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Article

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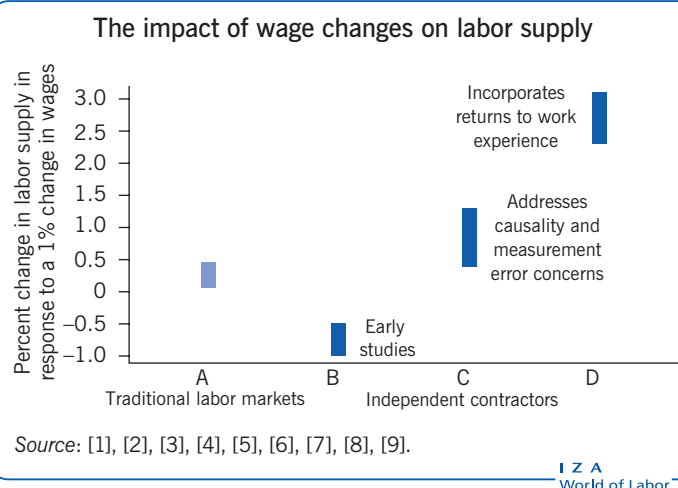
Do workers work more when earnings are high?

Studies of independent contractors suggest that workers' effort may be more responsive to wage incentives than previously thought

Keywords: labor supply, wage elasticity, substitution effect, reference dependence, returns to work experience

ELEVATOR PITCH

A fundamental question in economic policy is how labor supply responds to changes in remuneration. The responsiveness of labor supply determines the size of the employment impact and efficiency loss of progressive income taxation. It also affects predictions about the impacts of policies ranging from fiscal responses to business cycles to government transfer programs. The characteristics of jobs held by independent contractors provide an opportunity to overcome problems faced by earlier studies and help answer this fundamental question.



KEY FINDINGS

Pros

- ➕ Studies of independent contractors' labor supply offer advantages over studies that focus on more traditional labor markets, because earnings variation occurs on a daily basis and because workers have the autonomy to choose when to work.
- ➕ Studies of independent contractors' labor supply confirm a key prediction of standard economic theory: Workers with the flexibility to choose when to work choose to work more when earnings are temporarily high.
- ➕ Although several studies document what appears to be "irrational" worker behavior, the majority of the evidence suggests that any irrational tendencies play a limited role in labor supply decisions.

Cons

- ➖ Estimates of the response of labor supply to small and transitory variations in remuneration derived from more traditional labor markets may be erroneously small.
- ➖ To correctly estimate labor supply responses, researchers must identify changes in labor supply that are caused by changes in earnings, and ensure that errors in measuring labor supply do not create a spurious negative relationship between observed earnings and labor supply.
- ➖ When wages grow with work experience, relating wage variation with hours variation, as is done typically, will produce erroneously small estimates of the response of labor supply to transitory variations in remuneration.

AUTHOR'S MAIN MESSAGE

Studies of independent contractors' labor supply confirm a key prediction of standard economic theory: workers work more (in fact, quite a bit more) when earnings are temporarily high. Failing to identify a causal relationship between earnings and hours worked and failing to address errors in measuring hours worked can produce erroneously small or even negative estimates of workers' responsiveness to higher earnings. These findings suggest that the efficiency costs of progressive labor income taxation are larger than previously thought.

MOTIVATION

Do workers work more when earnings are high? Standard economic theory predicts two competing responses. On the one hand, higher remuneration makes leisure more costly because one must forgo greater compensation in order to enjoy it. This “substitution effect” induces individuals to work more. On the other hand, higher remuneration generates greater wealth so that one can afford to consume more of everything, including leisure. This “income effect” induces individuals to work less. While standard theory makes no prediction as to which effect dominates, it is unambiguous that the substitution effect is positive. Thus, when increases in remuneration are relatively small and transitory or are fully anticipated by the worker so that lifetime wealth is reasonably unchanged, standard theory predicts that workers will work more.

