# Contracts, Labor Supply and Income Targeting

By: Peter Chinloy, Daniel T. Winkler

Chinloy, P. and D. T. Winkler. (2011). Contracts, Labor Supply and Income Targeting. *Journal of Labor Research*, 32(2), 113-135. doi: 10.1007/s12122-011-9104-y

**The final publication is available at Springer via http://dx.doi.org/10.1007/s12122-011-9104-y**



**Abstract:**

In many professions and personal services, a firm offers a contract with either proportional revenue sharing of the worker's output or a contract with 100% revenue accruing to the worker in exchange for a fixed (debt) payment. Contingent on the contract, the worker chooses the mechanism to achieve the desired level of productivity. A higher revenue split induces the worker to be more productive in output per hour resulting in a higher wage. The relevant price of effort is the after-split, after-tax wage controlled for after-tax household income. Incentives through a higher split raise productivity and the return to effort. The sample is 1,559 U.S. real estate sales professionals paid on contract splits in 2007 and choosing their hours and effort. The compensated labor supply elasticity is positive and between approximately zero and 0.3 suggesting the absence of income targeting for these workers on split and 100% revenue contracts. But the inclusion of contractual income split provisions in the model substantially increases the labor supply elasticity.

**Keywords:** Contract incentives | Effort | Net wage | Income targeting

**Article:**

## Introduction

The standard neoclassical model assumes that workers are free to set their own hours or that they can select a job with an optimal wage-hours combination from a dense distribution of jobs (Farber *2005*). In recent years, the literature has evolved to examine workers that are free to set their own hours such as taxi drivers (Camerer et al. (*1997*); Chou (*2000*); Farber (*2005*, *2008*)); stadium workers Oettinger (*1999*) and bicycle messengers Fehr and Goette (*2007*). The findings of these studies are mixed as Camerer et al. (*1997*); Chou (*2000*) report negative wage elasticities of labor supply while the others generally report low and positive wage labor elasticities.

While studies of reference-dependent preferences of taxi drivers, stadium vendors and bicycle messengers have offered an opportunity to test income targeting, many sales professionals on

commission represent an important, yet overlooked, segment of workers who set their own hours. Commission-based sales professionals, especially those who receive both their share and the firm's share in exchange for a fixed recurring debt payment, represent a broad segment of the population. According to the Bureau of Labor Statistics, for example, the *Occupational Outlook Handbook* states that 517,800 real estate brokers and sales agents were employed in 2008 with a projected employment of 592,100 by 2018. Other sales professionals in insurance and financial planning, as well as manufacturing sales representatives often have similar exclusive contractual arrangements with their host firm.

The examination of real estate sales professionals adds a several dimensions. The problem of transitory demand shocks for taxi drivers as suggested by Camerer et al. (*1997*) is less likely to occur for real estate agents who are able to schedule their work according to the needs of their clients. Real estate sales professionals receive a range of commission splits up to a 100% contract; the 100% contracts most often occur when the sales professional receives the full commission amount (with no split with the firm) in exchange for a fixed debt payment. The impact of split has heretofore not been examined, yet it may influence labor supply elasticities and the propensity to income target. The survey data on real estate professionals includes household income and income from other non-real estate sources which permits an unbiased, compensated wage labor supply elasticity missing from most other studies.

A general model of performance and effort is developed based on contract terms, with workers taking into account their household and protected characteristics including race and gender. Their return to effort is the after-tax, after-split hourly wage. The model has three stages. In the first, the worker and firm negotiate a contract. The contract offers the worker a split of revenue. In the limit the contract offers the worker 100% of revenue in exchange for a fixed payment. Conditional on the contract the worker selects productivity per hour and a gross wage in the second stage. A higher split increases productivity, though this hypothesis is testable. In the third stage the worker selects effort or hours worked as the level of input along the productivity function. Effort depends on the return to work. A higher split raises the return to work. This test comes from whether effort's logarithmic coefficient in the return to work is positive. Workers have flexibility to choose hours, the contract, control and ownership mixes and productivity. Controlled for are their protected variables, taxes and household income.

The sample contains 1,559 salespeople surveyed in 2008 for calendar 2007. Most are sales agents and brokers offered a revenue (or commission) split at the beginning of the year. During the year they respond with revenue generated and hours worked. Some have a 100% revenue contract where the salesperson receives the full revenue generated by the in exchange for a fixed debt payment. The impact of a revenue split has heretofore not been examined, yet it is likely to influence the labor supply elasticity and possibly even the propensity to income target. This study also includes household income and residual (or other) income from other household members sources which permits an unbiased, compensated wage labor supply elasticity missing from most other studies.

The findings indicate that agents and brokers are more productive when incentives are increased. Those receiving a split between 61% and 70% of gross billings have hourly wages 20% higher than in the 51% to 60% group. Each employee's split is assigned to a decile. Those in the 61% to 70% group have a wage that increases by 2.1% for each percentage point increase in the split compared with those in the 51% to 60% category. The corresponding increases are 2.3%, 1.2% and 2.5% as marginal returns for a one percentage point split for those starting in the 71%, 81% and 91% categories. All of these employees are receiving splits or a division with the firm.

The 100% contract is a corner solution. The wage is 21% higher than for an employee receiving a split in the adjacent category of 91%–99%. These employees are renting from the employer, and constitute 11.5% of the sample. The self-selection term for being one's own boss is negative but not significant, indicating that there are no strong preferences for control. The firm can charge up to 21% as the rent for offering the control contract under risk neutrality.

The return to work is the product of the hourly wage, one minus the tax rate and the split. The hourly wage is fitted from the productivity equation and converted to an after-tax basis. Household income is on an after-tax basis. Skills and protected variables including race and gender are included.

Controlled for are the contract conditions of the split in categories and whether the employee has purchased either debt or equity from the firm. A 1% increase in the return to work increases hours worked by between 0.11% and 0.32% depending on the definition of after-tax household income. The normalized return to work is the hourly wage multiplied by the split and divided by household income. A 1% increase in the normalized return to work raises effort by between 0.02% and 0.14%. Across all specifications, these estimates are significantly different from zero. While women work 3% fewer hours, there are no differences in effort among White, Black, Asian or Hispanic employees after controlling for contract conditions and skills.

Agents and brokers respond positively to incentives. They are more productive when their split rises. They work more hours when the return to work is increased. The return to work is the product of the wage, taxes and split. Otherwise, the firm could reduce the split with the employee raising effort. The firm benefits by having a larger share of more output. That does not occur. Additionally, the wage elasticity is significantly higher when including split provisions in the model. Without considering split provisions in the model, the elastcity ranges from 0.04 to 0.1, or about 1/3 the correct magnitude. Therefore, split provisions appear to cause hours worked to respond more effectively to changes in the wage. As anticipated, increasing household or other income cause the wage elasticity to substantially decrease.

Background describes the background and context. The Model develops a model and the three stages. Data and Specification describes the data and empirical results are in Empirical Results. Implications and Conclusion discusses implications and offers concluding remarks.

**Background**

In professional employment contracts the worker has alternatives for control, ownership and a split. In two cases the worker pays the firm. In a control contract the worker makes a fixed payment up front in exchange for receiving all revenue generated. All residual revenue goes 100% to the worker and there is no split. An ownership contract involves the worker buying into the firm's profit. The profit is the fixed payments plus the remaining portions of splits, less expenses. A split is offered when the worker declines the control contract. Instead of an up-front debt payment, the worker and firm share gross revenue billed. The worker's holdings include either a control debt contract or a split and ownership.

