

High School Exit Examinations and Post-Secondary Labor Market Outcomes*

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ABSTRACT

Since the early 1980s, an increasing number of states have required students to pass statewide high school exit examinations (HSEEs) in order to graduate. States have generally adopted HSEEs in response to the perception that graduates typically lack skills required for success in the modern economy and that requiring students to pass a graduation test will make the diploma meaningful to employers. What do these education reforms mean for students' post-secondary economic and labor market prospects? The central hypothesis of our research is that state HSEE policies have the effect of widening gaps in employment rates, earnings, poverty rates, and public assistance use between students who have high school diplomas and those without them. To test this hypothesis we will model the association between state HSEE policies and labor market outcomes using data from the 1984-2003 Current Population Surveys (CPS) and the 1980 through 2000 U.S. Censuses.

High School Exit Examinations and Post-Secondary Labor Market Outcomes

Since the early 1980s a growing number of states have required students to pass statewide high school exit examinations (HSEEs) in order to earn high school diplomas. Although HSEEs have traditionally been minimum competency tests of basic skills, many states have recently moved to more challenging tests of higher-order skills. Members of the class of 2003 faced state HSEE requirements in 20 states.

States have generally adopted HSEEs in response to the perception that high school graduates lack the skills required for success in the “new economy” and that requiring students to pass a high-stakes test will make the high school diploma more meaningful to employers. Particularly motivating was a much-publicized report by The National Commission on Excellence in Education (1983), which began:

Our Nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world. This report is concerned with only one of the many causes and dimensions of the problem, but it is the one that undergirds American prosperity, security, and civility. We report to the American people that while we can take justifiable pride in what our schools and colleges have historically accomplished and contributed to the United States and the well-being of its people, the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people.

Among the commission’s recommendations was that “standardized tests of achievement ... should be administered at major transition points from one level of schooling to another and particularly from high school to college or work.”

The sentiments expressed in *A Nation at Risk* report continue to influence educational policy today, and states have invoked similar concerns about economic prosperity to motivate their HSEE policies. For example, in a booklet describing Florida’s high school exit exam, the Florida Department of Education (2001) noted that “students are increasingly expected to display high-level learning and perform complex problem solving. Today, the job market requires people who are proficient in advanced mathematics and who can read and construct meaning from difficult and technical texts.” Likewise, in a pamphlet explaining the new high school exit examination that will take effect for the class of 2008, Washington’s State Board of Education (2003) warned that “every day, job prospects and opportunities dwindle for high school graduates unable to do basic reading, writing and math tasks.” Elected officials have voiced similar sentiments. For example, Vito Gagliardi, Commissioner of Education for the state of New Jersey, asserted that New Jersey’s recently revised HSEE “will prepare [students] for successful futures in college and the working world” (New Jersey Department of Education 2001).

The logic of these common claims seems compelling. Technological change and industrial restructuring require more highly skilled workers than secondary schools currently produce. State HSEEs will certify that graduates have met higher standards and will maintain pressure on schools to improve the quality of their instruction. Yet despite the popularity of state HSEEs as a policy lever, relatively little research is available to support or refute the central claims of state HSEE proponents. In fact, we do not know whether employers value the skills that state HSEEs

assess or whether they respond to state HSEE policies by increasing their preference for high school graduates over those who fail to complete high school.

In the proposed project we will empirically evaluate the effects of state HSEE policies on labor market outcomes. The central hypothesis in this project is that state HSEE policies widen gaps in employment rates, earnings, poverty rates, and public assistance use between students who have high school diplomas and those who do not. We also hypothesize that these effects result (at least in part) from employers' perceptions of the content and value of state HSEEs.

As we argue below, we expect that the effects of state HSEEs on labor market outcomes should be felt most strongly among individuals who have completed no post-secondary schooling. State HSEE policies are likely to have less of an impact on the labor market value of college degrees than on the value of high school credentials. Employers who hire college-educated workers are probably much less likely to be concerned with basic literacy and numeracy skills and more concerned with advanced skills or knowledge. As a result, throughout our theoretical discussion and our proposed empirical analyses we focus on individuals who have completed no post-secondary schooling.

THEORETICAL BACKGROUND

Popular versions of two economic theories—*human capital theory* and *signaling theory*—motivate the implementation of state HSEE policies. Both theories would predict that state HSEE policies lead to increases in the productive capacity of high school diploma recipients. In contrast, *credential theory* would predict no independent association between diploma recipients' productivity and state HSEE policies.