A large literature is devoted to testing this theory. By and large, early studies are characterized by small, marginally statistically significant estimates of the substitution effect, leading many economists to conclude that workers are not very responsive to changes in remuneration [1]. Nevertheless, an alternative explanation for the widespread finding of small substitution effects lies in the characteristics of the industries and related data that are typically analyzed by researchers. In most industries, wages vary or are observed by the researcher on an annual basis. As a result, most studies attempt to estimate substitution effects by relating annual changes in average hourly earnings to annual changes in hours worked. However, annual wage changes are, arguably, neither small and transitory nor fully anticipated by the worker. In this case, lifetime wealth is not held constant and, therefore, the (positive) substitution effect cannot be estimated separately from the (negative) income effect. Furthermore, individuals are often constrained to work fixed hours. Such inability to respond to wage variation further attenuates estimates of the substitution effect.

To address these concerns, a recent and innovative literature has begun using data from industries that exhibit daily variation in both earnings and the quantity of labor supplied, studying workers such as taxicab drivers [2], [3], [4], bicycle messengers [5], baseball stadium vendors [6], and fishermen [7], [8]. The premise of these studies is that observed daily wage variation is small and transitory, so income effects are zero, and workers are autonomous, so they are able to adjust labor supply in response to wage fluctuations. Hence, the substitution effect is estimated properly. Indeed, several studies in this literature report much larger substitution effects than earlier studies, suggesting that workers are more responsive to temporary variation in earnings than previously thought [4], [5], [6], [7], [8]. Two studies, however, report large and statistically significant *negative* substitution effects, which, taken at face value, suggests that individuals work *less* when earnings are temporarily high, behavior that is not consistent with standard economic theory [2], [3]. Thus, while this new literature addresses several concerns of earlier studies, it also raises new questions.

DISCUSSION OF PROS AND CONS

A seminal study on the labor supply of independent contractors examined the daily labor supply behavior of New York City taxicab drivers [2]. The authors argue that the taxicab industry provides an ideal setting to estimate the substitution effect for two reasons. First, hourly earnings fluctuate on a daily basis. Since the impact of a one-day change in earnings on lifetime wealth is negligible, it is reasonable to assume that income effects

are zero and that the remaining labor supply response reflects the substitution effect only. Second, drivers are free to choose the number of hours that they work each day, so estimates will not be attenuated due to constraints on drivers' working schedules. In stark contrast to the prediction of standard theory, the authors find that New York City taxicab drivers work less when hourly earnings are temporarily high: a 1% increase in hourly earnings leads to a 1% decrease in labor supply on average. These findings were replicated several years later in a study on Singaporean taxicab drivers [3].

Two broad explanations for these controversial findings have been proposed. One is that standard theory does not adequately capture workers' behavior, and several studies have proposed alternative theories of labor supply that are capable of reconciling these findings. Another is that these studies do not satisfy some key empirical assumptions; subsequent studies have shown that these violations can spuriously generate negative estimates. Differentiating between these explanations is critical for evaluating theory and guiding policy.

Violations of empirical assumptions

Challenges

Researchers face two main empirical challenges when estimating the substitution effect. One challenge is identifying a *causal* relationship between hourly earnings and labor supply. In most industries, hourly earnings are determined by both labor supply and labor demand. This means that observed variation in hourly earnings may be due to shifts in supply, shifts in demand, or shifts in both. In other words, while variation in hourly earnings can cause variation in labor supply, variation in labor supply can also cause variation in hourly earnings. If observed variation in hourly earnings is due, at least in part, to shifts in supply, and if the researcher is unable to distinguish this type of variation, they will be unable to estimate the substitution effect properly.

To see this, consider an event such as a holiday. Many taxicab drivers will prefer not to work so that they may enjoy the holiday. This means that taxicab drivers will supply less labor for *any* level of hourly earnings because drivers' outside options are more valuable than usual. For plausible demand responses (such as no change in demand or an increase in demand for taxicab services) the researcher observes higher hourly earnings and lower labor supply on holidays relative to non-holidays. Taken at face value, it might appear that higher earnings reduce labor supply when, in fact, it is the other way around. If the researcher is unable to take all such events into consideration, estimates of the substitution effect will be negatively biased.