Control has led to increased output in some cases. Laffont and Matoussi (*1995*) find that farmers receiving a residual claim after paying rent have higher output and effort.[1] Self-employed doctors are more productive than those who are employees.[2] Control contracts attract jacks-of-all trades (Lazear (*2005*)), those previously successful (Gompers et al. (*2010*)) or favorable unobservable attributes (Chiappori and Salanié (*2000*), Chiappori et al. (*2009*)). Other reasons for control are having interpersonal skills (Hurst and Lusardi (*2004*)) or not being financially constrained (Cagetti and De Nardi (*2006*)).

The benefit to 100% ownership is not universal, with Moskowitz and Vissing-Jørgensen (*2002*) finding that those on these contracts could earn 10% more annually on a stock index fund. This discount comes from unreported pecuniary benefits, a desire for being one's own boss and a preference for skewness and tolerance for risk (Hamilton (*2000*)). In Bitler et al. (*2005*) entrepreneurial contracts increase hours and output. The split depends on skills, to induce incentives (Holmström and Milgrom (*1994*)) and motivate the long-term risk-taking of Knight (*1921*).[3]

The general context is how effort responds to the return to work when people have control over hours. Oettinger (*1999*) uses data on stadium vendors allowed to choose whether to work on a given day, though not the hours at each game. The wage elasticities of labor supply are positive, ranging between 0.5 and 0.7. In Helland and Showalter (*2009*) physician effort in hours worked declines with the severity of state liability rules. [4]

Farber (*2005*) finds that New York taxi drivers work longer hours when their hourly wage rises. Otherwise, drivers will quit early on days it is easy to make money and work longer when fares are scarce. In Farber (*2008*) the results are robust to reference-dependent preferences where there is a target level of income. The shifts end before an income target is reached. Fehr and Goette (*2007*) conduct a field experiment on bicycle messengers permitted to set hours. One subsample is given a higher commission rate than the other. The labor supply elasticity exceeds one for all hours worked, though an increase in days worked is partially offset by a decrease in daily hours.

Other evidence finds that effort declines when the return to work rises. Camerer et al. (*1997*) find that taxi drivers work fewer hours on higher-wage days. They attribute this finding to fixed daily income targets given transitory demand shocks. These shocks come from weather, holidays, day-

of-the week effects and conventions uncorrelated across days. Chou (*2000*) for taxi drivers in Singapore finds similar results.

Reconciling these conflicting results involves a set of requirements. Workers are able to choose their own hours given their after-tax wage and the split in contract. A more complete analysis involves the composition of the household to determine the after-tax income. Having a split offers another advantage. The split allows a test of whether effort is increasing with incentives.

## The Model

The worker is in a group, each of whom generates individual revenue to be split with the firm. A given worker is offered a split or proportion of generated revenue $s(X)$, $0 < s(X) < 1$ based on skills $X$. The alternative is that the firm offers a control contract where $s = 1$ in exchange for a payment $\kappa$. The worker chooses between equity from own work and a split less than one, or a debt contract. The firm separately offers ownership $p$ as a share of profits. It should be noted, however, that an $s$ is determined by the contracting brokerage firm based upon prior sales performance, experience and other relevant factors; the agent or broker does not determine the level of $s$ when $s < 1$.[5]

The worker responds to $s$ by determining productivity and effort. The worker generates gross billed revenue $y = wh$ from a wage $w$ and hours worked $h$. Total time available to the worker is $\gamma$. The utility is $u(\gamma - h, s: p, Z)$. Hours worked $h$ reduce utility and a higher contract split $s$ increases it. Utility is shifted by equity ownership$p$ and personal characteristics $Z$, $X \subset Z$. Personal characteristics include protected variables such as race and gender that affect utility but are not permitted to be used in the contract.

The worker is selecting on two binary decisions. Control with no ownership involves $s = 1$, $p = 0$ with utility $u_1(\gamma - h, s = 1: p = 0, Z)$. Ownership without control involves $s < 1$, $p > 0$ and $u_2(\gamma - h, s: p, Z)$. When neither control nor ownership is desired, the worker has $s < 1$, $p = 0$ with utility $u_0(\gamma - h, s: p = 0, Z)$. The worker wanting both control and ownership has $s = 1$, $p > 0$ and $u_{12}(\gamma - h, s = 1: p > 0, Z)$. The worker is making binary choices on whether to pay for debt and control and equity or profits. In the no-pay cases the worker takes a split contract with no control for $s < 1$ and no ownership for $p = 0$. The equity $p > 0$ is separate from profit-sharing and requires a capital contribution.

The decision $d = 1$ occurs for the debt contract when the worker has 100% control of revenue. The decision to buy equity in the firm involves $e = 1$. The worker with no payments for debt or equity has these indicators as zero. The worker taking on both debt and equity has $b = 1$. These workers want both control of their revenue and ownership of part of the firm's residual claim. Against the reference of having neither, the demand for debt and equity is

$$\begin{cases} d = \begin{cases} 0 \\ 1 \end{cases} & s = \begin{cases} 0 < s < 1 & u_1 < u_0 \\ 1 & u_1 \geq u_0 \end{cases} \\ e = \begin{cases} 0 \\ 1 \end{cases} & p = \begin{cases} 0 & u_2 < u_0 \\ > 0 & u_2 \geq u_0 \end{cases} \\ b = \begin{cases} 0 \\ 1 \end{cases} & d, e = \begin{cases} otherwise & u_{12} < \max u_i \quad i \neq 1,2 \\ 1 & u_{12} \geq \max u_i \quad i \neq 1,2 \end{cases} \end{cases} \tag{1}$$

The result is a position of a split $0 < s \leq 1$ from gross revenue and a share $0 \leq p < 1$ from the firm's net income. The split controls the worker's performance in gross revenue. In cases where the worker chooses not to be at a corner, taking a split less than one and ownership, the contract is $s > 0$, $p > 0$. The structure (1) allows for the discontinuities of imperfect capital markets for funding debt and equity. Preferences for control allow the worker to operate where returns are diminishing or even negative at the margin, contrary to conventional production.

Given this contract decision, the second stage is for the worker to choose the productivity or gross wage. The technology shifts with the split *s*, yielding gross revenue at a unit price of output. The gross revenue is *f*(*h*, *s*, *X*) depending on the split *s*, hours worked *h* and characteristics for education, experience, and specialization *X*. The gross revenue is the production function for output with a unit price. Production *f* is increasing, regular, invertible and concave in the hours and split *h*, *s*. The price of output is normalized at unity.

Conditional on the split, the worker has an incentive to shift *f* (*h*, *s*, *X*) upwards. The worker's after-split income is *sf* (*h*, *s*, *X*). The firm's return for a split $s < 1$ is (1-*s*) *f* (*h*, *s*: *X*). With full control, the employee receives *f* (*h*, $s = 1$, *X*)-$\kappa$ and the firm the fixed payment $\kappa$.

