

2007 AIR DISSERTATION FELLOWSHIP PROPOSAL

Estimating the Effect of Spatial Correlation on Models Describing
the Enrollment of Out-of-State Freshmen at Four-Year Colleges and Universities

Data set of Interest:

Integrated Postsecondary Education Data System (IPEDS)

Grant Amount Requested: \$14,404

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Project Summary

The competition between states and regions for talent is high and will likely increase in the future: “Not only does a state with a well-educated populace see increased tax revenues from its (better-paid) citizens, it is also able to use the education level of its citizens as a powerful lure for business and industry – a way to build its economy overall” (Western Interstate Commission for Higher Education, 2006). Understanding which factors are associated with an institution’s ability to attract out-of-state freshmen is essential to both college administrators and public policy makers as they consider ways to increase geographic diversity and attract talented students from other states. It is particularly important for public policy makers since studies have shown that approximately 60% of bachelor’s degree students will remain in the same state after graduation (Adelman, 2004, p. 16).

This project makes four contributions to the discussion on college choice and student migration: (a) it improves on previous models by reflecting the latest updates and changes to the Integrated Postsecondary Education Data System (IPEDS); (b) it examines the impact of spatial correlation on the estimates of the regression coefficients using a traditional spatial regression model; (c) it concurrently applies an artificial neural network to evaluate the quality and effectiveness of the spatial regression model; and (c) it uses geographic visualization techniques to show clusters and patterns in the enrollment data which might influence the analysis. It is innovative because it integrates spatial information at each point of the analysis process: describing the sample, building the model, and performing model diagnostics.

This study uses data from the institutional characteristics, enrollment, fall staff, and finance sections of IPEDS. Due to recent changes in IPEDS, complete data is only available for two years, 2002 and 2004. The model will include additional data from the Bureau of the Census and the Bureau of Labor Statistics. The empirical method used in the model is a spatial Poisson regression. A spatial Poisson regression was selected because the dependent variable is not continuous, but a rate, and because of the hypothesized spatial nature of the data. This is compared with a neural network, which makes no assumptions about the covariance structure, as a diagnostic of the traditional spatial regression model.

By identifying factors associated with the decision to enroll in an out-of-state college and examining the influence of geography on enrollment patterns, this study will be extremely valuable to college administrators and policy makers trying to attract out-of-state students. It will also provide some preliminary evidence on how much spatial correlation impacts models in higher education.

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Project Description

Problem Statement and Relevance to Policy

The National Center for Education Statistics reported that in fall 2004 approximately 24.6 percent of the 1.17 million freshmen students attending 4-year colleges enrolled in institutions outside of their home state (*Digest of Education Statistics*, 2005). Governors, state legislators, mayors, city councils and public policy think tanks across the nation have begun to investigate how to attract a larger share of this group. According to the Western Interstate Commission for Higher Education, “a good education is no longer just a way for an individual to get ahead. It is also, and increasingly, the best way a state can get ahead – and therefore a real economic priority” (Western Interstate Commission for Higher Education, 2006). The competition between states and regions for talent is high and will likely increase in the future: “Not only does a state with a well-educated populace see increased tax revenues from its (better-paid) citizens, it is also able to use the education level of its citizens as a powerful lure for business and industry – a way to build its economy overall” (Western Interstate Commission for Higher Education, 2006). Many states and regions have already taken actions to stanch the flow of talented individuals to other states (e.g., the HOPE Scholarship Program in Georgia), and many others, like Wisconsin, are discussing potential policies (“In the States,” 2007). Many have also developed programs to attract college freshmen from other states (e.g., the Greater Philadelphia CollegeTown Project).

Thomas Mortenson has commented that college student migration provides, “Important feedback information to states about the attractiveness of their higher education offerings, both public and private” (Mortenson, 2006, p. 1). Christopher Morphew has recommended that states examine the use of student migration as a policy tool for confronting the demographic and fiscal pressures affecting higher education in many states: “a) rapid enrollment growth (or loss), with much of the growth coming from historically underrepresented groups; b) citizen initiatives aimed at holding down government spending; c) overbuilt or underbuilt public higher education systems; and d) geographic realities that make serving citizens’ educational needs more difficult” (Morphew, 2005). Since there are many policy tools available to public officials, an evidence-based approach is needed to ensure that limited state resources are used in the most effective way to meet the state or region’s objectives.

The purpose of this study is to identify the institutional, regional, and state factors associated with an institution’s ability to attract out-of-state freshmen students. It will help lawmakers and college administrators evaluate programs designed to reverse brain drain and increase geographic diversity. Since colleges and universities

in the same area are likely to be similar, this study will test if spatial correlation exists between institutions, how it affects the estimates and standard errors in the model, and how sensitive the model is to changes in the specification of the spatial covariance structure.

Research Questions

Given the importance of the above problems to public policy, this study will examine the following research questions about the migration patterns of college freshmen in the United States:

1. Which institutional factors are associated with an institution's ability to attract out-of-state freshmen?
2. Which state and regional factors are associated with an institution's ability to attract out-of-state freshmen?
3. After adjusting for state and region, does additional spatial correlation exist in the model?
4. How does modeling spatial correlation change the estimates and standard errors in the model?
5. If spatial correlation exists, how sensitive is the model to the choice of spatial covariance structure?
6. Is there a difference between public and private institutions?
7. Are the factors consistent over time?

Assumptions

There are a number of important assumptions on which this study rests. The key assumptions are:

1. that there is a real relationship between the proposed independent variables and the dependent variable;
2. that the distribution of college students throughout the United States is not random;
3. that the data provided by institutions to IPEDS are accurate and the public use data files are free of errors;
4. that the data from the Bureau of Labor Statistics, the Census Bureau, and other agencies are accurate; and,
5. that the software used generates accurate results.

