

2004 AIR RESEARCH GRANT/ PROPOSAL
Improving Institutional Research in Postsecondary Institutions

**College financing and college completion:
Using ecological inference to investigate how types of aid received affects
retention and graduation outcomes**

Data set of interest: Integrated Postsecondary Education Data System (IPEDS)

Grant amount request: \$20,606

Principal Investigator
Kathryn S. Corder
Director, Academic Planning and Institutional Data
Western Michigan University
1903 W. Michigan Ave
Kalamazoo, MI 49008
269/387-4387
kathryn.corder@wmich.edu

Co-Principal Investigator
Tracy Pattok
Data Analyst, Academic Planning and Institutional Data
Western Michigan University
1903 W. Michigan Ave
Kalamazoo, MI 49008
269/387-4428
tracy.pattok@wmich.edu

Co-Principal Investigator
J Kevin Corder
Associate Professor, Department of Political Science
Western Michigan University
1903 W. Michigan Ave
Kalamazoo, MI 49008
269/387-5691
corder@wmich.edu

Authorized Institutional Representative
Jack Luderer, Vice President for Research
Western Michigan University
1903 W. Michigan Ave
Kalamazoo, MI 49008
269/387-8298
jack.luderer@wmich.edu

Principal Investigator

Authorized Institutional Representative

Co-Principal Investigator

Co-Principal Investigator

2. Project Summary

This project investigates retention and graduation rates of students receiving various types of financial assistance. The central objective is to learn if the expanded availability and use of student loan financing has improved the retention and graduation rates of college students. Our expectation is that the substitution of loan financing for grants will decrease persistence and graduation rates. We expect that institutional grants, in particular, will increase persistence both by lowering student unmet financial need and by encouraging integration of students into the academic community. We test these expectations with aggregate data. The project uses innovations in aggregate data analysis – new methods for ecological inference – to uncover individual-level relationships between type of financial aid and student outcomes. Ecological inference permits the use of aggregate institution-level data to learn about the individual-level relationships between student characteristics and student outcomes. We use aggregate data on the proportion of students receiving various types of aid and aggregate data on graduation rates reported in the Integrated Post Secondary Education Data System [IPEDS], as well as information about first-year retention rates collected by the Consortium for Student Retention Data Exchange [CSRDE]. The project offers both substantive insights into the link between financing and performance and an application of relatively new methods that are particularly suitable for data collected and disseminated in IPEDS. The proposal illustrates how ecological inference can expand the types and variety of questions that can be addressed with widely available aggregate data.

3. Table of Contents

Project Summary	2
Project Description	4
Introduction and background	4
Hypotheses	8
Sources of data	10
Methodological innovations	11
Proposed plan of work	16
Dissemination plan	16
Policy relevance	16
Audience	17
Conclusion	18
References Cited	19
Biographical Sketches	24
Budget and Budget Justification	30
Current and Pending Support	32
Facilities, Equipment and Other Resources	33

4. Project Description

Introduction and background

Contemporary college students are expected to bear an increasing proportion of college expenses. A combination of factors has led to an increase in costs for individual students. Policymakers and students have responded to these new pressures in ways that alter that types and amount of aid that is used to finance postsecondary education..

The use of students loans, in particular, as a method of financing education has expanded dramatically. In the 1989-90 academic year, 25 percent of all students and 22 percent of students at public 4-year institutions received some form of federal student loans. By 1996, that number rose to 42 percent of all students and 43 percent of students at public, 4-year institutions (Berkner, 2000). At the same time, the availability of grant aid has declined. The College Board reports that the percentage of total student aid covered by grants fell from 51 percent to 40 percent between 1993 and 2002. In the same period, the percentage of aid covered by loans rose from 47 percent to 54 percent and the total number of student borrowers expanded from nearly 3.8 million to over 6 million (College Board, 2003)

This dramatic increase in borrowing by 4-year college students may have important consequences for both completion rates and post-college choices. The use and availability of loans may affect both short-term decisions about persistence and, over the longer-term, the probability of degree completion for individual students. The proposed research focuses on the link between the type of aid that students choose to take during their first

year and subsequent persistence and graduation rates. The objective is to learn how aid choices affect these outcomes.

