LIFE COURSE AND NETWORK ADVANTAGE IN ORGANIZATIONS: PEAK AND TRANSITIONAL AGES

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This is an exploration of the interface between two areas of research, social networks and the life course. There are alternative strategies for such exploration. I prefer a strategy of anchoring on a phenomenon known well on one side and exploring how current understanding of the phenomenon is enriched by viewing it from the other side. Such a strategy ignores much of the interface, but ideas discussed are more likely to be incorporated into future research because they are concretely relevant to something well-known. Given my past research, I anchor on a well-known network phenomenon, exploring how a life-course perspective enriches what we know about the phenomenon.

The phenomenon is network advantage. Empirical research over the last two decades shows that achievement is associated with large, open networks. The gist of the network story is that the division of labor makes information homogeneous, tacit, and therefore sticky within clusters of densely-connected people such that clusters disconnect, buffered from one another by structural holes between them. Two people who have no connection with one another are more likely than connected people to operate in different clusters, working with different ideas and practices. The more disconnected the contacts in a person's network, the more likely the network spans

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structural holes. An individual whose social network spans structural holes (call such people network brokers, connectors, hubs, or entrepreneurs), have information diversity, timing, and arbitrage advantages. The network brokers are more familiar with the diversity of surrounding opinion and behavior, so they are more likely to detect productive new combinations of previously segregated information, and more likely to see alternative sets of people whose interests would be served if the new combination were brought to fruition. Thus, a structural hole is a potentially valuable context for action, brokerage is the action of coordinating across the hole with bridge connections between people on opposite sides of the hole, and brokers are the people who build the bridges. Network brokers are rewarded socially and materially for their work decoding and encoding information: People with access to structural holes are paid more than peers, receive more positive evaluations and recognition, get promoted more quickly to senior positions, and are more likely recognized as leaders (see Burt, 2005; Burt, Kilduff and Tasselli, 2013, for review of the argument and evidence).

Age is relevant to the network evidence. The achievements associated with structural holes become more likely as a person ages — compensation increases, people are more likely to hold senior positions in their organization, and older people in more senior positions are more likely to be recognized as leaders. Therefore, age is typically held constant in network predictions of achievement.

However, merely including age in a model predicting achievement ignores variation in the network effect across the life course. Trust and cooperation are central to network advantage, and both qualities vary with a person's age relative to others' in the demography of a population (Pfeffer, 1983; Wagner, Pfeffer, and O'Reilly, 1984; Zenger and Lawrence, 1989; Reagans and Zuckerman, 2001), and vary more generally over life-course events and transitions (Elder, 1975, 1995; Alwin, 2012). It is therefore reasonable to expect the network association with achievement to vary with age such that people at certain ages enjoy more advantage.

This chapter is about that possibility. I ask three questions: Are there certain peak periods in a manager's life when network advantage is more valuable? How are those

peak periods visible as transitions in the networks providing advantage? How is the achievement associated with network advantage contingent on peak periods? I provide illustrative answers to the questions using data on senior managers in banking, financial services, engineering, HR, software, and supply chain. The achievement-network association varies considerably with manager age, emerging most strongly during middle-age. I conclude that network models of advantage do not need to be re-defined to take life-cycle into account, but organization-specific norms about age and aging make life-cycle a factor to bear in mind when predicting achievement in any specific organization.

DATA

The six organizations from which I will draw evidence are listed in Table 1. The constituent people hold senior positions in their organizations, varying from just below direct reports to the CEO, down into middle management. Network and manager data are indicated in Table 1, along with publications in which the data have been described, often with a sociogram of the population network. The network data vary in richness from populations surveyed online with a single name generator eliciting "frequent and substantive contacts" to populations surveyed with a printed instrument eliciting contacts for several kinds of relations (the online and printed name generators are listed in Burt, 2010:284-286). For the purposes of this chapter, I focus on in the structure of the network around each manager relative to others in the same organization. I have not published a report on the software-engineering organization, but I have the same network and manager data described in the published reports on the supply-chain organization. Also, I have not published a report on the financial-services organization in the second row of Table 1, but the network data were obtained using the same instrument used in the supply-chain organization (augmented with 360 and email data).

