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Dropping the Geographic-Constraints Variable Makes Only a Minor Difference: Reply to Cox

Haifang Huang[1] and Yao Tang[2]

LINK TO ABSTRACT

The comment by Wendell Cox (2010) pivots off of two papers, one of which is ours, Huang and Tang (2010). Cox treats a range of issues. Our reply focuses on those most directly related to our work. Specifically, we would like to address the concern that the inclusion of both geographic and regulatory constraints in the regressions could underestimate the effect of regulations on housing prices. We will show that dropping the geographic-constraints variable from the regression has only a marginal effect in increasing the sizes of the coefficients on the regulatory-restrictions variable.

Before replying, we would like to provide a short description of the empirical work in Huang and Tang (2010). The paper studies the US housing price cycle between 2001 and 2009 using data from over 300 cities. We divide the price movements into two phases, an initial boom 2000 to 2006 and a bust 2006 thru 2009. We use the price booms and busts at the local level as dependent variables in cross-sectional regressions. The control variables are city profile and contemporaneous changes in economic conditions. The key right-hand-side variables are the regulatory and geographic constraints on housing supply. The measure of regulatory constraint is the Wharton Residential Land Use Regulatory Index (WRLURI) from Gyourko, Saiz and Summers (2008). The measure of geographic land constraint, obtained from Saiz (2010), is the proportion of undevelopable

1. Department of Economics, University of Alberta, Edmonton, AB T6G 2H4, Canada.
2. Department of Economics, Bowdoin College, 9700 College Station, Brunswick, Maine 04011-8497, USA. Email address: ytang@bowdoin.edu.

land that is lost to water bodies, wetlands and slopes within 50-kilometer radii from metropolitan central cities. The latter measure is at the metropolitan level; we assigned different cities the same value if they are within the same metropolitan area. From the regressions, we find that more restrictive residential land use regulations and geographic land constraints are linked to greater booms and busts in housing prices. We also interact the measures of supply constraints with variables proxying for the local impact of subprime mortgage credit expansion on housing demand. We find that both the geographic and the regulatory constraints amplify price responses to the subprime expansion in the decade, leading to greater price increases in the boom and subsequently bigger losses.[3] Both kinds of constraints are found to intensify the local boom-bust experience.

Regarding the empirical approach in Huang and Tang (2010), Cox (2010) raises the concern that the inclusion of both geographic and regulatory constraints could underestimate the effect of regulations on housing prices:

> …any approach that includes natural geographical constraints where there are interior regulatory geographical restrictions would have the potential to virtually negate coefficients for the restrictions and exaggerate coefficients for the natural geographical constraints. (Cox, 2010, 3)

Our view is that geography does not respond to regulations, so the variable of geographic constraints is unlikely to intermediate the effect of regulatory constraints on house prices. To the contrary, we believe that omitting geographic constraints has the potential to over-estimate the effect of regulations. The reason is that geographic constraints lead to higher land values, which in turn give homeowners stronger incentives to protect their housing investments by imposing constraints on new development (see Saiz 2010 and the references within for more discussion). Empirically, Saiz (2010) found that the measure of geographic constraints is correlated with more restrictive land use regulations. In the unlikely extreme case when regulations respond perfectly to geography constraints, the regulatory constraints themselves would simply intermediate the effect of geography and should not be included in the regressions at all.

Uncertainty in theory should be admitted. We can nevertheless assess the empirical relevance of Cox's concern by removing the geography variable from the regressions. This way, we give regulatory constraints all the benefit of the

3. The local impact of the subprime mortgage expansion on housing demand is proxied for by the rejection rates of mortgage applications before the subprime expansion and, alternatively, the prevalence of high-cost mortgage loans during the housing boom.

doubt. We report the regression outputs in Table 1 and compare them to regressions in which the geography variable is present.

