The Effect of Institutional Expenditures on Employment Outcomes and Earnings

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Abstract

In recent decades public attention on colleges has risen in response to rising college expenditures and costs. This study uses the Education Longitudinal Study of 2002 to investigate how spending impacts salaries and employment outcomes, controlling for selection and the endogeneity of graduation. Our findings indicate that spending on instruction increases salaries, the probability of full-time employment and job match for graduates, particularly for more disadvantaged students, while there are smaller benefits of spending on student services for less disadvantaged students. Non-graduates experience high returns to instructional spending, particularly those with less-educated or low-income parents.

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I. Introduction

Over the last few decades there has been a large increase in spending for both educational and non-educational purposes by colleges and universities in the United States. The particular areas of spending that have increased are dependent on the type of institution. Research-focused institutions, both public and private, have seen 10-22% increases in instructional spending, and on the private side, this has been accompanied by significant increases of over 35% in student services spending. Master's and bachelors focused institutions have also seen significant increases of roughly 30% in student services expenditures (Delta Cost Project, 2008).

Not surprisingly, the last decade has also seen a rise in public concern over the ever-increasing cost of four-year colleges. This concern has manifested itself in many magazine and newspaper articles, news headlines, and public discussion. In August of 2013, President Obama announced a plan to develop a rating system for colleges based on their cost, characteristics, and value as measured by outcomes such as graduation rates and earnings of graduates. The administration then plans to link these ratings to financial aid provided through the government, such as Pell grants[1]. Throughout these discussions, a focus on identifying how to keep college costs down, while also maintaining or increasing student outcomes has been a common thread.

Institutions have an interest in providing, and students have an interest in receiving, the highest quality post-secondary education such that the returns post-graduation are maximized. Students may also be concerned with the consumption value of their college education, which they may be willing to pay more for without any returns post-graduation. Therefore, students want to receive the best value and institutions have an incentive to provide it in order to attract the right students. Institutions need to know how best to spend their money; what type of spending has the biggest bang for its buck? Spending more money may result in higher quality, but knowing how to spend the dollars to maximize quality can keep costs down while still attracting the best students. Of course quality in higher education is multi-dimensional and difficult to define so in this paper we focus on one important component of it, labor market outcomes.

Unfortunately there is very little information about the payoff to particular institutional expenditures. Should institutions spend more on instruction, and therefore be able to capture and keep more high-quality faculty, or would this money be better spent on student services by providing opportunities for students to network and receive assistance during their time in college? The growth in

[1] See for example "Obama's Plan aims to Lower Cost of College." Tamar Lewin. NY Times, August 22, 2013.

expenditures in recent decades has not been uniform and there is no a priori reason to believe that an increased emphasis on research expenditures at a state flagship institution would have the same marginal impact on a student as that increase at a liberal arts college. Without understanding how different types of institutional expenditures may impact student outcomes we are unable to assess whether quality really has increased over this period of rising prices and expenditures.

This study uses a nationally representative data set of college students to examine how institutional expenditures by category impact labor market success, as measured by salaries and employment, both for college graduates and for students who do not receive a four-year degree. The results indicate that the student's own characteristics are very important in determining how each category of expenditures impacts these outcomes. Overall, it appears that expenditures on instruction have a positive impact on salaries and employment, particularly for lower-income students and those with less-educated parents, although these impacts are not precisely estimated. Instructional expenditures appear to be more effective at increasing the probability of a graduate getting a full-time job, and in being employed in a field which matches their field of study in college, particularly for more disadvantaged students. In contrast, while spending on student services may impact whether a student graduates and presumably factors into the consumption value of college, this impact is larger for more disadvantaged students, while having a larger impact on employment outcomes for more advantaged students. Research and academic support spending, the other two general categories of educational spending, have little consistent impact on earnings or employment.

This paper continues as follows: Section II discusses the literature on returns to college quality and spending. Section III introduces the data and model, followed by the results in Section IV. In Section V, we conclude.

II. Literature Review

The literature on returns to college quality is extensive and varied. Much of the focus on college quality has thus far been on the quality of peers, as measured by median SAT scores. Early papers found a positive return to attending institutions with better peers (see for example: Kane, 1998). One main concern of examining returns to college quality has been the selection of high-ability students into high quality institutions. Studies controlling for this selection have found mixed but mostly positive results (Behrman et al., 1996; Behrman, Rosenzweig, & Taubman, 1996; Brewer & Ehrenberg, 1996). Dale & Krueger used the quality of college application choices to control for selection on unobserved ability, finding no return to higher peer quality, except for minority students, or those with less educated parents (2002; 2011). Hoekstra (2009) used a regression discontinuity design to examine students just

barely admitted and those that just barely missed out on admission to a public institution. The results showed a significant positive impact of making the cut-off and attending the more selective public institution. Other studies have focused on other college characteristics such as type or control. Monks (2000) found that students graduating from private or doctoral institutions earn higher salaries, and that there is a return to college quality as measured by Barron's rankings of college competitiveness.

Fewer studies have examined the relationship between schooling and non-salary labor market outcomes. While some studies have found that increased schooling decreases the probability of unemployment, there is little examining the link between college quality and employment outcomes, although the data do show that there are big differences in amount of schooling and these employment outcomes (Baum, 2014). Brewer, Eide, & Ehrenberg (1999) do examine the link between college quality and the probability of graduate school attendance using Barron's rankings of college quality. Their results indicate that students attending more selective colleges are more likely to go on to graduate school.

Although peer quality is only one measure of college quality, it is the one that has received most of the focus so far. An alternative way to evaluate returns to school quality would be to examine how institutional spending habits may benefit students in the labor market. While Dale & Krueger's 2002 study did not find a link between median SAT scores and salaries for the average student, they did find that students graduating from schools with higher levels of institutional spending earned higher salaries. Similarly, examining college completion, in a 2014 paper Cohodes & Goodman find that students induced by a financial aid program to attend a lower quality college with much lower expenditures per student were negatively impacted and graduation rates declined. These papers raise the question of whether the type of institutional expenditure has a differential return in the labor market or whether it is only high total expenditures that matter.

Webber & Ehrenberg (2010) and Webber (2012) have found that the purpose of the institutional spending is important in determining institution graduation rates. In their 2010 paper they use a panel dataset of four year colleges and universities to estimate how the four main categories of educational expenditures – instruction, academic support, student services, and research – impact an institution's graduation rate. Their findings indicate that expenditures on student services have the largest positive impact on graduation rates, particularly at institutions with low-test scores and a high percentage of low-income students. Increases in instructional and academic support expenditures also have a small positive impact, while research expenditures appear to be negatively related to graduation rates. In a similar study, Ryan (2004) finds a link between increased instructional and academic support

expenditures and graduation rates. Webber (2012) conducts an analysis of graduation probabilities at the individual level using data from the public university system in Ohio. The findings are similar; student services expenditures benefit low test-score students, while instructional expenditures benefit high test-score students[2]. While the results indicate that the category of spending is important, they also illustrate that examining how spending affects the salaries of college graduates uses an endogenously selected sample.

More recent research has also found that the category of institutional expenditure is important in the matriculation decision, indicating that students sort into colleges based on where they spend their funds. Just as with outcomes, students of different backgrounds react differently to institutional spending (Griffith & Rask, 2013; Jacob, McCall, & Stange, 2013). Consistent with the findings on the impacts of institutional expenditures, low test-score students are more likely to matriculate at institutions with high levels of student services expenditures, indicating the importance of controlling for student sorting into institutions (Griffith & Rask, 2013).

