Do Some People Work Harder than Others? Evidence from Real Estate Brokerage

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Abstract:
The decision to work and its levels of intensity are estimated for the real estate brokerage industry where workers can set their own hours. A three-stage model of the brokerage labor market is presented with decisions made recursively between full- and part-time status, wage offers and hours worked. The application is to data from a cross-sectional survey of 6,842 real estate licensees in the United States for 1999. Conditional on self-selection, an expected wage for real estate licensees is estimated given skills and personal characteristics. That expected wage enters the supply-side equation for the number of hours worked. The findings indicate that skills such as education, experience and licensee status are related to higher wages, but there is a negative self-selection in wages: part-time workers have higher unmeasured skills. Schooling and experience decreases hours worked, consistent with increasing efficiency. The resulting labor supply elasticity with respect to the wage is 0.24.
Keywords Agency - Earnings - Labor supply - Part-time - Real estate brokerage - Race - Work choice

Article:
Introduction
The decision to work and to supply hours comes from worker choices and flexibility, given wages. However, most workers typically do not have choices over their hours or flexibility in their supply. They work the hours and at wages that the employer determines. Their choice is between employers and their discontinuous decision to take another job. That makes labor supply decisions difficult to estimate, to standardize and to compare.

Real estate brokerage provides a testing ground for labor market and compensation incentive theories that is not readily available elsewhere. As employees of the brokerage firm, agents and brokers as licensees set their own hours so that their compensation is determined by inherent skills and characteristics, and networks that produce clients. There is an endogenous labor supply function selected by the worker and contingent on the commission and compensation.

The estimation of labor supply functions in this paper takes into account the self-selection decisions on whether to work full-time or not. The wage is endogenous, dependent on personal skills and characteristics. Contingent on that wage, the licensee as agent or broker responds by selecting the hours worked.

In real estate, there is a labor supply function that is potentially upward sloping in the wage offered. Each employee chooses the hours to work, based on skills and other characteristics. In other work environments, employers set the work hours. "Clocking in" is used to determine hours worked for payroll purposes, not as part of an employee supply decision based on wages. As opposed to using total earnings, this paper develops a structural model to test skills and characteristics in determining the wage and hours. In the real estate brokerage industry, it is possible to test the hours worked by demographic groups, such as by race, gender, ethnicity, marital status and even political affiliation. These hours worked are endogenous, personally-determined decisions. The question addressed here is whether some people work harder than others given their skill sets and personal characteristics. The model also controls for location and firm characteristics.

The real estate brokerage licensee chooses recursively between full- and part-time status, wages offered and hours worked. There is a self-selection on whether to work full- or part-time, allowing for a test of whether there is a structural break between those who work more than 20 h a week, or full time and those who do not. The self-selection occurs because part-time licensees have a network of friends and relatives as potential clients. Full-time licensees must extend beyond their relationship network which is costly in time and effort. Each of these two groups, if there is a discontinuity, has an expected wage given skills and characteristics. That wage is dependent upon the number of hours worked and the labor supply. When using a direct regression such as the logarithm of earnings on a set of employee skills and characteristics, there is possible misspecification from ignoring self-selection biases.[1]

The application is to a cross-sectional survey of 6,842 licenses in the United States for 1999 conducted by the National Association of Realtors (NAR). Included are the earnings reported by real estate licensees such as agents and brokers.[2] The three-stage labor market is sequential on full- and part-time status, on wages and on hours worked.

Background

In 2005, there were 2.5 million licensed real estate agents and brokers in the United States, or nearly 2% of the labor force. Of these, 1.2 million were members of the National Association of Realtors.[3] These licensees worked in 236,000 offices for 98,000 firms.

As licensees surged by 26% between 2002 and 2004, average annual earnings fell from $52,000 to $49,300. That decline came amidst a robust real estate market, but an increase in part-time employment.[4] Apart from earning less than other financial sector professionals, but not adjusted for part-time status, the industry has not been immune to differences in outcome and performance between workers. Real estate licensees earn low returns to education using data from the United States Census (Jud and Winkler (*1998*)).[5] Carroll and Clauretie (*2000*) find that men have higher annual earnings than women as real estate licensees, again using Census data. Men earn more even if adjusted for marital status. These results come from a direct regression of the logarithm of total earnings on licensee skills and personal characteristics.[6]

Other studies of real estate salespeople have viewed total income as the dependent variable, with wages and hours as independent. Follain et al. (*1987*) for Illinois and Glower and Hendershott

(*1988*) for Ohio find that while experience yields a return, there are no differences in income by gender. Crellin et al. (*1988*) also find no statistically significant difference in earnings for non-brokers based on gender as well as for race. Within broker subsamples, women and African-Americans earn significantly less than white male counterparts.

From a survey of 16 residential real estate brokerage firms in Dallas and Houston, Abelson et al. (*1990*) find that females earn more than males. Although a small sample is employed, the authors find support for earnings increases based upon hours worked per week, formal education, work satisfaction and firm reputation.

