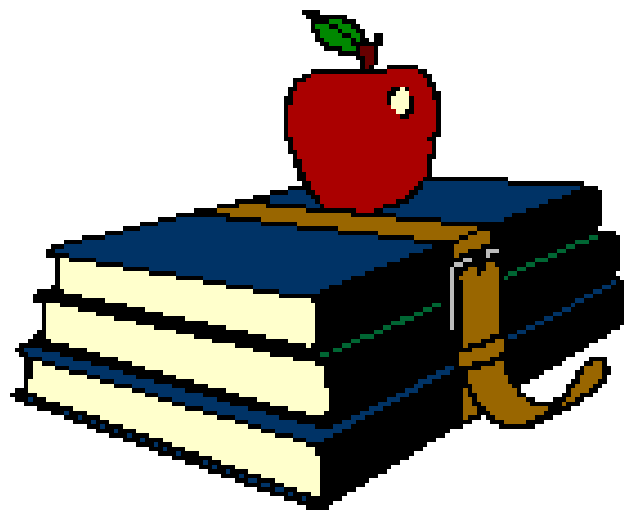


**The Impact of Higher Education
on the
Expected Work-Life Earnings
of
Kentucky Workers**



by

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The Impact of Higher Education on the Expected Work-Life Earnings of Kentucky Workers

Higher education can have significant long-term effects on a student's earnings potential. Workers with more education on average tend to have higher earnings than those with less education. But it costs time and money to attend a college, university, or vocational school. Students generally decide to extend their education beyond high school if they believe the long-term returns to education are greater than the shorter term costs of the schooling. Since the costs to the students occur over a fairly short two to eight year time period (for most people) while the returns accrue over a lifetime, expenditures on higher education can be analyzed as an investment in human capital.

In this study we illustrate the economic value of higher education, and examine the added value of attending school beyond high school, from just a single year to the attainment of a PhD degree, for people currently living in ten regions in Kentucky.

The main findings of the study are:

- Completing at least some higher education increases the present value of one's work-life earnings over what it would have been had one ended one's education with high school graduation. This holds for every classification of worker. The net present value of the work-life earnings of an Associate degree holder is estimated to be between \$140,000 (males in the Green River region) and \$360,000 (males in the Northeast Mountain region) greater than for a high school graduate. For a Bachelor's degree holder the difference is estimated to be between \$194,000 (females in the Elizabethtown region) and \$698,000 (males in the Gateway region). For a Master's degree holder the difference is estimated to be between \$230,000 (males in the Green River region) and \$740,000 (males in the Jefferson region). For a professional or PhD degree holder the difference is estimated to be between \$483,000 (females in the Gateway region) and \$1,350,000 (males in the Elizabethtown region).

- Work-life earnings profiles for males have greater initial predicted earnings and peak at higher values than for females.

- In general each step up in educational attainment is rewarded by increased predicted earnings. One exception to this is that for males there is virtually no difference in earnings whether one has had less than one year of college, more than a year but didn't graduate, or earned an Associate degree. On the other hand, for females there is a definite step up in earnings at the Associate degree level. Another exception is that (aside from in the Purchase-Pennyrile region) earnings for males with a Master's degree are no greater than for those with a Bachelor's degree. This is in stark contrast to females, where the holders of Master's degrees have a significant increase in earnings.

- Among the geographic regions, the present values of lifetime earnings, regardless of education level are generally highest for the Gateway, Jefferson, and Bluegrass regions, and lowest for the Southeast Mountain, Somerset, and Northeast Mountain regions. The present values of the latter group are generally about 70 percent those of the former group.

- There is a marked gender difference in the impact of education on the distribution of occupations among our sample. Except for at the professional and PhD level of education, the distribution of jobs among the seven occupational classes is much more concentrated in one or two sectors for women than for men. It is especially pronounced at the Associate degree level where for males no job class has more than 26 percent of the workers in any of the geographic regions, but for females both the Science, Legal and Health and the Sales and Office occupational groups each have at least 27 percent and up to 44 percent of the workers in all the geographic regions. At the Master's degree level, between 56 and 75 percent of females work in the Social Service, Education, Arts, Media and Military occupational sector, depending upon the geographic region, but only between 8 and 17 percent in Management, Business and Finance occupations. While the Social Service, Education, Arts, Media and Military job class is also generally the area of highest concentration for males, between 21 and 40 percent have Management, Business, and Finance occupations, depending upon the region.

- At all the levels of higher education, the total returns on that extra education tend to be highest for workers with jobs in either the Management, Business, and Finance or the Science, Legal, and Health occupational classes. At the Bachelor's degree level, the total returns for workers in the Social Service, Education, Arts, Media, and Military occupational class begin to edge up relative to the other occupational classes, and at the Master's degree level they are fully on par with the total returns received by workers in those two highest returning job sectors.

- There is a great deal of variation in the returns to an investment in higher education among workers in the seven occupational classes, regardless of which region of the state they live in, and among workers in the same occupational class between regions, regardless of which job sector they work in.

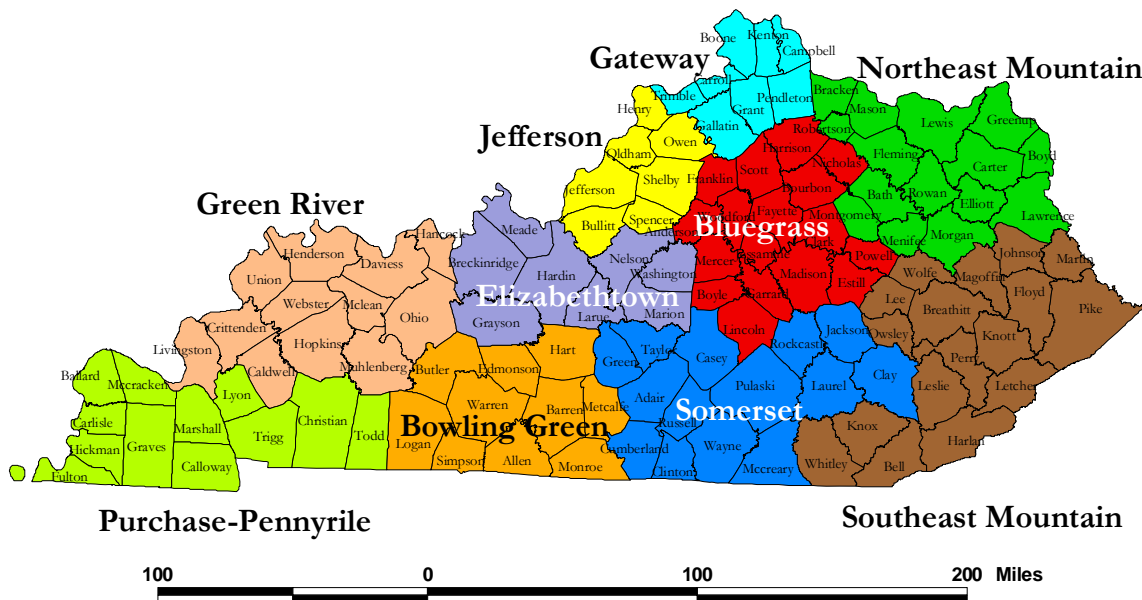
General Methodology

It is, of course, impossible to precisely predict an individual's future earnings, but economists have developed a methodology to measure the average financial

benefits to investments in education. These estimates of work-life earnings are expected average amounts based on current cross-sectional earnings data on workers of all ages, educational attainment, vocation, and other such characteristics. A linear regression model is statistically estimated, resulting in a model containing coefficients which give a prediction of the effects of education and other demographic variables on a worker's future earnings.

We use data from the 2000 decennial Census in this study. Specifically, the 5% PUMS data for Kentucky. The Census 5% PUMS files contain individual records of the characteristics for a 1 percent sample of people and housing units. The Kentucky 5% PUMS dataset is divided up into 16 public use microdata areas (PUMAs), each with a minimum population of 100,000. The PUMAs correspond fairly well with KCTCS enrollment clusters. In order to ensure that there would be adequate sample sizes for our statistical purposes, ten of the PUMAs were combined into four larger areas. The combinations were made with the goal of following the boundaries of the state's Area Development Districts as much as possible.

Kentucky Geographic Regions



Based upon U.S. Census Bureau Public Use Microdata Areas (PUMAs) and Kentucky Area Development Districts

Estimation

We use data from the 2000 Census PUMS 5% file to estimate an earnings equation for each of the ten geographic regions. Following standard practice in the literature, we fit a regression where the dependent variable is the logarithm of a worker's average earnings and the explanatory variables include a worker's experience, gender, and level of education. We also include explanatory variables for a worker's field of occupation since the monetary benefit from more schooling may vary considerably depending upon one's vocation. We ran the regression for all high school graduates in our database who worked at some point in 1999.

Thus, we make no distinction between year-round or part-year employment or between full-time or part-time employment. Factors determining such employment status, such as layoffs, illness, family matters, etc., generally are independent of a worker's prior educational attainment. The goal is to create a lifetime earnings profile for the average 2006 high school graduate under various possible scenarios of future educational attainment.

