



# ASSOCIATION FOR INSTITUTIONAL RESEARCH

Data and Decisions for Higher Education

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## PROPOSAL DETAILS

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### Project Description I

Title:

Majoring in STEM? An Inquiry into the Major Choice of Native and Immigrant College Students

Statement of the research problem and national importance:

The government has identified “making the improvement of Science, Technology, Engineering and Mathematics (STEM) education ... a top national priority.”<sup>[1]</sup> In FY2010, \$3.53 billion was invested on 252 distinct programs to promote students’ participation and performance in STEM fields (National Science and Technology Council, 2011). An ambitious goal was set, that is, to produce one million more U.S. college graduates with STEM degrees than what are expected at the current rates over the next decade (President’s Council of Advisors on Science and Technology, 2012). This would require a 34 percent annual increase. These policies are partly driven by the supply shortage of STEM workers in the domestic labor market (Department of Commerce, 2011). Another important motivation for this commitment concerns the nation’s long-term economic prosperity. As stated by President Obama, “reaffirming and strengthening America’s role as the world’s engine of scientific discovery and technological innovation is essential to meeting the challenges of this century.”<sup>[2]</sup>

When evaluating the current college educated STEM workforce, immigrants’ high concentration stands out. Data from the National Science Foundation (NSF) reveal that 24 percent of the college educated workers in STEM fields were born outside of the U.S. – twice their share in the total working population.<sup>[3]</sup> A growing body of literature has examined how high skilled immigrants contribute to domestic innovation and invention (Hunt, 2010; Kerr & Lincoln, 2010). Researchers have also explored their impacts on the employment and wages of their native counterparts (Bojas, 2009; Card, 2011; Peri & Sparber, 2011).

Despite the rising public concerns for the supply of STEM college majors and disproportionately high share of immigrants in STEM fields, we currently know little about immigrants’ representation in the STEM education pipeline in college. In this project, I seek to fill in this gap by evaluating the major choice of native and immigrant college students. Specifically, I will address the following three questions. First, are immigrant students highly concentrated in STEM majors in college? Second, what are the factors that are driving the gap in STEM majors between immigrant students and their native counterparts? Finally, how do these factors impact students’ choice of STEM majors? I will examine a wide range of potential determinants, including demographics, family backgrounds, academic ability, institutional characteristics, personal motivations and future wage returns.

I will focus on immigrants who received college education in the U.S. *rather than* those who were trained abroad.<sup>[4]</sup> The rationale is threefold: (1) immigrant students comprise an increasingly larger share of the college student population today. A recent report from the National Center for Education Statistics (NCES) finds that about 23 percent of all undergraduates in the nation were immigrants or second-generation Americans (Department of Education, 2012). Understanding their major choice therefore has important policy implications; (2) immigrant workers who arrived after college are likely to differ systematically from students who were educated in the U.S., and are therefore not a valid comparison group; (3) if it is only foreign college graduates with degrees of certain majors who are immigrating to the U.S., including them in the analysis would seriously bias the results due to self-selection.

To reflect the increasing diversity of the student body today, I will classify students into four groups: recent first generation immigrants, non-recent first generation immigrants, second generation immigrants and the native students. In addition, for each immigrant group, I will further compare how their choice of STEM majors varies by gender and race/ethnicity.

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[1] THE WHITE HOUSE, OFFICE OF THE RELEASE SECRETARY, NOVEMBER 23, 2009. "PRESIDENT OBAMA LAUNCHES 'EDUCATE TO INNOVATE' CAMPAIGN FOR EXCELLENCE IN SCIENCE, TECHNOLOGY, ENGINEERING & MATH (STEM) EDUCATION."

[2] *Ibid.*

[3] Data obtained from National Science Foundation (NSF), Scientists and engineers Statistical Data System (SeSTAT), Integrated Survey Data.

[4] Most of the existing literature does not distinguish whether the high skilled immigrants came before or after getting their college degree.

