

# Proposal: Estimating the Indirect Supply Effects of Proposed Housing Legislation

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December 2022

## 1 Motivation

Due to California’s housing shortage,[1] policy researchers routinely try to estimate the supply effects of proposed housing policies in California.[4][3][2] In the general case, policymakers and policy researchers would like to know the supply effects of regulatory changes that may never have been enacted anywhere before. It’s thus non-trivial to estimate these effects with observational data.<sup>1</sup>

Instead of leveraging observational data, practitioners leverage deterministic pro-forma analyses of economic feasibility. A pro-forma is a standardized spreadsheet that, in a way broadly accepted by the development industry and their lenders, evaluates whether a project offers enough returns to pursue. Because housing supply is almost entirely built by developers who, before building housing, evaluate these returns, practitioners believe the # of units that belong to financially viable projects mediates much of a policy’s total supply effect. So, when policymakers ask for supply effect estimates of policies, practitioners provide deterministic estimates of how many homes would be economically feasible to build given certain assumptions about how a policy affects a pro-forma. For example, policymakers may want to know what a \$100k reduction in impact fees would do to housing production, and practitioners would reduce development costs by \$100k to evaluate, at a per-parcel level, which projects would pencil out and, in turn, how many units those projects would yield in expectation.

This approach has a few shortcomings. First, no statistical research demonstrates housing production is causally affected by the number of units that are economically feasible to build, so the current pro-forma approach is a dead-end to estimating supply effects. Relatedly, it is not yet established in the literature to what extent these pro-forma estimates mediate a policy’s total supply effect. If the answer is ‘not much,’ that would be a valuable negative result to yield.

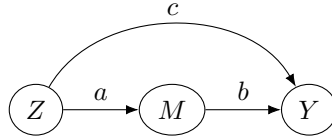
Second, these analyses provide deterministic estimates, without accounting for statistical uncertainty in how production is affected by feasibility, let alone accounting for the uncertainty in pro-forma assumptions. My dissertation aims to fill the above two research gaps.

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<sup>1</sup>Even where observational data of the relevant regulatory change exists, external validity concerns pose separate challenges.

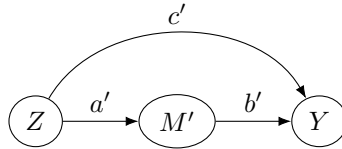
## 2 DAG of Interest

A housing policy's impact on housing supply is mediated by market actors' estimates of the economic feasibility of residential construction for a given parcel of land.



**Figure 1:** Treatment Z is a housing policy; mediator M is developers' estimate(s) of the economic return of residential construction on a parcel; and response Y is the number of units built on that parcel.

While **Figure 1** presents an accurate picture of the world, it is intractable to study since no dataset contains M, the economic feasibility estimates performed by developers. So, researchers instead study a proxy  $M'$ , which is simply their estimate of the economic return of residential development at a given time and location. Because pro-forma analyses are highly standardized, practitioners have a strong prior that  $M' - M$  is reasonably small. See **Figure 3**.



**Figure 2:** Z and Y are as before, but  $M'$  is an estimate for the economic return of residential construction on a parcel.

## 3 Definition of Feasibility

Let I be the net operating income, C be the cost, and D be the indicator variable for whether a property is redeveloped as housing. Then the economic feasibility F of developing housing is defined as:

$$F := \frac{E[I|D]}{E[C|D]} - \frac{E[I|D^c]}{E[C|D^c]}$$

The first term is known as the return on cost (ROC), and the second term is known as the local capitalization rate. When  $F > 0$ , market actors, like lenders and developers, consider the project feasible.<sup>2</sup>

<sup>2</sup>Other ways of operationalizing economic feasibility exist, but I will restrict my focus to this one metric at least until a data analysis motivates considerations of other measures.

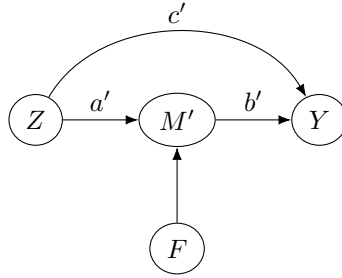
For simplicity, I will assume income for new development is simply the project’s square footage times Zillow’s estimate for top-end rent. Measuring the cost of development is the most challenging aspect of estimating feasibility. Where applicable, I will borrow assumptions from practitioners, supplemented by ENR’s construction cost index and the tax assessor’s land value data. I do not yet have a good way of estimating impact fee costs or salary costs.

To estimate the local capitalization rent, I will divide Zillow’s estimate for median rent per square foot against the existing building’s square footage, divided by the tax assessor’s entry for the land value.

The above should generate a rough measure of  $F$  that could be refined.

## 4 Method

Goal is to identify  $b'$



**Figure 3:** Fire ( $F$ ) as instrument for identifying  $b'$ .

## 5 Data

I combine several datasets:

- 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.
- San Francisco property tax rolls from 2007 to 2021. Includes additional covariates on developability on the site. Also includes land values that help calculate local cap rates and land values.
- To use Fire as an IV, I can follow Pennington’s approach of using San Francisco Fire Department Calls for Service. See here.[5]
- SF permit data to track size of projects that are built.
- Census data of SF census tracts in 2000

- Neighborhood boundaries from SF
- Zillow rent data for top-end and median
- ENR Construction Cost Index for time range of panel data
- WRDS interest rate dataset for time range of panel data

Data I don't have but would like to:

- Impact fee changes
- Inclusionary Zoning + AMI changes
- Commercial rents

## References

- [1] Chas Alamo, Brian Uhler, and Marianne O'Malley. *California's high housing costs: Causes and consequences*. Legislative Analyst's Office, 2015.
- [2] Alex Casey et al. *Modeling New Housing Supply in Los Angeles: Simulations from the Turner Housing Policy Dashboard*. Tech. rep. Turner Center, Oct. 2022.
- [3] Joe Distefano and Peter Calthorpe. *Can commercial corridors solve California's housing crisis?* Tech. rep. Urban Footprint, Aug. 2022.
- [4] Ben Metcalf et al. "Will Allowing Duplexes and Lot Splits on Parcels Zoned for Single-Family Create New Homes?" In: *Turner Center for Housing Innovation*. <https://turnercenter.berkeley.edu/research-and-policy/duplexes-lot-split-sb-9> (2021).
- [5] 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).