The firm's profit is maximized subject to the worker's preferences as a constraint. The employee's output is conditional on the ownership share, and the maximization is over the split as the decision variable. Corner solutions for those who prefer control have been taken into account in (1). Including only those on a split and buying no debt the maximization is

$$\begin{aligned} &\max_{s} \quad (1-s)\, f(h, s : p, X) \\ &ST \begin{cases} d = 0, e = 0 & u_1(\gamma - h, 1 : 0, Z) < u_0(\gamma - h, s : 0, Z) \\ d = 0, e = 1 & u_{12}(\gamma - h, 1 : p > 0, Z) < u_0(\gamma - h, s : 0, Z) \end{cases}. \end{aligned} \tag{2}$$

Then $(1-s)f(h,s:X)+\theta 1 u0(\gamma-h,s:0,Z)-u1+\theta 12 u0(\gamma-h,s:0,Z)-u12(\gamma-h,1:p>0,Z)$ is the associated condition. The return to not buying either debt or equity is $\theta_1$. The return to equity, conditional on not buying debt is $\theta_{12}$ Maximizing firm profits with respect to the split leads to the first-order condition

$$f(h, s^* : X) - (1 - s^*)\frac{\partial f}{\partial s} = \frac{\partial u_0}{\partial s}[\theta_1 + \theta_{12}]. \qquad (3)$$

This optimal split $s^*$ that solves (3) enters the second stage. Those who want control over all their revenue generated are at $s^* = 1$. The split and profit $s^*$, $p$ are predetermined prior to the worker selecting productivity, wage and hours.

Output $f(h, s^*: X)$ depends on effort $h$. It is shifted upwards by improved incentives $s^*$, and skill $X$, which includes the equity purchased $p$. Output per unit of effort or productivity is $g(s*,X)=fh$. In the second stage the worker selects productivity $g$ once the contract is determined. Increased incentives with the split induce the person to raise productivity if $\partial g \partial s > 0$.

The third stage occurs within the household. The employee determines the return to work based on the productivity selected and the contract split. The employee's household characteristics set the tax rate, leading to the work return

$$w*(s*,X)=(1-\tau)s*g(s*,X). \quad (4)$$

The work return is the product of three variables. The contract split $s^*$ is based on previous track record prior to performance. Contingent on that contract, the employee determines productivity. The household's tax rate shifts the return to work. With the contract and productivity predetermined, the return to work and income establish the employee's effort.

The budget constraint is on income $y$ from all sources and the value of leisure $s^*\ g(\gamma - h)$ scaled by $(1-\tau)$. The marginal utility of full income is $\theta$. Full income is the value of leisure $s^*\ g(\gamma - h)$ and cash received $y$, both measured after tax. Maximization of direct utility subject to the full income constraint yields indirect utility as

$$v((1-\tau)s*g,(1-\tau)y:s*,Z)=\max hu(\gamma-h,s*:Z)+\theta(1-\tau)(s*g(\gamma-h)+y). \quad (5)$$

Hours are conditional on the contract terms for split, debt and equity, personal characteristics and income. Effort is the negative of the ratio of the utility derivatives in the return to work and after-tax income. This condition yields

$$h*(w*,(1-\tau)y:s*,Z)=-\partial v(w*,(1-\tau)y:s*,Z)/\partial w*\partial v(w*,(1-\tau)y:s*,Z)/\partial(1-\tau)y. \quad (6)$$

Those with full control at $s = 1$ are included, with the conditional adjustment for being their own boss.

For effort $h^*$ and the return to work $w^*$, the compensated supply elasticity given the tax rate, split, debt, equity and productivity is $\partial \ln h* / \partial \ln w* = \partial \ln h* / \partial \ln(1-\tau)s*g$. Held constant is the after-tax income of the household.

The person increases effort in incentives $s^*$ when the elasticity is positive. A rise in the income-compensated, contract structure-adjusted, after-tax wage leads the worker to supply more effort. Otherwise, the firm reduces the split and benefits in two ways. The firm retains the higher percentage while the employee puts in more effort and generates additional revenue.

## Data and Specification

The data are from a spring 2008 survey of 72,000 members of the National Association of Realtors® (NAR) who are engage in real estate related occupations, including real estate agents and brokers in addition to non-commission workers. The survey captures the calendar year 2007. Data for sales professionals include the contract terms, decided at the beginning of 2007, and the performance in revenue and effort during the year. The contract includes the percentage split with the firm including 100% control with the firm as first claimant. Ownership of equity in the firm is reported. Performance includes gross and net income in sales revenue, business expenses and hours worked per week. Other information includes education, experience, gender, ethnicity and metro location. Firm characteristics and household income are also available from the survey.

The respondents report where they work. To control for local market conditions, the empirical model includes the change in employment from the Bureau of Labor Statistics and the median price of existing single-family houses in 2007 from the National Association of Realtors®. Although there are originally 9,977 usable observations in the data set, there are 1,559 sales professionals providing complete information on dependent variables for the split and ownership, wages, hours worked per week and household income. The contract conditions give a split for $s$ and an ownership stake for $p$. Those on a debt contract have $s = 1$, making a fixed payment to the firm and retaining any overage. The split remains predetermined before the agent chooses productivity or effort.

The system of equations is based on a recursive structure because each of the endogenous variables is determined sequentially; ownership and control are estimated first, and then followed by wages.[6] The bivariate probit includes ownership and control (no split versus a split). The second equation is the natural log of wages sample selection regression with sample selection parameters for ownership and control from the bivariate probit; coefficients in the sample selection equation are corrected for potential sample selection bias. The third equation is the natural log of hours equation with wages and income included as explanatory variables. Because the system of equations is recursive, identification problems that are most often associated with simultaneous equations are eliminated. With the possible exception of the $s = 1$ contract, the other contract variables are exogenous. Agents and brokers always prefer a higher split, but brokerage firms determine their split based upon their experience and sales performance in the past. The split is reported at the beginning of the year before their performance during the year is known.

The first estimation step is for the decision in favor of 100% control. This decision to take on debt $d = 1$ has determining variable $z1 = X1\beta1 + \varepsilon1 > 0$. The observed characteristics are $X_1$ with coefficients $\beta_1$ and error $\varepsilon_1$. Otherwise $d = 0$ and the agent splits revenue with the firm. The agent has ownership equity when $e = 1$ determined by $z2 = X2\beta2 + \varepsilon2 > 0$. Otherwise $e = 0$ and the agent has no ownership. The structure is bivariate probit with the form

$$\begin{cases} d = \begin{cases} 1 & z_1 = X_1\beta_1 + \varepsilon_1 > 0 \\ 0 & otherwise \end{cases} \\ e = \begin{cases} 1 & z_2 = X_2\beta_2 + \varepsilon_2 > 0 \\ 0 & otherwise \end{cases} \end{cases} \quad \varepsilon_1, \varepsilon_2 \sim N(0, \Sigma)\,. \tag{7}$$

Here Σ is the variance-covariance matrix of the errors. The variances are standardized at unity. The correlation coefficient between the errors for taking on debt and equity is $\rho$. When an agent both ownership and control the correlation coefficient is positive.

Recovered from this first step are two inverse Mills ratios $m_1$ and $m_2$ with respective coefficients $\lambda_1$ and $\lambda_2$. The fitted inverse Mills ratios from the first-stage regression are regressors in the productivity or hourly wage equation in the second step. The product $\lambda_1 m_1$ is the wage premium for having control. The premium for being an owner is $\lambda_2 m_2$.

