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Is the Growing Skill Premium a Purely Metropolitan Issue?

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Abstract: This paper documents that virtually all of the growth in the skilled wage premium over the 1980's in the United States was confined to metropolitan areas. Explanations for the growth in the skilled wage premium will therefore need to take location into account.

Keywords: skilled wage premium, metropolitan areas

JEL Classifications: J31, R23 F16

Data Source: Our data comes from the Integrated Public Used Microdata Series, Current Population Survey: Version 2.0 [Machine-readable database] by Miriam King, Steven Ruggles, Trent Alexander, Donna Leicach, and Matthew Sobek. Minneapolis, MN: Minnesota Population Center [producer and distributor], 2004.

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I. Introduction

One literature in economics has documented a growing wage gap between skilled and unskilled workers that emerged during the 1980's. Trade- and labor economists have hotly debated the cause of the growing skilled wage premium, as the 1980's was a relatively stable decade for the United States' labor market with an increased supply of skilled labor.¹ After long debate, Bound and Johnson (1992) arguably provided a consensus that the primary cause of the rising skilled wage premium was skill-biased technical progress.² Levinsohn (2002) provides an excellent survey of skill-biased technical progress as it relates to trade and wage inequality by skill.

A second literature has noted a large but stable wage gap between urban and non-urban workers. Papers by Roback (1982) and Glaeser and Maré (2002) in public and urban economics have implied that an urban wage premium should be expected because of differences in the cost of living. Using a general equilibrium setting, Roback identifies higher production amenity levels in metropolitan areas as compensating for higher wages and rents there. Glaeser and Maré document that the urban wage premium is large and interacts positively with experience. They interpret this as evidence that urban workers acquire skills more rapidly than non-urban ones, perhaps through greater opportunities in denser settings. Kim (2002) also documents that a substantial portion of the urban wage premium remains after controlling for differences in cost of living. He shows that the wage premium is related to unobservable differences in the quality of

¹ See Krugman (2000) for trade economists' perspectives on this issue.

² Some other explanations such as trade were also found to be valid to some extent, but not powerful enough to account for the large change in the relative wages.

urban and non-urban workers. Thus both Glaeser and Maré (2002) and Kim (2002) find that the large urban wage premium is related to skill differentials, whether acquired or innate.

While separate explanations for the rising skilled wage premium and metropolitan premium have been developed, little is known about how the two relate. Here we model and estimate the skill and urban wage gap trends jointly to better understand the wage gap for skill in light of location. Our intuition is that the “skill-biased technical progress” identified by Bound and Johnson (2002) as causing the growing skilled wage gap may in fact be a “skill- *and urban* biased technical progress.” Taking workplace computer use as an example, computers might be better used by skilled rather than unskilled labour. But computers might also better enhance productivity in urban areas than in non-urban ones, facilitating the denser networks of interactions required there, such as between managers and their workers (Bresnahan (1999)).

We use a spatial model to illustrate the potential effect of location-specific skill-biased technical progress on both skill and urban wage premia. We then test empirically for the degree to which the skilled wage premium is location specific, using a difference (skilled vs unskilled) in difference (1980 vs 1990) in difference (urban vs non-urban areas) approach with data from the United States’ Current Population Survey and Census.

II. A Spatial Equilibrium Model

Labor Supply Across Areas

Consider an economy with a traded good, X_1 , and a non-traded good X_2 . There are N workers with $i =$ two skill types: skilled s and unskilled u . There are also $j =$ two areas: metropolitan m , and non-metropolitan, n . While the proportion of skilled workers is exogenous,

workers of either skill can choose the area in which they work. Contingent on this choice, a worker of skill i chooses consumption to maximize

$$X_1^\theta X_2^{1-\theta} \text{ subject to } w_{ij} = X_1 + P_j X_2. \quad (1)$$

X_1 is the numeraire, P_j is the price of X_2 in area j , w_{ij} is the wage rate for skill i in area j , and individual labor supply is fixed at 1. Because each worker solving (1) can choose his area, the equilibrium condition across areas is

$$\ln w_{im} - \ln w_{in} = (1-\theta)(\ln P_m - \ln P_n) \quad \text{for } i = s \text{ or } u. \quad (2)$$

That is, the metropolitan wage premium for either skill will adjust to a purchase-weighted fraction of the price premium for the non-traded good.