I do not offer these six organizations as representative of organizations. The six are sufficient to illustrate the three patterns I have observed. I selected two for each

pattern to be sure my results were stable across more than one organization. I am confident that the results to be reported exist, but there certainly could be other patterns in organizations I have not studied.[1]

——— Table 1 and Figure 1 About Here ———

Figure 1 shows the usual achievement association with network advantage in the six Table 1 study populations. The horizontal axis distinguishes people by the extent to which their social networks give them access to structural holes. Network constraint measures the extent to which a person's network is confined to one group (Burt, 1992:Chap. 3; Burt, 2005:Chap. 1; Burt, Kilduff and Tasselli 2013:531-534). People with extensive access to structural holes are to the left in the graph. People with no access are to the right in the graph. The vertical axis in Figure 1 is a measure of achievement relative to peers. Within each organization, a person's compensation or promotion timing (fourth column in Table 1) is predicted by various individual differences (right-most column in Table 1) known from previous analysis to be associated with the predicted achievement. Job rank is not held constant because I will use it in the analysis, explicitly holding it constant when estimating network effects. The studentized residual from the prediction is a z-score measure of individual achievement relative to peers in the same organization, same function, business unit, geography, and similar on key demographic characteristics. The graph shows the usual nonlinear, downward sloping association in which network brokers (to the left in the graph) enjoy achievement higher on average than the achievements of people embedded in a single, dense cluster (to the right in the graph; cf., Burt, 2005:37, 69; 2012:547; Burt, Kilduff, and Tasselli, 2013:535). More specifically, achievement has a strong, negative association with log network constraint (-14.50 t-test, $P < .001$), with fixed effects for the six organizations and a control for manager job rank (1 for the highest rank in a population,

[1]Beyond the organizations in Table 1, I studied another four for this chapter. Three are organizations for which I have not published reports, and all four showed the "Old Valued" pattern reported below for two of the organizations in Table 1 (for which I have published reports). It did not seem productive for this exploration to have six examples of one pattern, so I only present results on the two organizations for which I have published reports.

one less for each rank lower). Other popular measures of access to structural holes are network betweenness (a count of the structural holes to which ego has exclusive access) and effective size (a count of ego's nonredundant contacts, i.e., the clusters to which ego is connected). Both measures reveal strong achievement-network associations as in Figure 1 (e.g., Burt, 2015), but I rely on the network constraint metric here.

PEAK AGE

The achievement expected with network advantage depends on social standing. Access to structural holes is a competitive advantage in detecting and developing good ideas, but implementation requires that the broker is accepted as a source of the good idea (or he needs to find someone whose endorsement makes the idea acceptable). Job rank can provide the needed social standing to be accepted, as can high network status in the informal organization, as can reputation with the people with whom one has worked. Age too can bestow social standing. Where grey hair is treated as a signal of credibility, a person can be too young to propose a significant idea. Elsewhere, a person can be too old — people from that generation do not understand current practice. Let the peak period in a study population be an age interval during which a person is most likely to be accepted as a credible source of ideas. I search for peak periods using the association between achievement and network advantage (as in network tests for diversity issues in an organization, Burt, 2010:Chap. 7). If the achievement-network association in Figure 1 is uniform across managers of different ages, then there is no peak period; good ideas are accepted from managers of any age.

Figure 2 shows that the association is not uniform across age. Rather, there is an inverted-U pattern that peaks in middle age. Access to structural holes increases with age for the young, to a maximum among people in their late thirties and early forties, then decreases with advancing age. The association with achievement follows a few years later, increasing from nothing for young managers, to a maximum among people

in their forties to early fifties, then decreasing with age back to nothing again. The graph at the top of Figure 2 shows that access to structural holes is highest on average for middle-age people, specifically people in their late thirties and early forties. In the late forties, and continuing thereafter, people have less and less access. The graph at the bottom of Figure 2 plots t-tests for the achievement association with log network constraint when the equation in Figure 1 is estimated within age groups. Again, the maximum achievement-network association occurs during middle age, during a manager's forties to early fifties. This is not an artifact of young people holding less senior job ranks. Differences in job rank are held constant in the graph at the bottom of Figure 2.

