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Genetics and sector of employment

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ABSTRACT

In this twin study we show that the penchant for a particular sector of employment has a genetic element: monozygotic twins evidencing a greater similarity of sector choice than dizygotic twins. The findings provide interesting evidence of a genetic basis for the choice to track together into the same sector. The effect sizes, though relatively small, raise the practice-based possibilities that management- or nurture-based approaches might be complemented with nature-based applications of recruitment and selection. Thus, while the research on public employee attraction, selection and attrition focuses nearly exclusively on managerial and behavioral approaches, our findings invite researchers to explore genetic aspects of public service attraction as a complementary approach.

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Introduction

The United States is currently facing a public personnel crisis. As reported in the 2018 Volcker Alliance report, *Preparing Tomorrow's Public Service*, "nearly one-third of federal career employees [are] eligible for retirement by the end of the decade [and similar] concerns have made recruitment and retention the top priorities for state and local governments" (Volcker Alliance 2018: 4). Mazmanian notes that "the federal workforce is aging, and young people aren't showing up for job openings" and Kettl observes that "we really do run the risk of losing a generation of [government] workers" (both cited in Mazmanian 2017).

While many practitioners and scholars (e.g., Linos, Reinhard, and Ruda 2017) are directing their focus toward management in "aggressively acquiring, retaining, motivating and rewarding talent" (National Association of State Personnel Executives 2016: 2), relatively little attention has been paid to more nature-based explanations of genetic selection into particular sectors of work. We do so now by asking whether there are genetic, or nature-based, aspects of the attraction to employment in a particular sector. Drawing on work some work within public administration (e.g., Koehler and Rainey 2008) but mostly beyond our own field, we argue that genetics can play a key role in understanding an employee's attraction and selection relative to occupational sector.

Using a sample of monozygotic (MZ or identical) and dizygotic (DZ) twins, we found that all twins exhibit fairly high probability of choosing the same occupational sector, but that the probability is higher for MZ twins. The effect sizes, though relatively small, raise the possibility that management- or nurture-based practices might be complemented with nature-based applications of selection/recruitment.

In the following sections we briefly review management approaches relevant to our inquiry and contrast them with genetic-based approaches. We then describe our sample, variables and methods of estimation.

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Management approaches to recruitment

Most of the public management research on individual drivers of government employment has focused on public-service motivation (PSM), and has sought to identify, measure, and unpack the implications of "an individual's predisposition to respond to motives grounded uniquely or primarily in public institutions or organizations" (Perry and Wise 1990: 368). For example, PSM measured at an initial point in time helps predict later sector/job choice (Wright and Christensen 2010; Wright, Hassan, and Christensen, Paarlberg, and Perry 2017), or PSM as a predictor of private-public sector switching (Hansen 2014).

A common explanation for public service career selection is that "a work environment nurturing and fulfilling such a motivation is more likely to be found in public sector organizations than in private sector organizations" (Kjeldsen and Jacobsen 2013: 902 referring to Perry and Wise's seminal paper). Within public sector organizations, scholars have shown that particular management practices can nurture or diminish employee PSM: transformational leadership style can nurture PSM (Paarlberg and Lavigna 2010; Wright, Moynihan, and Pandey 2012); performance-based pay diminishes PSM (Canton 2005); clear organizational structures of authority enhance PSM (Moynihan and Pandey 2007); contact with public beneficiaries and exposure to service opportunities enhance PSM (Ward 2014; Bellé 2013a); and, efforts toward organizational reform that clarify goals enhance PSM (Moynihan and Pandey 2007).

In short, while some earlier scholarship identifies pre-career antecedents of PSM, including religious, political, parental socialization and early service-oriented experiences (Perry 1997; Holt 2019), scholars mostly agree that "PSM of public employees is mainly the result of the organisational environment surrounding them" (Camilleri 2007: 373). While some view PSM as an intervening or independent variable (e.g., Bellé 2013b), managers and public management scholars have nearly singularly embraced a "nurture" approach to public service motivation. Some even describe the present understanding of PSM as being "characterized by environmental determinism" (Smith 2015). This is likely overly simplistic, especially given that the widely accepted definition of PSM begins, after all, with a nature-like term: "predisposition" (Perry and Wise 1990).

Although our read of the PSM research is that it is trending toward a nurtured/environmental approach, other fields have started to grapple with the more nature-oriented, deep psychological and biological factors in human decision-making and choice. Using PSM as a central point of reference, scholars like Koehler and Rainey (2008) have drawn on fields such as psychology, organizational behavior, sociology, economics and sociobiology to draw a "bigger picture" of understanding of why certain individuals are more service-oriented or service-motivated. They point out the evidence from sociobiology, for example, that other- or service-orientation may be a bio-evolutionary survival mechanism (2008:36).