Labor Demand Across Areas

We assume constant returns to scale technology, and represent the many price taking firms in an area with an aggregate representative. The area production function for the tradeable good is $X_1 = T_j F(K_j, L_j)$, where T_j is total factor productivity, K_j is capital, and L_j is aggregate demand for labor in area j . L_j is composed of both skilled and unskilled workers who differ in their respective efficiency units h_{sj} and h_{uj} , where $h_{sj} > h_{uj}$. The area demand for efficiency units of labour is:

$$L_j = h_{sj} N_{sj} + h_{uj} N_{uj}, \quad (3)$$

where N_{sj} and N_{uj} represent the number of skilled and unskilled workers in j .

Firms in the two areas have the same profit function for X_1 and choose K_j and L_j to maximize

$$T_j F(K_j, L_j) - w_j L_j - r_j K_j, \quad (4)$$

where r_j is the rental price of capital and w_j is the weighted average of skilled and unskilled

wages (or $w_j = (\frac{N_{sj}}{N_{sj} + N_{uj}})w_{sj} + (\frac{N_{uj}}{N_{sj} + N_{uj}})w_{uj}$). Finally, if each area's production technology is

Cobb-Douglas $F(K_j, L_j) = K_j^\alpha L_j^{1-\alpha}$ and there is free entry and zero profit in equilibrium, we

obtain the following isoprofit conditions across areas:

$$[1/(1-\alpha)] \ln [T_m/T_n] = \ln [w_m/w_n] + [\alpha/(1-\alpha)] \ln [r_m/r_n]. \quad (5)$$

From (5), higher total factor productivity in the metropolitan area can compensate firms there for higher rental rates and wages.

With competitive labor markets, skilled and non-skilled wages within an area are set equal to the value of marginal product ($w_{ij} = T_j F_{2j} h_{ij}$ for $i = s, u$) which implies

$$\ln w_{sj} - \ln w_{uj} = \ln h_{sj} - \ln h_{uj}. \quad (6)$$

Returning to our hypothesis, technical progress that was skill *and* urban-biased could be represented by an increase in h_{sm} and no change in h_{um} , h_{sn} and h_{un} . From equation (6) and the definitions of w_j and w_{ij} we can obtain the following comparative statics:

$$\frac{d(\ln w_{sm} - \ln w_{um})}{d \ln h_{sm}} > 0, \frac{d(\ln w_{sn} - \ln w_{un})}{d \ln h_{sm}} = 0, \frac{d(\ln w_s - \ln w_u)}{d \ln h_{sm}} > 0 \quad (7)$$

That is, technical progress that was skill and urban biased would raise the economy's overall skilled wage premium, but due entirely to increased polarization between skilled and unskilled wages in metropolitan areas.

III. Empirical Results

Data

To estimate the degree to which changes in the skilled wage premium have depended on area, we use cross-sectional data from the United States' Current Population Survey (CPS) for March 1981 and 1991. For all analysis, we restrict our samples to male heads of household. We use only positive earners between the ages of 18 and 65. Our wage variable is average hourly earnings, constructed as annual labor earnings divided by annual hours of work.

Difference-in-Difference-in-Difference Results

The rising wage gap between skilled (college educated) and unskilled (no college) workers during the 1980's is evident in our sample, in line with many other studies in the literature. From row 3 in Table 1, the overall wage gap for skill jumped from 30 percent ($=e^{.2625} - 1$) in 1981 to about 45 percent in 1991.

