COLLEGE FACULTY'S LABOR SUPPLY ELASTICITY: ESTIMATES USING SUMMER TEACHING STIPENDS

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ABSTRACT

In this paper, we attempt to measure the impact of a significant – and likely permanent – wage cut on university faculty's labor supply decisions. Using data from a mid-size public university in Texas, we investigate how individual faculty respond to a cut in summer compensation (i.e., the per-course stipend for teaching summer classes). We find that the average (across faculty) reduction in the stipend was 26 percent, while the reduction in an average faculty's overall annual income (salary plus summer stipend) was only 3 percent. We find that the income effect of a cut in compensation (slightly) dominates the substitution effect, as faculty in general chose to teach more. We also calculate the resulting elasticity of the supply of summer teaching with respect to the stipend for every individual faculty in our data; while the values range from about -14 to 19.4, the average elasticity is negative and small in magnitude, suggesting that even a substantial cut in summer stipends causes only a small decrease in courses taught.

BACKGROUND

In 2011, Texas legislators were faced with a $27 billion budget deficit that they proposed to fix without raising taxes or using the state's rainy day funds (Mangan, 2011). In order to begin to close this gap, the Texas legislature proposed to make drastic cuts to higher education funding throughout the state. Specifically, colleges and universities were at risk of losing up to 7.6 percent of their state funding, and some onlookers worried that cuts could potentially displace many minority students and students in need of financial aid (Mangan). Hacker (2011) noted that mid-year 2011 lawmakers decided to cut state funding by about 7 percent for public colleges and universities for the 2012-2013 academic year causing staff layoffs and student tuition hikes. Although many colleges in the state continued to increase tuition and fees during this time, several institutions have sought to implement cost reductions such as decreasing spending on campus aesthetics. Other potential strategies included taking advantage of technology in the class rooms, offering more online classes, and increasing class sizes.

At one public university, it was announced in early 2012 that to partially offset the budgets cuts, faculty pay for summer teaching would be reduced. Specifically, per-course compensation was changed from a fixed proportion of a faculty member's nine-month salary, to a series of stipends. Under the previous policy, full-time faculty members were paid 1/12 of their nine-month salaries per course. Table 1 shows the new compensation scheme for one course.

Table 1: Compensation After the Budget Cut	
Nine-month Salary	**One-course Stipend**
Up to $41,999	1/12 salary
$42,000 - $59,999	$3,500
$60,000 - $69,999	$4,000
$70,000 - $79,999	$4,500
$80,000 and over	$5,000

In other words, the salary cut is progressive so that as salary increases, cuts increase as well. For example, if a faculty member earns $42,000 in income, her compensation both before and after the cut is $3,500 per course. However, if a faculty member has a $60,000 salary, her compensation is reduced by $1,000 per course, and if she has a $90,000 salary, the cut is $2,500 per course.

In this paper we examine how faculty reacted to this cut in wages, including whether faculty members decided to teach more, less, or the same number of courses. In addition, the study will explore any systematic differences in behavior: for example, whether higher income earners reacted differently than lower income earners or whether there were any differences in behavior across genders or teaching disciplines.

We also explore the relationship between faculty behavior and compensation vis-a-vis its relevance to the higher education community as a whole. Texas, like much of the United States, has had to tighten its budget due to the recent recession. Institutions of higher education have had to make difficult choices about how to increase revenues or decrease costs. Faculty response to a cut in summer teaching stipends – i.e., the elasticity of the supply of labor – is a crucial piece of information that administrators need to know to be able to predict the extent of actual cost savings of such a move.