Summary of Previous Research

Among the first studies of college student migration was a dissertation by Groat (1962), which examined migration data from 1887 to 1958 using Shrock's efficiency ratios and Stouffer's "intervening opportunities" hypothesis. This was followed by *Migration of College and University Students in the United States* (Gossman, Nobbe, Patricelli, Schmid, & Steahr, 1968), which included separate analyses for control and academic level. Gossman's book included a gravity model to describe the effects of distance and other factors on migration as well as innovative maps to depict the flow of students between states and regions. Meredith (1971) wrote a dissertation describing college student migration from 1949 to 1968, which included some insight into the factors influencing

migration. These studies resulted in a number of articles that reviewed trends in college student migration (Fenske, Scott, & Carmody, 1974; Steahr & Schmid, 1972; Tuckman, 1970). During this time, the National Center for Educational Statistics produced analytical reports on college student migration that included state-to-state matrix tables (Wade, 1970, 1971). These tables were the foundation for a later study by Johns and Viehland (1989), which sought to create the same type of tables for fall 1986. Additionally, the major net exporters of students (e.g., New York, New Jersey, Illinois) began conducting studies to examine why students were leaving their states. Recently, work has been undertaken by Sá (2004) to apply a gravity model to the regional demand for higher education in The Netherlands. This study builds on the above studies, but specifically on those that use institutional data to estimate the demand for higher education from out-of-state students.

Data Sources

This study primarily uses data from the biennial survey of residence and migration from IPEDS collected by the National Center for Educational Statistics (NCES) in 2002 and 2004. It also includes data from the institutional characteristics, fall staff, and finance sections of IPEDS. Geographic boundary files will come from the U.S. Bureau of the Census and from files included with ESRI's ArcGIS software package. Additional data will be collected from postsecondary.org, the U.S. Bureau of the Census, and the Bureau of Labor Statistics. Weather data will be collected from the National Climatic Data Center. Information on bi- and multi-state agreements will be collected from various sources (e.g., Chronicle of Higher Education, WICHE website, state departments of education).

I am not aware of any serious flaws in any of the anticipated datasets that would prevent them from inclusion. The greatest concern about the validity of the data for this study is how accurately colleges track the home state of its students. This is particularly true of private institutions since all students are charged the same tuition and fees regardless of residency.

Model

Dependent Variables. Within the literature, either the percentage of non-resident students (Baryla Jr & Dotterweich, 2001; Mixon & Hsing, 1994; Mixon Jr & Hsing, 1994) or the number of non-resident students enrolled (McHugh & Morgan, 1984) have been used as the dependent variable. Both of these variables are not continuous and require special consideration when included in a statistical model. The number of non-resident students enrolled is a count, which makes it a discrete variable and not continuous. Likewise, the percentage of non-resident students

is also discrete. Methodologically, this creates a problem because when the dependent variable is discrete and not continuous, ordinary least squares (OLS) is no longer the best linear unbiased estimator. There is also a theoretical problem with these two measures since the number of out-of-state freshmen is a result of not only the appeal of the institution to this group, but also the admissions process of the university. Since public and private universities have different missions regarding out-of-state students, separate models will be developed for public and private universities. As many independent variables will be expressed as a percentage of total enrollment or per FTE, this model will use the percentage of out-of-state freshmen as the dependent variable.

Institutional Level Variables. A complete list of independent variables appears in Appendix A. The institutional level variables focus on five factors commonly associated with the decision to enroll at a college: institutional quality (Garcia, 1983), institutional characteristics (Barylá & Dotterweich, 2001, 2006), selectivity (Abbott & Schmid, 1975), campus life (Toma & Cross, 1998), and affordability (Dotterweich & Barylá Jr, 2005; Heller, 1999; Leslie & Brinkman, 1987; Perna, 2006; Tierney, 1982). To the extent that tuition is associated with quality, then increases in tuition will be associated with increases in out-of-state enrollment. Otherwise, all of the other variables in the model are expected to have a positive relationship with the percentage of out-of-state freshmen.

Regional and County Level Variables. In this study, “region” is defined as the area surrounding a particular university as opposed to a group of states. This level is included since the area surrounding an institution may play an important role in the college decision making process. Barylá and Dotterweich (2006) consider such regional factors as unemployment and per capita income in their model. The main variables at this level include unemployment, 18-21 year old population size, and population density. It is expected that students will be attracted to cities, which is represented by population density, and areas with larger numbers of people the same age. While students may not know the exact unemployment figure for a particular area, it is likely that they have some sense of the job prospects in a particular area. Unemployment is expected to have a negative effect on out-of-state student enrollment. After the individual characteristics, these variables are considered the most important in the model since they describe the community around the university.

State Level Variable. State variables reflect the state’s general intellectual milieu (Florax, Hall, Titheridge, & Wikhall, 2000), economic prosperity (Mak & Moncur, 2003), physical features, and support for higher education. The variables include bachelor’s degree attainment within the state, per capital income, and state appropriations for higher education. It also includes variables, such as average temperature and amount of coastline. It is uncertain

how valuable these variables will be to the model and additional variables at this level may be unnecessary and difficult to interpret.

Sample

The sample of institutions included in the analysis will include those institutions meeting the following criteria:

Year of School Universe: 2002 and 2004

State or Other Jurisdiction: Any

Geographic Region: All except Service Schools and Outlying Areas

Type of Institution: Public and Private not-for-profit, 4-year or above

Degree-granting Status: Degree Granting

Carnegie Classification 2000: Baccalaureate/Associates Colleges; Baccalaureate Colleges – General; Baccalaureate Colleges – Liberal Arts; Masters Colleges and Universities I & II; Doctoral/Research Universities Extensive & Intensive

Miscellaneous: Postsecondary and Title IV institution indicator (Ed Tab universe)

Sample Size: 1,401 institutions

Statistical Method

The statistical method proposed for this study is a spatial Poisson regression. Poisson regressions have been used extensively in epidemiology and the health sciences to model the number of cases of a particular disease in defined area over a certain period of time. This study models the number of out-of-state freshmen at a particular institution during the fall semester for two time periods. Non-spatial Poisson regression is simply a general linear model with the addition of a link function (Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2006). Initially, a base model will be developed assuming that the errors are independent. This reflects the general practice within higher education research. However, since institutions that are closer together are assumed to be more similar than those further apart, there is potential for spatial correlation (Anselin, Florax, & Rey, 2004). For example, all of the institutions in the Gulf States are facing similar economic conditions as a result of Hurricane Katrina. This is an extreme example, but in practice there are many non-measurable events and conditions which impact not only one university, but surrounding universities as well (e.g., a poor transportation network which makes traveling around the city difficult, sustained elevations in crime rates). Models using appropriate spatial covariance structures will be developed and compared with the independent errors model.