The link between ability-to-pay and college departure decisions is central to an important subset of research on persistence (classically, Becker 1964). With the publication and influence of Tinto's sociological theories of persistence and departure, financial considerations were relegated, in much of the literature, to a secondary role. Tinto's framework emphasizes the normative and structural integration of students and suggests ability to pay is a factor that enters only very late in a student's evaluation of the costs and benefits of persistence (Tinto 1993). Recent reappraisals of work of Tinto (especially, the recent collection of essays in Braxton, 2000) emphasize the need to expand research on departure beyond measures of academic integration. St. John, Caberra, Nora and Asker (2000) place particular emphasis on the need to combine insights from economic work with the sociological theories.

There is a longstanding interest in the link between financial aid and persistence. Since the creation of the federally-sponsored student loan initiative in the 1960s, policymakers have been interested in the aggregate effects of government subsidies on access to higher education. Overall, this body of research is unambiguous in the sense that higher levels of aid are clearly associated with higher probabilities of persistence and graduation. One meta-analysis (Murdock 1987) confirms the strong positive relationship between financial aid and persistence in college. But the broader literature is somewhat unclear on the effects of student employment, the impact of loans, and the optimal timing of aid ("front-loading" or assistance in later years). Two distinct methodological strategies have been adopted to confront the link between aid and persistence, the use of the national

survey and the use of institutional administrative data, each with different types of limitations. We propose to offer a third alternative, the use of aggregate data, to fill in gaps left by extant empirical research.

The typical methodological approach to investigate the link between aid type and outcomes is to collect individual-level data at a single university and to use logistic regression to estimate the effect of a number of individual-level variables on persistence or graduation. Early studies of this type included the types of financial aid given to students; later work added controls for ability to pay, the size of the various awards, and academic ability of the students. Fenske, Porter, and DuBrock (1999), for instance, found that gift aid only packages resulted in higher re-enrollment of freshmen, reinforcing similar findings reported in Astin (1975) and St. John (1989).

Murdock, Nix-Mayer, and Tsui (1995) found that students with high award amounts and low levels of unmet need were substantially more likely to complete the sophomore year. They also found that students with high loan amounts were less likely to persist to the second year, but attributed this to an institutional financial aid policy that targeted grants and institutional scholarships to students with high academic rankings and loans and work study to lower academically ranked students. In an innovative duration analysis of time to degree, DesJaridins, Ahlburg, and McCall (2002) find that certain work study and grant aid resulted in lower stop-out rates, especially if aid was awarded early in the college experience, but that loans are associated with higher stop-out rates. Lam (1999), in contrast, found that students receiving loans to attend a large urban public university attained a degree more quickly than students who did not receive loans.

One important limitation of this approach is the narrow range of institutions that have been singled out for analysis. The conduct of this type of research requires access to individual-level financial aid award and outcomes data. Due to privacy concerns and legal restrictions, these data are rarely shared across institutions. As a result, institutional research offices that do have access to the individual-level data have produced work that focuses exclusively on their own university. We cannot use this type of approach to learn, for instance, if the link between persistence and aid is stable across types of institutions. Does the type and amount of financial aid matter more at private or public colleges? In a unique and rigorous across-institution study using data from the Ohio Board of Regents, Bettinger (n.d.), finds that Pell Grants increases year-to-year persistence. Bettinger prescribes “front-loaded” grant aid, targeted to students in the early years of the college experience, to maximize persistence. In contrast, Murdock (1989) demonstrated that availability of financial aid has a stronger effect on later persistence than on first year retention

As an alternative to the single institution studies, a number of investigators have exploited the National Postsecondary Student Aid Studies (NPSAS) to estimate the relationship between aid and outcomes. Drawing on the 1996 study of Beginning Postsecondary Students (BPS), Chang Wei and Horn (2002) found that the persistence rate of Pell Grant recipients did not differ from that of non-recipients. This was the case despite the fact that Pell Grant recipients were likely to have characteristics that are traditionally associated with stop-out (financial independence, children and no high school diploma. Also appealing to BPS data, King (2002) describes how the combination of part-time work and student loan borrowing is associated with high levels of

persistence. The finding that part-time work led to persistence is consistent with a number of previous works (see Pascarella and Terenzini (1991)). Horn and Peter (2003) found that institutional grant aid was associated with higher levels of persistence, but the magnitude of the effect varied across types of institutions. Perna (1998) also found that the effects of aid on persistence varied by the type of aid received. Another NPSAS component, the Baccalaureate and Beyond Longitudinal Study, permitted some assessments of the impact of aid choices on later choices. McCormick, Nunoz, Shah, and Choy (1999) found that students with loan debt were somewhat less likely to pursue graduate studies.

