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ABSTRACT

Organizational demographers found that people who are demographically different from their colleagues, are most likely to leave. To explain this fact, demography and network ties are generally treated as equivalent. Critics claim that the use of demographics as a substitute for network ties is not justified, and called for research combining both approaches. The goal of this paper is to understand the subtleties of the turnover process, by simultaneously studying the impact of demographic position and network ties on turnover of professional employees. We test our hypotheses using event history analyses on a longitudinal dataset (1994-2004) of a medium-sized university faculty. Our findings indicate that demographic distance and strong external network ties have independent effects on turnover. We also found some support for interactions between demographic distance and network ties in determining individual turnover.

Keywords: Demography, Networks, Embeddedness, Turnover

Especially in professional organizations, where individual employees possess tacit knowledge and play a key role in the accomplishment of organizational tasks, individual mobility might have a huge impact on the functioning of work groups and organizations (e.g., see Sørensen 1999). As a result, understanding the determinants of individual turnover is an important research topic (e.g., Griffeth, Hom, and Gaertner 2000; Lee, Mitchell, Sablynski, Burton, and Holtom 2004; Maertz and Griffeth 2004; Pfeffer 1983). Given that individuals are embedded in a broader social environment, organizational sociologists emphasize the importance of this context in constraining and shaping individual turnover behavior (Dobrev 2005; Krackhardt and Porter 1985). Specifically, organizational demography (Pfeffer 1983) has proven to be a powerful paradigm showing that an organization's demographic composition and an individual's position in this composition (the so-called relational demography; Tsui, Egan, and O'Reilly 1992) are important precursors of turnover. Generally, demographic diversity tends to increase aggregate turnover rates, and isolated people with respect to demographic attributes are most likely to leave.

Two major reasons have been invoked for these stylized facts: one is based on the similarity-attraction hypothesis and the other on social identification theory (Tsui et al. 1992). The former states that people with similar characteristics are more likely to develop network ties (i.e., the network is homophilous; Reagans, Zuckerman, and McEvily 2004), which facilitates communication and social integration. The latter claims that people identify more with others that share the same attributes, without necessarily engaging in interpersonal interaction (Tsui et al. 1992). Social integration and identification, in turn, affect organizational attachment (Tsui et al. 1992) and turnover (O'Reilly, Caldwell, and Barnett 1989).

In building these arguments the organizational demography literature has tended to assume that demographic composition and social network ties are equivalent. "The rationale for

doing so is based on the assumption that the social network inside the organization (or "organizational network") is characterized by homophily, the tendency for strong network connections to occur more frequently between people who share an important demographic characteristic such as race, gender, or firm tenure" (Reagans et al., 2004, p. 101; McPherson, Smith-Lovin, and Cook 2001, for a review). Most turnover researchers have therefore also ignored the more proximal network ties as determinants of turnover, given that it is easier to get access to a person's demographic features (for exceptions see Krackhardt and Porter 1985; Krackhardt and Porter 1986). However, critics have argued that the tendency towards homophily depends on contextual characteristics such as an organization's culture or industry, and is often too weak to justify the use of demographics as a substitute for network ties (Lawrence 1997; Reagans et al. 2004). Not surprisingly, as shown by Reagans et al. (2004), organizational research could benefit much from simultaneously combining demography and network approaches.

To be sure, at the individual level, some research has been done analyzing the link between demography and social ties. Most of these studies focus on how being part of a racial or gender minority affects the structure and characteristics of informal networks (Ibarra 1993; Ibarra 1995; Mehra, Kilduff, and Brass 1998; Mollica, Gray, and Treviño 2003). These studies suggest, for instance, that the network ties of minorities demonstrate greater homophily than those of majorities (Mollica et al. 2003), despite the fact that minorities have less opportunity to form ties with people of the same background (Ibarra 1995). The role of ties and demography have also been studied in the realm of the personnel recruitment process, such as the hiring of new workers via employee referrals (Fernandez, Castilla, and Moore 2000) and discrimination in salary negotiations (Seidel, Polzer, and Stewart 2000). However, an integrated approach has, to the best of our knowledge, not been applied in the field of turnover by demography researchers.

Particularly for professional organizations, this is an important omission given that demography and social ties are less likely to be equivalent in such organizations. The reason for this is that professionals tend to build ties not only with peers in their own organization (intra-organizational or internal ties), but also of other organizations. Such external ties represent opportunities for mobility, pulling professionals out of organizations irrespective of their demographic distance[1] towards colleagues within the organization. Conversely, isolated individuals will not necessarily leave when they have strong ties with internal colleagues. To understand these subtleties of the turnover process we develop an overarching framework of the joint impact of demographic distance and network ties on the likelihood of individual turnover of professional employees. We take multiple demographic variables on board – i.e., gender, age, nationality, tenure and education – "since people are represented by a demographic profile rather than by one or two demographical variables" (Tsui and O'Reilly 1989, p. 419). We hypothesize about the differential effects of internal versus external network ties of professionals. In doing so, we also contribute to the social network literature, as previous studies in this field generally lack information on external connections (for a notable exception see Moynihan and Pandey 2008; Reagans et al. 2004). We also explicitly distinguish between strong and weak ties to find out whether the former are more important than the latter in affecting turnover, as is sometimes suggested but not explicitly tested by social network researchers (Krackhardt & Porter, 1985, 1986; for the opposite viewpoint see Granovetter 1973).

We test the derived hypotheses by means of event history analyses on a detailed, hand-collected and longitudinal dataset of one large faculty of a medium-sized Dutch university. The raw data involve voluntary turnover that was recorded every month over a period of eleven years (1994-2004). We opted for an academic setting for fundamental as well as pragmatic reasons.

[1] We use demographic distance and dissimilarity interchangeably throughout this paper.

First, organizational performance is to a large extent determined by the individual academics that are attracted, selected and retained by the university faculty. As a result, turnover constitutes an important event for such organizations, indicating that understanding the process of individual turnover is very salient. Second, next to demographic data, also network data are generally available for longer periods of time in such organizations. Network ties can be inferred from the patterns of cooperation observed in different publication outlets – i.e., through research collaborations reflected in co-authorships. This implies that the arguments we develop in the present paper apply to task-related ties. The availability of longitudinal information on both demographic features as well as network ties makes it feasible to study the complicated research question we are interested in here.

THEORETICAL BACKGROUND

Organizational demographers describe groups by means of their members' demographic characteristics, such as gender, ethnicity, age, tenure and education, which define a group's demographic composition. The latter, in turn, represents the group's baseline blueprint affecting the structure of social exchange and interaction (cf. Blau 1977; Pfeffer 1983). A distinction can be made between *ascribed* characteristics of people, which refer to socio-demographic features, and *acquired* characteristics, which relate to career and life history features (cf. McPherson et al. 2001). A stylized fact in the turnover literature is that people who are atypical with respect to ascribed and/or acquired characteristics are more inclined to leave the group than people who are rather 'typical'.

Popielarz and McPherson (1995) found that, in voluntary organizations, people who are atypical in terms of gender leave the group at a rate 84 per cent higher than the rate for members of the typical gender. Tsui et al. (1992) revealed, in a sample of 1,705 individuals of 151 work

units of three large US organizations, that gender and ethnical differences between a focal individual and the other members of the work unit have a strong and negative impact on organizational attachment, reducing psychological commitment and the intention to stay, and increasing absenteeism. Organizational attachment, and especially psychological commitment and intention to stay, are in turn strongly and negatively related to turnover (O'Reilly, Chatman, and Caldwell 1991). Similarly, with respect to age dissimilarity, the general finding is that such a difference is positively related to the intention to leave (e.g., Tsui et al. 1992) and to individual turnover (e.g., Wagner, Pfeffer, and O'Reilly 1984). Similar patterns of results emerge from the study of the effect of (dis)similarity in acquired characteristics such as education, experience and other career-related variables. Differences with respect to the average level of education, college curriculum, and experience outside the focal industry are found to have a positive impact on individual turnover (e.g., Jackson, Brett, Sessa, Cooper, Julin, and Peyronnin 1991; Popielarz and McPherson 1995). Finally, although non-findings have been reported as well (e.g., Jackson et al. 1991), differences in organizational tenure tend to be associated with an increased likelihood of turnover (cf. McCain, O'Reilly, and Pfeffer 1983).