Another income determinant for real estate sales professionals is the ability to list properties for sale. Larsen (*1991*) and Johnson et al. (*1988*) examine sales agent characteristics such as "likeability" and property listing outcomes for various agents which translates into income, but do not consider gender and race of the agents. Kennan (*2001*) discusses the role that agents play in bargaining and resolving private information differences between sellers and buyers. With an experimental game analysis, Yavas et al. (*2001*) show that a seller using a licensee obtains a higher sales price, but time on the market is increased. Gender and race are not examined in their theoretical and empirical models used in these studies.

In an expansion of the array of income determinants, Sirmans and Swicegood (*1997, 2000*) survey Florida and Texas licensees and show that perceived image as a real estate professional, job satisfaction, and having errors and omissions insurance are positively related to income. Males earn substantially more than females and race is not statistically significant.[7]

What has not been examined as extensively is the choice of licensees between full- versus part-time work, controlled for personal characteristics such as race, gender, age, marital status and political affiliation. Real estate licensees represent an informative employment pool because of the flexibility of schedule afforded to the worker, which is somewhat unique to this industry. Estimates of labor supply elasticities can be constructed that satisfy the condition that employees select their own hours. Licensees are employees of the brokerage firm that they work at, but have flexibility to select hours worked.

Model

The potential licensee first makes a decision about working full- or part-time, and then subsequently receives a wage offer. That decision tests for a discontinuity in work hour preferences. Once having assigned themselves to full- or part-time categories, they remain completely free to select their hours. Hours worked are endogenous, given the wage offer and selection. The direct regression of earnings on characteristics does not account for the endogeneity and self-selection. This structure may lead to incomplete results about personal characteristics such as race, gender and differential skill on earnings and hours worked.

The real estate licensee labor market has two fundamental characteristics. First, the licensees face the same demand conditions. Second, workers select hours worked. An individual has skills X such as education and experience, and characteristics Z such as race-ethnicity and sex. A licensee selects full- or part-time status. Once a person has selected work status, he or she is offered a wage in a second stage, given skills and personal characteristics.

By controlling for demand, choosing hours, and work status, differences in work performance are more carefully distinguished. The return to skills and education is estimated. Also, emerging from the analysis is the outcome facing women and minorities in the work force.

Given the skills and traits *(X,Z)* the individual decides on intensity of work. In most contact professions, a person has leads such as family and friends. Other contacts require more extensive development. With that structure, and with other choices over leisure and a limited set of other contacts, the person becomes a full-time licensee when indirect utility *V* is

$$V(I = 1 : X, Z, L) \geqslant V(I = 0 : X, Z, L). \quad (1)$$

Here *L* contains the variables that determine full- or part-time work. When the person chooses to work full-time, then $I = 1$.

For empirical purposes, part-timers are those working no more than 20 h a week. Full-time workers are those working more than 20 h a week. Both groups select the number of hours that they willing to work, conditional on full- or part-time status.

Let *I** be an index of intensity for choosing to work full-time. This index is based on the condition $V(I = 1) - V(I = 0) > 0$. The decision to work full-time and provide labor depends on variables *L*. Those variables have parameters α, so $L\alpha$ is the expected value of the index of working full-time.[8] Larger, more institutional firms may require that employees be full-time.

The index of full-time work intensity is $I* = L\alpha + \upsilon$. The full-time work intensity has an expected value $E(I*) = L\alpha$ and a disturbance term υ. The person works full-time when $L\alpha + \upsilon > 0$. Otherwise, the person is a part-timer. This condition is

$$\begin{cases} I* = L\alpha + \upsilon \\ I = 1 \quad L\alpha + \upsilon > 0 \\ I = 0 \quad L\alpha + \upsilon \leqslant 0 \end{cases}. \quad (2)$$

Some people, particularly real estate licensees, may choose part-time work deliberately. They have a network of family and friends or from social contact that produces listings and sales at low cost. This network causes a self-selection, with being in full- or part-time status not having a zero mean.

This error ε adjusted for the self-selection for full-time work is:

$$\begin{cases} E(\varepsilon \mid \upsilon > -L\alpha) = \lambda m \\ m \equiv \dfrac{f(-L\alpha)}{1 - F(-L\alpha)} \end{cases} \quad (3)$$

In Eq. 3, *m* is the inverse Mills ratio that adjusts for the self-selection between full- and part-time status. The density function of the error is *f* with cumulative probability *F*. The coefficient on the inverse Mills ratio is λ.

Conditional on the worker's skills and traits, the labor market offers an hourly wage

$$W = X\beta_X + Z\beta_Z + \lambda m + \varepsilon \quad (4)$$

In Eq. 4, β are parameters given error ε. When the coefficient of *m* is positive there are unobserved variables that both increase the probability of selection of full-time work and a higher than average score on the dependent variable. When the coefficient λ is negative, there are unobserved variables increasing the probability of selection of part-time work. There is probability of a lower than average score on the dependent variable. Unobservable factors such as social networks favor part-time status in real estate sales.

