Labor Supply, Flexible Hours and Real Estate Agents

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Abstract:

Real estate agents have flexibility in choosing hours and employers. These responses are tested with a five-equation recursive model. Agents choose between full- and part-time work. The conditional wage measures productivity adjusted for self-selection to each status. Hours worked in each status depend on the fitted after-tax wage and household income, yielding flexible supply elasticities. Using a 2005 survey of 8,450 U.S. real estate agents, a year of experience raises the full-time hourly wage by 2.5%. Conditional hours worked decline by 0.6%, implying an earnings return of 1.9% per year of experience. The labor supply elasticity for full-time agents is 0.21; it is almost zero for part timers.

Keywords: Real Estate Agents | Employment | Full-time Work | Part-time Work | Income

Article:

In labor markets few workers are able to set their own hours. Those paid on salary often have a block of hours set by their employer and a fixed schedule. Those paid by the hour receive compensation typically only when called in by the employer.

This situation is not generally the case in real estate. Real estate licensees, as agents and brokers, set their own hours and are paid principally on commission.[1] They have flexibility of labor supply and mobility between firms. Apart from relevance to the industry, these arrangements allow theories of labor supply to be estimated directly. In addition to measuring elasticities, the effects of skills, demographics, personal characteristics and also market and firm control variables are testable.

This article estimates a flexible labor supply equation allowing for differences between full- and part-time status. The structural form has five equations and three recursive steps. The agent selects whether to work full time. Conditional on this selection there are sequential separate full- and part-time equations for wages and hours. With no difference between working full or part time and no self-selection, there is a single wage-hour structure resulting in two estimating equations. Even in this two-equation case, agents choose their hours and respond to wage and tax changes.

The empirical application is to 8,450 U.S. real estate agents surveyed in 2005. Data are available on hours worked, agent compensation and household income as well as skills and demographics. Full-time status for the empirical implementation follows regulatory guidelines for benefit eligibility, requiring working 20 hours or more per week.[2]

A year of experience yields full-time agents a return about twice that of part timers. A year of experience raises the wage by 2.5% for a full-time agent, adjusted for self-selection. Hours worked fall by 0.6%, leading to an earnings return of 1.9%.

The labor supply elasticity for a real estate agent is low, even when allowing for flexible hours. For a full-time agent the elasticity is 0.21, and it is near zero for part timers. The results are robust to specification. Including gender, race and ethnicity, the labor supply elasticity is no higher than 0.28.

A test of flexibility in hours is based on the fitted values from the labor supply equation. All full-time agents have fitted hours worked of at least 20 per week, implying that none want to work part time. Only 1% of part-time agents have fitted weekly hours above 20, and the highest is 21.8. Agents are working the hours they want to, rather than those they must.

The next section provides background of the wages and hours literature. A theoretical model based on the agent choosing full- or part-time work follows. Data and empirical findings are reported subsequently. The last section describes conclusions and implications.

Background

Relatively low labor supply elasticities have been obtained, regardless of worker characteristics. Blundell and MaCurdy (1999) survey wage and income elasticities of hours worked. Uncompensated wage elasticities for men range from zero to 0.14. Income elasticities range between −0.28 and 0.01. Those estimates are for all workers, many of who have no control over the number of hours they work.

Research on the labor supply of workers who set their own hours has inconclusive findings. Farber (2005) finds that taxicab drivers have a low but positive labor supply elasticity of 0.5 and a positive intertemporal substitution on work. Camerer *et al.* (1997) find opposite results of a backward-bending negative labor supply elasticity. Positive results have been

obtained for stadium vendors (Oettinger 1999). Vendors work a fixed number of hours per day, but they can choose which days to work.

Within real estate, Hsieh and Moretti (2003) examine the productivity and hours of agents. Productivity declines as does the wage when free entry is permitted in expensive housing markets. Jud and Winkler (1998, 2000) find high labor supply elasticities in licensing requirements, but low returns to formal schooling. In the link between real estate and work, Rosenthal and Strange (2003) show that increased population density leads to lower hours worked.

A household's structure may affect wages and hours. In Carroll and Clauretie (2000) marital status and household size affect earnings of agents in insurance and finance but not in real estate. Turnbull and Dombrow (2007) find that compensation differentials of agents do not differ by gender.

While the real estate studies have addressed returns in earnings, they do not make the separate allocation to wages and hours that determine the supply elasticity. The amount of effort may respond to the wage as well as skills and demographic variables. That decision requires a breakdown of compensation between hours and wages. The structure can test whether the relatively low return to education in real estate is robust to the specification or whether the market rewards a different type of skill.

Model

The structural model is recursive. The real estate agent chooses between full- or part-time positions. Conditional on that decision, the labor market offers productivity or a wage function as the return on acquired skills. Within the full- or part-time markets and given the wage, the agent chooses effort or hours worked.

The agent has characteristics X including assets and wealth, other income, skills and personal and protected variables. Skills include education, experience and extent of real estate holdings. Personal variables include household income and marital status, which facilitate networking and productivity. Variables protected against discrimination such as race, gender and ethnicity are not part of employment arrangements, but they may enter individual decisions.

The agent makes a work choice indexed by I. Full-time work involves $I = 1$ with $I = 0$ for a part timer. Each of full- and part-time status offers an opportunity set of wages and hours (W_I, H_I) conditional on skills and personal variables. The part-time labor market offers lower hours H, so $H_1 > H_0$. Hourly wages are W_0, W_1, which is not necessarily lower in the part-time market.