Demographic turnover researchers have implicitly assumed that homophilous network ties mediate this effect. However, following Lawrence (1997) and Reagans et al. (2004), we argue that in most settings such an equivalence assumption is too simplistic. We therefore develop an integrative framework in Figure I that unravels how demography and ties combine in affecting turnover.

[Insert Figure I about here]

We suggest three possible pathways. First, demographically isolated individuals are more likely to leave because they have less internal and more external ties (indirect effect of demographic dissimilarity mediated by ties: Path 1). Second, they do so because they identify less with their

organization (direct effect of demographic dissimilarity not mediated by ties where the latter might have an independent additive effect on turnover: Path 2). Third, an individual's internal and external ties moderate the impact of being isolated on turnover (Path 3). In the following, we formulate specific hypotheses for each of the relevant paths, alongside a summary of previous findings. In doing so, we also hypothesize about the potentially different effects of weak versus strong ties on turnover.

The Indirect Effect of Demographic Distance (Path 1)

Demographic turnover research has mainly been built on the argument that similarity is an important basis of interpersonal attraction (Byrne 1969; O'Reilly et al. 1989; Wagner et al. 1984). The logic is that people who share similar characteristics are more likely to develop strong social intra-organizational ties, which in turn reduce conflict, facilitate communication and cohesion, increase attachment, and reduce turnover (O'Reilly et al. 1989; Wagner et al. 1984). Although social ties have not been measured in this research, the evidence generally suggests that similarity indeed makes people feel more comfortable and at ease (Tsui et al. 1992). For instance, group heterogeneity decreases individual and group-level social integration (O'Reilly et al. 1989; Williams and O'Reilly 1998). Moreover, similarity facilitates smooth group interaction processes, enhancing effective communication and reducing conflict (Carroll and Harrison 1998), which further reinforces cohesion and belongingness. With respect to the latter, Pelled et al. (1999) found that functional diversity was positively related to task conflict, whereas ethnic and tenure diversity were positively associated with emotional conflict.

Note that research on minorities, outside the realm of the turnover literature, did find evidence for the assertion that demography constrains the formation of social ties in cohorts of MBA students (Mehra et al. 1998; Mollica et al. 2003) and managers in organizations (Ibarra

1995). Network research, in turn, generally supports the importance of internal ties in predicting turnover (for a review see Brass, Galaskiewicz, Greve, and Tsai 2004; McPherson, Popielarz, and Drobnic 1992). Recently, Mossholder et al. (2005) reported, in a sample of about 170 medical workers, that interpersonal ties at work (i.e., network centrality and the extent of interpersonal citizenship behavior) negatively affect turnover. A series of studies by Feeley and colleagues also underscore the importance of network centrality (both closeness and degree)[2] in driving turnover (Feeley 2000; Feeley and Barnett 1997; Feeley, Hwang, and Barnett 2008).

Taken together, we therefore predict that the relationship between demographic isolation and turnover will be mediated, at least in part, by the focal person's number of intra-organizational social ties. Given that similarity affects the formation of strong ties (e.g., friendship and intimate ties), and that particularly the latter are important in spurring organizational attachment and integration (O'Reilly et al. 1989; Wagner et al. 1984), we expect this mediation effect to be stronger for strong versus weak ties.

> *Hypothesis 1. (a) A focal person's number of internal ties mediates the positive relationship between demographic dissimilarity and turnover; (b) this mediation effect is more pronounced for the number of strong compared to weak internal ties.*

The demographic position of an individual in her/his organization does not only affect the size of her/his intra-organizational network, but also the likelihood that s/he will develop extra-organizational ties. The fact that people form network ties with others who are close to them in demographic space (cf. Blau space), also implies that those who are at the edge of a group in social space (1) are the most atypical or demographically different group members and, at the same time, (2) have more ties to non-group members (McPherson et al. 1992; Popielarz and

[2] Degree refers to the number of ties a focal person has with others in the network, and closeness to the average number of links s/he has to all other nodes in the network. As both are supposed to measure network centrality, they are generally strongly related (Feeley, 2000).

McPherson 1995). As a result, 'atypical' persons will have more external network ties and, consequently, more access to external information and resources, as well as new opportunities (because structural holes are spanned; Burt 1997; Burt 2004).

McPherson and colleagues (1992) predicted that people will join more new groups when their individual network is large, and that network ties to non-members (members) of a group will decrease (increase) the duration of group membership. Based on a sample of over thousand individuals in ten Nebraska communities, they found that a large network size decreases the time between joining events with five to seven months. Additionally, each network tie to a group member increases the duration of the membership by over 60 per cent, whereas each non-member network tie reduces the duration of membership by about 6 per cent. Moreover, Popielarz and McPherson (1995) showed that individuals who are at the edge of the group and who have more ties to people from outside the group, leave their group at more than double the rate experienced by members who are in the center of their group and who have less ties to non-group members. In other words, those "who fall off the edges of the social network" are more likely to leave (Feeley and Barnett 1997, p. 374).

An important question is which type of external ties, strong or weak, will have the strongest mediating effect in pulling people out of organizations. Two alternative hypotheses can be developed in the present context of professionals. As "the strength of a tie is a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie" (Granovetter 1973, p. 1361), strong ties reflect more than mere professional relationships. Strong ties foster trust and cohesion, and therefore enable cooperative acts in situations of interdependence (Balkundi, Kilduff, Barsness, and Michael 2007; Gabbay and Zuckerman 1998; Ibarra 1995). Strong ties might be particularly valuable in the world of professionals, generally, and academics, particularly, where

cooperation requires trust, reciprocity and deep knowledge of each others' interests, talents, capabilities and working routines. Consequently, strong external ties might be potent forces pulling academics out of the focal organization.

Weak ties are also important, but for other reasons. They mainly provide individuals with non-redundant information (Granovetter 1973), potentially increasing an individual's information power and opportunity set (e.g., Gabbay and Zuckerman 1998; Gargiulo and Benassi 2000). In the present context, this might imply that external vacancies are more accessible to people with many external weak ties, increasing the likelihood of turnover. As both arguments are plausible, we do not formulate a specific hypothesis with respect to these two different pull mechanisms. Rather, we let the data speak.

Hypothesis 2. A focal person's number of external ties mediates the positive relationship between demographic dissimilarity and turnover.

The Direct Effect of Demographic Distance (Path 2)

The former set of hypotheses hinges on the equivalence of demography and social ties. The extent to which this assumption is true is likely to depend on the specific setting. For instance, McPherson's et al.'s model (1992) cited above has been supported in the context of voluntary organizations. Voluntary organizations are generally composed of members that share common preferences and goals. Given that membership is voluntary, people who do not fit are not constrained whatsoever to stay in the organization, and can easily search, via their network, for alternatives. In such a voluntary setting, an individual's demographic position is strongly related to her or his (homophilous) relationship ties, social interaction and organizational membership. However, for professional employees and organizations, at least three important

qualifications can be made with respect to the interplay between demographic distance and network ties.

First, demographics might be less salient in steering the formation of social ties in professional organizations. Preference similarity is part of the *reason d'être* of voluntary organizations, but in professional organizations individual careers and organizational task-related goals are more important. Depending on the context, professionals might tolerate or even appreciate diversity more than members of voluntary organizations (cf. Balkundi et al. 2007; Reagans et al. 2004). For example, professionals might value learning from interacting with demographically different colleagues. At the organizational level, strategies can be designed to stimulate identification on the basis of organizational membership rather than of demographic characteristics (Chatman, Polzer, Barsade, and Neale 1998). All this implies that social interaction is less guided by demographics.

Second, professional jobs often involve inter-organizational or international collaborations – for example, with colleagues in other organizations or elsewhere in the world, or with clients. Professional employees, therefore, understand the benefit of building extensive networks that contain a sufficient number of external references, regardless of their demographic position in the group. Indeed, Dess and Shaw (2001) showed that high-performing professionals attach much importance to networking activities.

Third, professional employees tend not only to be committed to their organization, but also to the profession to which they belong. Indeed, professionals generally attach high value to their job, and to excellent job performance *per se* (cf. Pelz and Andrews 1966). In contrast with earlier theories on commitment (Gouldner 1957), later studies revealed that high levels of professional commitment – arguably a necessary condition for high work performance – does not necessarily imply low levels of organizational commitment (e.g., Bamber and Iyer 2002; Lee

1969; Somech and Bogler 2002). Rather, professionals can show high levels of both if the employing organization provides an environment in which the professional task is supported, and in which people can feel embedded (e.g., Lee 1969). This set of qualifications suggests that demographic dissimilarity in professional organizations does not automatically imply a high (low) number of external (internal) network ties, such that full mediation by a focal individual's social network is unlikely.