One limitation of the NPSAS data is that there are few observations from different types of institutions. The 1999-2000 NPSAS contained responses from nearly 50,000 students at over 1,000 institutions. The number of students at various types of institutions (public or private, large or small, highly selective or less selective) is relatively small. The proposed research fills in the gaps between national-level surveys (which have few students per type of institution) and state-level and institution-level studies (which have few institutions but many student-level observations). We obtain estimates of the proportion of students with various types of aid that persist or graduate from a large number of diverse institutions.

Hypotheses

Economic and sociological work on college departure choices suggests a number of specific hypotheses to test with the aggregate data. Although we expect that each form of

aid will be associated with higher levels of persistence and graduation rates, we anticipate that the magnitude of the effects will vary by type aid.

Effects of institutional grant aid

Institutional grant aid should be associated with higher effects on persistence and graduation than either external grants or loans. Institutional aid serves the dual purpose of reducing costs and demonstrating the commitment of the institution to student success. The aid is perceived as exclusive to the institution. Further, many contemporary students devote substantial care to the search for the best institutional aid package, shopping for an award that defrays the most costs. Students should be reluctant to let go of this sought after aid. After controlling for student inputs (as detailed below) institutions that rely on institutional aid to subsidize students should experience higher levels of persistence and graduation.

Effects of federal and state aid

Government grants should positively influence student persistence and graduation rates, but to a lesser extent than institutional grant aid. Government grants do reduce the costs of attending college, but the grants are portable. Students can transfer or temporarily suspend study and have a reasonable expectation that government will be available in the future and at other institutions.

Effects of loans

Loans should positively influence student persistence and graduation rates, but the effect should be weaker than either form of aid. Extant research suggests that the effect of loans

may be positive or negative. We expect to observe positive effects on first year persistence especially, but the link between first year loan financing and graduation rates may be very weak or even negative. Loans do not carry the same kinds of integrative effects as aid and the future costs of loans repayment decreases the benefits of persistence and graduation. This combination of factors should reduce the benefits of loans as an instrument of financing.

The possible student performance and policy implications of these expectations are clear. If students are relying to a greater and greater extent on loans to finance education and use of loans is found to decrease persistence and graduation rates, then aggregate student success may decline over time as borrowing expands.

Sources of data

Our project exploits IPEDS data and recent methodological innovations to investigate the link between persistence and aid. IPEDS data includes aggregate – institution-level – data on success of freshman cohorts and the distribution of financial aid award across cohorts. We merge the IPEDS institution level data with data from two other sources – NCAA five year graduation rates and CSRDE first year retention rates to investigate both short-term and long-term affects of particular types of aid.

Beginning with Fall 1999 students, IPEDS includes four categories of financial aid information: percent of the first-time, full-time, degree-seeking cohort receiving loans, federal aid, state or local grants, or institutional grants. We can separately investigate the impact of each form of aid on persistence to the first year and, as data become available, on fifth and sixth year graduation rates. For this project, we propose to supplement the

IPEDS institution-level data with first-year persistence data from the 344 four-year institutions participating in the 2001 CSRDE and, in Fall 2004, with a broader set of NCAA institution-level data on fifth year graduation rates. In 2005, estimation of six year graduation rates for individuals receiving each type of aid described in IPEDS will be possible. Further, since IPEDS now includes data on transfer-out students from many institutions, the effect of each type of aid specifically on stop-out behavior can be estimated. The first step in the project is to estimate the impact of aid type on persistence, using combined data from IPEDS and CSRDE. The use of aggregate data permits merging of institutional information from a variety of sources for one analysis – a methodological strategy that both permits wider (and unanticipated) uses of existing aggregate data collections and economizes on the collection of new data.