The debt variables $X_1$ in the bivariate probit are years of experience, its square and credentials as an associate broker. Other skill variables include having a personal website and the separate numbers of commercial and residential properties owned. The firm variables include size by logarithmic number of agents and whether the entity is an independent non-franchise firm. Various income definitions are constructed. One is total household income, the agent's net revenue after the split plus earnings by other members and investment income. Another is residual income not earned by the head, earnings by other members plus investment returns.

Labor contracts prohibit protected variables for race, gender and ethnicity from being used in debt $X_1$. Since portfolio decisions are made by households, protected variables may affect buying equity in the firm. These are included in the equity variables $X_2$. Both sets include the skills of the person and size and characteristics of the firm and local market conditions.

The second stage estimates productivity conditional on the contract. This split is now a regressor as part of the contract. Included are the control and ownership premiums $\lambda_1 m_1$ and $\lambda_2 m_2$. The dependent variable is the gross wage, or split multiplied by productivity or

$$\ln w_g = \ln(sg) = X_w\beta_w + S\phi_w + \delta_{1w}\widehat{d} + \delta_{2w}\widehat{e} + \lambda_1 m_1 + \lambda_2 m_2 + \varepsilon_w. \tag{8}$$

The variables $X_w$ that determine the gross wage include skills, firm characteristics and the local market with parameters $\beta_w$. The split is divided into a category matrix $S$ with parameter $\phi\, w$.

The fitted values of the debt and equity corner contracts and their coefficients are $\delta 1 wd\hat{} + \delta 2 we\hat{}$. The premiums for control and ownership preferences are $\lambda_1 m_1 + \lambda_2 m_2$. The error is $\varepsilon w$.

The third stage is the estimation of effort conditional on the contract and wage. The fitted gross $\ln w\hat{} g$. That gross revenue is divided between the firm and employee by the predetermined split. The tax rate is $\tau$. The work return is

$$\ln \widehat{w} = \ln[(1-\tau)\widehat{w}_g] = \ln[(1-\tau)s\widehat{g}]. \qquad (9)$$

The first and second stages of the estimation set the split and productivity. The productivity is contingent on the split. The employee takes account of other household members in establishing the tax rate, leading to the return to work. Together with protected variables, skills and household income, the return to work determines effort.

With hours worked in logarithms, effort is

$$\begin{aligned} \ln h &= X_h\beta_h + S\phi_h + \delta_{1h}\widehat{d} + \delta_{2h}\widehat{e} + \eta_w \ln(1-\tau)\widehat{w}_g + \eta_y[\ln(1-\tau)y] + \varepsilon_h \\ &= X_h\beta_h + S\phi_h + \delta_{1h}\widehat{d} + \delta_{2h}\widehat{e} + \eta_w \ln\frac{\widehat{w}}{y} + \varepsilon_h \end{aligned}. \qquad (10)$$

The fitted return to work $w\hat{}=(1-\tau)sg\hat{}$ has effort elasticity $\eta w$. Household after-tax income is $(1-\tau)\, y$ with effort elasticity $\eta y$. The error is $\varepsilon h$. The lower condition in (10) occurs for the normalized return to work $w\hat{}gy$. Variables in $X h$ with parameters $\beta h$ are skills, firm characteristics, local market conditions and protected variables including race, ethnicity and gender. The categories of compensation split $S$ have coefficient $\phi h$. Fitted impacts on effort of owing debt or equity in the firm are $\delta 1 hd\hat{}$ and $\delta 2 he\hat{}$. If owning debt makes employees work harder, then $\delta 1 hd\hat{}>0$. Estimation is for both versions of (10) and various definitions of income.

The compensated, after-tax, after-split elasticity of effort with respect to return to work is $\eta w$. If $\eta w > 0$, people who choose their hours respond positively to incentives. A higher split raises the return to work. Increasing the return to work leads to increased effort. The elasticity of supply $\eta w$ is for workers controlling their hours and their intensity of work. It is compensated for income, taxes, split and ownership, debt, equity, skills and demographics. There is income targeting when $\eta w < 0$. A limiting case is when $\eta w = -1$.

Empirical Results

Sample statistics are in Table 1. Agents have an average of 14.7 years of experience. Those on a debt contract retaining a residual claim constitute 11.5% of the sample. Conventional wisdom is that agents receive a 50% split of a frequently-used commission rate of 6% for selling a house. The firm retains the remainder. The transaction has two sides for listing and selling. The listing agent receives 1.5%. The agent on the selling side receives the other 1.5%. The 50:50 split is not

the common practice as revealed in Table 1. In the sample 77% of agents receive more than 50% of gross commissions generated. Average gross commission income is $69,217. Average household income is $128,320 in 2007. Full-time licensees work an average of 45 h a week. [7]

**Table 1**. Sample statistics

| Variable | Description | Standard | | |
|---|---|---|---|---|
| | | Mean | Deviation | N |
| Sch | Years of schooling | 14.742 | 1.949 | 2,624 |
| Exp | Years of real estate brokerage experience | 11.352 | 9.697 | 2,611 |
| Exp2 | Square of *Exp* | 222.863 | 334.922 | 2,611 |
| Married | Marital status (Married = 1) | 0.716 | 0.451 | 2,624 |
| Female | Gender (Female = 1) | 0.569 | 0.495 | 2,624 |
| Black | Ethnicity (African-American = 1) | 0.026 | 0.160 | 2,624 |
| Hispanic | Ethnicity (Hispanic = 1) | 0.038 | 0.191 | 2,624 |
| Asian | Ethnicity (Asian = 1) | 0.024 | 0.154 | 2,624 |
| Seccar | Real estate as second career (Second career =1) | 0.958 | 0.200 | 2,624 |
| Persweb | Broker has a personal webpage for business (Personal webpage = 1) | 0.583 | 0.493 | 2,624 |
| Resprop | Number of residential investment properties | 0.999 | 2.380 | 2,620 |
| Commprop | Number of commercial investment properties | 0.166 | 0.656 | 2,605 |
| Asscbrok | Associate broker status (Associate broker = 1) | 0.167 | 0.373 | 2,624 |
| Brkown | Broker-owner status (Broker-owner = 1) | 0.135 | 0.342 | 2,624 |
| Indnfr | Independent non-franchise status (Independent non-franchise = 1) | 0.456 | 0.498 | 2,624 |
| Indfr | Independent franchise status (Independent franchise = 1) | 0.394 | 0.489 | 2,624 |
| Lsfsizf | Natural log of firm size (Number of sales employees) | 3.959 | 1.821 | 2,624 |
| Lmpr07 | Natural log of median metro area single-family house prices | 5.546 | 0.493 | 1,823 |
| Pchgemp | Percent change in employment | 1.032 | 1.415 | 2,044 |
| Profshar | Profit sharing plan status (Profit sharing plan = 1) | 0.037 | 0.190 | 2,624 |
| Sp51_60 | Broker commission split is 51%–60% | 0.159 | 0.366 | 2,624 |
| Sp61_70 | Broker commission split is 61%–70% | 0.240 | 0.427 | 2,624 |
| Sp71_80 | Broker commission split is 71%–80% | 0.150 | 0.357 | 2,624 |
| Sp81_90 | Broker commission split is 81%–90% | 0.059 | 0.236 | 2,624 |
| Sp91_99 | Broker commission split is 91%–99% | 0.051 | 0.221 | 2,624 |
| Sp100 | Broker commission is 100% (no split) | 0.115 | 0.320 | 2,624 |
| Ginct | Gross real estate income ($ 000) | 69.217 | 54.209 | 2,624 |
| Hinct | Gross household income ($ 000) | 128.320 | 101.269 | 2,624 |
| Resinct | Gross household income from non real estate sources ($ 000) | 59.104 | 87.759 | 2,624 |
| Ninct | Real estate income net of expenses and taxes ($ 000) | 44.080 | 38.466 | 2,624 |
| Nhinct | Household income net of expenses and taxes ($ 000) | 101.800 | 174.034 | 2,553 |