In Eq. 4 *W* is the hourly wage or return on skills and traits that a worker is offered conditional on the decision in Eq. 1. All potential workers are considering the same industry. The demand facing a particular person is $\widehat{W}(X, Z)$. This is the expected wage, given characteristics. The expected wage is the fitted value from the wage equation 4.

If Eq. 1 is satisfied, there is an index and a selection for $I = 1$ for those workers willing to work full-time. All workers select their own hours *H* which are endogenous. In a typical application, many workers are faced with a choice of working from 9 a.m. to 5 p.m. or not working. In this case, the hours are flexible, but conditional on a commitment to the industry.

Across an observed sample of workers in the same industry, able to choose their own hours, the direct utility level is $U(C, -H: X, Z, I = 1)$, with *C* defined as goods consumption, with price *P*. The maximization is for individuals who have already decided to work full-time or in the empirical analysis for at least 20 h a week. Once having made this choice, the workers are free to select any number of hours. Each worker has a market opportunity set offering a wage *W*, and selects hours *H*. Total time available is *T*, so $T - H$ hours are spent in non-working activities or leisure.

The third stage of the process is a separate, recursive utility maximization to select the number of hours to work. The constrained maximization problem is

$$V\left(\widehat{W}, P : X, Z, I = 1\right) = \max_{C,H} U(C, -H : X, Z, I = 1) + \theta\left[T\widehat{W} \geqslant \mathrm{PC} + (T - H)\widehat{W}\right] \quad (5)$$

The fitted or predicted wage given characteristics is $\widehat{W}$ and the price of a composite consumption good is *P*. The worker's full income for working all the time is $T\widehat{W}$. Here $T = 168$, if the worker puts in 24 hour a day, 7 day a week workweeks. The expenditure on goods is *PC*. The value of the leisure from time not working is $(T-H)\widehat{W}$. The price of another dollar of full income is θ. The constrained maximization is conditional on the person selecting full-time work, or more than 20 h a week.

The hours worked are obtained from Roy's Identity in the indirect utility function

$$H = -\frac{\partial V / \partial \widehat{W}}{\partial V / \partial Y} = H * \left(\widehat{W} : X, Z, I = 1\right) \tag{6}$$

based on the expectations that the worker has about the wage $\widehat{W}$ and the contingent decision on full- or part-time status. Taking a linear approximation to Eq. 6 yields the hours supply as

$$H = \gamma_W \widehat{W} + X\gamma_W + Z\gamma_Z + \varepsilon_H. \tag{7}$$

This yields a recursive system for the market for real estate licensees. Those wanting to sell houses choose between full- and part-time employment, set at whether they are willing to work more than 20 h a week. Conditional on that decision and each person's skills and characteristics, the labor market offers a wage. That is an expected or conditional wage. The conditional wage, preferences and characteristics determine the number of hours to work.

This structure corresponds to the market for real estate brokerage. Full- and part-time workers coexist within the industry. Each person has an hourly wage or return on skills. Here, the wage is based on performance. Each licensee determines the hours worked.

Specification, Data and Empirical Results

The models used in the empirical estimation include a probit selection criterion model and two recursive regression equations. The first stage is for the probit decision on working full- or part-time. The latent variable structure is $I* = L\alpha + \upsilon$, where $L\alpha$ is an index function and $\upsilon \sim N(0,1)$. The observables are $I = 1,\ I* = L\alpha + \upsilon > 0$ and $I = 0, I* = L\alpha + \upsilon \leqslant 0$. Then $\Pr(I* > 0) = \Pr(L\alpha + \upsilon > 0) = \Pr(\upsilon > -L\alpha) = \Pr(\upsilon < L\alpha) = F(L\alpha)$.

Each observation is binomial with probability $\Pr(I* > 0)$. The sample is sorted to that the first N_1 workers are full-time with $I = 1$ and the remaining $N - N_1$ have $I = 0$. The probability of the sample, if it is jointly independently and identically distributed is $\prod_{i=1}^{N_1} F(L_i\alpha) \prod_{i=N_1+1}^{N} [1 - F(L_i\alpha)]$. The likelihood function is

$$L = \prod_{i=1}^{N_1} F(L_i\alpha)^{I_i} \prod_{I=0} [1 - F(L\alpha)]^{1-I_i}$$