Review the literature and establish a theoretical grounding for the research:

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#### Literature Review

To gain a thorough understanding of students' major choice, I will integrate literature in both economics and education. On the one hand, economists typically place monetary returns in the center of the decision process. The basic idea is that different majors yield different future earnings (James et al., 1989). Students, as rational utility maximizers, will choose major according to the expected monetary returns (Caner & Okten 2010; Canning et al., 2002; Saks & Shore, 2005; Zafar & Wiswall 2012). For example, using data from the National Longitudinal Study of Youth 1979, Cannings et al. (2002) show that expected future earnings are an essential determinant of students' major choice. In contrast, exploiting variations in the relative wage returns induced by the business cycle, Beffy et al. (2012) find that college students in France are not particularly responsive to future wages when making major choice. Academic ability is also found to be critical in students' major choice (Arcidiacono, 2004, 2012; Stinebrickner & Stinebrickner, 2011). For example, using data from the National Longitudinal Study of the Class of 1972, Arcidiacono (2004) demonstrates that students with higher ability are more likely to sort into high paying majors. His more recent work using experimental data further suggests that ability sorting is stronger than sorting on expected earnings.

On the other hand, in studying students' major choice, educational researchers generally emphasize the impacts from individual characteristics, such as gender, race, and personal preference (Elliott, 1996; Gainor et al., 1998; Holland, 1966, 1985; Seymour & Hewitt, 1997; Smart et al., 2000). For example, applying Holland's person-environment fit theory on vocational choice, Smart et al. (2000) classify college disciplines into six different academic environments and argue that students "choose academic environments compatible with their personality types." Finally, it has been demonstrated that exposure to math and science in high school, institutional characteristics, family backgrounds, and the broader social and cultural context (Chang et al., 2010; Gruca et al., 1988; Levin & Wycokoff, 1991; Wang, 2011, 2012; Ware & Lee, 1988) also are influential factors in students' choice of STEM majors.

Unfortunately, the two disciplines have largely remained disconnected from each other. Arguably, as one of the most important decisions for college students, major choice is likely to involve a wide range of factors that cannot be adequately captured by either discipline alone. To overcome this shortcoming, I will examine an extensive set of potential determinants of college major choice, including students' demographics, family backgrounds, academic ability, institutional characteristics, personal motivation and future wage returns. In doing so, I will bridge the gap between two important but exclusive literatures and significantly advance our understanding of students' major choice.

### **Theoretical Framework**

Motivated by Becker's (1964) human capital investment theory, I will develop a simple model that describes how students choose majors. This model assumes students make major choice by comparing the associated benefits and costs with each major and then choose the one that brings them the most net utility. In particular, benefits include the future wage returns from the major as well as the non-pecuniary returns such as the development of personal interests and motivation. Costs mainly comprise of the time and effort required to master the major-specific knowledge and skills, which will be a function of the student's academic ability. The more capable a student is in a certain major, the less time and effort is involved.[1]

This intuitive model proposes four potential channels leading to the immigrant-native college major choice gap. The first is through their variation in academic ability. Immigrant students may have a comparative advantage in STEM majors due to their stronger math and science skills. In contrast, a better understanding of the social and cultural context of the host country may contribute to native students' comparative advantage in social sciences and humanities. Secondly, the major choice gap might stem from different personal motivation between native and immigrant students. For example, native students might be motivated by achieving social influence whereas immigrant students might be more driven by having steady work. As the students seek the major that best matches their personality and motivation, we would expect to see more native students with social science and humanity majors while more immigrant students with STEM majors. The third scenario is that immigrant students are "pushed" into STEM majors by labor market conditions. It has been observed that college educated immigrant workers usually earn substantially less than their native-born counterparts even within the same field. Since comparing to non-STEM fields, jobs in STEM sectors have higher average wage and a smaller native-immigrant wage gap, immigrant students may find it only optimal for them to pursue STEM majors. Finally, there might be substantial variation between native and immigrant students in the age they first attended college, the type of institutions they went to, their family size, their parents' education level etc., all of which can lead to their different major choice.