——— Figure 2 About Here ———

I know of no research on the inverted-U pattern in Figure 2, but the pattern is not inconsistent with McDonald and Elder's (2006) study of the ages during which social capital is an advantage in job search. McDonald and Elder do not have network data. They use the National Longitudinal Survey of Youth (NLSY) to compare jobs obtained through formal channels to the jobs obtained through a contact or without searching for the job. Relying on a "formal channel" is taken to indicate a person who does not have a network advantage in the job search. McDonald and Elder (2006:541) find the strongest difference during middle age, specifically for men in their thirties, and conclude: "during the middle of the work career, (1) people with the best social capital resources are more likely to get their new jobs without searching than through a formal job search, and (2) non-searchers receive better jobs on average than formal job seekers." Relative to the data available to McDonald and Elder, the data in Figure 2 are more clearly tied to personal achievement and network advantage, but as concluded by McDonald and Elder, the graph shows a peak association in middle age, which begins in a person's thirties, and continues here, past the ages available to McDonald and Elder, into a person's early fifties.

Digging past the aggregate pattern in Figure 2, age dependence within the individual study populations has one of three patterns displayed in Figure 3. The

organization-specific patterns are in some aspects similar to the aggregate pattern. As in the Figure 2 aggregate, middle-age managers consistently have the most access to structural holes within their organization (graphs at the top of Figure 3). Also as in the aggregate, the achievement association with network advantage is single-peaked within each organization. The achievement-network association does not oscillate across age in the graphs at the bottom of Figure 3. There is a single period of maximum association in each organization. And the inverted U can be seen in two of the organizations (lower-right graph, "Old and Young Devalued"). The graph shows achievement strongly associated with network advantage during middle age, after a youth has gained sufficient experience to be credible, and before past experience of the elderly is deemed no longer relevant to current operations.

——— Figure 3 and Table 2 About Here ———

In contrast to the aggregate, there are organizations in which middle-age managers are not the primary beneficiaries of network advantage. In the "Old Devalued" pattern (bottom-middle in Figure 3), the youngest managers also enjoy a strong association between achievement and network advantage. Only the elderly are excluded from network-associated achievement. The network association with achievement remains strong into a manager's 50s, after which the association weakens with increasing age.

The third pattern is most different from the aggregate. The "Old Valued" pattern (bottom-left in Figure 3) shows achievement more associated with network advantage for middle-age managers than it is for the youngest managers, but the strongest association occurs among the oldest managers. The association increases as a manager ages. This pattern looks suspiciously like an artifact of job rank since older managers are more likely to hold senior job rank, and network advantage is more beneficial for people in more senior job ranks, where work is more complex, crafted by the individual, and subject to collaboration from peers (e.g., Burt, 1997; 2005:156-162). The pattern seems robust to job rank, however, in that the regression model in the first

column of Table 2 shows that the Figure 3 pattern of increasing association between achievement and network advantage exists after job rank is held constant.

The models in Table 2 estimate the achievement-network association for managers in an organization's peak period, and the adjustment for managers not of peak age. For each organization, I distinguish a peak period of maximum achievement association with network advantage. Peak periods are indicated by the shaded area along each line in the graphs at the bottom of Figure 3.[2] For example, the regression model in the first column of Table 2 shows achievement higher for managers in more senior job ranks (10.3 t-test, $P < .001$), and strongly associated with network advantage during the peak period of ages 50 and older (-8.0 t-test for the weaker achievements of managers more constrained by lack of access to structural holes). For each year separating a manager's age from the peak ages in his organization, the achievement association with network constraint becomes weaker and weaker (5.9 t-test for the weakening negative association with network constraint, $P < .001$).

Beyond documenting the statistical significance of the distinction between peak and non-peak ages, the results in Table 2 is to show that peak period is a qualitative distinction more than a quantitative one. There are two models in Table 2 for each pattern of age dependency. The first model tests for slope adjustment outside the peak period according to a manager's number of years away from his organization's peak

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[2]The peak period for an organization is defined empirically as follows: Locate the maximum point on a returns-to-brokerage curve in the lower half of Figure 3. Test for the difference between the maximum achievement-network association, and the association in the adjacent age category. If the difference is negligible, add the adjacent age category to the peak period, and test for difference from the association in the next adjacent age category. When the difference is statistically significant, stop. For example, the maximum achievement-network association occurs for the HR managers age 50 to 54. The -.79 beta plotted in Figure 3 for HR managers in the 50-54 age category is negligibly different from the -.71 beta for HR managers age 55-59 (0.89 t-test, $P \sim .38$), so the peak period is extended to age 59. There are no older HR managers, so 59 is the upper end of the peak period in the HR organization. In the other direction, the -.79 beta for HR managers age 50-54 is significantly higher than the -.60 beta for HR managers age 45-49 (2.66 t-test, $P < .01$), so the peak period begins at age 50. The HR peak period of ages 50 through 59 is enclosed in grey shading in the lower-left graph in Figure 3.