Human capital theory is most closely aligned with policy makers' stated reasons for the need for state HSEEs. Human capital theory—commonly associated with the work of Gary Becker ([1964]1993), Jacob Mincer (1958) and Theodore Schultz (1961)—views students and their parents as utility-maximizing actors whose utilities are generally (but not necessarily) represented by the present discounted value of their lifetime earnings. Decisions about schooling reflect tradeoffs between foregone labor market participation (and earnings) and long-term gains from the investment in the knowledge and skills imparted to students by the schools they attend. According to human capital theory, people with greater knowledge and skills are more productive in the workplace and thus are more richly compensated by their employers for their labor. State HSEE requirements provide students with added incentive to acquire the knowledge and skills necessary to earn a high school diploma. As a result, in states where the knowledge and skills assessed by the state HSEE are valued by prospective employers, we would expect to find that the gaps between high school graduates and non-completers¹ with respect to wages, rates of unemployment, rates of poverty, and rates of public assistance use are greater than in states with no HSEE. According to human capital theory we also expect high school graduates' productive capacity to be even greater in states with more demanding HSEEs. Consequently, we anticipate that gaps between high school graduates and non-completers will be greatest in states with more challenging HSEEs.

¹ By “non-completers” we mean individuals who either began high school without subsequently completing it as well as individuals who never enrolled in high school (e.g., individuals who drop out prior to entering high school and immigrants who come to the U.S. at an early age but who do not enroll in U.S. schools).

Signaling theory (Spence 1973) would also anticipate a positive relationship between state HSEE policies and the labor market advantages that high school graduates enjoy over those who fail to complete high school. Though it is notoriously difficult to distinguish between the empirical implications of these two theories in practice (Frazis 2002), signaling theory differs from human capital theory in a few important respects. First, signaling theory does not necessarily equate schooling with *achieved* skills and knowledge. Rather, signaling theory leaves open the possibility that educational achievement merely distinguishes those who are endowed with characteristics attractive to employers (such as cognitive ability, persistence and interpersonal skills) from those who are not. *Unlike human capital theory*, signaling theory does not take as a foregone conclusion that education adds value to students' productive skills. Second, signaling theory suggests that education matters to employers not because more educated workers are *necessarily* more productive, but because information in the labor market is scarce. Employers may attach a probability distribution to the potential productivity of each job applicant. They may assign more narrowly bounded and somewhat higher probability distributions to the productive potential of applicants who have a certificate like a high school or college diploma. Consequently, signaling theory would predict a positive association between state HSEE policies and labor market outcomes.

In contrast to human capital theory and signaling theory, Randall Collins' theory of credentialism (1971; 1979) posits that employers achieve no productive ends by hiring employees who hold a high school diploma or bachelor's degree. Instead, they secure employees whose status cultures match their own and who will conform to organizational norms. Employers are engaged in an act of social closure whereby the 'other'—those lacking the status distinction that school is equipped to provide—is denied access to positions of power and prestige. According to Collins, the failure of schools to impart technical knowledge is unimportant. The main activity of schools is not to impart such knowledge, as is commonly believed, but instead "to teach particular status cultures, both in and outside of the classroom" (1971: 1010). Since credentialing theory views academic achievement as epiphenomenal at best, it would not anticipate any association between state HSEEs and labor market outcomes.

THE PRESENT STATE OF KNOWLEDGE IN THE FIELD

Research on state HSEEs has focused largely on educational outcomes. Researchers have evaluated the consequences of state HSEEs for students' chances of dropping out; for teachers' classroom practices; and for socioeconomic and race/ethnic disparities in these outcomes. There is mixed evidence about whether state HSEEs improve learning (Amrein and Berliner 2002b; Bishop et al. 2000; Bishop et al. 2001; Bishop, Moriarty, and Mane 2000; Carnoy and Loeb 2002; Carnoy, Loeb, and Smith 2003; Center on Education Policy 2003; Grissmer and Flanagan 1998; Raymond and Hanushek 2003) or affect dropout decisions (Jacob 2001; Muller and Schiller 2000; Warren and Edwards 2004; Warren and Jenkins 2003). Conversely, there is considerable evidence that such policies lead to classroom practices that do more to foster successful test-taking than to teach higher order thinking skills (O'Day and Smith 1993).

Despite the centrality of economic issues in motivating state HSEE policies, there has been very little research on the consequences of these policies for economic or labor market outcomes. The research that has been produced tends to ignore the substantial literature on the skills that employers seek from their high school educated and less educated workers. After situating our project in the broader literature on low-wage work, we review the few empirical articles that

address the effects of state HSEEs on labor market outcomes and address their important limitations.

Skill Demands for Less Educated Workers

Researchers generally agree that cognitive skills are persistently associated with earnings in the labor market (Murnane and Levy 1996; Murnane et al. 2001), but they disagree about the strength of this relationship (Cawley, Heckman, and Vytlačil 1999; Farkas et al. 1997). It is particularly difficult to tell the extent to which skill differences influence labor market outcomes among the less educated. For example, Cameron and Heckman (1993) find no difference in expected earnings between GED recipients and high school dropouts, implying limited returns to cognitive skills among such wage earners. Tyler, Murnane, and Willet (2000), however, find evidence that cognitive skills continue to matter even at this level, leading to differences between the earnings of dropouts who failed the GED and those who passed it.