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[1] For simplicity, I assume expenditures on tuition, books, and room and board are the same across majors.

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Describe the research method that will be used:

The project will be carried out in the following four steps.

#### **Step 1: Sample definition and variable construction.**

BPS: 2004/09 provides two samples for study. Sample 1 includes 16,684 students who were interviewed in the first survey in 2003-04 and again in the last survey in 2009. Any potential missing data in between were imputed. Sample 2 only consists of students who were survey respondents in all the three interview waves in 2003-04, 2006 and 2009, and has a smaller sample size of 16,123 students. To ensure findings from this project are robust to sample selection, I will analyze both samples using the recommend sample weights.

I will define STEM majors according to the classification from NCES, which mainly include biology, computer science, engineering, mathematics and statistics. A complete major list is provided in Table 1 in Appendix A. I am mainly interested in two related outcomes: *STEM entry* and *STEM completion*. *STEM entry* indicates whether the student ever had a STEM

major in college. *STEM completion* denotes whether the student graduated from college with a STEM degree.

To fully capture the diversity of today's college student population, I will define student's immigrant status based on 1) whether she was born in the U.S.; 2) whether her parents were born in the U.S.; 3) and whether she received K-12 education in the U.S. A student is a *first generation immigrant* if she was not born in the U.S.; a *second generation immigrant* if at least one of her parents was not born in the U.S.; and all the other students are considered as the *natives*. In addition, I will distinguish the *non-recent first generation immigrant* students who came to the U.S. before they started K-12 school from the *recent first generation immigrants* who came in later years. The rationale is that while not born in the nation, the non-recent first generation immigrant students received most of their education in the U.S. Their major choice might therefore be very different from the ones who came later. More details about the classification are listed in Table 2 in Appendix B. Finally, for students within each immigrant group, I will further categorize them according to their gender and race/ethnicity, with race/ethnicity divided into five mutually exclusive groups: White, Black, Hispanics, Asian and the Others.

### **Step 2: Are immigrant students more likely to major in STEM fields than their native counterparts?**

To empirically examine this question, I will utilize the following probit model:

$$P_i(\text{STEM}) = \beta_0 + \beta_1 IM_i + \epsilon_i \quad (1)$$

where  $i$  indexes student  $i$ . The outcomes are the probability of the student ever having a STEM major in college and the probability of her graduating from college with a STEM degree.  $IM$  is a dummy variable indicating her immigrant status.  $\epsilon$  is the random error term. Without accounting for other covariates,  $\beta_1$  in specification (1) will provide the benchmark estimate for the raw major choice gap in STEM fields between immigrant and native college students.

### **Step 3: What are the factors that are driving the gap in STEM majors between immigrant and native students? How do these factors impact students' choice of STEM majors?**

To explain the immigrant-native major choice gap in STEM fields, I will examine a wide range of factors, including demographics  $D$ , family backgrounds  $F$ , academic ability  $A$ , institutional characteristics  $I$ , personal motivation  $M$  and wage returns  $W$ . By adding to these variables to the basic specification, I will estimate the following equation:

$$P_i(\text{STEM}) = \beta_0 + \beta_1 IM_i + \beta_2 D_i + \beta_3 F_i + \beta_4 A_i + \beta_5 I_i + \beta_6 M_i + \beta_7 W_i + \epsilon_i \quad (2)$$

In particular, *demographics* include students' age, gender, and race/ethnicity. *Family backgrounds* account for their dependent status, family size, parents' education, and family income. *Academic ability* captures students' math and science skills, as measured by their SAT/ACT math scores, years and highest level of math classes in high school. *Institutional characteristics* indicate whether the institution is public or private, 2-year or 4-year etc. *Personal motivation* reflects students' important goals, such as being a community leader, being financially well-off, influencing political structure etc., derived from relevant survey questions. Finally, *wage returns* refer to the wages earned by native and immigrant college educated workers with degrees in a particular field of study. I will construct this variable using the most recent data from the 2011 American Community Survey (ACS) from the Census.