Methodological innovations

Ecological inference for 2 x 2 tables

The project capitalizes on recent methodological advances – originating in the work of King (1997) and recently extended in Wakefield (2004). A variety of early quantitative work in social science relied on aggregate data to draw inferences about individual behavior – such as using census data on race and literacy to estimate the literacy rate by race. A now classic work by Robinson (1950) identified what has become known as the ecological fallacy – the finding that correlations between aggregate quantities (such as census aggregations) varied depending upon the level of aggregation and, further, this aggregate level relationship was often very different from the individual-level

relationship. This revelation both called into question many existing social scientific claims and stimulated use of the individual level survey.

King (1997) triggered both a debate about the strategy of ecological inference and a renewed interest in the collection and use of aggregate data. Two distinct approaches to ecological inference dominated the early literature on aggregate data analysis -- Goodman's (1953) ecological regression approach and the method of bounds (outlined in Duncan and Davis 1953). King proposed a novel statistical approach that drew on the intuitions of both Goodman and Duncan and Davis. Linking the work of King to a large body of related work in biostatistics and epidemiology (see Richardson and Monfort 2000), Wakefield (2004) compares a variety of models for ecological inference and develops a computationally manageable Bayesian strategy for ecological inference.. We adopt the approach suggested by Wakefield.

The basic model

Ecological inference requires that we treat each university or observation as 2 x 2 table with known table marginals and unknown interior cells. We can observe, from the CSRDE data, the proportion of students from a freshman cohort that persist after one year. IPEDS provides us with information about the proportion of student receiving loans. The persistence of students receiving loans is not reported. Ecological inference involves the estimation of this unknown quantity. The 2 x 2 representation is reproduced as Table 1, below, using data from Western Michigan University.

Table 1. Distribution of grant aid and second year persistence at a large public university

	Proportion of cohort persisting beyond the first year [0.78]	Proportion of cohort leaving before the second year [0.22]
Proportion receiving loans [0.27]	Proportion receiving loans and persisting beyond the first year <i>[not reported in IPEDS or CSRDE]</i>	
Proportion not receiving loans [0.73]		

Source: IPEDS (1999 first-time, full-time undergraduates) and CSRDE (2001 report)

We use a Bayesian hierarchical model to estimate persistence rates of students with various types of student aid. Each observation (university or college) is treated as a separate 2 x 2 table with known marginals (number of persisting students (P) and number of students that depart (NP) and number of students who received, for instance, loans (L) or did not receive loans (NL) and unknown interior cells (number of students that received loans and persisted to the second year). The model, elaborated in Wakefield (2004), describes the observed number of students that persist (P) at the institution (the first stage of the hierarchy) as the sum of the draws from two independent binomial distributions – one representing students that received loans (persisting with probability p_0) and one representing non recipients (persisting with probability p_1).. Candidate values for the recipient and non-recipient persistence rates are selected such that each pair (p_0, p_1) is logically consistent with the observed aggregate persistence and use of aid. Any candidate values must satisfy the accounting identity:

$$P = (p_0 * L) + (p_1 * NL)$$

At the second stage of the model, acceptable candidate values for p_0 and p_1 are transformed via the logistic. The mean of each vector of logits is treated as a parameter that describes the mean behavior of loan recipients in the sample. The aggregate mean obtained in the second stage is retained and used in the calculation of the likelihood in the subsequent iteration of the model. New candidate values are selected, the means are updated, and this process is repeated. This iterative modeling strategy is implemented using source code adapted from *MCMCpack*, a suite of tools for Markov Chain Monte Carlo (MCMC) simulation developed for the R statistical package (Martin and Quinn, 2003).

Gill (2002) provides a thorough introduction to the Bayesian modeling framework and MCMC. MCMC methods exploit the enormous recent advances in computational power to simulate solutions to complex integration problems implied by high dimension Bayesian models. Although relatively novel, conventions for assessing convergence, diagnosing model performance problems, and reporting results are emerging in social science and statistics literature.

The extended model

One complication of the naïve model, in which each observation is modeled as a draw from a common mean, is that we fully expect there to be institutional characteristics that affect student performance exclusive of the distribution of aid. Previous research has indicated that student preparedness (measured via high school GPA or standardized test scores of incoming students), family income, or other student “inputs” as described in

Astin (1997) will affect persistence and graduation rates. Epidemiologists label these characteristics as “confounders” and prescribe the introduction of institution-level covariates to account for these across-institution differences (again, see Wakefield (2004, specifically Sec. 5.4). Specifically, at the second stage of the model, the logit of institution-level parameter p_o is regressed on a vector of institution-level covariates. The resulting coefficients are used to generate a predicted value for each institution. Both coefficients and the institution-level parameters are updated via MCMC. PI J. Corder has substantial experience with the estimation and interpretation of these models, including an evaluation of the robustness of the naïve model published in Corder and Wolbrecht (2004) and application of the extended model in Corder and Wolbrecht (n.d.).

