#) provides a good breakdown of the costs involved in building a typical single-family home.
- 6 This is for the producer price index for softwood lumber from the Bureau of Labor Statistics. Random Lengths data indicate that softwood lumber prices are up even more, from \$350 to \$1,040 per thousand board feet, between April 2020 and March 2021. The National Association of Home Builders estimates this has added \$24,000 to the price of a typical home.
- 7 This is based on the employment cost index for construction workers from the Bureau of Labor Statistics.
- 8 This includes 1-4 family residential construction loans and land development loans from the FDIC.
- 9 We estimate land values and the land share of house price across metropolitan areas based on data from the FHFA, CoreLogic, and the Engineering News Record. The FHFA land value methodology and estimates are available from "[The Price of Residential Land for Counties, ZIP codes, and Census Tracts in the U.S.](#)" Larson, Shui, Davis, and Oliner, FHFA Working Paper, November 2020.
- 10 The Housing Trust Fund and Capital Magnet Fund were established by the 2008 [Housing Economic and Recovery Act](#), but funding began only a few years ago. The HTF provides funds to state housing authorities for the development of affordable rental units. Housing authorities have flexibility in allocating these funds since each has different objectives and goals based on the needs of the local population. The CMF provides funds to Community Development Financial Institutions and other non-profit developers for increasing the supply of affordable housing. CDFIs are mission-driven financial institutions that provide financing for development in underserved communities. The HTF and CMF have the flexibility necessary to significantly increase the supply of affordable housing in real estate markets encumbered by a range of complex and costly problems.
- 11 Typically, in a Municipal Utility District a land developer funds the initial construction of roads, water, sanitary sewer, and drainage infrastructure necessary to complete a development. Tax advantaged bonds are then issued to reimburse the developer for the infrastructure improvements as the development creates taxable value needed to cover the debt. Property and ad valorem taxes as well as water, sewer and other utility revenues are used to pay off the bonds, which can take up to 30 years.
- 12 Infrastructure districts include Municipal Utility Districts in Texas, Community Development Districts in Florida, Metro Districts in Colorado, and Community Facility Districts in California and Arizona.

Overcoming the Nation's Daunting Housing Supply Shortage

About the Authors

[Jim Parrott](#) is a nonresident fellow at the Urban Institute and co-owner of Parrott Ryan Advisors, which provides strategic advice on housing finance issues to financial institutions active in the primary and secondary mortgage market. Parrott served in the Obama White House as a senior advisor at the National Economic Council, where he led the team charged with counseling the cabinet and president on housing issues. Earlier in the Obama administration, he was counsel to Secretary Shaun Donovan at the U.S. Department of Housing and Urban Development. Prior to his time in public policy, Parrott was a litigator, first in New York with Sullivan & Cromwell, and later in North Carolina with Smith Anderson. He served in Sri Lanka with the Peace Corps, has a BA in philosophy from the University of North Carolina, an MA in philosophy from the University of Washington, and a JD from Columbia Law School.

[Mark Zandi](#) is chief economist of Moody's Analytics, where he directs economic research. Moody's Analytics, a subsidiary of Moody's Corp., is a leading provider of economic research, data and analytical tools. Dr. Zandi is a cofounder of Economy.com, which Moody's purchased in 2005. Dr. Zandi is on the board of directors for MGIC, the nation's largest mortgage insurer, and is lead director of Reinvestment Fund, a national Community Development Financial Institution. Dr. Zandi is the author of *Paying the Price: Ending the Great Recession and Beginning a New American Century*, which provides an assessment of the monetary and fiscal policy response to the Great Recession. His other book, *Financial Shock: A 360° Look at the Subprime Mortgage Implosion, and How to Avoid the Next Financial Crisis*, is described by The New York Times as the "clearest guide" to the financial crisis. Dr. Zandi earned his BS from the Wharton School at the University of Pennsylvania and his PhD at the University of Pennsylvania. He lives with his wife and three children in the suburbs of Philadelphia.

[Cris DeRitis](#), Deputy Chief Economist of Moody's Analytics, and [Todd Metcalf](#), economist at Moody's Analytics, contributed significantly to this white paper.