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COMPETITIVENESS BRIEF

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THE BOTTOM LINE

The educational experience is a form of investment, perhaps the single most important for the nation's economic health.

On the Importance of Being Educated

College graduates earn considerably more than high school graduates, on average, and high school graduates earn more than dropouts. Although part of the higher earnings the educated enjoy may be explained by difference in ability, most is the result of their education.

Valuing education as a capital asset using standard methods shows it to be a major component of this nation's wealth. The educational experience is a form of investment, perhaps the single most important for the nation's economic health.

In recent years, two processes have been at work to increase the education premium in the United States. First, the evolution of technology has increased the relative demand for educated labor. Second, globalization of production has subjected unskilled labor in the U.S. to foreign competition to a much greater extent than skilled labor. Both of these processes are likely to continue.

Educational attainment is conventionally quantified by diplomas earned or years spent in school. By these measures, the U.S. workforce stands at the top of the world. A somewhat different picture emerges for international tests, which show American students lagging behind students in other nations in their mastery of math, science and reading.

PEOPLE WITH MORE EDUCATION EARN MORE

Earnings increase with education. Table 1 presents national mean annual earnings by age and educational attainment for year 2003 derived from the Census Bureau's Current Population Survey (CPS), for full-time year-round workers. Earnings increase with both age and education. The effects are substantial (Census 2005a).

For the 35 to 44 age group, male high school graduates earned 41 percent more than dropouts, while the corresponding premium for female high school graduates was 32 percent. Male holders of bachelor's degrees earned 85 percent more than male high school graduates; female bachelor's degree holders earned 76 percent more.

Male high school graduates age 55-64 earned 33 percent more than those age 25-34. For male college graduates the corresponding premium was 49 percent. Interestingly, mean earnings of females rise much less with age.

In addition to higher rates of pay, the more educated experience lower rates of unemployment. Between 1992 and 2005, the unemployment rate for those with less than a high school education averaged 8.5 percent nationally. For those who graduated high school, the average un-

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Table 1: Mean Earnings in the United States, 2003
Year-Round, Full-Time Workers by Educational Attainment and Age

	High School		College					
	Not High School Graduate	Graduate or GED	Some College, No Degree	Associate Degree	Bachelor's Degree	Master's Degree	Professional Degree	Doctorate Degree
Male								
25 to 34 Years	$24,533	$33,509	$40,417	$42,200	$53,272	$69,601	$89,474	$72,164
35 to 44 Years	$29,059	$40,885	$49,499	$50,831	$75,812	$88,352	$151,687	$113,799
45 to 54 Years	$30,633	$43,638	$52,314	$53,700	$78,430	$87,248	$168,333	$108,212
55 to 64 Years	$32,225	$44,619	$54,629	$55,887	$79,764	$93,680	$171,879	$117,769
Female								
25 to 34 Years	$20,574	$26,132	$27,927	$32,144	$47,358	$49,694	$71,932	$67,582
35 to 44 Years	$21,980	$28,974	$33,814	$38,079	$51,028	$58,089	$105,850	$97,756
45 to 54 Years	$21,994	$29,729	$36,008	$40,785	$50,770	$62,874	$76,770	$78,396
55 to 64 Years	$21,803	$30,591	$36,032	$37,467	$47,571	$58,913	$78,242	$95,664

Source: Census 2005a

employment rate was 4.8 percent; for those who attended college but did not earn a bachelor's degree, the average rate was 4.0 percent; for bachelor's degree holders, the average rate was 2.4 percent.

Earnings data for Washington State residents similarly exhibit strong correlations between earnings and education. Table 2 presents median annual earnings by age and educational attainment in Washington in 1999. (Note that the Washington earnings in Table 2 are not strictly comparable to the national earnings in Table 1, as the former are *medians* while the latter are *means.* Median earnings tend to be lower than mean earnings.) For median Washington males, the premium for a bachelor's degree over a high school diploma ranges from 38 to 49 percent; for median Washington females, from 43 to 58 percent (Census 2005b).

BUT TO WHAT EXTENT DOES EDUCATION CAUSE THESE HIGHER EARNINGS?