This model will use a linear mixed models (LLM) approach to model the data. Since the number of states in the study is fixed, no random effects are included in the model. Part of fitting a linear mixed model includes

specifying the covariance structure of the error term and then fitting the model using maximum likelihood. The standard procedures for fitting a linear mixed model and comparing models will be used (Littell et al., 2006).

Since one of the goals is to understand the importance of each of the factors involved in an institution's ability to attract out-of-state freshmen, the results will be compared with a neural network model to check for consistency in the results. This approach has been used in a number of other studies in education (Baker & Richards, 1999; González & DesJardins, 2002). The same variables used to develop the spatial regression model will be feed through the neural network. Since the neural network makes no assumptions about covariance and distribution, the results can then be compared against the findings of the spatial regression. Neural networks have often been accused of being "black boxes," but it is possible to perform sensitivity analysis on the model and examine the inner workings of the model, which provides insight into changes that might be made to the traditional spatial regression model (Miller & Han, 2001).

Additionally, this model will use various geographic visualization techniques to improve the analysis at all steps in the process (Andrienko & Andrienko, 1999, 2004). For example, rather than simply describing the number of out-of-state students in each state in public and private institutions, geographic visualization will be used to identify clusters of out-of-state freshmen. These clusters could be compared with the geographic distribution of college students and the general population to see if similarities or differences exist. This would provide extremely valuable information when analyzing the results of the model. After the model has been built, the errors can be plotted to identify geographic regions where the model might not be appropriate, which would suggest potential areas of improvement for the model.

Dissemination Plan

The dissemination of the research will occur in three phases. During the first phase, the main vehicle for disseminating the results of this study will be through presentations at professional conferences. At the 2007 AIR Forum, I will give a presentation on the analysis of spatial data in higher education with a particular emphasis on describing the flows of students between states. Proposals to present the final results will be submitted for the 2008 AIR Forum as well as for the annual meetings the American Educational Research Association and the Association for the Study of Higher Education. Additionally, since this topic touches on disciplines outside of education, I will also submit proposals to the ESRI Education User Conference and the Association of American Geographers.

During the second phase, I will seek to publish the findings in scholarly journals in both education (e.g., *Research in Higher Education*) and geography (e.g., *The Professional Geographer*). The completed dissertation will be microfilmed and made available through Dissertation Abstracts; it will also be available from the library at the University of Pennsylvania. I intend to make the full-text of the dissertation available through ERIC. Other dissemination possibilities include presentations at the North East Association for Institutional Research and the Middle States' Division of the Association of American Geographers.

The final phase reflects my staunch belief in the need for transparency in academic research. In this phase, I will provide access to the data, code, and maps from the project to other researchers through a personal website. I would also like to create a website to provide direct access to the database and provide migration reports for each state and region using tables, graphs, and maps.

Intended Audience and Potential Implications for the Practice of Institutional Research

The intended audience for this study includes federal, state and local public officials; public policy analysts; college administrators; and researchers in higher education and geography. While the main purpose of the project is to test the above model, a secondary purpose is to demonstrate the value of spatial analysis to institutional research and the need to collect more information on residence and migration patterns. While biennial surveys of enrollment by state of residence are a vast improvement over the quinquennial surveys of the past, there is little justification for maintaining this schedule given the increased use of student information systems and computers in institutional research. Longitudinal analysis of migration patterns would be greatly improved by collecting this data annually for each level of student (e.g., freshmen, undergraduates). In the past, residence and migration data were also collected by gender; however, it has never been collected nationally by ethnicity. Both of these additional variables would be helpful for understanding who migrates and why. I would also recommend that IPEDS begin collecting the latitude and longitude of each college as part of the institutional characteristics survey. While it is possible to geocode many institutions based on their address data in IPEDS, there are many addresses that can cause problems including post office boxes and campus roads that do not appear on standard maps. For most institutions, calculating the latitude and longitude would be as easy as visiting a website and typing in their address. Once this data has been collected in IPEDS, then calculating distances between universities, plotting universities on maps, and adjusting regressions for spatial autocorrelation will be much easier. These changes to the IPEDS survey would increase the reporting burden on institution research offices, but would greatly enhance the value and usefulness of IPEDS. In the future,

researchers studying higher education might even be able to download prepared ArcGIS shapefiles already loaded with frequently requested IPEDS data at the institutional and state levels.

Innovative Aspects of the Research

This study is innovative because it integrates spatial information at each point of the analysis process: describing the sample, building the model, and performing model diagnostics. By concurrently building a neural network and comparing it to the spatial regression model, this study looks forward toward advances in geographic knowledge discovery in databases (GKDD), which like its non-spatial equivalent, knowledge discovery in databases (KDD), represents the next generation of tools for institutional research. The fundamental hypotheses tested in this study are likely to have an impact on future studies of college student migration and college choice.

Appendix A: Variable List

Dependent Variables (two separate models, one for private and one for public universities)

Model 1: Out-of-State Student Enrollment Count

Model 2: Out-of-State Student Enrollment Percentage

Level 1: Institutional Characteristics

Variable Description	Notes	IPEDS Variable Name
Quality		
Instructional Expenses per FTE		INSREFTE
% Tenured Faculty		
Full-time Retention Rate		RET_PCF
Gov. Grants & Contracts per FTE	Research Funding – Fed., State, Local GC	
Endowment Assets per FTE	Value of Endowment Assets at Beginning of the Fiscal Year	
Student/Faculty Ratio	Enrollment FTE / Full-Time Instructional Faculty	
Affordability		
Avg. Amt. of Fed. Grant Aid		FGRNT_A
Avg. Amt. of State Grant Aid		SGRNT_A
Avg. Amt. of Inst. Grant Aid		IGRNT_A
Avg. Amt. of Student Loan Aid		LOAN_A
Total Price Out-of-State Students Living on Campus		COTSON
Institutional Characteristics		
Religious Affiliation	* Private model only	AFFIL
Institution Grants a Medical Degree		MEDICAL
Historically Black College or Univ.		HBCU
Carnegie Classification		CARNEGIE
Interstate Agreement Participant	Dummy (“1” Yes; “0” No)	
Selectivity		
Admit Rate	Admissions / Applicants	
Yield Rate	Enrolled / Admissions	
Score Reports	Percent of First-Time Degree/Certificate Seeking Students Submitting SAT and ACT Scores	SATPCT + ACTPCT
SAT I Verbal 75 th Percentile Score		SATVR75
SAT I Math 75 th Percentile Score		SATMT75
Campus Life		
Availability of Campus Housing	Total Dormitory Capacity per FTE	ROOMCAP/FTE
Pct. of Total Price for Room and Board		RMBRDAMT/COTSON
NCAA/NAIA Member for Football or Basketball	1 if ‘Yes’ for either sport 0 if ‘No’ for both	SPORT1 SPORT2
% of Full-Time Students	Full time total / Enrollment	
Diversity	(Black + Hispanic + Asian + AIAN)/ (Black + Hispanic + Asian + AIAN + White)	
Geographic Diversity	Number of States Represented by Entering Freshman Class	
Spatial		
Latitude & Longitude	Calculated from Address Data	N/A