Verification and robustness

At least two sources of information can be used to verify the accuracy of the estimates. First, the point estimate from WMU should correspond to what we observe in our own institutional data. Second, the overall mean rate of persistence or graduation by aid type should correspond to the survey data from NPSAS. The Bayesian approach permits us to leverage information in the survey data to improve estimates of quantities for institutions. The number of observations per institution is too small to permit institution-level conclusions to be drawn from BPS, but we can aggregate BPS respondents, for instance, by private and public institutions and benchmark the performance of our estimation technique to this national survey. We use available true values from WMU, national-level survey data from NPSAS, and canonical convergence diagnostics to evaluate the performance of the model

Proposed plan of work

Summer 2004. Data collection and estimation of the basic model. PIs K. Corder and Pattok will collect and organize the IPEDS and CSRDE data, producing a merged file of institutional data with first year retention rates. PI J. Corder will produce estimates of institution-level persistence and graduation outcomes by financial aid type and evaluate convergence diagnostics and model performance

Fall 2004. Verification and updates. PI Pattok will download the necessary NPSAS data to compute national level benchmarks to evaluate model performance. PI J. Corder will estimate the extended models to control for variation in student inputs across institutions.

Spring 2005. Manuscript preparation. The PIs will jointly prepare the manuscript and present the results at the 2005 AIR forum in San Diego.

Dissemination Plan

The results are to be presented at the annual AIR forum in 2005. PIs K. Corder and T. Pattok presented work at this conference in 2001. They are scheduled to present a paper on placement tests and course completion rates at the 2004 AIR forum. The PIs also expect to produce a manuscript for journal submission in 2005.

Policy relevance

As state support for higher education (in the form of appropriations for public universities, especially) are declining, individual students are expected to bear an increasingly large proportion of college expenses. Many students use a combination of

institutional, state, and federal aid – in the form of loans and grants, as well as income from work, to meet these expenses. If particular combinations of grants and loans are associated with student success, higher persistence and graduation rates, then both federal policymakers and institutional financial aid offices would have the incentive and capacity to construct and offer student aid packages that maximize the probability of student success. The prescribed mix of grants and loans may differ across institutions and be different for different types of students. But a better understanding of the link between type of aid and probability of completion is an important first step in the effort to decide the form of aid that institutions and government should provide for students.

Audience

The audience for this paper is both the financial aid community and the institutional research community. The substantive findings will interest decision-makers charged with understanding how the institutional allocation of aid affects persistence and graduation rates. As students bear a higher proportion of college costs, the amount of aid (and especially the loan portion of this aid) has also increased. We have limited information about the implications of these changes.

The methodological approach will also be of interest to the institutional research community. Due to privacy and legal restrictions, much of the information we have about student performance and behavior is aggregated at the level of the institution. Individual-level data is often simply unavailable. Ecological inference represents one way to extract individual-level information from aggregate data and novel applications for the technique have appeared in disciplines as diverse as political science and

epidemiology. Tools for ecological inference permit greater leverage of existing aggregate data collections, like IPEDS, by using reported data to generate unreported information (such as graduation rates as a function of aid received). These tools also permit the combination of separate aggregate data collections to inform new research question, such as the use of IPEDS data on aid and CDSRE data on persistence. This approach offers an empirical treatment of questions that would have previously required extensive and costly surveys.

Conclusion

Recent changes in the amount and distribution of public and institutional support to students will ultimately impact the persistence and completion rates for students. A limited amount of institutional studies of this link between persistence and aid type instructs as that the form of the aid can make a difference. The proposed research adds to this work with estimates of the persistence and graduation rates of students with various types of aid at a large number of diverse institutions.

The vast amount of aggregate data collected under federal and state reporting conventions can be used to generate a wide variety of information that is not directly observed or reported. Tools for ecological inference, while not offering a substitute for national and institutional surveys, offer an economic and innovative way to learn about student performance.