Genetics and sector of employment

The theoretical expectation that genetics might explain a particular service- or occupational-orientation has been taken up more broadly beyond than within the field of public administration. However, beyond testing the theoretical debate of shared-environment v. shared-genetics as explanatory factors, most of the work that we reviewed has taken a more atheoretical, empirical approach. Scholars have studied, for example, whether genetics or environmental factors play a more significant role in determining vocation. Some studies have compared biological and adoptive families as a method of identifying genetic influences (Ellis and Bonin 2003), while many other scholars utilize twin studies, comparing "fraternal" or dizygotic (DZ) twins to "identical" or monozygotic (MZ) twins. Twin studies create a natural experiment due to the genetic makeup of MZ and DZ twins: MZ twins share 100% of their genetic structure. Thus, assuming that the twins

share the same kind of environment, "greater MZ than DZ twin concordances … would indicate that genetic factors are important" (Nicolaou et al. 2008).

Vocational research using twins dates back to Carter (1932) who found the correlation in vocational interests to be 0.5 for MZ and 0.28 for DZ twins. He concludes that "[s]ince it is certain that the [vocational] interests of the monozygotic twins are more similar than those of the fraternal twins … , it seems probable that hereditary factors are more important in determining [vocational] interests than are environmental factors" (1932:653). These early, exploratory claims have been subsequently strengthened. Vandenberg and Stafford (1967: 18) found that "hereditary influences on vocational interests are not necessarily limited to high-level abilities such as those required for scientific and professional occupations, but range over the entire occupational spectrum." Roberts and Johansson (1974) found stronger correlations in MZ twins when measuring the predisposition toward an array of specific job characteristics (e.g., investigative, artistic, and social). Lykken et al. (1993) and Moloney, Bouchard Jr, and Segal (1991) both found that approximately 45 to 50% of the variance in their studies of vocational interest in twins was associated with genetics. Beyond general vocational interests, twin studies have also explored some broader attraction-selection-attrition framework dynamics. For example, in a study of 1,236 MZ and 1,165 DZ white male twins, McCall et al. (1997) sought to understand whether one is more likely to switch jobs or occupations based on genetics. They found that genetic factors were significant factors in both job and occupation switching.

Genetics has also been found to influence specific career choices. For example, Nicolaou et al. (2008), drawing on a sample from the TwinsUK registry to analyze the effects of heredity on entrepreneurial job choice, found that genetic influences ranged from 37 to 42% across seven operationalizations of entrepreneurship. A few of these authors continued this study later using the twin sample of the National Survey of Midlife Development in the United States (MIDUS), finding again that entrepreneurial job trait correlations are greater for MZ twins than for DZ twins (Nicolaou and Shane 2010).

Despite the many studies examining genetics and general vocational interests, attraction-selection-attrition, and specific job interests, we are unaware of published work that explores the role of genetics in the general sector choice, whether through sector or job-type. Beyond some work focusing specifically on military enlistment (Beaver et al. 2015), one important exception is Maczulskij's (2013) work, based on Finnish twin-pairs, which, oddly enough, examines whether the time one twin spends in the public sector reliably predicts the time that the other twin spends in the public sector. She concludes that genetics account for 30 to 40% of the length of service in public employment with little contribution from shared environment. It is unclear whether Maczulskij's findings equally apply in other national settings and, further, whether genetics are as responsible for private-public sector choice, generally, as it is for the length of service in public sector choice specifically studied in Maczulskij's work.

Method

We used secondary, anonymized data collected in 1995 and 1996 by the National Survey of Midlife Development in the United States (MIDUS), the MacArthur Foundation's Network on Successful Midlife Development. All methods were carried out in accordance with relevant guidelines and regulations. The main objective of MIDUS is to investigate the behavioral, psychological, and social factors of midlife development that affect physical health, emotional well-being, and social responsibility. MIDUS includes several samples: the national probability sample (N = 3,487), the siblings of these respondents (N = 950), a national sample of twin pairs (N = 1,914), and a selective oversampling of five major metropolitan cities (N = 757). Eligibility criteria include noninstitutionalized English-speaking adults aged 25 to 74 years residing in the 48

Table 1. Subcategories of occupation and industry groups assigned as government employment.