The agent's utility is $U_I(C_I, - H_I, X)$, $I = 0, 1$. Utility is increasing and concave in consumption of goods and services C_I and the negative of hours worked $- H_I$ given characteristics X. The price of the consumption goods is normalized at one.

Total time available for work is ρI. The marginal tax rate is τ. Household income from assets and labor income other than real estate sales is Y. The agent selects the alternative that maximizes utility V_I or

$$V_I(W_I, Y, X) = \max[U_I(C_I, -H_I, X) + \kappa[(1 - \tau)(\rho_I W_I + Y) \\ - C_I - (1 - \tau)W_I(\rho_I - H_I)] \quad I = 0, 1. \tag{1}$$

The budget constraint is $(1 - \tau)(\rho I \ W_I + Y) - C_I - (1 - \tau)W_I(\rho I - H_I) \geq 0.$[3] Full income after tax if the agent worked every hour is $(1 - \tau)\rho I \ W_I$. After-tax other income is $(1 - \tau)Y$. That total income is spent on consumption C_I and on time not working $(1 - \tau)W_I(\rho I - H_I)$.

Including income and the wage in the characteristics X, whether an agent works full time or part time depends on

$$I^* = V_1(X) - V_0(X) \geq 0. \tag{2}$$

As a linear specification, $I^* = X\alpha + \upsilon$. Here α are parameters and the expected intensity is $E(I^*) = X\alpha$. A disturbance term υ has zero mean with $E(\upsilon) = 0$. The agent works full time when $X\alpha + \upsilon \geq 0$, yielding

$$\begin{cases} I^* = X\alpha + \upsilon \\ I = 1 \quad X\alpha + \upsilon \geq 0 \\ I = 0 \quad X\alpha + \upsilon < 0 \end{cases} \tag{3}$$

The unconditional wage, differing between the full-time and the part-time markets is

$$\begin{cases} W_1 = X_W \beta_1 + \varepsilon_1 \quad I = 1 \\ W_0 = X_W \beta_0 + \varepsilon_0 \quad I = 0 \end{cases} \tag{4}$$

Here X_W is the list of variables determining the wage with parameters β and error ε.

For full-time agents with $I = 1$ the parameters are β_1, θ_1 with disturbance ε_1. For part timers with $I = 0$ the corresponding parameters and disturbance are β_0, θ_0, ε_0. The errors for the selection and the two wages (υ, ε_1, ε_0) have variance-covariance matrix

$$\Sigma = \begin{bmatrix} \sigma_{\upsilon\upsilon} & \sigma_{\upsilon 1} & \sigma_{\upsilon 0} \\ \sigma_{\upsilon 1} & \sigma_{11} & \sigma_{01} \\ \sigma_{\upsilon 0} & \sigma_{01} & \sigma_{00} \end{bmatrix}. \tag{5}$$

The expected values of the disturbances contingent on the choices are

$$
\begin{cases}
E(\varepsilon_1 \mid \upsilon > -X\alpha) = \delta_1 \dfrac{f(-X\alpha)}{1 - F(-X\alpha)} \equiv \delta_1 m_1 \\[2mm]
E(\varepsilon_0 \mid \upsilon \leq -X\alpha) = -\delta_0 \dfrac{f(-X\alpha)}{F(-X\alpha)} \equiv \delta_0 m_0
\end{cases}
$$

(6)

The density and distribution functions of the disturbance υ are f and F.

In (6) m_i $i = 0, 1$ is the inverse Mills ratio that adjusts for the self-selection between full- and part-time status. The coefficient on the inverse Mills ratio is δi $i = 0, 1$. Some agents have a network of family and friends or a network from social contacts that produce customers and sales at low cost. This network causes a positive self-selection on the part-time coefficient δ_0. If part timers are less skilled, then there is a negative self-selection and $\delta_0 < 0$. The wage equations, corrected for self-selection are

$$
\begin{cases}
W_1 = X_W \beta_1 + \delta_1 m_1 + \varepsilon_1 & I = 1 \\
W_0 = X_W \beta_0 + \delta_0 m_0 + \varepsilon_0 & I = 0
\end{cases}
$$

(7)

The fitted wages are $(\widehat{W}_1, \widehat{W}_0)$ in the full- and part-time sectors. These fitted wages together with tax rates determine the labor supply functions recursively as

$$
\begin{cases}
H_1 = X_H \gamma_1 + \eta_1 (1 - \tau) \widehat{W}_1 + \phi_1 (1 - \tau) Y + \omega_1 & I = 1 \\
H_0 = X_H \gamma_0 + \eta_0 (1 - \tau) \widehat{W}_0 + \phi_0 (1 - \tau) Y + \omega_0 & I = 0
\end{cases}
$$

(8)

The exogenous variables are X_H with parameters γ. The labor supply elasticity is η if hours and the after-tax fitted wage $(H_I, (1 - \tau)\widehat{W}_I)$ are in logarithms. Logarithmic after-tax income is $(1 - \tau)Y$, and φ is the income elasticity. The error in hours is ω.