We use six dummy variables for level of education beyond high school. The first is for workers who attended some college, but less than one year; the second is for those who attended more than a year of college but who failed to earn a degree; the third is for those whose highest degree is an associate degree; the fourth is for those whose highest degree is a bachelor's degree; the fifth is for those whose highest degree is a master's degree; and the sixth is for those whose highest degree is either a professional degree or a PhD. Since the omitted category is high school graduate, the dummy variables measure the difference in earnings compared with workers who finished their schooling with high school graduation.

Another variable measures the number of years a person could have been working after the completion of high school. However, we have no way of controlling for intermittent employment activity, but must assume that a person worked in each year after their schooling ended. For high school graduates we use the worker's age minus 18; for those who attended less than a year of college we use their age minus 19; for those who attended more than a year of college but didn't get a degree and for those who have an associate degree we use their age minus 20; for those who have a bachelor's degree we use their age minus 22; for those who have a

master's degree we use their age minus 24; and for those who have either a professional degree or a PhD we use their age minus 26. We are therefore not taking into account possible breaks in schooling or extra time needed to complete a degree. We also utilize the square of the experience variable in order to check if the work-life earnings profiles have the expected concave shape which shows earnings initially growing with each year of added experience, reaching a peak and then declining.

The model includes a dummy variable for gender, as well, equal to one for female workers and zero for males. The dummy measures the difference in earnings for women compared with men.

We also created seven dummy variables to capture differences among workers' occupations. The Census Bureau utilized a classification system for occupations with a few hundred occupational fields that were grouped into twenty-three major segments. We further aggregated that to seven occupation classes so that there would be a minimum of four hundred people in the database in each job class. The seven occupational classes are 1) management, business, and finance; 2) professional science, the legal profession, and healthcare practitioners or technicians; 3) social services, education, the arts, media, and the military; 4) personal services; 5) sales and office functions; 6) agriculture, construction, extraction, and maintenance; and 7) production, transportation, and material moving. Since the seven job categories are exhaustive and mutually exclusive, we needed to eliminate one of them from the regression equations. We chose to omit the sales and office variable since more workers (25%) had those sorts of jobs than any of the other classifications. Thus, the other occupation dummies measure the difference in earnings compared to workers in the sales and office professions.

The model also includes interaction terms among all of the variables. This allows us to check to see, for instance, if earnings change with experience differently depending upon one's educational attainment or gender or occupation, or if earnings profiles for a particular gender differ by occupation.

The fitted regression equations allowed us to chart the predicted experience-earnings profiles for various combinations of educational attainment, gender, and occupation. In turn, the predicted earnings for each level of education and gender allow for the calculation of the present value of work-life earnings. The present values are based on the probability of working at each age, the

probability of surviving to each age, and the ratio of the growth in wages to interest rates. Net present values, or the total returns to education, also take into account the costs of additional schooling. The factors utilized in the present value calculations were derived as follows:

Work probabilities. Since people do not always work, we use the Census data to calculate the percentage of people in the ten geographic regions who were working in 1999 for each education level and by gender for five year age ranges. These work probabilities adjust the earnings estimates downward to reflect the possibility

Table 1
Work Probabilities by Age, Gender, and Geographic Region

Male High School Graduates												
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
Bluegrass	0.866	0.915	0.905	0.878	0.877	0.882	0.854	0.778	0.621	0.404	0.280	0.234
Bowling Green	0.878	0.945	0.914	0.930	0.894	0.885	0.848	0.764	0.602	0.348	0.294	0.085
Elizabethtown	0.858	0.944	0.908	0.921	0.927	0.912	0.885	0.789	0.557	0.204	0.259	0.123
Gateway	0.918	0.910	0.956	0.897	0.930	0.915	0.844	0.816	0.607	0.291	0.267	0.181
Green River	0.849	0.926	0.901	0.922	0.901	0.873	0.883	0.734	0.606	0.247	0.271	0.147
Jefferson	0.853	0.905	0.922	0.883	0.901	0.921	0.847	0.794	0.571	0.352	0.201	0.121
Northeast Mountain	0.772	0.865	0.862	0.871	0.823	0.791	0.792	0.737	0.519	0.250	0.222	0.086
Purchase-Pennyrile	0.887	0.922	0.915	0.910	0.910	0.847	0.826	0.756	0.606	0.274	0.141	0.120
Somerset	0.844	0.872	0.892	0.856	0.860	0.782	0.734	0.734	0.540	0.357	0.167	0.176
Southeast Mountain	0.660	0.780	0.819	0.759	0.712	0.699	0.556	0.488	0.358	0.200	0.161	0.145
Female High School Graduates												
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
Bluegrass	0.824	0.783	0.750	0.776	0.844	0.770	0.772	0.654	0.452	0.224	0.175	0.058
Bowling Green	0.816	0.767	0.800	0.724	0.817	0.721	0.715	0.633	0.481	0.184	0.101	0.064
Elizabethtown	0.832	0.822	0.731	0.810	0.791	0.730	0.738	0.597	0.437	0.269	0.167	0.075
Gateway	0.876	0.746	0.822	0.828	0.792	0.780	0.777	0.647	0.534	0.233	0.178	0.084
Green River	0.774	0.699	0.681	0.768	0.745	0.742	0.653	0.584	0.332	0.178	0.175	0.035
Jefferson	0.819	0.759	0.788	0.774	0.787	0.799	0.716	0.683	0.469	0.206	0.179	0.052
Northeast Mountain	0.721	0.650	0.638	0.720	0.711	0.734	0.578	0.544	0.366	0.184	0.156	0.048
Purchase-Pennyrile	0.777	0.682	0.780	0.783	0.754	0.749	0.613	0.581	0.401	0.152	0.149	0.074
Somerset	0.681	0.645	0.660	0.751	0.780	0.700	0.600	0.489	0.327	0.250	0.182	0.012
Southeast Mountain	0.545	0.525	0.547	0.627	0.598	0.547	0.412	0.454	0.302	0.157	0.103	0.019
Male's with less than 1 year of college or more than a year but no degree												
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
Bluegrass	0.891	0.954	0.963	0.940	0.916	0.931	0.934	0.847	0.676	0.479	0.340	0.167
Bowling Green	0.893	0.903	0.959	0.962	0.881	0.929	0.873	0.705	0.579	0.300	0.294	0.350
Elizabethtown	0.904	0.955	0.963	0.969	0.952	0.919	0.896	0.781	0.667	0.355	0.200	0.222
Gateway	0.935	0.980	0.993	0.964	0.942	0.949	0.915	0.860	0.694	0.481	0.306	0.122
Green River	0.857	0.970	0.899	0.956	0.965	0.896	0.855	0.694	0.708	0.457	0.273	0.250
Jefferson	0.915	0.941	0.971	0.950	0.921	0.901	0.871	0.852	0.643	0.392	0.306	0.182
Northeast Mountain	0.824	0.929	0.946	0.892	0.913	0.889	0.817	0.754	0.432	0.375	0.348	0.263
Purchase-Pennyrile	0.905	0.949	0.961	0.909	0.904	0.928	0.889	0.773	0.616	0.290	0.267	0.130
Somerset	0.851	0.963	0.882	0.961	0.794	0.840	0.790	0.735	0.667	0.375	0.250	0.333
Southeast Mountain	0.746	0.873	0.892	0.857	0.802	0.778	0.728	0.607	0.448	0.263	0.111	0.000
Female's with less than 1 year of college or more than a year but no degree												
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
Bluegrass	0.891	0.856	0.815	0.875	0.859	0.826	0.861	0.709	0.531	0.263	0.203	0.087
Bowling Green	0.896	0.833	0.814	0.802	0.880	0.808	0.795	0.759	0.515	0.190	0.167	0.113
Elizabethtown	0.867	0.795	0.800	0.828	0.853	0.925	0.766	0.730	0.405	0.296	0.190	0.091
Gateway	0.937	0.857	0.855	0.826	0.893	0.873	0.885	0.716	0.508	0.386	0.241	0.079
Green River	0.786	0.793	0.797	0.815	0.862	0.836	0.840	0.600	0.471	0.224	0.196	0.137
Jefferson	0.914	0.908	0.885	0.830	0.843	0.856	0.811	0.687	0.583	0.336	0.204	0.062
Northeast Mountain	0.828	0.780	0.798	0.846	0.831	0.795	0.712	0.679	0.476	0.176	0.318	0.077
Purchase-Pennyrile	0.857	0.808	0.769	0.820	0.815	0.880	0.712	0.658	0.433	0.500	0.231	0.068
Somerset	0.856	0.778	0.800	0.710	0.818	0.825	0.682	0.574	0.435	0.348	0.300	0.091
Southeast Mountain	0.611	0.669	0.664	0.755	0.674	0.721	0.544	0.606	0.368	0.205	0.149	0.040

that a person may not work at a particular age. Why a person may not be working is irrelevant to this study as the many possible reasons are largely independent of the decision to extend one's schooling after high school and we are interested in the average economic impact of higher education. Because of small sample sizes we combined education level categories above the high school

graduate level. We merged the data for the two categories of those who attended college but failed to get a degree; the two categories of those with associate and bachelor's degrees, and the two categories of those with master's, professional, or PhD degrees. See Table 1 for this data.