Despite the growing literature on the importance of *how* the institutional expenditures are spent, there are no studies that disaggregate the effect of expenditures on labor market outcomes. In particular, there are no studies that control for selection of students into institutions, and for the endogeneity of the graduation decision. It also seems clear that the relationship between institutional spending and student outcomes is complicated and depends on the background of the student, and possibly on the institutional setting. This study adds to the literature on college quality by examining these questions. We examine how each category of educational spending impacts salaries and employment, controlling for student selection and college graduation. Our results will help build this growing literature, as well as provide policy implications for institutions concerned with the labor market success of their graduates. Finally, the results will provide new insights into the underlying forces behind institutional expenditures and student outcomes.

III. Data & Methods

III.A Description of Data

To answer these questions of how college spending decisions affect labor market outcomes we use the Education Longitudinal Study of 2002 (ELS:02), produced by the National Center for Education Statistics. The ELS:02 is a nationally representative data set of high school sophomores in 2002. Roughly

[2] Institutional expenditures have also been linked to student engagement, but the results are mixed, as the relationship depends on the category of spending and the individual's own characteristics (Pike, Smart, Kuh, & Hayek, 2006).

15,000 10th graders were originally surveyed in 2002, and then follow-up surveys were administered in 2004 (their senior year of high school), 2006, and finally in 2012. During the first and second follow-up surveys, information on students' college interests and matriculation decisions were collected. By 2012, when most students that had attended college after high school had graduated or left school for the labor market, the respondents were asked to provide information on their current employment status, educational attainment, and earnings. Using these data, we identified the sub-sample of students that attended a four-year college or university immediately following graduation from high school, so as to capture the traditional college-going population, which will be our main sample.

Information on respondent's SAT scores and high school GPA were taken from the first follow-up and the high school transcript study respectively. These were linked with parental income and education levels from the original survey given to respondents' parents in 2002. The survey data reports a categorical measure of parents' highest level of education which was turned into a continuous measure by matching years of education to each category. Labor market outcomes, including annual earnings in 2011, and whether the respondent was employed full-time in 2011, and for how many weeks they were employed, were taken from the third follow-up.

These data were linked to college spending characteristics obtained from the *Integrated Post-Secondary Education Data System* (IPEDS) in the following way. Data were collected from IPEDS on four-year colleges' total spending, and spending on instruction and student services. Each of these spending measures was converted to 2012 dollars, and measured per full-time student equivalencies. These measures are linked to the student's start year. Indicators for college control and type (doctoral, master's or baccalaureate) were derived from IPEDS data as well. Median SAT scores for incoming classes were calculated as the middle of the interquartile range, and were obtained from IPEDS. For colleges that only reported ACT scores, the median was converted to the equivalent SAT score.

A list of all colleges to which each respondent applied was taken from the second follow-up. These were linked to the college spending measures and school median SATS discussed above. Averages of these measures were calculated for each respondent. The resultant data set contains roughly 5,000 four-year college students with valid labor market outcomes in 2011, of which roughly 2,800 graduated from college[3].

III.B Description of Model

[3] All sample sizes are rounded to comply with restricted data agreements.

Our empirical model is based on a basic human capital framework. We assume that earnings are a function of individual characteristics such as gender, race, and ability, as well as characteristics of the college attended[4]. College quality is assumed to contribute to a worker's human capital and their opportunities in the labor market. There are many ways one could measure college quality: there is peer quality as has been studied extensively in the literature, school spending, and school reputation which would be reflected in something like a ranking. Here we will focus on quality as measured by institutional expenditures. Our analysis ultimately separates total institutional expenditures by type – instruction, academic support, student services, and research - to test how each of these categories of spending may impact labor market outcomes. Later in the paper we will discuss any differences that arise if we control for all three different types of quality as mentioned above.

It is reasonable to hypothesize that institutional spending devoted to different purposes may impact graduates' labor market outcomes differently. Spending on instruction may have a direct impact on human capital formation, helping to build skills that will be rewarded in the labor market. Results from the literature demonstrate this, as instructional spending helps to increase graduation rates. Similarly, student services expenditures have been shown to affect student outcomes in college. These expenditures go to on-campus offices such admissions, and career services, as well as to support student organizations and student health services. While these expenditures may not have as direct a link to human capital formation as we might think instructional expenditures should, they still may have impacts on labor market outcomes. Students attending schools that devote significant resources to student services may also have more labor market opportunities available to them. For example, colleges with many student organizations may have created a network of alumni that provides more opportunities for current graduates than a school with very little emphasis on student services. Student services expenditures may work to build non-cognitive skills that enhance human capital and improve labor market outcomes. The other two main categories of education spending, research and academic support, might also impact students' labor market outcomes, but the connections are less obvious. Research spending that is accompanied by opportunities for students to be involved in the research may increase human capital. If however, high research spending affects outcomes through the talented faculty brought into such programs, then instructional spending will reflect this mechanism.

Given this theoretical framework our goal is to estimate a model as in equation (1):

[4] Presumably labor market outcomes are also a function of labor market experience. However, we only observe these outcomes at one point in time with very little variance in years of experience. Therefore, we do not include this measure in our models.

$$(1)\ Y_{is} = \alpha_0 + X_i\beta + Z_s\gamma + \varepsilon_{is}$$

Where Y_{is} represents a labor market outcome, either the log of earnings, an indicator for whether the respondent was employed full-time, or an indicator for whether the job in which the respondent was employed matches the field of study in college, of respondent i that graduated from school s. The vector X contains individual characteristics for respondent i in time period t, including gender, race/ethnicity, ability as measured by SAT score and high school GPA, and controls for occupation. We also control for family background through parents' highest level of education and the log of parental income. The vector Z contains the school specific variables measuring expenditures per full-time equivalent (FTE) student for the school at which the student started their four-year degree.

Under this framework, assuming that there are benefits of institutional spending and following the literature, it seems reasonable to assume that students will sort into institutions accordingly. Therefore we should expect that students with unobservable characteristics that allow them to benefit highly from institutional expenditures should enroll at higher rates in institutions with higher spending. If it is the case that these unobservable characteristics are complementary to institutional spending the coefficients in gamma will likely exhibit upward bias, indicating a more positive benefit of institutional spending. In contrast, it may be that some categories of institutional spending are substitutes for low levels of unobservable characteristics. In this situation students with lower levels of positive unobservables will be more likely to enroll in institutions with high levels of spending and any effect of spending will be biased towards zero. Therefore, it is important to control for any unobservable characteristics that may influence both school choice and labor market outcomes.

To do this we use a method based on the theory developed in the work of Dale & Krueger (2002). First, we assume that college admissions decisions are made as a function of an individual's characteristics. These come in two types, observable and unobservable. The admissions officer sees the ability level of applicants as measured by high school GPA and other test scores. They also obtain information on characteristics unobservable to the econometrician, such as motivation and tenacity, through such instruments as application essays and letters of recommendation from teachers. It is these unobservable characteristics that will affect which college each student attends that may also have an impact on their future wages.