Level 2: Regional and County Characteristics

Regional Data	Source	Level
Population Density	Bureau of the Census	County
Unemployment	Bureau of Labor Statistics	County
18-21 Population (2000)	ESRI Data	County
Closest Airport	ESRI Data	Point

Level 3: State Characteristics

<i>Regional Data</i>	<i>Source</i>	<i>Level</i>
Avg. January Temperature	National Climatic Data	State
Avg. September Temperature	National Climatic Data	State
State Per Capita Income	Bureau of Labor Statistics	State
Educational Attainment (Bachelor's)	NCES	State
Coastline	ESRI	State
Higher Education Appropriations	Postsecondary.org (public institutions model)	State

Appendix B: Project Timeline

Date	Tasks	Deliverables
2007		
January	Obtain IRB Exemption under Category 4	AIR Grant Proposal
February	Draft Dissertation Proposal	
March	Draft Dissertation Proposal	
April	Data clean-up and preliminary analysis	Dissertation Proposal Hearing
May	Preliminary data analysis Generate maps, tables, and graphics Prepare AIR Forum Presentation	
June	Assemble first draft of dissertation	AIR Forum Presentation (Research Methods & Preliminary Results)
July	Assemble first draft of dissertation Improve data analysis based on feedback Draft AERA Presentation Proposal	First draft of dissertation
August	Improve data analysis based on feedback Draft AIR Forum Presentation Proposal	AERA Annual Meeting Proposal
September	Improve data analysis based on feedback	AIR Forum Presentation Proposal
October	Improve data analysis based on feedback	
November	Assemble second draft of dissertation	Second draft of dissertation
December	Editing and revision	Progress report to AIR (12/1/07)
2008		
January	Editing and revision	
February	Editing and revision	
March	Assemble final draft of dissertation Prepare AERA Presentation (if accepted)	Final draft of dissertation
April	Editing and revision	Dissertation Defense AERA Presentation (Final Results)
May	Commencement Exercises Preparation of manuscript for submission to UMI, library, and ERIC.	ASHE Presentation Proposal AIR Forum Presentation (Final Results)
June	Draft final report	Final Report to AIR (06/30/08)
July	Prepare journal article from dissertation	
August	Prepare journal article from dissertation	
September	Prepare journal article from dissertation	
October	Prepare ASHE presentation (if accepted)	Submit journal article for consideration
November		ASHE (Final Results)
December	Prepare proposals for presentations at other conferences.	

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- Wade, G. H. (1971). *Residence and migration of college students; fall 1968, analytic report*. Washington, D.C.: National Center for Educational Statistics.
- Western Interstate Commission for Higher Education. (2006). *Workforce Report: Utah*. Boulder, CO.

Biographical Sketches

Doctoral Student

Allan Joseph Medwick is a fifth-year doctoral student in the Higher Education Management Program at the University of Pennsylvania Graduate School of Education. Mr. Medwick currently holds master's degrees in higher education management and governmental administration. Prior to graduate school, he completed his bachelor's degree in economics and Italian from La Salle University. He started working as a Research Analyst in the Office of Institutional Research at Kean University after completing the coursework required for his doctorate. His research interests include economics, finance, data mining, longitudinal data analysis, geospatial data analysis, and international education. Mr. Medwick's other interests include Asian and Chinese studies, Austrian economics, and college health.

In addition to taking statistics courses in his doctoral program, Mr. Medwick has explored additional statistical methods through professional development courses offered by SAS, SPSS, AERA, and ESRI. Most recently, he attended the invitation-only Summer Data Mining Training for Educators hosted by SAS. In 2005, he participated in the Summer Data Policy Institute, where he gained experience with the national educational datasets as well as training on the proper analysis of complex survey designs. He has completed three online courses (45 course hours) on geospatial analysis (ERSI virtual campus) as well as courses on multilevel and hierarchical linear modeling (AERA), linear mixed models (SAS Global Forum), and data mining (SPSS). He also attends the webinars hosted by AIR and SPSS. Mr. Medwick has given presentations on statistical analysis and survey research for the American, Mid-Atlantic, and Southern College Health Associations. He has also made presentations on longitudinal data analysis at meetings of both AERA and AIR. Mr. Medwick is a member the American Statistical Association and the American Association of Geographers.

Mr. Medwick has the requisite statistical skills needed to conduct the proposed study and has developed a network of professional statisticians and geographers with which he can consult. As a migrant student for college and graduate school from New Jersey, the state considered the largest net exporter of students, this topic is of personal interest to the researcher. He is confident that his research will help start a discussion on improving spatial analysis of national educational data.

Allan Joseph Medwick
Curriculum Vitæ

EDUCATION

University of Pennsylvania Graduate School of Education Philadelphia, PA
Doctor of Education, Higher Education Management, expected May 2008
Distinctions: Dean's Fellowship (full tuition and stipend)

University of Pennsylvania Fels Institute of Government Philadelphia, PA
Master of Governmental Administration, December 2004

University of Pennsylvania Graduate School of Education Philadelphia, PA
Master of Science in Education, Higher Education Management, August 2002

La Salle University Philadelphia, PA
Bachelor of Arts, May 2001
Dual Major: Economics & Italian **Minor:** Catholic Studies
Distinctions: *Maxima cum laude*, University Honors Program, Dean's List, Flubacher Scholarship (Economics), Founders' Scholarship, John McShain Scholarship, Alpha Epsilon (Alumni Honor Society)

ADDITIONAL TRAINING

Central Connecticut State University Hartford, CT
Introduction to Data Mining (Stat 521), Spring 2007

Foundation for Economic Education Irvington-on-Hudson, NY
Austrian Economics: History, Theory, and Prospects for the 21st Century Seminar, July 24-2006
Distinctions: Received fellowship to attend conference.