Another challenge is coping with errors in measuring labor supply. In many studies, hourly earnings are not observed by the researcher and are instead calculated by dividing daily earnings by daily hours worked. If hours worked are measured with error, this procedure creates a spurious negative correlation between hours worked and hourly earnings, a problem known as "division bias" [10]. To see this, consider the following example: Suppose that a taxicab driver faces hourly earnings of \$20 on two different occasions and chooses to work eight hours on both, thereby earning \$160 each time. Suppose that hours worked are correctly recorded as eight hours on one occasion, but incorrectly recorded as ten hours on the other. This error could be due to poor recall or could simply be a transcription error. When calculating hourly earnings from total daily earnings and

hours worked, the researcher will find that the driver chose to work eight hours when earnings were \$20 per hour and ten hours when earnings were \$16 per hour. Thus, it would appear that the driver chose to work less when earnings were high.

Although researchers do their best to address concerns about causality and measurement error, data availability and industry characteristics impose constraints, and many argue that the early taxicab studies' findings reflect an inability to address these concerns adequately. For example, in the study of New York City taxicab drivers, the authors attempt to address causality concerns by controlling for factors that shift labor supply, such as weather conditions and the day of the week. The idea is that by controlling for these factors, the remaining variation in hourly earnings is *independent* of labor supply. However, that the factors adequately control for shifts in labor supply is a strong and untestable assumption, leaving the validity of the method open to debate.

Solutions

Several studies have attempted to cope with causality and measurement error concerns by using what is known as an instrumental variables approach. This approach entails identifying a source of variation in hourly earnings that is unrelated to labor supply preferences and to individual-level measurement error in daily hours worked.

Possibly the first study to apply this method to independent contractors examined the daily labor supply behavior of stadium vendors at Major League Baseball games in the US [6]. A vending subcontractor hired vendors to sell food and beverage products in the stands during games and paid vendors a straight commission on sales. Vendors were free to choose whether or not to work each game. Their hourly earnings varied from game to game for a number of reasons, including the extent of competition from other vendors. The author argues that game attendance is a suitable instrumental variable for hourly earnings because it affects vendors' earnings but not their preferences for working. The rationale is that the more fans there are in the stadium, the greater the demand is for food and beverages, and the higher the vendors' hourly earnings will be. At the same time, conditional on a set of observable factors such as the timing of the game and the prevailing weather conditions, game attendance does not *per se* affect preferences for work and so does not shift the supply of vendors. This approach also avoids concerns related to measurement error because stadium attendance should not be correlated with errors in reported hours worked. In stark contrast to the findings in the early taxicab studies, results from this study indicate that a 1% increase in hourly earnings leads to a 0.5–0.7% increase in labor supply.

Another study that used an instrumental variables approach to address causality and measurement error concerns examined the daily labor supply behavior of commercial lobster trap fishermen in Florida [7]. Licensed lobster fishermen were free to fish as many days and for as many hours per day as they wished, provided the season was open and there was daylight. Daily earnings were the product of price and catch, and both varied on a daily basis. The author argues that the moon phase is an ideal instrumental variable for hourly earnings because it affects fishermen's earnings but not their preferences for working. Catch rates are demonstrably higher during new moon periods when waters are dark at night and lobsters are more likely to move from under cover with less fear of being detected by predators. At the same time, conditional on catch rates, fishermen's preferences for work are not otherwise affected by the moon phase. Fishermen operate during daylight hours, dock vessels in deep ports where they are not affected by tides, and do not participate in other fisheries that might be similarly affected by the moon

phase. As in the study of stadium vendors, this approach avoids concerns related to measurement error because the moon phase is not correlated with errors in reported hours worked. Results from this study indicate that a 1% increase in hourly earnings leads to a 1.1–1.3% increase in labor supply.

A similar study examined the daily labor supply behavior of South Indian fishermen [8]. Here, too, the authors argue that the moon phase is an ideal instrumental variable for hourly earnings. The authors also argue that internationally determined prices of fish and the price of inputs, such as fuel, serve as additional instrumental variables for hourly earnings because they affect the profitability of fishing, but not preferences for work and because they are not correlated with errors in reported hours worked. Results from this study indicate that a 1% increase in hourly earnings leads to a 0.8–1.3% increase in labor supply.