Though scholars generally assume that skills are rewarded because they increase worker productivity, there is relatively little research on the demand side of the equation to support this assumption. Using data from the Multi-City Study of Urban Inequality (MCSUI) employer surveys, Holzer (1998) and Moss and Tilly (2001) provide evidence of increasing employer demands for cognitive skills. According to Holzer, most new jobs require literacy and numeracy skills, as well as typing and rudimentary computer skills. The skill requirements are substantial, even when only a high school diploma is required of workers. Moss and Tilly (2001) echo Holzer's (1998) findings, emphasizing that the demand for skills is not restricted to technical jobs alone. Over 40% of employers who responded to the MCSUI survey indicated that the skills they require of workers had increased over time.

These cognitive skills are skills that could, in principle, be measured by a state HSEE. If employers are aware of the state HSEE and believe that it effectively discriminates between individuals who do and do not have the skills they seek, we would expect to find an association between the implementation of a state HSEE and educational differences in labor market outcomes. The magnitude of these differences, and thus our ability to detect them given a limited sample size, depends heavily on the importance employers attach to the skills that state HSEEs measure *relative to other attributes that employers desire in their workers*. It may be the case that employers place greater weight on attributes and skills that are *not* measured by state HSEEs, especially when hiring relatively uneducated workers.

There is a solid empirical basis on which to question the salience of academic skills to employer evaluations of workers. Research on the earnings of high school graduates (Sewell and Hauser 1975) and adults in general (Cawley, Heckman, and Vytlačil 2001) consistently shows that background characteristics, including cognitive ability, account for less than 10% of the variance in earnings. Even of this 10%, a substantial portion is attributable to what are generally referred to as "noncognitive skills," or skills and attitudes unrelated to the abilities tested by achievement tests. Bowles and Gintis, in a meta-analysis of 25 studies, estimate that only about 20% of the effect of years of education on earnings is accounted for by measured cognitive skills (Bowles and Gintis 2002). The other 80%, they suggest, largely reflects attitudes, behaviors, and personality characteristics.

The evidence for the limited importance of cognitive skills and the potential role of noncognitive skills in labor market outcomes discussed above is only indirect. Modest relationships between cognitive skills and earnings outcomes may result from measurement error on both sides of the

equation. The omission of other worker attributes such as race/ethnicity, sex, industry- or occupation-specific experience, and network ties may account for unmeasured components of residual earnings variance wrongfully attributed to noncognitive skills. There is, however, a substantial body of work that shows that employers are quite explicit in the value they place on noncognitive worker attributes. (For reviews of this literature, see Bills (1988; 1992), Cappelli (1995) and Farkas (2003).) Cappelli (1995), for example, finds that employers say that character and attitude are of paramount importance in their hiring decisions. Other characteristics they look for include responsibility, discipline, pride, and enthusiasm. Bills (1988) suggests that personality is about as important to employers as formal education. More recently, Moss and Tilly (2001) found that employers of high school graduates are less concerned with cognitive skills than they are with things like dependability and interpersonal communications. “[A]ttitude,” they write, “trumps technical facility in large numbers of low-skill jobs.” (p. 61)

If Moss and Tilly (2001) are correct, then state HSEEs may have only a limited impact on labor market outcomes for high school graduates. State HSEEs do not purport to measure attitudes, dependability, or interpersonal communication skills. The propensity of employers to consider such characteristics in hiring and compensation decisions, moreover, is less consistent with human capital theory than it is with credentialing or signaling theory. If we find that state HSEE policies have limited effects on labor market outcomes, it may be because employers who are willing to hire applicants with no college education and limited employment experience do not particularly value the skills that state HSEEs measure.

Effects of State HSEEs on Labor Market Outcomes

Research on the effects of state HSEE policies—like the literature on labor market returns to cognitive skills—relies mostly on indirect evidence. We are not aware of any research that elicits employer perceptions of state HSEEs. There are, however, a few studies based on secondary data analysis that try to infer the effects of state HSEEs on labor market outcomes. Using data from the 1990 U.S. Census, Dee (2003a; 2003b) estimated a series of fixed effects models of the impact of course graduation requirements and minimum competency testing policies—of which HSEEs are a part—on educational attainment, unemployment, and earnings. His sample was restricted to individuals who turned 18 at some point between 1980 and 1988. Dee found that these education policies “sometimes reduced educational attainment but also generated some improvements in the probability of employment.” The effects on employment probabilities were largely restricted to black males, and there were no effects on earnings.

Dee’s findings are limited in three important respects that bear directly on the research questions that we address in this proposal. First, he did not isolate the effects of state HSEE policies from the effects of other state policies. Second, because of the sample restrictions described above, his results pertain only to members of the high school graduating classes of 1980 through 1988. Dee’s results tell us nothing about the consequences of minimum competency tests on labor market outcomes for students who should have graduated after 1988. In 1980, only one state (New York) had an HSEE; by 1988 this figure had risen to 12 states, but another dozen states have implemented state HSEE policies for post-1988 graduating classes. Furthermore, the level of difficulty of state HSEEs increased in several states after 1988. Third, because he used cross-sectional data, Dee was forced to assume that individuals’ state of residence at the time of the 1990 U.S. Census was the same as the state in which they were enrolled in high school. He acknowledged this as a potential bias—a bias that would necessarily bias coefficients toward zero—and he noted that his are likely lower-bound estimates of the effects of minimum

competency tests on the outcomes he considers. While true, this is especially problematic in the case of earnings: Dee's (2003a; 2003b) findings pertaining to earnings may be partly the result of this bias.