| | | | | |
|---|---|---|---|---|
| Nresint | Net household income from non real estate sources ($ 000) | 32.106 | 175.103 | 2,553 |
| Hrs | Hours worked per week | 44.909 | 12.069 | 2,624 |
| Gwage | Gross hourly wage | 30.999 | 24.125 | 2,624 |
| Nwage | Net hourly wage | 19.835 | 17.203 | 2,624 |
| Lginc | Natural log of gross real estate income | 10.750 | 1.018 | 2,624 |
| Lhinc | Natural log of household income | 11.526 | 0.717 | 2,624 |
| Lresinc | Natural log of gross household income (from non real estate sources) | 8.081 | 4.900 | 2,624 |
| Lninc | Natural log of income net of expenses and taxes | 10.263 | 1.022 | 2,624 |
| Lnhinc | Natural log of household income | 10.533 | 2.883 | 2,553 |
| Lnresin | Natural log of net household income (from non real estate sources) | 6.085 | 5.328 | 2,553 |
| Lhrs | Natural log of hours worked per week | 3.769 | 0.268 | 2,624 |
| Lgwage | Natural log of gross hourly wage | 3.069 | 0.970 | 2,624 |
| Lnwage | Natural log of net hourly wage (net of expenses and taxes) | 2.582 | 0.989 | 2,624 |
| Lwoir | Natural log of (gross wage divided by income from non-real estate sources) | -5.012 | 5.218 | 2,624 |
| Lwtir | Natural log of (gross wage divided by household income) | −8.457 | 0.846 | 2,624 |

The first stage contract selection results are in Table 2. For the entire model, the log likelihood of −1,549 is statistically significant at the 1% level. The correlation coefficient $\rho$ is 0.42, significant at the 1% level. Debt and equity holdings are positively correlated. The non-zero correlation coefficient and significance on the estimating equation support the bivariate probit specification.

**Table 2**. Contract selection: bivariate probit

| **Variable** | **(1)** | | **(1)** | | **(3)** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Entrepreneurship *s* = 1** | | **Ownership** | | **Marginal effects** | | | |
| | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** | **Direct** | **Indirect** | **Combined** | **Dummy** |
| Constant | −1.3115[b] | −8.140 | −0.6437[b] | −2.872 | – | – | – | – |
| Exp | 0.0507[b] | 4.191 | 0.0660[b] | 5.263 | 0.0187 | −0.0085 | 0.0102 | – |
| Exp2 | −0.0007[a] | −2.110 | −0.0010[b] | −2.883 | −0.0003 | 0.0001 | −0.0001 | – |
| Married | 0.1900[a] | 2.372 | 0.1070 | 1.269 | 0.0700 | −0.0137 | 0.0562 | 0.0550 |
| Asscbrok | −0.0597 | −0.644 | – | – | −0.0220 | – | −0.0220 | −0.0217 |
| Persweb | 0.1683[a] | 2.364 | – | – | 0.0620 | – | 0.0620 | 0.0614 |
| Female | – | – | −0.2426[b] | −3.237 | – | 0.0311 | 0.0311 | 0.0309 |
| Black | – | – | 0.3715 | 1.616 | – | −0.0476 | −0.0476 | −0.0446 |
| Hispanic | – | – | −0.1917 | −0.907 | – | 0.0246 | 0.0245 | 0.0253 |
| Asian | – | – | 0.5967[b] | 3.300 | – | −0.0764 | −0.0764 | −0.0686 |
| Seccar | – | – | −0.3117 | −1.897 | – | 0.0399 | 0.0399 | 0.0379 |
| Resprop | 0.0398[b] | 3.170 | 0.0297 | 1.715 | 0.0147 | −0.0038 | 0.0109 | – |
| Commprop | −0.0368 | −0.806 | 0.2998[b] | 8.812 | −0.0136 | −0.0384 | −0.0519 | – |
| Indnfr | −0.0617 | −0.836 | 0.3734[b] | 4.349 | −0.0227 | −0.0478 | −0.0705 | −0.0700 |
| Lsfsizf | −0.1162[b] | −6.027 | −0.3083[b] | −13.580 | −0.0428 | 0.0395 | −0.0033 | – |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lresinc | −0.0224[b] | −3.303 | – | – | −0.0083 | – | −0.0083 | – |
| Rho(1,2) | 0.42 | 7.25 | | | | | | |
| Log Likelihood | −1548.96 | | | | | | | |
| N | 2,590 | | | | | | | |

The dependent variable is owners with 100% commission. Marginal effects are the partial derivatives of E[y1|y2 = 1] with respect to the vector of characteristics. The estimate of E[*Sp100*|*Brkown* =1] = .287. They are computed at the means of the independent variables. Marginal effects for the dummy variables are the combined effects computed using E[y1|y2 = 1,d = 1] - E[y1|y2 = 1,d = 0] where d is the dummy variable

[a]Statistically significant at the 0.05 level,

[b]Statistically significant at the 0.01 level

The first block of results is for selecting control with a share of 100%. More experienced people have an increased probability of wanting control. One more year of experience has a coefficient of 0.05, with a decreasing marginal effect. Other variables increasing the probability of taking a 100% contract are having a personal website and owning other residential properties. Working at a large firm reduces the probability of control. Higher household income reduces this probability.

The probability of holding equity is increasing in experience. A year more of experience has a coefficient of 0.06. Ownership of the firm is increasing for holding commercial properties. Those who work at independent, non-franchised firms have an increased probability of owning equity. Large firms offer fewer opportunities either to have control over income or obtain ownership. Since ownership is a portfolio allocation as opposed to an employment contract, protected variables including gender, race and ethnicity are included. Women are less likely to be owners. Within the racial and ethnic groups, Asian-Americans are more apt to be owners.

The third block of results in Table 2 contains the marginal effects for receiving all revenue earned contingent on holding ownership. A year of experience leads to a 1.9% direct effect in the probability of owning debt in the firm. After the indirect effect of ownership, the incremental probability of holding debt is 1%. Salespeople who own residential real estate have a 1% higher probability per property of having the 100% control contract. The control probability decreases by 0.3% per 1% increase in firm size, and it declines in income.

Table 3 reports the second-stage productivity equation with the gross hourly wage as the dependent variable. This wage is the productivity choice made by the salesperson, contingent on the contract. The first column is when no adjustments for debt or equity are included. The second column adjusts for debt, the third for equity and the fourth for both. The results focused on are for the last column with both included. For those on a split comprising 88.5% of the sample, the results are similar across specifications.