For a number of years, economists have debated the extent to which the positive correlation between educational attainment and earnings represents the effect of education on earnings. As University of California economist David Card explains, "In the absence of empirical evidence, it is very difficult to know whether the higher earnings observed for better-educated workers are *caused* by their higher education, or whether individuals with greater earnings capacity have chosen to acquire more schooling" (Card 1998, emphasis in original).

It's plausible that high ability individuals gain more, on average, from education than low ability individuals do. If this is the case, the more able would have an incentive to stay in school longer, causing ability and educational attainment to be positively correlated even if education had no effect on earnings at all.

The possibility that the observed earnings premium to education might include the effect of ability is called the problem of "ability bias."

Table 2: Median Earnings in Washington State, 1999
Year-Round, Full Time Workers by Educational Attaiment and Age

	High School		College		
	Not High School Graduate	Graduate or GED	Some College	Bachelor's Degree	Advanced Degree
Male					
25 to 34 years	$22,892	$31,002	$34,451	$42,666	$47,479
35 to 44 years	$28,181	$37,719	$42,294	$56,091	$62,310
45 to 54 years	$29,743	$40,233	$44,359	$56,474	$66,198
55 to 64 years	$33,013	$39,493	$43,944	$57,250	$62,494
Female					
25 to 34 years	$17,053	$23,705	$26,460	$33,996	$37,051
35 to 44 years	$20,061	$26,092	$30,502	$41,170	$45,924
45 to 54 years	$19,884	$26,772	$31,361	$41,044	$48,749
55 to 64 years	$20,565	$25,822	$30,967	$39,663	$48,282

Source: Census 2000b

The ability bias question is of great practical importance: If education causes the higher earnings, then increasing educational attainment will be an effective strategy for increasing incomes.

Economists have tried a number of techniques to separate the effects of ability from schooling (including studies of the earnings of identical twins). Based on his review of this empirical work, Card concludes that schooling and ability are positively correlated and that the simple estimates do overstate the returns to school. However, this upward bias is small, only "on the order of 10 percent." Thus, of the roughly $35,000 by which the earnings of the average 35-to-44-year-old college graduate exceeded the average earnings of a male 35-to-44-year-old high school graduate in 2003, about $3,500 reflected differences in ability and $31,500 was the effect of education.

In addition, Card concludes that schooling is subject to diminishing returns. Holding ability constant, the return for early years of schooling is greater than the return for later years.

Economists describe the process of education as investment in "human capital." The earning increments associated with education are substantial, and as a result the value of the human capital created through education is huge. For example, Dale Jorgenson and Barbara Fraumeni prepared a comprehensive accounting of U. S. investment and wealth for the years 1948 to 1984 that included education as investment in human capital. They concluded that "Investment in human capital is at least four times the magnitude of investment in non-human capital; moreover, the value of wealth in the form of investment in human capital is over eleven times the value of nonhuman or physical capital" (Jorgenson and Tice 1989).

THE PREMIUM TO EDUCATION HAS INCREASED OVER TIME

In recent years U.S. incomes have become more unequal. This increasing inequality has largely been driven by increasing inequality in earnings from employment, as opposed to capital income. In part, the increasing inequality of earnings is the effect of a widening of the education premium (Nickell and Bell 1996, Dew-Becker and Gordon 2005).

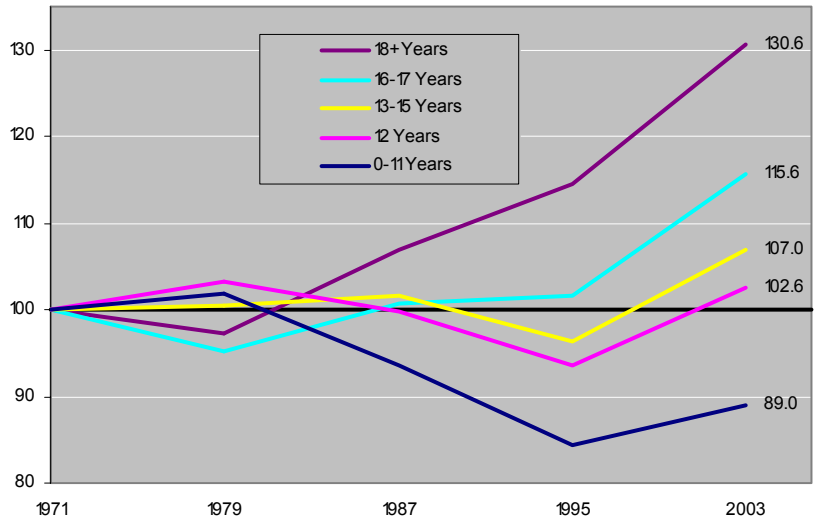
Chart 1 shows the evolution of mean weekly wage, adjusted for inflation, by education, at eight-year intervals from 1971 to 2003. Only the college educated saw substantial gains over the period. For high school dropouts, the real weekly wage in 2003 was 11 percent below the 1971 level. For high school graduates real wages increased a scant 2.6 percent over the