The only research to date that has explicitly focused on the impact of state HSEE policies (as opposed to minimum competency testing policies in general) on labor market outcomes has been by Bishop and colleagues (e.g., Bishop and Mane 2001a; Bishop, Moriarty, and Mane 2000). Bishop, Moriarty, and Mane (2000) used nationally-representative data on high school seniors in the 1980 High School and Beyond (HSB) study and the 1992 National Educational Longitudinal Study (NELS); they restricted their analyses to seniors who graduated after the completion of their senior year. Seniors in HSB were followed up two, four, and six years after graduation, and NELS seniors were followed up two years after graduation. The authors regressed wage rates on HSEE requirements and a long list of student-level covariates.

The HSB results presented by Bishop, Moriarty, and Mane (2000) suggest that HSEE requirements had no effect on men's wages in the early 1980s, but had large effects on women's wages, such that women who faced HSEE requirements earned an average of 5.1% more per year. In their analyses of HSB data, Bishop, Moriarty, and Mane (2000) relied on students' reports of HSEE policies. Because of concern about the accuracy of such reports, Bishop and Mane (2001b) reanalyzed the HSB data using principals' reports of HSEE policies. In revised analyses they found that HSEE requirements had positive effects on the wage rates and earnings of male and female members of the graduating class of 1980.

In the more recent NELS data, Bishop, Moriarty, and Mane (2000) found substantial positive effects of HSEE requirements on men's and women's wages in each of the two years following graduation. Bishop and Mane (2001a; 2001b) expanded the analyses of NELS data presented by Bishop, Moriarty, and Mane (2000) by exploring the ways in which the effects of HSEE requirements on labor market outcomes vary by sex, grade point average, socioeconomic status, race/ethnic group, and prior test scores.

One serious limitation of the work by Bishop and colleagues is that the authors adjust for few state-level covariates. Bishop and Mane (2001a) include measures of states' unemployment rates and mean earnings in manufacturing and retail in their analyses of NELS data, but it seems clear that there are a number of other state characteristics that might influence both economic outcomes and states' decisions about whether to adopt HSEE policies. As a result, it may be that the apparent effects of HSEE requirements on wages are simply an artifact of unobserved state characteristics. A second and more serious limitation of this work is the manner in which HSEE requirements are measured and operationalized in their analyses. Bishop and colleagues are not clear about whether they are estimating the effects of "state HSEE requirements" or HSEE requirements more generally (which may be required by school districts or schools acting on their own). Beyond this conceptual issue, NELS school administrators' reports of state HSEE requirements are inaccurate and unreliable (Jacob 2001; Warren and Edwards 2004). Using restricted data on the state in which NELS respondents' schools were located, it is possible to consider within-state variability in school administrators' reports of state policy. In no large state is there unanimity about state policy; in most states 30 to 40 percent of school administrators indicated that a state HSEE was required for graduation when no such policy was in place (or vice versa). Jacob (2001), Warren and Edwards (2004) and others have used other information, external to the NELS, to measure state HSEE policies in their analyses of the effects of these policies on high school dropout; we will do the same.

A more fundamental limitation of all of the work reviewed above is that the research pertains only to the 1980s and very early 1990s. It is not clear whether the reported findings hold for more recent cohorts of students. Until about 1990 states' HSEEs typically consisted of multiple-choice measures of minimum competencies in the basic skills of reading, writing, and arithmetic. There were calls for tests of higher-order, more complex skills, but the basic skills were more clearly defined and relatively easier to test (Bond and King 1995; Linn 1995). However, beginning in the early 1990s—and particularly after a 1991 Department of Labor Report (The Secretary's Commission on Achieving Necessary Skills (SCANS) 1991)—some states moved to more challenging tests that were aligned with higher curriculum standards (American Federation of Teachers 1997; National Research Council 1999).

Finally, all of this research relies exclusively on indirect evidence to establish the effect of state HSEE policies on labor market outcomes. It assumes that the presence of a (net) association between state HSEEs and labor market outcomes implies that employers recognize and value the skills tested by the state HSEE. *The proposed analyses will overcome the conceptual and technical shortcomings of the work reviewed above, but perhaps more importantly it will offer the first empirical assessment of the labor market consequences of state HSEE policies for students in graduating classes beyond 1992.*

With support from the Spencer Foundation, Dr. Warren has been working in recent years to catalogue information about state HSEE policies in each state from the mid-1970s to the present and to estimate the impact of these policies on high school dropout rates. This project will be completed by summer 2005. Drs. Warren and Grodsky have recently submitted a proposal to the United States Department of Education to investigate the impact of state HSEE policies on students' achievement test scores in the National Assessment of Educational Progress (NAEP). Below we briefly describe each of these ongoing projects.