. Here $I_i = 1$ for full-time workers and zero otherwise. The logarithm of the likelihood function is

$$\begin{aligned} \ln L &= \sum_{i=1}^{N_1} I_i \ln F(L_i\alpha) + \sum_{i=N_1+1}^{N} (1 - I_i) \ln (1 - F(L_i\alpha)) \\ &= \sum_{i=1}^{N_1} I_i \ln F(L_i\alpha) + \sum_{i=N_1+1}^{N} (1 - I_i) \ln (F(-L_i\alpha)) \end{aligned} \tag{8}$$

$$\ln L = \sum_{I=1}^{N} \ln F(q_i L_i \alpha)$$

since $1 - F(L\alpha) = F(-L\alpha)$. The logarithmic likelihood function is where $q = 2I - 1$ Estimation of the parameters is by maximizing the likelihood function in parameters or

$$\begin{aligned} \frac{\partial \ln L}{\partial \alpha} &= \sum_{i=1}^{N_i} \frac{f(L_i\alpha)}{F(L_i\alpha)} L_i - \sum_{i=N_1+1}^{N} \frac{f(L_i\alpha)}{1-F(L_i\alpha)} L_i = 0 \\ &= \sum_{i=1}^{N} \frac{f(L_i\alpha)}{F(L_i\alpha)} I_i - \frac{f(L_i\alpha)}{1-F(L_i\alpha)} (1 - I_i) = \sum_{i=1}^{N} \frac{q_i f(q_i L_i\alpha)}{F(q_i L_i\alpha)} L_i = 0 \end{aligned} \tag{9}$$

$$\sum_{i=1}^{N} u_i L_i = 0$$

Generalized method of moments estimation satisfies the orthogonality condition where

$$u_i = \begin{cases} f_i \left[\dfrac{I_i}{F(L_i\alpha)} - \dfrac{1 - I_i}{1 - F_i(L_i\alpha)} \right] \\ f_i \left[\dfrac{I_i - F(L_i\alpha)}{F(L_i\alpha)(1 - F_i(L_i\alpha))} \right] \end{cases} \tag{10}$$

The direct residual is $I_I - F(L_i\alpha)$.

Here $I = 1$ for full-time employment (FT = 1), and $I = 0$ for part-time employment (FT = 0). The vector L includes independent variables related to the logarithmic probability of a person selecting full-time employment, and α is the coefficient estimates from the probit model. Indicators of full-time employment are productivity measures and firm variables or places of employment. Individual productivity measures include the number of listings sold during the year (*Soldlist*) and the number of acquired listings during the year (*Listacq*). These variables are described in Table 1. Firm characteristics include whether the licensee is an independent contractor (Employee = 0) of an employee of a firm (Employee = 1), whether the individual works for a franchise firm (Fran = 1) or an independent firm (Fran = 0), and firm size (*Lfsize*) expressed in logarithmic form. The estimate of the sample selection variable is retained.

Table 1 Variable description

Income and hours worked	
Hrs	the number of hours worked in real estate per week,

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Inc	the annual earnings from all real estate activities,
Lhrs	the natural log of the number of hours worked in real estate,
Linc	the natural log of annual earnings from all real estate activities,
Lwage	the natural log of the annualized wage, and
Wage	the annualized wage (the annual earnings divided by hours worked per week).
Individual characteristics	
Asian	a dummy variable indicating whether the respondent is an Asian American,
Black	a dummy variable indicating whether the respondent is an African American,
Broker	a dummy variable indicating whether the respondent holds a broker's license,
Employee	a dummy variable indicating whether individual is an employee of a firm.
Exp	the number of years of real estate experience,
Exp2	the number of years of real estate experience squared,
Expf	the number of years of experience with the present firm,
Female	a dummy variable indicating the gender of the respondent is female,
FT	a dummy variable indicating full-time employment (>20 h per week).
Indian	a dummy variable indicating whether respondent is an American Indian,
Latin	a dummy variable indicating whether the respondent is of Latin descent,
Listacq	the number of listings acquired during the year,
Married	a dummy variable indicating the respondent is married,
Naff	the number of real estate firms with which the respondent has been affiliated,
Owner	a dummy variable indicating whether the respondent is the firm owner, and
Rep	a dummy variable indicating respondent's affiliation with the Republican Party,
Sch	the number of years of schooling based on highest level of education completed,
Sjob	a dummy variable indicating whether real estate is a respondent's first or second career, and
Soldlist	the number listings sold during the year.
Firm variables	
Fran	a dummy variable indicating a national franchise affiliation, and
Lfsize	the natural log of the brokerage firm size (number of employees).
Location variables	
FW	a dummy variable indicating residence Far West region.
GL	a dummy variable indicating residence Great Lakes region,
ME	a dummy variable indicating residence Mideast region,
NE	a dummy variable indicating residence New England region,

Income and hours worked	
PR	a dummy variable indicating residence Plains region,
RM	a dummy variable indicating residence Rocky Mountain region, and
SE	a dummy variable indicating residence Southeast region, and
SW	a dummy variable indicating residence Southwest region.

The regional dummy variable classifications are taken from the U.S. Department of Commerce, Bureau of Economic Analysis.