period. The wage in 2003 for those who had graduated college was 15.6 percent higher than in 1971, while that for those who had two or more years of post-graduate work was up 30.6 percent (Autor et al. 2005). (Interestingly, during the first eight-year period, 1971 to 1979, the pattern is reversed, with real wage gains for the less well educated and wage losses for the more highly educated.)

In Washington State, the annual earnings for male bachelor's degree holders who worked full time rose by an inflation-adjusted 21 percent between 1989 and 1999. For male high school graduates the corresponding increase was 7 percent.

Economists explain these changing wage premiums in terms of changing demand for and supply of educated labor. As Nobel laureate Jan Tinbergen said, the evolution of the wage structure is a "race between technological development and access to education" (cited by Katz and Autor 1998).

Chart 1: Mean Weekly Wage By Education
1971 = 100



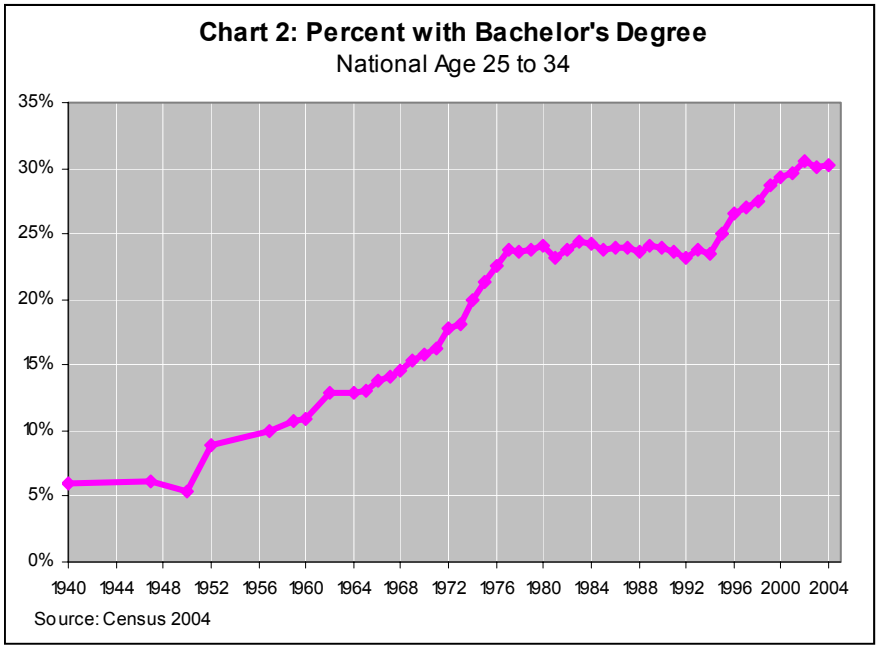
Source: Autor et. Al. 2005

On the supply side, educational attainment has increased dramatically in the U.S. over the past century. In 1910, only 13 percent of the population age 25 and higher were high school graduates and only 2.7 percent were college graduates. (Fully 23.8 percent had less than 5 years of elementary education.) By 2004, 85.2 percent of the adult population were high school graduates or had passed the GED test; 27.7 percent had a bachelor's or higher degree (Census 2004). For Washington State, 89.7 percent were high school graduates, or the equivalent, and 29.9 percent had a bachelor's degree or higher (Gardner 2005a, 2005b).