We assume that colleges accept students for which some function of their characteristics, both observable and unobservable, exceeds a college-specific threshold. Therefore, given a student's observable characteristics, being accepted to or attending a higher quality college should reflect a higher level of unobservable characteristics. Under this assumption we can control for student revealed quality

using the average quality level of the institutions to which the student applied, as in the "self-revelation" models developed by Dale & Krueger (2002). Different from Dale & Krueger, we control for the average total institutional spending of the colleges to which each student applied, rather than the average median SAT score of these institutions, as this is how we will measure college quality. Identical models will be estimated using average median SAT score to see how sensitive our estimates are to this choice. Given our controls for selection of students into colleges, labor market outcomes are compared for respondents who applied to institutions with similar spending habits, and therefore revealed themselves to have similar unobservable preferences or characteristics with regards to institutional spending. The effect of college spending is then identified off of variation in spending at the colleges actually attended. These models are as in (2):

$$(2)\ Y_{is} = \alpha_0 + X_i\beta + Z_s\gamma + S_s\lambda + \varepsilon_{is}$$

Where S is a vector containing the average total spending at the institutions to which the student applied. S also contains the number of applications reported. The estimates in γ would contain causal estimates of the effects of college spending on labor market outcomes for college graduates if the assumptions given above hold. However, as has been shown in the literature, institutional spending also impacts whether a student will graduate from college, and these effects may differ by spending category. Therefore, our estimation needs to adjust for a second level of selection; students that go to institutions with high levels of spending are more likely to graduate and show up in our labor market sample of college graduates.

To control for this sample selection, we introduce a selection equation which we used to adjust our labor market equation with a Heckman selection correction. This equation is as in (3):

$$(3)\ \ Graduate_{is} = \alpha_0 + X_{is}\delta + Z_s\pi + S_s\phi + \varepsilon_{is}$$

Where graduate is a 1 if student i graduated from school s, and a 0 if they started at school s but failed to graduate by 2011. We exclude students that are still enrolled in college at the time of the third follow-up, so this should accurately reflect the sub-sample of students that will not be receiving a four-year degree, despite starting one. The Z vector contains institutional spending measures as above, and similarly the S vector contains the measures of each student's application choices as above. The vector X contains student characteristics such as gender, race, HS GPA and SAT, and parents' income and education level. In order to identify our selection equation separately from our second stage equation, and not rely on non-linearities alone, an additional variable is included measuring the average number of hours a student worked during their first-year of college. This measure should be a strong predictor

of whether a student graduates as it will indicate how cost constrained the student is, with an expectation that students that worked more during their first-year of college would be less likely to be able to afford to graduate from college. Importantly, it is unlikely that this variable would be correlated with future labor market outcomes on its own, as students working more hours during their first-year are unlikely, on average, to be more likely to be working in a job connected to their careers during their first year of college than students who worked few hours[5].

Our final model is then a selection model with equation (3) as the first step of the Heckman two-step procedure, and equation (2) as the second, including the inverse mills ratio calculated from the results of estimating equation (3). This final specification controls for selection of students into institutions, as well as selection of students out of college through a degree. The estimates in γ reflect causal estimates of the effect of institutional spending on labor market outcomes for college graduates.

III.C. Descriptive Statistics

Descriptive statistics for the ELS:02 sample are shown in Table 1 for the whole sample of college students and for the sub-samples of students that did and did not graduate from college. The overall sample is fairly representative of the national college-going population. The sample is roughly 56% female, 10% black, and 8% Hispanic. However, female students are slightly less likely to graduate, with only 55% of the graduate sample being female. Similarly, black students make up a smaller percentage of the graduate sample. Students that graduated from college have higher ability as measured by SAT scores or high school GPA, and come from more highly educated parents with higher incomes, than do students that fail to graduate from college. Students that ultimately do not graduate from college work roughly 3 more hours on average a week in their first year of college which is indicative of an income constraint. As expected, college graduates earn higher salaries (roughly a $7,000 difference on average), and are more likely to be employed full-time. Additionally, although most students are employed full-time by 2011 (over 70% on average), fewer are in a job that closely matches their field of study in college, and graduates are 10 percentage points more likely to be in such a job. These average salaries appear low, below the national average. However, they are for graduates only 3 years out of college at

[5] It is important to note that there is a literature examining how working during college may impact college outcomes, but the findings are mixed. Darolia (2014) finds little impact on college GPA, but a decrease in total credit hours taken, while Scott-Clayton (2012) finds a small positive relationship between work hours and credit hours completed. Ehrenberg & Sherman (1987) find that increased work hours significantly decreases graduation probabilities for four-year students. This first-stage exclusion restriction remains strong when the model is estimated for only those with parental income in the top 25th percentile indicating that it is a strong instrument for the entire range of incomes in the sample.

a maximum, were measured in 2011 for many students that would have entered the labor market during the great recession of 2008, and there is significant variation in this measure.

There are also clear relationships between institutional spending measures and whether students graduate. Students that did graduate from a four-year college attended one that on average spent roughly $2000 per FTE student more on instruction and $400 more on student services than did an institution attended by the average student that did not graduate from college. Total expenditures are also markedly different, and there is far more variance in these measures in the sample of institutions attended by students that did graduate from college.

IV. Results

IV.A. Earnings

We start our analysis by estimating equation (1), and then adding controls as in equations (2) and then using equation (3) to control for sample selection to illustrate how controlling for these two selection pathways can impact our estimates of college quality[6]. In the original estimates aggregate total institutional expenditures are used as the measure of college quality. These results are shown in Table 2. The first two columns have no controls for graduation and estimate the combined effect of total expenditures on graduation and salaries simultaneously, with the second column including controls for selection into colleges. In column (3) the sample is restricted to four-year college graduates only and no controls for selection into college are included. The results in these 3 columns indicate a significant positive impact of total expenditures on salaries that is very similar to that found by Dale & Krueger (2002) using the College & Beyond data, although slightly smaller in magnitude. The fourth column includes the characteristics of the applied schools to control for selection into colleges. The coefficient on total expenditures is still significant although the magnitude has decreased slightly.

The next columns of Table 2 estimate the model in two steps. In column (5) the results of estimation of the Heckman selection equation are shown. The exclusion restriction, number of hours worked in the first-year of college, is highly significant and of the expected sign. Total expenditures have a strong significant impact on the probability of graduating. However, the coefficient on total expenditures in the salary equation has shrunk to half of its original size, and is no longer significant. Similarly, in Columns (7) and (8) when both selection into colleges and out of college through graduation are controlled for as in equation (3), total expenditures has a smaller, although now insignificant, impact on graduation probability, and a small positive insignificant impact on salaries.

[6] Models of salary are estimated for the sub-sample of workers reporting an income of $5,000 or more. The results are not sensitive to this cut-off.

These results suggest that both levels of selection are very important in understanding how college quality, as measured by total expenditures, impacts labor market outcomes. It appears that college spending plays a very important role in whether a student graduates, which in turn affects their salary. There also appears to be a small, although imprecisely measured, positive impact of expenditures for these college graduates that is separate from the effect on obtaining a degree. These results are consistent with the human capital theory laid out earlier.