**Table 3**. Productivity and intensity: gross hourly wage

| Variable | (1) | | (2) | | (3) | | (4) | |
|---|---|---|---|---|---|---|---|---|
| | Neither | | Control $s = 1$ | | Ownership | | Both | |
| | Coef. | T-stat. | Coef. | T-stat. | Coef. | T-stat. | Coef. | T-stat. |
| Constant | 0.9117[b] | 3.298 | 0.8498[b] | 3.055 | 0.9037[b] | 3.187 | 0.9008[b] | 3.161 |
| Exp | 0.0680[b] | 9.883 | 0.0629[b] | 8.103 | 0.0679[b] | 9.696 | 0.0648[b] | 8.527 |
| Exp2 | −0.0014[b] | −7.416 | −0.0014[b] | −6.963 | −0.0014[b] | −7.446 | −0.0014[b] | −7.128 |
| Married | 0.1977[b] | 4.247 | 0.1870[b] | 3.933 | 0.1974[b] | 4.256 | 0.1900[b] | 4.027 |
| Asscbrok | 0.0173 | 0.294 | 0.0420 | 0.679 | 0.0177 | 0.302 | 0.0242 | 0.407 |
| Indfr | 0.0445 | 0.993 | 0.0439 | 0.981 | 0.0460 | 0.989 | 0.0357 | 0.752 |
| Lsfsizf | 0.0568[b] | 4.647 | 0.0691[b] | 4.633 | 0.0581[b] | 3.396 | 0.0604[b] | 3.505 |
| Lmpr07 | 0.1679[b] | 3.940 | 0.1690[b] | 3.987 | 0.1677[b] | 3.960 | 0.1692[b] | 3.968 |
| Pchgemp | 0.0608[b] | 3.762 | 0.0603[b] | 3.759 | 0.0607[b] | 3.779 | 0.0607[b] | 3.752 |
| Persweb | 0.0034 | 0.078 | −0.0184 | −0.400 | 0.0032 | 0.074 | −0.0121 | −0.265 |
| Seccar | −0.1371 | −1.242 | −0.1324 | −1.214 | −0.1353 | −1.220 | −0.1415 | −1.268 |
| Resprop | 0.0356[b] | 3.501 | 0.0288[b] | 2.577 | 0.0354[b] | 3.446 | 0.0311[b] | 2.804 |
| Commprop | 0.0664[a] | 2.056 | 0.0737[a] | 2.239 | 0.0645 | 1.766 | 0.0808[a] | 2.107 |
| Sp51_60 | 0.2165[b] | 2.959 | 0.2196[b] | 2.999 | 0.2164[b] | 2.976 | 0.2193[b] | 2.995 |
| Sp61_70 | 0.4124[b] | 6.502 | 0.4174[b] | 6.576 | 0.4129[b] | 6.536 | 0.4146[b] | 6.517 |
| Sp71_80 | 0.6393[b] | 8.861 | 0.6456[b] | 8.953 | 0.6395[b] | 8.915 | 0.6430[b] | 8.891 |
| Sp81_90 | 0.7591[b] | 7.832 | 0.7660[b] | 7.923 | 0.7595[b] | 7.880 | 0.7626[b] | 7.852 |
| Sp91_99 | 1.0099[b] | 9.215 | 1.0134[b] | 9.276 | 1.0106[b] | 9.266 | 1.0104[b] | 9.206 |
| Sp100 | 0.7401[b] | 9.383 | 1.3341[b] | 3.238 | 0.7394[b] | 9.408 | 1.2189[b] | 2.82 |
| Brkown | 0.0513 | 0.714 | 0.0338 | 0.470 | 0.0750 | 0.339 | −0.0710 | −0.301 |
| Control $m_1$ | – | – | −0.3138 | −1.470 | – | – | −0.2401 | −1.119 |
| Ownership $m_2$ | – | – | – | – | −0.0139 | −0.113 | 0.0150 | 0.127 |
| Adjusted $R^2$ | 0.25 | | 0.25 | | 0.25 | | 0.25 | |
| F-statistic | 29.82 | | 28.45 | | 28.31 | | 27.03 | |
| Log Likelihood | −1986.50 | | −1974.88 | | −1975.93 | | −1974.78 | |
| N | 1,606 | | 1,606 | | 1,606 | | 1,606 | |

[a]Statistically significant at the 0.05 level

[b]Statistically significant at the 0.01 level

While there are no differences on debt and equity investments, employees respond to split incentives. The production function shifts upward at each increase in split. For those receiving a split between 51% and 60% of gross revenue, the hourly wage is 21.9% higher than the reference group receiving 50% or less.[8] In the 61% to 70% group, the wage is 41.4% above the reference. The marginal return is 19.5%. For representative agents at the midpoint of their groups, the increase in split is 10 percentage points. For each percentage point increase in the split the hourly wage rises by 1.9%. This is the marginal return to the employee from raising the split.

The gross hourly wage is 64.3% higher for those with a 71% to 80% split than the reference group. The marginal return is 2.3% per percentage point of split as compared with the 61% to 70% group. For those in the 81% to 90% group the marginal return is 1.2% per split point. The marginal return is 2.5% for those in the 91%–99% group. In all categories, the sequential

marginal returns are 1.9%, 2.3%, 1.2% and 2.5%. They are all positive. Employees increase their productivity at each successive increase in the split.

The debt contract is at 100%. The problem is determining what the reference group is. Employees at 100% would not necessarily have a 91% to 99% split if they declined debt. They may have a preference for being their own boss despite not being highly productive. In the first column with no adjustment, those on a debt contract have a wage 74% higher than the reference group at a 50:50 split. The inverse Mills ratio self-selection terms for holding debt and equity are not significant. Nor is the preference for being one's own boss.

The wage and productivity respond positively to conventional skills. Another year of experience increases the wage by 6.8%, with the impact decreasing. The square of experience is negative in the wage equation. The wage is at a maximum at 23 years of experience including the quadratic term.[9] Owning residential or commercial real estate raises the gross hourly wage by 3.6% and 6.6% respectively per property. A 10% increase in firm size increases productivity by 0.6%. The systematic local market for employment growth and level of house prices raise the wage. A 1% increase in local employment raises the gross wage by 6%. A 10% increase in the metro median house price increases the gross wage by 1.7%.

Table 4 estimates effort as the third stage of the sequence. Effort is contingent on the contract and selection of productivity. The person has control over work hours, given the choice of contract and gross wage or productivity in the sequential first and second stages. Endogenous wage and income variables in the model include *Lnwage*, *Lnresin*, *Lhhinc*, *Lwoir* and *Lwtir*. Therefore, a 2SLS model is estimated using instrumental variables.[10] The OLS model results are shown in the Appendix. The negative wage elasticity estimates using OLS are negative and statistically significant; this indicates that the endogeneity problem could have a substantial effect.