In the wage regression for the second stage the natural logarithm of actual wage is the dependent variable. Independent variables include individual characteristics *X* and *Z*, firm or business of employment *B*, location *C* and the inverse Mills ratio $\hat{m}$ sample selection correction.[9] The fitted values for wages are retained and subsequently used in the hours worked regression equation. The third stage regression equation has the natural logarithm of hours worked per week as the dependent variable. Independent variables include individual and firm characteristics, and the fitted values for wages.[10] The wage and hours worked regression equations are:

$$\begin{cases} W = X\beta_X + Z\beta_Z + B\beta_B + C\beta_C + \lambda\hat{m} + \varepsilon \\ H = \gamma_W\widehat{W} + X\gamma_W + Z\gamma_Z + B\gamma_B + C\gamma_C + \varepsilon_H \end{cases} \quad (11)$$

The equations in (11) are estimated recursively. The hourly wage equation *W* has as a regressor the self-selection inverse Mills ratio $\hat{m}$ from Eq. 4. That estimation yields a fitted wage $\widehat{W}$ that determines how many hours a person should work. In each equation, the person brings skills *X* and personal characteristics *Z* to firms in the labor market. Firm characteristics *B* include franchise and size, and location variables *C* are designated by region.

A survey of 40,000 members of the NAR was completed in 1999. Members were sent a membership profile questionnaire. Participants in the survey returned 7,655 usable questionnaires which represents a 19.1% response rate. Discarding questionnaires with missing data reduces the final sample size to 3,930 observations; a sample size of 3,600 for the full-time sample and 330 observations for the part-time sample.

Table 2 presents the descriptive statistics for the probit model (8). Full-time employment *(FT)* is defined as more than a 20 h work week. The probit model includes the combined sample of full-time and part-time real estate professionals. In this sample, 92% of the survey participants were classified as full-time, selling an average of 24.5 listings a year (*Soldlist*) and acquiring 16.7 listings (*Listacq*). Only 6% of the participants categorized themselves as employees of the brokerage agency (*Employee*); 49.8% of the respondents worked at entities described as franchise firms.

Table 2 Descriptive statistics

Variable	Full time only		Combined sample	
	Mean	Std. Dev.	Mean	Std. Dev.
Asian	0.014	0.12	0.015	0.12
Bfemale	0.006	0.08	0.007	0.08

Variable	Full time only		Combined sample	
	Mean	Std. Dev.	Mean	Std. Dev.
Black	0.013	0.11	0.014	0.12
Broker	0.273	0.45	0.266	0.44
Employee	0.061	0.24	0.060	0.24
Exp	13.960	9.44	13.823	9.51
Exp2	284.038	347.51	281.422	348.11
Expf	7.514	7.01	7.441	7.02
Female	0.491	0.50	0.493	0.50
Fran	0.506	0.50	0.498	0.50
FT	1.000	0.00	0.916	0.28
FW	0.126	0.33	0.123	0.33
GL	0.069	0.25	0.069	0.25
Hrs	45.417	11.12	43.282	12.77
Inc	73,348.600	62,351.00	69,060.400	61,802.90
Indian	0.003	0.05	0.003	0.05
Latin	0.026	0.16	0.027	0.16
Lfsize	2.836	0.92	2.814	0.92
Lhrs	3.782	0.27	3.716	0.34
Linc	10.849	0.87	10.754	0.91
Listacq	17.758	20.92	16.650	20.44
Lwage	7.067	0.80	7.038	0.80
Married	0.738	0.44	0.739	0.44
ME	0.053	0.22	0.052	0.22
Naff	1.253	1.32	1.237	1.31
NE	0.141	0.35	0.141	0.35
Owner	0.010	0.10	0.011	0.11
PR	0.115	0.32	0.116	0.32
Rep	0.513	0.50	0.513	0.50
RM	0.107	0.31	0.107	0.31
Sch	14.511	2.03	14.526	2.05
SE	0.246	0.43	0.247	0.43
Sjob	0.094	0.29	0.089	0.28
Soldlist	26.091	21.88	24.530	21.71
SW	0.118	0.32	0.120	0.32

Variable	Full time only		Combined sample	
	Mean	Std. Dev.	Mean	Std. Dev.
Wage	1,600.760	1,328.14	1,559.890	1,333.63
White	0.948	0.22	0.945	0.23
N	3,600		3,930	

Means and standard deviations of the regression variables as described in Table 1.

The summary statistics of the full-time sample are also shown in Table 3; this sample is used for the regressions. Of the survey participants, approximately 74% are married (*Married*) and 49% are female (*Female*). Brokers (*Broker*) comprise approximately 27% of the survey respondents. Related work experience (*Exp*) represents the respondent's years worked in the real estate industry with a mean of 14 years, but a standard deviation of 9.5 years. Work experience with the existing firm (*Expf*) has a mean of 7.5 years and a standard deviation of 7 years. The average number of other real estate brokerage firms that the licensee has been affiliated with (*Naff*) averages 1.3. Only 1% of the sample owns real estate firms (*Owner*).