In Table 3, we investigate what type of institutional spending is responsible for the positive coefficients in Table 2. All models shown are the second stage of a Heckman selection equation, controlling for selection into colleges as in Table 2. Instructional expenditures make up a large portion of the educational expenditures at four-year institutions and are also highly correlated with total expenditures. This makes it difficult to isolate the effect of each category of expenditures, holding all other spending constant. In Table 3 we start by controlling only for instructional expenditures and total expenditures in column (1). We then add in each of the other categories of educational spending one at a time. In column (1) we see that there is a positive, although insignificant, effect of instructional expenditures on salaries. Presumably the coefficient on instructional expenditures may be picking up any effect of other institutional spending that goes hand-in-hand with high instructional expenditures. In column (2), in addition to instructional expenditures, we add student services spending. The coefficient on instruction remains very similar in magnitude, but is still not significant. The coefficient on student services spending suggests that there is little impact of this type of spending on salaries. Similarly, as we add in academic support spending in Column (3), and research spending in column (4), we see the coefficient on instruction fall slightly, but remain remarkably robust, given the high level of correlation between spending categories. Academic support spending appears to have a small insignificant, but positive, effect on salaries, which remains fairly robust as we add in research spending in column (4). Similar to student services spending, research spending does not appear to contribute to salaries on average. For the remainder of our estimates, we will use the model in column (4) as our preferred specification, despite the imprecise estimates. The spending categories we are controlling for are very highly correlated, so the large standard errors are to be expected. Therefore the results in column (4) can be interpreted in one of two ways. Either none of the categories has any impact on salaries, or instruction has a consistently positive impact, while academic support has a small, but also consistently positive impact, and neither of the other two categories has a consistent impact on salaries.

The results shown in Table 3 suggest that there might be a sizeable return to instructional expenditures for the average student, although the impacts are not significant, and there does not appear to be any return to student services spending, which has been found to increase graduation probabilities. In Table 4 we allow the impact of all 4 types of spending to differ by student characteristics. We report both the first-stage selection equation and the salary equation for each set of interactions. In Columns (1) and (2) we interact spending with the log of parents' income, in Columns (3) and (4), the spending measures are interacted with parental education level, and finally in the last two columns spending is interacted with student's ability as measured by high school GPA. There are few significant effects, or differences by student background, but a couple stand out. First, academic support spending appears to only be beneficial for higher-ability students, with the impact increasing in ability. Second, research spending significantly increases salaries for students from higher-income backgrounds, with this effect increasing in parental income.

Despite a lack of significance for the other spending categories, there does appear to be a consistent pattern. Instructional expenditures appear to have a positive effect on salaries that is larger for students from more disadvantaged backgrounds; the effects are decreasing in parental income, parental education, and ability. Although the magnitudes appear to jump around a bit more and tell a less consistent story, there also appears to be a pattern with student services expenditures that tells an opposite story. Student services expenditures appear to be most beneficial for students from more advantaged backgrounds. Academic support and research expenditures, aside from the significant effects already discussed, appear to be the least robust. Overall, although the effects are not precisely estimated, these results suggest that instructional expenditures act as a substitute for student background, helping those from more disadvantaged backgrounds more. Conversely, student services expenditures are most valuable to more advantaged students, working as complements to these backgrounds.

Although most of the literature has focused on the return to college quality for graduates, there is also a substantial literature that suggests that some college is better than none, suggesting that some human capital might be obtained in a short enrollment at college, even if one does not finish with a degree. To look at how these measures of college quality impact salaries for non-graduates, the same selection model is estimated for this group with the results for the second-stage salary equations displayed in Table 5. Column (1) shows a positive effect of instructional expenditures on salaries for non-graduates. Most interestingly, the return to instruction is much larger than that for graduates. Although also not significant, there is some evidence that student services, academic support and

perhaps research spending have small positive impacts on salaries for the average non-graduate. Columns (2) through (4) interact these measures with parents' income, parents' education, and ability, as in Table 4. As we saw with graduates, the effect of instructional spending appears to be decreasing in parents' education level and income, with the former relationship being significant. Interestingly, for non-graduates the relationship reverses in terms of ability; instructional expenditures increase salaries significantly more as ability increases. Academic support and student services expenditures do not appear to have a consistent relationship with salaries of non-graduates, in terms of the students' background and ability. Research spending does significantly increase salaries for non-graduates, but with a declining effect as student ability increases. These results show that even for students that fail to graduate, attending a four-year institution with high instructional expenditures can have a very high return in the labor market post-schooling, particularly for students with less-educated parents, and high-ability non-graduates.

IV.B. Employment

In Tables 6 and 7, we turn to employment outcomes. In Table 6 we show results for estimations of whether the respondent reported being employed full-time during the third follow-up. Similar to the effects on salaries for graduates, Column (1) suggests a small positive, insignificant, impact of instructional, student services, and academic support expenditures with little effect of research spending. Column (2) shows that instructional spending significantly increases the probability a student is employed full-time, but this effect is decreasing in parental income. And just as we saw with salaries, this effect is reversed for student services spending. Increased student services spending significantly increases the probability of being employed full-time after graduation, with the effect increasing in parents' income. Although not significant, these patterns also appear in columns (3) and (4) for parental education and ability. Academic support and research expenditures have no significant relationships with full-time employment, but also follow the same pattern as student services spending although with much smaller effects; these types of spending appear to be most beneficial for students from more advantaged backgrounds.

The results of Table 6 suggest that instructional spending can act as a substitute for a more advantaged background, increasing the probability of acquiring a full-time job. Student services spending appear to be most useful for more advantaged students. If the pathway through which student services spending affects employment is through networking and non-cognitive skill formation, it may be the case that the types of student organizations that contribute to networks and these skills

are more available to more-advantaged students. Therefore, they are able to take advantage of the benefits of this type of spending, leading to an increase in full-time employment.

IV.C. Occupation Match

Another measure of employment success would be whether a graduate lands a job that closely matches their major, and therefore likely the skill set gained in college. Not all graduates aim to obtain high-paying jobs, as many intend to enter much lower-paying sectors, such as teaching. Others may take lower-paying jobs to remain in a field that matches their interests more closely. To examine whether institutional spending impacts the quality of the job match, we use the survey question from the ELS:02 asked in the 2012 follow-up survey "How closely related is your current/most recent job to the major or field of study you had when you were last enrolled in college?" We considered respondents who answered closely or somewhat related to be in a job that matches their field, versus those who are not. We estimated selection equations as above with this outcome, with the results displayed in Table 7.

In column (1), the results of the second stage of the selection equation are displayed. Increasing instructional expenditures significantly increases the probability that a graduate is in a well-matched job. Although not significant, student services spending also appears to have a small positive impact. Interestingly, academic support expenditures have a large, significant, negative impact on job match. Research expenditures appear to have very little impact. In columns (2) through (4) we interact the spending measures with parents' income, education, and student ability as before. A similar pattern as in the previously discussed results is apparent. Instructional expenditures have a significant positive impact on job match, with this effect appearing to decrease as parental education and income increase, although the change is not significant. However, there is a significant decrease in the effect of instructional expenditures as ability decreases, indicating that instructional expenditures are particularly helpful at placing lower-ability graduates into jobs that match their major field well.

As with our other results, student services spending is more beneficial for more advantaged graduates, having a significant positive impact for higher parental income and education, and student ability. Academic support expenditures have a similar pattern with regard to student background as instructional expenditures. Although none of the interactions are significant, academic support expenditures are more effective at promoting job match for more disadvantaged students. Research expenditures don't appear to have a consistent relationship with student background and job match, but they do significantly increase the probability of a job match for higher-ability students. This may reflect that institutions that spend heavily on research likely graduate a number of STEM (Science,

technology, engineering, and mathematics) majors that place well in jobs closely related to their major. Although these models control for occupation, they do not control for major. When controlling for major instead of occupation, the coefficients for research spending decrease in magnitude and are no longer significant.