In the unrestricted case there are five equations, for selection between full- and part-time status in (3) with two separate wages and hours in (7) and (8). Testable restrictions reduce the structure to as few as two equations, one each for wages and hours. If the δ are zero there is no self-selection and

$$
\delta_0 = \delta_1 = 0.
$$

(9)

Full- and part-time agents do not differ in their networks or other unmeasured variables. The system reduces to four equations, two for wages and two for hours. Full- and part-time agents have the same wage or productivity, and there is no self-selection when

$$
\beta_1 = \beta_0 = \beta \qquad \delta_1 = \delta_0 = 0.
$$

(10)

There is one equation for wages along with two for hours.

Agents have no difference in effort in full- and part-time markets when

$$\gamma_1 = \gamma_0 = \gamma \qquad \eta_1 = \eta_0 = \eta. \quad (11)$$

Together with conditions (10) where there is no self-selection and common productivity, the system contains two equations. In the two-equation recursive system the wage and hours are

$$\begin{cases} W = X_W \beta + \varepsilon \\ H = X_H \gamma + \eta(1-\tau)\bar{W} + \phi(1-\tau)Y + \omega \end{cases} \quad (12)$$

There is a single wage equation W that pools over full- and part-time workers. That estimation occurs first, yielding fitted value $\bar{W}$. That fitted wage enters the hours equation with supply elasticity η. The five-equation system reduces to two under the test restrictions (10) and (11).

The specifications are used to test real estate agent work flexibility. Skills such as experience allow an agent to be more productive. That productivity implies $\beta > 0$, whether for full- or part-time or all markets. If the agent is able to work more efficiently, it requires less effort to sell a house, so $\gamma < 0$. With the wage and hours measured in logarithms, the total return in income from one unit of investment, such as a year of experience, is $W + H$. The associated rate of return is the derivative with respect to that characteristic, or $\beta + \gamma$. A skill allows total earnings to rise even if effort declines, leading to $|\beta| > |\gamma|$. The gain in productivity is partially spent on reducing effort if $\gamma < 0$, but there remains a gain in total earnings.

Even if hours are flexible, the earnings target theory indicates a backward-bending labor supply elasticity, or $\eta < 0$. Agents are working flexible hours including being part time, and they have a threshold total earnings. The alternative is that there is flexible response and hours are increased when incentives rise with $\eta > 1$. All of these tests apply to the complete system (3), (7) and (8) and any restrictive form including the two equations in (12).

Equations (3) and (12) are estimated after categorizing the variables into five groups. These categories are: (a) protected: gender, race, ethnicity; (b) personal: marital status, household income; (c) skills: education, experience, real estate investments, real estate as second career; (d) firm: size, ownership structure and (e) market: employment, employment growth.

Variables in a given category are included or excluded from the estimating equations.[4] The probit equation includes protected, personal and skill category variables; firm and market variables are assumed not to affect the part-time versus full-time employment decision. The wage equations have personal, skills, firm and market categories as well as the fitted probit values. Protected variables for gender, ethnicity and race are excluded from initial wages and hours equations. They are included later for robustness checks. The hours equations include personal and skill categories and the fitted after-tax wages, but they exclude firm and market

category variables. The exclusion is based on recognition that individuals control their own hours rather than the firm or market.

The recursive system does not have interdependence among the endogenous variables. In the probit, only the dependent variable is endogenous. The wage and self-selection are endogenous in the productivity or wage equations. Hours and the fitted wage are endogenous in the effort or hours equations. The wage is conditional on the probit, using the two-step Heckman (1979) method. Hours are conditional on the after-tax wage and income.

Data and Empirical Results

The data are from a survey of real estate agents in residential sales conducted in the spring of 2005 by the National Association of Realtors. There are 8,450 respondents with data on total compensation, hours worked, education, experience, gender, race, ethnicity, household income and sufficient characteristics to estimate the marginal tax rate. The marginal tax rate is calculated from the TAXSIM model using the residence of the agent.[5] That residence by ZIP code is matched with employment growth and unemployment rates in the local market.

Total gross annual compensation includes all income from sales or listing of residential property. Agents report annual business expenses including car, rental and office expenses. Those business expenses are subtracted from total gross compensation to yield annual net earnings. Net earnings divided by hours worked per week yields the hourly wage. The hourly wage is on an annualized basis. The variables are summarized and described in Table 1 including means and standard deviations.

Table 1. Descriptive statistics

Variable	Total Sample			Part-Time Sample			Full-Time Sample		
	Mean	**Std. Dev.**	**Obs.**	**Mean**	**Std. Dev.**	**Obs.**	**Mean**	**Std. Dev.**	**Obs.**
Asian	2.039	14.136	3972	5.508	22.839	472	1.571	12.439	3500
Black	4.053	19.723	3972	7.839	26.907	472	3.543	18.489	3500
Broker	21.073	40.788	3972	15.254	35.993	472	21.857	41.334	3500
Dec04emp	1.100	1.018	2922	1.198	1.101	365	1.086	1.005	2557
Empgrwth	1.257	1.256	2922	1.224	1.342	365	1.261	1.243	2557
Exp	11.511	10.309	3944	10.591	10.840	468	11.635	10.230	3476
Fedsttax	39.047	2.007	3830	38.918	1.949	445	39.064	2.014	3385