5. References Cited

Astin, A.W. 1975. *Preventing students from dropping out*. San Francisco: Jossey Bass.

Astin, A.W. 1997. "How "Good" is your institution's retention rate?" *Research in Higher Education*. 88:647-58:

Becker, G.S. 1964. *Human capital: A theoretical and empirical analysis with special reference to education*. New York: National Bureau of Economic Research.

Berkner, Lutz. 2000. *Trends in Undergraduate Borrowing: Federal Student Loans in 1989-90, 1992-93, and 1995-96*. Washington DC: National Center for Education Statistics.

Bettinger, Eric. N.d. "How financial aid affects persistence." In *College Choices: The Economics of Where to Go, When to Go, and How to Pay for it*. Caroline M. Hoxsby, ed. (forthcoming). Chicago: University of Chicago Press.

Braxton, John M. (ed.). 2002. *Reworking the Student Departure Puzzle*. Nashville: Vanderbilt University Press.

Chang Wei, Christina and Laura Horn. 2002. *Persistence and Attainment of Beginning Students with Pell Grants*. Washington DC: National Center for Education Statistics.

Corder, J. Kevin and Chirstina Wolbrecht. 2004. "Using prior information to aid ecological inference: A Bayesian approach" in *Ecological Inference: New Methodological Strategies*. Gary King, Martin Tanner and Ori Rosen, eds. Cambridge: Cambridge University Press.

Corder, J. Kevin and Christina Wolbrecht. N.d. "Incorporating Women Voters After Suffrage." Typescript. Western Michigan University and the University of Notre Dame

DeJardins, Stephen, Dennis Ahlberg and Brian McCall. 2002. A temporal investigation of factors related to timely degree completion. *Journal of Higher Education*. 73:555-581

Duncan, Otis Dudley and Beverly Davis. 1953. "An Alternative to Ecological Correlation." *American Sociological Review* 18:665-666.

Fenske, Robert, John D. Porter and Caryl DuBrock. 1999. "Analyzing Student Aid Packaging to Improve Low-Income and Minority Student Access, Retention and Degree Completion." Paper presented at the 35th Annual Forum for Institutional Research. Boston, MA [EDRS]

Gill, Jeff. 2002. *Bayesian Methods: A Social and Behavioral Sciences Approach*. Boca Raton, FLA: Chapman and Hall.

Horn, Laura and Katharin Peter. 2003. What Colleges Contribute: Institutional Aid to Full-time undergraduates attending four-year colleges and universities. Washington DC: National Center for Education Statistics

King, Gary. 1997. *A Solution to the Ecological Inference Problem: Deconstructing Individual Behavior from Aggregate Data*. Princeton, NJ: Princeton University Press.

King, Gary, Ori Rosen, and Martin Tanner. 1999. "Binomial-Beta Hierarchical Models for Ecological Inference." *Sociological Methods and Practice* 28:61-90.

King, Jacqueline. *Crucial Choices: How Students Financial Decisions Affect Their Academic Success*. Washington, DC: American Council on Education Center for Policy Analysis

Murdock, Tullise, Laurie Nix-Mayer, and Ping Tsui. 1995. "The Effect of Types of Financial Aid on Student Persistence Towards Graduation." Paper presented at the 35th Annual Forum for Institutional Research. Boston, MA [EDRS]

Murdock, Tullise A. 1989. "Does Financial Aid Really Affect Retention." *Journal of Student Financial Aid*. 19:4-16.

Murdock, Tullise A. 1987. "It Isn't Just Money: The Effects of Financial Aid on Student Persistence." *The Review of Higher Education*. 11:75-101

McCormick, Alexander, Anne-Marie Nunoz, Vishant Shah, and Susan Choi. *Life After College: A Descriptive Summary of 1992-3 Bachelor's Degree Recipients in 1997: With an Essay on Participation in Graduate and First Professional Education*. Washington DC: National Center for Educational Statistics.

Lam, Lap-Pun. 1999. Assessing Financial Aid Impacts on Time-to-Degree for Non-transfer Undergraduate students at a large public university. Paper presented at the Annual Forum of the Association for Institutional Research. Seattle, WA. [EDRS]

Pascarella, Ernest and Patrick Trenzini. 1991. *How College Affects Students*. San Francisco: Jossey-Bass

Martin, Andrew and Kevin Quinn. 2003. *MCMCPack* A package distributed by the R Project for Statistical Computing. <http://www.r-project.org>.