Dr. Warren—in collaboration with graduate and undergraduate research assistants at the University of Minnesota—recently submitted a paper for publication in which he investigated the extent to which state HSEEs are associated with state-level high school completion rates in the United States. In this paper, the investigators estimated a series of state and year fixed effects models using a new measure of state-level high school completion rates and information about states' HSEE policies between 1973 and 2000. They found that state HSEEs—particularly “more difficult” examinations that have recently been implemented in some states—are associated with lower high school completion rates and higher rates of General Educational Development (GED) test taking. Furthermore, they found that the association between state HSEEs and high school completion is stronger in states with higher poverty rates.

Given that state HSEEs are fundamentally designed to improve student achievement, it is surprising that so little empirical research has investigated the association between state HSEE policies and students' proficiency in core academic subject areas. There is no solid evidence about whether state HSEE policies are related to higher levels of student achievement. In their ongoing collaborative work, Drs. Warren and Grodsky are using long-term trend NAEP achievement and background data in conjunction with external information about states' HSEE policies to explore hypotheses regarding the association between state HSEE policies and student achievement in reading, mathematics, and science between 1970 and 2004. This project will provide much-needed information about (1) the association between state HSEE policies and long-term trends in academic achievement levels; (2) variations in this association across

students from different socioeconomic, academic, and racial/ethnic backgrounds; and (3) the attributes of states' HSEE policies that are most strongly associated with student achievement.

The project described in the present proposal takes our collaborative work—and indeed the research focus in the area—in an important new direction. Are state HSEEs associated with young adults' employment rates, earnings, poverty rates, and public assistance use?

The long-term goal of our work on state HSEEs is to provide empirical evidence that can facilitate sound policy decisions. Proposals to implement or amend state HSEE policies result in heated debates about the efficacy and fairness of these policies. Unfortunately, such debates take place in the absence of sound empirical evidence about the positive and negative consequences of state HSEE policies.

We argue that judgments about whether to implement, abandon, or modify state HSEE policies should be firmly based on the weight of the evidence concerning both the potential problems with state HSEE policies and the potential benefits of those policies. Are state HSEEs associated with lower rates of high school completion? Dr. Warren's recent findings suggest that they are. On the positive side, are state HSEE policies associated with (their intended) positive outcomes, like higher rates of student achievement, improved college preparedness, and greater workforce productivity? Recent evidence suggests that state HSEE policies may have desirable consequences for student achievement (Bishop 2001; Bishop et al. 2000; Bishop et al. 2001; Carnoy and Loeb 2002; Jacob 2001; Raymond and Hanushek 2003), but again the research literature is thin and much more work needs to be done. As reviewed above, the research literature on the consequences of state HSEE policies for post-high school labor market outcomes also leaves a great deal of room for further investigation. It is only when sound information about the positive and negative consequences of state HSEE policies is available that policy makers can make informed decisions about whether the costs of state HSEEs are outweighed by their benefits.

RESEARCH DESIGN

Our longer-term project will include a mixed methods study that will provide both direct and indirect evidence concerning the effects of state HSEE policies on labor market outcomes. In the paper that we will present at PAA in 2005 we will model the independent association between state HSEE policies and labor market outcomes using data from the 1984 through 2003 Current Population Surveys (CPS) and the 1980 through 2000 U.S. Censuses. In subsequent work we will explore the mechanisms through which this association operates by completing semi-structured interviews with a random sample of 60 employers in four states that vary in the nature and history of their HSEE policies.

In each part of our investigation, we will focus only on young adults who are not enrolled in school and who did not complete any post-secondary education. Again, we contend that if state HSEEs matter for labor market outcomes then they should matter because they affect employers' perceptions of the value of high school diplomas and thus of the relative utility of hiring diploma recipients and dropouts. As workers accumulate experience of additional years of formal schooling, the effect of a state HSEE is likely to be moderated by these other sources of human capital. The best way to address our empirical research questions is to consider changes in the labor market value of a high school diploma over time and across states as state HSEE policies are implemented and amended.

Quantitative Analyses to be Presented at PAA: State HSEEs and Labor Market Outcomes

Our quantitative analyses test our central hypothesis that state HSEE policies have the effect of widening gaps in employment rates, earnings, poverty rates, and public assistance use between students who have high school diplomas and those who do not. We will conduct three separate sets of quantitative analyses, building on the complementary strengths of the CPS and the decennial census data. Combined, the results of these analyses will provide sound and nuanced answers to our research questions.

Our quantitative analyses will require annual data on states' HSEE policies. With support from the Spencer Foundation, Dr. Warren has recently completed collecting key data on states' HSEE policies. We have information about whether students were required to pass state HSEEs as a pre-requisite for graduation for each state and for each graduating class between 1977 and 2004. In some cases, students were required to take—but not necessarily pass—state HSEEs, and in other cases students received non-standard diplomas (but diplomas nonetheless) if they did not pass the state HSEE. In neither case is receipt of formal diplomas contingent on passage of a state HSEE, so we do not count these cases as having state HSEE policies. Information about whether particular states made passage of an HSEE a graduation requirement is available from published sources for a limited number of years (e.g., American Federation of Teachers 1997; Amrein and Berliner 2002a; Bond and King 1995; Jacob 2001; National Research Council 1999; U.S. Department of Education 2003), but with highly varying degrees of accuracy. The bulk of our information about state HSEE requirements—and about the administrative details of these policies—is derived from state education agency web sites, scrutiny of newspaper archives, and personal communications with officials in state education agencies.