A recent study returned to the New York City taxicab industry with a newer and much larger data set [4]. The author collected information on all taxi trips made in New York City over a five-year period (around 180 million trips). Given this wealth of data, the author was able to use one random subsample of drivers and their trips to estimate the substitution effect and another random non-overlapping subsample to construct estimates of hourly earnings for each day in the sample to use in the main estimation. Provided errors in measuring labor supply are not correlated across drivers (i.e. drivers do not systematically over- and under-report labor supply in the same manner) this method alleviates concerns associated with measurement error. Results from this study indicate that a 1% increase in hourly earnings leads to a 0.4–0.8% increase in labor supply.

Another way to circumvent concerns about causality and measurement error is to induce variation in hourly earnings experimentally. The idea is simple: because the researcher is responsible for varying hourly earnings, they can be sure that this source of variation is not due to shifts in labor supply. And even if hours worked are measured with error, this cannot create a spurious negative relationship between hours worked and hourly earnings because hourly earnings are observed directly. Following this method, one study temporarily varied the commission rate offered to bicycle messengers in Zurich, Switzerland [5]. Each messenger in the study was offered the standard commission rate during a four-week period and a 25% increase in the standard rate for another four-week period. Messengers were informed of the duration and the size of the commission increase, and they were free to work as many shifts and complete as many deliveries as desired during the entire experiment. Results from this study indicate that a 1% increase in hourly earnings leads to a 1.1–1.3% increase in labor supply.

To demonstrate the practical importance of using the right source of earnings variation to estimate the substitution effect, several of the studies discussed in this section also use *all* sources of earnings variation for comparison [4], [6], [7]. The idea is that the difference between estimates derived using all sources of variation and those using only variation that is independent of labor supply and free of measurement error provides a gauge of the extent to which estimates may be negatively biased. Indeed, each study finds that estimates can be severely negatively biased if a robust methodology is not followed.

In sum, a number of careful studies find that workers are, in fact, quite responsive to transitory variation in hourly earnings. These studies also demonstrate that failure to identify the right source of variation in hourly earnings can produce spurious negative estimates of the substitution effect.