By comparing the estimates of  $\beta_1$  from the equation (1) and (2), this estimation strategy will allow me to explain how much of the immigrant-native major choice gap is driven by the above influential factors. In addition, exploiting the estimates of the respective covariates, I will also be able to demonstrate how these factors impact students' choice of STEM majors.

### **Step 4: How does the major choice vary by gender and race/ethnicity?**

It has been observed that women and minorities are disproportionately underrepresented in STEM fields (Anderson & Kim, 2006; Joy, 2000; Zafar, 2009). It would therefore be informative to know how the immigrant-native major choice gap in STEM fields varies by gender and race/ethnicity. To gain insights into this question, I will create a set of dummy variables by interacting students' immigrant status with their gender and race/ethnicity. I will then estimate the probability of

majoring in STEM fields for students from each of these cells, still holding the native students as the comparison group. The equation to estimate is therefore the following,

$$P_i (\text{STEM}) = \beta_0 + \beta_1 \text{Cell}_i + \epsilon_i \quad (3)$$

Estimates from equation (3) will demonstrate whether the immigrant-native major choice gap varies by gender and race/ethnicity. They will also indicate for students from each gender and race/ethnicity group, how their choice of STEM majors varies by immigrant status.

Next, I will explore the sources of the variation by adding to equation (3) the full set of explanatory variables used in Step 3. The equation to estimate is the following,

$$P_i (\text{STEM}) = \beta_0 + \beta_1 \text{Cell}_i + \beta_2 D_i + \beta_3 F_i + \beta_4 A_i + \beta_5 I_i + \beta_6 M_i + \beta_7 W_i + \epsilon_i \quad (4)$$

Uploaded Appendix Document(s):

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- [Appendix C](#)
- [Appendix A](#)
- [Appendix B](#)

### Project Description II

Will you use NCES target dataset? Yes

Please check all NCES datasets that apply

- Beginning Postsecondary Student (BPS) Longitudinal Study and Transcript Data

Explain why each dataset best serves this research. Include a variable list for each dataset used.

I will use the restricted –use Beginning Postsecondary Students Longitudinal Study 2004/09 (BPS: 2004/09) from the NCES. The survey tracks the postsecondary educational experiences of a nationally representative cohort of students who first started college during the 2003-04 academic year. Follow-up surveys were conducted at the end of their third and sixth years after entering college. For the purpose of this project, the BPS: 2004/09 has several advantages. First, it provides rich student-level information such as demographic characteristics, academic ability, and family background etc., which would enable me to carry out a rigorous examination on students' major choice. Second, it reflects the demographic composition of today's college student population, including growing trends towards internationalization. 11.8% of the students are first-

generation immigrants and 12.4% of them are second-generation immigrants.<sup>[1]</sup> It is also one of the largest postsecondary student surveys from the NCES, including over 16,000 students. Finally, because the data are recent, I will be able to provide policy makers with timely insights into the current STEM education. Since the BPS: 2004/09 provides only limited employment data, I will construct the major-specific wage data for native and immigrant college educated workers using the most recent data from the 2011 ACS. The variable list is provided in Appendix C.

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[1] This figure is close to the 23 percentage found in a recent NCES report. U.S. Department of Education, National Center for Education Statistics (NCES), July, 2012. "New Americans in Postsecondary Education, A Profile of Immigrant and Second-Generation American Undergraduates."

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Will you use NSF target dataset? No

Explain why each dataset best serves this research. Include a variable list for each dataset used.