period. The model in column one of the table is an example. An HR manager age 55 is zero years away from the peak period for the HR organization. An HR manager age 49 is one year below peak period. An HR manager 40 years of age is 10 years below peak period. The slope adjustment for years-away-from-peak in an "Old Valued" organization is statistically significant (5.9 t-test), showing that the achievement-network association for managers in these organizations gets stronger as a manager gets closer in age to the peak period for his organization. In contrast, slope adjustments for years away from the peak period are negligible for the other four organizations — the ones in which old managers are devalued (1.1 t-test) and the ones in which old and young are devalued (0.4 t-test).

The second models in Table 2 make a qualitative distinction between being in versus out of the peak period. For example, the model in the second column of Table 2, shows achievement strongly associated with job rank, as in the first column, but averages all managers outside the peak period to estimate two associations between achievement and network constraint: one for managers inside the peak period (second row) and another for managers outside the peak period (second row minus sixth row adjustment). Each pattern of age dependency shows a significantly positive adjustment for managers outside their organization's peak period, indicating a significantly weaker achievement-network association for managers outside the peak period — in organizations where old is valued (3.0 t-test), in organizations where old is devalued (2.9 t-test), and in organizations where both old and young are devalued (3.1 t-test). My inference is that adjustment for non-peak managers is defined less by their years away from the peak period than by whether or not they are outside the peak period. What matters for network advantage is not how much a manager differs from his organization's privileged age, just whether or not he or she is of privileged age.

TRANSITIONAL AGE

Given peak periods for network advantage in the organizations, I want to know whether the occasion of a manager entering or leaving peak period is marked by change visible in the manager's network. For this exercise, I need to know the ages of cited contacts, which I have for three of the organizations; the three represented by bold lines at the bottom of Figure 3 — the HR organization, the supply-chain organization, and the investment bank. Citation data for the three organizations are aggregated in Table 3. Citations are treated as symmetric. A citation between ages 40 and 42 is simultaneously a citation between ages 42 and 40. Each cell of the symmetric table contains two entries: the actual frequency of citations between row and column, and the frequency expected if age were independent of citations (in parentheses). For example, there are 356 citations connecting managers age 30-34 with colleagues age 30-34. Given the number of citations involving managers in that age group, there would be less than half that number if citations were made independent of age (140.5 in parentheses is computed as 1018 times 1018 divided by the total number of citations, 7376).

——— Table 3 About Here ———

Table 3 shows two patterns. First, the managers prefer to cite colleagues their own age. This homophily preference (McPherson, Smith-Lovin, and Cook, 2001, especially pages 424-425 on age homophily) is evident from the observed frequencies in the diagonal cells being larger than the frequency in parenthesis expected if citations were made independent of age. For example the observed citations between people within the 30-34 age category are more than twice what would be expected under independence (356/140.5, or 2.53). In contrast, citations between managers age 30-34 with managers age 50-54 occur less than half as often as would be expected under independence (47/113.2, or .42). On average, the observed frequencies in the diagonal cells of Table 3 are more than twice what would be expected under independence (2.23 average ratio of observed to expected in the seven diagonal cells). The observed frequency of citations between people separated by an age category is about three quarters what would be expected under independence (.78 average ratio in the 15 relevant off-diagonal cells).

The other pattern in Table 3 is an age transition in the mid-40s. For the first three age categories in the table, citations are concentrated within one's own age group and the adjacent age group. In contrast, managers age 45-49 are more likely than expected to cite anyone older than themselves. They are unlikely to cite colleagues younger. Managers in the older age categories are more likely than expected to cite managers 45 years or older, and less likely than expected to cite colleagues younger than 45. There is a transition in the mid 40s: citations are more likely than expected between people on either side of the transition and less likely than expected between people on opposite sides of the transition.

This is not to say that age 45 is a key transition year. Age categories in Table 3 are a convenience for aggregating data. Age 45 is on the border of an arbitrary category for aggregating the data.