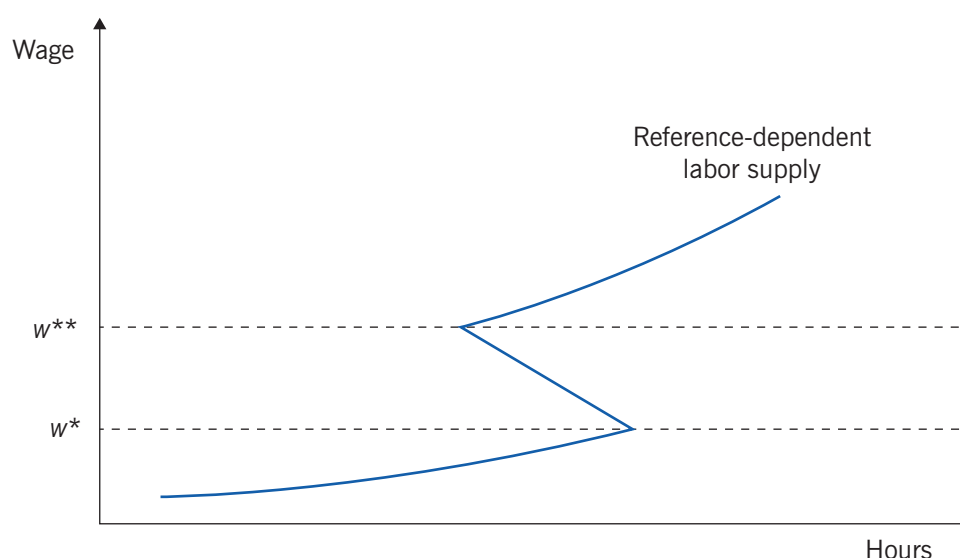
Violations of theoretical assumptions

Reference-dependent preferences

A common assumption in models of labor supply is that workers are fully rational. However, a growing literature suggests that workers may instead be “behavioral” in that the choice of how much to work is influenced by how the outcomes (hours worked and, in particular, income earned) compare to reference points. The predominant theory of reference dependence posits that workers form daily income targets and are “loss averse” with respect to reaching these targets. For a loss-averse worker, the feeling of loss that is experienced when falling short of the target income is greater than the feeling of gain that is experienced when exceeding the target income by the same amount. This asymmetry creates a propensity for individuals to work just as much as is necessary to earn their target income. This behavior implies that, over some range of wages, individuals will work less when wages are high and more when wages are low. Figure 1 illustrates a reference-dependent worker’s labor supply.

When wages are particularly low, reaching the income target becomes too costly. A worker would have to work far too many hours to reach their target, and the reward is not great enough to compensate for this effort. Over this range of wages (those below w^* in Figure 1), the hard-to-reach income target ceases to affect labor supply decisions, and behavior resembles the standard model. Similarly, when wages are particularly high, reaching the same income target becomes very easy. Over this range of wages (those above w^{**} in Figure 1), the easy-to-reach income target ceases to affect labor supply decisions, and, again, behavior resembles the standard model. The magnitudes of w^* and w^{**} depend on the worker’s income target. The higher the income target, the higher w^* and w^{**} are. The distance between w^* and w^{**} depends on how large the feeling of loss

Figure 1. Reference-dependent worker’s response to wage variation



Note: For low wages (those below w^*) and high wages (those above w^{**}), reference-dependent workers work more as wages increase. For mid-range wages (those between w^* and w^{**}), the desire to earn a target income induces workers to work less as wages increase.

Source: Author's own illustration.

from falling short of the income target is relative to the feeling of gain from exceeding it. The larger this difference is, the larger the range in wages over which labor supply will bend backward is (i.e. workers will work less as wages increase). In the extreme case where a worker cares only about reaching their target, labor supply will bend backward for all wages.

According to this theory, the substitution effect is negative when wages vary between w^* and w^{**} . Thus, this theory is able to reconcile the surprising results of the early studies on taxicab drivers. A growing literature has attempted to substantiate this theory, and some studies report evidence supporting this notion of reference-dependent preferences.

Many of these studies continue to focus on the taxicab industry. One posits that a reference-dependent taxicab driver should be more likely to quit working once they have earned their income target because their incentive to work decreases sharply at this point [11]. Indeed, the author finds that the probability that drivers quit after reaching their income targets is very high. However, the author also finds that drivers' income targets appear to vary substantially and unpredictably from day to day and that most shifts end before drivers reach their income targets. In light of these mixed results, the author concludes that the evidence is not consistent with an important role for reference dependence in labor supply decisions.

Another study of New York City taxicab drivers builds on this analysis by specifying a theory for how income targets are formed [12]. The authors posit that income targets are the result of workers' rational expectations. Workers have beliefs about what hourly earnings will be before they begin their shifts. Based on these beliefs, workers plan whether and how many hours to work. These plans generate expected daily incomes, which serve as workers' income targets. Because hourly earnings and each worker's desire to work can vary on a daily basis, income targets can also vary on a daily basis, but the manner in which they vary is predictable if the researcher can predict hourly earnings and labor supply preferences. To test this theory, the authors rely on the following insight: according to standard theory, the probability that a driver works late in their shift is unrelated to the level of earnings early in the shift, provided that early earnings are not a significant predictor of later earnings. However, the probability that a reference-dependent driver works late in their shift is lower if early earnings are high because the driver is more likely to have reached their income target earlier in the day. The authors find that this seems to be the case.