Table 1: Regression Outputs

Variables	$\frac{P_{2006}-P_{2000}}{P_{2000}}$ (1)	$\frac{P_{2006}-P_{2000}}{P_{2000}}$ (2)	$\frac{P_{2009}-P_{2006}}{P_{2006}}$ (3)	$\frac{P_{2009}-P_{2006}}{P_{2006}}$ (4)
regulation	5.64 (2.08)***	6.64 (2.30)***	-4.55 (0.92)***	-5.78 (0.93)***
undevelopable land (%)	0.48 (0.13)***		-0.26 (0.04)***	
reject %	0.11 (0.24)	0.02 (0.24)	-0.43 (0.1)***	-0.43 (0.11)***
regulation * rejection	0.5 (0.15)***	0.59 (0.16)***	-0.31 (0.08)***	-0.35 (0.08)***
undevelopable land * rejection (%)	0.4 (0.009)***		-0.007 (0.004)**	
Δ employment 2000-2006 (%)	1.08 (0.36)***	0.84 (0.39)**		
Δ median household income 2000-2006 (%)	3.85 (0.36)***	4.84 (0.38)***		
Δ employment 2006-2009 (%)			1.28 (0.22)***	1.11 (0.22)***
population density in 2000	0.67 (0.47)	0.82 (0.56)	-0.24 (0.14)*	-0.52 (0.22)**
population in 2000	-0.007 (0.003)**	-0.007 (0.003)**	0.001 (0.0007)**	0.002 (0.0008)**
mean household income in 2000	0.03 (0.08)	0.04 (0.09)	-0.12 (0.04)***	-0.14 (0.05)***
proportion of urban population (%)	0.46 (0.5)	0.6 (0.48)	-0.11 (0.31)	-0.25 (0.3)
unemployment rate (%)	2.64 (1.30)**	2.10 (1.40)	0.31 (0.4)	0.29 (0.44)
proportion of vacant housing units (%)	0.006 (0.78)	-0.07 (0.94)	-0.34 (0.26)	-0.36 (0.24)
Const.	56.89 (2.01)***	57.40 (2.16)***	-25.32 (0.79)***	-25.45 (0.83)***
Obs.	327	327	327	327
R^2	0.62	0.58	0.33	0.23
F statistic	79.53	68.96	12.68	8.73

Notes: (1) The variables shown on the top row are dependent variables. (2) The numbers in the parentheses are robust standard errors. (3) *, **, and *** indicate statistical significance at 10%, 5%, and 1%.

The dependent variable in columns 1 and 2 is the house price boom (changes in house prices from 2000 to 2006). Column 1 includes the measure of

geographic constraints on the right-hand side; column 2 does not. The specifications in the two columns are otherwise identical. The common dependent variable in columns 3 and 4 is the price bust (changes from 2006 to 2009). The specifications of the two columns are again identical except that the geographic measure is present in column 3 but not in column 4. The comparisons between columns show little difference in the point estimates of the coefficients on regulation. When the measure of geographic constraints is included, a one standard deviation increase in WRLURI, holding other variables fixed at the sample means, raises the size of price boom by 5.64 percent and deepens the price bust by 4.55 percent. When the geographic measure is removed, the same increase in WRLURI raises the boom by 6.64 percent and worsens the bust by 5.78 percent.[4] Thus, removing the geographic measure changes the results in the direction suggested by Cox, but the changes are very minor.

Cox also raises questions about the measure of regulatory constraints (the Wharton Residential Land Use Regulatory Index (WRLURI) from Gyourko, Saiz and Summers 2008). We are not in a position to address those concerns. But given the measures available to us, we do not find evidence for Cox's concern that the geographic-constraints measure soaks up, and thus masks, much of the impact of the regulatory-constraints measure.

References

Cox, Wendell. 2010. Constraints on Housing Supply: Natural and Regulatory. *Econ Journal Watch* 8(1): 13-27. **Link**

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4. Because interactive terms are present on the right-hand side, we removed the sample means from all right-hand side variables before interacting them with one another. This way, we can interpret the coefficients on non-interaction terms as the marginal effects at the sample mean.

About the Authors

Haifang Huang is an assistant professor in the Department of Economics, University of Alberta. His research areas are macroeconomics, housing economics and the studies of well-being. His recent publications include articles in the *Industrial and Labor Relation Review* and the *British Journal of Political Science*. His email is haifang.huang@ualberta.ca.

Yao Tang received his Ph.D. from the University of British Columbia, Vancouver. He is currently an assistant professor in the department of economics at the Bowdoin College. His fields of specialization are macroeconomics, international economics, business economics, and applied econometrics. His email is ytang@bowdoin.edu.

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