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Will you address the NPEC focus topic? No

If yes, please briefly describe:

**Project Description III**

Provide a timeline of key project activities:

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2013 May

Review relevant literature

Develop the theoretical model

Write up literature review and theoretical framework

2013 June

- Start data cleaning
- Define the analysis samples
- Construct variables of interest
- Conduct basic descriptive analysis

2013 July

- Develop the empirical model
- Run the baseline regressions (Step 2, equation (1))
- Prepare and submit American Educational Research Association (AERA) Annual Meeting proposal

2013 August

- Further develop the empirical model
- Run the other regressions (Step 3&4, equation (2) (3) (4))
- Write up the regression results

2013 September

- Present the preliminary findings to faculty
- Makes changes to the analysis based on feedback received
- Refine the model, run additional regressions and robustness tests
- Write up the findings

2013 October

- Write up the first full draft
- Circulate the draft within the department
- Meet with advisor and other faculty members for further feedback
- Prepare and submit Association for Institutional Research (AIR) Forum proposal

2013 November

- Revise the draft based on feedback received
- Write up the second draft

2013 December

- Present the project again to faculty
- Prepare for the job talks and interviews
- Write the midyear report for AIR

2014 January

- Attend job interviews at American Economic Association (AEA) Annual Meeting
- Get more feedback on the paper

2014 February – March

- Present the project to other academic departments at job fly-outs
- Prepare dissertation

2014 April

- Further revise the draft based on feedback received
- Write, defend and submit dissertation
- Submit the paper to leading academic journals
- Present the project at AERA Annual Meeting

2014 May

- Present the project at AIR Forum
- Write the final report for AIR

List deliverables such as research reports, books, and presentations that will be developed from this research initiative:

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I will present the research findings from this project to the faculty and graduate students of the Department of Economics at the University of Notre Dame. I also plan to present the project at professional conferences such as the American Educational Research Association (AERA) Annual Meeting and the Association for Institutional Research (AIR) Annual Forum. Mid-year and final reports will be submitted to AIR. Finally, I will submit the final draft of the paper to leading peer-reviewed journals.

Describe how you will disseminate the results of this research:

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I will disseminate the findings from the proposed project in the form of conference presentations and publications in peer-reviewed journals. The professional conferences are: 1) The American Educational Research Association (AERA) Annual Meeting and 2) The Association for Institutional Research (AIR) Annual Forum. I will submit the final paper to leading academic journals in both education and economics, including 1) Journal of Higher Education, 2) Review of Higher Education, 3) Research in Higher Education and 4) Economics of Education Review.

Provide a reference list of sources cited:

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#### **IRB Statement**

Statement of Institutional Review Board approval or exemption:

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The proposed project has already been approved for exemption by the Human Subjects Institutional Review Board (HSIRP) at the University of Notre Dame (Protocol #: 12-06-390) under Category 4: research using existing specimens/data.

#### **Statement of Use of Restricted Datasets**

To empirically examine the choice of STEM majors between the native and immigrant students, I have applied access to the restricted-use data from the Beginning Postsecondary Students Longitudinal Study 2004/09 (BPS: 2004/09). The application has been approved by the Data Security Office of the Institution of Education Sciences (IES). The data will be installed on a standalone desktop in a secured office. In working with the data, I will strictly follow the security requirements outlined in the license agreement.

## Biographical Sketch

As the first person in my family to attend college, I firmly believe in the unlimited potential individuals can realize through education. With this belief, I started pursuing my doctoral study at the University of Notre Dame after graduating from Sichuan University, China with a Bachelor's degree in Economics. I hope that the proposed project, as well as my future research, will enlighten the general public's understanding of the important value of education and inform policy makers of effective policies that could improve individuals' educational attainment.

The first few years in graduate school have laid me with a solid background in general economic theories and methodologies. I have also examined the specific topics in my research areas such as the economics of education, labor economics and public economics. Finally, I have greatly sharpened my quantitative and analytical skills by taking several advanced econometrics courses.

One of my research projects examines the effect of merit-based scholarship programs on students' college attainment. For a thorough understanding of these programs, I collected a substantial amount of relevant data, such as information on states' scholarship policies, higher education systems, labor market conditions, and demographic composition from a variety sources. I then conducted quantitative analysis using rigorous econometrics techniques. Findings from this project have been successfully presented at the department seminars, workshops, and the 2012 Midwest Economics Association Annual Meeting. Based on the valuable feedback, I have been revising the initial draft. I now plan to submit the final version of the paper to one of the leading journals such as Journal of Higher Education and Economics of Education Review.