Two of the studies discussed in the previous section also test for reference dependence. In the study of Swiss bicycle messengers, although messengers worked more shifts during the high commission period, they completed fewer deliveries per shift [5]. One explanation for this behavior is fatigue. Messengers find it too tiring to both work more shifts and complete more deliveries per shift. Another explanation is that messengers have daily income targets and are loss averse with respect to reaching these targets. To distinguish between these explanations, the authors conduct a second experiment in which they assess messengers' loss aversion by examining choices over lotteries. They find that only messengers who exhibited loss aversion in the second experiment reduced effort per shift in the first experiment, which suggests that the reduction in effort is attributable to loss aversion and not fatigue. Nevertheless, the propensity to work more shifts dwarfed the propensity to complete fewer deliveries per shift, so that total deliveries completed increased substantially during the high commission period.

In the study of South Indian fishermen, although fishermen are more likely to work if current earnings are high, they are less likely to work if recent cumulative earnings are high [8]. The authors account for recent labor supply, so they argue that the propensity not to work following higher earnings is not due to fatigue. Still, the effect of recent earnings on labor supply is quite small, especially in comparison to the effect of current hourly earnings. The authors interpret these findings as weak evidence of reference dependence in which fishermen set weekly, rather than daily, income targets.

In sum, a number of studies have found evidence of reference-dependent preferences in labor supply. However, the practical importance of reference dependence remains unclear. These studies also demonstrate that the effects of reference dependence on labor supply are small in comparison to the usual desire to work more when earnings are temporarily high.

Returns to work experience

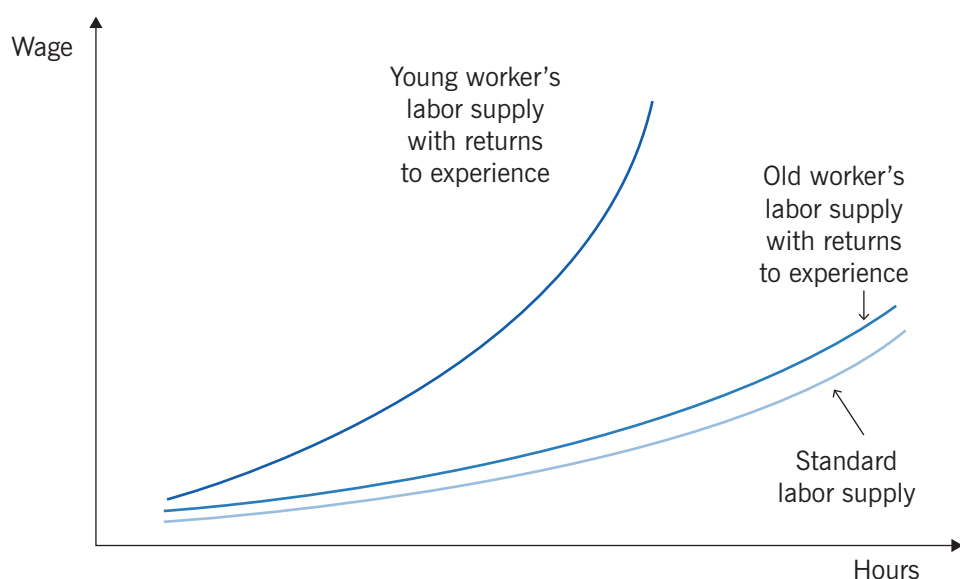
Another common assumption in models of labor supply is that wages are determined independently from labor supply choices. However, a multitude of evidence suggests that wages increase with work experience, which means that individuals can increase future wages by working more today. As a result, workers receive two types of remuneration for work today: the current wage and higher future wages, or returns to work experience. Because workers choose how much labor to supply based on their total remuneration, relating wage variation with hours variation, as is done typically, will not produce a reliable estimate of the substitution effect. Instead, this method will produce an attenuated estimate of the substitution effect because a 1% change in the wage is always less than a 1% change in total remuneration when workers benefit from gaining work experience.

Because returns to work experience are not observable, total remuneration is not observable, and it is generally not possible to estimate the substitution effect directly. Previous studies have addressed this issue by specifying and estimating a relationship between labor supply and returns to work experience together with the estimation of the substitution effect. However, this method is not without drawbacks. First, estimating these complex relationships requires rich data, which may not be available. Second, estimates of the substitution effect are sensitive to the assumptions made about the relationship between labor supply and work experience. Third, estimation methods are computationally taxing.

