Proposal: How Much Housing Will Get Built if Building Housing Costs Less?

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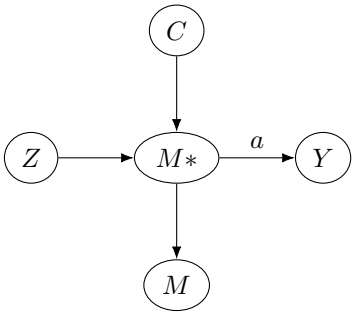
Prerequisite knowledge: Causal inference, errors-in-measurement, panel data analysis.

Computing: No specialized computing resources are required.

Brief description: Due to California's housing shortage,[1] policy researchers routinely try to estimate how proposed housing policies will impact the number of homes built per year in California.[6][5][4] In the general case, policymakers would like to know the supply effects of regulatory changes that have never been enacted anywhere before. It's thus challenging to estimate these effects with observational data.[1] A solution to this problem rests in the fact that policy researchers have a strong prior regarding how new laws impact the economic return of building housing.[6][5][4] If we also knew the causal effect of such returns on housing production, we could then estimate the indirect supply effects of new legislation. This dissertation aims to evaluate how housing production is driven by changes in the economic return of residential development. In the DAG below, the relationship a is the quantity of interest. The identification strategy is to employ at least one instrumental variable in a panel data setting.



Above, Z is an arbitrary instrumental variable; M* is a latent variable reflecting the expected economic return of developing a project of a given size

[1] Even where observational data of the relevant regulatory change exists, external validity concerns pose separate challenges.

on a particular parcel of land in a given year; M is the observed, mismeasured proxy for M*; C is the set of economic conditions that are unaffected by the instrument; Y is the housing produced in a given year on a given parcel.

Of special note is that $M = g(M^*, \Delta M, t, l)$, where g is a non-linear function, $\Delta(M)$ denotes measurement error, t denotes time, and l denotes location. M^* is latent as it is a mental construct.[2] There are several ways to measure M^*,[3][4] and most measures are expressed as a rate of return - that is, they are measured in percent terms, not absolute dollar amounts. Unfortunately, though there are multiple ways to measure M^*, these multiple measures are not independent conditioned on M^*, as all measures rely on estimates for revenues and costs, which are themselves composed of variables that contain errors in measurement or may only contain a proxy.[9][8] In particular, there will certainly be errors in measuring construction costs, fees, land values, and rent. Imposing a tractable structure on the relationship between M and M^* is a key challenge in this dissertation.

As for the instrumental variable Z, I am considering instruments ranging from fires to government policy. Previous research has already used accidental fires as an instrumental variable and found that serious, accidental fires strongly predicted housing production.[7] The story for why this effect would be mediated through M^* is as follows: if an accidental fire diminishes property values, then that reduces land acquisition costs, increasing the economic return of developing a project on that parcel of land. However, it's plausible that some accidental fires may have a direct effect on housing production not mediated by economic feasibility if the fire burned down a home that the previous residents want to rebuild and return to, economic costs notwithstanding. I will assess whether this is negligible and whether I can make this IV valid by only considering cases where the building that burned down was non-residential.

Along similar lines to accidental fires, I will explore whether suicides that occur within a home constitute a valid IV. This data is available via SF Police Department logs from 2003 to today. Some research suggests that property values decrease substantially when there's a death within the home, particularly because California mandates the reporting of deaths-within-the-home that occurred within 3 years of the home's sale.[2] If the home's value decreases and the house is sold, then the economic return of building housing would increase. This IV may be endogenous to economic conditions that drive the residential development market, and so I will have to explore whether that's the case and whether there's a workaround.

Additionally, I will explore whether a particular government policy could

[2] Alternatively, one could reconceptualize M^* to be some sociological phenomenon, i.e. the perceived economic return among market actors. (This would, among other things, change whether there are Berkson-type measurement errors.) But because it's easier to find data on actual economic indicators than on the market perceptions of residential developers, I will view M^* as a mathematical construct. Nevertheless, I expect M^* is highly correlated with market actors' perceptions and actions, so there may be ways to mitigate mismeasurement of M^* by using market actors' actions (such as pulling or abandoning a permit) as a proxy.

constitute a valid instrument. For example, San Francisco levies cultural district impact fees that have spatial discontinuities in where the fees are applied. It seems plausible that the imposition or modification of these fees may have an identifiable effect on production.

For all of these instruments, it's challenging to estimate their effect on M^*. There is sufficient data to estimate each instrument's effect on an input to M, but the instrument's effect on M^* and M interacts with other economic and regulatory conditions, and so there will be greater measurement error.

Another complication comes from that fact that the SUTVA assumption may be violated on a long enough time horizon. For example, research shows that building new housing supply in SF decreases rents within a 100m radius of the new supply.[7] Lower rents certainly depress the economic return of residential development, and so treating one parcel may affect the local rents of neighboring parcels after a proposed project winds its way through years of permitting and construction.

Finally, another complexity to note is that my treatment is continuous and dynamic, which requires specialized methods.

Data availability:

- Newly released San Francisco panel data from 2001-2016 on 150k parcels of land and whether the parcel was developed. This dataset includes variables for the parcel's zoning, historical status, and potential building envelope. (On Github Repo.)
- San Francisco property tax rolls from 2007 to 2021. Describes land values and features of each parcel. See here
- San Francisco Fire Department Calls for Service. (See here.)
- SF building permits (here) and planning permits (here).
- Census data in 2000 (here)
- Zillow rent data for 2001-2016 (here)
- ENR Construction Cost Index for 2001-2016. (On Github repo.)
- WRDS interest rate dataset for 2001-2016. (On Github repo.)

References

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[3] Peter Byrne, Pat McAllister, and Peter Wyatt. "Precisely wrong or roughly right? An evaluation of development viability appraisal modelling". In: *Journal of Financial Management of Property and Construction* (2011).

[4] Alex Casey et al. *Modeling New Housing Supply in Los Angeles: Simulations from the Terner Housing Policy Dashboard*. Tech. rep. Terner Center, Oct. 2022.

[5] Joe Distefano and Peter Calthorpe. *Can commercial corridors solve California's housing crisis?* Tech. rep. Urban Footprint, Aug. 2022.

[6] Ben Metcalf et al. "Will Allowing Duplexes and Lot Splits on Parcels Zoned for Single-Family Create New Homes?" In: *Terner Center for Housing Innovation. https://ternercenter. berkeley. edu/research-and-policy/duplexes-lot-split-sb-9* (2021).

[7] Kate Pennington. "Does building new housing cause displacement?: the supply and demand effects of construction in San Francisco". In: *The Supply and Demand Effects of Construction in San Francisco (June 15, 2021)* (2021).

[8] Susanne M Schennach. "Mismeasured and unobserved variables". In: *Handbook of Econometrics*. Vol. 7. Elsevier, 2020, pp. 487–565.

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