Female	55.715	49.679	3972	57.203	49.531	472	55.514	49.702	3500
FT	88.117	32.363	3972	0.000	0.000	472	100.000	0.000	3500
Indfr	35.851	47.962	3972	25.000	43.347	472	37.314	48.371	3500
Native	0.730	8.514	3972	0.636	7.955	472	0.743	8.588	3500
Latin	3.122	17.393	3972	2.754	16.383	472	3.171	17.526	3500
Lhrs	3.643	0.513	3972	2.565	0.566	472	3.789	0.278	3500
Lnatw	6.276	1.111	3830	6.488	0.986	445	6.249	1.123	3385
Lnhinc	11.351	0.842	3972	11.206	0.735	472	11.371	0.854	3500
Lnwage	6.773	1.113	3972	6.988	1.001	472	6.744	1.124	3500
Lsfsizf	3.942	1.986	3972	3.312	2.035	472	4.027	1.964	3500
Married	73.263	44.264	3972	76.271	42.587	472	72.857	44.476	3500
Owner	1.032	10.109	3972	1.271	11.215	472	1.000	9.951	3500
Resprop	1.277	3.820	3963	1.028	2.424	471	1.311	3.970	3492
Sch	14.686	1.978	3968	14.945	2.066	471	14.651	1.964	3497
Seccar	95.619	20.469	3972	96.398	18.653	472	95.514	20.702	3500

Notes: The data include responses from a 2005 survey of 8,450 residential real estate licensees. Marginal tax rates were downloaded from the National Bureau of Economic Research at http://www.nber.org/~taxsim. The ZIP code is used to determine total employment and the employment growth in local markets. *Asian* is the percentage of Asian American agents in percentage points, *Black* is the percentage that are African American, *Broker* is the percentage that are brokers, *Dec04emp* is the employment in millions in the metropolitan area in December, 2004, *Empgrwth* is annual employment growth, *Exp* is years of experience, *Fedsttax* is the federal plus state percent tax rate applicable to the metropolitan area, *Female* is the percentage of female agents, *FT* is the percentage of full timers, defined as working more than 20 hours per week, *Indfr* is the percentage working in independent franchise offices, *Native* is the percentage of American Indian licensees, *Latin* is the percentage that are Americans of Hispanic heritage, *Lhrs* is the natural log of hours worked per week, *Lnatw* is the natural log of after-tax net annualized wages, *Lnhinc* is the natural log of the net annual household income, *Lnwage* is the natural log of the net annualized wage, *Lsfsizf* is the natural log of the brokerage firm size defined by number of employees, *Married* is the percentage married, *Owner* is the percentage who are owners, *Resprop* is the number of residential

properties held for investment purposes, *Sch* is the number of years of schooling based on the highest level of education completed, and *Seccar* is the percentage whose second career is real estate.

Table 2 reports the probit estimates for the probability along with the marginal effects of being employed full versus part time. Married agents are less likely to work full time as are Asian and African Americans. The probability of full-time status increases with household income.

Table 2. Probit estimates: Probability of working full or part time

Variable	Probit Model			Marginal Effects			
	Coefficient	*t* ratio	*p* value	Coefficient	*t* ratio	*p* value	Elasticity
Constant	0.4300	1.004	0.315	0.0827	1.004	0.316	
Sch	−0.0414	−3.081	0.002	−0.0080	−3.089	0.002	−0.132
Exp	0.0012	0.460	0.645	0.0002	0.460	0.645	0.003
Seccar	−0.0322	−0.233	0.816	−0.0062	−0.233	0.816	−0.007
Resprop	0.0061	0.703	0.482	0.0012	0.703	0.482	0.002
Married	−0.1952	−3.036	0.002	−0.0376	−3.045	0.002	−0.031
Female	−0.0709	−1.314	0.189	−0.0136	−1.314	0.189	−0.009
Black	−0.4613	−4.030	0.000	−0.0888	−4.031	0.000	−0.004
Asian	−0.6620	−4.367	0.000	−0.1274	−4.357	0.000	−0.003
Native	0.0939	0.296	0.768	0.0181	0.296	0.768	0.000
Latin	0.0611	0.393	0.694	0.0118	0.393	0.694	0.000
Lnhinc	0.1415	4.131	0.000	0.0272	4.151	0.000	0.349
Log Likelihood	−1,395.08						
Chi Squared	71.74						
N	3,931						

Notes: Probit model results are of full-time versus part-time employment based on a 2005 National Association of Realtors survey of 8,450 residential real estate sales professionals. Coefficients are heteroskedastic consistent. Missing data results in a sample size of 3,931

observations. *Sch* is years of schooling based on the highest level of education completed, *Exp* is years of real estate experience, *Seccar* = 1 if respondent's second career is real estate, *Resprop* is the number of residential properties held for investment purposes, *Married* = 1 if married, *Female* = 1 if female, *Black* = 1 if African American, *Asian* = 1 if Asian American, *Native* = 1 if Native American, *Latin* = 1 if of Latin descent, and *Lnhinc* = the natural log of household income.

Estimates of the wage function are in Table 3. A test on full- and part-time subsamples indicates that the wage coefficients are not equal.[6] The full- and part-time wage estimates are reported in addition to those for the combined sample, and they are corrected for heteroskedasticity.

Table 3. Hourly wage regressions: full time, part time and combined.