Our most basic measure expresses whether passage of a state HSEE was a requirement for obtaining a diploma. However, there is reason to believe that “easier” state HSEEs are less strongly related to labor market outcomes than “more difficult” ones. Based on information about the grade level of proficiency to which state HSEEs were aligned, we have classified states' HSEEs as either “minimum competency” or “more difficult” examinations. Briefly, if any component of a state HSEE assessed mastery of any curricular material that is introduced during the high school years—9th grade and beyond—we classify the state HSEE as “more difficult.” All other state HSEEs are classified as “minimum competency.” Although rudimentary, this classification has proven useful. Warren, Jenkins, and Kulick (2004) demonstrated that the association between “more difficult” state HSEEs and high school completion is much stronger than the association between “minimum competency” state HSEEs and that outcome.

ANALYSES OF CPS OUTGOING ROTATION GROUP DATA

The Bureau of Labor Statistics has conducted the CPS since 1948 under the auspices of the Bureau of the Census. The CPS interviews approximately 50,000 households per month in such a way that it is possible to generalize to the national and state levels. Although the CPS is mainly intended to provide employment data for the U.S., the survey also collects demographic information such as age, sex, race, marital status, educational attainment, and family structure. Each household is interviewed once a month for four consecutive months, then not interviewed for eight months, and finally interviewed once a month for four consecutive months. “Outgoing Rotations Groups” (or ORGs) refer to the cohorts that are in their 4th or 8th months in the survey. Because new households are added and old ones are dropped each month, there are eight

“rotation groups”—cohorts of households starting their interviews in the same month—in the sample in any given month. Because of this design, the number of cases in the CPS ORG files is typically about three times as large as the number of cases in any single monthly CPS file. We will analyze data from all rotation groups to improve the precision and reliability of our estimates.

We will restrict our analytic samples to adults who were between the ages of 20 and 23 at the time of interview, who were not enrolled in school, and who had completed no post-secondary schooling. Using this sample selection scheme we have 7,883 cases in the 2001 CPS ORG file (to choose one year as an example). In the 2001 file, we have an average of 155 cases per state (with the fewest cases—73—in D.C.); this means we expect to have an average of about 3,100 observations per state in the 1984-2003 CPS ORG file. Throughout our analyses, we will employ BLS provided sampling weights so that our results will be generalizable to the population defined above. Because of changes over time in measures, record layout, and other technical matters, we will utilize the Unicon Corporation’s CPS Utilities, which include well-documented CPS ORG files with measures that are consistent over survey years.

The CPS data will permit analyses of all four of our dependent variables. Our measure of employment status is derived from a series of questions that determine whether respondents are employed, not employed, or out of the labor force. Our measure of weekly earnings is derived from an item that ascertains respondents’ usual weekly earnings from their main job, before taxes and other deductions and including overtime pay, tips, and commissions. Each respondent was also asked the amount of public assistance income they receive. For our purposes, respondents receiving *any* such income will be counted as public assistance users. Finally, each individual observation includes a measure of household size and household income, allowing us to derive indicators of poverty status. In separate models, we will operationalize poverty status as household income at or below 100% of the federal poverty line, 150% of that line, and 50% of the median household income for a household of the respondent’s household size.

To take full advantage of the repeated cross-sectional design of the CPS ORG data, we will estimate a series of state fixed effects models. This specification will enable us to flexibly model both individual and state level effects over time, adjusting for year- and state-specific patterns in each of the outcome variables, as well as individual-specific determinants of labor market success. Below we discuss our modeling strategy for logged weekly earnings; details for modeling the nominal outcomes (employment, public assistance use, and poverty status) are identical except that we will use a logit link function.

Although we might have decided to analyze these data using multi-level (or “hierarchical”) modeling techniques, we have elected to pursue fixed effects models for several reasons. First, the fixed effects approach avoids applying additional and unnecessary parametric constraints to the model (such as normality of level-2 disturbances). Second, the fixed effects model is more parsimonious because we do not estimate a complex covariance structure among level-2 disturbances. Third, the second level of analysis—states—constitutes a census and not a sample. Therefore it is not clear to us what to make of the sampling distribution of the level-2 disturbances.