24 subcategories of occupation groups	12 subcategories of industry groups
Chief executives and general administrators, public administration	U.S. Postal Service
Administrators and officials, public administration	Elementary and secondary schools
Teachers, prekindergarten and kindergarten	Libraries
Teachers, elementary school	Social services
Teachers, secondary school	Executive and legislative offices
Teachers, special education	General government
Librarians	Justice, public order, and safety
Social workers	Public finance, taxation, and monetary policy
Judges	Administration of human resources programs
Library clerks	Administration of environmental quality and housing programs
Postal clerks, exc. mail carriers	Administration of economic programs
Mail carriers, postal service	National security and international affairs
Mail clerks, exc. postal service	
Eligibility clerks, social welfare	
Supervisors, firefighting and fire prevention occupations	
Supervisors, police and detectives	
Fire inspection and fire prevention occupations	
Firefighting occupations	
Police and detectives, public service	
Sheriffs, bailiffs, and other law enforcement officers	
Correctional institution officers	
Public transportation attendants	
Welfare service aides	
Armed services member	

Notes: Current public service industry (n = 799); Past public service industry (n = 260); Current/past public service industry (n = 1059); Current public service occupation (n = 459); Past public service occupation (n = 128); Current/past public service occupation (n = 587); Current/past public service industry and occupation (n = 1123)

contiguous states. All respondents participated in a 30-minute telephone interview and two self-administered mail-back questionnaires requiring about 90 minutes to complete.

The twin dyads were identified by screening a representative national sample of approximately 50,000 households for the presence of twins. The 14.5% of respondents who reported twins in their families were then asked whether it was permissible for the research team to contact the twins to request their participation in the survey. The 60% of respondents who provided such permission were invited to the MIDUS recruitment process. Zygosity for each twin pair was determined by self-report using questions regarding similarities in eye and hair color as well as how often people were confused regarding the twins' identities during childhood. Because the focus of this study was on genetic factors of twins affecting career choice, twin pairs of unidentified zygosity were excluded (N = 25). In addition, we only focused on same-sex dizygotic (DZ) twins since the equal environment assumption of behavioral genetic research may not apply to opposite-sex DZ twins. With the same concerns about equal environments, we also limited our analysis to twin pairs living together for more than 15 years. As a result, the final sample included 2,772 individuals or 1,386 twin pairs—715 monozygotic (MZ) pairs and 671 same-sex DZ pairs.[1]

Occupation and industry: dependent variables

Many scholars have devoted considerable attention to differences and similarities between public and private sector organizations (Rainey 2014). For example, in developing their theory of the public-private distinction, Perry and Rainey (1988) suggest that three prevailing criteria used to differentiate between the two sectors are ownership, funding, and mode of social control (either polyarchy or market). Similarly, Houston (2011) has distinguished public and private sector employees based on the locus, i.e. working for government, and focus, i.e. delivering public services, of occupation. Furthermore, Houston proposed separating public service occupations from

Table 2. Tabulation of monozygosity and similarity of sector choice.

	DZ (%)	MZ (%)	Total (%)
Different Sector	47(15.6)	35(10.3)	82(12.8)
Same Sector	254(84.4)	306(89.7)	560(87.2)
Total	301(100)	341(100)	642(100)

government employment because a number of government employees do not engage in directly offering public services whereas many public service employees are not actually employed in governmental organizations. For instance, categories of public service occupations include public service jobs in human health, safety and welfare such as health care professionals, child care-employees, fire-fighters, police officers, and social work professionals. Building on the concept of focus of employment, we classify individuals in public service occupations or industries as public employees regardless of whether they work inside or outside of government.

MIDUS contains information about the occupations and industries in which the respondents had worked in the past and were working in at the time the data were collected. Respondents were categorized into nine occupation groups including 408 subcategories and 12 major industry groups consisting of 221 subcategories according to the 1980 US Census classification codes. These variables—occupation and industry—certainly overlap but seem to be based on two different coding protocols: the Dictionary of Occupational Titles (DOT) and the Standard Industrial Classifications (SIC), respectively. From these specific categories, we determined 24 categories in the occupation groups and 12 categories in the industry groups to be areas of public-service–oriented employment. By coding these categories as 1 and other categories as 0, we created a dummy-coded variable: current/past public-service industry and occupation. Table 1 provides the names of the categories in detail.

Results

We dichotomized twin variables, coding them 1 for MZ and 0 for DZ. There were 317 MZ pairs and 261 DZ pairs who worked in the public-service industry/occupation presently or in the past. We then matched these employment variables to determine those sets of twins that had worked in the same sector in the present or past. We also determined those sets of twins that had not worked in the same sector in the present or past. Table 2 reports the cross-tabulation of the similarity of sector and monozygosity/dyzogosity recording.