SAS Institute Long Beach, CA
Summer Data Mining Training for Educators, August 14-18, 2006

American Educational Research Association Chicago, IL
Multilevel and Hierarchical Linear Modeling, April 8, 2006

Ludwig von Mises Institute Auburn, AL
Mises University, August 2005
Distinctions: Received scholarship to attend conference and passed Mündliche Prüfung (oral examination).

**Association for Institutional Research, National Science Foundation,
National Center for Educational Statistics** Washington, DC
Summer Data Policy Institute, June 2005

SAS Global Forum 2005 Philadelphia, PA
Using Mixed Models for Repeated Measures and Random Effects Data, April 2005

ESRI Virtual Campus Redlands, CA
Learning ArcGIS 9, July 2005
Basics of the Geodatabase Data Model, May 2004
Understanding Map Projections and Coordinate Systems, May 2004

**International Foundation of Employee Benefits Plans
The Wharton School of the University of Pennsylvania** Philadelphia, PA
Certified Employee Benefit Specialist (CEBS), July 2001
Certificate of Academic Achievement in Personal Financial Planning, December 2001

HIGHER EDUCATION EXPERIENCE

Kean University

Research Analyst

Union, NJ
(09/05 – Present)

- Analyzed alumni wage data obtained from the New Jersey Department of Workforce and Labor Development.
- Designed and published annual Faculty and Student Profile and departmental profiles.
- Cleaned and submitted unit record enrollment and degree data to New Jersey Commission on Higher Education.
- Responded to internal and external requests for data.

University of Pennsylvania Graduate School of Education

Research Assistant

Philadelphia, PA
(09/02-12/03)

- Conducted research on data collected from the Integrated Postsecondary Education Data System (IPEDS) and Computer-Aided Science Policy Analysis and Research (WebCaspar) database.
- Instructed fellow graduate students in the manipulation and interpretation of IPEDS data using Microsoft Access and SPSS.

University of Pennsylvania School of Engineering and Applied Science

Graduate Intern for Student Affairs

Philadelphia, PA
(09/01-05/02)

- Advised students on writing and implementing a business plan for a store to sell Penn Engineering merchandise.
- Advised student groups on financial matters including budgets and purchasing.
- Organized school-wide events and guest lecturers.

CONFERENCE PRESENTATIONS

Research Presentations

Medwick, A. (2005, June). Improved Methods for the Analysis of Longitudinal Data: An Introduction to Linear Mixed Models. Paper presented at the Association for Institutional Research Annual Forum, Chicago, IL.

Medwick, A. (2005, April). Improved Methods for the Analysis of Longitudinal Data: An Introduction to Linear Mixed Models. Paper presented at the American Educational Research Association Annual Meeting, San Francisco, CA.

Demonstrations and Workshops

Medwick, A. (2006, October). Statistics and Surveys for College Health Professionals. Workshop presented at the Mid-Atlantic College Health Association Annual Meeting, Lancaster, PA.

Medwick, A. (2005, June). Desktop Publishing for Institutional Researchers: Using Adobe InDesign CS2 to Create Professional Reports. Demonstration presented at the Association for Institutional Research Annual Forum, Chicago, IL.

Medwick, A. (2006, May) Statistics and Surveys for College Health Professionals. Workshop presented at the American College Health Association Annual Meeting, New York, NY.

Medwick, A. (2006, March). A Quick Consult on Statistics and Surveys for College Health Professionals. Workshop presented at the Southern College Health Association Annual Meeting, Miami, FL.

PUBLICATIONS

Medwick, A. (2006). Using Conditional Formatting in Excel to Create a Dashboard. *The Electronic AIR*, 26(42).

PROFESSIONAL ACTIVITIES

Proposal Reviewer

Association for the Study of Higher Education: 2005, 2006
American Educational Research Association: 2006 (Section J - Divisions 2, 3, and 4)
Association for Institutional Research: 2007 (Track 6)

Conference Planning

Mid-Atlantic College Health Association Conference Planning Committee, 2003-present
North East Association for Institutional Research Local Arrangements Committee, 2007 Annual Meeting

Committees

University of Pennsylvania
Student Health Insurance Advisory Committee, 2002-2005
Student Health Advisory Board, 2002-2004
Provost's Mental Health Outreach Task Force, 2001-2002

PROFESSIONAL ASSOCIATIONS

Educational and Institutional Research Associations

Association for Institutional Research, Member
Overseas Chinese Association for Institutional Research, Member
North East Association for Institutional Research, Member
New Jersey Association for Institutional Research, Recording Secretary
Association for the Study of Higher Education, Member
American Educational Research Association, Member

Other Professional Associations

American Association for Asian Studies, Member
Mid-Atlantic Regional Association for Asian Studies, Member
American Association for Chinese Studies, Member
American Association of Geographers, Member
American Statistical Association, Member

College Health Associations

American College Health Association, Member
Mid-Atlantic College Health Association, Board Member (Member-at-Large)

OTHER WORK EXPERIENCE

School District of Philadelphia

Philadelphia, PA
(05/04-11/04)

Volunteer Intern

- Co-authored a paper, "Private Partnerships in Public Education," for the School District's Innovations in Education Conference.

AON Consulting

New York, NY
(5/01-8/01)

Intern

- Prepared reports of health and welfare program utilization.
- Analyzed bids from providers for health and welfare program renewals.
- Created customized research reports on benefit options and industry standards for clients.

Prudential Financial

Newark, NJ

Intern

(05/99-08/99, 05/00-08/00)

- International Foundation of Employee Benefit Plans Internship Program
- Conducted financial account analysis and reconciliation for the Prudential Retirement Plan.
- Communicated with an outside law firm concerning compliance on various items, including a new domestic partner/qualified adult program.
- Edited 1999 Annual Enrollment materials and other communications.