In a joint project with my mentor, Professor Abigail Wozniak, a noted researcher who has worked extensively on the returns to higher education, we examine an important, yet largely overlooked return from obtaining a college education, that is, an enhanced ability to make long distance moves. Exploiting the restricted-use data from the Census Bureau, we constructed the life-cycle migration profiles for the survey respondents. By matching the detailed location data to their demographic information, educational attainment, and labor market conditions, we were able to empirically estimate how college education contributes to individual's higher mobility rate as well higher income. My belief in the value of education was further strengthened through this research experience. Not only so, I have also gained invaluable knowledge of working with restricted-use data, from the initial access application to the final requests for releasing the results, which has well prepared me for the utilizing the restricted-use BPS data for the my dissertation project.

In this project, I aim to provide a thorough understanding of the major choice of native and immigrant students, focusing on their choice of STEM majors. The interest in college major choice stems from my deep passion for the value of education. The perspective of a comparative analysis on native and immigrant students, on the other hand, is motivated by my international background. My educational and research experience in both China and the U.S. has uniquely exposed me to the cross-country variation in students' major choice. Are immigrant students more likely to choose STEM majors than the natives? What are the factors that are driving the variation? And how do these factors impact students' choice of STEM majors? Arguably, insights into these questions are not only important for building up a college-educated STEM workforce but are also especially relevant as the higher education today becomes more internationalized.

## Budget Requirements

Salary/Stipend: \$15755.00

Tuition and fees: \$1650.00

Travel: \$1200.00

Other travel related expenses: \$800.00

Other research expenses: \$595.00

Total Request: \$20000.00

### **Funding History**

I have been a recipient of a full Tuition Scholarship from the University of Notre Dame which covers all my tuition during graduate school.

Between 2009 and 2013, I have been a graduate research assistant to the Department of Economics. The research assistantship provides me with an annual stipend of \$15,755 and a health insurance of \$1,650. All the department funding will end by May of 2013 when AIR funding begins.

This research proposal has not received any other funding before. The proposal was also submitted to the National Academy of Education (NAEd) Spencer Dissertation Fellowship program. I have not received any prior funding from AIR.

### **Letter of Support from Dissertation Faculty Advisor**

- [Letter of Support](#)

Table 1 STEM majors based on NCES's classification

STEM	Non-STEM
Agriculture/natural resources/related	Social sciences: History; Psychology; Public administration/ social service etc.
Biological and biomedical sciences	Humanities: Architecture; Visual and performing arts;
Computer/information science/support	Communication/ journalism; English; Foreign language etc.
Engineering	Education
Mathematics and statistics	Business
Physical sciences	Health professions
Engineering technologies/related fields	Legal professions

Table 2 Definition of Immigrant Status

	Foreign- born	Foreign-born parent(s)	Foreign K-12 school
Recent 1 <sup>st</sup> gen	Y	Y	Y
Non-Recent 1 <sup>st</sup> gen	Y	Y	N
2 <sup>nd</sup> gen	N	Y	N
Natives	N	N	N

## Variable List

BPS: 2004/09 and 2011 ACS variable names are listed in parentheses.

From BPS: 2004/09

### *SAMPLE WEIGHTS*

Sample weight for sample 1, with 16,684 students (WTA000)

Sample weight for sample 2, with 16,100 students (WTB000)

### *Outcome Variables*

Major when first enrolled in 2003-04 (MAJ04A)

Major when last enrolled 2006 (MAJ06A)

Major when last enrolled 2009 (MAJ09A)

Degree types attained through 2006 (ATTYPE3Y)

Degree types attained through 2009 (ATTYPE6Y)

### *Explanatory Variables*

#### *Immigrant Status*

Immigrant status (IMMIGRA)