Moreover, Tsui et al. (1992) claimed that demographic dissimilarity might have an additional effect on organizational attachment that does not hinge on the similarity-attraction hypothesis and, therefore, does not require interaction (social ties) among individuals whatsoever. Their argument is based on self-categorization theory, stating that people classify themselves and others into social categories on the basis of features such as age, race, status or religion. People do so because they derive self-esteem and positive identity by defining the psychological group to which they belong and by maximizing the latter's distinctiveness with out-groups (Kramer 1991; Tajfel and Turner 1986). "An important characteristic of a psychological group is that individuals can identify with it and derive self-identity without necessarily engaging in interpersonal interaction with all or any members of that group" (Tsui et al. 1992, p. 553). Thus, a dissimilar individual will identify less with her/his group, which decreases one's self-esteem and positive identity. This in turn might spur turnover, irrespective of the features of one's intra-organizational network.

Taken all these arguments together, it is therefore plausible that demographic distance has an additional direct positive effect on turnover not mediated by the number of internal and external ties. Conversely, network ties would then affect an individual's rate of turnover independently of her or his demographic position relative to group members. This leads to the

following hypothesis, for which the same qualifications about weak and strong ties developed above apply.

> *Hypothesis 3. (a) There is a direct positive relationship between demographic dissimilarity and turnover; (b) there is a direct negative relationship between a focal person's number of internal ties and turnover (more pronounced for the number of strong compared to weak internal ties); and (c) there is a direct positive relationship between a focal person's number of external ties and turnover.*

The Moderating Effect of Internal and External Ties (Path 3)

Finally, demographic distance and network ties might interact in affecting individual turnover, as visualized in Figure 1 (Path 3). The extent to which demographic dissimilarity actually triggers turnover could depend on an individual's number of internal and external network ties, which define the opportunity structure. For example, demographic dissimilarity might be less important when individuals are strongly connected to the organization by means of a dense internal network. Similarly, an isolated member might not leave an organization if (s)he has little or no external network ties, and hence is not connected to many outside opportunities. Conversely, despite a large number of external network ties, an individual might not consider to leave the organization when her or his demographic position is close to the position of other members, resulting in strong feelings of integration. More generally, in the absence of full equivalence between demography and ties, both can be substitutes in affecting individual turnover. Again, we expect strong internal ties to have a larger moderating effect than weak internal ties. With respect to external ties, both strong and weak ties can be important, as explained above. This gives

Hypothesis 4. (a) There is a positive relationship between demographic dissimilarity and turnover when the focal person's number of internal ties is low (moderation is more pronounced for the number of strong compared to weak internal ties); (b) there is a positive relationship between demographic dissimilarity and turnover when the focal person's number of external ties is high.

METHODOLOGY

To test our hypotheses we need detailed data on demographics, networks and voluntary turnover events, including additional information to rule out alternative explanations. Collecting such, partly private, data requires full commitment and participation of the organization under study. Fortunately, one large faculty of a medium-sized university decided to grant access to all relevant career and network information for a period of eleven years (1994-2004). Specifically, from personnel files we could record entry, exit and promotion dates, information on work place features, and several demographic characteristics (such as age, gender and nationality) of each employee. This data was complemented with information from the employees' curricula vitae (e.g., educational background). Finally, internal annual reports, listing all publications of faculty members, were used to map employees' cooperative links with others through co-authorships, which was used to construct network tie measures.

We only focus on employees who are (or have been) assistant, associate or full professor at this faculty in the period of observation, including both tenured employees and those in tenure track positions. Conditional upon performance, tenure track employees obtain a permanent appointment after, generally, three or five years. Overall, these employees constitute the 'professional core' of the faculty. As core professionals have (a prospect on) long-run employment contracts, they are strongly engaged in the functioning of departments and the

faculty as a whole (cf. Pfeffer and Moore 1980). Fitting in a group, social integration and issues of (voluntary) turnover are more relevant for core faculty than for temporary staff. This is why we decided not to include research assistants and PhD students in our sample. Our sample consists of 134 core professionals (35 of whom have left the faculty within our period of observation). A few exceptions aside (see below), all information was recorded on a monthly basis.

Dependent Variable and Modeling Framework

We model voluntary exit at the individual level of analysis. Each employee is assigned a record for each month, which has value of zero if the employee has not left by the end of the month and value of one if the employee *voluntarily* leaves the faculty. The latter is basically defined as leaving before the end of the contract.[3] Employment termination because of dismissal, retirement or death is not considered in our analyses, nor is reduction to part-time employment due to other reasons than accepting a job elsewhere, such as child care-taking.

We use event history analysis to model the hazard of exit as a function of demographic (dis)similarity and network ties. The dependent variable in event history analysis is the hazard rate or the instantaneous rate of individual turnover from the organization. The rate is defined as

$$r(t) = \lim_{dt \to 0} \frac{\Pr[exit(t, t+dt) | t]}{dt} ,$$

where $r(t)$ is the hazard rate, and $\Pr[\text{exit}(t,t+dt) \mid t]$ represents the probability that an employee will leave during the interval (t, $t+dt$), given that this employee did not yet leave before t

[3] We added to this category seven employees who accepted a job elsewhere without reducing their affiliation with our focal faculty to zero. Here, we applied the rule of thumb that a reduction of an appointment to less than .5 full-time equivalents implies that the employee's primary loyalty is with the other employer. All but one of these seven cases retained appointments at our focal faculty of 30 per cent or less, the one exception keeping a 40 per cent affiliation. Robustness analyses without this latter case produce results very similar to the ones reported here.

(Blossfeld and Rohwer 2002, p. 32-33). In our study, the time variable refers to an individual's organizational tenure. The tenure clock starts ticking from the moment an employee is appointed to a core position in the faculty (i.e., as an assistant, associate or full professor), irrespective of whether this involves a tenure track position or a permanent position without probation period.

With respect to the duration (in this case, tenure) dependence of the rate, event history analysis can take several routes. Non-parametric specifications imply no assumptions about the distribution of event times. In parametric models, in contrast, the dependence of the hazard rate on time is fully specified. One such parametric method involves breaking the time variable (in this case, tenure) into fixed intervals, the so-called pieces, and to fit constant rates within each interval (Blossfeld and Rohwer 2002; Carroll and Hannan 2000; Tuma and Hannan 1984). This method is referred to as the piecewise exponential rate model, which "constrains temporal variation in the rate to be a step function in duration" (Carroll and Hannan 2000, p. 136). It is widely used because it offers a very flexible way to incorporate temporal variation in hazard rates without the need to make strong assumptions on the specific form of duration dependency (Blossfeld and Rohwer 2002). Intervals are inductively selected by carefully looking at the data. It allows to take into account that events may be more common in specific (tenure) intervals than in others. The piecewise exponential rate model can be represented by

$$r(t) = \exp(\alpha_l + A\alpha),$$

where α_l is a constant coefficient associated with the lth tenure period, A is a row vector of covariates, and α is an associated vector of coefficients (Blossfeld and Rohwer 2002; Carroll and Hannan 2000). In the present analysis, we split the employees' organizational tenure, based on visual inspection of the cumulative hazard function, into five pieces to describe the tenure dependence of the exit rate. These pieces are (in months):]0, 36[, [36, 60[, [60, 108[, [108, 132[

and [132, ∞]. Sensitivity analyses (including Cox proportional hazard rate models, where the duration dependence of the rate is not specified at all) reveal that the findings do not depend on our interval choice.

Because the covariates vary over time, they were updated at the beginning of each month (or year, when monthly information was not available: see below for details). Time-varying covariates imply repeated observations for the same person. As a result, the assumption of independence of observations is untenable, which means that the conventional estimate of the variance-covariance matrix of the coefficients (including the standard errors) is not appropriate. Therefore, we estimate and report robust standard errors based on the Huber/White/sandwich estimator of variance, which takes the clustering of observations on persons into account. We use STATA to estimate the vector of parameters with the method of maximum likelihood.