It is clear, however, that this rising skill premium is not observed across the economy. Rather, it is location specific, occurring primarily in urban areas. The last column of Table 1 shows a 13.5 percent increase in the skill premium in metropolitan areas (row 9) in contrast to a 2.9 percent increase in non-metropolitan areas (row 6). From the last row of Table 1, we see that the difference in the skilled wage premium between metro and non-metro areas grew from a slight 1.5 percent in 1981 to a puzzling 12.0 percent in 1991. In short, the rise in the skilled wage premium occurred only in metropolitan areas and resulted in a substantial difference in that premium between metro and non-metro areas.

We attempt next to capture this metropolitan-specific rise in the skilled wage premium in a linear regression context. By doing so, we can estimate the above difference-in-difference-in-difference result with control over other relevant individual characteristics and can test whether the changes identified are statistically significant. We estimate the following pooled wage specification:

$$\ln w_{it} = \alpha + \beta' \mathbf{Z}_{it} + \delta_1 t + \delta_2 S_{it} + \delta_3 M_{it} + \delta_4 t \times S_{it} + \delta_5 t \times M_{it} + \delta_6 M_{it} \times S_{it} + \delta_7 t \times S_{it} \times M_{it} + \varepsilon_{it}. \quad (8)$$

$\ln w_{it}$ refers to the log hourly wage rate of individual i in year t , and $\mathbf{Z}_{it}$ is a vector of individual characteristics including age, race and region. S_{it} is a skill dummy variable equal to one if the individual attended college, M_{it} is a metropolitan dummy variable equal to one if the individual lives in a metropolitan area, t is a time dummy variable equal to one if the year is 1991, and ε_{it} is a pure random error term. To compare with the previous descriptive results, δ_2 and $(\delta_2 + \delta_4)$ represent the skill wage premia for 1981 and 1991 respectively when we omit interaction variables between skill and location ($M_{it} \times S_{it}$ and $t \times S_{it} \times M_{it}$). Similarly, area coefficients δ_3 and $(\delta_3 + \delta_5)$ represent the metropolitan wage premia for 1981 and 1991, respectively. δ_4 and δ_5 represent the change in the skill premium and the change in the metropolitan premium, respectively, during the 1980's. Finally, δ_7 represents the interaction between skill, area and time, or the change in the difference in skilled wage premium between urban and non-urban areas during the 1980's.

Table 2 presents the results for equation (8), with several interesting findings. Column (1) shows a *Metro* wage premium ($\hat{\delta}_3$) of about 17 percent ($=e^{.1561}-1$) and a *Skill* premium ($\hat{\delta}_2$) of

about 33 percent. Column (2) shows that the skilled wage premium grew significantly over the 1980's, ($\hat{\delta}_4 = .0818$) as did the metropolitan wage premium ($\hat{\delta}_3 = .0719$). However, when we include an interaction term for all three dummy variables – *Time*, *Metro* and *Skill* in Column (3), it picks up most of the wage dynamics over the decade so that the interaction term for *Time* and *Skill* ($\hat{\delta}_4$) becomes insignificant. This is important because it suggests that the rising skilled wage premium during the 1980's was limited to metropolitan areas only.

IV. Robustness Check

To test the robustness of our empirical results, we use more comprehensive Census data to replicate our CPS results. We also extend our sample points from two (1981 and 1991) to five (1976, 1981, 1986, 1991 and 1996).

Census Results

We use the 1980 and 1990 Census One Percent Metropolitan Public Use Microdata Samples (IPUMS). In this sample we also find an upward trend in the 1980's in the skilled wage gap overall and in the metropolitan skilled wage gap in particular. Similarly, when we include the interaction terms for all three dummy variables (time, skill and metropolitan status) as in column (4) of Table 3, the metropolitan skilled wage premium increases by about 8 percent. As before, this picks up most of the wage dynamics over the decade, so that the estimated change in the skill premium in non-metropolitan areas is only 2 percent.³

³ All of these results are available upon request.