COMPUTER SKILLS

Microsoft Applications: Word, Excel, Access, PowerPoint, Publisher, and Outlook

Databases: Microsoft SQL Server

Statistical & GIS: SPSS, SAS, Statistica, ArcGIS

Graphic Design: Adobe Acrobat, Adobe InDesign

Languages: Visual Basic, SQL

AWARDS & HONORS

John A. Hargleroad Award (Mid-Atlantic College Health Association), October 2005

Travel Grant to Study Chinese Educational System (University of Pennsylvania), May - June 2004

Gamma Iota Sigma (Insurance & Risk Management Society), Inducted December 2000

Omicron Delta Epsilon (Economics Honor Society), Inducted April 1999

Eagle Scout (Boy Scouts of America), 1995

Faculty Dissertation Director

Dr. Laura W. Perna's scholarship uses an integrated theoretical approach and a variety of analytical techniques to understand the ways in which individual characteristics, social structures, and public policies separately and together enable and restrict the ability of women, racial/ethnic minorities, and individuals of lower socioeconomic status to obtain the economic, social, and political opportunities that are associated with two aspects of higher education: access as a student and employment as a faculty member.

Most of the book chapters, journal articles, monographs, and technical reports listed below rely on quantitative analyses of the NCES databases, particularly NELLS, BPS, B&B, NSOPF, IPEDS, and NPSAS. Perna's research has employed a range of quantitative techniques, including descriptive analyses, OLS and logistic regression analyses, and hierarchical linear modeling.

Her research has been supported by grants from the American Education Research Association, the Association for Institutional Research, and the Lumina Foundation for Education and been recognized by the Association for the Study of Higher Education's 2003 Promising Scholar/Early Career Achievement Award. Perna serves as a member of the technical review group for the GEAR UP Follow-up evaluation, the technical work group for the Upward Bound evaluation, the technical review panel for the National Postsecondary Student Aid Study, the external advisory committee for the National Council of Higher Education Loan Programs, and the Lumina Foundation for Education's Research Advisory Committee. In addition, she serves or has served on the editorial boards of the Review of Higher Education, the Journal of College Student Development, and the Journal of the Professoriate, and is a consulting editor for Research in Higher Education.

LAURA W. PERNA
Abbreviated CV
Associate Professor
Graduate School of Education
University of Pennsylvania
3700 Walnut Street, Philadelphia, PA 19104
lperna@gse.upenn.edu / 215-746-2522

EDUCATION

Ph.D., Education, University of Michigan
M.P.P., Policy Studies, University of Michigan
B.S., Economics, The Wharton School, University of Pennsylvania, magna cum laude
B.A., Psychology, College Arts & Sciences, University of Pennsylvania, magna cum laude

WORK HISTORY

2005 – University of Pennsylvania, Associate Professor and Higher Education Program Coordinator
1999 – 2005 University of Maryland, College Park
1999 – 2000 Visiting Assistant Professor
2000 – 2005 Assistant Professor
1996 – 1999 Frederick. D. Patterson Research Institute of the United Negro College Fund
1999 Acting Director
1996 – 1999 Research Scientist and Director of Data Analysis
1995 – 1996 University of Dallas, Director Institutional Research and Planning,
1990 – 1994 American Institute for Paralegal Studies, Inc.
1992 – 1994 Director Business Affairs – May 1992 to January 1994
1990 – 1992 Director Strategic Business Projects
1988 - 1990 Hudson County Executive's Office, Assistant Director Intergovernmental Relations

SELECTED PUBLICATIONS

Chapters in Books

- Nettles, M.T., Perna, L.W., & Millett, C. (1998). Race and testing in college admissions. Chapter 7 in G. Orfield & E. Miller (Eds.), *Chilling admissions: The affirmative action crisis and the search for alternatives* (pp. 97-110). Cambridge, MA: The Civil Rights Project, Harvard University.
- Swail, W.S., & Perna, L.W. (2002). Pre-college outreach and early intervention programs: A national perspective. In W.G. Tierney & L.S. Hagedorn (Eds.), *Increasing access to college: Extending the possibilities for all students* (pp. 15-34). Albany, NY: State University of New York Press.
- Perna, L.W., & Swail, W.S. (2002). Pre-college outreach and early intervention programs. In D. E. Heller (Ed.), *Condition of access: Higher education for lower income students* (pp. 97-112). Westport, CT: Praeger Publishers (ACE/Oryx Series on Higher Education).
- Perna, L.W. (2003). Studying faculty salary equity: A review of theoretical and methodological approaches. In J. C. Smart & A. Bayer (Eds.), *Higher education: Handbook of theory and research*, Volume 18 (pp. 323-388). Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Thomas, S. L., & Perna, L. W. (2004). The opportunity agenda: A reexamination of postsecondary reward and opportunity. In J. C. Smart (Ed.), *Higher Education: Handbook of theory and research*, Volume 19 (pp. 43-84). Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Perna, L.W. (2005). The key to college access: A college preparatory curriculum. In W. G. Tierney, Z. B. Corwin, & J. E. Colyar (Eds.), *Preparing for College: Nine Elements of Effective Outreach* (pp. 113-134). Albany, NY: State University of New York Press.
- Perna, L. W., & Weidman, J. C. (2006). Introductory essay, Section two: Identifying meaningful problems and approaches to inquiry across and within fields. In C. F. Conrad and R. Serlin (Eds.), *SAGE handbook on research in education: Engaging ideas and enriching inquiry* (pp. 53-58). Thousand Oaks, CA: Sage Publications, Inc.
- Johnson, J. N., Conrad, C. F., & Perna, L. W. (2006). Minority-serving institutions of higher education: Building upon and extending lines of inquiry for the advancement of the public good. In C. F. Conrad and R. Serlin

(Eds.), *SAGE handbook on research in education: Engaging ideas and enriching inquiry* (pp. 263-277). Thousand Oaks, CA: Sage Publications.

Perna, L. W. (2006). Studying college choice: A proposed conceptual model. In J. C. Smart (Ed.), *Higher Education: Handbook of theory and research*, Vol. XXI (pp. 99-157). Springer.