THEORY

Economic theory has much to say about how wage changes affect a worker's willingness to work. Neo-classical labor supply theory describes a rational agent as making a choice between leisure, a normal good, and income, which can be used to buy goods and services in the market. Time spent working is compensated and translates into ability to buy more goods and services but necessarily leads to less leisure time. When wages change, workers are pulled in two separate directions. When a worker's wage decreases, the opportunity cost of leisure decreases as well and as the cost of leisure time has decreased, and workers will consume more leisure and work less. This is known as the *substitution effect* of a wage change. Simultaneously, a wage cut makes the same worker feel poorer as the new wage is unable to buy as many goods and services. This worker will consume less leisure and desire to spend more hours working. This *income effect* of a wage decrease pulls the worker in the opposite direction from that of the substitution effect. When it is impossible to separate these two conflicting impacts, a wage decrease can increase,

decrease, or not change a worker's preferences for time spent in the labor market in the static, one-period labor supply model.

PREVIOUS STUDIES

Past empirical studies of labor supply theory are few and far between because researchers do not often observe exogenous wage changes, and also because most workers are not able to decide their own work hours. However, some creative studies of occupations with flexible wage and hours do exist. Economists observe labor markets such as hot dog vendors, taxi cab drivers, and even pigeons – in an experimental laboratory setting – because they provide the opportunity to test labor supply behavior in situations where workers are not constrained to a fixed number of daily work hours. One problem that has plagued many empirical investigations of labor supply effects is that when little response to a wage change is found, it is not clear whether the income and distribution effects are both large or both small (though it is apparent that they offset each other; see, for example, Kimbal and Shapiro (2008).)

Studies of Income and Substitution Effects of Wage Changes

Farber (2003) models the labor supply of taxicab drivers using an inter-temporal utility function and extends the classic labor supply model to multiple periods, where workers choose labor supply to maximize lifetime income. His results suggest that the income effect of a daily wage change is small, which he interprets as support for the standard inter-temporal labor supply model. Farber also tests the target earning model: if taxicab drivers are target earners then they would quit early on the days in which wages are high and work longer hours on days when wages are low. Farber finds that New York taxicab drivers are not target earners, which suggests that the average cab driver is more likely to stop work due to the amount of hours on the job rather than the amount of daily wages earned. In other words, there appears to be no significant income effect in cab drivers' behavior.

In contrast to Faber's results, Goette, Huffman, and Fehr (2004) do find some evidence of an income effect. They propose an alternative to the standard neoclassical labor supply model that draws on recent work in linking psychology and economics (see, for example, Kahneman and Tversky (2000).) In Goette et al.'s model, workers experience loss aversion to earnings below a "reference" level and diminishing sensitivity to earnings above this target level. The model suggests that workers are target earners and that they exert less effort on days when wages are higher than normal and more effort when wages are low.

In a study of baseball stadium vendors, Oettinger (1999) finds some evidence of a pronounced substitution effect. As with taxi drivers, stadium vendors experience large variations in expected wages and have some flexibility in choosing their work hours. They are free to choose their work days but they are expected to work the game until the seventh inning. In the experiment, the vendors were paid through a commission rate and therefore had wages that depended on game attendance. Oettinger finds that labor participation changed as opportunity to earn more in a given day changed: on average, vendors chose to work those game days in which their expected earnings were equal to or exceeded their opportunity cost of work. Influences on

the decision to work include the visiting team's popularity, the game's importance, and day of the week. Oettinger concludes that, in every model used, the labor supply elasticity of the vendors was strongly positive. This means that his findings agree with the standard labor supply model rather than the model of reference dependent utility.[1]

Studies have shown that the income and substitution effects influence genders and age groups somewhat differently (Peracchi and Welch, 1994; Eklof and Sacklen, 2000; Blau and Kahn, 2006.) This is likely due to the option to retire faced by elderly workers and the different roles men and women traditionally have held in the family. According to past research, the income and substitution effects on men aged 25 to 55 are minimal. Married women have shown to have a similar response rate to that of men when it comes to changes in the hours of work associated with a wage change. But, married women differ from men in that they have shown to be more responsive than men to a wage change when deciding to participate in the labor force.[2]