We conducted a series of one-way analyses of variance (ANOVA) to compare the mean differences between MZ and DZ twins in terms of three attitudinal characteristics, namely life satisfaction, optimism, and perceived contribution to others. We did this to rule out the possibility of omitted variable bias caused by socially influenced attitudes between twins. According to the person–organization fit theory, job seekers are likely to be attracted by an organization that is congruent with their attitudinal characteristics, such as personality, beliefs, and values (Chapman et al. 2005; Resick, Baltes, and Shantz 2007). This suggests that attitudes may result from a similarity in opinions and values between twins and may have a significant impact on their choice of the same sector. The results of ANOVA demonstrate no significant differences, by zygosity, across these available measures of twins' attitudes. This suggests that the mean attitudinal differences between MZ and DZ twins, at least on these measures, do not suggest significantly different attitudinal socialization. Thus, the model that follows does not seem unduly influenced by omitted variable bias resulting from socially influenced attitudes among twins (Table 3).

Logistic regression was performed in order to determine whether sector choice differed in terms of zygosity. Table 4 reports the results for the logistic regression, which indicate that there is a statistically significant difference in the incidence of similarity of sector choice between the

Table 3. One-way ANOVA comparing mean differences between MZ and DZ twins in items measuring attitudes.

Attitudes	Survey items	MZ Mean (SD)	DZ Mean (SD)	Prob > F
Life satisfaction	At present, how satisfied are you with your life?	1.463 (0.917)	1.403 (0.683)	0.179
Optimism	Please indicate how well each of the following describes your optimism.	1.759 (0.844)	1.704 (0.789)	0.225
Perceived contribution to others	When you think about your life as a whole up to the present, how would you rate your contribution to the welfare and well-being of other people?	2.171 (0.805)	2.177 (0.846)	0.891

Note: Life satisfaction, optimism, and perceived contribution to others were measured on a 4-point Likert-type scale, where 1 = a lot or excellent, 2 = some, 3 = a little, and 4 = not at all. Monozygotic (MZ) pairs N = 301; same-sex dizygotic (DZ) pairs N = 341.

Table 4. Results of logistic regression.

Variable	Odds Ratio	Standard Error	Z	P>|Z|
Monozygosity	1.618	0.387	2.01	0.044
Constant	5.404	0.859	10.62	0.000
Includes Huber-White robust standard errors				
Log likelihood = −243.218 LR $\chi^2(1)$=4.05 Probability = 0.044 N = 642				

two twin groups (odds ratio = 1.59; $p = 0.05$). This is an important result as it suggests a significant effect of genetic differences on twins' share of the same sector of employment.

The results indicate that the overall probability of similarity of sector choice is fairly high, but that the probability is higher for monozygotic twins.

Discussion

The purpose of this study was to expand the literature on the determinants of occupational interests in public-sector employment through a comparison of MZ twins and DZ twins taken from the National Survey of Midlife Development in the United States (MIDUS) database. One of the most significant and interesting questions related to sector choice has to do with why certain individuals decide to work in public-service organizations, e.g., government. Although a great deal of empirical research has been aimed at answering this question by exploring the role that individual-level motivational factors play in the selection of public-sector employment, one potential factor that has been overlooked in public service research is the impact of genetic factors on the tendency to be public employees. In this regard, our study is the first that attempts to advance the literature on the heritability of work interests in the public sector. Genetic analyses like the ones conducted in this study might serve as intellectual starting points rather than endpoints, and they several provide potential avenues of further inquiry into public management.

Since our study revealed that the occupational-sectors of MZ twins are more similar than those of DZ twins, it seems plausible that hereditary factors are important in determining public-sector career choices. Our finding is consistent with the findings of previous studies outside public

administration that found that vocational interests are inherited (Carter 1932; Vandenberg and Stafford 1967; Lykken et al. 1993; Nicolaou and Shane 2010; Beaver et al. 2015). This suggests that there is a genetic component inducing individuals to follow public-service career paths. In particular, given the considerable evidence on the correlations between public-service motivation (PSM) and individuals' public-sector employment (Wright and Christensen 2010; Lee and Choi 2016; Pedersen 2013; Kjeldsen and Jacobsen 2013), our study opens a new avenue for research on career-choice decisions by focusing on genetic influences. While PSM has been a significant variable of interest in studying public-sector employment, the finding here indicates that sector choice may be due, in part, to heritability.

We employed a simple logistic regression to examine whether genetic factors induced individuals to engage in public-sector jobs. Our findings are powerful in that we are able to control for most exogenous influences: MZ twins share the same exposure to environmental facts as DZ twins. In theory, only levels of shared DNA differ. This is the compelling logic behind the classic twin-based research design (Alford and Hibbing 2004). Thus, our findings, supported by the shared-environments assumption, provides evidence of the genetic influence on individuals' public-sector choice.

