Group-Specific Bias in IV Estimates of Housing Supply Elasticity*

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May 12, 2025

1 The Wiebe [2025] Critique

Wiebe [2025] correctly notes that Louie et al. [2025] take the supply elasticity ψ_i outside the covariance term after grouping cities into "high" and "low" elasticity bins. Algebraically this requires $\psi_i = \psi_j$ within each bin; if ψ is heterogeneous, the simplification is not exact.

If tighter supply limits in-migration, population (and thus total income) will be lower in low-ψ cities, yielding $Cov(\psi_i, Y_i) \neq 0$. In fact, one would expect $Cov(\psi_i, Y_i) > 0$ based on this argument.

2 What Are the Correlations in the Data?

In the data, the correlations between ψ_i and Y_i are small, less than 0.2 in absolute value and generally not statistically significant. Furthermore, in contrast to the argument above, the correlations are **generally negative**. This suggests that the specific bias mentioned by Wiebe [2025] that would push estimates in high- and low-elasticity groups towards each other is not a major concern in the data. In fact the opposite bias may actually be present so that if these correlations were empirically relevant they might actually push the IV estimates further apart than they should be (i.e. our specifications would be biased towards finding differences in supply elasticities).

3 Monte Carlo with Louie, Mondragon, and Wieland (2025) Grouping

The analysis in Wiebe [2025] does not make clear to what extent a correlation between the supply elasticity ψ and income growth Y_i is an important problem for the analysis in Louie et al. [2025].

To assess the potential bias from this correlation, we conduct a Monte Carlo simulation. Each simulation consists of 300 cities (matching our sample size) whose supply elasticity ψ_i is drawn from a lognormal distribution with mean 0.79 and standard deviation 0.54 based on Saiz [2010].[1] We allow for the kind of bias discussed in Wiebe [2025] by drawing an exogenous component of income growth z from a standard normal and computing income growth as

$$Y_i = \rho * \frac{\psi_i - \bar{\psi}}{std(\psi_i)} + \sqrt{(1 - \rho^2)} * z_i \tag{1}$$

where ρ is the correlation of ψ_i and Y_i, $\bar{\psi}$ is the mean of ψ_i, and $std(\psi_i)$ is the standard deviation of ψ_i.

The correlation between ψ_i and Y_i is varied from -0.9 to 0.9 in increments of 0.15. A non-zero correlation $\rho = Corr(\psi_i, Y_i)$ introduces the bias identified by Wiebe [2025].

*The views expressed here are those of the authors and do not necessarily reflect those of the Federal Reserve Bank of San Francisco or the Federal Reserve System.

[1]The log Saiz elasticity has minimal skewness and a Kurtosis close to 3.

Prices and quantities are generated from the housing market equilibrium

$$P_i = \frac{\varepsilon_y}{\psi_i + \varepsilon_p} Y_i, \quad H_i = \frac{\psi_i \varepsilon_y}{\psi_i + \varepsilon_p} Y_i, \tag{2}$$

with $\varepsilon_y = \varepsilon_p = 1$.[2]

3.1 Results

We sort cities by their supply elasticity ψ_i as in Louie et al. [2025]. We then estimate the IV supply elasticity $\hat{\psi}^{IV}$ in each group.

Figure 1 contrast the average IV estimate $\hat{\psi}^{IV}$ with the true mean elasticity $\bar{\psi}$ for each group across correlations $\rho \in [-0.9, 0.9]$.

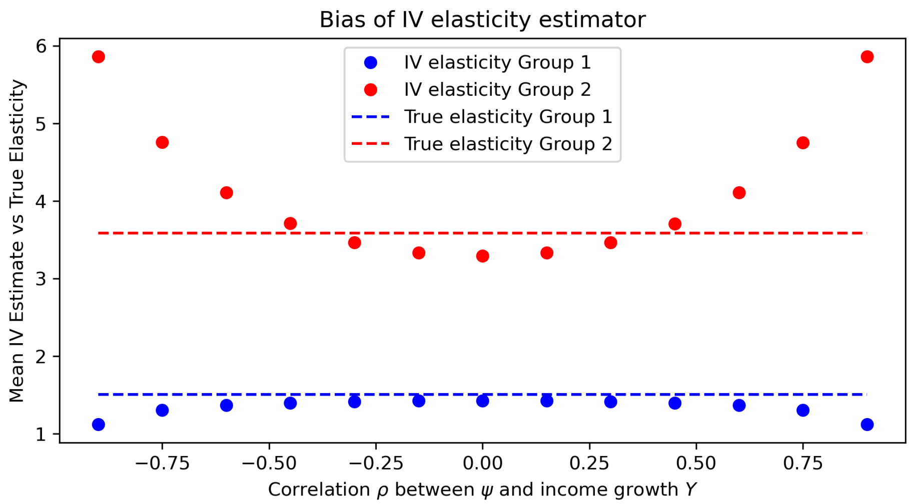

Figure 1: IV bias as a function of ρ in low- and high-ψ groups. Dots are IV estimates; dashed lines are true means.