IV.A Robustness Checks

Although our controls for selection are based on the self-revelation technique developed by Dale & Krueger (2002), our identification differs in that we use average expenditures of the colleges to which the student applied, rather than the average of the median SAT scores of these schools. As we are primarily interested in controlling for selection into institutions based on how they spend, our technique should pick this up more effectively. However, it's possible that we are not fully controlling for selection. To see how robust our results are to alternative selection controls we tried two things. First, we estimated all of the above models controlling for average median SAT of applied schools rather than average expenditures. The results remain essentially unchanged, with no change in the patterns and significance discussed in the results section. Our second check expands our current controls to average expenditures at applied colleges by category. Therefore, rather than controlling for average total expenditures, we control for average instructional, average student services, average academic support, and average research expenditures. This may more fully capture any selection into schools based on spending in each category. However, these measures are likely to be highly correlated, as they are at each individual institution. When re-estimating all of the above models with these disaggregated spending controls, we find that the results do not change.

Our second concern is that these results may be specific to this sample or time-period. It is possible that the effect of institutional expenditures has changed over time as the labor market has changed. It is also worth noting that the respondents in the ELS:02 would have graduated college right as the great recession was starting in the U.S. There may be a different effect of expenditures when the labor market is experiencing a downturn than when we are in a growth cycle. To investigate whether the effects are different at a different time period, or with a different sample, we utilize the National Education Longitudinal Study of 1988 (NELS:88). Similar to the ELS:02, the NELS:88 samples a nationally representative sample of high school students, although they started in the 8^{th} grade rather than the 10^{th} grade. These respondents were followed through college and into the labor market. As with the ELS:02, labor market characteristics are taken roughly 3 years following the student's graduation from college, in 1999. We construct our sample and models as above, limiting ourselves to students who

attended college immediately following high school graduation in 1992[7]. The results of the second-stage equations of logged salary are shown in Table 8 for graduates, with interactions by parents' income, education, and student's ability. Additionally, we display the descriptive statistics for the variables used in the models in column (1).

The results are very similar, both in magnitude and pattern, to what we saw in Tables 3 and 4. Instructional and student services expenditures both appear to have positive effects on salaries, but their relationship to student background is the opposite. With the NELS:88 data, increasing instructional expenditures significantly increases salaries with a decreasing effect as parental education increases. Student services have a significant impact as well, but the effect is growing in parental education level. Although academic support expenditures have no significant impacts, as with the ELS:02, they follow a similar pattern as instructional expenditures, helping more disadvantaged students more. As before, research expenditures have little consistent impact on salaries.

The results from the NELS:88 sample indicate that the patterns found with the ELS:02, although sometimes imprecisely estimated, are robust to another time period and sample. This gives us more confidence in our estimates and suggests that the effect of institutional expenditures has changed little over time.

Finally, it is possible that college quality is college quality, no matter how you measure it, and what we are estimating is not the effect of changing spending per se, but rather changing quality itself. In order to interpret our results as we have, for a change in institutional spending by category, we estimated all of the models above including both median SAT and the US News & World Report Ranking of the institution in the student's first-year of college. These two measures should capture peer quality and any reputational quality that could affect labor market outcomes as well. The results are very robust to these additions, although in most cases the standard errors on the spending measures grow because of the collinearity in these measures of quality. Most importantly, the significant results in the previous tables remain significant and of similar magnitude, or drop just below the 90% confidence threshold but maintain a similar magnitude.

V. Discussion

[7] One limitation of NELS:88 is that only 2 of the schools to which the student applied for college are collected. Therefore, our selection controls might be slightly less effective, if the two schools listed are not representative of the entire application choice set. More positive for our identification, students in the NELS:88 sample applied to fewer colleges on average (3-4) than those in ELS:02, so this subset may capture the application choice set fairly accurately.

Given the recent focus on college spending, costs, and students' success post-graduation, we need to better understand the link between institutional spending and student outcomes. This paper uses a nationally representative dataset of students, ELS:02, to shed light on this issue. Our models examine how the four main categories of educational spending previously shown to impact students' outcomes – instruction, student services, academic support, and research – affect the salaries of both graduates and non-graduates, controlling for the selection of students into institutions and the endogeneity of the graduation decision. We then examine how these spending measures can impact full-time job placement and job match.

First, our findings mesh well with the existing literature, while illustrating why controlling for both dimensions of selection are important for identifying the actual labor market impacts of college quality as measured by spending. Although institutional expenditures appear to have a large return in the labor market for college graduates, some of this effect is actually a result of a higher probability of graduation from institutions with high expenditures. Second, it appears that instructional and student services expenditures are the main avenue through which institutional spending impacts graduates' and non-graduates' labor market outcomes.

Our findings have revealed some interesting patterns regarding the impact of instructional and student service expenditures. Instructional expenditures have the highest return for more-disadvantaged students, those with less-educated parents, low parental income, and lower ability levels. This is similar to the findings of Webber & Ehrenberg (2010) and Webber (2012) of the effects of spending on graduation probability. Therefore, not only do instructional expenditures help to compensate for more disadvantaged backgrounds during college but these expenditures continue to help these students in the labor market. They may increase salaries, and more strikingly, they make these students significantly more likely to gain full-time employment and to land a job that closely matches their skill-set formed in college. It's important to note that these effects are not limited to college graduates; those that fail to graduate also benefit from attending a college with high instructional expenditures, particularly if they are from a disadvantaged background.

In contrast, expenditures on student services have a larger impact on labor market outcomes of college graduates from more advantaged backgrounds. This type of expenditure also significantly increases the likelihood that students, particularly those from more advantaged backgrounds, will find a job in a field related to their college major. The student organizations and services provided by these funds may benefit students from a more advantaged background the most, providing important networking opportunities that spillover into the post-schooling labor market. These organizations may

also build human capital directly by providing important skills in team-work and interacting with different types of people that could lead to better skills in job interviews or on the job. It appears that more advantaged students are able to take advantage of these opportunities more effectively.

Given these findings, how economically significant is spending? In Table 9 we show the effects on salaries of a college with spending levels at the 25th percentile for each category increasing their spending to either the median level of spending in that category or to the 75th percentile. In each of these calculations we assume that no other category of educational spending is changing, and that total expenditures are unchanged. Therefore, the total increase in spending per student comes from a decrease in non-educational spending. We also only examine how these spending changes would affect salaries, holding the probability of graduation constant, but of course we know that in many cases these increases in spending would also increase the probability of graduation, further increasing salaries. We show the effects for both graduates and non-graduates for comparison. Instructional spending has the largest impact, as a move from 25th to the median increases salaries roughly 1.5% for graduates and 4.07% for non-graduates. A larger increase to the 75th percentile increases salaries a total of 4.56% and 12.54% for each type of worker respectively. Academic support has a much smaller, but still meaningful impact. A move from the 25th to the median of academic support spending increases salaries of graduates by just less than 1%, and non-graduates by just over 2%. The larger move to the 75th percentile results in increases of 3% and 6% respectively. Finally, student services expenditures, which appear to play a larger role in getting a job and in what type of job you get, have small increases in salaries, but primarily for non-graduates: an increase from the 25th to 50th percentile increases salaries 2.8%, and 8.56% if expenditures increase to the 75th percentile. Although it would be difficult for an institution to move quickly from the 25th to the 75th percentile of spending in any category, it is clear from these numbers that an increase in spending on instruction and to a lesser extent student services and academic support (both quickly growing areas of expenditures) could have economically significant impacts on salaries.

