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Early-Career Residential Migration of Agriculture and Human Environmental Sciences B.S. Graduates: Evidence from One Land-Grant University

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The zip codes of agriculture (n = 346) and human environmental sciences (n = 304) bachelor's degree graduates were examined six to seven years after graduation to describe and compare pre-college and post-college residences (rural versus metropolitan) by major and overall. A majority of agriculture graduates were from rural areas (61.6%), and a majority of human environmental sciences graduates were from metropolitan areas (55.9%). Majorities of both agriculture (54.9%) and human environmental sciences (70.1%) graduates lived in metropolitan areas post-graduation, resulting in a net loss of 100 college-educated rural youth. Among rural graduates, there was no significant difference in the percentage of agriculture (62.4%) and human environmental sciences (57.5%) graduates currently living in rural areas. Among metropolitan graduates, twice as many agriculture graduates lived in rural areas after graduation as compared to human environmental sciences graduates. Graduates from rural areas were 11 times more likely than graduates from metropolitan areas to live in rural areas after graduation. Regardless of pre-college residence or major, nearly 40% of graduates lived in their home community after graduation, and 60% lived within 50 miles of their home community. Further research is needed to understand the decision-making processes and factors undergirding these residential patterns.

Keywords: agriculture, brain drain, human sciences, graduates, residential migration

Introduction

The out-migration of the most academically-talented youth from rural areas has been dubbed the “rural brain drain” and poses a threat not only to the social and economic vitality of rural communities, but also to their very survival (Artz & Yu, 2009; Carr & Kefalas, 2009; McGranahan & Beale, 2002). This out-migration of the “best kids” (Carr & Kefalas, 2009, p.

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29) leaves many rural communities with lower levels of human and social capital (Garasky, 2002; Gibbs, 2005), decreasing and aging populations (Lichter & Brown, 2014; Monk, 2007), decreasing tax bases (Gibbs, 2005), and shrinking economies (Pettrin, Schafft, & Meece, 2014).

Human capital has been defined as, “productive wealth embodied in labour [sic], skills, and knowledge” (Organization for Economic Cooperation and Development, 2001, para. 2). Human capital theory (HCT) postulates that individuals primarily (but not exclusively) invest their time and money in education and training to develop their human capital with the expectation that this investment will result in higher future incomes (Tan, 2014). According to Goldin and Katz (2008), U.S. wage growth for much of the 20th Century was largely driven by increases in human capital through more widespread and higher levels of educational attainment.

HCT provides a logically-compelling framework for examining the “rural brain drain.” Under this scenario, the most academically-talented rural youth graduate from high school and leave home to attend colleges and universities (Carr & Kefalas, 2009). Upon graduation, with a degree and major that may or may not even be in demand in the rural home community (Marré, 2014), graduates enter the job market and are confronted with the reality of the rural-metropolitan wage gap, where college graduates employed in rural areas earn significantly less than graduates employed in metropolitan areas (Artz, Kimle, & Orazem, 2014; Kusmin, Gibbs, & Parker, 2008). Thus, given the assumptions of HCT, even graduates who desire to live in (or return to) rural areas may ultimately choose, if somewhat reluctantly, to accept employment and consequently live in metropolitan areas (Carr & Kefalas, 2009), or rural graduates may make economic sacrifices as the cost of returning to rural communities (von Reichert, Cromartie, & Arthun, 2011).

Agriculture and human environmental sciences as academic disciplines are historically connected to rural America with roots in Land-Grant Colleges (Seevers & Graham, 2012). Artz and Yu (2009) found that Iowa State University’s Colleges of Agriculture and Life Sciences and Human Sciences attracted the highest percentages of students from rural areas and had the highest percentages of graduates living in rural areas. The researchers posited that majors in these colleges were more closely aligned with rural employment opportunities than majors in other colleges. A number of studies (Johnson, Edgar, Edgar, Pate, & Steffen, 2015; McCallister, Lee, & Mason, 2005; Wildman & Torres, 2001) have found that students from small-town and rural areas make up significant portions of the undergraduate enrollment in departments and colleges of agriculture.