A Larger Time Series

To see if our findings result from comparing two idiosyncratic years, we present in Figure 1 the changes in skilled wage premia by area between 1976 and 1996. Figure 1 confirms that the skilled wage premium grew rapidly during the 1980's, due almost entirely to its rapid increase in metropolitan areas. In contrast, the skilled wage premium in non-metropolitan areas has stayed at about 25 percent since 1976.

V. Discussion

Clearly, skill-biased technical change alone cannot explain a growing skilled wage gap that is confined to urban areas. While offering no definitive explanation, we noted earlier the possibility that technical progress in the 1980's was both skill *and* urban-biased in the gains to productivity it conferred. A second explanation for the urban nature of the rising skilled wage gap comes from the positive interaction between skill and metropolitan area in the CPS regressions in Table 2. In the framework of Jovanovic and Rob (1989), skilled workers may better decrease the cost of acquiring knowledge and facilitating communication for urban than non-urban employers. A third explanation might be one of composition. Perhaps skill-intensive industries grew faster inside metropolitan areas than outside them in the 1980's, disproportionately drawing more highly educated workers. The higher urban demand for skilled labor would then contribute to the additional premium such workers would enjoy. Distinguishing between these explanations empirically would be a useful next step.

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Figure 1. Skilled Wage Premia Over Time

Table 1. Log wage difference (in skill level) in difference (in metropolitan status) in difference (in time period) results, CPS 1981 and 1991

		1981	1991	Change (1991-1981)
Skill wage premium overall	Mean log unskilled hourly wage	2.3852	2.3155	-.0697
	Mean log skilled hourly wage	2.6477	2.6887	0.0410
	Difference (Skill Premium)	.2625	.3732	.1107
Skill wage premium in non- metropolitan areas	Mean log unskilled hourly wage	2.2966	2.2104	-.0862
	Mean log skilled hourly wage	2.2533	2.4758	-.0575
	Difference (Skill Premium) (1)	.2367	.2654	.0287
Skill wage premium in metropolitan areas	Mean log unskilled hourly wage	2.4380	2.3593	-.0787
	Mean log skilled hourly wage	2.6896	2.7378	.0482
	Difference (Skill Premium) (2)	.2516	.3785	.1269
D-D-D	(2)-(1)	.0149	.1131	.0982

Table 2. Regression adjusted diff-in-diff-in-diff. results, CPS 1981 and 1991

	(1)	(2)	(3)
	Basic Model	(1) + Premium Trend	(2) + Interaction Trend
<i>Intercept</i>	.4713 (.0301)***	.5116 (.0303)***	.5175 (.0304)***
<i>North East</i>	.1202 (.0064)***	.1195 (.0063)***	.1206 (.0063)***
<i>North Central</i>	.0922 (.0060)***	.0943 (.0060)***	.0949 (.0060)***
<i>West</i>	.0788 (.0062)***	.0809 (.0062)***	.0826 (.0062)***
<i>Race</i>	.1549 (.0076)***	.1559 (.0076)***	.1559 (.0076)***
<i>Age</i>	.0716 (.0014)***	.0714 (.0014)***	.0714 (.0014)***
<i>Age</i> ²	-.0007 (.0000)***	-.0007 (.0000)***	-.0007 (.0000)***
<i>Metro</i>	.1561 (.0051)***	.1237 (.0068)***	.1123 (.0085)***
<i>Skill (College)</i>	.2816 (.005)***	.2395 (.0065)***	.2181 (.0117)***
<i>Time</i>	-.0587 (.0045)***	-.1469 (.0091)***	-.1185 (.0106)***
<i>Metro*Skill</i>	---	----	.0307 (.0141)**
<i>Time*Metro</i>	---	.0719 (.0101)***	.0330 (.0101)***
<i>Time*Skill</i>	---	.0818 (.0091)***	.0092 (.0177)
<i>Time*Metro*Skill</i>	---	---	.0914 (.0207)***
N	50180	50180	50180
Adj-R ²	0.1923	0.1947	0.1958

***, **, * refer to significance at the 1%, 5% and 10% levels. Numbers in parentheses are standard errors. Race is equal to one if white.