Table 1 (continued)
Work Probabilities by Age, Gender, and Geographic Region

	Male's with AA or BA degrees											
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
Bluegrass	0.908	0.965	0.983	0.952	0.969	0.964	0.942	0.848	0.679	0.429	0.516	0.118
Bowling Green	0.880	0.983	0.980	1.000	0.963	0.930	0.896	0.870	0.652	0.353	0.571	0.000
Elizabethtown	0.941	0.960	1.000	0.935	0.951	0.911	0.922	0.765	0.625	0.286	0.533	0.308
Gateway	0.961	1.000	0.983	0.983	0.979	0.952	0.959	0.821	0.758	0.448	0.593	0.207
Green River	0.871	0.987	0.985	0.957	0.952	0.949	0.932	0.846	0.750	0.643	0.455	0.276
Jefferson	0.882	0.950	0.973	0.978	0.973	0.967	0.928	0.893	0.671	0.455	0.319	0.186
Northeast Mountain	0.871	0.960	0.948	0.935	0.960	0.929	0.913	0.892	0.762	0.429	0.429	0.400
Purchase-Pennyrile	0.900	0.962	0.988	0.956	0.946	0.882	0.976	0.813	0.725	0.269	0.529	0.200
Somerset	0.833	0.942	0.976	0.947	0.935	0.854	0.886	0.741	0.652	0.417	0.333	0.308
Southeast Mountain	0.765	0.922	0.935	0.862	0.859	0.932	0.804	0.750	0.529	0.304	0.400	0.188
	Female's with AA or BA degrees											
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
Bluegrass	0.926	0.903	0.847	0.848	0.898	0.879	0.842	0.747	0.492	0.324	0.282	0.049
Bowling Green	0.951	0.921	0.870	0.864	0.875	0.902	0.818	0.737	0.520	0.364	0.333	0.029
Elizabethtown	0.870	0.914	0.813	0.856	0.940	0.897	0.868	0.619	0.200	0.286	0.125	0.034
Gateway	0.966	0.892	0.867	0.862	0.851	0.900	0.868	0.694	0.433	0.333	0.250	0.083
Green River	0.978	0.902	0.890	0.882	0.864	0.928	0.900	0.606	0.444	0.286	0.000	0.057
Jefferson	0.921	0.921	0.852	0.851	0.824	0.880	0.805	0.723	0.521	0.191	0.230	0.101
Northeast Mountain	0.946	0.925	0.853	0.875	0.879	0.875	0.780	0.677	0.417	0.364	0.429	0.067
Purchase-Pennyrile	0.914	0.850	0.901	0.846	0.860	0.850	0.771	0.756	0.459	0.227	0.083	0.049
Somerset	0.845	0.861	0.886	0.823	0.768	0.868	0.758	0.667	0.353	0.455	0.118	0.103
Southeast Mountain	0.738	0.869	0.881	0.855	0.819	0.866	0.759	0.429	0.382	0.000	0.300	0.063
	Male's with MA, Professional, or PhD degrees											
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
Bluegrass	1.000	0.964	0.976	1.000	0.971	0.967	0.934	0.924	0.787	0.700	0.343	0.222
Bowling Green	1.000	1.000	1.000	1.000	1.000	0.964	0.800	0.957	0.650	0.524	0.357	0.000
Elizabethtown	1.000	1.000	1.000	1.000	1.000	0.933	1.000	1.000	0.917	0.857	0.500	0.250
Gateway	1.000	1.000	1.000	1.000	1.000	1.000	0.972	0.946	0.889	0.571	0.385	0.313
Green River	1.000	1.000	1.000	1.000	1.000	0.969	0.923	0.852	0.750	0.500	0.462	0.286
Jefferson	0.800	0.942	0.985	0.994	0.981	0.980	0.974	0.924	0.832	0.573	0.509	0.216
Northeast Mountain	1.000	0.800	0.960	0.933	0.889	0.793	0.938	0.909	0.647	0.538	0.375	0.300
Purchase-Pennyrile	1.000	1.000	1.000	1.000	0.966	0.971	0.927	0.963	0.697	0.571	0.300	0.313
Somerset	1.000	0.900	1.000	1.000	0.857	0.964	1.000	0.833	0.583	0.364	0.300	0.571
Southeast Mountain	n/a	0.923	0.926	0.975	0.944	0.925	0.814	0.809	0.500	0.368	0.357	0.087
	Female's with MA, Professional, or PhD degrees											
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
Bluegrass	0.500	0.945	0.864	0.930	0.926	0.912	0.851	0.846	0.649	0.333	0.333	0.056
Bowling Green	1.000	0.944	0.966	1.000	0.914	0.921	0.813	0.861	0.647	0.000	0.000	0.083
Elizabethtown	1.000	0.917	0.926	0.900	0.917	0.946	0.857	0.739	0.571	0.750	0.429	0.000
Gateway	1.000	0.875	0.918	0.875	0.911	0.935	0.864	0.818	0.563	0.375	0.364	0.176
Green River	0.000	1.000	0.947	0.923	0.935	0.962	0.909	0.742	0.583	0.375	0.625	0.050
Jefferson	0.900	0.911	0.904	0.898	0.922	0.908	0.911	0.806	0.738	0.440	0.286	0.122
Northeast Mountain	1.000	1.000	0.906	0.931	0.938	0.936	0.800	0.846	0.556	0.455	0.375	0.125
Purchase-Pennyrile	1.000	0.900	0.905	0.938	0.920	0.974	0.911	0.825	0.579	0.400	0.333	0.063
Somerset	0.800	0.913	0.960	1.000	0.938	0.977	0.833	0.714	0.429	0.333	0.333	0.000
Southeast Mountain	0.750	1.000	0.943	0.938	0.974	0.974	0.725	0.914	0.333	0.211	0.273	0.000

Survival rates. The return to investment in higher education is greater the longer one lives due to an extended work-life. We adjust the estimated earnings at each age by the probability that an individual reaches that particular age. The survival rates estimates use data from the U.S. National Center for Health Statistics publication National Vital Statistics Reports, Vol. 54, No. 14, April 19, 2006 (as revised March 28, 2007). See Table 2 for an abbreviated version of this data.

Table 2
Survival Probabilities by Age and Gender
(for selected ages)

Age	Males	Females
18	1.000	1.000
20	0.998	0.999
25	0.991	0.997
30	0.984	0.994
35	0.977	0.990
40	0.967	0.985
45	0.952	0.976
50	0.931	0.963
55	0.900	0.945
60	0.859	0.918
65	0.798	0.876
70	0.713	0.815
75	0.600	0.728
80	0.457	0.606

Growth in wages and interest rates. As a proxy for the future growth in wages we use the average growth in the average hourly earnings of production workers from 1964 to 2006. This data comes from the U.S. Bureau of Labor Statistics. The average growth rate in production wages was 4.60%. The interest rate we use is the average 3-month Treasury Bill secondary market rate (discount basis) from 1964-2006. This comes from the U.S. Federal Reserve Board's historical data (Statistical Release H.15). The average interest rate was 5.80%. Because this period includes a wide range of economic conditions these averages should be good proxies for the long-term average over the next several decades.

Real 2006 dollars. The Consumer Price Index is used to adjust the present value estimates from 1999 to 2006 dollars. The CPI for 1999 was 166.6 while the annual 2006 CPI was 201.6.

Tuition and fees. To calculate the total return to education we need to calculate the annual cost of higher education from tuition, fees, books and other supplies and then calculate the present value of these costs for each year of schooling. We assume that those who at-

tend college for less than one year incur a full year of costs; that those who attend more than a year but don't get a degree and those who receive an Associate degree incur two years of costs; that those who receive a Bachelor's degree incur four years of costs; that those who receive a Master's degree incur six years of costs; and that those who receive either a professional or PhD degree incur eight years of costs. We further assume that all these costs are incurred in the years immediately succeeding high school graduation.

We use tuition, fee, book and supply cost information from KCTCS and the University of Kentucky for the 2006-07 academic year. Fulltime tuition and fees in the KCTCS was \$3,270. Annual undergraduate tuition and fees at UK were \$6,510 for lower division students and \$6,698 for upper division students. Graduate school tuition at the University of Kentucky was \$7,036; MBA tuition was \$7,552; Law school tuition was \$12,842; Medical school tuition was \$21,312; Dental school tuition was \$19,534; Pharmacy school tuition was \$16,308; and professional doctoral students paid \$9,174. For the two additional years of schooling needed to earn a Master's degree and the four years of additional schooling required to earn a professional or PhD degree we weighted tuition based on Fall 2006 enrollment by degree program for each of the colleges making up the University of Kentucky. In all cases we assume that books and other supplies cost \$800 per year, which is the budget figure published for student use by the University of Louisville. Table 3 shows these present values of tuition, fees, books and other supplies.

Table 3
Present Values of Tuition, Fees, Books, and Supplies

Educational Attainment	Present Value
Less than 1 year of college	\$4,024
More than 1 year of college, no degree	\$8,003
Associate degree	\$8,003
Bachelor's degree	\$28,786
Master's degree	\$43,816
Professional or PhD degree	\$73,662

There are also opportunity costs to obtaining a higher education. A college student is foregoing the income that could have been made had he or she been working since high school graduation. Since we assume that no income is earned until a person's schooling is finished, when we calculate the difference between a high school graduate's present value of work-life earnings and that of someone with more education the opportunity costs are accounted for.