Citizenship status 2003-04 (CITIZEN2)

Student was born in the US (USBORN)

Parents were born in the US (PARBORN)

Ever attended foreign K-12 school (FORESCH)

#### *Academic Ability*

High school GPA (HSGPAPREP)

ACT/ SAT score (TESATDER)

SAT math score (TESATMDE)

Highest level of high school math (HCMATH)

Years of math in high school (HCYSMATH)

Years of science in high school (HCYSSCIE)

#### *Important Goals*

Whether being a community leader/ being financially well-off/ having children/ influencing political structure/ leisure time/ living close to relatives/ moving away from hometown/ steady work/ helping others was an important personal goal for the respondent

(MPT04B/ MPT04C/ MPT04D/ MPT04E/ MPT04F/ MPT04G/ MPT04H/ MPT04I)

#### *Demographic Characteristics*

Race/ethnicity (RACE)

Gender (GENDER)

Age first year enrolled (AGE)

#### *Family Background*

Dependency status (DEPEND)

Parents' highest level of education (PAREduc)

Family income group (INCGRP)

Family size (HSIZE)

#### *Institutional Characteristics*

Carnegie classification of the institution (CC2005B)

Institution state (INSTSTAT)

From 2011ACS

*Wage Returns (From ACS 2011)*

Place of birth (BPL)

Father's birthplace (FBPL)

Mother's birthplace (MBPL)

Year of immigration (YRIMMIG)

Years in the US (YRSUSA1)

Citizenship status (CITIZEN)

Age (AGE)

Race (RACE)

Sex (SEX)

Employment status (EMPSTAT)

Wage and salary income (INCWAGE)

Educational attainment (EDUC)

Field in which the person received a Bachelor's degree (DEGFIELD)



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8 January 2013

Dear Members of the AIR Dissertation Grant Selection Committee:

I write in support of **Ning Jia**'s application for an AIR Dissertation Grant. Ms. Jia is currently a fourth year PhD candidate at the University of Notre Dame. I have known and advised her in that capacity for two years. In that time, she has developed a strong track record of research on US education issues, particularly in higher education. Not only is Ms. Jia an accomplished scholar with a bright job market future, her work is also an excellent fit with AIR's mission of encouraging research on these issues using the national data sets assembled by NCES and NSF.

Ms. Jia's proposal centers on a project related to the education of recent college graduates in STEM (Science, Technology, Engineering and Math) fields at US post-secondary institutions. This is a top education policy issue for the current administration as employers increasingly call for assistance in expanding their access to technologically skilled workers. Immigrants have been a ready source of such labor, but little is known about how US policymakers might use lessons from immigrant achievement to inform policy toward US higher education more generally.

In particular, Ms. Jia observed that the existing economic literature on the STEM labor force has tended to focus on issues related to the current immigrant labor supply, answering questions like "Do high skilled immigrants lower wages for high skilled natives through competition?" or "Do high skilled immigrants crowd natives out of advanced degree programs?" Such questions have an important place in our understanding of the issue of high skilled immigration, but they ignore the production of high skilled immigrants within our own US institutions and the lessons that this might offer for natives. This is the gap that Ms. Jia seeks to address in her dissertation research. Specifically, she plans to use models of major choice to understand whether and why foreign born college students choose STEM fields more often than native born college students. Insights from her research should help policymakers and higher education officials craft programs that do a better job of attracting and supporting native college students through completion of a STEM degree.

Ms. Jia's proposed dissertation research is an especially good fit with AIR's mission, since the central data source in her paper is the restricted version of NCES's Beginning Postsecondary Student data. She will work with both the transcript and longitudinal versions of this data. The BPS data provide a rich set of background variables on recent college students and graduates that are ideal for her project. She has already arranged for access to secure research space on the Notre Dame campus, acquired the data, and begun preliminary analysis. Ms. Jia is uniquely qualified, among all our graduate students, to

succeed under these data conditions. For the last two years, she has worked with me on another project involving restricted access versions of large nationally representative data. As part of that project, we access restricted versions of the National Longitudinal Surveys at a secure data center in Chicago. Ms. Jia is therefore very experienced with the challenges of using this type of data. It requires not only standard data analysis skills, but also the ability to organize and complete a project around the additional confidentiality requirements of restricted data.