I want see past arbitrary age categories, to see the specific ages at which transitions occur. Is age 45 in fact a key transition age? The network concept of structural equivalence is useful here. Two physical ages i and j are structurally equivalent, and so fall within the same social category of age, to the extent that people of ages i and j connect similarly with people of other ages (Burt, 1991). Imagine that the seven rows in Table 3 are expanded to one row for each age between 30 and 60. Two ages are structurally equivalent to the extent that people of either age have similar connections with colleagues of each age. Such structural equivalence is often measured by a Euclidean distance between the age-specific profiles of relations with other ages (equation in Figure 4), and distances between adjacent ages can be plotted as illustrated in Figure 4 to detect age transitions. The upper-right graph in Figure 4 shows an age transition at the end of a manager's career. The ages of colleagues cited by older managers become increasingly distinct. Transition could occur as a manager rises to managerial rank (lower-left graph), or as a person makes a transition in mid-life (lower-right graph, as illustrated for the mid-40s managers in Table 3). A further possibility is that there are no age transitions, manifest as each year about equi-distant from the adjacent year (upper-left graph in Figure 4).

——— Figure 4 and Figure 5 About Here ———

Figure 5 contains illustrative concrete results from a structural-equivalence analysis of age using network data from the national probably sample of Americans contacted for the 1985 General Social Survey (Burt, 1991). Age transitions are indicated by lines in the graph. Characteristic relations within each social category of age are visible in the graph and described in the table. For example, the late-30s are marked by the entry of children as discussion partners, the late-40s by the disappearance of parents as discussion partners, the mid 60s by the disappearance of coworkers as discussion partners, and so on.

Figure 6 shows that there are age transitions at career entry and sunset. The transitions are not turning points in the sense of crisp events — such as the loss of employment, or elevation to the top of a large company. These transitions are turning points in the sense of a visible shift in social behavior that marks a new course for subsequent life (e.g., Abbott, 2001:Chap. 8). More important to this chapter, the transitions are not coincident with peak periods. The graphs at the top in Figure 6 show the ages at which managers in each organization are most likely to cite colleagues their own age. The graphs at the bottom in Figure 6 show Euclidean distances between adjacent ages within each organization.

The organization in which old managers are valued shows an age transition corresponding to the peak period for network advantage in the organization. The peak period is age 50 and above. The structural equivalence distances show an age transition beginning around age 50 (lower-left in Figure 6), and that age transition is to networks composed of other old managers (upper-left in Figure 6).

The organization in which old managers are devalued shows an age transition that has no overlap with the peak period. The age transition occurs as young people rise to managerial rank (lower-middle in Figure 6). There is a slight tendency for the higher homophily in youthful networks to be replaced with contacts of more varied age (upper-middle in Figure 6). That does not correspond to the peak period in this organization. Youth is within the peak period. It is the older managers who do not benefit from

network advantage. But there is neither age transition, nor change in homophily, evident in the networks of the older managers.

——— Figure 6 About Here ———

The organization in which old and young are devalued also shows an age transition that does not map onto the peak period. The age transition is again at the end of the career (lower-right in Figure 6) and involves increasing homophily as older managers limit their citations to other older managers (upper-right in Figure 6). The age transition for older managers corresponds to the lack of achievement associated with network advantage for older managers in this organization. But there is neither age transition, nor change in homophily, evidence in the networks of the young managers and they too lie outside the peak period for network advantage in this organization.

CONCLUSIONS

The association between achievement and network advantage is not uniform across age. There are peak periods during which achievement is more linked with network advantage. In the aggregate, the peak is during middle-age (Figure 2), but individual organizations display one of three single-peaked patterns (Figure 3): There is an “Old Valued” pattern in which the peak period is at the end of the career: achievement becomes increasingly linked to network advantage as a person ages. There is an “Old Devalued” pattern in which the peak period is at the beginning and middle of the career: network advantage is consistently valuable until a person reaches his 50s, after which increasing age sees achievement decreasingly associated with network advantage. Finally, there is an “Old and Young Devalued” pattern in which the peak period is during middle age: network advantage is most valuable for middle-age managers, offering little value to young or old managers.