Independent contractors who experience daily wage variation provide an alternative solution to the estimation problem that arises when wages grow with work experience. Typically, wages are low and the returns to work experience are high early in a worker's career, and the opposite is true toward the end of their career, when little time remains to benefit from additional experience. This implies that the ratio of wages to total remuneration and, therefore, the responsiveness of labor supply to wage changes grow over a worker's career. These relationships are illustrated in Figure 2.

Notice that the labor supply of an older worker closely resembles labor supply in the standard framework where total remuneration is composed solely of the current wage. This observation suggests that one may closely approximate the substitution effect by estimating the standard (but incorrect) model on a group of older, highly experienced individuals near retirement. This approach does not depend on assumptions about the

Figure 2. Workers' responses to wage variation early and late in their careers



Source: Author's own illustration.

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relationship between labor supply and returns to work experience, but it does require observing workers over several periods during which the returns to work experience are approximately zero. This is unlikely to be possible when wages are observed on an annual or even quarterly basis, but independent contractors who experience daily wage variation provide ideal data for which to apply this strategy.

One US study does this by using data on the labor supply decisions of commercial lobster trap fishermen in Florida [9]. The authors examine responses of older, highly experienced fishermen near retirement; new entrants to the fishery; and the full population of fishermen. They argue that returns to work experience are negligible for retiring fishermen, but positive for the other two groups, especially for new entrants. This suggests that the estimated substitution effect based on the sample of retiring fishermen closely approximates the true value, while estimates based on the other two samples are attenuated. The authors find that a 1% increase in hourly earnings leads to a 2.3–3.1% increase in labor supply for retiring fishermen, a 1.3% increase in labor supply for the full population, and approximately no change in labor supply for the new entrants. These results support the theory that wages grow with work experience and that workers take this form of remuneration into consideration when making labor supply decisions over their careers. They also suggest that the substitution effect may be much larger than previously thought.

LIMITATIONS AND GAPS

The workers studied in this literature (taxicab drivers, bicycle messengers, baseball stadium vendors, and fishermen) may not be representative of the larger workforce. The jobs held by these individuals offer considerable flexibility in working hours and come with considerable risk in income earned. It is possible that the individuals who choose to hold jobs with these characteristics differ in fundamental and important ways from the rest of the workforce so that if faced with more frequent earnings variation and

no constraints on working hours, a typical worker would be more or less responsive to earnings variation than the types of workers studied here.

Additionally, testing for reference-dependent preferences is inherently challenging. Without knowing how reference points are formed, it is very difficult to assess how labor supply responds to variations in wages.

SUMMARY AND POLICY ADVICE

Studies that examine the daily labor supply behavior of independent contractors avoid several criticisms of earlier studies that focus on the annual labor supply behavior of more traditional workers. By and large, this new literature reports much larger estimates of the substitution effect, suggesting that workers' effort is quite responsive to short-term variations in earnings. These findings suggest that the efficiency costs of progressive income taxation are larger than previously thought.

Although this literature confirms a key prediction of standard economic theory, several studies also document behavior that is not consistent with standard theory. First, a number of studies document a tendency of workers to work just as much as is necessary to earn a target daily income. Nevertheless, any tendency to "income target" appears to be small relative to the usual propensity to work more when earnings are high.

Second, one study documents evidence consistent with a theory in which workers can increase future earnings via experience gained by working more today. One implication from this finding is that estimations based on the standard model will produce erroneously small estimates, leading researchers to infer that workers are less responsive to temporary changes in the incentive to work than they actually are. A second implication is that permanent tax changes can have larger short-term effects on labor supply than transitory tax changes, which undermines the argument that transitory tax cuts are an ideal tool for short-term economic stimulus. A third implication is that the effect of permanent tax changes in the long term can be much more profound because a reduction in current labor supply leads to lower future wages, amplifying the effect of a tax change on total lifetime labor supply.

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Competing interests

The IZA World of Labor project is committed to the *IZA Guiding Principles of Research Integrity*. The author declares to have observed these principles.

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Further reading

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