Econometric Studies of Responses to Wage Changes

Many of the empirical studies of labor supply responsiveness employ a discrete choice model of one kind or another (Haan, 2004; Kornstad and Thoresen, 2007; Peichl and Siegloch, 2010, and van Soest, 1995 among others.) This approach more accurately reflects workers' decision to, say, work full- or part-time (or not work at all). The reported results on estimated wage elasticities typically indicate a small positive response, but the magnitudes of elasticity estimates do not seem to converge to a consensus; for example, van Soest (1995) finds significant positive own-wage elasticities for both men and women, when labor supply decisions are made by spouses as a family. Peichl and Siegloch (2010) find that the positive labor supply response to a simulated workfare reform – requiring individuals receiving welfare to perform work tasks – is offset by as much as 25 percent by labor demand elasticity. They argue that not including a measure of labor demand responsiveness biases the resulting supply elasticity estimates.

Kornstad and Thoresen (2007) examine how costs of childcare affect mothers' decisions to participate in the labor market and the choice of work hours. They find a positive but small participation elasticity with respect to wages and a negative elasticity with respect to other, non-labor income. As expected, labor supply elasticity with respect to childcare costs is negative.

Chetty et al. (2011) include adjustment costs into their model of labor supply and taxation and conclude that these adjustment costs may be responsible for ``bunching'' of workers at the kink points in the tax schedule. Because this bunching varies across occupations and demographic groups in a way that is correlated with labor supply responsiveness, the authors conclude that the presence of adjustment costs may be responsible for the discrepancy between studies using micro data (which tend to report small elasticities) and those using macro data (which tend to find large elasticities).

SUMMER SCHOOL

Background

Faculty are typically not required to teach during the summer, but they may choose to do so for extra income. A decrease in compensation for the summer term necessarily decreases the opportunity cost of a faculty member's leisure time. Faculty members who choose to work during the summer term must work the full term and are required to work on a day to day basis unlike, say, taxicab drivers or stadium vendors. As a result, it is impossible for faculty members to select the exact number of hours they wish to work on a given day or during the summer term. However, faculty members affected by the wage can choose to teach more/fewer courses, find work elsewhere, or cease teaching in the summer entirely.

The college and university summer term is often perceived as a time when many higher education faculty choose to rest from the rigors of the fall and spring semesters to either travel or spend their time elsewhere focused on research or personal hobbies. Summer school traditionally provides a smaller number of course offerings than do regular semesters and is often used to teach special classes and aid resident students in gaining credit hours to shorten their time to graduation (Kobayashi, 1996-1997). The idea of a summer session was introduced to the academic world in the late 1800's to help students accelerate their degree plan; however, many higher education facilities have failed to attract resident students to enroll in summer school because of the students' need to work or lack of student interest in attending summer school. In the 1960's, some colleges and universities experimented with implementing the trimester where the summer term was included into the full academic year in order to meet the demands of the increasing number of students enrolling in school, but this system never became commonplace.

Summer Faculty Compensation and Effect on Productivity and Morale

Comm and Mathaisel (2003) explore the relationship between faculty compensation and faculty morale for the full academic year and how this relationship may affect the quality of an institution. The researchers state that the main goal of higher education institutions is to prepare future employees for the job market and, in order to successfully accomplish this goal college and university faculty must play an active role in their students' education. However, for faculty members to properly fill their educational roles they should be adequately compensated for their time invested in their students and other academic priorities. Comm and Mathaisel found that over half of the faculty members sampled from a small private college felt that they were undercompensated as compared to similar colleges or universities. In addition, the researchers found that the majority of faculty members studied were taking on teaching responsibilities beyond their full time jobs for extra income and half of the faculty studied sought additional income outside of the university in some form such as consulting. Findings such as these could call into question faculty commitment and the quality of academic services they are providing to the institution.[3] Hearn (1999) analyzed salary data and historical patterns in order to determine the relationship between salary and productivity and to discuss possible salary policies to

increase faculty productivity at research universities. Hearn states that salaries should be strongly connected to the productivities of workers which would suggest that as a worker's productivity increases, so should wages. However, he describes the connection between productivity and compensation as tenuous and often ignored by higher education policies. An example of such a policy would be to more tightly link faculty salaries to performance, although quantifying productivity to compensate faculty for their effort can be very difficult. Additionally, tying faculty compensation to productivity could have some undesired effects such as large disparities in income among faculty members.