Chart 2 shows the percent of the (national) age 25 to 34 cohort that possessed a bachelor's degree for the years 1940 to 2003. The rate of increase in the bachelor's attainment accelerated in the early 1970s as the baby boomers began to move through this age group. The flood of boomers greatly increased the relative supply of young college-educated workers. Some speculated at the time that we were sending more students to college than justified by the demand for college-educated workers (Freeman 1976). After 1977, however, the share of college graduates in the 25 to 34 age group plateaued, with growth in bachelor's attainment not resuming until 1995. (The decennial censuses show that the 24.7 percent of age 25 to 34 Washingtonians had a college degree in 1980 compared to 23.0 percent in 1990.)

Two factors have combined to increase the demand for educated workers. The first is that the process of technological change has been "skill-biased," meaning new technologies have tended to favor the use of highly educated workers. For example, the introduction of numerically controlled machinery has simultaneously decreased the overall demand for labor in manufacturing and increased the skill levels required for the jobs that remain.

In recent years, perhaps the most important technological changes have involved computers and telecommunications. The strong productivity growth seen in the 1990s stemmed from three sectors: computer hardware, computer software and telecommunications (Jorgenson and Stiroh 2000). Computerization shifts the demands for skills, "sharply raising demand for the cognitive and interpersonal skills used by educated professionals and managers; reducing demand for clerical and routine analytical skills that comprised many middle-educated white collar jobs; and reducing demand for routine manual skills of many previously high-paid manufacturing production jobs. Somewhat paradoxically, computerization has probably had little impact on the demand for the non-routine manual skills used in many 'low-skilled' service jobs such as health aides, security guards, orderlies, cleaners, servers, etc" (Autor, Katz and Kearney 2005).



The second factor increasing the relative demand for educated workers is globalization. Dramatic improvements in transportation and communications technology—Cargo containers and fiber optic cable—have "flattened" the world, and as a result international trade has increased at a more rapid pace than economic activity in general (Levinson 2006; Friedman 2005). Trade in intermediate goods has grown particularly rapidly. Robert Feenstra and Gordon Hanson demonstrate that trade in intermediate inputs, which they call "production sharing" (and others call offshoring), has "much the same impact on labor demand as does skill-biased technical change: both of these will shift demand away from low-skilled activities, while raising relative demand and wages of the higher skilled." Production sharing arrangements tend to tap relatively low-skill, low-wage foreign labor forces putting downward pressure on low-skilled wage rates in the U.S. (Feenstra and Hanson 1999, 2001).

Skill biased-technical change and globalization have combined to steadily increase the relative demand for college educated labor. Economists David Autor, Lawrence Katz and Melissa Kearney (2005) conclude,

> The evolution of the college-high school wage premium over the last four decades – a modest rise in the 1960s, a decline in the 1970s, and a steep rise in the 1980s continuing [at] a more moderate rate in the 1990s – is well-explained by a strong and rather steady trend growth in the relative demand for college versus non-college labor overlaid with fluctuations in the rate of growth of the relative supply of college equivalents (particularly the surge in new college graduates of the 1970s and sharp slowdown of relative supply growth starting in the early 1980s).

Going forward, the relative demand for skilled workers should continue to grow.

YEARS OF SCHOOLING IS A CRUDE MEASURE

The number of years of schooling completed is an imperfect index of educational attainment as "seat time" does not guarantee mastery of the relevant set of skills. The performance of U.S. students on various international examinations illustrates this. U.S. students often score below students who have spent an equivalent length of time in school in other countries.

Consider first the tests given in 2003 by the Organization for Economic Co-operation and Development's Programme for International Student Assessment (PISA). PISA 2003 was taken by well over a quarter of a million 15-year-old students in 41 countries, including the thirty countries that are members of the OECD.