Table 3 Probit results of full-time versus part-time employment

Independent variable	Probit model		Marginal effects	
	Estimated coefficient	*t*-statistic	Estimated coefficient	*t*-statistic
Constant	0.0473	0.43	0.0022	0.42
Fran	0.0470	0.64	0.0022	0.64
Soldlist	0.0529[a]	9.24	0.0025[a]	7.38
Listacq	0.0227[a]	3.11	0.0011[a]	3.16
Employee	0.3903[a]	2.71	0.0128[a]	3.67
Lfsize	0.1085[a]	2.78	0.0050[a]	2.64
Log likelihood	−873.88[a]			
Chi-square (5 df)	518.74			
N	3,930			

Estimated coefficients and *t*-statistics for probit model are as shown.
[a]indicates statistical significance at the 1% level.

Full-time sample respondents work an average 45.4 h per week. The average full-time sample participant has some college education, having completed 14.5 years of formal schooling (*Sch*). Employment with a national franchise (*Naff*) or a subsidiary of a national company (*Fran*) is represented by about 50% of full-time sample respondents.

The largest percentage of respondents lives in the Southeast region (*SE*), the area of residence reported by 24.7%. Among the other regions, 12.6% live in the Far West (*FW*), 11.8% in the Southwest (*SW*), 10.7% in the Rocky Mountains (*RM*), 11.5% in the Plains (*PR*), 6.9% in the Great Lakes (*GL*), 5.3% in the Mideast (*ME*), and 14.1% in the New England (*NE*).

Table 3 shows the probit model results for full-time employment. Full-time employment is defined as working more than 20 h per week.[11] All independent variables are statistically significant at the 1% level with the exception of whether the licensee is working for a franchise (*Fran*). All variables have the anticipated positive sign. The probability of an individual being a full-time licensee increases by 0.25% for sold listing (*Soldlist*), and increases the probability by 0.11% for each listing acquired. Licensees working as employees (*Employee*) instead of independent contractors are more likely to work full-time. Although franchise firms did not have a greater probability of hiring full-time individuals, larger firms were more likely to hire them (*Lfsize*). The probability of full-time employment increases by 0.50% given a 1% increase in firm size.

The least squares and sample selection regression results for wages are shown in Table 4.[12] While the regressions are statistically significant, the sample selection equation coefficient λ is negative and statistically significant at the 1% level. There is a negative self-selection. Part-time workers have higher hourly wages because of unobservable characteristics.

Table 4 Hourly wage equation, least squares and sample selection regressions (Dependent variable = Lwage)

Independent variable	**Least squares regression**		**Sample selection regression**	
	Estimated coefficient	***t*-statistic**	**Estimated coefficient**	***t*-statistic**
Constant	5.4609[a]	49.33	6.0252[a]	35.01
Sch	0.0309[a]	5.04	0.0418[a]	4.62
Exp	0.0587[a]	13.00	0.0369[a]	5.56
Exp2	−0.0013[a]	−12.23	−0.0008[a]	−4.85
Expf	0.0136[a]	5.51	0.0114[a]	3.13
Naff	0.0267[b]	2.22	0.0218	1.23
Married	0.0918[a]	3.28	0.0758	1.84
Female	−0.0174	−0.68	0.0077	0.21
Sjob	0.1939[a]	4.58	0.1568[b]	2.48
Rep	0.0791[a]	3.20	0.0566	1.55
Indian	−0.2411	−0.99	−0.2799	−0.77
Black	−0.4970[a]	−3.25	−0.3625	−1.67
Bfemale	0.3313	1.52	0.1956	0.63
Asian	0.0073	0.07	0.1285	0.89
Latin	−0.0794	−1.03	−0.0039	−0.04
Broker	0.2459[a]	7.55	0.1809[a]	3.70
Fran	0.0775[a]	2.98	0.0278	0.58
Lfsize	0.1066[a]	7.06	0.0286	1.02
Owner	−0.2014	−1.66	0.3682[b]	2.29

Independent variable	Least squares regression		Sample selection regression	
	Estimated coefficient	*t*-statistic	Estimated coefficient	*t*-statistic
ME	0.1631[a]	2.70	0.1577	1.77
GL	0.0330	0.60	0.0673	0.83
PR	−0.0124	−0.26	−0.0047	−0.07
SE	0.0448	1.16	0.0445	0.78
SW	−0.0214	−0.46	0.0162	0.24
RM	0.1583[b]	3.31	0.1805[b]	2.56
FW	0.2242[a]	4.90	0.2927[a]	4.35
IRM (λ)	–	–	−2.3090[a]	−13.93
Log-likelihood	−3,933.02[a]		−3,557.98[a]	
N	3,600		3,600	

Estimated coefficients and *t*-statistics for wages regression are as shown.
The inverse mills ratio (IMR) coefficient (λ).
[a]indicates statistical significance at the 1% level.
[b]indicates statistical significance at the 5% level.

For given skills, part-time workers earn higher hourly wages. The self-selection coefficient is negative, favoring these part-time workers. The results are consistent with part-timers obtaining a small number of low-cost listings and sales from connections, family and friends. These transactions yield higher hourly wages, as the real estate market prices down the demand functions of these part-timers. Part-timers' unobservable skills lead to added transactions in the real estate market.