For two reasons, I interpret the peak period in an organization to be less a network phenomenon than a cultural, or institutional, phenomenon. First, years away from the peak matters less for achievement than whether or not a manager is within the peak period (Table 2). Second, observable transitions in manager networks do not map onto

people entering and leaving the peak period (Figure 6). Peak is not about the structure of a manager's network. It is about how colleagues react to the manager's network. The peak period in an organization is a qualitative state of eligibility, a category defined by organization history and prevailing social norms.

The analysis has implications for management careers. The most obvious is that able work by a network broker need not yield achievement for brokers outside the peak age in their organization. A person can be too young to have her profound idea accepted. A person can be too old to be taken seriously as the CEO of a technology start-up. Beyond explaining why some people fail, the implications are a call to action: There are opportunity costs for a manager of peak age who does not try to benefit from network brokerage. Action delayed past peak age can be too late as much as action before peak age can be premature.

Broader implications for careers across employers could be inferred from the results (Bidwell and Briscoe, 2010): Begin the career in an area or organization in which the young benefit from network advantage ("Old Devalued" organization), then switch mid-career to an organization in which the middle-aged benefit from network advantage ("Old and Young Devalued"), then finish in an organization that celebrates the most experienced managers ("Old Valued").

Here is a quick caution against such inference: The presented results establish that network advantage is age dependent, but the results do not explain why advantage is age dependent. The cross-sectional data establishing age dependency do not distinguish age, from cohort, from period effects. The text is written in terms of age effects. People at peak age benefit more from network advantage. With more contextual information, the results could have been discussed in terms of period effects if peak ages reflect the kind of work being done when the network data were gathered. Or, the results could have been discussed in terms of cohort effects. For example, there was an internal labor market for managers in the computer manufacturer that displays an "Old Valued" pattern in Figure 3. People joined the firm early and stayed in the firm for the rest of their working lives; not everyone, but most people. The elderly

managers most benefiting from network advantage were not just old, they were initial employees in the organization who grew up together as the organization prospered. They were respected as members of the initial cohort of employees who built the organization. A new hire of comparable age would not enjoy the same respect.

——— Figure 7 About Here ———

Two summary points are illustrated in Figure 7, which is the same as Figure 1, but aggregated here to distinguish managers of peak age in their organization (bold line and solid dots) from managers outside their organization's peak age (dashed line and hollow dots). The first point is that the achievement-network association is significantly lower for mangers outside their organization's peak age period. The dashed line in Figure 7 is lower than the bold line, and the slope adjustments for non-peak managers are statistically significant in the Figure 7 table. Second, the difference in network advantage for peak versus non-peak managers is a difference of magnitude more than form. Achievement has the same downward-sloping, nonlinear association with network constraint for peak and non-peak managers, and there is a strong correlation between achievement and network constraint for managers outside their organization's peak age (-.68). The correlation is stronger for managers of peak age, but there is an achievement association with network advantage for both peak and non-peak managers. I conclude that network models of advantage do not need to be re-defined to take life-cycle into account. The models predict achievement for peak and non-peak managers as a function of information breadth, timing, and arbitrage advantages. However, the significant difference between the resulting achievements of peak and non-peak managers means that organization-specific norms about age and aging make life-cycle a factor to bear in mind when predicting achievement in any specific organization.