From the student's point of view this is true as well. Although attending more selective institutions that spend more on their students can be costly for students, there are some clear gains from doing so. A student considering a selective liberal arts college in the top 25 of the US News & World Report rankings can expect to pay roughly $10,000 more per year than if they attended a much less-selective liberal arts college ranked around 100 on the same list. For that extra $40,000, the student can expect to receive roughly $15,000 more in instructional expenditures. Assuming a 5%

annual growth rate in salaries on average[8] and a 5% discount rate, the growth in salaries as a result of the higher spending levels would overtake the higher tuition costs within roughly 15 years in the labor market. The distinction is even more obvious for selective public institutions versus less-selective public institutions. The difference in cost is often less than $5,000 per year, with the more selective institutions spending roughly 100% more ($10,000) on instruction per student. These very rough back of the envelope calculations indicate that paying the higher tuition for a more selective institution that spends more money on their students can very often be worth it.

It also appears that some institutions could increase graduates' salaries by diverting expenditures from student services to instruction. However, it is important to note that these institutions would likely hurt graduation probabilities of their students by doing this, given the findings of Webber & Ehrenberg (2010) and Webber (2012) indicating the importance of student service expenditures, particularly for more disadvantaged students. Therefore, it appears that the best way to increase salaries of graduates is to divert spending from non-educational purposes to instruction.

Overall, our findings illustrate the importance of instructional expenditures, both for students that graduate and for those that don't. They also indicate that student services expenditures can have positive effects for some students. Furthermore, our results highlight the importance of accounting for selection and graduation. Policymakers interested in examining the link between spending and outcomes will need to account for this.

[8] 5% average annual growth derived from BLS (2012).

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Table 1: Descriptive statistics for four-year college students in ELS:02

	Full Sample	Graduates	Non-Graduates
Female	0.563	0.554	0.574
Black	0.095	0.077	0.118
Hispanic	0.076	0.074	0.079
Other Race	0.05	0.049	0.053
SAT	1001	1028	967
	(346)	(339)	(352)
High School GPA	3.03	3.11	2.94
	(0.961)	(0.960)	(0.955)
Parent's Education	15.74	16	15.4
	(2.56)	(2.51)	(2.59)
log(parent income)	11.3	11.38	11.2
	(0.94)	(0.87)	(1.01)
Work hrs in first-year College	11.04	9.71	12.74
	(12.4)	(11.4)	(13.4)
Average Exp. Applied Schools	5996	6434	5440
(in $100,000s)	(6023)	(6071)	(5917)
Number of Applications	3.48	3.62	3.30
	(2.38)	(2.42)	(2.31)
Salary in 2011	34038	36839	30347
	(27196)	(25730)	(28606)
Employed Full-Time in 2011	0.717	0.74	0.688
Job Matches Major in 2011	0.635	0.681	0.576
Instructional Expenditures/FTE	14364	15376	13075
	(18343)	(19136)	(17199)
Academic Support Exp./FTE	3654	3883	3363
	(5788)	(5892)	(5642)
Student Services Exp./FTE	2635	3768	2466
	(2392)	(2503)	(2232)
Research Exp./FTE	6571	7487	5405
	(17835)	(19592)	(15233)
Total Expenditures/FTE	48956	53404	43294
	(85593)	(100866)	(60386)
Observations	5210	2920	2290

Note: Means shown with standard deviations in parentheses. College characteristics are given for four-year institution at which student started their post-secondary education.

Table 2: Log Earnings regressions using Education Longitudinal Study of 2002, with and without selection controls

	All Four-Yr Students		Graduates		All Four-Yr Students w/ Graduation Controls			
		Selection Controls		Selection Controls				Selection Controls
	Log(Salary)	Log(Salary)	log(Salary)	Log(Salary)	Graduate	Log(Salary)	Graduate	Log(Salary)
Female	-0.0654***	-0.0721***	-0.0795***	-0.0877***	-0.0856**	-0.0562*	-0.0929**	-0.0619**
	[0.0204]	[0.0205]	[0.0254]	[0.0255]	[0.0384]	[0.0295]	[0.0385]	[0.0297]
Black	-0.0188	-0.0304	0.0523	0.0400	-0.0926	0.110**	-0.110	0.102*
	[0.0334]	[0.0335]	[0.0457]	[0.0458]	[0.0675]	[0.0524]	[0.0677]	[0.0526]
Hispanic	-0.0436	-0.0542	-0.0284	-0.0400	0.0851	-0.0644	0.0651	-0.0743
	[0.0355]	[0.0355]	[0.0450]	[0.0451]	[0.0717]	[0.0532]	[0.0720]	[0.0534]
Other Race	-0.0480	-0.0569	-0.0594	-0.0700		-0.0728		-0.0834*
	[0.0427]	[0.0427]	[0.0547]	[0.0547]		[0.0506]		[0.0504]
Student SAT	2.49e-05	1.86e-06	9.19e-05	6.68e-05	4.31e-05	0.000122	7.84e-06	0.000111
	[6.87e-05]	[6.88e-05]	[8.82e-05]	[8.85e-05]	[0.000140]	[0.000104]	[0.000142]	[0.000104]
High School GPA	0.126***	0.129***	0.118***	0.122***	0.330***	-0.0611*	0.333***	-0.0594*
	[0.0216]	[0.0216]	[0.0294]	[0.0294]	[0.0440]	[0.0344]	[0.0440]	[0.0344]
Parents' Education	-0.00622	-0.00703*	-0.00353	-0.00430	0.0303***	-0.0139**	0.0287***	-0.0144**
	[0.00408]	[0.00408]	[0.00512]	[0.00513]	[0.00832]	[0.00610]	[0.00833]	[0.00611]
Log(Parental Income)	0.0433***	0.0404***	0.0469***	0.0432***	0.0551**	-0.00162	0.0508**	-0.00454
	[0.0121]	[0.0121]	[0.0155]	[0.0155]	[0.0239]	[0.0182]	[0.0240]	[0.0183]
Log(Total Expenditures/FTE)	0.0383***	0.0290*	0.0417**	0.0340*	0.0751**	0.0239	0.0520	0.0215
	[0.0148]	[0.0151]	[0.0178]	[0.0181]	[0.0302]	[0.0214]	[0.0343]	[0.0219]
Avg Exp. Of Applied Schools		-2.97e-08		-3.38e-08			1.85e-07	-4.70e-08
		[3.08e-08]		[2.95e-08]			[3.70e-07]	[4.02e-08]
# of College Apps.		0.0156***		0.0145***			0.0229***	0.00831
		[0.00416]		[0.00509]			[0.00851]	[0.00610]
Avg. Hours worked/Week					-0.00573***		-0.00538***	
					[0.00123]		[0.00123]	
Observations	4350	4350	2510	2510	4460	4460	4460	4460

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1 All models also control for occupation and include a constant, and flags for missing high school GPA and SAT scores.

Table 3: Log Earnings regressions from Heckman Selection models for graduates, using ELS:02 to examine how category of spending affects earnings.