Murdock, Tullisse A. 1989. "Does Financial Aid Really Affect Retention." *Journal of Student Financial Aid*. 19:4-16.

Murdock, Tullisse A. 1987. "It Isn't Just Money: The Effects of Financial Aid on Student Persistence." *The Review of Higher Education*. 11:75-101

Pern, Laura. 1998. "The Contribution of Financial Aid to Undergraduate Persistence" *Journal of Student Financial Aid*. 28:25-40.

Richardson, S. and C. Monfort. 2000. "Ecological Correlation Studies." In *Spatial Epidemiology: Methods and Applications*, eds. P. Elliott, J. Wakefield, N.G. Best, and D.J. Briggs. Oxford: Oxford University Press.

Robinson, William S. 1950. "Ecological Correlation and the Behavior of Individuals." *American Sociological Review* 15:351-57.

St. John, E.P. 1989. The influence of student aid on persistence. *Journal of Student Financial Aid*. 3:52-68

St. John, E.P., Alberto Cabrera, Amaury Nora, and Eric Asker. 2000. "Economic Influences on Persistence Reconsidered: How can Finance Research Inform the Reconceptualization of Persistence Models? In *Reworking the Student Departure Puzzle*. Braxton, John (ed.) Nashville: Vanderbilt University Press.

The College Board. 2003. *Trends in Student Aid*. New York, NY: College Entrance Examination Board.

Tinto, Vincent. 1993. *Leaving College: Rethinking the Causes and Cures of Student Attrition*. Chicago: University of Chicago Press (second edition).

Wakefield, Jon. 2004. Ecological Inference for 2x2 tables. *Journal of the Royal Statistical Society. Series A.* 167:1-42.

6. Biographical Sketches

Kathryn S. Corder

a. Professional Preparation

Southern Illinois University at Edwardsville Accountancy B.A. 1993

b. Appointments

1998-present Director, Academic Planning and Institutional Data, Western
Michigan University

1997-1998 Programmer, Office of the Provost, Western Michigan University

1996-1997 Programmer, Office of the Registrar, Western Michigan University

1988-1995. Director, Social Science Computing Facility, Washington
University – St. Louis

c. Grants / Training

Training. SAS Institute. SAS Users Group International Conference. March, 1991.

Training. Data Warehousing. National Center for Higher Education Management
Systems (NCHEMS). June, 2000.

Tracy Pattok

a. Professional Preparation

Michigan Technological University Metallurgical Engineering B.S., 1990

b. Appointments

2000 – present Data Analyst, Western Michigan University

1992 – 2000 Program Mgr, National Center for Manufacturing Sciences

c. Grants / Training

Grant – Department of Energy, Office of Industrial Technologies, 1992 & 1997
\$700,000, Predictive Model and Methodology for Heat Treatment Distortion
Collaborative Project. (DOE 92-0077)

Grant – Department of Defense, Manufacturing Technology Directorate, Wright
Laboratory, \$14 Million, 1992 & 1996, Predictive Model and Methodology for Heat
Treatment Distortion Collaborative Project. (USAF F33615-96-2-2619)

Training – Finite Elements: Linear, Static Analysis, University of Michigan, 1995

d. Publications

Pattok, T.L.; Ferguson, B.J.; Petrus, G.J., Predicting Residual Stress and
Distortion in Steel Components Due to Heat Treatment, 1998, Iron & Steel Society:
Mechanical Working and Steel Processing Conference Proceedings.

Pattok, T.; Ferguson, B.L.; Petrus, A Software Tool to Simulate Quenching of Alloy Steels, 1999, 3rd International Conference on Quenching and Control of Distortion Proceedings.

Pattok, T.; Dowling, W.E., Ferguson, B.L.; Shick, D.; Ludtka, G.M.; Prantil, V.; Lusk, M.; Predictive Model and Methodology for Heat Treatment Distortion: Final Report, 2000.