Let Y_{ijk} represent the logged weekly earning for person i in state j in year k . Our main interest is in the effect of state HSEE requirements on this outcome. We wish to model state-specific growth curves for logged weekly earnings for high school graduates and for non-completers,

operationalized as a series of two-way and three-way interactions. Most of these interactions are nuisance terms, useful for adjusting growth curves for exogenous factors and for supporting graphs of the possible effects of state HSEEs. The model can be written as

$$y_{ijk} = \gamma_{0j}(STATE_j) + \gamma_{1j}(Year * STATE_j) + \gamma_{2j}(Year^2 * STATE_j) + \gamma_{3j}(HS_{ij} * STATE_j) + \gamma_{4j}(Year * HS_{ij} * STATE_j) + \gamma_{5j}(Year^2 * HS_{ij} * STATE_j) + \beta_6(HSEE_{jk}) + \beta_7(HSEE_{jk} * HS_{ij}) + \zeta_p(X_{ij}) + \psi_q(Z_{jk}) + e_{ijk}, \quad (1)$$

where $STATE_j$ is a design matrix of dummy variables for each state and the District of Columbia, $Year$ is operationalized as a quadratic with the main term deviated from 1984 for ease of interpretation. HS is a dummy variable for high school completion (with non-completers in the reference category) and X_{ij} is a matrix of other individual-specific covariates. These additional covariates include age (a proxy for potential work experience, deviated from 20), sex, race/ethnicity, marital status, number of children, disability status and labor union membership. Finally, Z_{jk} is a matrix of state-year specific factors that may influence both labor market outcomes and a state's propensity to institute an HSEE. Z_{jk} includes measures of each state's industrial base (e.g., percentage of jobs in manufacturing, percentage in retail); investment in public education (e.g., per student expenditures); demographic composition (e.g., percentage minority, percentage recent immigrants); and other characteristics.

As we have written Equation 1, the γ coefficients are free to vary across states, whereas the β coefficients and the coefficient vector ζ_p are assumed to be invariant across states. The intercept is suppressed in this model so that each state and the District of Columbia has its own coefficient. γ_{0j} estimates the expected logged hourly earnings of a 20-year-old *non-completer* in state j (without an HSEE) in 1984 with values of 0 on all X_{ij} , while γ_{3j} estimates the expected logged weekly earnings for an otherwise comparable *high school graduate*. State-specific growth curves for the earnings of non-completers are captured by the coefficient vectors γ_{1j} and γ_{2j} , and state-specific growth curves for the earnings of high school graduates are captured by the coefficient vectors γ_{4j} and γ_{5j} . β_6 estimates the effect of state HSEEs on the weekly earnings of non-completers and β_7 the effect for graduates. Our central substantive hypotheses are that β_6 will be less than or equal to 0 and that β_7 will be positive and statistically significant.

As we have written it, Equation 1 does not discriminate between more challenging and less challenging state HSEEs. In a second model we will further distinguish between “minimum competency” and “more difficult” HSEEs by substituting dummy variables for each type of state HSEE into the $HSEE$ terms of Equation 1. We will also experiment with alternative ways of operationalizing year, such as a spline with segments anchored by the peaks and troughs of national business cycles.

ANALYSES OF 1980, 1990, AND 2000 DECENNIAL CENSUS DATA

For the purposes of these analyses we will select individuals in the 1980, 1990, and 2000 U.S. Census Public-Use Microdata Samples (PUMS) who were between the ages of 20 and 23, who were not enrolled in school, who had completed no post-secondary schooling, who were living in one of the 50 states or D.C. during the typical high school years, and who were either born in the U.S. or who immigrated prior to the typical ages of high school entry. These sample restrictions leave us with 255,111 cases in the 2000 PUMS (to choose one year as an example) for an average of 5,002 cases per state (with the fewest cases—459—in D.C.). Throughout our

analyses, we will employ Census provided sampling weights so that our results will be generalizable to the population defined above. Because of changes over time in measures, record layout, and other technical matters, we will utilize the Minnesota Population Center’s Integrated Public-Use Microdata Series (IPUMS) files that include well-documented PUMS files with measures that are consistent across decennial censuses.

In our analyses of CPS ORG data, we do not have access to explicit information about the year or state in which respondents completed (or dropped out of) high school. With the decennial data, however, we are in a stronger position because we have measures of where these 20 to 23 year olds lived five years prior to their census enumeration—when they would have been 15 to 18 years of age, the prime ages of high school attendance. As in the CPS ORG analyses, we assume that those who graduated from high school did so when they turned 18. To the extent that we are incorrect about the year or state in which respondents graduated, our estimates of the differences in outcomes for high school graduates and non-completers, as well as the effects of state HSEE policies on those outcomes, are biased toward zero.