Results

Predicted earnings. To examine the shape of the experience-earnings profiles, we have graphed, for each of the ten geographic regions, the predicted experience-earnings profile for each level of educational attainment by gender. All of the profiles have the expected concave shape. (See Figure 1. All of the profiles are shown in 1999 dollars. An appendix has the experience-earnings profiles for each gender/educational attainment pairing so that variation among the geographic regions may be directly compared.)

The profiles for males have greater initial predicted earnings and peak at higher values. In general each step up in educational attainment is rewarded by increased predicted earnings. There are some interesting exceptions, however. One exception is that for males there is virtually no difference in earnings whether one has had less than one year of college, more than a year but didn't graduate, or earned an Associate degree. On the other hand, for females there is a definite step up in earnings at

the Associate degree level. This may be largely an artifact of the distribution of occupations among our sample. For males, there is a movement out of service jobs and into management, business, and finance, and science, legal, and healthcare occupations as educational level increases from less than a year of college to an Associate degree, but between 31% and 48% of jobs remain in the two blue collar sectors. For females, however, there is an extreme shift from sales and office and service occupations to science, legal, and healthcare occupations. The latter class of jobs tends to have higher pay than the first two job types. In fact, the predicted earnings for a worker in the science, legal, and healthcare occupations are much higher at all levels of education than they are for workers in either the services or sales and office occupations.

Another exception is that (aside from in the Purchase-Pennyrile region) earnings for males with a Master's degree are no greater than for those with a Bachelor's degree. This is in stark contrast to females, where the holders of Master's degrees have a significant increase in earnings. Again, this may be an artifact of the distribu-

Figure 1
Predicted Experience-Earnings Profiles for Each Level of Educational Attainment by Gender and Geographic Region

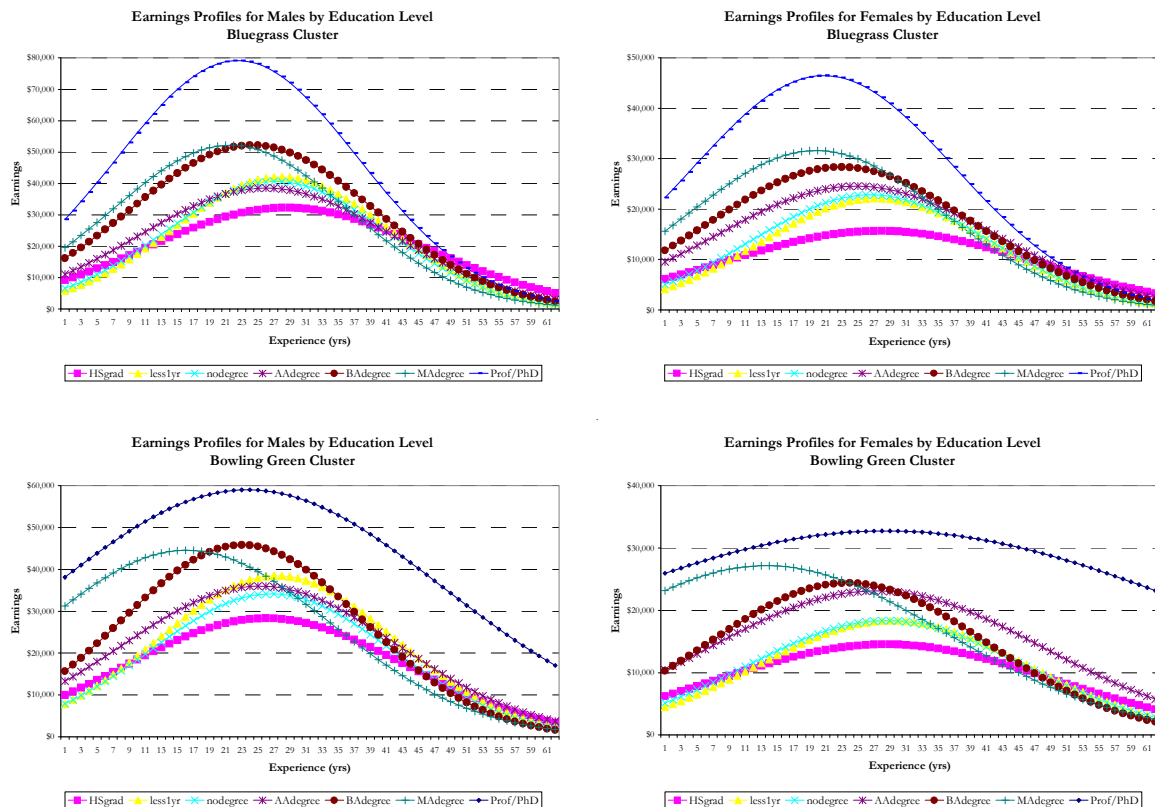


Figure 1 (continued)
Predicted Experience-Earnings Profiles for Each Level of Educational Attainment
by Gender and Geographic Region
(1999 Dollars)

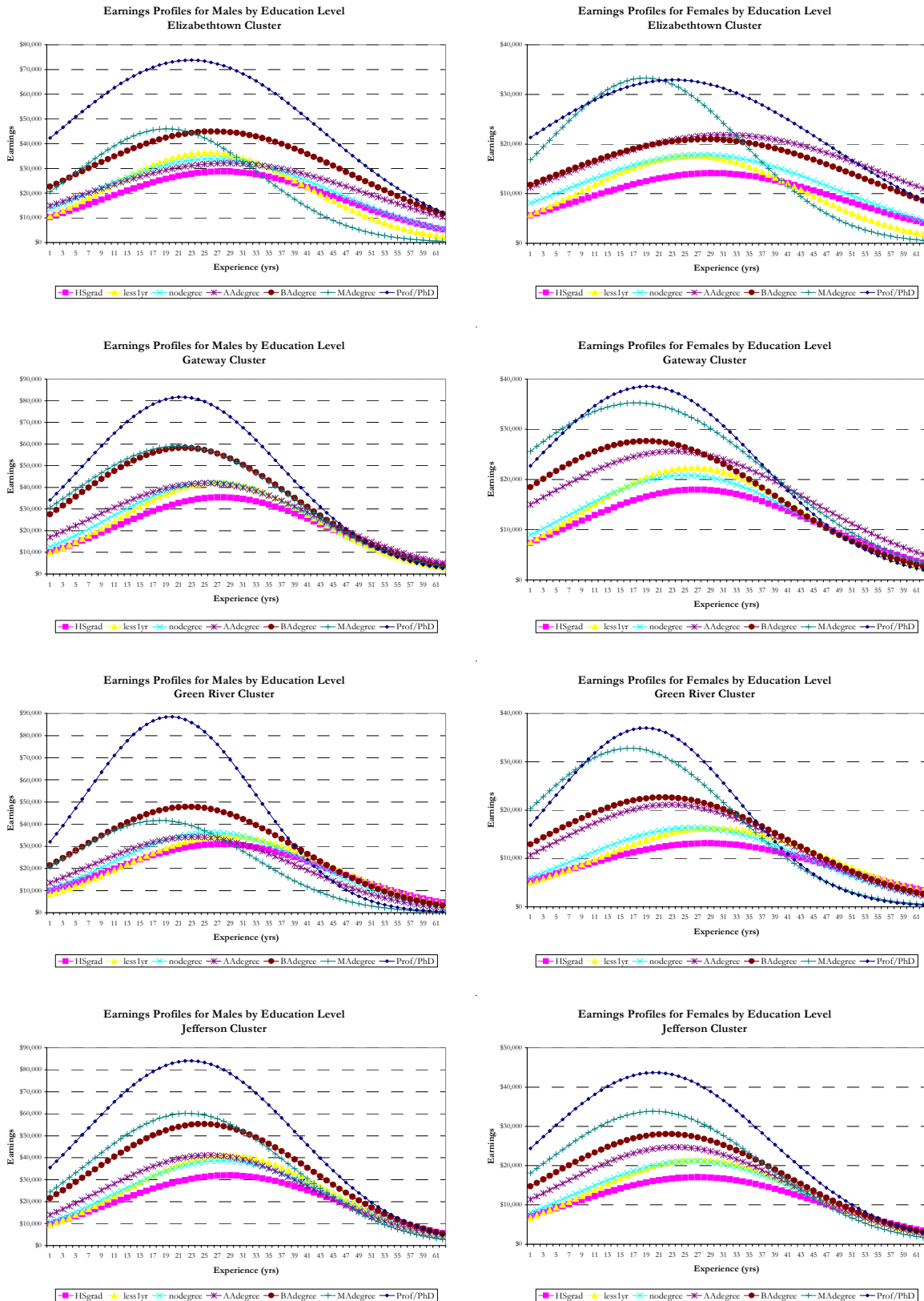
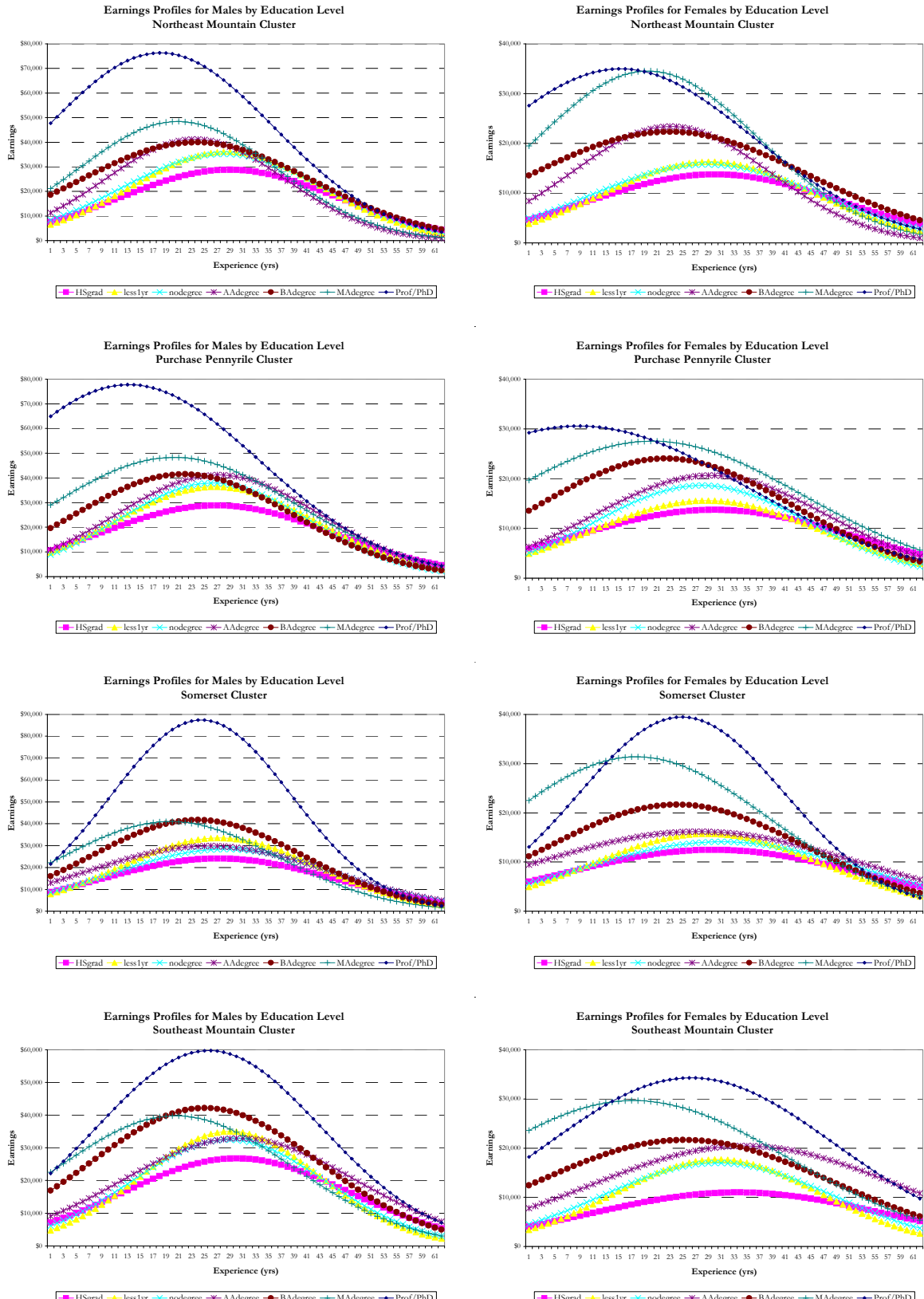