Using survey and institutional data, Artz et al. (2014) studied a stratified random sample of 5,416 Iowa State University bachelor’s degree graduates, representative of the 84,917 alumni between 1982 and 2006, to determine the economic returns to agriculture degrees based on employment sector (i.e., agriculture or nonagriculture) and job location (i.e., rural or urban). The researchers

found that only 21% of graduates were employed in agriculture in 2007, and that 60% of the agricultural jobs were located in urban, not rural, areas. In 2007, agriculture graduates working in rural areas made significantly less than agriculture graduates in urban areas working in agricultural (-\$16,427) and in nonagricultural (-\$36,207) jobs. Thus, even for agriculture majors, there appeared to be an economic incentive to work in urban areas.

In addition to economic rewards for metropolitan employment, Cortright (2014) noted a general preference among young college graduates for metropolitan living. According to Burbank and Keely (2014), 86% of 19 to 29 year-olds preferred to live in urban (38%) or suburban (48%) areas. Further, Demi, McLaughlin, and Snyder (2009) found that only 23.8% of rural 11th grade students aspiring to complete a bachelor's degree wanted to live in their rural home communities at age 30. There was a negative correlation between educational aspirations and desire to remain in the home community.

Estes, Estes, Johnson, Shoulders, and Edgar (in press) determined that graduates of the College of Agricultural, Food and Life Sciences, which includes the School of Human Environmental Sciences, at the University of Arkansas were significantly more likely than graduates of other colleges to both come from rural areas and to live in rural areas after graduation. The current study presents a further analysis of the original data to determine if there are differences between agriculture and human environmental sciences majors in pre- and post-college residence patterns.

Purpose and Objectives

The purpose of this study was to describe and compare the migration patterns of 2007 and 2008 agriculture and human environmental sciences graduates from a mid-south Land-Grant University located in a primarily rural state. Specific objectives were to:

1. Determine the percentages of agriculture and human environmental sciences graduates originally from rural and metropolitan communities and determine if there is a significant ($p < .05$) association between major and home community;
2. Determine the percentages of agriculture and human environmental sciences graduates currently residing in rural and metropolitan communities and determine if there is a significant ($p < .05$) association between major and current community;
3. Determine the percentages of agriculture and human environmental sciences graduates currently residing in rural and metropolitan communities by pre-college community; determine if there are significant ($p < .05$) associations between major and current community when controlling for pre-college community; and determine if there are significant associations ($p < .05$) between pre-college community and current community when controlling for major; and

4. Determine the percentages of agriculture and human environmental sciences graduates currently residing in home or nearby (≤ 50 miles) communities when controlling for pre-college community or major; determine if there are significant ($p < .05$) associations between major and currently residing in home or nearby communities when controlling for pre-college community; and determine if there are significant ($p < .05$) associations between pre-college community and currently residing in their home or nearby communities when controlling for major.

Methods

The data set for this study was provided by the University of Arkansas Alumni Association in March 2014 and included parents' (or guardians') zip codes at the time students first enrolled in the university, graduates' current zip codes, and the undergraduate college and major for all 2007 and 2008 bachelor's degree graduates ($N = 650$) from the College of Agricultural, Food and Life Sciences (AFLS), which includes the School of Human Environmental Sciences. According to the University of Arkansas Alumni Association, alumni mailing addresses (including zip codes) are updated every 90 days to ensure that all alumni mailings reach the intended recipient at his or her current address (T. Dover, personal communication, June 30, 2015). No names or other personal identifiers were provided to maintain the anonymity of graduates. Graduates from 2007 and 2008 were selected for study because at seven or six years, respectively, after graduation, these alumni were likely to have completed any post-graduate education and early-career transfers and be settled into fairly stable residential environments (von Reichert, Cromartie, & Arthun, 2014).