Focal Independent Variables

We constructed two focal independent variables. Following Tsui et al. (1992; 1989), we collected demographic information about tenure, age, nationality and education to generate dissimilarity indices,[4] whilst network tie variables were constructed using information on co-authorships. Demographic dissimilarity variables were updated monthly, and network tie variables on a yearly basis. We use the academic department to which a person belongs as the reference group for calculating a focal individual's *demographic distance* vis-à-vis the other group members. In most universities, departments are organized around recognizable disciplines, grouping together people with relatively similar fields of expertise. In many faculties (including the one under study), the department is the lowest level in the hierarchical structure, with clearly

[4] We did not include a focal individual's gender dissimilarity in the analyses as gender (male = 1, and female = 0) and dissimilarity appeared to be strongly correlated (-.72), causing problems of multicollinearity.

defined task responsibilities and decision power. As a result, the department can be regarded as the most salient and recognizable entity to define a person's demographic position relative to colleagues. For *network ties*, the faculty is the benchmark for distinguishing external from internal links, as turnover is defined at the faculty and not at the department level.

In measuring demographic distance, a distinction needs to be made between continuous and categorical demographic variables. For our continuous demographic characteristics *age* and *tenure*, we assess an individual *i*'s distance to the other department members with the mean squared Euclidean distance to each group member *j*, which is

$$\sqrt{\frac{\sum (X_i - X_j)^2}{(n-1)}} \quad ,$$

where X_i refers to the (continuous) demographic characteristic of the focal individual *i*, X_j denotes the (continuous) demographic characteristic of department member *j* ($i \neq j$), and *n* is the total number of department members. This operationalization is common in organizational demography research (Boone, van Olffen, van Witteloostuijn, and De Brabander 2004; Wagner et al. 1984; Westphal and Zajac 1995).

For our categorical demographic variables *nationality* and *educational background*, we calculate the squared proportion of members with the same background, and subtract this from one. Hence, we have

$$1 - P_i^2,$$

where P_i^2 is the squared proportion of group members that share the same background as focal individual *i* (Boone et al. 2004; Westphal and Zajac 1995). As for nationality, we distinguish between 18 categories, including European countries such as Belgium, Germany and Great-Britain, and non-European regions such as America and Australia. With respect to education, we

distinguish 15 disciplines, among which economics, mathematics, engineering, physics, political sciences, and law.

The dissimilarity indices indicate the extent to which a person is different from the other department members with respect to tenure, age, nationality and education. Although we expect that dissimilarity generally increases the likelihood of turnover, the effect sizes of these different isolation scores may differ somewhat. For instance, employees in an academic context might show relatively high levels of tolerance toward colleagues with different nationalities and educational backgrounds, by the very nature of their profession. In contrast, differences in tenure may well be associated with strong cohort effects as far as firm-specific knowledge, experiences and values are concerned, hampering across-cohort communication and cohesion (e.g., Pfeffer 1985; Williams and O'Reilly 1998). Especially tenure dissimilarity might thus be a very important driver of individual turnover (see also Harrison and Carroll 2006). Given this logic, we ran analyses with all demographic similarity dimensions separately.

However, an alternative argument is that turnover is affected by an individual's multi-dimensional distance *vis-à-vis* other members. Specifically, especially individuals that are atypical on several demographic dimensions simultaneously may feel particularly isolated, boosting the likelihood of turnover. This logic is consistent with the faultlines literature (e.g., Lau and Murnighan 1998; Molleman 2005), which stresses the importance of the coalescence of demographic attributes in describing group structure, and in understanding tension and conflict. Therefore, we also calculated an *overall* individual's dissimilarity score by standardizing all four dissimilarity scores, and subsequently calculating the average.

Network information was retrieved from comprehensive listings of the publication output of all faculty, using information on co-authorships. Each core employee's publications (excluding working papers) were listed in annual overviews of research output (per department). We prefer

these overviews to publications listed in the Web of Science, because we now have information about the network ties of all employees, including those who have not published in outlets listed in the Web of Science. Following the lead of earlier work (e.g., Frenken, Hölzl, and De Vor 2005; Oh, Choi, and Kim 2005), we use information on the focal employee's co-authors (within a given time period) to map important features of this individual's network. A disadvantage of this method is that we do not capture an individual's entire salient network. Our data are restricted to professional network ties only. Although we do not underestimate the importance of friendship relations at work (cf. Podolny and Baron 1997), a focus on professional relationships seems warranted in the present context. Professional employees are highly motivated to achieve professional excellence (e.g., May, Korczynski, and Frenkel 2002; Pelz and Andrews 1966), making professional ties of primary importance. A major advantage of using this co-authorship information is that we are able to map a professional's network for long periods of time. The often-used alternative, where individuals are asked to list their major network ties (e.g., Carroll and Teo 1996; Cross and Cummings 2004; Ibarra 1995), would not be feasible in our retrospective longitudinal context.

Two features of network ties are measured. First, the *size of the network* is assessed by counting the number of different co-authors a person published with in a given year. In doing so, we make a distinction between *internal* and *external* ties. A tie is coded as internal when the co-author also works in our focal faculty, and as external otherwise. To distinguish *weak* from *strong* ties we decompose an individual's total number of unique (internal and external) ties at time *t* into strong and weak ties based on the extent to which the tie is enduring over time. We adopt a three-year window to do so. A three-year window is enough to discern stable cooperation over time. A longer time window would imply loosing too many observations at the beginning of our observation period. We illustrate our measures with the fictive example presented in Figure

II, which lists the co-authors with whom a focal person published in the years 2002, 2001 and 2000, including the number of yearly publications realized with each co-author.

[Insert Figure II about here]

The *number* of *internal* and *external* unique professional ties for this person in year 2002 is three and two, respectively. Of these ties, we define strong ties as co-authors with whom the focal person also worked in the two years prior to 2002. In this example, there is only one strong external tie (i.e., the tie with co-author A) and not a single strong internal tie. All co-authors with whom the individual worked in one additional year prior to 2002 are labeled as semi-strong. We count two semi-strong internal ties (with co-authors C and E) and zero external semi-strong ties. All other ties are 'new' in 2002, and are therefore regarded as weak (one internal and one external weak tie, with co-authors D and B, respectively). All network tie variables are lagged twelve months. So, we assume that it takes about one year for the effect of network-driven pull factors to be fully effectuated (i.e., job switch). Note that the network variables are updated on a yearly basis, as monthly information is not available.

Control Variables

First, as turnover events are generally clustered at the end of the academic year, we include a dummy variable *September*. Second, we control for *faculty size* (the number of academic staff employed by the faculty) as an indicator of the faculty's well-being. Third, we add four departmental characteristics that might impinge on turnover: *department size*, (lack of) *promotion opportunities* within the department, departmental *rate of turnover* during the previous month, and *mean tenure* of the members of the department. The latter two variables are indicators of the relative stability of the social system, which is known to affect social integration and the likelihood of turnover (Sampson 1991). We take on board an estimate of a focal individual's

(lack of) *promotion opportunities* within the department. For assistant (associate) professors, this variable is the ratio of associate (full) and assistant (associate) professors. These ratios capture crowding in positions one level above the focal person's position in the department. For full professors, this variable is set at zero.[5]

Finally, we computed a series of individual-level variables describing a person's background and career. Following Jackson et al. (1991), we include an individual's *age* and *gender*. We construct two dummies to control for a person's *nationality*: one dummy equals one for persons with a nationality from one of the faculty countries' neighboring countries, and the other equals one for persons with another foreign nationality. The reference category is the nationality of the home country of the focal faculty, in both cases. A dummy variable indicates whether the employee has obtained her or his *PhD* in our focal faculty. We add prior *organizational tenure at entry* in a core faculty position, as employees may have worked in temporary positions in the focal faculty (e.g., as a research assistant or PhD student) before they entered into these core positions. Both variables might indicate strong local commitment. We created dummy variables (*Associate professor* and *Full professor*) to control for an employee's position, with *Assistant professor* as the reference category. *Positional tenure*, which is the time (in months) since the last promotion, is taken on board to account for the possibility that an individual might search for a better position elsewhere when her or his internal career is blocked. An individual may also be pulled out of our focal faculty if (s)he performs above average. To control for this, we include the yearly *number of publications* produced by the focal individual. In counting these publications, we only consider Web of Science publications and other publications

[5] For privacy reasons, we were not able to collect information on salaries, which could also affect turnover ((Gibbons 1997). Note, however, that salary levels in the home country of the focal faculty are highly regulated, implying that their impact on exit motivation is, in all likelihood, extremely low, given that by far the majority of job moves were national.

that the faculty considers to be of high quality.[6] All control variables are updated on a monthly basis, except for the number of publications.