Figure 1 (continued)
Predicted Experience-Earnings Profiles for Each Level of Educational Attainment
by Gender and Geographic Region
(1999 Dollars)



tion of occupations, as females have a much stronger shift out of sales, office, and service jobs into social services, education, arts, media, and military jobs with this increase in educational level than do males.

We can also see in the graphs that predicted earnings for a worker with a Master's degree peak early (somewhat less so for professional and PhD holders) but tend to decline much more rapidly than any other level of educational attainment. This may be partially due to a changing mix of degree fields between older generations of workers and newer. Specifically, the MBA degree is much more prevalent now than it was just a couple decades ago. Workers with MBA degrees may be on a higher salary path than previous Master's degree holders who were probably specializing more in social service, education, and the humanities.

There is considerable difference in the earnings trajectories among the different occupational classes, especially in regard to the height of peak earnings. The differences between occupational classes and between clusters for a given occupational class are much more easily observed and digested when presented in the summary form of present values, so we defer that discussion to the next section.

Present values. The present value of earnings for each degree is the sum over each year of age of the earnings adjusted for work probability and survival probability, and discounted by the ratio of the growth in wages to the interest rate. During the years in school, the earnings for a particular degree are equal to zero. Table 4 shows, for each of the ten geographic regions, the estimated present values of earnings through age 80 for each education level by gender.

In general, the present value of earnings for women is about half of that for men. Women who only have a high school degree do the worst, as compared to men, while women who have a Master's degree come closest to similar men's earnings (a bit over two-thirds of the present value of male lifetime earnings). This is the result of the particular mix of occupations of men and women, differences in the number of full-time versus part-time workers, and other life choices.

Among the geographic regions, the present values of lifetime earnings, regardless of education level are generally highest for the Gateway, Jefferson, and Bluegrass regions, and lowest for the Southeast Mountain,

Somerset, and Northeast Mountain regions. The present values of the latter group are generally about 70 percent those of the former group.

For those whose education ends with high school graduation the present value of earnings ranges from about \$188,000 for females from the Southeast Mountain region to nearly \$950,000 for males from the Gateway region. However, women in the Southeast Mountain region can increase the present value of their lifetime earnings by nearly 70 percent with just another year of education. Generally, that extra year of higher education increases the present value of earnings by about 20 percent, but for men in the Green River region earnings only increase by six percent. However, further years of higher education without a degree do not increase the present value of earnings for either men or women in most of the clusters, the major exception being females in the Purchase-Pennyrile region.

Making the added investment to an Associate degree brings a mixed bag of results. For men, while in most of the clusters it results in a present value increase of about 20 percent, any increase is pretty negligible for men in the Elizabethtown and Green River regions. But for women it's a different story, earning an Associate degree brings about an average increase of 35 percent in the present value of lifetime earnings, with women in the Bowling Green, Green River, and Southeast Mountain regions earning almost 50 percent more, and women in the Northeast Mountain region experiencing a 60 percent earnings increase.

The general pattern for an Associate degree is reversed for the extra education required to earn a Bachelor's degree. Except for in the Northeast Mountain and Purchase-Pennyrile regions, earning a Bachelor's adds 25 to 30 percent to the present value of earnings above what is estimated for an Associate degree. However, for women, except in the Purchase-Pennyrile and Somerset regions, any increase in earnings is very small. While the men who are earning a Bachelor's degree are moving more into the Management, Business and Finance class of occupations, the women are heading far more into Social Service, Education, Art, Media, or Military occupation set (with fewer employed in the Science, Legal and Health set of occupations).

Adding a Master's degree, in general, has very little impact on the earnings of males (and actually reduces the present value of work-life earnings compared to a Bachelor's degree for nearly half the clusters), the one

Table 4
Present Value of Earnings by Gender, Educational Attainment, and Geographic Region

Education Level	Male									
	Bluegrass	Bowling Green	Elizabethtown	Gateway	Green River	Jefferson	Northeast Mountain	Purchase-Pemmyric	Somerset	Southeast Mountain
Present value of earnings										
High School	\$850,192	\$778,465	\$803,359	\$946,407	\$832,540	\$854,949	\$689,284	\$792,542	\$626,995	\$536,362
Less than 1 year of college	\$989,420	\$929,267	\$971,666	\$1,116,409	\$885,151	\$1,054,057	\$835,082	\$939,359	\$804,313	\$684,670
More than 1 year of college, no degree	\$956,100	\$821,343	\$956,512	\$1,138,513	\$926,703	\$1,004,261	\$837,333	\$920,643	\$707,051	\$654,121
Associate degree	\$1,034,272	\$1,012,256	\$958,350	\$1,242,733	\$972,583	\$1,146,523	\$1,048,642	\$1,076,729	\$841,221	\$800,289
Bachelor's degree	\$1,335,093	\$1,174,287	\$1,282,781	\$1,644,199	\$1,329,298	\$1,505,122	\$1,120,404	\$1,130,095	\$1,064,140	\$1,042,278
Master's degree	\$1,321,476	\$1,228,515	\$1,203,590	\$1,677,650	\$1,062,401	\$1,595,276	\$1,158,055	\$1,384,846	\$1,070,757	\$1,024,417
Professional or PhD degree	\$1,918,369	\$1,641,163	\$2,149,242	\$2,086,970	\$2,032,770	\$2,155,578	\$1,866,823	\$2,123,450	\$1,869,907	\$1,333,297
Difference from High School										
Less than 1 year of college	\$139,227	\$150,803	\$168,308	\$170,001	\$52,811	\$199,108	\$146,398	\$146,817	\$177,318	\$148,308
More than 1 year of college, no degree	\$105,907	\$42,878	\$153,153	\$192,106	\$94,363	\$149,311	\$148,048	\$128,101	\$80,056	\$117,759
Associate degree	\$184,080	\$233,791	\$154,991	\$296,326	\$140,243	\$291,574	\$359,357	\$284,187	\$214,226	\$263,927
Bachelor's degree	\$484,901	\$395,823	\$479,423	\$697,792	\$496,958	\$650,172	\$431,119	\$337,553	\$437,146	\$505,916
Master's degree	\$471,284	\$450,051	\$402,231	\$731,243	\$230,061	\$740,326	\$468,771	\$592,304	\$443,762	\$488,055
Professional or PhD degree	\$1,068,177	\$862,698	\$1,345,883	\$1,140,563	\$1,200,429	\$1,300,629	\$1,177,538	\$1,330,908	\$1,242,912	\$796,935
Total return to extra education										
Less than 1 year of college	\$135,203	\$146,778	\$164,284	\$165,977	\$48,787	\$195,084	\$142,374	\$142,793	\$173,294	\$144,284
More than 1 year of college, no degree	\$97,904	\$34,876	\$145,150	\$184,103	\$86,360	\$141,309	\$140,046	\$120,098	\$72,053	\$109,756
Associate degree	\$176,077	\$225,788	\$146,988	\$288,323	\$132,240	\$283,571	\$331,355	\$276,184	\$206,223	\$255,924
Bachelor's degree	\$456,114	\$367,037	\$450,636	\$669,005	\$468,171	\$621,386	\$402,333	\$308,766	\$408,359	\$477,129
Master's degree	\$427,468	\$406,235	\$358,415	\$687,427	\$186,246	\$696,511	\$424,955	\$548,488	\$399,946	\$444,239
Professional or PhD degree	\$994,515	\$789,036	\$1,272,221	\$1,066,901	\$1,126,767	\$1,226,967	\$1,103,876	\$1,257,246	\$1,169,250	\$723,273