Her preliminary work has already yielded interesting descriptive results. Using the secure BPS data, she finds differential enrollment in STEM across immigrants and natives. This might be expected, but she digs further and finds large differences across types of immigrants in the likelihood of a STEM major. These are present both across immigrant groups defined by time in the US as well as across different race and ethnicity groups of immigrants. Although this early work is largely descriptive, I believe it has already produced results that are likely to be widely cited. Ms. Jia's ultimate goal is to explain immigrant-native differences in STEM enrollment, using immigrant-immigrant differences as a stepping stone to an explanation. Her project is therefore positioned to provide important new insights on how these gaps arise. As such, her work will ultimately be of great interest to both education researchers and policymakers.

As mentioned above, Ms. Jia has a track record of strong work on topics in higher education. She has already completed a chapter of her dissertation in this area. That project examines the impact of state merit scholarship programs. She brings valuable new insights to that literature by taking a broad view of the many such programs currently in operation. She finds important heterogeneity across state programs in several dimensions: in terms of their overall impact on college completion rates; in their impacts on different methods of college completion (Associate's versus Bachelor's); and on their cost effectiveness. This paper is currently in preparation for submission to a journal, likely the *Journal of Public Economics*. The results will surely provide policymakers with important ideas for how to strengthen these programs. Given her record of accomplishment, Ms. Jia is very well positioned to complete her proposed project for AIR, which would form the capstone chapter in her dissertation and will in all likelihood be her job market paper.

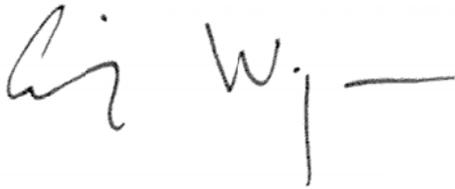
I believe I am well qualified to advise Ms. Jia's work, especially since her focus is on higher education. I am a younger faculty member, but I have already served on three dissertation committees. I therefore am well acquainted with the process of guiding students to a complete dissertation. Several of my publications examine how college attendance or completion affects later outcomes for individuals who receive it. I am therefore familiar with the economics research on higher education. I am also a member the National Bureau of Economic Research's Education Group. This provides me with very up-to-date exposure to the economics of education research more broadly. Finally, I am a fellow of Notre Dame's Institute for Educational Initiatives. This is an umbrella group bringing together researchers from across Notre Dame with interests in education research. Our sociology and psychology departments both have a strong presence in education research. My membership in this Institute has provided me with ample contacts in other disciplines with whom Ms. Jia can consult on the non-economics aspects of her project.

In closing, let me summarize the PhD program here at Notre Dame and Ms. Jia's place in it. The Notre Dame Economics PhD program underwent a significant reorganization in the early 2000's. We began admitting graduate students again – PhD only – after the reorganization period was completed in 2006. We regularly compete for graduate students with other highly ranked doctoral programs in economics—including Yale University, Michigan State University, and the University of Wisconsin. This competition demonstrates the high caliber of both Notre Dame's economics graduate students and our program. Last year alone we placed students at DePaul University, the University of Richmond,

and the University of Cincinnati. Ms. Jia ranks very well within her cohort. As I mentioned, I am newer to advising, but I advised the student of ours who was placed at the University of Cincinnati last year. I believe Ms. Jia's work is considerably stronger than that student's, and I expect her to ultimately do very well on the job market.

I strongly recommend her for an AIR dissertation grant. I believe she is an outstanding fit for your program and will go on to produce useful and influential research with this funding.

Sincerely,

A handwritten signature in black ink, appearing to read "Abigail Wozniak". The signature is written in a cursive style with a horizontal line at the end.

Abigail Wozniak