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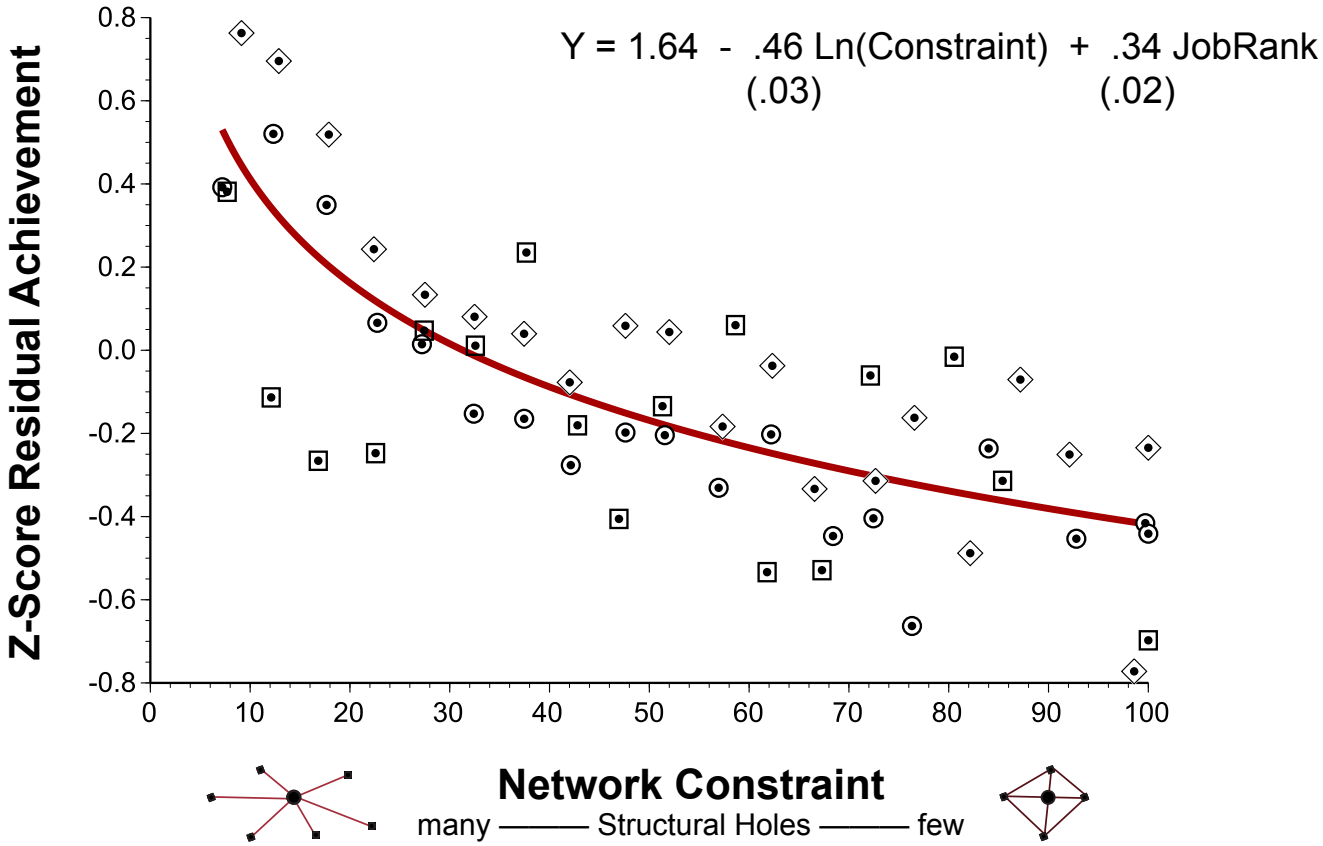
Table 1.
Six Study Populations

	N	Network	Performance	Controls
Computer Manufacturer (Burt 1992:115ff., 2010:195ff.)	170	General Discussion (9 generators)	Relatively Early Promotion	Job Rank, Function, BU, Geography
Financial Services	654	Frequent and Substantive Work Discussion (also 360 & email data)	Relative Compensation	Job Rank, Function, Age, BU, Gender, Geography
HR in a Commercial Bank (Burt, 2010:80-85)	283	General Discussion (11 generators)	Relative Compensation	Job Rank, Function, Age, BU, Gender, Geography, Job Eval
Investment Bank (Burt, 2007, 2010:85-93)	531	Frequent and Substantive Work Discussion (from 360 data)	Relative Compensation	Job Rank, Function, Age, BU, Gender, Geography, Peer Eval
Software Engineering in Electronics	113	Frequent and Substantive Work Discussion	Relative Compensation	Job Rank, Function, BU, Education, Gender, Geography
Supply Chain in Electronics (Burt, 2004, 2007, 2010:72-78)	455	Frequent and Substantive Work Discussion	Relative Compensation	Job Rank, Function, Age, BU, Education, Gender, Geography

Figure 1.
Network Advantage and Access to Structural Holes



NOTE — Symbols in the graph are average scores across 2,206 senior people in the six Table 1 firms, within five-unit categories on the horizontal axis. Vertical axis is manager achievement measured by z-score annual compensation, evaluation, or promotion adjusted for associated manager differences on control variables in Table 1. Job rank is not held constant. Symbol ◉ indicates averages for the managers in organizations where returns to brokerage increase with age (r_{xy} = -.84 across averages in graph). Symbol ◘ indicates averages where returns decrease with age (r_{xy} = -.92), and ◈ indicates averages where returns increase and decrease (r_{xy} = -.52). Regression equation in the graph is estimated with controls for job rank and firm fixed-effects (respectively 18.21 t-test and 70.36 $F_{2,2136}$ F-test, P < .001; standard errors in parentheses beneath coefficients).

