Who Benefits Most from a University Degree?:

A Cross-National Comparison of Selection and Wage Returns in the US, UK, and Germany

Jennifer Flashman
Yale University
jennifer.flashman@yale.edu

Renee Reichl Luthra
Institute for Social and Economic Research
University of Essex
rrluthra@essex.ac.uk

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Abstract

Given limited resources and an extended recession, it is critical to understand what is gained from investments in post-secondary education. In this paper, we study the heterogeneous returns to post-secondary education across three unique country contexts. Drawing on panel data and matching techniques, we compare parallel analyses of the US, the UK, and Germany to discover how wage returns to a college degree differ depending on individuals' propensities to complete university. Studying men in their later careers, we find important variation across countries. In both the UK and Germany, we find negative selection into university; those least likely to complete benefit most from completion. By contrast, in the US, at later ages, those most likely to complete benefit most from completion. In supplementary analysis, we show that at least some of this variation can be explained by differences in the size and prevalence of academic post-secondary sectors in each country.

Introduction

In the past four decades, the percentage of young adults eligible for and attending higher education rose dramatically. A recent cross-national study of higher education noted that, across the 15 countries under consideration, both eligibility for and attendance in higher education doubled for cohorts born between 1940 and 1970 (Shavit et al., 2007). This rapid expansion is mirrored in the increasing proportion of educational spending devoted to higher education. Public expenditure on tertiary education currently comprises over 30% of the total spending on education in OECD countries, amounting to an average of 1.5% of total GDP (OECD, 2011). Given a limited amount of resources and the real prospect of an extended recession in both the United States and Europe, it is critical to understand what is gained from the often substantial investments in post-secondary education by both individuals and the state.

A vast amount of literature in both sociology and economics is focused on identifying the benefits to higher education (Brand and Xie, 2010, Hout, 2012, Manski and Wise, 1983, Card, 1999, Carneiro et al., 2011). Early work primarily studies the identification problem. How do we estimate the causal effect of higher education when we cannot observe the counterfactual? How would Sam's income differ if he had completed college, when in fact he did not? How would Joe's income differ if he had not completed a college degree, when in fact he did? More recently, the focus of this literature has shifted to issues of heterogeneous returns. Does everyone benefit equally from a university degree and if not, who benefits most? The answer to this question seems to depend greatly on the approach. Using nonparametric matching techniques recent research reports that those who with the *lowest propensity* to complete a college degree gain the most from having one (Dearden et al., 2004, Brand and Xie, 2010). By contrast, Carneiro et al (2011) combine matching techniques within a latent class model of the desire to attend college and show that students positively select into college. Their findings suggest that policies which encourage college attendance for those least likely to attend will likely have lower economic returns. While the debate continues (Hout, 2012), an important and unanswered question is: why? Why do we observe heterogeneous returns to education? One way to examine this question is through cross-national research. The tracking regimes, opportunities to enter higher education, costs of higher education, and alternatives to higher education differ widely across countries. How do these institutional differences influence heterogeneous returns to education?

This paper utilizes a cross-national approach to engage with these questions, asking: 1) Who benefits the most from a university degree in the US, Germany, and the United Kingdom? and 2) How do patterns of heterogeneity in these returns differ across country contexts? Drawing on panel data and matching techniques, we conduct parallel analyses for Germany, the United Kingdom and the United States to explore the co-variation between the propensity to complete a university education and its economic returns. The educational characteristics of institutions in these three countries vary widely and this variation should lead to different returns to a university degree. By taking this approach, we can begin to discover in what educational contexts those most likely to benefit from a university degree actually attain one.

Background

Selection and Heterogeneous Returns to a University Degree

Estimating the income returns to education poses several challenges. A large methodological literature examines the possible endogeneity of education decisions (Manski and Wise 1983; Card 1999; 2001; Brand and Xie 2010). If workers who complete post-secondary schooling systematically differ from those who do not in unobserved ways that influence income, then the estimated returns to post-secondary schooling will be biased. Although researchers agree that bias exists, it remains unclear whether unmeasured selection upwardly or downwardly biases estimates. On the one hand, according to a utility maximization model, those most likely to benefit financially from a college[1] education should be more likely to complete post-secondary schooling, leading to positive selection and upwardly biased estimates of the returns to college (Carneiro, Hansen, and Heckman 2003; Heckman, Urzua, and Vytlacil 2006; Willis and Rosen 1979)

On the other hand, sociologists argue that many non-economic factors, such as class and gender norms (Buchmann et al., 2008), informational inequities (Grodsky and Jones, 2007), or social network composition (Perna and Titus, 2005), influence post-secondary attendance and completion decisions. As a result, college attendance and completion may be disconnected from ability, particularly among the most advantaged individuals, and those most likely to complete college may not be those who would gain the most in terms of economic returns. In other words, young adults may be *negatively* selected into college in terms of the eventual economic returns.

Underlying this discussion is the assumption that the returns to a college education are heterogeneous: some graduates stand to gain more from their degree than others. From a policy perspective, one would want to ensure that those who stand to gain the most from a degree are most encouraged to attend. Thus, even in the absence of omitted variables, a simple regression predicting wages or earnings would be insufficient to direct policy because it could not identify which groups of people experience greater returns than others (Black et al 2008; Tuor and Backes-Gellner 2008; Heckman et al 2008).

Recent research from the US and the UK simultaneously addresses two related issues: first, whether the economic returns to a degree are heterogeneous, and second, whether heterogeneity in returns is a function of the propensity to attend (Brand and Xie, 2010). These authors demonstrate negative selection into college: individuals who are *least* likely to complete college receive the greatest earnings returns to a college education (Brand and Xie 2010). Brand and Xie (2010) utilize propensity score matching to simultaneously account for multiple sources of heterogeneity in the income returns to post-secondary education. They show, in the US case, that the propensity to complete college and income returns are negatively associated. They further demonstrate that the negative association between propensity to complete college and income returns is constant throughout the life course, as well as for earlier and later birth cohorts. Their results are corroborated with smaller experimental studies that

[1] Throughout this article, we use college and university interchangeably to refer to academic post-secondary education leading to a bachelor's degree or the equivalent in the particular country context.

show that expanding University access to students who would not otherwise attend (lower performing women or minorities, for instance) resulted in more positive labor market returns to college for these students (Maurin and McNally, 2008, Bowen and Bok, 1998, Attewell and Lavin, 2007).

Although controversial (Carneiro et al., 2011) this body of work suggests that despite a massive recent growth in higher education, the US needs to further continue its efforts to expand access to higher education, particularly for the least advantaged individuals. However, the United States is a particularly unique context. The monetary costs of college are high while the non-monetary barriers to college attendance are relatively low. With an underdeveloped vocational education system, there are few non-academic post-secondary education options. Primary and secondary schools are not formally tracked and the informal tracking tends to group students based on race and socioeconomic status rather than aptitude, ability, and desire (Lucas, 1999). And finally, college attendance has become a norm, particularly among the middle class (Grodsky and Riegle-Crumb, 2010). Together, these features of the American schooling system may strongly encourage the negative selection observed by Brand and Xie. However, it is impossible, without a comparative study, to determine whether it is these unique institutional characteristics that contribute to this pattern of negative selection.

In this article, we replicate the Brand and Xie (2010) analysis in two additional country contexts: the United Kingdom and Germany. These countries represent very different governmental and educational contexts compared to the US. Below we describe the educational systems of each country and key characteristics of the countries that may lead to differences in the returns college graduates receive across countries.

Country Contexts

Early rigid tracking and a highly developed vocational track characterize the German educational system. Between ages 10 and 12 (depending on the state) teachers, parents, and students together decide which educational track students should enter: Gymnasium, Realschule, or Hauptschule[2]. These tracks are housed in separate schools and prepare students for different post-secondary activities. Gymnasium is the highest level, preparing students for the Abitur exam—a requirement for entrance into university. Realschule is a less academic alternative to attending Gymnasium. Students typically go on to a higher vocational school for post-secondary education. Finally, Hauptschule is the lowest educational track in Germany. Hauptschule typically leads to continuing part-time vocational education and/or an apprenticeship. In 2006, approximately 40% of German secondary students were enrolled in an academic program, while the other 60% were enrolled in vocational programs. Transition to academic tertiary education is highly selective – in the same year, only 35% of German secondary students transitioned into tertiary education, compared to 57% in the UK and 64% in the US (OECD 2010). Most universities in Germany charge nominal fees and are state run. Additional cost of living assistance is available to all tertiary level students; prior to 1983 cost of living for lower income families was state supported and after 1983 half of this support was to be repaid in mortgage repayments after

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[2] Other, less common secondary school options include *Gesamtschule,* an integrated secondary school including all tracks, and other private options such as *Waldorfschule*.

graduation. The number of years it takes to attain a bachelor's degree depends on the subject studied; however, the average time to degree is usually around 12 semesters or 6 years, significantly higher than in the US or the United Kingdom.

In the United Kingdom (excluding Scotland and Northern Ireland), education is compulsory for all children between ages 5 to 16. Compulsory education is free with the important exception of independent or public schools, which account for 6% of students and have much higher than average college attendance and completion rates, and higher eventual earnings. At 16, students may choose to continue with their academic education and complete A-Level exams (required for entrance into university), enter a further education institution to pursue vocational training, or leave school completely. At the secondary level, vocational and academic programs are often housed in the same institutions. Almost 60% of upper secondary students continue with the academic program. Vocational training is less developed than in Germany, with only 31% of UK youth enrolled in vocational upper secondary education, in comparison to 60% of Germans in 2006. Tuition fees for University were not introduced in the UK until 1998. The 1962 Education Act guaranteed tuition and maintenance support from Local Education Authorities for all students pursuing higher education. This support declined in real value throughout the 1980s, and in 1990/1991 a student loan scheme was introduced and maintenance grants phased out (Cheung and Egerton, 2007). Acceptance rates for University have hovered around 75% since the mid-1990s, however, only about half of pupils in 2009 obtained the two or more A-level certifications necessary to apply for a University position. A bachelor's degree typically takes 3 years to complete. A tertiary vocational program typically takes 1-2 years. University attendance and completion increased especially rapidly in the UK in the past decade; in 2009 45% of 25-29 year-olds in the UK completed a university degree, as compared to only 26% in 2000.