Parents' zip codes (at the time the student entered the university) and graduates' current zip codes were used to classify each graduate's pre-college residence and current residence as either rural/small town (hereinafter referred to as rural) or metropolitan based on the Rural-Urban Commuting Area (RUCA) zip code approximation database (Rural Health Research Center [RHRC], n.d.). The RUCA zip code approximation database is based on U.S. Department of Agriculture (USDA) RUCA codes and was last updated in 2005 (Hart, Larson, & Lishner, 2005). Primary RUCA codes range from 1 to 10, with codes 1 through 3 being *metropolitan* and codes 4 through 10 considered *rural* (U.S. Department of Agriculture Economic Research Service [USDA-ERS], 2012). Under this classification, a zip code was considered rural if it did not contain or partially contain a city of 50,000 or more in population (USDA-ERS, 2012).

Data were analyzed using descriptive and nonparametric statistics; the 0.05 *alpha* level was set *a priori* for all tests of statistical significance. The magnitude of all significant associations was described using odds ratios (*ORs*) and their 95% confidence intervals (Stokes, Davis, & Koch, 2012).

Results

The 650 AFLS bachelor's degree graduates in 2007 and 2008 were evenly distributed between years at 50.1% and 49.9%, respectively. The graduates were fairly evenly divided between agriculture (53.2%) and human environmental sciences (46.8%) majors. Overall, the specific majors with the most graduates were apparel merchandising and product development (19.4%), human development and family sciences (16.2%), agricultural business (16.0%), animal science (10.8%), and human development and family sciences (10.8%). A majority of agriculture graduates were male (58.1%), while the predominant majority of human environmental sciences graduates were female (90.5%). Overall, 64.6% of AFLS graduates were female and 35.4% were male. Chi square analyses revealed no significant ($p > .05$) differences by year for number of graduates, major (agriculture or human environmental sciences), or gender; thus, graduates from the two years were combined for all subsequent analyses.

Objective One

A majority of agriculture majors were originally from rural areas (61.6%), while a majority of human environmental sciences majors were from metropolitan areas (55.9%). As shown in Table 1, there was a significant association ($p < .001$) between major and pre-college residence. The calculated *OR* of 2.03 ($CI_{95} = 1.49$ to 2.78) indicated that agriculture graduates were approximately twice as likely to be from rural areas compared to human environmental sciences graduates.

Table 1. Pre-College Residence of Agriculture and Human Environmental Sciences Graduates

Major	Rural ($n = 347$)		Metro ($n = 303$)		χ^2
	<i>f</i>	%	<i>f</i>	%	
Agriculture ($n = 346$)	213	61.6	133	38.4	19.87***
Human Environmental Sciences ($n = 304$)	134	44.1	170	55.9	

Note: *** $p < .001$.

Objective Two

Six or seven years after graduation, a slight majority of agriculture graduates (54.9%) and a larger majority of human environmental sciences graduates (70.1%) were living in metropolitan areas (see Table 2), indicating a rural to metropolitan migration both by major and overall. There was a significant ($p < .001$) association between major and current residence, with a higher percentage of agriculture graduates (45.1%) living in rural areas as compared to human environmental sciences graduates (29.9%). The *OR* of 1.92 ($CI_{95} = 1.39$ to 2.66) indicated agriculture graduates were nearly twice as likely as human environmental sciences graduates to currently live in a rural area.

Table 2. Current Residence of Agriculture and Human Environmental Sciences Graduates

Major	Rural (n = 247)		Metro (n = 403)		χ^2
	f	%	f	%	
Agriculture (n = 346)	156	45.1	190	54.9	15.77***
Human Environmental Sciences (n = 304)	91	29.9	213	70.1	

Note: *** $p < .001$.

Objective Three

To gain a better understanding of who moves from rural to metropolitan communities (or, less commonly, from metropolitan to rural communities), students were grouped by pre-college residence and their current residences were examined by major. As shown in Table 3, the majority of rural agriculture (62.4%) and rural human environmental sciences (57.5%) graduates currently lived in rural areas. There was no significant ($p > .05$) association between major and current residence for graduates originally from rural areas.