The results in these studies help to provide insight into the relationship between financial compensation and its effects on faculty morale and productivity, which institutional policy makers may find useful when developing faculty compensation policies. These may include a decrease in the number of faculty members willing to teach during the summer term, a decrease in time faculty are willing to devote to classes and the university, a decline in faculty morale, and a difficulty in retaining faculty. Ehrenberg et al. (1990) use a large longitudinal database to examine the causes of faculty turnover. Although they do not specifically examine the impact of summer pay on faculty retention, they do find that higher compensation leads to increased retention rates for assistant and associate professors. The results suggest no such link for full professors, who may have stronger links to their institutions, and also may not have as many alternative employment opportunities.

It should also be noted that the new summer compensation policy may not equally affect faculty members due to differences in wealth, age, gender, or status at the university. For example, an older, more experienced professor is likely to hold a more secure and well paid position than a younger, less experienced professor. Moreover, that same professor will likely possess greater wealth than his younger colleague because he has had a greater amount of time to invest and save his money. Thus the more experienced professor is less dependent on income earned during the summer term than the less experienced professor.

DATA DESCRIPTION

We obtained the data on faculty summer teaching assignments in 2011 and 2012 from the university's administrative software system ("Banner"). Data on faculty salaries employed by state institutions are public; we used the *Annual Budget for Fiscal Year 2010-2011* as our source. Because there were no salary increases (i.e., raises) from a designated "merit" pool in 2011, the nine-month contract salaries of faculty remained largely the same in 2012.[4]

We eliminated observations on adjunct faculty (sometimes referred to as "instructors") since they do not have a permanent position with the university and do not always have the opportunity to teach in any given term. We also dropped observations on teaching assignments that were obviously non-standard courses such thesis supervision, practicums, internship supervision, and undergraduate sections of graduate courses, which are often created simply for accounting purposes and do not represent separate classes. Finally, we dropped observations for faculty who joined the University in fall of 2011 (and thus had no opportunity to teach in the summer of 2011) as well as those who left the University before summer of 2012. Our resulting dataset contains 246 total observations.

The mean nine-month salary in our sample is $60,749.40. The mean one-course stipend paid in the summer of 2011 is $5,062.48. The mean stipend paid in 2012 is $3,878.81, approximately 24 percent lower than the year before. The mean total compensation received for summer teaching in 2011 is $8,363.87; in 2012, it is $6,327.67 – about 21 percent less. In other words, there is at least some suggestion of an adjustment by faculty vis-a-vis their teaching choices as the impact on total summer pay is (slightly) smaller.

Table 2: Mean and Median Salaries by College						
	Business	**For. & Ag.**	**Sci. & Math**	**Education**	**Lib. Arts**	**Fine Arts**
Mean	$78,270.34	$65,785.82	$59,650.52	$58,695.99	$53,937.23	$52,184.50
Median	$83,304.00	$63,423.00	$56,448.50	$56,442.00	$49,478.50	$50,557.50

To investigate this further, we compared the average income (= salary + summer compensation) actually received by faculty in 2011 and 2012.[5] The average total income, as defined above, fell from $69,113.27 in 2011 to $67,077.07 in 2012, for only about a 3 percent decrease. We interpret this as mild evidence of the income effect in aggregate.

Turning to the demand side, the total cost of summer school to the university – that is, the cost of all sections taught, in terms of faculty compensation – in 2011 is $2,057,511, while in 2012 it is $1,556,606. It is worth noting that the total number of sections taught stayed nearly the same: there were 411 total sections taught in 2011 and 405 in 2012. This suggested that the demand the university faces for teaching faculty's services is very inelastic.