Table 2: Scores and Rankings on PISA 2003
OECD Countries

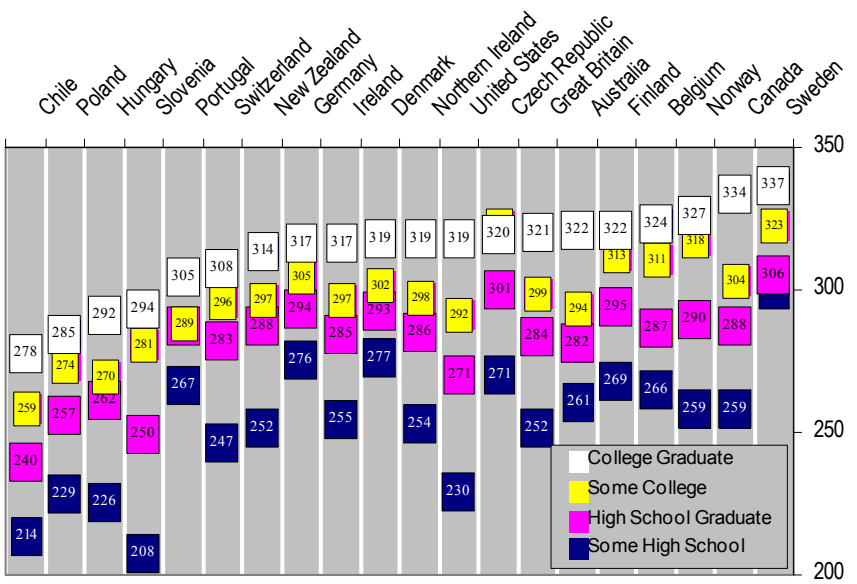
	Math		Reading		Science		Cumulative Spending ($) Per Student Ages 6 to 15	
	Score	Rank	Score	Rank	Score	Rank	Amount	Rank
Australia	524	8	525	4	525	4	58,480	13
Austria	506	15	491	18	491	19	77,255	3
Belgium	529	6	507	9	509	11	63,571	8
Canada	532	5	528	3	519	8	59,810	12
Czech Republic	516	10	489	20	523	6	26,000	22
Denmark	514	12	492	16	475	26	72,934	6
Finland	544	1	543	1	548	1	54,373	15
France	511	13	496	14	511	10	62,731	9
Germany	503	16	491	18	502	15	49,145	16
Greece	445	27	472	26	481	25	32,990	21
Hungary	490	21	482	21	503	14	25,631	23
Iceland	515	11	492	16	495	17	65,977	7
Ireland	503	16	515	6	505	13	41,845	19
Italy	466	25	476	25	486	22	75,693	4
Japan	534	4	498	12	548	1	60,004	11
Korea	542	2	534	2	538	3	41,802	20
Luxembourg	493	20	479	23	483	24	na	
Mexico	385	29	400	29	405	29	15,312	25
Netherlands	538	3	513	8	524	5	55,416	14
New Zealand	523	9	522	5	521	7	na	
Norway	495	19	500	10	484	23	74,040	5
Poland	490	21	497	13	498	16	23,387	24
Portugal	466	25	478	24	468	27	48,811	17
Slovak Republic	498	18	469	27	495	17	14,874	26
Spain	485	23	481	22	487	21	46,774	18
Sweden	509	14	514	7	506	12	60,130	10
Switzerland	527	7	499	11	513	9	79,691	2
Turkey	423	28	441	28	434	28	na	
United Kingdom	na		na		na		na	
United States	483	24	495	15	491	19	79,716	1
Average	499.6		493.8		498.9		52,554	
US % of Average	96.7%		100.3%		98.4%		151.7%	

Source: Programmme for International Student Assessment 2004 na: not available

The first six columns of Table 2 presents the mean scores and rankings for students from 29 OECD countries in three subject areas: mathematics, reading, and science. (Mean scores for the United Kingdom failed to meet reliability standards and were not published.) The U.S. ranked 25th in mathematics, 16th in reading and 20th in science. The fifth column reports the cumulative amount spent on the average student over 10 years, from age 6 through 15, for 26 of the countries (per student spending for Luxembourg, New Zealand, Turkey and the United Kingdom is not available). The U.S cumulative spending per student, $79,716, ranks highest.

Next consider the International Adult Literacy Survey (IALS), conducted in the mid-1990s. IALS was designed to provide a comparative assessment of the literacy skills of working age populations. It defined literacy broadly as the ability to use "printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential." The test recognized three separate domains: *prose* literacy (the ability to understand and use texts), *document* literacy (the ability to locate and use information in structured documents such as job applications, payroll forms, transportation schedules and maps) and *quantitative* literacy (the ability to apply arithmetic operations to accomplish such tasks as balancing a

Chart 4: Average IALS Scores By County and Educational Attaiment



Source: OCED et al. 1997

checkbook or calculating a tip). On each of these domains the test measures literacy on a scale from 0 to 500.