Higher wages for part-time licensees could come from rising marginal costs of obtaining networks and contacts that bring in listings and generate sales. People with individual networks from a social group including family and friends are able to generate reinforcing contacts at a lower cost and with greater reputation. That low-cost effect dissipates once a person has exhausted the network contacts.

The finding that more skilled people have higher wages is consistent with human capital investment. Education serves a human capital function and is not a signal. The wage is determined endogenously from a worker's skills and ability. More schooling and experience produce a higher return. Those who have more skills or capital investment earn higher wages per hour. An additional year of schooling (*Sch*) increases the wages by 4.2%, and real estate work experience (*Exp*) increases wages by 3.7% per year. When holding constant experience and schooling, an added year of firm-specific experience increases wages by 1.1%. Those who have made real estate a first career (*Sjob*) have a 17% larger wage.[13] A broker earns a wage that is 19.8% higher than a salesperson. Schooling and experience are human capital investments made by a licensee. Financial capital investments pay off. A licensee who is an owner, with equity investment in the firm, earns a higher hourly wage.

By comparison, the sample selection regression results in Table 3 indicate that there are no differences in hourly wages by personal characteristics. Marital status, race, ethnicity and gender do not lead to significant differences in hourly wages. Republicans do not earn higher hourly wages, controlling for skills. The least squares regression, which does not correct for the sample selection bias, shows higher wages for those who are married, Republican, and lower wages for black real estate professionals. The firm characteristics are not statistically significant when including the sample selection correction.

Only two of the regional dummy variables are statistically significant. Those groups earning higher hourly wages work in the Rocky Mountains (*RM*) or the Far West (*FW*). Those areas produce higher returns than in the benchmark New England. The statistically significant least squares regression coefficient for the Midwest region becomes insignificant in the sample selection regression.

Table 5 presents the results of the sample selection regression for the annualized hours worked per week (*Lhrs*) regressions. The fitted wages variable coefficient (*Lwagefit*) from the hourly wages sample selection regression is positive and statistically significant at the 1% level of confidence, indicating that higher wages are related to longer hours worked. The labor supply elasticity, or percentage change in hours worked with the hourly wage is 0.24.

Table 5 Hours worked equation, 2SLS and sample selection regressions (Dependent variable = Lhrs)

Independent variable	**2 Stage using Lwage least squares regression**		**2 Stage using Lwage sample selection regression**	
	Estimated coefficient	***t*-statistic**	**Estimated coefficient**	***t*-statistic**
Constant	3.4662[a]	11.77	2.3386[a]	23.15
Sch	−0.0009	−0.33	−0.0076[a]	−2.81
Exp	0.0048	1.36	−0.0072[a]	−3.32
Exp2	−0.0001	−1.41	0.0002[a]	3.04
Expf	−0.0015	−1.30	−0.0044[a]	−4.00
Naff	−0.0008	−0.17	−0.0064	−1.23
Married	0.0024	0.21	−0.0149	−1.22
Female	−0.0378[a]	−4.05	−0.0340[a]	−3.08
Sjob	0.0284	1.52	−0.0121	−0.65
Rep	0.0248[b]	2.53	0.0093	0.87
Indian	0.0157	0.18	0.0621	0.59
Black	0.0354	0.57	0.1367[b]	2.05
Bfemale	−0.0803	−0.99	−0.1408	−1.49
Asian	−0.0095	−0.25	−0.0297	−0.67
Latin	−0.0267	−0.95	−0.0137	−0.41

Independent variable	2 Stage using Lwage least squares regression		2 Stage using Lwage sample selection regression	
	Estimated coefficient	*t*-statistic	Estimated coefficient	*t*-statistic
Broker	0.0799[a]	4.49	0.0286[a]	1.95
Fran	0.0145	1.40	−0.0020	−0.18
Lfsize	0.0110	1.36	−0.0119	−1.76
Owner	0.0236	0.52	0.0620	1.18
Lwage	0.0352	0.66	0.2405[a]	14.67
Log-likelihood	−310.44[a]		−924.07[a]	
N	3,600		3,600	

Estimated coefficients and t-statistics for wages regression are as shown.
The inverse mills ratio (IMR) is the sample selection coefficient (λ).
[a]indicates statistical significance at the 1% level.
[b]indicates statistical significance at the 5% level.

Another year of schooling decreases the logarithm of the number of hours worked by 0.0076. This reduction is of three-quarters of 1% for every year of schooling. At the sample mean of 45.3 h, another year of schooling translates allows a licensee to work about 1 h a week less conditional on remaining full-time. The number of hours worked decreases by 0.72% per year of general experience (*Exp*), and by 0.44% per year of firm-specific experience (*Expf*). This finding suggests that more education and experience increase efficiency, which results in reduction in hours worked. Females work about 3.4% fewer hours, but African-Americans work an average of 14.6% more hours. Owners (*Owner*) work about 2.9% more hours than non-owners. Firm size and franchise affiliation are not significantly related to the number of hours worked.