Table 4 (continued)
Present Value of Earnings by Gender, Educational Attainment, and Geographic Region

Education Level	Female									
	Bluegrass	Bowling Green	Elizabethtown	Gateway	Green River	Jefferson	Northeast Mountain	Purchase-Pemmyric	Somerset	Southeast Mountain
Present value of earnings										
High School	\$394,868	\$364,230	\$353,450	\$467,649	\$304,721	\$431,920	\$289,290	\$327,609	\$287,612	\$188,533
Less than 1 year of college	\$503,199	\$432,933	\$439,143	\$587,063	\$392,543	\$550,547	\$366,538	\$379,939	\$365,575	\$319,953
More than 1 year of college, no degree	\$519,422	\$432,107	\$467,805	\$559,940	\$397,613	\$548,367	\$364,346	\$426,253	\$337,901	\$318,257
Associate degree	\$643,470	\$647,010	\$592,916	\$739,698	\$582,585	\$656,045	\$582,860	\$501,530	\$449,688	\$471,460
Bachelor's degree	\$702,665	\$618,729	\$547,238	\$748,486	\$602,850	\$720,766	\$611,491	\$622,850	\$540,544	\$534,326
Master's degree	\$790,429	\$753,226	\$825,766	\$961,107	\$846,913	\$882,100	\$910,535	\$796,967	\$867,176	\$848,101
Professional or PhD degree	\$1,111,839	\$897,996	\$898,523	\$950,271	\$863,158	\$1,103,345	\$924,059	\$811,267	\$877,296	\$844,346
Difference from High School										
Less than 1 year of college	\$108,332	\$68,702	\$85,694	\$119,414	\$87,822	\$118,627	\$77,248	\$52,330	\$77,963	\$131,420
More than 1 year of college, no degree	\$124,554	\$67,877	\$114,355	\$92,291	\$92,892	\$116,447	\$75,056	\$98,644	\$50,289	\$129,723
Associate degree	\$248,602	\$282,780	\$239,467	\$272,049	\$277,864	\$224,125	\$293,570	\$173,921	\$162,076	\$282,926
Bachelor's degree	\$307,797	\$254,499	\$193,788	\$280,837	\$298,129	\$288,846	\$322,201	\$295,242	\$252,932	\$345,793
Master's degree	\$395,562	\$388,996	\$472,316	\$493,458	\$542,192	\$450,181	\$621,245	\$469,358	\$579,564	\$659,568
Professional or PhD degree	\$716,971	\$533,766	\$545,073	\$482,622	\$558,437	\$671,426	\$634,769	\$483,658	\$589,685	\$655,813
Total return to extra education										
Less than 1 year of college	\$104,307	\$64,678	\$81,669	\$115,389	\$83,798	\$114,603	\$73,224	\$48,306	\$73,939	\$127,396
More than 1 year of college, no degree	\$116,551	\$59,874	\$106,352	\$84,288	\$84,889	\$108,444	\$67,054	\$90,641	\$42,287	\$121,721
Associate degree	\$240,599	\$274,777	\$231,464	\$264,046	\$269,861	\$216,122	\$285,567	\$165,918	\$154,073	\$274,924
Bachelor's degree	\$279,011	\$225,713	\$163,002	\$252,051	\$269,343	\$260,060	\$293,415	\$266,455	\$224,146	\$317,007
Master's degree	\$351,746	\$345,181	\$428,500	\$449,642	\$498,376	\$406,365	\$577,429	\$425,542	\$535,749	\$615,752
Professional or PhD degree	\$643,309	\$460,104	\$471,411	\$408,960	\$484,775	\$597,764	\$561,107	\$409,996	\$516,023	\$582,151

exception being the Purchase-Pennyrile region. This could be because an average of 38 percent of male Master's degree holders work in the Social Service, Education, Art, Media, or Military occupations, while only 14 percent of male Bachelor's degree holders do. However, since an overwhelming average (among the 10 regions) of 67 percent of female Master's degree holders work in this occupational sector and their present values increase between 12 percent and 60 percent, there must be a significant difference in the types of jobs males and females hold within this class of jobs. The Master's degree is also the educational level at which gender differences are least.

For men across all geographic regions, a professional or PhD degree adds considerably (roughly 50 percent, on average) to the present value of earnings. Since schooling for a professional or PhD degree is generally along a different track than schooling for a terminal Master's degree we compare these present values to those estimated for Bachelor's degree holders. In terms of the increase in present values over a Bachelor's degree we find no gender difference. Except for the Purchase-Pennyrile region (where men do much better) and Southeast Mountain region (where women do much better) there's no significant difference in the percentage increase in earnings over what might be earned in a lifetime with a Bachelor's degree. Workers in the Gateway region get the least income boost from a professional or PhD degree, but they also have the highest present value of lifetime earnings for Bachelor's degree holders.

Total returns to higher education. To calculate the total return to education, we subtract the present value of the cost of tuition, fees, books, and other supplies from the difference in the present value of earnings for the particular degree from the present value of earnings for a high school graduate. The total returns are also in Table 4. Generally, higher education is a good deal, reaping long-term rewards much greater than the short-term monetary outlay. But there is a great deal of variation both between the occupation classes and among the geographic regions. The charts in Figure 2 illustrate this.

For both men and women with less than a year of college, total returns are lowest in the services sector and highest in the Management, Business, and Finance and Science, Legal and Health sectors. But the spread between the different regions is also greatest for those better returning sectors. While the Gateway region can boast of the best total return for an occupational class for both males and females, it's also the home of the worst return

among all the regions and occupations, for the Social Services, Education, Arts, Media, and Military occupations. In general, both men and women in the Elizabethtown region and men in the Northeast Mountain region experience above average returns for this little extra bit of education. The relative position of the other regions varies a great deal from one set of occupations to the next.

With more than a year of college but still no degree the disparity between the total returns for the Management, Business and Finance and Science, Legal and Health occupation classes increases considerably. But in these two sectors the total returns for the Bowling Green and both Northeast and Southeast mountain regions lag far behind the other regions of the state. Generally, men in the Gateway region experience above average total returns for this level of education, but no other region, for either men or women, is consistently above average across the occupations.

In most of the geographic regions the total returns for an Associate degree in the Agriculture, Construction and Extraction sector are almost on par with those in the Management, Business, and Finance and Science, Legal, and Health sectors. While at the immediately lower level of education Bowling Green and both mountain regions did poorly in those latter two occupational sectors, at the Associate degree level they do relatively well (though Bowling Green still lags a bit for science, legal, and health jobs).

At the Bachelor's degree level of education, total returns for the Social Services, Education, Arts, Media, and Military occupation class begin to advance relative to the other sectors, though they are still largely on par with those experienced by workers in the Production, Transportation, and Material Moving and Services occupation sectors. Thirty-one percent of all women with a Bachelor's degree work in the service, education, and arts jobs, but except for in the two mountain regions the total returns are fairly modest. Fully 45 percent of men and 38 percent of women with Bachelor's degrees work in either Management, Business and Finance or Science, Legal and Health occupations and that is where the big payoff for that extra education is.

At the Master's, professional, and PhD degree levels, with fewer individuals in each occupation-region cell for the Services, Agriculture, Construction and Extraction and Production, Transportation, and Material Moving sectors the results for those occupations become more sensitive to outliers, which may explain the wider spread

in the estimates of total returns in those occupational classes for these levels of extra education beyond high school.