Academic Journal Articles (* indicates refereed manuscript, +indicates invited manuscript)

- *Martinez, V., Godwin, K., Kemerer, F., & Perna, L. W. (1995). The consequences of school choice: Who leaves and who stays in the inner city. *Social Science Quarterly*, 76, 485-501.
- *Perna, L.W. (1998). Does financial aid help students to attend higher priced colleges? *Journal of Student Financial Aid*, 28(1), 19-38.
- *Perna, L.W. (1998). The contribution of financial aid to undergraduate persistence. *Journal of Student Financial Aid*, 28(3), 25-40.
- +Perna, L.W., Freeman, K.E., & Nettles, M.T. (1999). The use of affirmative action in the college admissions process for African Americans. *Review of African American Education*, 1(1).
- *Perna, L.W. (2000). Differences in the decision to enroll in college among African Americans, Hispanics, and Whites. *Journal of Higher Education*, 71, 117-141.
- *Perna, L.W. (2001). Sex differences in faculty salaries: A cohort analysis. *Review of Higher Education*, 24, 283-307.
- *Perna, L.W. (2001). The contribution of historically Black colleges and universities to the preparation of African Americans for faculty careers. *Research in Higher Education*, 42, 267-294.
- *Perna, L. W., & Swail, W. S. (2001). Pre-college outreach and early intervention. *Thought and Action*, 17(1), 99-110.
- *Perna, L.W. (2001). Sex and race differences in faculty tenure and promotion. *Research in Higher Education*, 42, 541-567.
- *Perna, L.W. (2001). The relationship between family responsibilities and employment status among college and university faculty. *Journal of Higher Education*, 72, 584-611.
- *Perna, L.W. (2001). Undergraduate borrowing at the federal limit before and after the 1992 reauthorization of the Higher Education Act. *Journal of Student Financial Aid*, 31(1), 25-38.
- *Perna, L. W. (2002). Pre-college outreach programs: Characteristics of programs serving historically underrepresented groups of students. *Journal of College Student Development*, 43, 64-83.
- *Perna, L.W. (2002). Sex differences in the supplemental earnings of college and university faculty. *Research in Higher Education*, 43, 31-58.
- *Perna, L.W. (2003). The status of women and minorities among community college faculty. *Research in Higher Education*, 44, 205-240. (AIR Forum Issue)
- *Perna, L.W. (2003). The private benefits of higher education: An examination of the earnings premium. *Research in Higher Education*, 44, 451-472.
- *Perna, L.W., & Titus, M. (2004). Understanding differences in the choice of college attended: The role of state public policies. *Review of Higher Education*, 27(4) 501-525.
- *Perna, L.W. (2004). Understanding the decision to enroll in graduate school: Sex and racial/ethnic group differences. *Journal of Higher Education*, 75, 487-527.
- *Perna, L. W., Steele, P., Woda, S., & Hibbert, T. (2005). State public policies and the racial/ethnic stratification of college access and choice in the state of Maryland. *Review of Higher Education*, 28, 245-272.
- *Perna, L. W. (2005). Sex differences in faculty tenure and promotion: The contribution of family ties. *Research in Higher Education*, 46, 277-307.
- *Perna, L. W. (2005). A gap in the literature: the influence of the design, operations, and marketing of student aid programs on the formation of family college-going plans and resulting college-going behaviors of potential students. *Journal of Student Financial Aid*, 35(3), 7-15.
- *Perna, L.W., & Titus, M. (2005). The relationship between parental involvement as social capital and college enrollment: An examination of racial/ethnic group differences. *Journal of Higher Education*, 76, 485-518.
- *Perna, L. W. (2005). The benefits of higher education: Sex, racial/ethnic, and socioeconomic group differences. *Review of Higher Education*, 29, 23-52
- *Perna, L. W., Milem, J. F., Gerald, G., Baum, E., Rowan, H., & Hutchens, N. (2006). The status of equity for Black undergraduates in public higher education in the South. *Research in Higher Education*, 47, 197-228. AIR Forum Issue.
- *Perna, L. W. (2006). Understanding the relationship between information about college costs and financial aid and students' college-related behaviors. *American Behavioral Scientist*, 49, 1620-1635.

- *Perna, L. W., & Li, C. (2006). College affordability for middle-income students: Implications for college opportunity. *Journal of Student Financial Aid*, 36(1), 7-24.
- *Perna, L. W., Gerald, D., Baum, E., & Milem, J. F. (in press) The status of equity for Black faculty and administrators in public higher education in the South. *Research in Higher Education*, AIR Forum Issue.

Monographs

- Perna, L.W. (1997). *The contribution of financial aid to the price of four-year institution attended by 1989-90 freshmen*. Institute for Higher Education Law & Governance, University of Houston, Monograph 97-2.
- Perna, L.W. (2001). *Undergraduate borrowing at the federal limit before and after the 1992 reauthorization of the Higher Education Act*. Institute for Higher Education Law & Governance, University of Houston, Monograph 01-02.
- Swail, W. S., with Redd, K. & Perna, L.W. (2003). *Retaining minority students in higher education: A framework for success*. ASHE-ERIC Reader, Volume 30, Number 2. San Francisco, Ca: Jossey-Bass.

Technical Reports

- Nettles, M.T., & Perna, L.W. (1997). *The African American education data book: Higher and adult education, Volume I*. Fairfax, VA: Frederick D. Patterson Research Institute of The College Fund/UNCF.
- Nettles, M.T., & Perna, L.W. (1997). *The African American education data book: Preschool through high school education, Volume II*. Fairfax, VA: Frederick D. Patterson Research Institute of The College Fund/UNCF.
- Nettles, M.T., & Perna, L.W. (1997). *The African American education data book: Transition from school to college and school to work, Volume III*. Fairfax, VA: Frederick D. Patterson Research Institute of The College Fund/UNCF.
- Nettles, M.T., Perna, L.W., & Freeman, K.E. (1999). *Two decades of progress: African Americans moving forward in higher education*. Fairfax, VA: Frederick D. Patterson Research Institute of The College Fund/UNCF.
- Nettles, M.T., Perna, L.W., & Bradburn, E.M. L. (2000). *Salary, promotion, and tenure status of minority and women faculty in U.S. colleges and universities*. Washington, DC: National Center for Education Statistics. (NCES 2000-173)
- Swail, W.S., Redd, K., & Perna, L.W. (2002). *Retaining minority students in higher education: A framework for success*. Washington, DC: The Pell Institute for the Study of Opportunity in Higher Education.
- Perna, L. W. (2004). *Impact of student aid program design, operations, and marketing on the formation of family college-going plans and resulting college-going behaviors of potential students*. Boston, MA: The Education Resources Institute, Inc. (TERI).
- Gladieux, L., & Perna, L. (2005). *Borrowers who drop out: A neglected aspect of the college student loan trend*. San Jose, CA: National Center for Public Policy and Higher Education.
- Perna, L. W., Li, C., & Cooper, M. (2006). *Improving educational opportunities for students who work*. Indiana Project for Academic Success. <http://www.indiana.edu/~ipas1/>
- Perna, L. W., & Thomas, S. L. (2006). *A framework for reducing the college success gap and promoting success for all*. Washington, DC: National Postsecondary Education Cooperative.