Variable	Full-Time Sample			Part-Time Sample			Combined Sample		
	Coefficient	t ratio	p value	Coefficient	t ratio	p value	Coefficient	t ratio	p value
Intercept	−1.7277	−3.942	0.000	3.5729	2.397	0.017	−1.4525	−4.378	0.000
Sch	0.0006	0.059	0.953	0.0088	0.325	0.745	0.0045	0.536	0.592
Exp	0.0247	14.016	0.000	0.0123	2.531	0.011	0.0231	13.626	0.000
Seccar	−0.1290	−1.595	0.111	0.1144	0.440	0.660	−0.1142	−1.913	0.056
Resprop	−0.0025	−0.515	0.607	0.0841	4.284	0.000	0.0030	0.464	0.643
Married	−1.1111	−2.321	0.020	−3.2233	−1.922	0.055	−0.8138	−1.729	0.084
Broker	0.0939	2.177	0.029	0.1214	0.815	0.415	0.0688	1.856	0.063
Owner	−0.1040	−0.568	0.570	−0.7215	−1.731	0.083	−0.1633	−0.926	0.354
Indfr	0.1239	3.571	0.000	−0.0440	−0.381	0.703	0.0879	2.670	0.008
Lsfsizf	0.0032	0.364	0.716	0.0312	1.249	0.212	−0.0036	−0.424	0.672
Empgrwth	0.0336	2.467	0.014	0.0652	1.806	0.071	0.0384	2.796	0.005
Dec04emp	0.0130	0.768	0.443	0.0688	1.550	0.121	0.0246	1.528	0.126
Lnhinc	0.7342	19.608	0.000	0.2584	1.840	0.066	0.7089	25.091	0.000
*Lnhinc * Married*	0.0762	1.790	0.073	0.2871	1.887	0.059	0.0527	1.265	0.206
Self−Sel.	−0.0638	−0.184	0.854	−0.1472	−0.457	0.648			

(m)									
Adj. R^2	0.44			0.19			0.40		
F Statistic	144.22			6.89			146.17		
Log Likelihood	−3,114.96			−463.68			−3,659.87		
N	2,532			361			2,893		

Notes: Regression results for full-time, part-time and all workers are based on a 2005 National Association of Realtors survey of residential licensees. Full time and part time are sample selection regressions that include self-selection from the employment probit model in Table 2. Regression coefficients are heteroskedasticity consistent. Dependent variable is the natural logarithm of annualized hourly wage. *Sch* is years of schooling based on the highest level of education completed, *Exp* is years of real estate experience, *Seccar* = 1 if the respondent's second career is real estate, *Resprop* is the number of residential properties held for investment purposes, *Married* = 1 if married, *Broker* = 1 if a real estate broker, *Owner* = 1 if the owner of a brokerage firm, *Indfr* = 1 if working in an independent office of a national franchise, *Lsfsizf* is the natural log of brokerage firm size measured by the number of employees, *Empgrwth* is the employment growth in the metropolitan area in percent, *Dec04emp* employment is the total employment in millions in the metropolitan area reported in December 2004, *Lnhinc* = the natural log of household income, and *m* is the sample selection inverse Mills ratio from the probit model.

Part-time agents spend their time differently than full-time agents. The ratio of listing acquisitions to sales is 66% for part timers versus 85% for full timers, suggesting potential latent effects.[7] Part timers do not have unobserved skills that lead to higher wages. The coefficient on the self-selection m_1 is negative but statistically insignificant at the 5% level for the full-time and part-time samples in Table 3.

Another year of experience raises the hourly wage of a full-time agent by 2.5%. A year of experience raises the hourly wage of a part-time agent by 1.2%, about one-half the return of the full timer. An additional year of schooling does not increase wages for either group.

The coefficient for entering real estate after a career elsewhere is statistically significant in the combined sample but disappears in the subsamples. In the combined sample, those whose first career was real estate earn 10.8% more than when an agent is a subsequent choice.[8] Residential property held as investments leads to a higher wage only in the part-time sample. Part timers earn a return to experience in real estate investment that full timers gain elsewhere.

For full-time agents, the elasticity of the wage in household income is 0.73. For part-time workers the corresponding estimate is 0.26. Marital status has no effect when including a

multiplicative variable with household income. The higher household income predominantly reflects agents who are married.

Full-time agents who are affiliated with an independent franchise have an hourly wage 13.2% higher; for the combined sample the increase is 9.2%. Firm size is not statistically significant. The general economic environment has a positive impact on wages for the complete sample. The elasticity of the wage with respect to employment growth is 3.4. For the combined sample, wages rise 3.8% per 1% increase in employment growth. The size of the market in the level of employment is not statistically significant.

The labor supply estimates are in Table 4. All regressions in this table employ two-stage least squares. The fitted values of annualized wages are estimated in the first step. These are converted to after-tax wages using TAXSIM. The natural logarithm of the resulting after-tax wages is used in the labor supply equations for full- and part-time agents.

Table 4. Hours worked regressions: full time, part time and combined.

Variable	2SLS Full-Time Sample			2SLS Part-Time Sample			2SLS Combined Sample		
	Coef.	t ratio	p value	Coef.	t ratio	p value	Coef.	t ratio	p value
Intercept	3.5754	13.772	0.000	3.9640	3.908	0.000	3.5545	9.805	0.000
Sch	0.0035	0.980	0.327	−0.0278	−2.009	0.045	−0.0134	−2.456	0.014
Exp	−0.0058	−2.538	0.011	0.0049	1.489	0.137	−0.0034	−0.988	0.323
Seccar	0.0498	1.566	0.117	−0.3042	−4.015	0.000	−0.0072	−0.183	0.855
Resprop	0.0021	0.719	0.472	−0.0094	−0.425	0.671	0.0009	0.273	0.785
Married	0.3315	1.405	0.160	0.1935	0.167	0.867	−0.2747	−0.869	0.385
Broker	0.0224	1.267	0.205	−0.0537	−0.668	0.504	0.0723	2.850	0.004
Lnatw	0.2137	2.416	0.016	−0.0750	−0.353	0.724	0.1550	1.087	0.277
Lnhinc	−0.1025	−1.522	0.128	−0.0238	−0.264	0.792	−0.0559	−0.538	0.591
*Lnhinc * Married*	−0.0290	−1.446	0.148	−0.0145	−0.138	0.891	0.0202	0.746	0.456
Log Likelihood	−839.76			−263.16			−2,350.02		
N	2,489			344			2,833		