Compulsory education in the United States is likewise free until the age 18, and students are informally tracked throughout primary and secondary education in comprehensive schools. For the past 30 years, private school enrollment has remained fairly steady at 10% of the primary and secondary school students. At the age of 18, students who successfully complete the 12th grade and obtain a high school diploma are eligible for enrollment in post-secondary education. Although the United States was a leader in college attendance and completion rates throughout the past four decades, expansion has flatlined in the past ten years, especially in terms of college completion, and as of 2009 40% of 25-29 year olds have completed college. In contrast to Germany and the UK, which offer two main types of post-secondary education, vocational and academic, the US system is characterized as *diversified* (Meek 1996), including in its lower post-secondary strata, programs that are vocational as well programs that lead to academic qualifications, such as two-year colleges. Due in part to the plethora of options, the US post-secondary system affords greater access, with high enrollment rates. However, the relatively high tuition costs and lack of public support for maintenance costs lead to lower conditional completion rates (Lau, 2003) than in the UK and Germany. Vocational training in the United States is also weaker and less often linked to apprenticeship and job opportunities than in Germany (Shavit and Müller, 1998).

This brief overview of the three country systems suggests three major areas of differentiation between the country contexts. These differences are summarized in table 1. The first is the financial calculus of a University degree. The costs—both the direct costs of tuition and maintenance as well as the

opportunity costs of lost wages while in education—differ dramatically between the three countries. Both the direct and opportunity costs are lowest in the United Kingdom due to the highly subsidized University attendance and the short average time to degree. Similarly, the direct costs of a University degree in Germany are essentially zero, but the longer time to degree, an average of 6 years, substantially increases the opportunity costs. Finally, in the US, opportunity costs are on par with Germany even though the time to degree is shorter, due to higher median earnings. A crude calculation of the opportunity costs of obtaining a University degree in each country is included in the second row of table 1. The second area of differentiation is the level of selection into university. Whereas the UK and Germany had relatively small numbers pursuing a university degree in the 1970s and early 1980s, and these students were chosen through highly selective standardized exams, higher education in the US was significantly less selective. Eligibility was determined merely by high school completion. Costs rather than institutional barriers (i.e. entrance exams or acceptance into university) led the US population of college completers to be selected. A final source of variation lies in the economic returns to a college degree: highest in the US, and lowest in Germany. This variation is due as much to taxation differences between the three countries as to the actual pre-tax wage differences.

[TABLE 1 ABOUT HERE]

Hypotheses

We expect that institutional differences in the three countries considered here will influence the direction and strength of selection into college attendance and completion.

Vocational Training and Tracking

As can be seen in table 1, there is considerable variation across our three countries in the selectivity of University completion. Germany is the most selective. Although 86% of Germans born in the late 1950s and early 1960s finished upper secondary school, only 16% went on to complete a University degree, with a further 16% who finished a vocational post-secondary or nonacademic tertiary degree. University education in Great Britain is similarly selective; however, only 67% of the population completed upper secondary school, and of these nearly a third completed University, whereas 12% completed a vocational degree. In contrast, 30% of US adults born between 1954 and 1963 earned a college degree, of the 89% who completed high school. In the US, only 10% of those born during these years obtained vocational training.

In countries with developed vocational schooling programs and where vocational education leads clearly into a job, we expect that selection into college completion will be positive rather than negative. With more extensive post-secondary training options, the relative costs of pursuing academic, rather than vocational, post-secondary education will be higher and more transparent than in a country where vocational education is undeveloped and less connected with work opportunities. Additionally, a larger vocational education program should diminish stigma associated with pursuing vocational rather than academic post-secondary education, even among the more advantaged. Together, these factors should lead to more positive selection among the college educated.

By contrast, rigid tracking from an early age has been documented to lead to greater performance inequality (Hanushek and Wößmann, 2006), which should lead to negative selection. Because track placement is often highly correlated with socioeconomic background, and track placement in rigidly tracked countries determines an individual's eligibility for university attendance, the privileged will benefit from such systems, regardless of skill, ability, and aptitude, leading to negative selection.

For the countries examined in this paper, these two factors can be conceived as countervailing effects. The country with the weakest vocational system, the United States, is also the country with the weakest tracking, characterized by comprehensive secondary schools until the age of 18. By contrast, Germany's highly developed vocational system is countered by early, highly stratified tracking at the age of 10 that has been shown to increase class reproduction (Pfeffer, 2008). The UK represents something of a middle ground, with less distinct tracking and weaker vocational training than Germany but more selective University eligibility requirements and stronger vocational training than in the United States.

Costs

Government subsidization of post-secondary education may influence selection in either direction – it may increase positive selection in attendance and completion by allowing those who stand to benefit most to attend, regardless of financial constraints; on the other hand, it is also possible that if the costs of post-secondary education are unilaterally reduced, those who have less to gain may still pursue post-secondary training, negatively influencing selection.

As can be seen from table 1, the costs of a college degree vary widely between the three countries. In each country, the cost of a college degree borne by students and their families was considerably less in the cohorts under consideration here than they are today; still there is substantial variation with the lack of subsidization in the US on the one hand and the state subsidized higher education systems of the UK and Germany on the other. For instance, in 1976 the average cost of tuition and room and board at a public University in the US was $6,877 (in 2006 dollars); in contrast, higher education was essentially free for UK and German students during this same time period. However, the lost wages due to a longer average time to degree further sets Germany apart from the UK.

In terms of costs, then, the US stands out as the highest cost country, followed by Germany, and finally the UK, with the lowest opportunity and direct financial costs for higher education.

Selection

The level of academic and nonacademic selectivity into Universities may also have negative or positive association with the level of returns to college completers in the labor market. On one hand, only allowing the best performers into a University may enhance positive selection; if only the best and most able select into university, these future workers will be most able to put their human capital to work in terms of wage returns in later life. On the other hand, if pre-college performance is largely an indicator of socioeconomic background, strongly "meritocratic" selection mechanisms may only serve to reproduce class inequalities, leading to greater negative selection into college completion and diminished labor market returns.

Germany stands out again as the most selective; however the United Kingdom was also highly selective for the cohorts under observation here. The fact that relatively few students obtained the secondary credentials—A-levels in the UK or Abitur in Germany—necessary to attend Universities suggest that the selection process may occur informally in these countries, such that students self select prior to the entrance exams rather than in response to them. In contrast, given the diversity of colleges with different entrance requirements, the US does indeed stand true to the adage that there is a "college for everyone." Selectivity into college is less tightly linked to former academic performance in the US compared to in Germany and the UK, in concurrence with the higher numbers attending.

Returns

The level of returns expected from a University degree should influence selection. If the returns are extremely high, even those who stand to gain less in terms of wages, relatively speaking, will still be motivated to attend and complete college. If those who would gain less also are more likely to attend for other reasons, for instance greater financial resources, then higher returns should negatively influence selection. Higher returns should also influence negative selection through noneconomic mechanisms. If higher wage returns to a college degree are correlated with higher noneconomic incentives to college completion such as social prestige, due to a high societal valuation of the signaling worth of a college degree, than we should also expect higher returns to yield more negative selection. Finally, returns to a college degree are also strongly correlated with the availability of vocational training options discussed above. If vocational training systems are well developed and linked to high paying occupations, than the relative worth of a college degree will be less than if the only post-secondary option is an academic university degree. If there are other legitimate and valued ways of accumulating human capital beyond University attendance, then University attendance may lose some of its unique signaling power. We therefore expect that higher returns to a college degree should be negatively associated with selectivity.

Due to its well-developed vocational system as well as its more progressive taxation system, the relative earnings of University graduates are much lower in Germany than in the US, with the UK again as a middle ground between the two.

In the empirical analysis to follow, we compare selectivity of a college degree across these three country contexts. Given the number of possible selection mechanisms outlined above, we cannot address each of these hypotheses independently. For instance, the positive effect of free University tuition on selectivity in Germany and the UK might be offset by the more rigid tracking and stricter academic requirements for attendance; similarly, any positive effect of the greater access to University in the US on college completion selection might be offset by the much higher relative wages of college graduates in the US relative to Germany and the UK. However, our findings provide a first response to the more fundamental question of whether these institutional differences create cross-national variation in selection at all. In a series of supplementary analyses, we then further explore possible mechanisms for the variation observed, by comparing cohorts *within* the UK to assess the importance of University selection, and comparing selection into University to selection into other forms of post-secondary education in Germany to assess the role of a developed vocational system. Again, although these

analyses are not definitive proof of any single hypothesis, they provide insight into possible mechanisms underlying the cross-national selection observed.

Methods

We begin with a simple analysis of the wage returns to a college education in each country separately. The level of an individual's wages (*W*) is a consequence of whether that individual completed college (*T*), a series of covariate controls (*X*) that affect both whether he attends college and wages, and an error term (*u*), or:

$$W_i = \beta \cdot T_i + \gamma \cdot X_i + u_i \tag{1}$$

Where β represents the estimated average effect of completing college on wages. We make two important assumptions about this model in order to claim that β represents the causal effect of a college education on wages. First, we assume that those who attend and complete college are not different (in unmeasured ways) from those who do not. Second, we assume that those who complete college, *T*, all receive the *same* benefit for completion.