The two-stage least squares regression, which does not include the fitted values from the hourly wages sample selection regression, does not indicate significant coefficients for schooling, experience, and hourly wages. The coefficient for African-American real estate licensees is not statistically significant, but the coefficient for Republican is positive and statistically significant. The differences between the two regressions are quite noteworthy. The implication is that caution is required in interpreting direct regressions of the logarithm of earnings on characteristics.

Concluding Remarks

A theoretical model is developed that divides the real estate labor market into three stages. In the first, the person decides on whether to work full- or part-time. This is a self-selection decision in which unobservable characteristics including social contacts and networks are involved. A part-timer with these close but unmeasured contacts and networks obtains a higher hourly wage in the second stage.

The hourly wage is determined endogenously based on the skills of real estate licensees such as agents and brokers, and it is increasing in the skills including education and experience. Education is not an unproductive signal. When the person determines his or her own wage per

hour, those with higher skills obtain a higher return. Another year of schooling increases the hourly wage by 4%.
Skilled people work more efficiently as well. A person with another year of schooling works slightly (but significantly) fewer hours. A more educated and more experienced licensee is able to use time more productively in converting showings and tours to transactions. Combining the effects of hourly wages and hours worked, total earnings rise with schooling, experience and years with the firm. So real estate brokers and licensees are able to have greater wage productivity per hour, use their time more efficiently and obtain higher total earnings.
The results appear contrary to popular belief that part-time licensees in the real estate profession earn low wages and are unproductive compared to full-timers. Part-timers are not a drag on the industry. Instead, part-time licensees appear to be more productive than full-timers on an hourly basis, and their reliance on personal networks appears to be an effective and method of generating income.

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Footnotes

[1] Prior direct regressions of the logarithm of total earnings on various personal characteristics such as education along with hours worked. These traditional equations do not account for the self-selection decision to work part-time, the self-selection of wage offers or the endogeneity of hours worked.

[2] Real estate has a number of occupations where workers can set their own hours. These occupations are ideal for testing full models of labor supply. In most jobs, workers cannot set

their own hours. Further, the data for real estate licensees include information on protected or restricted personal variables not reported in government-sponsored surveys.

[3] These data are from the National Association of Realtors (NAR) website http://www.realtor.org as well as National Association of Realtors (*2004*).

[4] This large number of buyers and sellers and freedom of entry and exit has had a smaller impact on the actual commission charged for the sale of a single-family house. The United States Government Accountability Office (*2005*) has reported that the commission for single-family housing has remained in a range of between 5% and 7% of the sales price, regardless of the level of the price or market.

[5] Workers in financial services such as banking and insurance earn a higher return to schooling. More educated licensees are more likely to adopt productivity-enhancing technology (Benjamin et al. (*2002*)).

[6] Agency issues also can occur with the brokerage sales contract. Rutherford et al. (*2005*) examine the conflicts between principals and agents in the brokerage contract for residential houses using Dallas-Fort Worth area data. Munneke and Yavas (*2001*) find that contract structure does not affect productivity. Sales through conventional brokers and those that receive all the commission such as at RE/Max do not result in differential selling times.

[7] For Texas licensees, Sirmans and Swicegood (*2000*) find that the use of personal assistants and the use of computer technology enhance earnings. Their results are similar to those in their 1997 study: male licensees earn more than females, but race is not statistically significant. A test for differences in the means conducted on a variety of variables including high political activity shows no statistical significance at the 5% level.

[8] Munneke and Slade (*2000*) note self-selection issues in commercial real estate indices.

[9] The Heckman (*1979*) two-step estimation procedure for sample selection bias is applied as follows: (1) the probit equation is estimated and used for finding constructing the inverse Mills ratio, (2) the sample selection regression is estimated using the regression parameters including the sample selection correction variable $\hat{m}$. Failure to correct for a statistically significant sample selection bias results in problem similar to an omitted variable bias. The estimated regression coefficients would be biased and inconsistent if a correction is not made. The sample of part-time real estate professionals may be systematically different from that of full-timers due to differences in unobservable characteristics.

[10] A sample selection variable is not included in the hours worked equation because the fitted values for wages from the hours worked equation includes a selection bias correction, and the fitted values enter the hours worked regression. In addition, the selection mechanism is part-time versus full-time work which is defined by the number of hours worked.

[11] Respondents were asked to choose intervals of average work week including less than 20, 20–39, 40–59 or more than 60 h. The categorization of full-time employment of at least a 20 h work week produced the most significant probit results.

[12] The wage is annual income divided by the average work week. Respondents were not asked to provide the number of weeks worked per year. The variable used in the regression is the natural logarithm of wages which enables an interpretation of the coefficients in terms of percentage changes.

[13] To determine the estimated percentage change, the following transformation is used: $\exp(D)-1$, where D is the dummy variable coefficient.