Table 3. Current Residence of Agriculture and Human Environmental Sciences Graduates by Pre-College Residence

Pre-College Residence	Current Residence				χ^2
	Rural (n = 247)		Metropolitan (n = 403)		
Major	f	%	f	%	
Rural (n = 347)					0.85 ^{NS}
Agriculture (n = 213)	133	62.4	80	37.6	
Human Environmental Sciences (n = 134)	77	57.5	57	42.5	
Metropolitan (n = 303)					5.71*
Agriculture (n = 133)	23	17.3	110	82.7	
Human Environmental Sciences (n = 170)	14	8.2	156	91.8	
Rural (n = 347)	210	60.5	137	39.5	160.22***
Metropolitan (n = 303)	37	12.2	266	87.8	

Note: ^{NS}Not Significant ($p \geq .05$); * $p < .05$; *** $p < .001$.

A majority of both agriculture (82.7%) and human environmental sciences (91.8%) graduates originally from metropolitan areas currently lived in metropolitan areas (see Table 3). However, there was a significant ($p < .05$) association between major and current residence for students originally from metropolitan areas. Although small, the percentage of metropolitan agriculture graduates living in rural areas (17.3%) was twice as large as the percentage of metropolitan human environmental sciences graduates living in rural areas (8.2%). The calculated *OR* indicated a metropolitan agriculture graduate was 2.33 ($CI_{95} = 1.15$ to 4.73) times more likely to currently live in a rural area compared to a metropolitan human environmental sciences graduate.

There was a significant ($p < .001$) association between pre-college and current residence when controlling for major (see Table 3). A majority of rural graduates returned to rural communities (60.5%), and an even larger majority of metropolitan graduates returned to metropolitan communities (87.8%). The calculated *OR* indicated it was 11.02 ($CI_{95} = 7.34$ to 16.53) times more likely that a rural graduate would currently live in a rural area than would a metropolitan graduate.

Objective Four

There were no significant ($p > .05$) associations between major and percentages of graduates currently living in their home communities for either rural or metropolitan graduates (see Table 4). Slightly less than 40% of graduates, regardless of pre-college community or major, lived in their home communities.

Table 4. Agriculture and Human Environmental Sciences Graduates Returning to Home or Nearby (≤ 50 miles) Communities by Pre-College Residence

Pre-College Residence	Graduates Residing in:					
	Home Community ($n = 251$)			Nearby Community ^a ($n = 390$)		
	<i>f</i>	%	χ^2	<i>f</i>	%	χ^2
Rural ($n = 347$)						
Agriculture ($n = 213$)	85	39.9	0.12 ^{NS}	127	59.6	0.08 ^{NS}
Human Environmental Sciences ($n = 134$)	51	38.1		82	61.2	
Metropolitan ($n = 303$)						
Agriculture ($n = 133$)	52	39.1	0.13 ^{NS}	82	62.6	0.36 ^{NS}
Human Environmental Sciences ($n = 170$)	63	37.1		99	58.2	
Rural ($n = 347$)	136	39.2	0.10 ^{NS}	209	60.2	0.02 ^{NS}
Metropolitan ($n = 303$)	115	38.0		181	59.7	

Note: ^{NS}Not Significant ($p > .05$).

^aIncludes graduates living in their home community.

There were no significant ($p > .05$) associations between major and living in a nearby community (within 50 miles of home community) for either rural or metropolitan students (see Table 4). Approximately 60% of graduates, regardless of pre-college community or major, lived in or near their home communities as measured from center of pre-college zip code area to center of current zip code area.

Finally, there was no significant ($p > .05$) association between pre-college community type and the percentages of students either returning to their home communities or to within 50 miles of their home communities (see Table 4). Approximately 4 in 10 graduates originally from rural or

metropolitan communities returned to their home communities, while approximately 60% of each group currently lived in or within 50 miles of their home communities.