In this article we are interested in whether and how these effects may be heterogeneous across a population. Following Brand and Xie (2010) we relax the homogeneity assumption by first estimating individuals' different probabilities of completing college given a vector of covariates *X*.

$$P = p(T_i = 1|X) \tag{2}$$

If we again assume that the vector of covariates *X* captures all of the ways that those who complete college are different from those who do not complete college, then we can assign each individual *i* a propensity score *P* that describes his likelihood of completing college conditional on *X*.

Individuals are matched on their propensities to complete college and grouped into balanced strata. Within a propensity score strata (i.e. a group of individuals with similar propensities to complete college), some individuals completed college while others did not. We estimate a hierarchical linear model with these propensity score strata. In the level 1 equation we estimate individuals' wages comparing those who completed college with those who did not within each strata. The level 2 equation then estimates a linear trend of the level 1 results. A negative trend suggests that individuals who are least likely to complete college benefit more than individuals who are most likely to complete college. A positive trend suggests that those most likely to complete college benefit more than individuals least likely to complete college. No significant effect at level 2 suggests that the returns to a college degree do not vary depending on propensities to complete college.

Propensity score models, like all non-parametric models, cannot account for unobservable characteristics, and are therefore still susceptible to omitted variable bias. However, by utilizing very rich, longitudinal data, including measures of cognitive and academic ability normally unobserved, propensity matching models better simulate an experimental setting with control and treatment groups than standard OLS regression. Moreover, as the focus of our paper is on heterogeneous treatment—the returns to a college degree for high propensity strata relative to low propensity strata—our findings will

remain valid *even with* omitted variable bias as long as the omitted variables bias the strata in similar magnitudes and directions and as long as omitted variable bias is fairly similar across countries.

Propensity score matching models followed by hierarchical linear models identifying effects within strata and heterogeneous effects across strata are estimated using the user written command hte in Stata version 11 (Ben et al., 2007).

Although we cannot employ any direct statistical measure of the causes of variation in the returns to post-secondary education *across* countries (since we only study three countries), in our discussion section we discuss how differences may be related to institutional environments.

Data

The data requirements for this analysis are quite stringent; to properly measure the returns associated with post-secondary education, we require earnings information at an age when respondents can be expected to have settled into a career, as well as detailed background, behavioral, and educational information throughout the life course. To maximize comparability across countries, we rely on several data sources with substantial overlap in design and time period.

National Child Development Study

In the United Kingdom, we use data from the National Child Development Study (NCDS), a longitudinal study that surveyed all children born in one week in March of 1958 in England, Scotland and Wales (N=17,634). Eight waves of data have since been collected from the entire cohort at key ages throughout the life course, including at ages 7, 11, 16, 23, 33, 41/42, and 50/51. Participation has remained high across the survey waves: over two thirds of the original participants are retained at the most recent wave. Although originally collected to study the circumstances and outcomes of birth, the focus of the NCDS has shifted as respondents aged focusing on socioeconomic background, social development, and educational outcomes at younger ages, school leaving, the labor market, marriage, and fertility at older ages. The NCDS also includes important cognitive ability tests as well as detailed achievement information from all respondents. Given the wealth of educational information on respondents and high response rates, the NCDS provides an ideal look at the life-course of a cohort in the UK. To invoke time-order reasoning for causality, this analysis relies on variables observed in adolescence and early childhood to predict college completion, and focuses on wages when respondents are at ages 50/51 in 2008/9 (wave 8).

National Longitudinal Study of Youth

In the United States we use data from the 1979 National Longitudinal Study of Youth (NLSY). These are the same data used by Brand and Xie (2010). The NLSY is a nationally representative sample of individuals who were between 14 and 22 in 1979 (N=12,686). The sample of respondents was interviewed annually through 1994 and then every other year since. In 2010-11, 7,565 individuals responded to the survey, for a retention rate of 76 percent. With a focus on important life-course transitions, these data provide an abundance of information on respondents throughout their life

course, including cognitive ability tests, academic achievement, and socioeconomic background in adolescence, and educational attainment, occupation, and family in adulthood. To maximize comparability with the other surveys, we draw on variables from adolescence to predict college completion and focus on wages when respondents are 45-48 in 2010, the most recent data available.

National Education Panel Study

In Germany, we use data from the recently collected National Education Panel Study (NEPS). In contrast to the NCDS and NLSY, which are a long running single cohort studies, the NEPS is still in its beginning stages. Between 2007 and 2012, respondents from six cohorts were sampled and interviewed with the goal of creating a multi-cohort panel study. We focus here on the adult cohort. A random sample of register residents from birth cohorts between 1956 and 1988 was identified. Interviews occurred between 2007 and 2008 as part of the "Working and Learning in a Changing World" study (ALWA). 10,404 individuals were interviewed in this first data collection. In 2009/2010 a follow-up survey was conducted as part of NEPS with 6,572 of the original sample. This sample was freshened with 5,077 additional respondents sampled again from the register of residents. These new data widen the scope of the study to include those born between 1944 and 1955. The final sample is representative of the population in Germany born between 1944 and 1988 (N=11,649). Finally in 2010/2011 the willing respondents from the previous survey were re-surveyed (N=9,352). The focus of this study is on the educational histories and experiences of respondents and their subsequent occupational, family, and educational outcomes, making NEPS an ideal data source data for this project. NEPS also represents the only longitudinal panel study with sufficiently rich educational information and sample size for this analysis in Germany. Because this study is in its early stages, unlike the other two surveys, we must rely on retrospective data from respondents' childhood and adolescence. It is well known that retrospective data can be less reliable than contemporaneous data sources, however educational information is generally found to be one of the most reliably recalled characteristics (Dex 1995). Attitudinal information is less reliably recalled, and for this reason we utilize reports of educational attitudes from late adulthood, acknowledging that such reports may be endogenous to our treatment variable of interest, college attainment[3].

Samples

This analysis is interested in the wage returns to a university education. We therefore focus on the sample of individuals who 1) are at risk for completing a university degree, and 2) are employed but not self-employed. In the first case, this means that we exclude those who are highly unlikely to obtain the qualifications necessary for entrance into a University: high school drop-outs in the US, those with no credentials (GCSEs/O-levels) in the UK, and those who attended Hauptschule (the lowest track) in Germany. We also limit the analysis to men. Women present many challenges particularly in the age-range we study. They are more likely to exit the labor market for periods of time and more likely to work part time (Kalleberg et al., 2000). Because family, work, and education interact in important ways and

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[3] Omitting these attitudinal variables has little effects on the substantive findings, however these variables are retained to maintain consistency with the analyses of the other countries.

are often endogenously determined for women, we chose to simplify the analysis by focusing exclusively on men.

In the case of the UK, we exclude anyone who has not completed their GCSE's (formerly known as O-levels) by wave 5 (age 33). This excludes 634 respondents. Because the school system differs in important ways in Scotland, this analysis also excludes all respondents who grew up in Scotland (517). In order to maintain comparability across years, we exclude those who did not participate in both the wave 5 and the wave 8 surveys (1,757). Those missing data on academic achievement or cognitive ability are also excluded from the analysis (1,126). Finally, an additional 850 respondents are excluded because we did not have wage information for them at the time of the wave 8 survey. These sample restrictions leave us with a sample of 1,062 50/51 year-olds in 2008/9.

In Germany, we initially limit the sample to men born between 1948 and 1958 in West Germany (N=1,381). At the time of the wave 2 survey, these respondents are between 52 and 62 years old. As we mention above, Germany changed their policy on university costs in 1983. To capture the cohort who truly experienced a no cost university education, including living expenses, we chose to focus on those who were at least 25 by 1983. We only have wage information for those employed in 2010, during the second wave of the survey, excluding 235 respondents who are not employed. An additional 122 respondents are dropped because they did not report wages. Finally, those who attended the lowest track of school, hauptschule, are dropped, for a loss of 132 cases. These restrictions leave us with a sample of 892 men born between 1948 and 1958, observed in 2010.

In the US, we focus on the male respondents who were between 14 and 17 years old at the time of the 1979 survey. We limit the sample to those who completed high school by 1990, are employed with an income in 2010 (at ages 45-48), took the cognitive ability test before completing high school, and are not missing information on any of the variables used in the analysis. With these sample restrictions our final N is 1,178, with a loss of X- cases total.

Measures

We recreate the set of variables used in Brand and Xie (2010) with small modifications as necessitated by differences in survey instruments and country specific differences. Table 2 provides a description of the measures used to predict the propensity score strata for completing college across the three surveys. This set of variables including parental education and income, academic achievement, cognitive ability, parental encouragement, and tracking, is widely used to predict both educational attainment and occupational status in sociology (Raftery and Hout, 1993, McLanahan and Sandefur, 1994, Hauser et al., 1983). Although the measurement of most variables is straightforward, we discuss a few harmonizing issues across the surveys, and variations in measurement.

[INSERT TABLE 2 ABOUT HERE]

Race/ethnicity in the US includes two dummy variables indicating whether the respondent is Black and whether the respondent is Hispanic. Although there is important race/ethnic heterogeneity in the UK, only 14 respondents in our final sample are other than white or Caucasian, and are therefore marked

only by one dummy variable "other." In Germany, we capture race/ethnic minorities with a dummy variable indicating that the respondent (or his or her parent(s)) was born outside of Germany.