If individuals' sector choice of employment is, in part, heritable, this may help to explain the mixed findings on the relationships between PSM and public-sector choice (e.g., Kjeldsen and Jacobsen 2013). In addition, scholars have previously explained various working environments of public organizations including job security, opportunity for advancement, and incentives as important factors in sector choice, but given the present findings, genetic variation also plays a likely role.

With these observations in mind, we note that the substantive effect of genetics is modest. MZ twins exhibit a 1.6 greater odds, compared to DZ twins, of being employed in the same sector. So while genetics play a role, they far from eclipse the role that organizations might play in attracting, selecting and retaining public service employees. Applied to our question of interest, the quiet crisis of smooth, sustained succession of government employees is likely to be best achieved through a mix of (1) recognizing the role of individual "nature-"like attributes and (2) environmental "nurturing" by way of effective recruitment and messaging (e.g., Linos, Reinhard, and Ruda 2017). In short, our findings point to a return to Schneider's (1987) work that "attributes of people" should be considered first in understanding organizations. Only then can organization's influence on people be properly understood.

There are some limitations and caveats that need to be addressed. First, our study relied on twin samples in the United States and in a single era; it is plausible that research using twin samples in different countries or in other eras may generate different findings. Second, even though the results indicate that genetic factors are likely to make individuals choose the public sector as their workplace, these findings should not be regarded as though genes determine who will and who will not engage in public-service work. Some evidence suggests that genetic influences could be enhanced or attenuated depending on exposure to certain environmental or social factors (Caspi et al. 2002; Rutter 2006; Beaver et al. 2015).

We were unable to fully engage these possibilities in our study. For example, one counterargument to the genetic argument could be that that MZ twins have a closer social bond and therefore they are more likely to make the same choices in life regarding sector. This could be tested by comparing MZ twins, who have shared environment during childhood, with MZ twins who have been adopted to separate families/raised separately/only shortly lived together. While we excluded those cases where twins lived together less than 15 years from estimation, they constituted only 27 pairs of twins. Consequently, testing the effect of a developed social bond over the course of the childhood experience is beyond our capacity for these data. Future work would clearly benefit by exploring the interaction effects of genes and various environments and social connections on sector choice.

Relatedly, we acknowledge that the shared-environments assumption may fail to hold and that twins may not have been exposed to the same environments in childhood. For purposes of this study we focused on twins living together more than 15 years and made an assumption that most violations would be equally distributed across MZ and DZ pairs. We cannot fully address potential omitted variable bias in instances where parents or teachers treat MZ twins differently compared to DZ twins, in ways that make similarity of sector choice more likely among the former than among the latter. Future work should be designed to explicitly control for this.

Conclusion

With these qualifications in mind, we return to the public service motivation scholarship, which began with a notion that certain individuals are predisposed to public-service work (Perry and Wise 1990). Notwithstanding this nature-based heritage, much of the evolution of the work on PSM has been to focus on the nurture-based managerial levers that can be pulled to leverage PSM's role in job attraction, selection or retention. While this variety of work should continue (Christensen, Paarlberg, and Perry 2017), we raise here the importance of nature-based attributes to provide a fuller view of what influences individuals to select public service work.

Our findings confirm that genetics plays a role in similarity of sector choice. So while Fountain's (2017) relevant inquiry, "how can we incentivize the next generation to get involved in public service?" is certainly partly, if not primarily, addressed through effective management practices, the picture is more complex. Genetic similarity appears to affect sector choice, so public service involvement may depend, at least in part, on genetic predisposition. We do not advocate genomic selection, nor do we advocate its use by any organization. Yet, many HR current practices involve personality and intelligence testing - traits that may also be related to genomic information. As such, we note that it is early days for our understanding of such effects on the likelihood that a person is attracted to the public service. We believe that the role of genetics in public service attraction, selection and retention certainly warrants further scientific investigation, if only because public service practitioners will continue to seek to engage the pressing issue of recruitment, and our knowledge of such matters remains largely limited to non-genomic causes.

Note

1. Our approach of comparing same-sex, DZ and MZ pairs is not unlike other work, e.g, McClearn, Gerald E., Boo Johansson, Stig Berg, Nancy L. Pedersen, Frank Ahern, Stephen A. Petrill, and Robert Plomin. 1997. "Substantial genetic influence on cognitive abilities in twins 80 or more years old." *Science* 276 (5318): 1560-1563.

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Data availability

Data for this article are available through the National Survey of Midlife Development in the United States (MIDUS).

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