Discussion and Recommendations

The results of this study document the reality of the “rural brain drain” even among students majoring in agriculture and human environmental sciences at one Land-Grant University. Of the 347 graduates originally from rural areas, only 210 (60.5%) were living in rural areas six or seven years after graduation. Although this loss was partially offset by the 37 metropolitan graduates currently living in rural areas, rural communities experienced a net loss of 100 agriculture and human environmental sciences B.S. graduates from two graduating classes. This out-migration, while less than for other colleges at this university (Estes et al., in press), represents a significant loss in human capital for these rural communities.

This research also supports Human Capital Theory in that, overall, graduates were drawn to metropolitan areas where the economic returns to education tend to be greater (Artz et al., 2014). However, the migration of rural agriculture and human environmental sciences graduates was not as pronounced as the earnings differentials found by Artz et al. (2014) would suggest, possibly indicating that the noneconomic advantages of rural living may somewhat offset the economic advantages (von Reichert et al., 2011). Further research should be conducted to examine the career and residential decision-making processes of rural graduates.

Agriculture graduates were both significantly more likely ($OR = 2.03$) than human environmental sciences graduates to be from rural areas (61.6% versus 44.1%, respectively) and more likely ($OR = 1.92$) to currently live in rural areas (45.1% versus 29.9%, respectively). This is consistent with previous research (Johnson et al., 2015; McCallister et al., 2005; Wildman & Torres, 2001).

There was no significant difference between majors in the percentage of rural graduates currently living in rural areas; a majority of both rural agriculture (62.4%) and rural human environmental sciences (57.5%) majors were currently living in rural areas. Conversely, metropolitan agriculture majors were significantly more likely ($OR = 2.33$) than metropolitan human environmental sciences majors to currently live in rural areas. Thus, pre-college residence and major may interact to affect post-college residence only for some metropolitan agriculture majors. Further research should be conducted to better understand the nature of this interaction.

Overall, graduates originally from metropolitan areas were overwhelmingly (87.8%) living in metropolitan areas six or seven years after graduation. Despite the small gain in metropolitan agriculture graduates currently living in rural areas previously noted, rural graduates were 11.02 times more likely than metropolitan graduates to currently live in a rural area. While there was a

degree of “stickiness” associated with pre- and post-college residence for both rural and metropolitan students, this “stickiness” was much greater for students from metropolitan areas. Thus, metropolitan areas gained human capital relative to rural areas by retaining nearly 90% of their graduates while attracting approximately 40% of rural graduates.

There were no significant differences between agriculture and human environmental sciences graduates or between graduates from rural or metropolitan areas in the percentages of graduates currently living in their home community or within 50 miles of their home community. Almost 40% of all graduates currently lived in their home community, while approximately 60% currently lived either in or within 50 miles of their home community. Thus, all majors exhibited an equal propensity to remain close to home, regardless of major or home community. Further research should be conducted to determine whether students are motivated to remain close to home due to the availability of good career opportunities, or if graduates accept less-than-optimal career opportunities as a way to achieve their goal of remaining close to home (von Reichert et al., 2011).

Research should be conducted to determine the specific types of jobs secured by agriculture and human environmental sciences graduates living in rural areas. Are these graduates working in careers that make use of the specific skill sets developed in their degree programs, or are students accepting out-of-field employment as the cost of living in a rural area (von Reichert et al., 2011)?

Land-Grant Universities, especially disciplines in agriculture and human environmental sciences, with their historical commitment to rural areas, must play a key role in enhancing rural economic opportunities (Lichter & Brown, 2014). If rural communities are to survive, this role must include economic development activities that will increase the demand for college-educated workers in rural communities. Without availability of sufficient high-skill jobs, rural communities will most likely continue to export their most academically-talented students to metropolitan areas, while failing to attract significant numbers of metropolitan graduates.

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