Several variables are used to capture respondents' social background including parental education, income, and occupation. Unfortunately, in the NEPS data, parental income when the respondent was a child or adolescent is not available. Parental income is included in the NLSY and NCDS analyses. Because occupational status plays a vital role to socioeconomic status, the development of norms, and access to educational opportunities, we include a series of dummy variables to indicate whether the respondent's father was in a managerial or professional occupation, a skilled occupation, or an unskilled occupation in all three surveys. An indicator of whether the respondent lived with two parents is included in all surveys but measured at different ages in each survey.

High school academic achievement in the NCDS is captured by respondents' scores on standardized math, reading and generalized ability tests. In the NEPS, respondents' self-reported grades at the time they left high school are used to measure academic achievement. We also include an indicator for whether the respondent passed the Abitur test, required for entrance into an academic university program. We do not have a direct measure of academic achievement in the NLSY. Track placement provides a proxy for achievement in the NLSY with an indicator of whether the respondent is enrolled in college preparatory curriculum. In the NCDS, those who have completed at least 2 A-level exams are considered to be college prep. In the NEPS, we use respondents' school type as an indicator of their track placement.

The quality of the cognitive ability tests available in each survey differs widely. The NLSY uses the Armed Services Vocational Aptitude Battery (ASVAB), a battery of 10 intelligence tests measuring knowledge and skill in areas such as mathematics and language. This test was administered to all respondents prior to high school completion. This is a widely used intelligence test used throughout the US (Hunter et al., 1985). The NCDS uses a general ability test to measure intelligence. It includes a verbal and non-verbal component. In contrast to the ASVAB, the general ability test was developed for the survey as a survey instrument when respondents were 11 years old, however it correlates highly with IQ-tests administered in late adolescence (Douglas 1967). The third wave of the NEPS includes a similar general ability test to capture respondents' cognitive abilities, unfortunately, this data is not available at the time of writing. In the future, we plan to replicate our results here including the general ability test scores, acknowledging however that ability scores gathered after completing education are likely endogenous to educational attainment.

As we mention earlier, all background variables and achievement variables are retrospective reports in the NEPS data whereas in both the NCDS and NLSY these are reported when respondents are children and adolescents. It is well known that recall increases error and weakens the explanatory power of social background variables (Hauser et al., 1983). Unfortunately, this may make our propensity score models for Germany weaker indicators of actual propensities to complete University than for the UK and US, which utilize contemporaneous measures. This weakness will likely be further exacerbated by the omission of cognitive ability and parental income in the German data.

Dependent Variable

In the level 1 HLM analysis, we predict respondents' wages. To measure wages in the NLSY we use respondent's self-reported gross hourly wages, log transformed including a .5 constant for those who report 0 wages. In the NEPS and NCDS, respondents' reported gross monthly earnings were divided by 4.33 are then divided by actual hours worked per week to compute the hourly wage.

Independent Variable

Again our key interest here is in the effect of college completion on wages. In NEPS, a college completer is any respondent who reports a college degree at the point of observation (2010). For the NLSY, following Brand and Xie, college completion is restricted to those with a degree by 1993, when the respondents were 28-31. For the NCDS, similarly, we restrict college completion to those with a completed degree by 1991, when respondents were 35 years old.

Results

Homogenous Effects

Table 3 presents the results of a standard regression analysis predicting the wage returns to a college education in the United Kingdom, Germany, and the United States. We focus on late career wage returns, when respondents are 50-51 in the UK, 52-62 in Germany, and 45-48 in the US.[4]

Consistent with past research, we find positive wage returns to completing a university degree. In both the UK and the US, men benefit significantly from completing a college degree. In the UK, those with a college degree make 21% more per hour compared to those who did not complete a degree. These benefits are even larger in the US; a man with a college degree in the US makes 27% more than observationally identical men who did not complete a college degree. By contrast, in Germany, men who completed an academic university degree earn 11% more than observationally identical men but this result is not statistically significant at the p<.05 level.

As expected, the wage benefit received from a university degree is highest in the US—where inequality is greatest, non-college options are scant, and costs for attaining a college degree are high—and lowest in Germany.

<center>[INSERT TABLE 3 ABOUT HERE]</center>

Heterogeneous Treatment Effects

These estimates of course assume that all men experience the same benefit (or non-benefit) from a college degree. While these estimates reveal cross-national variation in the average effect of college

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[4] Ideally we would additionally consider returns earlier in a respondent's life course. Because cohort data are not available yet in Germany, we would be comparing 30 year olds in 2010 in Germany to 33 year-olds in 1991 in the UK, to 29-32 year-olds in the US in 1992. To avoid the conflation of period with age effects, we chose to focus on the later career returns in order to compare similar aged individuals during similar periods.

education on those who attend college—assuming that we are controlling for the key set of covariates on which respondents select into college—in this paper we are most concerned with cross-national variation in how the relative gains to a college degree differ across graduates with different propensities to complete a degree. To explore the possibility of heterogeneous effects, we carry out the propensity score analysis described above, matching those who complete college with those who do not complete college on key background, achievement, and behavioral characteristics. In the UK and US cases, this matching results in five strata. Those in the first strata have the lowest propensity to attend college (between 0 and .1) while those in the 5th strata have the highest propensity to attend college (between .6 and 1). In Germany, matching results in four strata.

Table 4 shows how these strata line up with the observed characteristics of respondents in each of the three datasets. We separate means by whether respondents graduated college or not. Two patterns are important to observe. First the differences between those who do not complete college and those who do complete college, in each stratum, are minimal. Among those in the first strata (0 to .1 propensity to complete college in the US and UK, 0 to .2 propensity in Germany), there are only small differences between those who complete college and those who do not. Their parents make approximately the same amount of money (in the US and UK), have similar levels of education, and work in similar kinds of occupations. They also have similar levels of achievement and similar cognitive abilities. These similarities within strata between those who complete college and those who do not are consistent across the strata identified. Across each survey within each stratum, balancing criteria were met.We are therefore assured that we are comparing very similar individuals within each strata, allowing us to examine the relationship between propensity to complete college and wage returns while minimizing individual within-strata variation.

 Second, as we move across strata, socioeconomic advantage and achievement increase. For example, among the non-college completers in strata 1 in the UK, 25% of fathers work in unskilled occupations and have on average less than 10 years of education. Among non-college completers in strata 5 in the UK—those most likely to complete college—only 11% of their fathers work in unskilled occupations, 40% work in managerial or professional occupations, and they have 11 years of education, on average. Indeed these respondents have much higher scores on cognitive ability and achievement tests than do those in stratum 1. This descriptive link between parental background and propensity to complete college is similar in Germany. In the United States, the differences are even more pronounced: the fathers of non-college completers in stratum 1 have on average three fewer years of education than those in stratum 5, and only 1 in 10, versus 1 in 2, fathers in professional occupations. The high cost of college in the United States, combined with the relative low academic requirements for gaining entrance, perhaps explain why the propensity to complete college is so strongly linked with socioeconomic background in the US compared to the other two countries.

[INSERT TABLE 4 ABOUT HERE]

We are interested in how the treatment—completing college—affects wages and how these effects might vary across individuals' propensities to complete college. The institutional and cultural norms of the three countries under consideration here may affect these heterogeneous returns in important

ways, leading to both positive and negative selection into university. We have already seen in table 4 that the likelihood of university completion appears to be more tightly linked to socioeconomic background in the US compared to the UK or Germany.

In table 5, we turn to our central research question, asking whether those who are most likely to complete college are those who enjoy the greatest wage benefits. Table 5 shows the results of the HLM estimates of the effect of a college degree on logged hourly wages for men in the UK, Germany, and the US. These models estimate a different effect for each propensity stratum. The strata results are then used to estimate a linear trend across strata. A negative slope suggests *negative* selection; those who gain the most from a college degree are the least likely to attend, whereas a positive slope suggests positive selection.

[INSERT TABLE 5 ABOUT HERE]

Among 50 year-old men in the UK in 2008, the wage returns for those least likely to complete college (stratum 1) are quite high. Men in this stratum, who complete a college degree, earn 41% more per hour compared to similar men, equally likely (or unlikely in this case) to complete college, but who do not complete. As the propensity to complete college increases, the returns to actually completing college decrease. For example, men in the 3rd stratum earn 12% more than similar men in the same stratum who do not complete college, and this advantage is no longer statistically significant (p<.05 level). Among those in the 5th and highest stratum,—those most likely to complete college—those who complete college have wages only 10% higher than those who do not complete. Although the estimated effect of the college degree in each strata is greater than 0, these effects are only statistically significant at the p<.05 level in strata 1, and 2. Of course, because the number of observations identifying these effects is small in some cases, the standard errors are larger than would be expected from a standard regression approach. Still, for the UK, this analysis strongly supports the conclusion of negative selectivity for a college degree in the UK. The bottom of table 5 summarizes the linear trend across strata, and we see that for the UK, moving from one stratum to the next highest *decreases* the returns in expected hourly wages by 7%. In other words, as an individual's propensity to complete college increases in the UK, his wage returns fall, compared to someone with a similar propensity to complete college but who does not complete. Thus, although essentially all UK college graduates benefit from their degree, those least likely to attend stand to benefit the most.

Turning to the results for Germany in the second column, we see as similar story of negative selection, but the results are less definitive due to a smaller sample size. Individuals in the first stratum who completed college earn 32% more than those with a similar (low) propensity to complete college who did not complete. By contrast, those with the highest propensity to complete university (in stratum 4) who in fact completed earn only 4% more than those with a similar propensity who did not complete. One major outlier, however, is in stratum 2; our estimates suggest that among those with between a .2 and .4 propensity to complete university, those who indeed completed make 74% *less* than those who did not complete. Of course, referring back to table 4, this result is based on a very small number of cases (17, with only 5 college completers) and as a result is estimated with a large amount of error and not statistically different from zero. The estimated linear trend confirms the negative trend observed.