J. Kevin Corder

a. Professional Preparation

University of Chicago	Political Science	B.A., 1986
Washington University in St. Louis	Political Science	M.A., 1990
Washington University in St. Louis	Political Science	Ph.D., 1993

b. Appointments

2000-present	Associate Professor, Western Michigan University
1995-2000	Assistant Professor, Western Michigan University

c. Grants / Training

Research Grant. Political Science Program. National Science Foundation.

“Collaborative Research on Women’s Vote Choice and Turnout”.

\$108,435. With Christina Wolbrecht, University of Notre Dame.

SAS Institute Training. SAS Users Group International Conference.

March, 1991.

d. Publications

i. Closely related to project

J. Kevin Corder and Christina Wolbrecht. 2004. "Using Prior Information to Aid Ecological Inference: A Bayesian Approach". In *Ecological Inference: New Methods and Strategies*. Gary King, Martin Tanner and Ari Rosen, eds. Cambridge University Press (forthcoming)

J. Kevin Corder and Christina Wolbrecht. N.d. "Women's Turnout After Suffrage: New Answers to Old Questions" [Currently under review]

ii. Other significant publications

J. Kevin Corder and Susan Hoffman. 2004. "Privatizing Federal Credit Programs: Why Sallie Mae?" *Public Administration Review*. Forthcoming (March/April 2004)

J. Kevin Corder. 2004. "Are federal programs immortal?" *American Politics Research* (forthcoming, March 2004)

J. Kevin Corder. 2003. "Structural Choice and Political Control of Bureaucracy: Updating Federal Credit Programs." *Politics, Policy, and Organizations*, eds. Ken Meier and George Krause. Ann Arbor: University of Michigan Press.

J. Kevin Corder. 2001. "Acquiring New Technology: Comparing Nonprofit and Public Sector Agencies." *Administration and Society* (May) 194-219

J. Kevin Corder. 1998. *Central Bank Autonomy: The Federal Reserve System in American Politics*. The Financial Sector of the American Economy Series. New York: Garland Publishing. (200 pp.)

J. Kevin Corder. 1998. "Political Control of Federal Credit Subsidy: Small Business Administration 7(a) Loan Guarantees." *American Review of Public Administration* (June) 28:166-187

BUDGET AND BUDGET JUSTIFICATION

College financing and college completion

a. Salary and Wages

Co-Principal Investigator (J. Corder)

2 FTE summer months (2/9 of academic year salary) \$13,015

Total Salaries and Wages \$13,015

b. Fringe benefits (31% of 13,015) \$4,034

Total Fringe benefits \$4,034

c. Travel (2005 AIR Forum In San Diego)

Travel for CoPIs, Corder, Corder and Pattok

to attend the AIR forum in San Diego

Air (3 @ \$350.00) \$1050

Hotel (2 rooms @ \$200.00 for 3 nights) \$1200

Meals per diem (\$39.00 for 4 days for 3 PIs) \$468

Ground transport (\$10.00 per day for 4 days for 3 PIs) \$120

Airport transfers (\$20.00 each way for each PI) \$120

Total Travel \$2,938

d. Other Direct Costs

Statistical Software for the Office of Academic Planning and Institutional Data	
STATA v8.0 (with educational discount)	\$599.
TOTAL AMOUNT OF AWARD	\$20,606

The budget includes summer funds for J. Corder to work with K. Corder and Pattok to produce estimates of student persistence by aid type in summer 2004. J. Corder has developed statistical software to conduct the analysis and the budget includes funds for the purchase of commercial statistical software (STATA) that will be used to share project data. J. Corder owns a single user license for STATA and the funds will be used to purchase a second copy for Pattok.

Travel support is request for one trip – to the AIR forum in San Diego in 2005. The PIs will jointly present the results at the forum.

Current and Pending Support

None

Facilities, Equipment and Other Resources

The Office of Academic Planning and Institutional Data (directed by PI K. Corder) reports IPEDS data and has considerable expertise in the use of IPEDS for peer comparison and analysis. PIs Corder and Pattok have access to both substantial desktop computational resources and technical support from the Office of Information Technology. The grant budget includes funds to purchase a copy of STATA, the statistical software the PIs will use to manage and share project data (and merge the institutional data).

PI J. Corder has a powerful desktop workstation that will be used for estimation and analysis. Corder owns licenses for the software necessary for the project. The software used for ecological inference was developed by PI J. Corder for research on women's voting behavior in the 1920s with support from the National Science Foundation.