Structure of the Data

Figure III provides a visual representation of the structure of the data. Actual turnover is observed some time *after* the employee has decided to leave. Generally, this period is about three months. Therefore, the control variables (except for the dummy variables, such as the *September* and both nationality dummies) were lagged with a period of three months. We determined the lag structure of the focal independent variables, dissimilarity indices and network tie measures, as follows. As demographic distance, on the one hand, constitutes a *push* factor, we expect its effects to be relatively instantaneous, therefore lagging it with three months. Network ties, on the other hand, *pull* individuals away from the employing organization through the creation of (awareness of) new job alternatives. It is likely that it takes more time for these effects to materialize fully. Therefore, we opt for a lag of one year (12 months) for the measures of network ties. Sensitivity analyses show that, by and large, the results are robust when using different lag structures for the core independent variables (available upon request).

[Insert Figure III about here]

RESULTS

Table I reports the descriptive statistics and correlations among all variables under study, and Table II provides the estimates of the piecewise exponential rate models.

[Insert Tables I and II about here]

[6] Our focal faculty uses an internal research outlet list for performance evaluation and budget allocation purposes, ranking publications from high to low in terms of quality. We count all publications on this list that were ranked as so-called A, B and C-publications – i.e., articles in international journals, book chapters and non-English articles.

In Model 1, the results of the baseline model are presented. The estimates of the tenure pieces reveal a U-shaped relation with exit, with a decreasing rate up until about eight years, increasing again afterwards. Apparently, there is relatively high turnover in the first three years of peoples' careers, and after eight years when academics are fully developed. This pattern seems to be consistent with the idiosyncrasies of academic careers. The exit rates are especially high in September, as expected. And also the lack of promotion opportunities spurs exit (albeit the coefficient is only marginally significant). Not surprisingly, foreign core faculty with non-neighboring country nationalities is more likely to leave, probably because they are more mobile to begin with. Organizational tenure at entry, signaling local commitment, does indeed decrease turnover. Finally, the positive effect of the number of publications shows that productive researchers are more likely to leave.

In Model 2, we test for the main effects of the demographic distance variables, which were lagged three months. Tenure dissimilarity has a strongly positive and significant effect on the hazard of turnover. A unit increase in tenure dissimilarity increases the hazard of turnover with two per cent ($e^{.02} = 1.02$). The exit rate is approximately twice as high for persons with a dissimilarity score of one standard deviation above the mean (i.e., 109.44), as compared to people with an average dissimilarity score of 75.33 (compare $e^{.02*75.33} = 4.51$ with $e^{.02*109.44} = 8.92$). The estimates of the other dissimilarity scores (age, nationality and education) are all positive but not significant. Model 3 reveals that the effect of our overall indicator of demographic distance is positive and significant, as expected.

In Models 4 and 5, we estimate the effects of our network tie variables, which are lagged one year, on turnover. Model 4 reveals that the total number of internal and external network ties does not significantly affect turnover. In Model 5 we zoom in on the network effects more closely by decomposing the number of internal and external ties in strong, semi-strong and weak ties.

This model shows that only the number of strong external ties has a large significantly positive effect on turnover (the effect of strong internal ties is negative, but not significant). Specifically, one additional strong external network tie almost doubles the rate of turnover ($e^{.59} = 1.80$). Interestingly, the results reveal that semi-strong and weak ties do not affect turnover; only strong external ties seem to matter.

To limit the size and complexity of the models we focus on overall dissimilarity in the remaining analyses because this variable turned out to be the main driver of turnover in the previous analyses.[7] Hypotheses 1 and 2 are tested by adding the decomposed internal and external network tie variables, respectively, to Model 3, which includes the dissimilarity index. Models 6 and 7 reveal that there is no evidence of mediation as the coefficient of the dissimilarity index is not affected by the inclusion of the tie variables. Finally, we tested for interaction effects (Hypothesis 4) between the dissimilarity index and all our network tie variables (see Table III). The interaction between overall demographic dissimilarity and strong internal ties is negative and significant (Model 8), suggesting that the positive impact of demographic distance on turnover decreases as the person has a higher number of strong internal network ties. Furthermore, the positive interaction between dissimilarity and weak internal network ties (Model 10) suggests that weak internal ties are not sufficient in retaining demographically different people within the organization. Finally, the interaction between the overall dissimilarity score and semi-strong external network ties (Model 12) indicates that isolated individuals show a higher likelihood to leave when they have some external ties, possibly evolving towards strong network ties. All the other product terms are not significant.

[Insert Table III about here]

[7] All these analyses were also run with tenure dissimilarity instead of our dissimilarity index. The results are almost exactly the same (available upon request).

Taken together, the results of these analyses suggest that *demographic distance* and *strong external ties* contribute independently in predicting turnover, supporting Hypothesis 3a and 3c, without any evidence for mediation (Hypotheses 1 and 2). Moreover, our results show that *overall demographic distance* and *strong internal ties* interact in determining individuals' decisions to leave, which is in support of Hypothesis 4a. The interaction between overall demographic distance and semi-strong external ties is consistent with Hypothesis 4b, but does not provide full support for this prediction.

DISCUSSION

In this paper, we integrated two important strands of literature on the determinants of individual turnover into one overarching theoretical framework. We studied how demographic distance and network ties combine to impact on an employee's decision to stay with or to leave the current organization. The purpose of our effort is to contribute to the ongoing debate in the turnover literature concerning the relative explanatory power of psychological theories focusing on demographic distance versus sociological theories that emphasize network ties between individuals (Reagans et al. 2004, p. 101).

Our results show that overall demographic distance positively affects the likelihood of turnover. Detailed analyses reveal that especially tenure dissimilarity seems to drive this finding. It is well-established in the literature that tenure-related cohort differences are associated with fundamental differences in perception with respect to organizational norms and routines, which hampers cohesion and communication, ultimately spurring turnover (e.g., Wagner et al. 1984; Williams and O'Reilly 1998). Interestingly, the main effects of being isolated on the other demographic features age, nationality and education turned out not to be significant. We speculate that in knowledge-producing academic settings, diversity on these general features

might actually be valued positively, potentially offsetting the negative consequences of being 'atypical' on these characteristics.

With respect to network ties, our results show that it is not so much the overall size of the network that affects turnover, but rather the extent to which individuals have *strong external* ties. Specifically, academics that have *enduring* collaborative ties with co-authors from other universities are much more likely to leave than their colleagues without such ties (even after controlling for research productivity). At least two, not mutually exclusive, reasons can be offered to explain this importance of strong external ties.

One possibility can be found in the observation that trust and reciprocity are important features of successful scientific collaboration. Such trust and reciprocity gradually develop in the course of repeated interaction and collaboration. As a result, strong enduring ties are extremely valuable for academic professionals. If these ties happen to be external, organizational members might be pulled toward the organization to which their strong ties belong. In other words, strong external ties might drive 'targeted mobility'. Employees move toward their strong ties as this may further facilitate and enhance collaboration. In contrast, weak network ties imply relatively irregular or non-systematic collaboration events. In this case, the advantages of leaving are not very clear, and may not outweigh the perceived cost of turnover. To test this 'targeted mobility' hypothesis, we would need to have detailed information about where people who left actually went to, which we could unfortunately not obtain in many of our turnover cases. Tracing the career mobility of professional employees, thereby taking into account where new employees come from and where leavers go to, would prove an interesting topic for future research.

Another more general explanation is that especially *strong external* network ties tend to increase a person's visibility and reputation in the academic world, more so than internal ties and/or weak external ties, with important spill-over effects for this individual's career

opportunities. Published work, whether it is realized with external or internal ties, always increases the author's visibility in academia. However, *external* ties might be of higher status, as cooperation with outside colleagues *per se* is highly valued in most European universities. In addition, *strong* external ties, which imply mutual trust, are more likely than weak external ties to create additional opportunities of all kind, such as invited lectures, keynote speeches and visiting scholarships. All these activities contribute to the focal individual's curriculum vitae, generating new job opportunities, regardless of the physical location of the strong external ties.