Moving from one stratum to the next decreases expected hourly wages by 8%, when comparing within strata. Although this effect is not statistically significant at the p<.05 level, the results suggest that in Germany, among later career workers, those most likely to complete college benefit less than those least likely to complete college. Given the strong vocational education sector that provides access to secure, stable, and well-paying jobs, it is surprising that we observe a similar level of negative selection in Germany as in the UK. However, given the highly restricted access to University in Germany and its tight link to an early and rigid tracking system, it is perhaps less surprising that we see negative selection into university completion.

Finally the last column of table 5 presents results from the US. The benefits to completing a college degree are greatest in the US, and, in later life, these benefits increase as one's propensity to complete college increases[5]. Among those least likely to complete college (in the first stratum), those who actually complete make 30% more an hour compared to those who do not complete college in the same stratum. By the fifth stratum, those who complete college make more than 60% more per hour compared to those who do not complete college. In the US, those who attend college clearly receive increasing benefits across propensity score strata. The estimated slope of the linear trend suggests that moving from one stratum to the next highest increases wage benefits by 10%. Despite the high cost of college in the US, those who stand to benefit the most from a college degree are indeed those most likely to obtain one. The greater accessibility of college, and less restrictive academic requirements, appear to allow more able students to overcome the stronger links between socioeconomic background and higher education in the United States.

These cross-national comparisons are further illustrated in Figure 1. The negative trends across propensity score strata in the UK and Germany mirror one another. Those least likely to complete college in the UK and Germany receive the greatest wage benefit. In the US, we observe positive selection among male workers at the peak of their careers.

[INSERT FIGURE 1 ABOUT HERE]

This analysis describes selection into and through college in these three country contexts. Although we find important variation across countries, this analysis cannot help us to understand the mechanisms leading to either positive or negative selection. As we discuss earlier, there are many important differences between these countries. For example, whereas the US has the most expansive and least

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[5] This result stands in stark contrast to the results of Brand and Xie (2010), who find non-significant but negative selection across propensity score strata using the same data. In an effort to confirm our findings, we replicated the analysis of Brand and Xie (2010) using data from earlier observations of the NLSY cohort (as they did in their article). In this replication, we indeed found negative selection across propensity score strata. We believe that there are important changes in selection that occur across the life-course of individuals, particularly in the US. High- and low-propensity individuals end up choosing different occupations with different amounts of required training and with different income trajectories. The result is that in the early and mid-career, these low-propensity individuals appear to benefit more, but by the late-career, high-propensity individuals have caught up, shifting the selection trend from negative to positive. We explore this life-course trend in a separate paper (Luthra and Flashman 2012).

selective academic post-secondary college system, university attendance for the same birth cohorts in the UK and Germany was fairly uncommon. How does the expansiveness of higher education within a country impact wage selection? In the next section, we explore this possible mechanism for negative selection by studying changes in selection as the result of the academic post-secondary educational expansion that occurred for later cohorts in the UK.

Another important possible explanation for cross-national variation in the returns to a college degree is the availability of alternative post-secondary education. As discussed above, Germany provides an opportunity to examine whether selection into post-secondary education is altered when vocational degrees are included as a viable outcome. Thus, we also examine whether selection into post-secondary education more generally differs from selection specifically into the more elite and selective University education in Germany.

Finally, the analysis shown above suggests that the higher costs of a University degree in the US are not necessarily sufficient to create negative selection. In our final supplementary analysis, we ask whether indeed college cost is as much a driver in negative selection as expected in the literature. To do so, we take advantage of an exogenous price increase in University attendance in Germany, comparing cohorts who attended University before the abolition of free living expense assistance to those who attended University after government transfers transitioned into loans which would need to be in part repaid.

Supplementary Analysis: Circumstances Leading to Negative Selection

Educational Expansion

In the UK, university attendance and completion is comparatively rare. However, in the last 30 years, the UK has expanded their university system, most notably with the transformation of former polytechnic colleges and central institutions into full-scale universities in 1992, increasing the number of universities from 56 to 94. Even before 1992, attendance at universities was increasing. For example, approximately 20% of the NCDS cohort completed university, most attending between 1976 and 1979. Among the children born in 1970 from the British Cohort Study (BCS)—designed to mirror the NCDS survey—more than 30% completed university, most attending right before the major expansion in 1992. While education expanded, university education remained free until 1998.

Hence these two cohorts—the NCDS cohort born in 1958, and the BCS cohort born in 1970—provide a test of the impact of educational expansion on selection into and through university. On the one hand, as seen in table 4 above, college attendance and completion is strongly associated with socioeconomic background in all three countries. If the norms, values, and resources associated with higher socioeconomic status are the main predictors of college attendance, rather than individual ability, we would expect that as the educational system expands, opportunities should open up to individuals of lower socioeconomic status and negative selection should decline. On the other hand, we also observed that college completion is positively associated with measures of academic ability and intelligence. If the most capable individuals are also the most likely to attend and complete university, then expanding the system will increase negative selection by allowing those less capable of capitalizing on a college degree to obtain one. By comparing a birth cohort which enjoyed greater access to University to a

cohort with more restricted access, we hope to further illustrate the role that University selectivity plays in the selection differences we observe between the US and Germany and the UK.

[INSERT FIGURE 2 ABOUT HERE]

Figure 2 shows results of the propensity score analysis from the 1958 and 1970 cohorts in the UK at ages 33 and 34 respectively[6]. The graph on the left shows the earlier results from the NCDS cohort born in 1958. Even at age 33, there is a strongly negative trend in returns to a university degree across propensity score strata. Moving from one propensity score stratum to the next decreases one's wage returns 6%. While wage returns are positive across the board, those least likely to complete college benefit most from completion. Between 1976, when the NCDS cohort started to attend university, and 1988, when the BCS cohort started to attend, educational expansion was in progress. In other words, the BCS cohort experienced greater opportunity to attend university. Their wage returns are shown on the right side of figure 2. Although still negative, the linear trend of their wage returns is less steep. Moving from one stratum to the next decreases wage returns just over 1%, compared to others within their propensity score strata. Between these two cohorts, selection changed—becoming less negative. Although we cannot test directly that this changing selectivity is the result of educational expansion, these results provide suggestive evidence that expansion helps to get those who would benefit most from attending university to actually attend.

Vocational Education

In Germany, vocational schooling programs are popular and highly developed. If we expanded the definition of college completion to include those who completed vocational post-secondary education programs, the number of individuals classified as completers would double. Comparing selectivity among University completers (ISCED 5A) to selectivity among all post-secondary higher education completers (ISCED 5B and 5A) thus serves two purposes. First, it allows us to inquire into the effects of a different operationalization of expansion: does the wider participation in a broader definition of post-secondary education change the selection story in Germany? At the same time, increasing the availability of viable vocational post-secondary options is not equivalent to simply expanding university access. Vocational degrees in Germany are shorter, more applied, and more strongly tied to the private sector through internships and knowledge exchange (cite). Thus, a comparison of University and general post-secondary education illustrates whether greater choice in post-secondary track and the stronger training to work linkages of vocational training generate less negative. The left side of figure 3 shows the wage returns for all 52-62 year-old NEPS respondents who completed post-secondary education—both vocational and academic. The right side of figure 3 shows the wage returns for those who completed an academic university degree. The difference in the wage returns across propensity score strata is striking. As we observed earlier, those who complete university education are negatively selected. Those with the lowest propensity to complete benefit most. By contrast, when we turn to the left graph in figure 3, we find small but positive selection. Moving from one stratum to the next increases wage returns just

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[6]We observe wages at earlier ages in this analysis for comparability across the cohorts. Full results from the BCS available on request.

over 2%. In other words, negative selection only occurs in academic university education. Among those who complete post-secondary education more generally, those most likely to complete also benefit most.

[FIGURE THREE ABOUT HERE]

What do these results mean for Germany, and for our cross-national comparison more generally? On the one hand, the tracking system seems to exacerbate inequalities by limiting opportunity for those who would benefit most from an academic post-secondary education. On the other hand, their strong and developed vocational programs seem to make up for the limited academic opportunities by providing real non-academic opportunities to high paying jobs and pathways into them. The individuals most likely to participate in these non-academic programs are also those who benefit most from them. Observationally equivalent men with non-academic degrees do not earn less than those with academic degrees in Germany, as reported earlier in table 3. These results suggest that this form of educational expansion—expanding the vocational sector rather than the academic sector—can also help to equalize the wage benefits received by those participating in post-secondary education.

Educational Costs

Finally, in Figure 4, we see results again from Germany concentrating on differences in selectivity between cohorts (men ages 52-62 in 2010) who received cost of living subsidies during University and cohorts (ages 41-51) who were required to repay half of the government cost of living subsidies in mortgage payments. This policy shift significantly increased the cost of college attendance in Germany, although attendance costs were still lower than for similar age cohorts in the US. With this analysis, we wish to examine what, if any, effect a price increase had on selectivity for those cohorts born close to both sides of the change.

[FIGURE FOUR ABOUT HERE]

On the left hand side of figure 4, we see that among men for whom higher education was essentially free and living expenses required no repayment, the returns to a college degree dropped on average 9% from each lower to higher propensity strata. In contrast, those men who needed to repay part of their government subsidized living costs actually display slightly more positive selection: the slope across propensity strata is only -.036, for a 4% drop in wage returns from each higher to lower strata. This result suggests that an increase in the costs of University borne by college completers had no negative relationship with selection into a University degree; to the contrary, selection became more positive during this period of change.