At the Master's degree level, the MBAs in the Management, Business and Finance sector do very well (except for men in the Green River and Elizabethtown regions), but it is notable that the people working in the Social Services, Education, Arts, Media and Military job

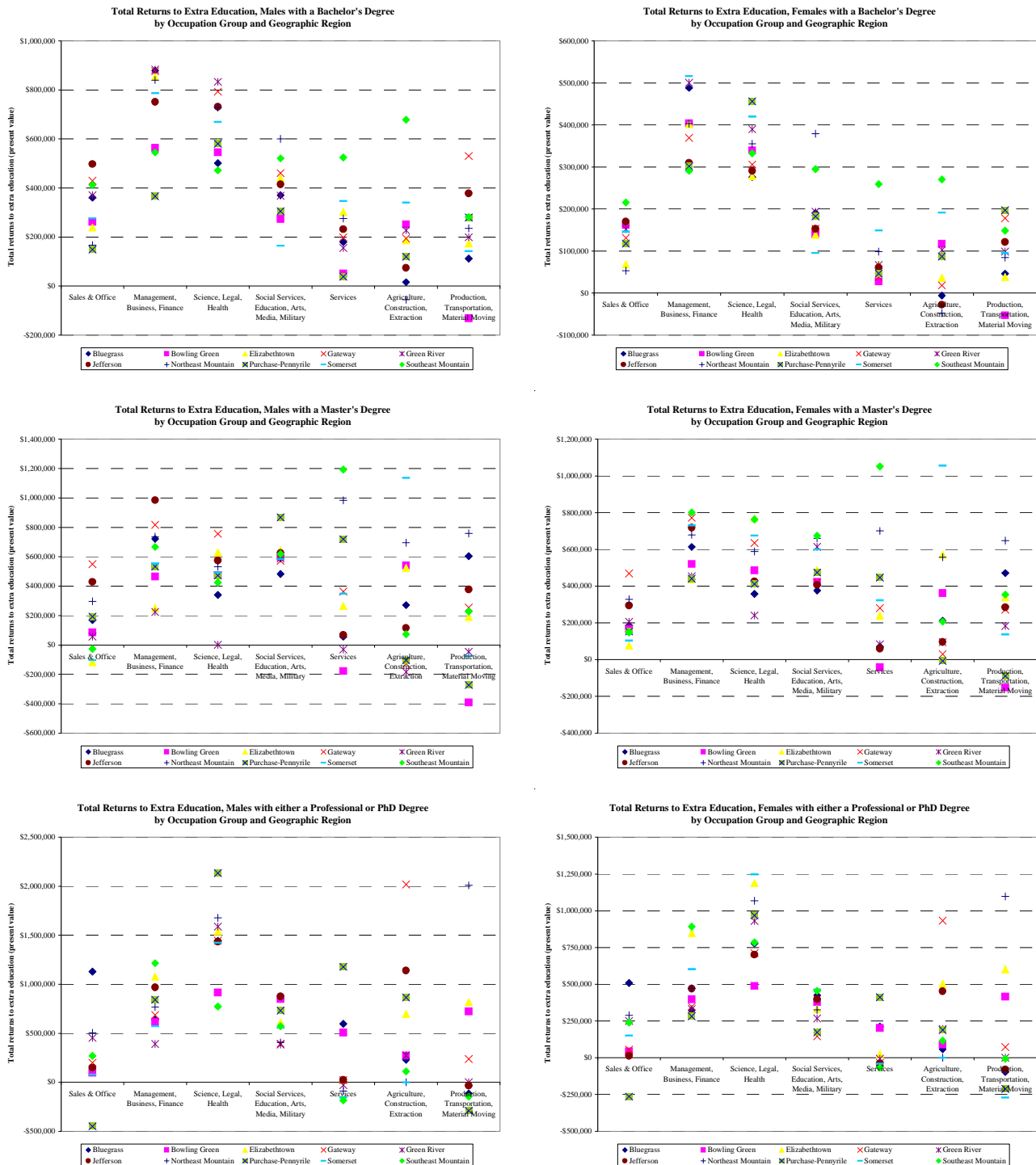
Figure 2
Total Returns to Extra Education for Each Level of Educational Attainment
by Gender, Geographic Region, and Occupation Group



sector earn equally good total returns no matter what region of the state they reside in. At this level of education the men and women in these more selfless and artsy occupations reach parity with those employed in the business, science, legal, and health sectors of the economy.

MBA's in the Jefferson region do very well, but workers in the Science, Legal, and Health occupations in the Green River region do rather poorly.

Figure 2 (continued)
Total Returns to Extra Education for Each Level of Educational Attainment
by Gender, Geographic Region, and Occupation Group



This is also the level of education which has the least gender disparity in lifetime earnings. But despite the fact that two-thirds of women with a Master's degree work in the Social Services, Education, Arts, Media, and Military sector, the Business, Management, and Finance and Science, Legal, and Health sectors have smaller gender gaps in terms of the present value of lifetime earnings (women's earnings are 77.3 and 76.0 percent of men's versus 70.9 percent).

Total returns at the professional or PhD degree level vary a great deal, but it is clear that, as might be expected, workers in the Science, Legal and Health sector experience the greatest returns to their investment in their education.

Caveats

These results are based on cross-sectional data that give a picture of the earnings of workers in a given year. This analysis therefore assumes that as today's younger workers age their earnings will resemble the current earnings of older workers. But the earnings of older workers today may not be reflective of the earnings of workers of the same age in the future. For example, as the economy shifts away from skilled manufacturing jobs we may find that the difference in earnings between a high school graduate and those who attend college keeps widening

The mix of occupations in the Kentucky economy may change in the future (or be different for younger and older workers today), and since the experience-earnings profiles differ substantially for some of the occupational classes our estimates may not hold true.

The present value estimates for women likely underestimate the total return to education since past discrimination and changing lifestyle choices are probably reflected in lower earnings for today's older women relative to older men.

Different values of the interest rate and the growth in earnings will lead to different estimated results, though they will affect all groups and educational levels equally. However, the returns to higher education will decrease if the interest rate increases relative to the growth in earnings.

Survival probabilities may vary depending on factors that correlate with educational attainment. For instance, smoking may decrease and exercise may increase with education, resulting in higher survival probabilities for college graduates than for high school graduates. If this is the case, then our present values underestimate the returns to education (though in this case, part of the return is due to a factor independent of the actual education).

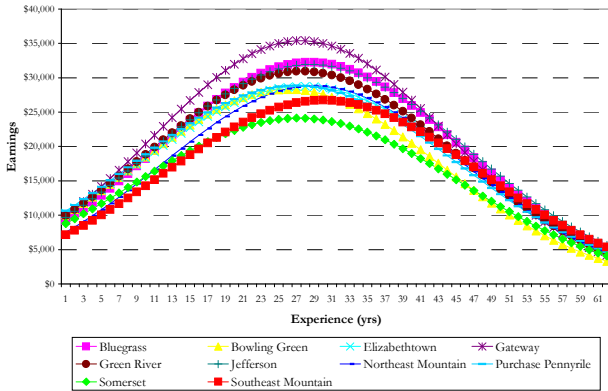
The estimates are based upon the regression coefficients, which have a degree of statistical error. The estimated coefficients are the best linear unbiased coefficients, however, meaning that they are the best that we can do with the data at hand.

References

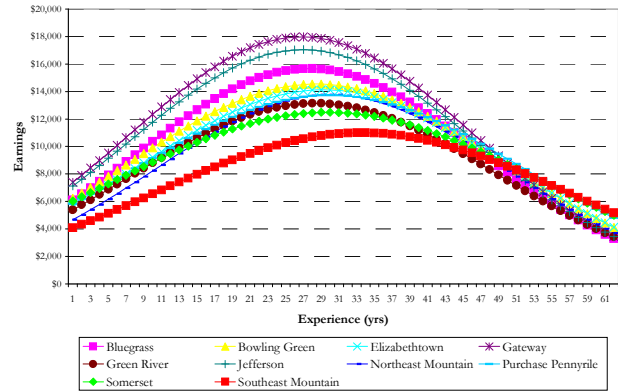
- Berger, M., and D.A. Black, "The Long Run Economic Impact of Kentucky Public Institutions of Higher Education," Mimeograph, September 15, 1993.
- Coomes, P., and S. Gohmann, "The Impact of the University of Louisville on the Louisville Economy," Mimeograph, June, 1994.
- Day, J.C., and E.C. Newburger, The Big Payoff: Educational Attainment and Synthetic Estimates of Work-Life Earnings, U.S. Bureau of the Census, Current Population Reports, P23-210, July, 2002.
- Kentucky Council on Postsecondary Education, 2006-07 Tuition & Mandatory Fee Rates.
- Kornstein, B., "The Impact of Higher Education on the Expected Work-Life Earnings of Louisville Area Workers," Mimeograph, July 8, 2003.
- National Center for Health Statistics, National Vital Statistics Reports, Vol. 54, No. 14, April 19, 2006 (as revised March 28, 2007).
- U.S. Bureau of Labor Statistics, Average Hourly Earnings of Production Workers, Current Employment Statistics, May, 2007.
- U.S. Bureau of Labor Statistics, Consumer Price Index - All Urban Consumers, May, 2007.
- U.S. Census Bureau, 5-Percent Public Use Microdata Sample (PUMS) Files, May, 2007.
- U.S. Census Bureau, 2000 Census of Population and Housing, Public Use Microdata Sample, United States: Technical Documentation, July, 2003.
- U.S. Federal Reserve Board, Federal Reserve Statistical Release H.15, May, 2007.
- University of Louisville, www.louisville.edu, cost data on various web pages, May, 2007.