Remarkably, we did not find a significant negative effect of strong internal ties on the hazard of turnover. One explanation for this non-finding may be found in the operationalization of network tie variables. Specifically, as we have focused on professional ties, we have no information on the relation between friendship ties at work and individual turnover. Friendship ties, however, can be expected to have a strong impact on individual turnover. Although professional and friendship ties may often be closely related (Podolny and Baron 1997), we believe that academic employees can have a number of friendship ties over and beyond their professional ties, and that friendship ties may be important in predicting individual turnover (cf. Feeley et al. 2008; Moynihan and Pandey 2008).

We did find some interesting interactions between network tie variables and the demographic distance score, however. The results suggest that the higher likelihood of turnover for demographically isolated people can be reduced by having strong internal network ties. Weak internal network ties, in contrast, seem to increase the likelihood of turnover even further (as indicated by the positive interaction between demographic distance and weak internal ties). Finally, the positive interaction between demographic distance and semi-strong external ties shows that the likelihood of exit of demographically isolated employees increases with these employees' access to other job opportunities. Taken together, these results suggest that both

embeddedness or integration *and* opportunities for professional growth drive individual turnover. On the one hand, turnover of isolated employees can be reduced if these employees are able to achieve professional goals within the organization (through strong internal ties). On the other hand, turnover of isolated people will be enhanced if these employees have no opportunities for professional achievement within the organization, and if they have external connections that may allow them to achieve professional growth. Remarkable is that semi-strong ties are sufficient to pull an individual out of the organization.

Our research results were not in support of the equivalence model of demography and network ties. This result contributes to the literature for at least two reasons. First, confronting our findings with earlier work hints at what might be the boundaries of application of the pure network-based homophily model. As already touched upon above, the latter theory might be particularly applicable to the context of voluntary organizations, in which demographically defined social networks are important for recruitment, selection and retention of organizational members (cf. McPherson et al. 1992, p. 157). Clearly, in an academic context, social interaction is less confined by local organizational boundaries. Knowledge creation implies interaction with other professionals in a much larger community, belonging to the same but also to different organizations, nationally and internationally. Academics' reference group, therefore, not only consists of local colleagues, but also of alters with similar expertise elsewhere in the academic world, irrespective of location. This implies that identification processes are both local and global, where the latter are gaining importance due to advances in communication technology (cf. Van Alstyne and Brynjolfsson 2005), the increasing emphasis on research excellence, and the internationalization trend.

The implication is that a person's demographic position within the organization does not necessarily define her or his internal and external network ties in such settings. This does not

imply that local demographic similarity is not important for professionals – on the contrary. Our findings show that being similar clearly affects the willingness to stay, presumably by facilitating day-to-day interaction and fulfilling a person's need to belong. Interestingly, the tendency of isolated individuals to leave is countered when the focal person has strong internal ties (as shown by the interaction between dissimilarity and strong internal ties). This finding has important implications for the management of diversity of professional organizations and universities: by stimulating long-run collaboration among colleagues, turnover can be prevented.

Second, and more generally, our findings underscore that a comprehensive understanding of the behavior of professional social systems requires the study of both a system's demographic composition and its members' (internal and external) network ties (Balkundi and Harrison 2006; Reagans et al. 2004). Similarly, Balkundi and Harrison (2006, p. 62) concluded their recent meta-analysis on network structure and team functioning by pointing to the "need for theory that *simultaneously* accounts for attribute and structural (relational) influences on team effectiveness. Those influences might be parallel and independent, interactive, or serial." In our study, we found interesting interaction effects between demographic position attributes (demographic distance) and network ties. Obviously, much more work is needed to unravel the interplay between these influences in different contexts. We believe that future research will benefit much from building bridges between demography and network research, combining psychological and social explanations of turnover.

This study is not without limitations, of course. These limitations point to interesting avenues for further research. Firstly, the fact that we focus on one case obviously limits the generalizability of our findings. As it is extremely time consuming to collect detailed longitudinal data on both demographic features *and* network ties, we were only able to study one case. Notwithstanding this caveat, we do think our case is revealing. For one, it serves as a benchmark

case, showing that in an academic professional setting (unlike in voluntary organizations) demographic distance and strong external network ties generate independent effects on turnover. Moreover, our case points to the need to develop more comprehensive demographic and network theories that specifically apply to the mobility of professionals. In this respect, our findings suggest that such theories should focus on how demographic features and network ties relate to the tension between an individual's local (organizational) and global (professional) embeddedness, which is so typical for many professional settings.

Secondly, it would be interesting to find out whether academics tend to form ties more often with colleagues who are demographically similar (cf. McPherson et al. 1992). If that would indeed be the case, it is possible that the operation of the similarity-attraction principle is not constrained by local organizational boundaries, as people also develop an external tie network based on similarity. We did not directly study the link between demographic distance and the tie formation process due to the absence of information about the external partner's demographic characteristics. Even if such data would have been available, however, analysis of the (external) tie formation process would be extremely complicated as one cannot observe the features of the persons not selected in the network.

Thirdly, for the sake of parsimony, we focused on the interplay between demographics and networks. It would be interesting to find out how organizational characteristics, such as culture and HRM policy (or changes of these characteristics over time), moderate the impact of both focal demographic distance and network tie variables. In this respect, Chatman et al. (1998) argued that demographic characteristics may be especially important if there is no other salient basis for identification (cf. 'functional antagonism'). Via the HRM policy and the organizational culture, organizations can stimulate employees' identification with the organization *per se*, irrespective of the demographic composition of its members. For instance, we speculate that the

impact of demographic distance and external network ties on turnover might be smaller in so-called 'high-commitment' organizations, where fit between employees and organization is strongly emphasized, than in 'star organizations', where the focus is on excellence and individual development (cf. Baron and Hannan 2002). As star organizations do not intend to create a strong common bond, (visible) demographic characteristics of people belonging to the same organization might become more salient in the local identification process of professionals. At the same time, we would also expect that employees of star organizations will be more sensitive to the pull force of external ties, because professional identification probably dominates local identification in such organizations.

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FIGURE I. Demographic dissimilarity, network ties and turnover

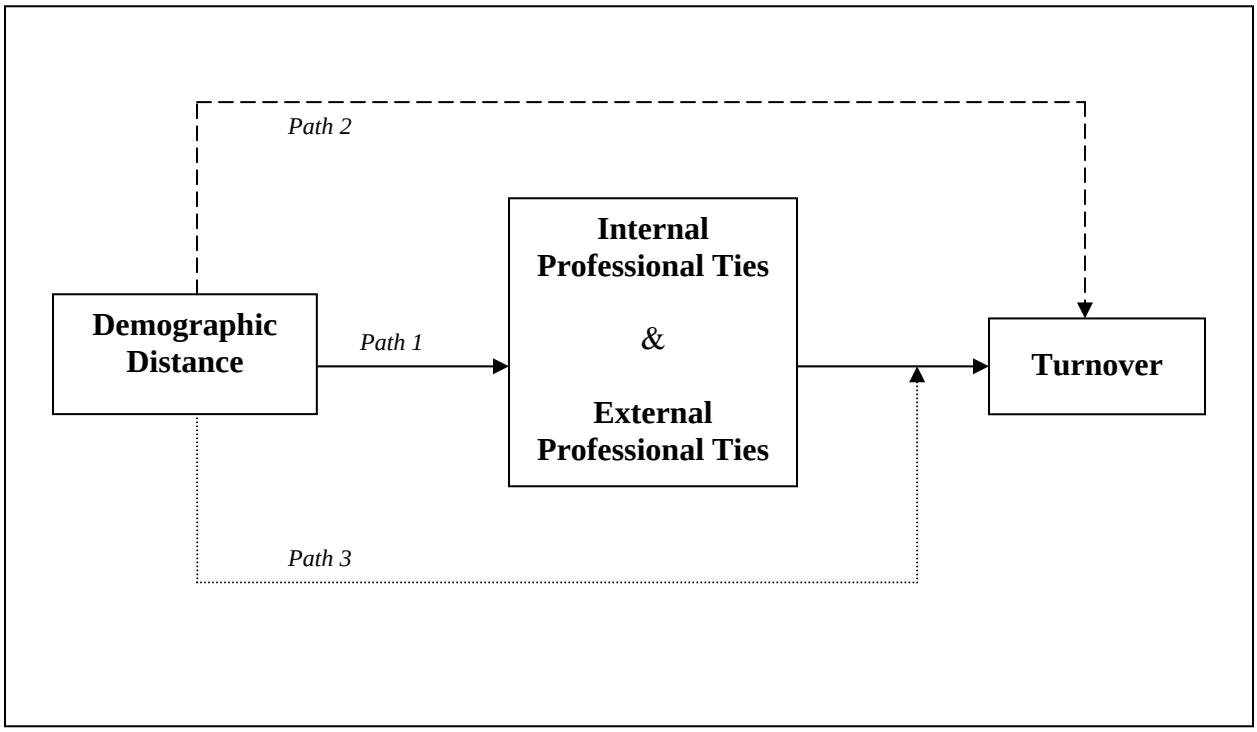

FIGURE II. Example of the operationalization of network ties

		Internal	External
		Frequency of collaboration	
2002	Co-author A		3
	Co-author B		1
	Co-author C	1	
	Co-author D	1	
	Co-author E	1	
2001	Co-author A		3
	Co-author F		1
	Co-author G	1	
2000	Co-author A		1
	Co-author C	2	
	Co-author G		1
	Co-author E	1	
	Co-author H	1	