It is possible that the expansion of higher education that occurred between these two cohorts offset any negative effect in increase in cost. Alternatively, the sensitivity of college attendance to costs may be less than originally hypothesized, or perhaps exert a positive effect on selection by discouraging those who stand to gain less from attending. Either of these explanations would also fit with the cross-national findings reported above; namely that the highest cost country, the US, also has the most positive relationship between the propensity to complete college and its economic returns in late career.

Discussion

In this paper, we study the heterogeneous returns to post-secondary education across three unique country contexts. Given the large amount of resources that both individuals and countries pour into post-secondary education, it is important to understand the benefits received by college completers in the labor market. Studying the United Kingdom, Germany, and the United States—three countries with very different educational systems—we find important variation in the level of wage returns experienced by individuals who pursue a university education. Confirming previous research, wage returns are largest in the US, followed by the UK, and then Germany. However, we also look deeper to examine how University degrees are distributed across those who can expect to obtain different wage returns for them in their later careers. In other words, we ask how the wage returns to a college degree might differ depending on individuals' propensities to complete university. In both the UK and Germany, we find negative selection into university; those least likely to complete benefit most from completion. By contrast, in the US, at later ages, those most likely to complete benefit most from completion.

These results are surprising in several ways. First, we follow Brand and Xie's original analysis, which finds *negative* selection in the US. We replicate this result with earlier waves of the NLSY data and find the same result. However, as respondents age, selection seems to flip, becoming positive by the time respondents are 45-48 years old. In other work, we explore changes in selection across the life course and find that college educated individuals with a high propensity to attend University have initially lower earnings, but steeper career wage profiles that allows them to surpass peers without a college degree at older ages. These steeper wage profiles result in eventual positive selection in the United States, but not in Germany or the UK (Luthra and Flashman 2012). The conclusion that selection is more positive in the US than the other two countries is also surprising given some of our original hypotheses. We expected that the higher cost of university attendance might discourage less advantaged students from attending, creating negative selection by restricted access for more able youth of lower socioeconomic backgrounds. We also expected that the higher overall returns to a college degree in the US might encourage even those students with lower expected returns *relative to other students* to attend college, also creating negative selection. Our findings contradict these expectations.

Second, given the strong vocational sector in Germany along with free post-secondary education, we expected selection in Germany to be positive rather than negative. Our expectation was that by providing alternative post-secondary training options that are not stigmatized and lead to high paying jobs, only those students most capable of capitalizing on an academic degree would choose to do so. Similarly, we also expected that the very low cost and elite selection into University in the UK would create more positive selection than in the US. In the UK, only the most academically able youth were admitted into college, and financial means were decoupled from the ability to attend. The fact that social class gradients across propensity strata are less defined in Germany and the UK than in the US seemed to further support these expectations. Yet again, our initial cross-national analysis did not confirm these expectations.

 To further explore these contradictory findings, we therefore turned to supplementary single country analyses, which allowed us to exploit temporal and definitional variation *within* countries in an attempt

to shed light on the mechanism behind differences *between* them. In the first of three supplementary analyses, we focus on the role of educational expansion on wage selection. The US has the most expansive and least selective academic university sector of these three countries. Can this feature explain the results of positive selection in the US and negative selection in the UK and Germany? To explore this question we study changes in selection across two cohorts in the UK who experience different academic post-secondary educational opportunities. Results from this analysis suggest that restricted access to university negatively influences the relationship between the propensity to complete university and its economic returns. More recent UK cohorts, who experienced a higher rate of college attendance and completion, also displayed less negative selection than older cohorts for whom a college degree was a more uncommon and elite characteristic. Returning to our original hypotheses, this analysis, combined with the more positive selection observed in the US, supports the expectation that opening University access and promoting greater attendance and completion helps disadvantaged individuals with a low propensity to complete college, but a high potential reward, to complete a college degree.

In our second supplementary analysis, we attempted to further explore the role of vocational training on selection into post-secondary education. Although selection into an *academic* degree is negative in Germany, including vocational post-secondary education with academic post-secondary education reverses trends in wage benefits across propensity score strata. If we consider all post-secondary education in Germany, those most likely to complete this education are the ones most likely to benefit from it. This result suggests that a developed vocational sector does positively influence selectivity in overall post-secondary degrees as we expected, but that the propensity to obtain the more elite and restricted University degree remains negatively associated with late career wage benefits.

The results from these two comparisons emerge in the absence of changes in costs associated with completing higher education. In recent years however, Germany and, to a much larger extent, the UK have introduced additional costs to attaining higher education. These costs may have an important impact on selection, in both positive and negative ways. Costs create a barrier to college completion, particularly among those from lower socioeconomic backgrounds. On the other hand, costs may also potentially present a disincentive to individuals who would not benefit from the education. Given the extra cost, these individuals may forego a university education leading to a more efficient use of resources and positive selection. The finding of positive selection in the US, where costs are highest, provides some initial support for the latter conclusion.

To explore this mechanism further, we next compared the selection of two cohorts in Germany: those who attended University prior to the transformation of a grant into a loan program and those who attended University after this shift. Our findings provide further support for the conclusion that higher costs might not increase, but rather offset, negative selection. German men born in the earlier cohorts were actually more negatively selected into a University degree than those who attended University under loan schemes. This finding suggests that rising education costs may not be as detrimental to the economically efficient attainment of University degrees, or that expanding University *access* may be sufficient to offset any negative impact from higher costs.

As always, this analysis has some limitations. We are unable to show statistically that educational expansion makes wage selectivity more positive. However, we find it convincing that in the cases that we study, expansion seems to be positively associated with wage selection. Furthermore, this analysis focuses primarily on later life returns to post-secondary education. As with the US case, these returns may vary in important ways across the life-course, and this variation could shed important light on the mechanisms leading to positive and negative selection. We explore this possibility in another paper. We also focus our analysis only on the employed population and only on the population of men. As employment is more and more tied to educational attainment, particularly in the US context, our observations of wage selection may result from selection into the employed population. Additionally, women are increasing their university attendance at unprecedented levels in each of these three countries. This dramatic increase should have important effects on both their propensities to attend and complete college, and their likelihood of participating in the labor market. While these trends should not impact our current analysis (because it is occurring in more recent cohorts), it is an important part of the story about returns to education that needs to be explored and understood.

The goals of this analysis were to describe trends in heterogeneous returns across different country contexts, and to explore a possible mechanism for heterogeneous returns—educational expansion. We find wide variation in the wage benefits received by individuals across the UK, US, and Germany, and at least some of this variation can be explained by differences in the size and prevalence of the academic post-secondary sectors in each country.

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TABLES and FIGURES

Table 1. Comparison of Costs, Benefits, and Selection in Germany, the United Kingdom, and the United States

	Germany	United Kingdom	United States
Costs[g]	Very low: free tuition and maintenance support from 1971-1983 Time to degree: 6 years[h]	Very low: Free tuition and guaranteed maintenance support from 1962-1990. Time to degree: 3 years	Medium: Tuition, Fee Room and Board in 1976: Private $14,127; Public $6,877[i] Time to degree: 4 years
Opportunity Cost[j]	$171,969	$98,358	Public University: $230,308 Private University: $259,308
Benefits[k]:	1.91	2.4	2.68
Selection: Percent 45-54 in 2008 with at least upper secondary education[l]	86%	67%	83%
Percent 45-54 in 2008 with at least university degree[m]	16%	20%	30%

[g] Blundell et al. (2005)
[h] Bildungsbericht (2006)
[i] Baum (2008) reported in 2006 US Dollars
[j] Day and Newburger (2002)
[k] OECD Education at a Glance (2010)
[l] OECD Education at a Glance (2010)
[m] OECD Education at a Glance (2010)

Table 2. Mean values of analysis variables by non-college/college graduate status and survey

	UK(NCDS)		Germany (NEPS)		USA (NLSY)	
	Non-Grad	Grad	Non-Grad	Grad	Non-Grad	Grad
Dependent Variable						
Logged Hourly Wages						
Age 45-48					2.94	3.66
Age 50/51	2.66	3.09				
Age 52-58			2.90	3.23		
Variables Measuring Propensity to Complete College						
Social Background						
Black					0.18	0.08
Hispanic					0.06	0.04
Migration Background			0.16	0.15		
Parents' income	184.27	205.77			17,878	24,782
Mother's education	9.88	10.55	9.53	11.21	11.40	13.25
Father's education	9.97	11.33	10.66	12.48	11.44	14.21
Father's occupation						
Professional/Manager	0.22	0.42	0.18	0.41	0.16	0.48
Non-manual/Skilled	0.56	0.47	0.35	0.28	0.46	0.28
Manual/Unskilled	0.22	0.11	0.39	0.24	0.12	0.06
No occ/Missing			0.08	0.07	0.26	0.19
Intact family	0.91	0.94	0.93	0.95	0.72	0.82
Number of siblings	2.13	1.91	2.15	1.69	3.29	2.39
Rural residence	0.50	0.52			0.25	0.20
Ability and Academics						
Academic Achievement						
Math Test Score	-0.26	0.92				
Reading Test Score	-0.19	0.66				
Scores on School Exams	0.28	0.55				
Grades/Rank			2.29	2.03	0.64	0.30
Completed Abitur			0.19	0.92		
Track placement						
2+ A-Levels	0.06	0.68				
Comprehensive school			0.31	0.06		
Realschule			0.25	0.03		
Vocational School			0.15	0.03		
Gymnasium			0.29	0.88		
College Prep					0.24	0.59
Cognitive ability	-0.20	0.71			0.05	0.79
Social-Psychological						
Respondent values learning			0.85	0.89		
Teachers' encouragement	0.24	0.36				
Parents' encouragement	0.50	0.64				
Friends' college plans	0.08	0.05			0.42	0.80
N	828	234	526	127	932	246

Table 3. Homogenous effects of a university degree on wages

	UK	Germany	United States
	2008	2010	2010
	Age 50	Age 52-58	Age 45-48
Homogenous Returns			
College Completion	0.210 **	0.108	0.275 **
	(0.047)	(0.070)	(0.087)

Note: ** p<.01, * p<.05. Standard errors included below coefficient estimates in parentheses.
All models include the controls listed in table 2.