Table 3: Summer Teaching Course Load Changes by Income Quartiles				
	Top Quartile	**3rd Quartile**	**2nd Quartile**	**Bottom Quartile**
Increased	16	12	11	21
Decreased	11	23	17	9
No Change	35	26	33	31
Total	62	61	61	61

RESULTS

Of the 233 faculty who saw their compensation reduced, 119 did not change their behavior, 58 faculty increased the number of sections they taught, while 56 individuals taught fewer sections. We calculated the implied elasticity for each individual in our dataset (elasticities were computed using the "midpoint" or "arc" formula to calculate changes in both *P* and *Q*.) The resulting values range from -14.2 to 19.4 with a mean of -0.0365. This suggests, once again, that on balance, the income effect is more pronounced than the substitution effect.

We were also interested in whether gender or income matters in explaining an individual's response to a reduction in wage. Estimated correlation coefficient between the dummy *male?* and elasticity is 0.038, while correlation between *salary* and elasticity is 0.039, neither of which is statistically significant. It appears that the response to a wage change is independent of those factors.

Table 4: Mean Elasticity by Gender	
Male	0.0627
Female	-0.16

Table 4 summarizes mean calculated elasticities by faculty gender; Table 5 presents mean elasticities broken down by faculty discipline (i.e., college), and Table 6 breaks down mean elasticity by faculty salary. Table 7 provides a two-way glance at the changes in teaching load by both college and gender.

There do not appear to be substantial differences across teaching disciplines: all of the mean elasticities by college are small in absolute value, suggesting that there is a full spectrum of individual responses within each college. The income quartiles, on the other hand, do reveal an interesting pattern: faculty in the middle of the salary distribution (i.e., middle two quartiles) tended to teach more in response to a decrease in stipends, while faculty at both extremes of the income distribution taught less. Given rather small group sizes, it is difficult to draw any definitive conclusions from these results, even if the standard *t*-test suggests that there is a significant difference at the 5 percent level.

Table 5: Mean Elasticity by College					
Business	**Forestry & Agric.**	**Sci. & Math**	**Education**	**Lib. Arts**	**Fine Arts**
0.05	0.08	0.089	0.24	–0.8	1.09

Table 6: Mean Elasticity by Nine-month Salary Quartile			
Top Quartile	**3rd Quartile**	**2nd Quartile**	**Bottom Quartile**
–0.014	0.38	0.38	–1.1

NOTES AND CAVEATS

Several caveats are worth mentioning at this point. First, we get to observe in our data the actual teaching assignment of each faculty in both summers. This does not necessarily imply that that would have been each individual's optimal choice had they been given complete freedom to choose any number of courses to teach. Some departments allocate the scarce sections among faculty using some mechanism (e.g., seniority, a rotation of some kind, etc.) and limit any faculty to, say, two courses per summer. Other departments have plenty of teaching opportunities to go around – i.e., sections to fill – and are only constrained by the University policy limits on summer teaching.

Second, a cut in the summer teaching stipend for a faculty is clearly not the same as an hourly wage cut for an hourly employee in terms of its effect on the decision to supply more or less labor. Faculty are generally not free to choose the number of hours they work given their teaching assignment; in other words, a professor is forced to make an all-or-nothing decision of

whether to teach a class in exchange for a fixed stipend, not how many hours to work for per-hour wage. With that said, it is also entirely plausible that some faculty may respond by agreeing to teach a course but reducing their effort in other ways – spending less time preparing for class, switching to less labor-intensive testing methods, reducing office hours, and so forth. We do not get to observe the level of effort exerted in our data, either before or after the wage change.