	(1)	(2)	(3)	(4)
Log(Instructional Exp./FTE)	0.0446	0.0443	0.0399	0.0388
	[0.0607]	[0.0656]	[0.0659]	[0.0658]
Log(Student Services Exp./FTE)		0.000159	-0.00200	-0.00698
		[0.0240]	[0.0243]	[0.0283]
Log(Academic Support Exp./FTE)			0.0179	0.0186
			[0.0324]	[0.0326]
Log(Research Exp./FTE)				-0.00192
				[0.00606]
Log(Total Exp./FTE)	-0.0217	-0.0214	-0.0328	-0.0247
	[0.0525]	[0.0536]	[0.0576]	[0.0615]
Observations	4440	4440	4440	4440

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1 All models also control for gender, race, HS GPA, students' SAT score, parents' education, logged parental income, occupation and include a constant, and flags for missing high school GPA and SAT scores. All models are the second stage of a Heckman Selection model where the first-stage predicts the probability of graduating and appearing in the earnings sample. All models also control for selection using the average expenditures at schools to which the student applied, and the number of applications sent.

Table 4: Heckman Selection models for log earnings using ELS:02, allowing the effect of spending to differ by parental education or income, or student ability.

	(1)	(2)	(3)	(4)	(5)	(6)
Group for interactions:	***Log(Parental Income)***		***Parents' Education***		***Ability***	
	Graduated	**Log(Salary)**	**Graduated**	**Log(Salary)**	**Graduated**	**Log(Salary)**
HS GPA	0.332***	-0.0534	0.330***	-0.0535	0.824**	-0.406*
	[0.0442]	[0.0342]	[0.0442]	[0.0342]	[0.332]	[0.235]
Parents' Education	0.0291***	-0.0151**	0.290**	-0.0925	0.0294***	-0.0152**
	[0.00836]	[0.00609]	[0.127]	[0.0904]	[0.00835]	[0.00609]
Log(Parental Income)	0.892**	-0.348	0.0488**	-0.00399	0.0463*	-0.00204
	[0.390]	[0.282]	[0.0241]	[0.0182]	[0.0240]	[0.0182]
Log(Instructional Exp./FTE)	0.281	0.106	0.378	0.0800	-0.0822	0.0945
	[0.788]	[0.587]	[0.376]	[0.282]	[0.195]	[0.146]
Group * Log(Instructional/FTE)	-0.0196	-0.00587	-0.0201	-0.00269	0.0467	-0.0187
	[0.0690]	[0.0511]	[0.0232]	[0.0170]	[0.0585]	[0.0432]
Log(Student Services Exp./FTE)	0.455	-0.569	0.0724	-0.135	0.222*	-0.00131
	[0.497]	[0.367]	[0.237]	[0.179]	[0.128]	[0.0942]
Group * Log(Student Services Exp./FTE)	-0.0347	0.0494	-0.00109	0.00814	-0.0552	-0.00155
	[0.0436]	[0.0321]	[0.0148]	[0.0111]	[0.0403]	[0.0294]
Log(Academic Support Exp./FTE)	0.512	0.0925	0.116	-0.0396	0.153	-0.183*
	[0.564]	[0.426]	[0.267]	[0.201]	[0.128]	[0.0961]
Group * Log(Academic Supp./FTE)	-0.0464	-0.00637	-0.00792	0.00359	-0.0535	0.0667**
	[0.0494]	[0.0372]	[0.0167]	[0.0124]	[0.0400]	[0.0297]
Log(Research Exp./FTE)	0.0829	-0.147*	0.0342	-0.0358	0.0703***	-0.0106
	[0.103]	[0.0796]	[0.0466]	[0.0347]	[0.0256]	[0.0193]
Group * Log(Research/FTE)	-0.00525	0.0129*	-0.000740	0.00217	-0.0157*	0.00282
	[0.00915]	[0.00701]	[0.00296]	[0.00218]	[0.00808]	[0.00598]
Log(Total Exp./FTE)	-0.0749	-0.0329	-0.0692	-0.0275	-0.0694	-0.0301
	[0.0859]	[0.0615]	[0.0872]	[0.0617]	[0.0865]	[0.0617]
Observations	4440	4440	4440	4440	4440	4440

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1 All models also control for gender, race, students' SAT score, the average expenditures at applied schools, the number of applications sent, and include a constant, and flags for missing high school GPA and SAT scores. First-step selection models also include the average number of hours worked during the first-year of college, and the logged earnings models include controls for occupation.

Table 5: Log Earnings regressions from Heckman Selection models for non-graduates, using ELS:02 to examine how category of spending affects earnings, and how this impact differs by parental income, education, and student ability

	(1)	(2)	(3)	(4)
	Base Model	**Parental Income Interaction**	**Parents' Education Interaction**	**Ability Interaction**
HS GPA	0.311***	0.312***	0.309***	-0.241
	[0.0417]	[0.0417]	[0.0417]	[0.322]
Parents' Education	0.00465	0.00379	0.176	0.00457
	[0.00804]	[0.00806]	[0.122]	[0.00801]
Log(Parental Income)	0.0729***	0.346	0.0726***	0.0708***
	[0.0233]	[0.391]	[0.0233]	[0.0232]
Log(Instructional Exp./FTE)	0.109	0.308	0.585*	-0.232
	[0.0846]	[0.786]	[0.344]	[0.177]
Group * Log(Instructional/FTE)		-0.0168	-0.0312	0.114**
		[0.0695]	[0.0216]	[0.0544]
Log(Student Services Exp./FTE)	0.0481	0.584	-0.197	0.104
	[0.0365]	[0.496]	[0.219]	[0.121]
Group * Log(Student Services Exp./FTE)		-0.0472	0.0160	-0.0203
		[0.0438]	[0.0139]	[0.0388]
Log(Academic Support Exp./FTE)	0.0403	-0.312	0.0768	0.135
	[0.0422]	[0.529]	[0.248]	[0.119]
Group * Log(Academic Supp./FTE)		0.0313	-0.00254	-0.0333
		[0.0467]	[0.0157]	[0.0381]
Log(Research Exp./FTE)	0.0107	6.39e-05	-0.0302	0.0589**
	[0.00761]	[0.0874]	[0.0435]	[0.0239]
Group * Log(Research/FTE)		0.000968	0.00266	-0.0163**
		[0.00779]	[0.00282]	[0.00770]
Log(Total Exp./FTE)	-0.119	-0.124	-0.1000	-0.111
	[0.0830]	[0.0833]	[0.0835]	[0.0832]
Observations	4450	4450	4450	4450

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1 All models also control for gender, race, students' SAT score, the average expenditures at applied schools, the number of applications sent, and include a constant, and flags for missing high school GPA and SAT scores. First-step selection models also include the average number of hours worked during the first-year of college, and the logged earnings models include controls for occupation.

Table 6: Heckman Selection models for whether employed Full-Time in 2011 using ELS:02, allowing the effect of spending to differ by parental education or income, or student ability.