Chart 4 shows average scores across the three domains at four levels of educational attainment for 20 countries. What is striking is the way that the U.S.'s relative performance varies with the length of time spent in school. For the lowest educational category—corresponding to high school dropouts—the U.S.'s literacy score is far below all but four of the countries (Chile, Hungary, Poland and Slovenia). For the second category—corresponding to high school graduates—the U.S.'s literacy score is again fifth lowest, while for the third group, those with at least some postsecondary education, the U.S.'s literacy score is sixth lowest. Only for the fourth group, college graduates, is U.S. literacy close to the average of the developed nations.

Further evidence of the weakness of years of schooling as a measure of knowledge comes from studies of the effectiveness of individual teachers. These studies show that certain teachers consistently achieve greater gains in student performance, as measured by test scores. Eric Hanushek summarizes one such study: "Looking at the range of quality for teachers in a single large urban district, teachers near the top of the quality distribution can get an entire year's worth of additional learning out of their students compared to those near the bottom . . . That is, a good teacher will get a gain of 1½ grade level equivelents while a bad teacher will get ½ year for a single academic year" (Hanushek 2003). Students of both teachers are credited with one year of schooling, though the former's students have learned three times as much as the latter's have learned in the course of that year.

TEST SCORES DO MATTER FOR EARNINGS

Francine Blau and Lawrence Kahn demonstrate that wages are strongly linked to IALS literacy scores. They estimate wage equations on IALS data including both years of schooling and literacy test scores as explanatory variables. The coefficients for performance on the IALS tests are of comparable magnitude to the coefficients for years of schooling "suggesting that education and cognitive skills are both important determinants of wages and roughly equally so" (Blau and Kahn 2001).

Richard Murnane, John Willett and Frank Levy similarly found that performance on an elementary math test was an important predictor of wages. They examined two data sets comprising high school graduates from the classes of 1972 and 1980 respectively. Subjects were given a math test during their senior year that "assessed students' skills in following directions, working with fractions and decimals, and interpreting line graphs. . . . The test contained no items requiring knowledge of geometry or advanced algebra." College graduates had higher average

scores on these tests than those who did not progress beyond high school. The estimated impact on wages of the test-score difference is as big as the impact of college itself (Murnane et al. 1995).

Papers by Robert Barro and by Hanushek and Dennis Kimko find test scores help to explain international differences in growth rates. Barro's analysis includes both test scores and average years of schooling at the secondary level and beyond as explanatory variables and finds test scores to be "quantitatively much more important" (2000). Hanushek and Kimko similarly relate growth to both test scores and average years of schooling and find test scores to have nearly six times the impact of years of schooling (2000).

SIMILARLY COURSES MATTER

Other analysts have found that the particular curriculum studied (and performance in that curriculum) is an important determinant of subsequent earnings.

A paper by Heather Rose and Julian Betts relates the courses taken in high school to earnings 10 years after graduation and finds that a high level curriculum in 11th and 12th grades (advanced algebra, calculus, two years advanced English, two years chemistry, third and fourth years foreign language) adds as much to earnings as two additional years of schooling (Rose and Betts 2004). Courses in advanced math have a particularly strong impact, as does math GPA.

At the college level, a paper by Peter Arcidiacono finds that large earnings differences exist across majors and that these differences do not just reflect the sorting of students by ability. Again, the courses taken matter for earnings (Aridiacono 2004).

DISCUSSION

Education is perhaps the most important example of human capital.

The process of education builds skills that are economically valuable. Looking at year-round, full-time workers in 2003, high school graduates on average earned about $8,500 more than those who dropped out before graduating high school, adjusted for ability. Similarly, college graduates averaged about $23,000 more than high school graduates.

Changing technology and globalization have combined to increase the return to education. Between 1971 and 2003 the real weekly wage for age 25-34 high school dropouts fell by 11 percent. In contrast, the real wage for age 25-34 college graduates rose by 15.6 percent.

A good portion of the value of education is captured in test scores. This raises troubling issues. In spite of high levels of spending per student, US performance falls only in the middle of the pack in international tests of high school level Students. Comparisons of adult literacy are particularly grim when we look at high school dropouts and high school graduates.

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