We operationalize our outcome variables for these models in the same way as for the CPS ORG models. We control for the same individual-level attributes in the census analyses as we do in the CPS ORG analyses, but since we have only three years of census data we operationalize year as two dummy variables (1990 and 2000, contrasted with the omitted decade, 1980). Our decennial model can be written as

$$\begin{aligned}
 y_{ijk} = & \gamma_{0j}(STATE_j) + \beta_1(year_{1990}) + \beta_2(year_{2000}) + \gamma_{3j}(HS_{ij} * STATE_j) + \\
 & \beta_4(year_{1990} * HS_{ij}) + \beta_5(year_{2000} * HS_{ij}) + \beta_6(HSEE_{jk}) + \beta_7(HSEE_{jk} * HS_{ij}) \\
 & + \zeta_p(X_{ij}) + \psi_q(Z_{jk}) + e_{ijk}.
 \end{aligned} \tag{2}$$

In contrast to Equation 1, Equation 2 allows fixed effects for state and for year, but does not allow for the interaction of state and year. In other words, outcomes in all states are assumed to undergo identical shifts in 1990 and 2000, although states may differ from one another in their expectations for each year. These state and year fixed effects models completely account for (1) variables that remain constant over time but vary across states (e.g., geography, historical legacies, and structures of state education agencies) and (2) variables that are constant across states but vary over time (e.g., national education and economic policies, nationwide recessions, advances in education technology, and international competition and conflict). This means that the only covariates that could induce spuriousness in associations between state HSEE policies and our outcomes are those that vary both across states and over time. That is, we must account for variables that (1) vary across states and over time, (2) are associated with states’ decisions to implement HSEE policies, and (3) are associated with the outcomes we consider. We try to account for likely sources of endogeneity in the state-year specific matrix Z_{jk} , described above.

STRENGTHS AND LIMITATIONS OF EACH SOURCE OF DATA

For our purposes, the CPS ORG data are affected by three weaknesses, two of which are related to migration and one of which is related to coverage bias. *First*, we do not know with certainty the year or state in which respondents actually completed (or dropped out of) high school. Without this information we are forced to make two assumptions: We assume that individuals graduated in the year in which they turned 18 and we assume that respondents attended high school in the same state in which they resided at the time of their CPS interview; we can estimate the magnitude of the latter problem by considering migration rates in U.S. Census data. To the

extent that these assumptions are false, our estimates of the impact of state HSEEs on labor force outcomes will be biased toward zero.

Second, we cannot ascertain country of birth from the CPS ORG data prior to 1994. This is particularly problematic for Hispanics, as recent research based on the 2000 U.S. Census shows that of the 30% of Hispanics who failed to complete high school, half never attended school in the United States (Fry 2003). If Hispanic dropouts are more disadvantaged on average than non-Hispanic dropouts due to never attending school in the United States, our failure to distinguish between native and foreign-born Hispanics may upwardly bias estimates of the differences in outcomes between graduates and dropouts.

Fortunately, we can estimate the magnitude of the bias introduced by the omission of nativity in the 1984-1993 CPS ORG in two ways. First, the CPS ORG data contain information about nativity beginning in 1994. To understand how the omission of nativity information affects our substantive results, we will estimate all models on the full (1984-2003) time series—without controls for nativity—and then on the more recent (1994-2003) time series—with controls for nativity. Second, we will re-estimate models for the entire 1984-2003 CPS ORG series excluding states with high rates of international immigration. We will then compare parameter estimates from these models to models in which all states are included.

Third, by design the CPS only samples individuals from the *non-institutionalized* population. Inmates in jails and prisons are excluded from the sampling frame. This exclusion probably has little effect on the sample of high school graduates, but may bias the sample of non-completers because those who fail to complete high school are at greater risk of incarceration. If the population of inmates who fail to complete high school is negatively selected relative to the population of those at large who fail to complete high school, our estimates of the disadvantage associated with failing to complete high school, and thus perhaps of the effect of HSEE policies, will be biased toward zero. Fortunately, as we describe below, the decennial data offer a check on this possibility.

Census data offer much more power, based on their substantially greater sample sizes. The decennial samples also include more detailed information about domestic and international migration histories, as described above. Finally, the decennial data include observations of jail and prison inmates, allowing us to evaluate the degree to which the exclusion of inmates biases our parameter estimates in the CPS ORG analyses. To do so, we will estimate a Heckman sample selection model, incorporating the hazard of incarceration into our substantive equations. This amounts to first estimating a probit of the probability of incarceration and then augmenting the X_{ij} matrix in Equation 2 with the inverse Mill's ratio from the probit equation. The magnitude of the shift in the state HSEE coefficients from Equation 2 to the model adding the inverse Mill's ratio will give us an idea of the degree to which the exclusion of the institutionalized population from the CPS ORG data may lead to biased estimates of the effect of state HSEEs.

Estimates based on the decennial data are more limited than those based on CPS in one important respect: The decennial data allow observations at only three points in time. This reduces our ability to identify state-specific rates of change in our dependent variables and, more importantly, deviations from those patterns that may be attributable to state HSEE policies.

To capitalize on the size of the decennial sample and the temporal coverage of the CPS ORG samples, we will conduct a third set of analyses pooling both sources of data. In the combined

model, we will renorm the weights in each sample so that the sum of sample weights equals the sample size. This will ensure that weighted results generalize to the population of interest in each time frame but will also give greater weight to the decennial data, adding support to our growth curves. These analyses will be based on Equation 1, with state-specific growth curves for all outcomes. For the combined model, the individual covariate matrix X_{ij} will be restricted to covariates available across data sets.

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