Table 4. Description of propensity score strata, NCDS, NEPS, and NLSY

	Non-Grad	Grad	Non-Grad	Grad	Non-Grad	Grad	Non-Grad	Grad	Non-Grad	Grad
	United Kingdom									
	0-.1		.1-.2		.2-.4		.4-.6		.6-1	
Rural Residence	.50	.63	.49	.37	.51	.50	.58	.56	.56	.52
Mother's Education	9.80	9.90	9.82	9.65	10.17	9.96	10.34	11.28	10.60	10.75
Father's Education	9.77	9.82	10.26	9.63	10.57	10.24	11.32	11.25	10.82	11.92
Parents' Monthly Income	180.4	186.3	192.5	190.8	198.1	182.0	194.8	207.3	200.6	213.7
Father Professional Occ	.17	.26	.30	.35	.39	.29	.50	.33	.40	.48
Father Non-skilled Occupation	.25	.21	.13	.15	.14	.21	.17	.06	.11	.08
Intact Family	.91	.95	.92	.85	.91	.96	1.00	.89	.94	.96
Siblings	2.15	2.02	2.11	2.63	2.07	1.73	2.04	1.84	1.98	1.84
General Ability Test Score	-.46	.20	.37	.24	.52	.54	.86	.88	.94	.85
Scores on A-Levels/O-Levels/GCSE's	.22	.29	.40	.39	.49	.48	.50	.56	.58	.61
Took A-Levels	.00	.00	.00	.00	.09	.17	.50	.50	.89	.96
Reading Score	-.43	-.04	.41	.44	.57	.62	.71	.67	.75	.79
Math Score	-.59	.11	.49	.51	.68	.71	.94	.80	1.21	1.12
Teacher Encouragement	.22	.21	.30	.26	.24	.21	.28	.50	.43	.40
N	619	19	92	20	64	24	18	18	35	153
	Germany									
	0-.2		.2-.4		.4-.6		.6-1			
Mother's Education	9.11	10.92	11.87	9.00	9.51	11.12	11.09	11.02		
Father's Education	10.34	11.27	13.46	7.63	10.39	11.82	11.87	12.89		
Father Manager/Prof Occupation	0.15	0.28	0.47	0.24	0.10	0.11	0.34	0.45		
Father Skilled Occupation	0.36	0.43	0.11	0.15	0.25	0.63	0.50	0.22		
Father Non-skilled Occupation	0.40	0.23	0.28	0.43	0.56	0.26	0.14	0.24		
Intact Family	0.92	1.00	1.00	0.83	12.66	0.89	0.96	0.95		
Gymnasium	0.18	0.44	0.58	0.49	0.37	0.67	0.93	0.92		
Vocational School	0.11	0.16	0.07	0.16	0.29	0.00	0.00	0.01		
Realschule	0.25	0.16	0.03	0.15	0.05	0.07	0.00	0.01		
Abitur	0.08	0.29	0.17	0.49	0.96	1.00	1.00	1.00		
GPA	0.62	1.56	1.33	3.13	2.31	2.63	2.42	2.00		

	Non-Grad	Grad	Non-Grad	Grad	Non-Grad	Grad	Non-Grad	Grad	Non-Grad	Grad
					United States					
	0-.1		.1-.2		.2-.4		.4-.6		.6-1	
Black	0.21	0.22	0.12	0.19	0.12	0.09	0.15	0.07	0.09	0.05
Hispanic	0.06	0.16	0.07	0.06	0.05	0.02	0.05	0.03	0.04	0.03
Father's Education	11.38	10.74	12.88	12.91	13.47	13.70	13.68	13.96	14.81	15.75
Family Household Income	16,116	16,945	19,724	19,829	22,113	19,884	20,244	18,544	22,354	28,300
Father Professional Occupation	0.09	0.14	0.22	0.20	0.29	0.27	0.25	0.45	0.50	0.62
Father Skilled Occupation	0.48	0.33	0.53	0.51	0.39	0.51	0.34	0.42	0.25	0.21
Intact family	0.69	0.87	0.75	0.72	0.79	0.74	0.70	0.68	0.88	0.888
Number of siblings	3.61	3.22	2.55	2.42	2.65	3.05	2.72	1.98	2.47	2.30
Rural Residence	0.23	0.49	0.29	0.22	0.32	0.21	0.20	0.36	0.24	0.14
College Prep	0.12	0.20	0.28	0.22	0.44	0.44	0.67	0.53	0.68	0.70
ASVAB Test	-0.22	0.16	0.37	0.41	0.51	0.52	0.71	0.69	0.81	0.96
Friends' College Plans	0.53	0.40	0.52	0.54	0.69	0.79	0.72	0.59	0.92	0.90
N	638	18	130	24	87	33	36	32	41	139

Table 5. HLM predicting the effect of college completion on logged hourly wages

	United Kingdom		Germany		United States	
	2008-2009		2010		2010	
	Age 50-51		Age 52-62		Age 45-48	
Heterogeneous Returns						
College Completion Strata						
1	.415	**	0.324	**	0.301	
	(0.102)		(0.115)		(0.311)	
2	0.285	*	-0.794		0.109	
	(0.118)		(0.618)		(0.165)	
3	.121		0.195		0.394	*
	(0.110)		(0.159)		(0.174)	
4	0.274		0.044		0.259	
	(0.162)		(0.115)		(0.204)	
5	0.102				0.611	***
	(0.094)				(0.208)	
Slope	-0.070	*	-0.086		0.104	
	(0.033)		(0.054)		(0.072)	
Constant	0.441	***	0.397	*	-0.004	
	(0.110)		(0.157)		(0.240)	

Note: ** p<.01, * p<.05. Standard errors included below coefficient estimates in parentheses. Level 2 slope estimates control for marriage, children, and (in Germany) years of experience.

Figure 1. Logged Wage Returns to a University Degree across Propensity Score Strata, United Kingdom, Germany, and the United States
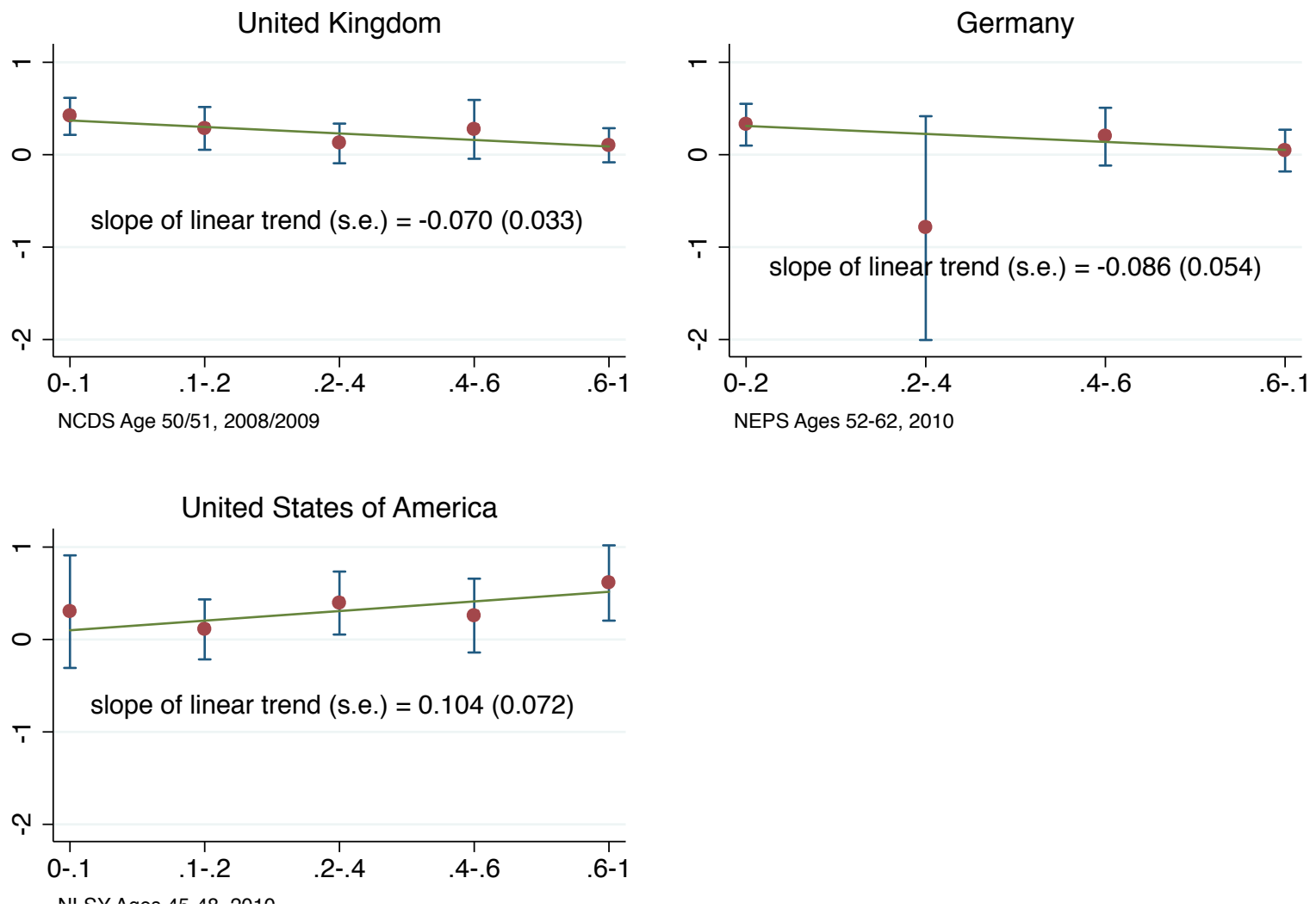