Notes: Two-stage least squares (2SLS) labor supply regression results for full-time, part-time and all workers are based on a 2005 National Association of Realtors survey of residential real estate sales professionals. Regression coefficients are heteroskedasticity consistent. Dependent variable is the natural log of hours worked per week. *Sch* is years of schooling based on the highest level of education completed, *Exp* is years of real estate experience, *Seccar* $= 1$ if the respondent's second career is real estate, *Resprop* is the number of residential properties held for investment purposes, *Married* $= 1$ if married, *Broker* $= 1$ if a real estate broker, *Lnatw* is the natural log of net annualized after-tax wages predicted from the wage function (Table 3), and *Lnhinc* = the natural log of household income.

Of particular interest is the effect of experience on hours worked. Full-time agents decrease their hours by 0.58% with each year of experience, conditional on the hourly wage. The experience coefficient in the hours-worked equation is opposite in sign to those in the wage equation. Skill increases the wage. Conditional on the wage, skill reduces effort.

A full-time agent with 11 years of experience works 6.4% fewer hours than a rookie. Full timers work 44 hours a week on average, as shown in Table 1. In comparison with part-time agents, the difference in hours worked is 2.8 hours a week or 140 hours per year. The agent with 11 years of experience receives a 27.2% higher hourly wage than the rookie, according to Table 3. Adding the effort and productivity effects as −0.064 and 0.272, total earnings are 20.8% higher for the 11-year full-time veteran as compared with the rookie.[9]

For part timers, the experience coefficient in the hours equation is not statistically significant at the 5% level. Table 3 indicates that total wages for part-time agents increase by 13.5% for 11-year veterans compared to rookies. Full timers have a 7.3% higher total earnings return as a premium over part timers. That premium is earned by a full timer receiving more experience per year than a part timer.

Hours worked by part-time agents decrease with schooling by an average of 2.8% per year. Schooling is not statistically significant in the wages equation. More educated part timers are not more productive, but they economize on effort.

Brokers work 7.5% more hours in the combined sample. Having made real estate a career leads to a higher wage and lower hours. For the combined sample, the decrease in wages is 10.8% for those who choose real estate as a second career.

Marital status and household income are not statistically significant in the hours regression. The interaction of these variables is not statistically significant. Higher household income does not lead to substitution of work for leisure, and marriage does not affect hours. Owning investment properties does not lead to spending more time as an agent on listing and selling. Brokers work more hours than agents in the combined sample.

The elasticity of labor supply with respect to the after-tax wage is 0.21 for the full-time sample. This estimate is positive and significant with a t statistic of 2.4. The elasticity of supply for part timers was zero. Table 4 has separate wage and income elasticities. Uncompensated Marshallian wage elasticities with hours H and wage W are $\eta_u = \frac{\partial \ln H}{\partial \ln W}$. Compensated Hicksian wage elasticities from the Slutsky equation are $\eta_c = \eta_u - \frac{WH}{(1-\tau)Y}\frac{\partial \ln H}{\partial \ln (1-\tau)Y}$, where $\frac{\partial \ln H}{\partial \ln (1-\tau)Y}$ is the income elasticity in after-tax income $(1-\tau)Y$. Hicksian elasticities are larger when leisure is a normal good. In Table 4, the income elasticity estimates are negative, indicating that leisure is a normal good, but they are not significant. Consequently, the compensated and uncompensated wage elasticities can be viewed as the same, or $\eta_c = \eta_u$.

Farber (2005) finds positive but low uncompensated labor supply elasticities for those who can choose their own hours. Camerer *et al.* (1997) find negative supply elasticities if there is an earnings target. That is not the case for real estate licensees. Agents are not targeting a specific total earnings level. Instead, they respond positively to after-tax wages.

Table 5 reports tests for equality of the paired parameters in the wage and hours equations for agents. Experience leads to a 2.5% increase in hourly wages for full timers and 1.2% for part timers. This 1.3% differential is statistically significant at the 5% level in Table 5. Hours worked decrease by 0.58% per year of experience for full timers but increase by 0.49% for part timers. This differential is statistically significant from zero at the 1% level. Statistically significant differentials are evident for investments in residential property and household income in wages and for having real estate as not a first career in hours.

Table 5. Tests for equality of coefficients, full time versus part time.

