Is there a law of one price for labor?

The simplest earnings regressions explain about 25% of the variation.

Adding information on industry, occupation, union, location, demographics, ..., explains up to 50%.

Can explain even more within firms, but wage equalization should occur across firms.
Measurement error

Recall bias
Wage versus benefits versus unpriced job amenities
Hours
Salary versus wage
Imputation

Bias toward zero, low $R^2$
Fig. 1: Wage Gap Estimates from Male Full Sample, Imputed Earners, and Respondents


Fig. 2: Schooling Returns among Female Respondents and Imputed Earners, 1998-2002


Why does real wage
= wage/price index
overcorrect?

Suppose two goods, Housing, H, and other, X

Price of X is similar everywhere, but there are high priced and low priced housing areas
<table>
<thead>
<tr>
<th>City, State</th>
<th>Median Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lansing, MI</td>
<td>93000</td>
</tr>
<tr>
<td>Pittsburgh, PA</td>
<td>126600</td>
</tr>
<tr>
<td>Dallas, TX</td>
<td>134700</td>
</tr>
<tr>
<td>Omaha, NE</td>
<td>138800</td>
</tr>
<tr>
<td>Kansas City, MO</td>
<td>150600</td>
</tr>
<tr>
<td>Houston, TX</td>
<td>155900</td>
</tr>
<tr>
<td>Des Moines, IA</td>
<td>156200</td>
</tr>
<tr>
<td>Minneapolis, MN</td>
<td>176200</td>
</tr>
<tr>
<td>Seattle, WA</td>
<td>307300</td>
</tr>
<tr>
<td>Boulder, CO</td>
<td>352400</td>
</tr>
<tr>
<td>New York, NY</td>
<td>395100</td>
</tr>
<tr>
<td>San Francisco, CA</td>
<td>591200</td>
</tr>
<tr>
<td>Honolulu, HI</td>
<td>621600</td>
</tr>
</tbody>
</table>

Should wages fully reflect these price differences?

National Association of Realtors [http://www.realtor.org/research/research/metroprice](http://www.realtor.org/research/research/metroprice)
Application: Response to a housing price differential, Ames and San Francisco

Median House Price

Des Moines $156K
San Francisco $591K

National Association of Realtors

HOW CAN SAN FRANCISCO COMPETE FOR WORKERS?

**How does local price variation affect returns to education?**

- Compute ratio of college earnings to high school earnings for each metro area
- Match on potential experience, $k$
- Standardize distribution of potential experience of college graduates at national level

\[
R_{kj} = \frac{W_{kj}^{16}}{W_{kj}^{12}}
\]

\[
R_j = \sum_{k=25}^{55} \left( \frac{\text{Pop}_{k}^{US_{16}}}{\text{Pop}_{k}^{US_{16}}} \right) \cdot \left( \frac{W_{kj}^{16}}{W_{kj}^{12}} \right)
\]
Correlation between housing prices and returns = -0.54

Two types of workers in each city \( j \), college educated (1) and high school educated (0), paid

\[ w_j^1 \quad \text{and} \quad w_j^0 \]

Utility depends on consumption of housing, \( H_j \), priced locally at \( p_j \); a good \( X \) priced equally everywhere at \( p_X = 1 \), so relative housing price is \( p_j \), and the level of local amenities, \( A_j \)

\[ u^1(H_j,X_j,A_j); u^0(H_j,X_j,A_j) \]

Utility has to be the same everywhere for each worker type,

All income is spent on \( H_j \) and \( X_j \), but appreciation of \( H_j \) may depend on \( A_j \). Expenditures are

\[ w_j^1 = e^1(p_j(A_j),u^1,A_j) \]
\[ w_j^0 = e^0(p_j(A_j),u^0,A_j) \]
How would local prices affect returns to schooling?