	(1)	(2)	(3)	(4)
	Base Model	Parental Income Interaction	Parents' Education Interaction	Ability Interaction
HS GPA	0.0516	0.0471	0.0476	0.0937
	[0.119]	[0.123]	[0.121]	[0.510]
Parents' Education	-0.0410***	-0.0409***	0.0769	-0.0413***
	[0.0150]	[0.0151]	[0.174]	[0.0152]
Log(Parental Income)	0.0895**	0.277	0.0878**	0.0893**
	[0.0353]	[0.472]	[0.0358]	[0.0353]
Log(Instructional	0.0532	1.868*	0.571	0.262
Exp./FTE)	[0.124]	[1.081]	[0.535]	[0.284]
Group *		-0.158*	-0.0315	-0.0679
Log(Instructional/FTE)		[0.0938]	[0.0315]	[0.0813]
Log(Student Services	0.0428	-1.186*	-0.0622	-0.0653
Exp./FTE)	[0.0576]	[0.658]	[0.356]	[0.179]
Group * Log(Student		0.107*	0.00654	0.0351
Services Exp./FTE)		[0.0573]	[0.0215]	[0.0546]
Log(Academic Support	0.0290	-0.655	-0.184	-0.0888
Exp./FTE)	[0.0624]	[0.824]	[0.398]	[0.202]
Group * Log(Academic		0.0592	0.0126	0.0373
Supp./FTE)		[0.0718]	[0.0240]	[0.0615]
Log(Research Exp./FTE)	0.00902	-0.0147	-0.0622	-0.00431
	[0.0133]	[0.151]	[0.0706]	[0.0390]
Group *		0.00203	0.00439	0.00415
Log(Research/FTE)		[0.0132]	[0.00424]	[0.0115]
Log(Total Exp./FTE)	-0.217*	-0.211*	-0.214*	-0.212*
	[0.117]	[0.117]	[0.117]	[0.117]
Observations	5080	5080	5080	5080

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1 All models also control for gender, race, students' SAT score, the average expenditures at applied schools, the number of applications sent, and include a constant, and flags for missing high school GPA and SAT scores. First-step selection models also include the average number of hours worked during the first-year of college, and the logged earnings models include controls for occupation.

Table 7: Heckman Selection models for whether job in 2011 matches field of study in college using ELS:02, allowing the effect of spending to differ by parental education or income, or student ability.

	(1)	(2)	(3)	(4)
		Parental Income	Parents' Education	Ability
	Base Model	Interaction	Interaction	Interaction
HS GPA	0.124	0.138	0.102	0.398
	[0.140]	[0.143]	[0.141]	[0.541]
Parents' Education	0.00312	0.00411	-0.00322	0.00189
	[0.0152]	[0.0153]	[0.186]	[0.0153]
Log(Parental Income)	0.0342	0.0637	0.0329	0.0312
	[0.0410]	[0.510]	[0.0414]	[0.0406]
Log(Instructional	0.243*	0.724	1.007*	0.848***
Exp./FTE)	[0.127]	[1.099]	[0.548]	[0.285]
Group *		-0.0420	-0.0480	-0.201**
Log(Instructional/FTE)		[0.0955]	[0.0326]	[0.0823]
Log(Student Services	0.0285	-0.0323	-0.698**	-0.330*
Exp./FTE)	[0.0591]	[0.658]	[0.349]	[0.177]
Group * Log(Student		0.00528	0.0450**	0.117**
Services Exp./FTE)		[0.0572]	[0.0213]	[0.0546]
Log(Academic Support	-0.198***	-0.775	-0.352	-0.409**
Exp./FTE)	[0.0636]	[0.831]	[0.386]	[0.186]
Group * Log(Academic		0.0503	0.00902	0.0686
Supp./FTE)		[0.0725]	[0.0237]	[0.0581]
Log(Research Exp./FTE)	0.0180	0.149	-0.0844	-0.0552
	[0.0142]	[0.155]	[0.0695]	[0.0393]
Group *		-0.0116	0.00635	0.0234**
Log(Research/FTE)		[0.0135]	[0.00422]	[0.0115]
Log(Total Exp./FTE)	-0.208*	-0.204*	-0.189	-0.196
	[0.121]	[0.120]	[0.122]	[0.122]
Observations	5150	5150	5150	5150

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1 All models also control for gender, race, students' SAT score, the average expenditures at applied schools, the number of applications sent, and include a constant, and flags for missing high school GPA and SAT scores. First-step selection models also include the average number of hours worked during the first-year of college, and the logged earnings models include controls for occupation.

Table 8: Log Earnings regressions from Heckman Selection models for graduates, using NELS:88 to examine how category of spending affects earnings, and how this impact differs by parental income, education, and student ability

	(1) Descriptive Stats	(2) Base Model	(3) Income	(4) Education	(5) Ability
HS GPA	2.24	-0.111***	-0.110***	-0.110***	-0.372***
	(1.52)	[0.0288]	[0.0288]	[0.0288]	[0.129]
Parents' Education	14.64	-0.0226***	-0.0225***	-0.0446	-0.0222***
	(4.41)	[0.00579]	[0.00580]	[0.0488]	[0.00578]
Log(Parental Income)	9.88	-0.0161	-0.0522	-0.0154	-0.0148
	(3.70)	[0.0286]	[0.0628]	[0.0286]	[0.0285]
Log(Instructional Exp./FTE)	9.2	0.0503	0.163	0.267*	0.0779
	(0.639)	[0.0565]	[0.117]	[0.148]	[0.0785]
Group * Log(Instructional/FTE)			-0.0111	-0.0149*	-0.00890
			[0.0102]	[0.00892]	[0.0239]
Log(Student Services Exp./FTE)	7.32	0.0270	-0.00964	-0.154*	0.00482
	(0.642)	[0.0279]	[0.0749]	[0.0928]	[0.0471]
Group * Log(Student Services Exp./FTE)			0.00365	0.0123**	0.0116
			[0.00704]	[0.00602]	[0.0170]
Log(Academic Support Exp./FTE)	7.67	0.0257	-0.120	-0.0941	-0.0479
	(0.775)	[0.0327]	[0.0954]	[0.118]	[0.0557]
Group * Log(Academic Supp./FTE)			0.0144	0.00782	0.0324
			[0.00896]	[0.00768]	[0.0206]
Log(Research Exp./FTE)	5.92	0.00224	0.00434	-0.0170	0.000877
	(3.353)	[0.00575]	[0.0151]	[0.0188]	[0.00998]
Group * Log(Research/FTE)			-0.000227	0.00136	0.000480
			[0.00144]	[0.00124]	[0.00368]
Log(Total Exp./FTE)	10.41	-0.0727	-0.0707	-0.0675	-0.0772
	(0.742)	[0.0535]	[0.0535]	[0.0536]	[0.0534]
Observations	3630	3160	3160	3160	3160

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1 All models also control for gender, race, students' SAT score, the average expenditures at applied schools, the number of applications sent, and include a constant, and flags for missing high school GPA and SAT scores. First-step selection models also include the average number of hours worked during the first-year of college, and the logged earnings models include controls for occupation.

Table 9: Effect of increasing expenditures for schools at the 25th percentile of spending

		25th - 50th Percentile	25th-75th percentile
Instruction	Graduates:	1.50%	4.56%
	Non-Graduates:	4.07%	12.54%
Academic Support	Graduates:	0.97%	2.93%
	Non-Graduates:	2.04%	6.16%
Student Services	Graduates:		
	Non-Graduates:	2.80%	8.56%

Note: Estimates are calculated using the percentage increase in each type of spending required to move a school from the 25th percentile to the given higher percentile, and the effects are taken from Tables 3 and 5. These calculations assume total spending is held constant, so all increases in these spending categories come from decreases in non-educational spending.