CONTRACTS AND GRANTS

- Principal Investigator, National Association of Student Financial Aid Administrators (NASFAA) Sponsored Research Grant: "An examination of the effects of financial aid on student choice of college to attend;" 1996, \$500.
- Principal Investigator, American Educational Research Association (AERA) Research Grant: "The role of historically Black colleges and universities in preparing African Americans for faculty careers;" 1998-99; \$15,000.
- Principal Investigator, American Educational Research Association (AERA) Research Grant: "Racial/ethnic group differences in the realization of educational plans;" 2000-01; \$15,000.
- Principal Investigator, Association for Institutional Research (AIR) Research Grant: "The status of women and minorities among community college faculty;" 2001-02; \$30,000.
- Principal Investigator, University of Maryland General Research Board (GRB) Summer Research Award: "Understanding the decision to enroll in a graduate program: Sex and racial/ethnic group differences;" 2002; \$8,750.
- Principal Investigator, Lumina Foundation for Education: "Understanding the choice of college attended by students with low family incomes and low socioeconomic status: The role of state context;" 2002-03; \$42,200.

Co-Principal Investigator and Project Coordinator, Lumina Foundation for Education: "Race equity and diversity in public higher education in the South;" 2004-06; \$323,800.

Co-Principal Investigator, Lumina Foundation for Education: "Combined impact of federal, state, and institutional policies on prospective students' opportunity for college;" 2004-6; \$321,500.

Co-Principal Investigator, Graduate School of Education: "Increasing the representation of African American women in STEM education: The role of Historically Black colleges and universities;" 2006-07; \$50,000.

Co-Principal Investigator, University of Pennsylvania, Diversity Fund. "Increasing the representation of African American women in STEM education: The role of Historically Black colleges and universities;" 2006-07; \$2,000.

SELECTED COMMITTEES AND ADVISORY BOARDS

GEAR-UP Program, Follow-Up Evaluation, Technical Review Group, 2005-07.

National Postsecondary Student Aid Study (NPSAS:08), Technical Review Panel, 2006-08.

Upward Bound Program 5-year evaluation, Technical Work Group, 2006-2010.

National Council of Higher Education Loan Programs (NCHELP), External Advisory Committee, 2006 - .

Lumina Foundation for Education, Research Advisory Committee, member, 2006 - 2008.

FELLOWSHIPS, PRIZES, AND AWARDS

Promising Scholar/Early Career Achievement Award, Association for the Study of Higher Education, 2003.

Budget

Estimated Expenses (June 1, 2007 – May 31, 2008)

Personnel

Doctoral Student: 6.0 FTE academic year months @ \$1,500/mo \$9,000.00

Personnel Total **\$ 9,000.00**

Dissemination of Research Findings

2008 AIR Forum – Seattle, WA
 Economy Airfare \$ 500.00
 Hotel (5 nights @ \$150.00) \$ 750.00
 Registration \$ 400.00
 Per Diem (5 days @ \$64.00) \$ 320.00
2008 AIR Forum Total **\$ 1,970.00**

2008 AERA Annual Meeting – San Diego, CA
 Economy Airfare \$ 500.00
 Hotel (6 nights @ \$125.00) \$ 750.00
 Registration \$ 150.00
 Per Diem (6 days @ \$64.00) \$ 384.00
2008 AERA Annual Meeting Total **\$ 1,784.00**

Registration Fees for Local Conferences **\$ 400.00**

Dissemination of Research Findings Total **\$ 4,154.00**

Other Direct Costs

Materials and Supplies (e.g., toner, cotton paper) \$ 200.00
Statistical texts not available from the library or ILL \$ 350.00
Handouts for Conferences \$ 75.00
Microfilming of Dissertation \$ 80.00
Copyrighting of Dissertation \$ 45.00
Statistical and Design Software \$ 500.00

Other Direct Costs Total **\$ 1,250.00**

TOTAL AMOUNT REQUESTED **\$14,404.00**

Budget Explanation

Personnel expenses were calculated based on working approximately fifteen hours per week on my dissertation during the grant period. The purpose of including a salary line item was to cover the tuition that the University of Pennsylvania charges to doctoral students on dissertation status. Domestic travel costs are budgeted so I can present the findings of my research at the 2008 AIR Forum and 2008 AERA Annual Meeting. The travel costs are very rough estimates; the actual expenses are expected to be lower.

Other direct costs include expenses associated with submitting the final copy of my dissertation, providing handouts at conferences, statistical software, and purchasing materials and supplies. It also includes a line for statistical texts not available from the library. It generally takes at least three months for libraries to acquire and catalog new publications, so many newer texts in this field are not easily available through Borrow Direct (other Ivy League libraries), EZ Borrow (other academic libraries in Pennsylvania), or Interlibrary Loan. This small amount would allow me to purchase these books if they are not available from any other source. Other expenses related to the production and dissemination of the research will be paid with the personal funds of the author.

Current and Pending Support

I have not received any financial support from the University of Pennsylvania since December 2004 except for two travel grants (\$200 each) to present at meetings of the American Educational Research Association and the Southern College Health Association. I have been employed by Kean University since September 2005. Kean provides salary and benefits in exchange for 35 hours of work per week. There are limited funds available for travel. I am not seeking, nor will I seek, funding for my dissertation from any other source.

Facilities, Equipment, and Other Resources

The Integrated Postsecondary Education Data System (IPEDS) does not require a special data license. I have downloaded the complete IPEDS files as well as special subsets of the data using the Dataset Cutting Tool. I have stored all of the raw data in a SQL Server Database. My personal computer has enough resources to perform statistical analysis on large amounts of data and includes some of the necessary programs for analyzing statistical and geospatial data (e.g., SAS, SPSS, and ArcGIS). As a doctoral student at the University of Pennsylvania, I continue to have access to all of the university's resources.

Special Information and Supplementary Documentation

A letter of recommendation from my faculty dissertation director, Dr. Laura Perna, will be sent to the AIR office under separate cover.