**Table 4**. Effort: logarithm of weekly hours

| | **(1)** | | **(2)** | | **(3)** | | **(4)** | | **(5)** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** |
| Constant | 2.9845[c] | 12.762 | 3.3788[c] | 20.678 | 3.7636[c] | 14.475 | 3.5419[c] | 32.780 | 4.6498[c] | 15.741 |
| Age | 0.0087 | 1.236 | 0.0109[b] | 2.285 | 0.0121[b] | 2.162 | 0.0145[c] | 3.300 | 0.0152[c] | 3.200 |
| Age2 | −0.8952[a] | −1.274 | −0.0001[b] | −2.447 | −0.0001[b] | −2.340 | −0.0001[a, b] | −3.391 | −0.0002[c] | −3.413 |
| Married | −0.0714[b] | −2.347 | 0.0013 | 0.049 | 0.0015 | 0.060 | 0.0591[b] | 2.453 | 0.0423[b] | 2.017 |
| Female | −0.0356 | −1.571 | −0.0358[b] | −2.257 | −0.0365[b] | −1.969 | −0.0350[b] | −2.378 | −0.0392[b] | −2.497 |
| Black | 0.0527 | 0.807 | 0.0093 | 0.223 | 0.0379 | 0.745 | −0.0152 | −0.411 | 0.0003 | 0.007 |
| Hispanic | 0.1124 | 1.728 | 0.0345 | 0.822 | 0.0144 | 0.321 | −0.0091 | −0.280 | 0.0051 | 0.143 |
| Asian | −0.0692 | −1.13 | −0.0342 | −0.80 | −0.0516 | −1.06 | −0.0291 | −0.75 | −0.0396 | −0.95 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | 8 | | 7 | | 0 | | 2 |
| Seccar | 0.0287 | 0.454 | −0.0105 | −0.243 | 0.0022 | 0.045 | 0.0066 | 0.164 | −0.0123 | −0.299 |
| Resprop | −0.0146* | −2.412 | −0.0069 | −1.604 | −0.0078 | −1.677 | −0.0019 | −0.513 | −0.0052 | −1.443 |
| Commprop | −0.0375 | −1.838 | −0.0145 | −0.990 | −0.0125 | −0.799 | −0.0028 | −0.254 | −0.0021 | −0.181 |
| Sp51_60 | −0.1954* | −2.515 | −0.0824 | −1.765 | −0.0816* | −2.097 | −0.0998* | −2.051 | −0.0580 | −1.920 |
| Sp61_70 | −0.1897 | −1.881 | −0.0263 | −0.459 | −0.0309 | −0.697 | −0.0331 | −0.642 | −0.0034 | −0.108 |
| Sp71_80 | −0.2857* | −2.196 | −0.0688 | −0.917 | −0.0785 | −1.389 | −0.0641 | −1.103 | −0.0304 | −0.841 |
| Sp81_90 | −0.2901[b] | −2.037 | −0.0702 | −0.847 | −0.1080 | −1.556 | −0.0523 | −0.817 | −0.0195 | −0.440 |
| Sp91_99 | −0.3320[b] | −2.024 | −0.0661 | −0.703 | −0.1001 | −1.320 | −0.0313 | −0.486 | −0.0096 | −0.197 |
| Sp100 | −0.5299* | −2.365 | −0.1534 | −1.171 | −0.1477 | −1.583 | −0.2205 | −1.634 | −0.0774 | −1.382 |
| Brkown | 0.2633[c] | 2.918 | 0.1395[b] | 2.071 | 0.1209 | 1.680 | 0.1974[c] | 3.011 | 0.1024[b] | 2.248 |
| Lnwage | 0.3198[c] | 2.946 | 0.1146 | 1.762 | 0.2040[c] | 3.680 | – | – | – | – |
| Lnresin | – | – | −0.0114[b] | −2.401 | – | – | – | – | – | – |
| Lnhinc | – | – | – | – | −0.0676[b] | −2.251 | – | – | – | – |
| Lwoir | – | – | – | – | – | – | 0.0180[c] | 4.058 | – | – |
| Lwtir | – | – | – | – | – | – | – | – | 0.1407[c] | 4.304 |
| Log Likel. | −863.21 | | −247.42 | | −499.54 | | −167.62 | | −298.55 | |
| N | 1,580 | | 1,559 | | 1,559 | | 1,599 | | 1,599 | |

[a]Multiply coefficient by $10^{-4}$

[b]Statistically significant at the 0.05 level

[c]Statistically significant at the 0.01 level

The wage and income net of incentives are defined in five different ways in Table 4. The first column is where the wage is uncompensated for income. As in all specifications in the table, the wage is defined as after the split and taxes. The dependent variable is the logarithm of hours worked per week. The labor pricing variable is the logarithm of the after-split, after-tax hourly wage. The elasticity of labor supply is 0.32 with a t-statistic of 2.9. No income variables are included.

Column (2) includes residual income. This income is received from non-labor sources including investments and from other household members on an after-tax basis. The labor supply elasticity compensated for this income is 0.11 (1.7) with t-statistics in parentheses. The income elasticity is −0.01 (2.4). Total income, including from the worker is in column (3). The compensated labor supply elasticity is 0.20 (3.60) with income elasticity −0.07 (2.25). In both cases the estimates are significant at the 5% level. Both the wage and income are defined after taxes and split. Income is after taxes and includes that from investments or other household members.

The final two columns report on the normalized return to work divided by total income. In column (4) income is residual excluding that of the employee. In column (5) all income is included. The specification accommodates homogeneity of degree zero of preferences in prices and income. In column (4) the compensated labor supply elasticity in the wage-income ratio is 0.02 (4.06) excluding income from own work. Including that income in column (5) the elasticity is 0.14 (4.30).

The labor supply elasticities for the five specifications range from 0.02 to 0.32. None are negative. All are significantly positive at the 10% level, and four of five at 5%. Farber (*2008*) notes that if there is measurement error in hours, there is an inverse effect on the wage. The estimated elasticities are forced downward, but remain non-negative. The estimates are for workers who control their own hours and after taxes, income and incentives and splits. They adjust for preferences for control and ownership, and demographic characteristics of the household.

Among the other variables using the results from the last column, older people work harder up to a point. One year older in age is leads to a 1.5% increase in hours, though that impact is concave. Married people work 4.2% more hours and women the same percentage less. Owners work 10.2% more hours, and there is no difference across race and ethnicity in effort.

The question of the impact of split contractual provisions is addressed in Table 5. With the removal of all split contract dummy variables and without the first step 100% contract probit from the first step, re-estimated labor supply elasticity estimates are shown in Table 5. The wage elasticity is considerably smaller without the split provisions. In the first block, for example, the elasticity would be 0.08 without the provisions, but is actually 0.32. The compensated elasticity shown in the next two blocks are only 0.04 and 0.11without the split provisions, but rise to 0.11 and 0.20 respectively when the split provisions are captured in the model.

**Table 5**. Labor supply elasticity without control for split

| | **Model 1** | | **Model 2** | | **Model 3** | | **Model 4** | | **Model 5** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** |
| Lnwage | 0.0808[b] | 4.109 | 0.0370 | 1.333 | 0.1114 | 1.074 | – | – | – | – |
| Lnresin | – | – | −0.0268[a] | −2.093 | – | – | – | – | – | – |
| Lnhinc | – | – | – | – | −0.0276 | −0.316 | – | – | – | – |
| Lwoir | – | – | – | – | – | – | 0.0948[a] | 2.438 | – | – |
| Lwtir | – | – | – | – | – | – | – | – | 0.1271[b] | 4.346 |

[a]Statistically significant at the 0.05 level

[b]Statistically significant at the 0.01 level

Implications and Conclusion

Relatively few people are able to control their own hours. Similar to taxi drivers and stadium workers, sales professionals in real estate brokerage set their own hours, and for those on a 100% contract, they have debt contracts requiring fixed periodic payments in exchange for the benefit of affiliation with their host contracting real estate firm. That contract governs the decision to perform, including on revenue and effort.