Counting the ties

	Internal	External
Weak	1	1
Semi-strong	2	0
Strong	0	1

FIGURE III. Structure and measurement of the data

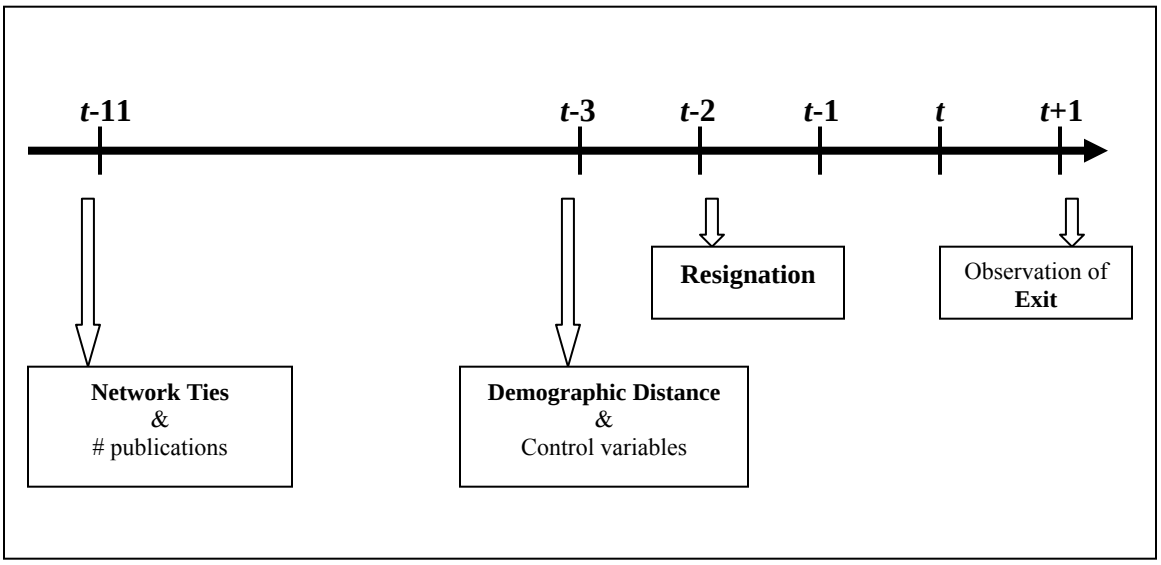

TABLE I. Descriptive statistics and bivariate correlations

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. September	.08	.28	1												
2. Faculty size	95.92	7.52	.01	1											
3. Department size	8.27	4.28	-.001	.09*	1										
4. Rate of turnover	.01	.03	-.06*	-.03*	.04*	1									
5. Mean tenure	88.80	36.56	.01	.17*	-.48*	-.06*	1								
6. Lack of prom. opport.	.51	.74	-.002	.03*	-.01	-.01	.03*	1							
7. Age	42.46	8.31	-.01	.11*	-.43*	-.02	.41*	-.07*	1						
8. Gender	.90	.30	-.001	-.08*	-.06*	.01	.10*	-.19*	.27*	1					
9. Nationality (neighbor)	.16	.37	.003	.05*	-.10*	-.01	.21*	-.09*	-.04*	-.10*	1				
10. Nationality (other)	.05	.22	-.001	.01	-.02	.0002	-.12*	.02	.01	-.10*	-.10*	1			
11. Organ. tenure at entry	58.95	40.00	-.004	-.08*	-.15*	-.02	.35*	.03*	.46*	.28*	-.20*	-.14*	1		
12. Associate professor	.28	.45	.002	-.02	-.10*	.02	-.05*	.53*	.01	-.09*	-.04*	.12*	-.05*	1	
13. Full professor	.34	.47	-.0004	.03*	-.09*	.01	.07*	-.47*	.32*	.24*	.001	-.10*	.22*	-.45*	1
14. PhD	.43	.50	-.003	-.02	.37*	-.003	-.24*	.06*	-.29*	-.002	-.27*	-.20*	.30*	-.09*	-.12*
15. Positional tenure	53.42	32.12	.01	.24*	-.18*	-.02	.32*	-.16*	.62*	.16*	-.04*	-.02	.33*	-.14*	.12*
16. # publications (lagged)	1.94	2.61	-.01	-.20*	-.10*	.03*	-.02	-.12*	-.04*	.10*	.02	-.03*	-.02	-.005	.27*
17. Tenure dissimilarity	75.33	34.11	.01	.36*	-.14*	.005	.19*	-.02	.27*	.13*	-.07*	-.01	.33*	-.08*	.19*
18. Age dissimilarity	12.33	25.81	.02	-.09*	.02	.08*	-.05*	-.01	.01	.03*	-.05*	.05*	-.001	.02	-.01
19. Nationality dissimilarity	.50	.31	.002	.15*	-.03*	.02	-.03*	.01	-.01	-.19*	.49*	.35*	-.15*	.08*	-.03*
20. Education dissimilarity	.42	.33	-.01	-.14*	.12*	.01	-.28*	.02	.07*	-.08*	-.14*	.07*	.02	-.01	-.04*
21. Dissimilarity index	.004	.48	.01	.14*	-.01	.06*	-.08*	.002	.17*	-.06*	.11*	.22*	.10*	.001	.05*
22. # internal ties	1.09	1.47	-.004	-.13*	-.02	.03*	.06*	-.16*	-.03*	.14*	.03*	-.12*	.10*	-.09*	.35*
23. # external ties	1.60	2.27	.001	-.03*	-.16*	.03*	-.02	-.08*	-.01	.04*	.02	-.06*	-.09*	-.01	.28*
24. Strong internal ties	.27	.63	.001	.0004	-.04*	.02	.04*	-.09*	-.03*	.14*	.02	-.07*	.01	-.04*	.22*
25. Strong external ties	.13	.48	.002	.05*	-.04*	.02	-.05*	-.09*	-.01	.06*	-.01	-.01	-.08*	-.08*	.22*
26. Semi-strong int. ties	.33	.71	-.002	-.11*	-.05*	.02	.05*	-.15*	-.02	.09*	-.001	-.11*	.06*	-.09*	.27*
27. Semi-strong ext. ties	.42	.48	-.004	.04*	-.11*	.02	-.03*	-.06*	-.02	.01	-.002	-.04*	-.15*	-.001	.19*
28. Weak internal ties	.49	.84	-.005	-.13*	.03*	.02	.03*	-.09*	-.01	.06*	.03*	-.07*	.12*	-.04*	.22*
29. Weak external ties	1.04	1.68	.003	-.07*	-.15*	.02	.004	-.06*	.01	.03*	.03*	-.05*	-.01	.01	.20*