Wage Regressions			Hours Worked Regressions		
Variable	**Coefficient Difference**	t **value**	**Variable**	**Coefficient Difference**	t **value**
Sch	−0.0082	0.286	*Sch*	0.0313	2.191*
Exp	0.0124	2.393*	*Exp*	−0.0107	2.670**
Seccar	−0.2433	0.893	*Seccar*	0.3540	4.309**
Resprop	−0.0866	4.285**	*Resprop*	0.0115	0.513
Married	2.1122	1.211	*Married*	0.1380	0.117
Broker	−0.0275	0.177	*Broker*	0.0761	0.924
Owner	0.6175	1.357	*Lnatw*	0.2887	1.256

Indfr	0.1679	1.393	*Lnhinc Married*	−0.0786	0.698
Lsfsixf	−0.0280	1.059	*Lnhinc **	−0.0145	0.135
Empgrwth	−0.0316	0.820			
Dec04emp	−0.0558	1.175			
Lnhinc	0.4758	3.275**			
Lnhinc * Married	−0.2109	1.335			
m	0.0834	0.176			

Notes: We present test statistics for differences in the part-time versus full-time regression coefficients for the wage and labor supply regressions. These *t* tests assume unequal subsample variances (Greene 2007). The significance levels are denoted by ** for 0.01 and * for 0.05. *Sch* is years of schooling based on the highest level of education completed, *Exp* is years of real estate experience, *Seccar* = 1 if the respondent's second career is real estate, *Resprop* is the number of residential properties held for investment purposes, *Married* = 1 if married, *Broker* = 1 if a real estate broker, *Owner* = 1 for owing the firm, *Indfr* = 1 for being in an independent franchise office, *Lsfsizf* is the natural log of the brokerage firm size defined by number of employees, *Empgrwth* is the percent annual employment growth, *Dec04emp* is employment in millions in the metropolitan area in December 2004, *Lnatw* is the natural log of after-tax net annualized wages, and *Lnhinc* = the natural log of household income.

After the first year, a full-time worker has a 2.5% higher wage but works 0.6% fewer hours, so total earnings rise by 1.9%. Skill leads to a productivity effect, increasing output per hour and allowing fewer work hours and more time for leisure. Part timers and full timers are benefiting from productivity gains, spending part of the gain by working fewer hours.

Full timers and part timers earn positive returns to experience. For the full-time sample, more experienced workers work fewer hours. For the part-time sample, schooling reduces hours worked.

The findings are consistent with previous research in other occupations. Skilled workers at the aggregate level may be working more hours (Prescott, Rogerson and Wallenius 2006). Over time, skilled workers are taking less leisure as time not worked, and the less skilled are taking more (Aguiar and Hurst 2007). Those estimates do not control for full- and part-time status and do not adjust for what happens within the same job classification.

While the sorting is between full- and part-time workers on total hours, the estimating equations are separate for each status. The fitted values of the hours worked may be less than 20 per week for a full-time agent and more than that for one on part-time status. The result is a misclassification. Some people are working part time when they would rather have a full-time job or vice versa. As a robustness test, the fitted hours worked per week are obtained for each agent. Those hours were tested for being at least 20 weekly among full timers and no more than that for part timers.

All full-time agents have predicted hours worked of at least 20 per week. For the 344 part timers, there are four or about 1% who have fitted hours of more than 20 weekly. For these four, the highest fitted value is 21.8 weekly hours. The lowest is 20.005. The strongest work demand among part timers is for 21.8 hours a week, essentially retaining part-time status. This test confirms the flexibility of hours among real estate agents. Virtually all agents are working the hours they want, not those they are obliged to.

Protected variables are defined formally in U.S. legislation. Workers having these protected characteristics cannot be discriminated against, harassed or paid differently. These protected variables are race, ethnicity, religion, gender, age above 40, family status, disability, veteran status, sexual orientation and political affiliation. Underlying the assumption is that fundamental productivity is not different by a protected variable. To test this condition, the protected variables available for gender, race and ethnicity are included in the wage equation.

The hours equation is reestimated with the fitted values from this wage equation. In Table 6, the hourly wage does not differ by gender, race or ethnicity for real estate agents. All of the coefficients on race, gender and ethnicity are insignificantly different from zero. Retaining significance are total household income, with an wage elasticity greater than one, and experience. One more year of experience increases the hourly wage by 2%.

Table 6. Hourly wage and hours worked regressions with protected variables for the full-time sample.

Variable	Wages: Full-Time Sample			Hours: 2SLS Full-Time Sample		
	Coef.	t ratio	p value	Coef.	t ratio	p value
Intercept	−5.0841	−1.161	0.246	3.7178	15.169	0.000
Sch	−0.1002	−0.823	0.411	0.0036	0.910	0.363
Exp	0.0275	3.328	0.001	−0.0075	−4.009	0.000
Seccar	−0.1875	−0.513	0.608	0.0588	1.753	0.080
Resprop	0.0084	0.332	0.740	0.0022	0.686	0.493

Married	−1.9078	−0.852	0.394	0.4164	1.693	0.090
Broker	0.0900	0.479	0.632	0.0174	0.940	0.347
Owner	−0.1552	−0.192	0.847	–	–	–
Female	−0.2376	−0.964	0.335	–	–	–
Black	−1.4704	−0.925	0.355	–	–	–
Asian	−1.8457	−0.747	0.455	–	–	–
Native	0.4922	0.530	0.596	–	–	–
Latin	0.2289	0.544	0.586	–	–	–
Indfr	0.1156	0.766	0.444	–	–	–
Lsfsizf	0.0034	0.088	0.930	–	–	–
Empgrwth	0.0296	0.498	0.618	–	–	–
Dec04emp	0.0077	0.104	0.917	–	–	–
Lnhinc	1.0590	2.578	0.010	−0.1525	−2.787	0.005
Lnhinc * Married	0.1062	0.568	0.570	–	–	–
Self-Sel. (m)	7.6667	0.861	0.389	−0.0350	−1.645	0.100
Lnatw	–	–	–	0.2819	4.067	0.000
Log Likelihood	−3,099.32			−1,088.55		
N	2,532			2,489		