Appendix: Estimated Experience-Earnings Profiles by Gender and Geographic Region

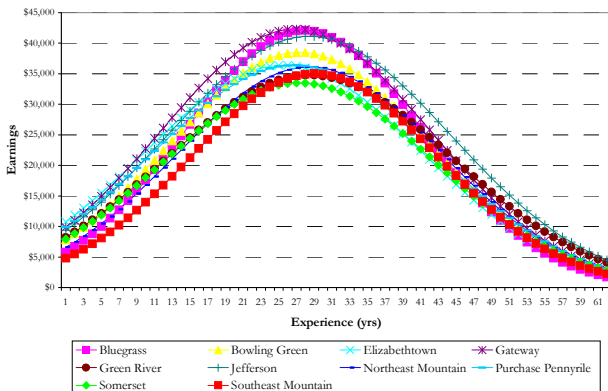
Earnings Profiles for Males with Just a High School Degree by Geographic Region



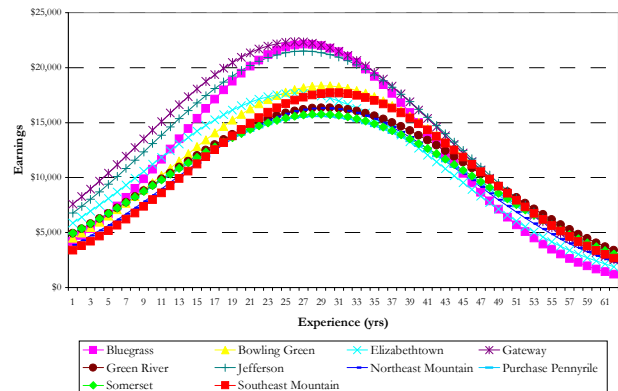
Earnings Profiles for Females with Just a High School Degree by Geographic Region



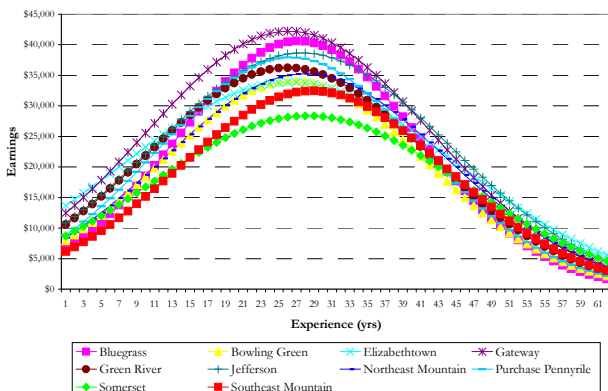
Earnings Profiles for Males with Less Than One Year of College by Geographic Region



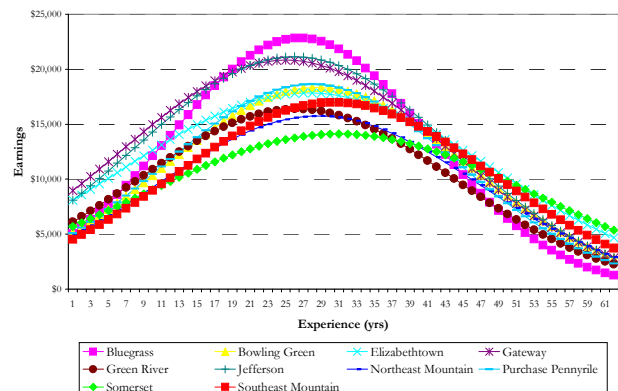
Earnings Profiles for Females with Less Than One Year of College by Geographic Region



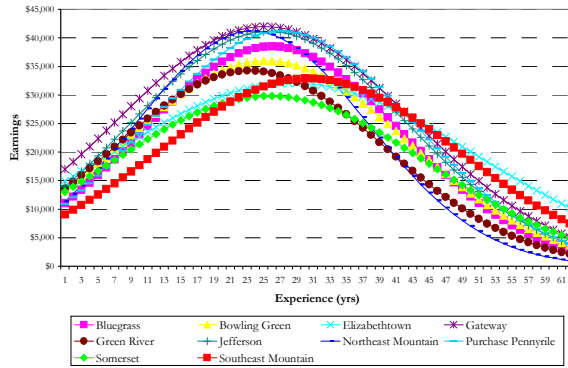
Earnings Profiles for Males with More Than a Year of College but No Degree, by Geographic Region



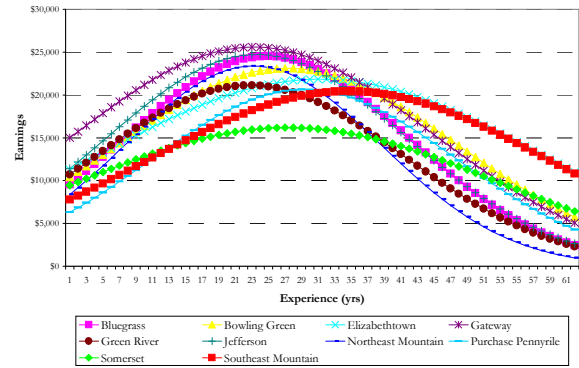
Earnings Profiles for Females with More Than a Year of College but No Degree, by Geographic Region



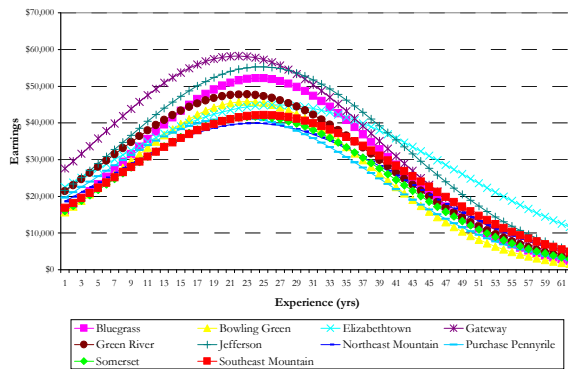
Earnings Profiles for Males with an Associates Degree by Geographic Region



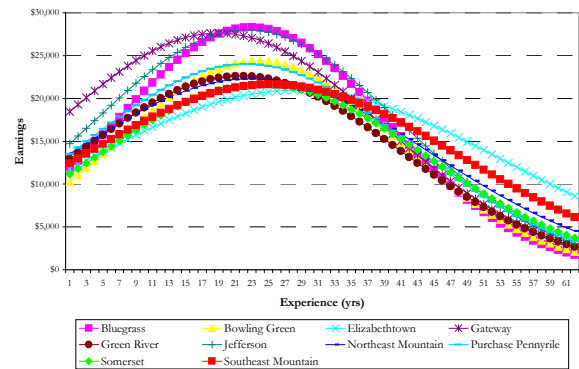
Earnings Profiles for Females with an Associates Degree by Geographic Region



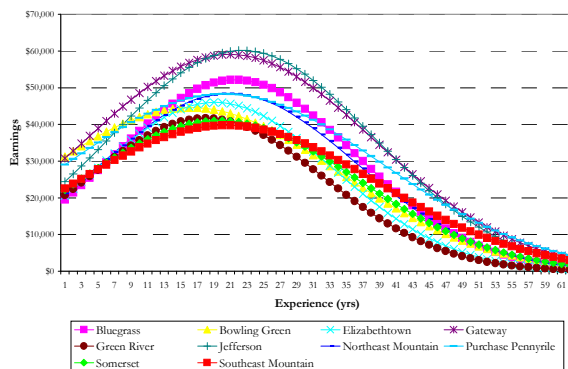
Earnings Profiles for Males with a Bachelors Degree by Geographic Region



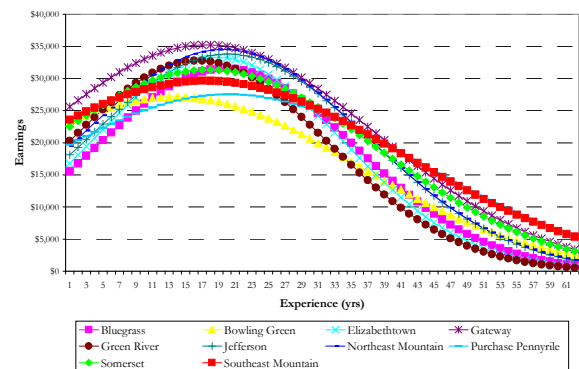
Earnings Profiles for Females with a Bachelors Degree by Geographic Region



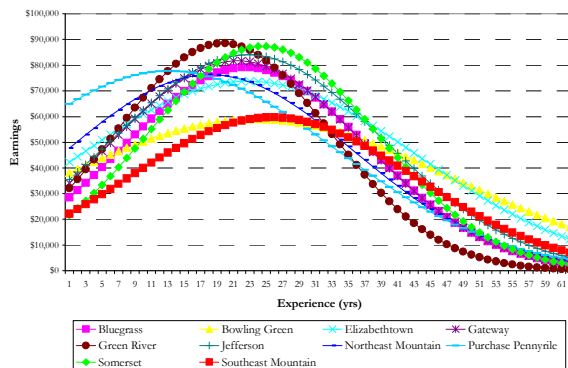
Earnings Profiles for Males with a Masters Degree by Geographic Region



Earnings Profiles for Females with a Masters Degree by Geographic Region



Earnings Profiles for Males with either a Professional or PhD Degree by Geographic Region



Earnings Profiles for Females with either a Professional or PhD Degree by Geographic Region