The compensated labor supply elasticities estimated are positive in all cases. None are larger than 0.3, though all are larger than zero. At the median estimate of 0.2, a 10% increase in after-tax, after-split hourly wages increases hours worked by 2%. The sample mean estimate of the hours worked per week is 44. The increase is 0.9 h per week. These findings indicate that regardless of the controversy regarding negative versus positive wage labor supply elasticities for taxi drivers, the labor supply elasticities, compensated and uncompensated, are uniformly positive. However, the inclusion of split contractual provisions in the model increases the estimated labor supply elasticity. The increase can be sizable from a range of 0.04–0.11 without split provisions to 0.12–0.32. Therefore, although there is no evidence of income targeting as all estimates of the wage elasticity are positive; real estate agents and brokers respond to contract incentives and continue to work as their wage increases, even though higher household income may induce them to work fewer hours.

## Appendix

**Table 6**. Labor supply elasticity using OLS

| | **Model 1** | | **Model 2** | | **Model 3** | | **Model 4** | | **Model 5** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** | **Coef.** | **T-stat.** |
| Lnwage | −0.0223[c] | −3.964 | −0.0217[c] | −3.893 | −0.0211[c] | −3.323 | – | – | – | – |
| Lnresin | – | – | −0.0095[c] | −9.571 | – | – | – | – | – | – |
| Lnhinc | – | – | – | – | 0.7354[a] | 0.036 | – | – | – | – |
| Lwoir | – | – | – | – | – | – | 0.0072[c] | 6.063 | – | – |
| Lwtir | – | – | – | – | – | – | – | – | −0.0322[c] | −4.951 |

[a]Multiply coefficient by $10^{-4}$

[b]Statistically significant at the 0.05 level

[c]Statistically significant at the 0.01 level

## References

Ackerberg DA, Botticini M (2002) Endogenous matching and the empirical determinants of contract form. J Polit Econ 110:564–591

Bitler MP, Moskowitz TJ, Vissing-Jørgensen A (2005) Testing agency theory with entrepreneur effort and wealth. J Finance 60:539–576

Cagetti M, De Nardi M (2006) Entrepreneurship, frictions and wealth. J Polit Econ 114:835–869

Camerer C, Babcock L, Loewenstein G, Thaler R (1997) Labor supply of New York City cab drivers: one day at a time. Q J Econ 111:408–441

Chiappori P-A, Salanié B (2000) Testing for asymmetric information in insurance markets. J Polit Econ 108:56–78

Chou, YK (2000) "Testing alternative models of labor supply: evidence from taxi-drivers in Singapore," University of Melbourne Research Paper 768

Farber (2005) Is tomorrow another day? The labor supply of New York cab drivers. J Polit Econ 113:46–82

Farber HS (2008) Reference-dependent preferences and labor supply: the case of New York City taxi drivers. Am Econ Rev 98:1069–1082

Fehr E, Goette L (2007) Do workers work more if wages are high? Evidence from a randomized field experiment. Am Econ Rev 97:298–317

Gompers P, Anna Kovner, Josh Lerner, and David Scharfstein (2010) "Performance persistence in entrepreneurship." J Financ Econ. forthcoming

Hamilton BH (2000) Does entrepreneurship pay? An empirical analysis of the returns to self-employment. J Polit Econ 108:604–631

Headen A (1990) Wage, returns to ownership, and fee responses to physician supply. Rev Econ Stat 72:30–37

Helland E, Showalter M (2009) The impact of liability on the physician labor market. J Law Econ 52:635–663

Holmström B (1979) Moral hazard and observability. Bell J Econ 10:74–91

Holmström B, Milgrom P (1994) The firm as an incentive system. Am Econ Rev 84:972–991

Hurst E, Lusardi A (2004) Liquidity constraints, household wealth and entrepreneurship. J Polit Econ 112:319–347

Knight FH (1921) Risk, uncertainty, and profit. Hart, Schaffner, and Marx, Boston MA: Houghton Mifflin Company

Laeven L, Levine R (2008) Complex ownership structures and corporate valuations. Rev Financ Stud 21:579–604

Laffont J-J, Matoussi MS (1995) Moral hazard, financial constraints and sharecropping in El Oulja. Rev Econ Stud 62:381–399

Lazear E (2005) Entrepreneurship. J Labor Econ 23:649–680

Moskowitz TJ, Vissing-Jørgensen A (2002) The returns to entrepreneurial investment: a private equity premium puzzle? Am Econ Rev 92:745–778

Oettinger GS (1999) An empirical analysis of the daily labor supply of stadium vendors. J Polit Econ 107:360–392

Chiappori P-A, Salanié B, Salanié F, Gandhi A (2009) Identifying preferences under risk from discrete choices. Am Econ Rev Pap Proc 99:356–362

Prendergast C (2002) The tenuous trade-off between risk and incentives. J Polit Econ 110:1071–1102

Rosen S (1992) The market for lawyers. J Law Econ 35:53–85

**Footnotes**

1 In Ackerberg and Botticini (*2002*) a fixed rent is a more efficient contract because the tenant is providing the effort and is a residual claimant. This condition holds if the professional and firm have the same levels of risk aversion. Splits apply when the firm is more able to bear risk or the revenue streams are more uncertain.

2 In Headen (*1990*) a premium exists for entrepreneur doctors after adjustment for self-selection. Offsetting this effect is the scale in back-office billing and built-in referral networks from having hospitals owning medical practices. By 2008 more than half the doctors in the United States were working at practices owned by hospitals up from fewer than 20% in 2002, even if the front-office look remained the same. Rosen (*1992*) estimates similar structures for lawyers.

3 In Prendergast (*2002*) the assignment of incentive contracts depends on the risk of output. When output is less risky firms pay on input. When output is more risky, compensation is based proportionally on output. For professionals, output is not only individually observed but risky. The Holmström (*1979*) incentive compatibility constraints apply. Laeven and Levine (*2008*) evaluate contract terms.

4 Helland and Showalter (*2009*) use data from the Physician Practice Costs and Income Survey. A 1% severity increase in liability lowers effort by 0.3%. For doctors over age 55 the reduction in effort is 1.2% for a similar severity increase. Allowing the wage to be exogenous in the effort equation causes a downward bias in the measured elasticity. Another source of downward bias is if the wage is determined by dividing total earnings by hours. Under income targeting drivers are working harder when fares are scarce and less when there are more customers.

5 An example of 100% compensation is the Re/Max franchise where $s = 1$. Even firms such as Re/Max offering $s = 1$ in exchange for a debt payment will examine a broker's prior sales

performance and experience, for example, because the reputation of the franchise is based upon the abilities of their brokers.

6 In a recursive set of equations, the solution to the *n*th endogenous variable involves only the first *n* equations of the model, and therefore, the endogenous variables on the right-hand side of the equation s do not need to be correlated to the error terms.

7 Part-time workers defined as working less than 20 h per week are eliminated from the sample because they often sell properties to a social network of friends and family. The findings are largely the same when including part-time workers, but the inclusion of part-time workers creates a potential for sample selection bias. Part-time workers with relatively few hours are most often less experienced and tend to receive lower splits than full-time workers.

8 The exact percentage change requires the following transformation: $y = e^{x}$ where $x$ is the regression coefficient. For convenience purposes, the estimates will be discussed without the transformation

9 The maximum is determined by solving for *Exp* in the following equation: $\delta GrossWages \delta Exp = 0$

10 This is equivalent to using fitted values for the endogenous variables in the model.