Dropping \( j \) subscripts for simplicity, returns defined by

\[
R_j = \frac{w^1}{w^0} = \frac{e^1(p(A), u^1, A)}{e^0(p(A), u^0, A)}
\]

Amenities affect local housing prices.
How do they affect returns to schooling?
When would areas with amenities lower returns to education?

\[
\frac{\partial R}{\partial A} = R_A \\
= \left[ \left( \frac{\partial e^1}{\partial p} \cdot \frac{dp}{dA} \right) + \frac{\partial e^1}{\partial A} \right] e^0 - \left[ \left( \frac{\partial e^0}{\partial p} \cdot \frac{dp}{dA} \right) + \frac{\partial e^0}{\partial A} \right] e^1 \\
\leq 0
\]

Negative when

\[
\left[ \left( \frac{\partial e^1}{\partial p} \cdot \frac{dp}{dA} \right) + \frac{\partial e^1}{\partial A} \right] - \frac{e^1}{e^0} \cdot \left[ \left( \frac{\partial e^0}{\partial p} \cdot \frac{dp}{dA} \right) + \frac{\partial e^0}{\partial A} \right] \leq 0
\]

Note, Shephard’s Lemma implies

\[
\frac{\partial e}{\partial p} = H^0
\]
\[
\left[ \left( H^1 \cdot \frac{dp}{dA} \right) + \frac{\partial e^1}{\partial A} \right] - \frac{e^1}{e^0} \cdot \left[ \left( H^0 \cdot \frac{dp}{dA} \right) + \frac{\partial e^0}{\partial A} \right] < 0
\]

Divide by \( e^1 \), multiply by \( A \), and rearrange

\[
\frac{dp}{dA} \frac{A}{p} \left[ \frac{pH^1}{e^1} - \frac{pH^0}{e^0} \right] + \left[ \frac{A}{e^1} \frac{\partial e^1}{\partial A} - \frac{A}{e^0} \frac{\partial e^0}{\partial A} \right] < 0
\]

\[
\eta_A [s^1_H - s^0_H] + [\varepsilon^1_A - \varepsilon^0_A] < 0
\]
\[ \eta_A [s^1_H - s^0_H] + [\varepsilon_A^1 - \varepsilon_A^0] < 0 \]

\[ \eta_A > 0 \quad \text{Housing price elasticity with respect to local amenities} \]

\[ s^*_H > 0 \quad \text{Budget share of housing} \]

\[ \varepsilon_A^k < 0 \quad \text{Elasticity of expenditures with respect to the amenity. Holding utility and prices fixed, how does } A \text{ affect } e? \]

**What has to be true for the negative sign to hold?**

**What has to be true for amenities to have no effect on returns to education?**
What about the effect of housing prices directly?

\[ \frac{\partial R}{\partial p} = R_p = \frac{\left[ \left( \frac{\partial e_1}{\partial p} \right) e^0 - \left( \frac{\partial e_0}{\partial p} \right) e^1 \right]}{(e^0)^2} \]

\[ = \frac{p \left[ (H^1) \right] e_1}{e_0} - \frac{p \left[ (H^0) \right] e_1}{e_0} \]

\[ = \frac{R}{p} [s_H^1 - s_H^0] < 0 \]

What has to be true for housing prices to have no effect on returns to education?

Multiply and divide by \( p \), multiply and divide first term by \( e^1 \)
\[ R_j = \gamma_0 + \gamma_1 P_j + \gamma_2 (BA/HS)_j + \epsilon_j. \]

**Table 3. Estimated Regression Coefficients: Dependent Variable is the Return to College**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Unweighted OLS</th>
<th>Weighted OLS</th>
<th>Median Regression</th>
<th>Robust Regression</th>
<th>Trimmed, Based on DFIT Stat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing Price Index</td>
<td>-0.083</td>
<td>-0.108</td>
<td>-0.088</td>
<td>-0.098</td>
<td>-0.106</td>
</tr>
<tr>
<td></td>
<td>(0.0248)</td>
<td>(0.0262)</td>
<td>(0.0263)</td>
<td>(0.0222)</td>
<td>(0.0173)</td>
</tr>
<tr>
<td>Ratio of College Graduates to HS Graduates</td>
<td>0.135</td>
<td>0.139</td>
<td>0.146</td>
<td>0.139</td>
<td>0.155</td>
</tr>
<tr>
<td></td>
<td>(0.0181)</td>
<td>(0.0252)</td>
<td>(0.0249)</td>
<td>(0.0187)</td>
<td>(0.0141)</td>
</tr>
<tr>
<td>( R^2 ) or pseudo ( R^2 )</td>
<td>0.163</td>
<td>0.197</td>
<td>0.099</td>
<td>—</td>
<td>0.272</td>
</tr>
<tr>
<td>N (number of metro areas)</td>
<td>253</td>
<td>253</td>
<td>253</td>
<td>253</td>
<td>231</td>
</tr>
</tbody>
</table>