Notes: Regression results for full-time workers are based on a 2005 National Association of Realtors survey of residential licensees. The full-time sample selection regression includes self-selection from the employment probit model in Table 2. Regression coefficients are heteroskedasticity consistent. Dependent variable is the natural logarithm of annualized hourly wage. Sample selection based on probit model in Table 2. *Sch* is years of schooling based on the highest level of education completed, *Exp* is years of real estate experience, *Seccar* = 1 if respondent's second career is real estate, *Resprop* is the number of residential properties held for investment purposes, *Married* = 1 if married, *Broker* = 1 if a real estate broker, *Owner* = 1 if owner of a brokerage firm, *Female* = 1 if female, *Black* = 1 if African American, *Asian* = 1 if Asian American, *Native* = 1 if Native American, *Latin* = 1 if of Latin descent, *Indfr* = 1 if working in an independent office of a national franchise, *Lsfsizf* is the natural log of brokerage

firm size measured by the number of employees, *Empgrwth* is the employment growth in the metropolitan area in percent, *Dec04emp* employment is the total employment in millions in the metropolitan area reported in December 2004, *Lnhinc* = the natural log of household income, *m* is the sample selection inverse Mills ratio from the probit model, and *Lnatw* is the natural log of net annualized after-tax wages predicted from the wage function (Table 3). 2SLS = two-stage least squares.

These fitted wages are converted to an after-tax basis and the hours reestimated, with results reported in Table 6. The resulting labor supply elasticity is 0.28, with a *t* statistic exceeding 4 and similar to that in Table 3. The collinearity among protected and other variables, along with limited degrees of freedom led to a singularity in the part-time equation. That singularity prevents part timers and full timers from being compared. Given the similarity in elasticities, the results of Tables 3–5 are supported with a more general wage specification.

Conclusion

Real estate agents have the flexibility of choosing hours worked and their employers. Based on characteristics and preferences, agents select full- or part-time work. The market responds with an hourly wage based on skills and conditional on the choice. The agent constructs an after-tax hourly wage and household income in determining hours worked. There are up to five estimating equations for the self-selection between full- and part-time work and conditional wages and hours.

Job-related skills include education, experience and whether a person has invested in a firm or the industry. Agents can invest by obtaining skills such as education or experience or by buying houses, shown to have a return in Rutherford, Springer and Yavas (2005). The findings indicate that full- and part-time workers increase their wages through experience, although full timers benefit almost double as much for each additional year of experience. Schooling does not increase the hourly wage for either group.

On the firm level, these results have productivity and contract incentive implications for workers and their employers. On a macro level, there are relevant taxation and productivity effects. Future research may seek to examine other workers who set their own hours to determine whether the findings are unique to real estate.

Footnotes

1. The payment of a commission for real estate transactions remains the predominant contract for sales. Miceli, Pancak and Sirmans (2007) raise issues as to the optimality and obsolescence of the contract. There are 3.2 million real estate licensees in the United States as of January 2008, according to the membership tracker http://www.arello.org.

2. That definition follows regulations for qualified pension plans. A definition of 20 hours per week over a 50-week year is used for eligibility. Employers have responded by using these rules to classify part timers as those working fewer than this hourly number as not being eligible for pensions and other benefits.

3. In an intertemporal context with time as a subscript and assets $V_t(A_t, t) = \max [U_t(C_t, H_t, X_t) + \kappa\, V_t(At_{+1}, t+1)]$ where κ where is a discount factor. The optimal conditions are

$$
\begin{cases}
U_C(C_t, H_t, X_t) = \lambda_t \\
U_H(C_t, H_t, X_t) \geq \lambda_t W_t\,. \\
\lambda_t = \psi(1 + r_{t+1})\lambda_{t+1}
\end{cases}
$$

Here $\lambda_t = \frac{\partial V_t}{\partial A_t}$ is the marginal utility of wealth, ψ is the discount factor and A_t is assets. These are the same atemporal conditions, with the Euler equation. The consumer chooses savings, with discount rate $\psi (1 + rt_{+1})$.

4. The wages equation also includes *Owner* and *Broker* dummy variables, while the hours equation includes the *Broker* variable. It may be argued that the *Broker* variable be not only a status in the brokerage firm but also related to skills, while the *Owner* variable could be a skill or personal variable depending on one's perspective.

5. Subsample sizes for ethnicity and gender can be estimated by multiplying the respective dummy variable coefficient by the full sample size. See Richard and Coutts (1993) for a discussion of the TAXSIM model. The National Bureau of Economic Research suggests the use of TAXSIM to estimate marginal tax rates. The data were downloaded from http://www.nber.org/~taxsim.

6. The Chow (1960) test compares the residual sum of squares of the combined sample versus the subsamples. The calculated F statistic is 10.89, which exceeds the critical value at the 5% level of significance.

7. Part-time sales professionals acquired an average of 4.08 listings per year and sold 6.16 listings, while full timers acquired 14.36 listings and sold 16.90 listings.

8. The transformation for dummy variable coefficients in the natural log regression is $y = e^x - 1$ where x is the regression coefficient and y is the transformed value.

9. The effect on total productivity is determined as $(1 + \Delta w)(1 + \Delta h) - 1$ where Δw is the percentage change in the wage rate and Δh is the percentage change in the hours worked.

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