TABLE I (continued). Descriptive statistics and bivariate correlation

	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
14. PhD	1															
15. Positional tenure	-.18*	1														
16. # publications (lag)	-.05*	-.10*	1													
17. Tenure dissimilarity	-.02	.35*	-.08*	1												
18. Age dissimilarity	-.004	.03*	.01	.03*	1											
19. Nationality dissimilarity	-.21*	-.03*	-.06*	-.03*	-.04*	1										
20. Education dissimilarity	.14*	.01	.04*	-.01	-.01	.15*	1									
21. Dissimilarity index	-.04*	.18*	-.04*	.50*	.43*	.52*	.58*	1								
22. # internal ties	.003	-.07*	.56*	-.01	.05*	-.09*	-.04*	-.04*	1							
23. # external ties	-.15*	-.02	.57*	.04*	.04*	-.06*	.01	.01	.33*	1						
24. Strong internal ties	-.04*	-.07*	.38*	.07*	.07*	-.05*	-.09*	-.001	.63*	.24*	1					
25. Strong external ties	-.08*	.04*	.30*	.09*	.03*	-.05*	-.02	.02*	.24*	.45*	.26*	1				
26. Semi-strong int. ties	-.04*	-.02	.42*	-.05*	.03*	-.09*	-.06*	-.08*	.68*	.22*	.25*	.19*	1			
27. Semi-strong ext. ties	-.11*	-.03*	.40*	.06*	-.01	-.06*	-.02	-.01	.20*	.63*	.16*	.24*	.23*	1		
28. Weak internal ties	.07*	-.05*	.35*	-.03*	.01	-.04*	.04*	-.01	.70*	.21*	.13*	.06*	.15*	.03*	1	
29. Weak external ties	-.11*	-.02	.47*	-.004	.05*	-.03*	.02	.01	.27*	.88*	.17*	.19*	.11*	.24*	.24*	1

Note: The dissimilarity scores were lagged with a period of three months, whereas the network variables (as well as the number of publications) were lagged with a period of one year.

TABLE II. Piecewise constant rate models of individual turnover

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Tenure 0-36 months	-2.82 (2.64)	-2.96 (2.63)	-2.81 (2.56)	-2.97 (2.69)	-3.65 (2.78)	-3.39 (2.61)	-3.02 (2.63)
Tenure 36-60 months	-3.24 (2.47)	-3.17 (2.47)	-3.21 (2.37)	-3.32 (2.52)	-3.90 (2.61)	-3.69 (2.43)	-3.34 (2.46)
Tenure 60-108 months	-3.44 (2.71)	-3.21 (2.63)	-3.41 (2.57)	-3.55 (2.78)	-4.08 (2.86)	-3.80 (2.62)	-3.60 (2.65)
Tenure 108-132 months	-2.32 (2.83)	-2.18 (2.74)	-2.36 (2.67)	-2.46 (2.91)	-2.88 (2.95)	-2.68 (2.72)	-2.54 (2.72)
Tenure >132 months	-2.24 (2.91)	-2.27 (2.71)	-2.20 (2.73)	-2.38 (2.97)	-2.85 (2.99)	-2.57 (2.76)	-2.30 (2.76)
September	1.01** (.42)	.98** (.42)	.97** (.42)	1.01** (.42)	1.01** (.41)	.99** (.42)	.96** (.42)
Faculty size	-.04* (.03)	-.06* (.03)	-.04* (.03)	-.04* (.03)	-.03 (.03)	-.03 (.03)	-.04~ (.03)
Department size	.05 (.06)	.05 (.06)	.05 (.06)	.04 (.06)	.03 (.06)	.04 (.06)	.04 (.06)
Rate of turnover	-4.74 (9.26)	-5.83 (9.45)	-6.63 (9.69)	-4.83 (9.27)	-5.06 (9.56)	-6.33 (9.58)	-6.91 (9.87)
Mean tenure	-.001 (.01)	-.004 (.01)	.0005 (.01)	-.001 (.01)	-.001 (.01)	-.001 (.007)	.004 (.01)
Lack of promotion opport.	.31~ (.21)	.24 (.21)	.28 (.21)	.31~ (.21)	.27 (.23)	.28 (.23)	.25 (.22)
Age	.02 (.04)	.03 (.04)	.02 (.04)	.02 (.04)	.02 (.04)	.01 (.04)	.02 (.04)
Gender	-.22 (.48)	-.35 (.50)	-.19 (.47)	-.23 (.49)	-.17 (.49)	-.05 (.47)	-.27 (.46)
Nationality (neighbor)	.24 (.49)	.02 (.62)	.03 (.49)	.29 (.51)	.19 (.49)	.01 (.49)	.01 (.48)
Nationality (other)	1.31** (.55)	.93 (.72)	.94* (.57)	1.42** (.57)	1.36** (.57)	1.01* (.58)	.86 (.59)
PhD	1.03* (.53)	1.12* (.60)	1.06* (.53)	1.05* (.54)	1.04* (.56)	1.00* (.54)	1.13* (.54)
Organ. tenure at entry	-.02** (.01)	-.03** (.01)	-.02** (.01)	-.02** (.01)	-.02** (.01)	-.02** (.01)	-.02** (.01)
Associate professor	-.17 (.59)	-.23 (.60)	-.15 (.59)	-.21 (.59)	-.19 (.58)	-.22 (.58)	-.12 (.60)
Full professor	-.42 (.66)	-.70 (.68)	-.46 (.65)	-.56 (.68)	-.74 (.69)	-.61 (.67)	-.61 (.68)
Positional tenure	.03 (.03)	.04 (.03)	.03 (.03)	.03 (.03)	.03 (.03)	.02 (.03)	.04 (.03)
Positional tenure squared	-.0002 (.00)	-.0003(.0002)	-.0003(.0002)	-.0002(.0002)	-.0003(.0002)	-.0002 (.0002)	-.0003 (.0003)
# publications (lag)	.14** (.05)	.16** (.07)	.15** (.06)	.10~ (.07)	.11 (.08)	.13* (.06)	.15** (.07)
Tenure dissimilarity		.02** (.01)					
Age dissimilarity		.004 (.004)					
Nationality dissimilarity		.49 (.89)					
Education dissimilarity		.36 (.62)					
Dissimilarity index			.70** (.34)			.76** (.32)	.67* (.36)
# internal ties (lag)				.14 (.13)			
# external ties (lag)				.02 (.09)			
Strong internal ties (lag)					-.42 (.36)	-.47 (.36)	
Strong external ties (lag)					.59* (.26)		.51* (.31)
Semi-strong internal ties (lag)					.25 (.23)	.32 (.22)	
Semi-strong external ties (lag)					-.12 (.19)		-.15 (.20)
Weak internal ties (lag)					.25 (.21)	.22 (.19)	
Weak external ties (lag)					-.01 (.12)		-.04 (.12)
Log Likelihood	-49.48***	-.45.15***	-47.11***	-48.98***	-45.94***	-44.95***	-45.73***

Number of observations is 6475; Number of subjects is 134; Number of exits is 35.

* p < .05, ** p < .01, *** p < .001, and ~ is marginally significant (p < .1); Robust standard errors are reported in parentheses.

TABLE III. Piecewise constant rate models of individual turnover – Interactions between dissimilarity and network ties

	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Dissimilarity index	.93** (.35)	.62 (.44)	.24 (.47)	.81* (.40)	.37 (.34)	.94** (.37)
Network Ties						
Strong internal ties (lag)	-.37 (.35)	-.48 (.35)	-.43 (.31)			
Strong external ties (lag)				.51* (.29)	.62* (.28)	.52* (.31)
Semi-strong internal ties (lag)	.31 (.24)	.28 (.21)	.31 (.21)			
Semi-strong external ties (lag)				-.18 (.20)	-.27 (.27)	-.16 (.20)
Weak internal ties (lag)	.22 (.19)	.20 (.20)	.10 (.24)			
Weak external ties (lag)				-.02 (.12)	-.04 (.12)	-.01 (.11)
Interactions						
Diss. * Strong internal ties	-.58* (.32)					
Diss. * Semi-strong internal ties		.27 (.27)				
Diss. * Weak internal ties			.51* (.30)			
Diss. * Strong external ties				-.34 (.34)		
Diss. * Semi-strong external ties					.55* (.28)	
Diss. * Weak external ties						-.19 (.16)
Log Likelihood	-44.30***	-44.63***	-43.52***	-45.38***	-44.33***	-45.05***

Number of observations is 6475; Number of subjects is 134; Number of exits is 35.
* p < .05, ** p < .01, *** p < .001, and ~ is marginally significant (p < .1); Robust standard errors are reported in parentheses.
Note: All models presented in this table also included the control variables of the baseline model (model 1 in Table 2). For the sake of simplicity, we decided to report only the coefficients of the main independent variables, and the coefficients of the interactions.