Table 7: Summer Teaching Course Load Changes by College and Gender

	Business				**Education**				**Fine Arts**				**Forestry and Agriculture**				**Liberal Arts**				**Science and Math**			
	M		**W**		**M**		**W**		**M**		**W**		**M**		**W**		**M**		**W**		**M**		**W**	
	Number	(% of group)	Number	(% of group)	Number	(% of group)	Number	(% of group)	Number	(% of group)	Number	(% of group)	Number	(% of group)	Number	(% of group)	Number	(% of group)	Number	(% of group)	Number	(% of group)	Number	(% of group)
Increased	7	25	3	23	6	26	11	23	4	29	1	25	2	29	0	0	10	31	6	21	8	24	2	22
Decreased	6	21	1	8	5	22	18	38	5	36	0	0	1	14	0	0	9	26	5	18	7	21	3	33
No change	5	54	9	69	12	52	19	40	5	36	3	75	4	57	4	100	15	43	17	61	18	55	4	44
Total	**28**		**13**		**23**		**48**		**14**		**4**		**7**		**4**		**34**		**28**		**33**		**9**	

CONCLUDING REMARKS

In this study, we examine the labor-supply response of college faculty at a public university in Texas to a significant reduction in per-course stipends offered for teaching during the summer session. We are able to observe individuals' teaching choices over the course of two summers – before and after the cut in compensation – which allows us to control for many unobservable factors (i.e., a natural experiment.) We find that, while individual responses varied widely, on balance the number of course sections taught remained virtually unchanged. This

suggests that the university administration may be able to get away with paying significantly less for summer courses, as the supply of teaching appears to be quite inelastic, at least in aggregate.

While we do not find significant differences in faculty behavior across genders, there does appear to be some variation over income levels: those with salaries in the middle two quartiles chose to teach more, while those with low and high salaries taught less.

As an extension of this work, it would be interesting to follow up with these faculty for another year (stipends remained unchanged for the 2013 summer session). Another year gives college professors a chance to make additional adjustments – find alternative employment, make labor-supply decisions involving spouses, etc. – that may reveal a different pattern of responses. A priori, we would surmise that the longer-run labor supply elasticity is greater than the short-run elasticity we find from examining just one year of data.

ENDNOTES

[1] Laboratory studies and animal test subjects have also been used to test `worker' response to wage changes. Battalio et al. (1981) test whether pigeons' behavior is consistent with the labor supply model, where wages were measured in payoffs per pigeon peck – more pecks to dispense a fixed amount of food translated to a lower wage and fewer pecks translated to a higher wage. Because of the laboratory conditions, the authors were able to separate the income and substitution effects and they found that these pigeons reacted to a wage change much like economic theory would suggest.

[2] It should be noted that more recent studies are concluding that married women's response rate when deciding to participate in the labor force are becoming similar to that of men.

[3] Tracey (1980) surveyed the faculty members at the University of Maryland, College Park and found indicated that faculty teaching in the summer indicated an overall need for money as a key motivation for teaching during the summer. In addition, the faculty members were asked to indicate the worst parts about summer school and overall the faculty response predominantly concerned the inadequate compensation for their time devoted to the university. Overall, faculty members agreed that the university could improve the summer term by increasing compensation and offering more courses to compensate for the difficulties in covering all the appropriate class material in the five and one-half week summer term.

[4] Even in years when there are no “merit” raises, some salaries are adjusted using the “equity pool.” These are typically relatively small raises and affect only a small proportion of faculty.

[5] We assume here that faculty did not turn to other sources of income when faced with a cut in teaching stipends. Clearly, this may overstate the impact of the cut, especially on those who chose not to teach in 2012. However, we believe this may not be a substantial effect for two reasons. First, the stipend reductions were announced sufficiently late in the academic year so that faculty had either already committed to teach or would have difficulty finding other sources of income if they wanted to engage in other paying activities (consulting, seeking grant funds, etc.). Second, given the university's rural location, few faculty have opportunities such as consulting readily available to them nearby as may be the case for schools located in urban areas.

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