United Kingdom

slope of linear trend (s.e.) = -0.070 (0.033)

0-.1   .1-.2   .2-.4   .4-.6   .6-1

NCDS Age 50/51, 2008/2009

Germany

slope of linear trend (s.e.) = -0.086 (0.054)

0-.2   .2-.4   .4-.6   .6-.1

NEPS Ages 52-62, 2010

United States of America

slope of linear trend (s.e.) = 0.104 (0.072)

0-.1   .1-.2   .2-.4   .4-.6   .6-1

NLSY Ages 45-48, 2010

Figure 2. The Impact of Educational Expansion on Logged Wage Returns across Propensity Score Strata, United Kingdom

United Kingdom

1958 Cohort

slope of linear trend (s.e.) = -0.062 (0.027)

NCDS Age 33, 1991

1970 Cohort

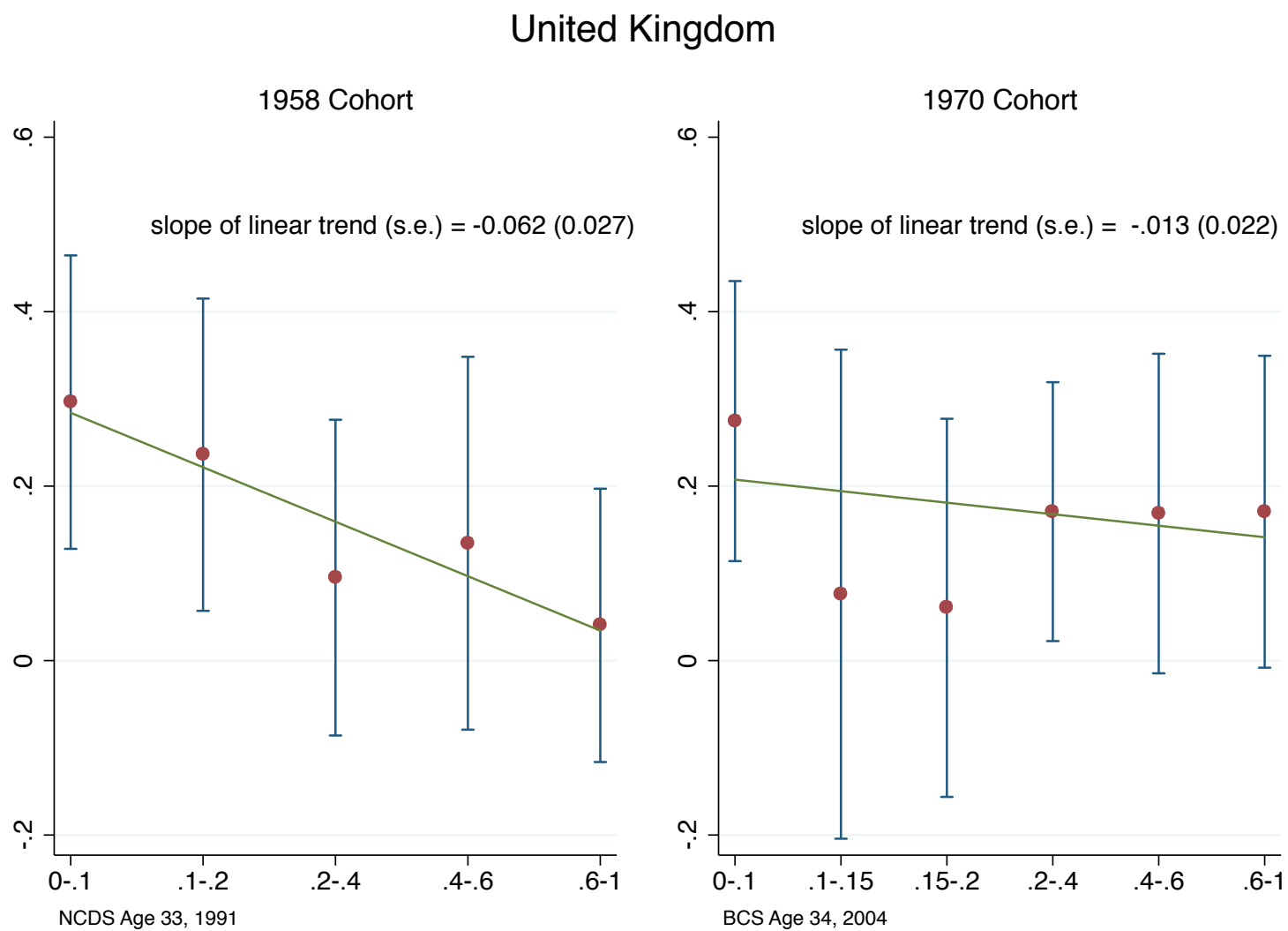slope of linear trend (s.e.) = -.013 (0.022)

BCS Age 34, 2004

Figure 3. The Impact of Vocational *and* Academic Post-Secondary Education on Logged Wage Returns across Propensity Score Strata, Germany

Germany

All Post-Secondary Education

slope of linear trend (s.e.) = 0.022 (0.032)

NEPS Ages 52-62, 2010

Academic Post-Secondary Education
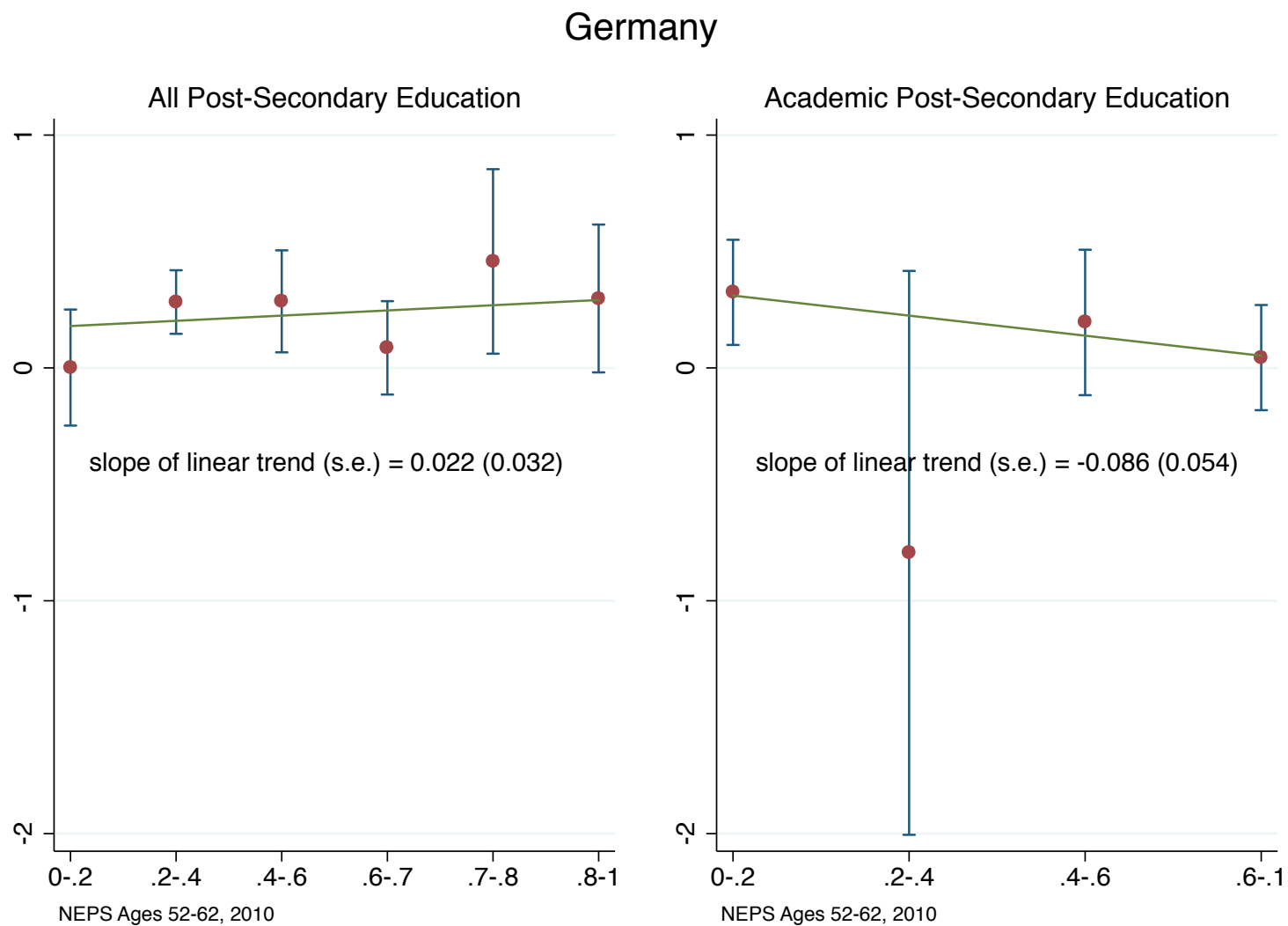
slope of linear trend (s.e.) = -0.086 (0.054)

NEPS Ages 52-62, 2010

Figure 4

Wage Returns to a College Degree
Germany