- **Baseline** $(\rho = 0)$**.** The IV estimator tracks the true mean closely: $\hat{\psi}^{IV}_{\text{low}} = 1.43$ vs $\bar{\psi}_{\text{low}} = 1.51$, and $\hat{\psi}^{IV}_{\text{high}} = 3.32$ vs $\bar{\psi}_{\text{high}} = 3.59$.
- **Empirical correlations** $(|\rho| \leq 0.2)$**.** Endogeneity biases both groups' IV estimates in the same direction and by similar proportions, so the difference $\hat{\psi}^{IV}_{\text{high}} - \hat{\psi}^{IV}_{\text{low}}$ remains informative about the true gap.
- **Extreme correlations** $(|\rho| \geq 0.7)$**.** Bias becomes nonlinear: the high-ψ group is pulled strongly upward, whereas the low-ψ group is pulled modestly downward. Thus, large correlations imply that the IV estimator is biased **towards finding large differences between the groups**.

3.2 Why i sthe IV Estimator Biased Up in the High–ψ Group but Down in the Low–ψ Group for Large Correlations?

Within either group the IV estimate of the supply elasticity can be written

$$\hat{\psi}^{\text{IV}}_g = \frac{Cov(Y,H)}{Cov(Y,P)} = \frac{\mathbb{E}\Big[\dfrac{Y_i^2\,\psi_i}{\psi_i + \varepsilon_p}\Big]}{\mathbb{E}\Big[\dfrac{Y_i^2}{\psi_i + \varepsilon_p}\Big]} = \frac{\mathbb{E}[w_i\psi_i]}{\mathbb{E}[w_i]}, \qquad w_i = \frac{Y_i^2}{\psi_i + \varepsilon_p}. \tag{1}$$

[2] We abstract from other supply and demand shocks to isolate the importance of the $Cov(\psi_i, Y_i) \neq 0$ critique.

The true group mean is simply $\bar{\psi} = \mathbb{E}[\psi_i]$.

For $\rho = 0$ the weight is decreasing in ψ_i because there is less price variation in high elasticity cities. This explains why the IV estimator is biased down in both groups when ρ is small.

To explain the biases for large $|\rho|$, note that Y is generated as $Y = \rho \dfrac{\psi - \bar{\psi}}{\sigma_\psi} + \sqrt{1-\rho^2}\, z$, with $z \sim \mathcal{N}(0,1)$ independent of ψ,

$$\mathbb{E}\big[Y^2|\psi\big] = \rho^2\left(\tfrac{\psi-\bar{\psi}}{\sigma_\psi}\right)^2 + (1-\rho^2) = A\,\psi^2 + B\psi + C. \tag{2}$$

where $A = \frac{\rho^2}{\sigma_\psi^2}$, $B = -2\rho^2\frac{\bar{\psi}}{\sigma_\psi^2}$, and $C = (1-\rho^2) + \rho^2\frac{\bar{\psi}^2}{\sigma_\psi^2}$.

Hence the weight is the function

$$w(\psi) = \frac{A\psi^2 + B\psi + C}{\psi + \varepsilon_p},$$

which is increasing in ψ once ψ exceeds a threshold ψ^* and $\rho \neq 0$.

For $|\rho| \geq 0.7$, $\psi^* \in (2.5, 3)$. In the data, the median supply elasticity is 2.26.

- **Low–ψ group (constrained).** All observations have $\psi < \psi^\star$, where the denominator effect dominates and $w(\psi)$ decreases with ψ. The IV average is therefore pulled below the unweighted mean $\bar{\psi}$.
- **High–ψ group (unconstrained).** Here $\psi > \psi^\star$ for most observations, so $w(\psi)$ increases with ψ and gives extra weight to the largest ψ values. That pushes $\hat{\psi}^{\text{IV}}$ above $\bar{\psi}$.

4 Implications for the Wiebe [2025] Critique

Any bias arising from empirical ψ-Y correlations, $\rho \in (-0.2, 0.2)$, acts similarly on both halves of the sample. It therefore cannot explain the Louie et al. [2025] empirical finding that elasticity estimates are nearly identical across low and high elasticitiy groups. For large correlations, which are not present in these data, the IV estimator is biased towards finding large differences between the groups. This is the opposite of the Louie et al. [2025] finding. The Wiebe [2025] critique is therefore not a concern for the Louie et al. [2025] results.

5 Conclusion

The small empirical correlations between supply elasticities and income growth and the Monte Carlo simulation reinforce the conclusion of Louie et al. [2025] that supply constraints do not explain house price and housing quantity growth across cities.

References

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