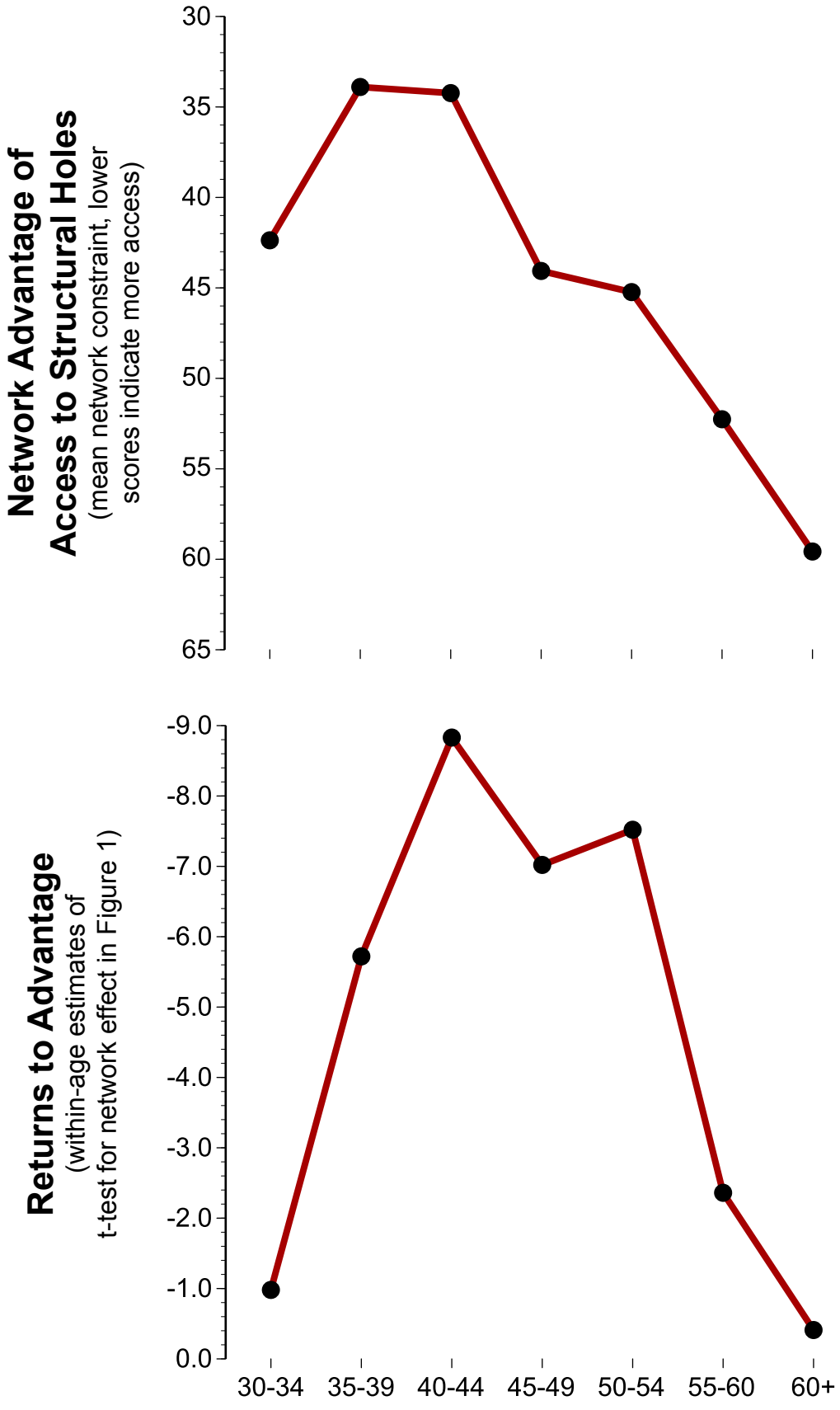
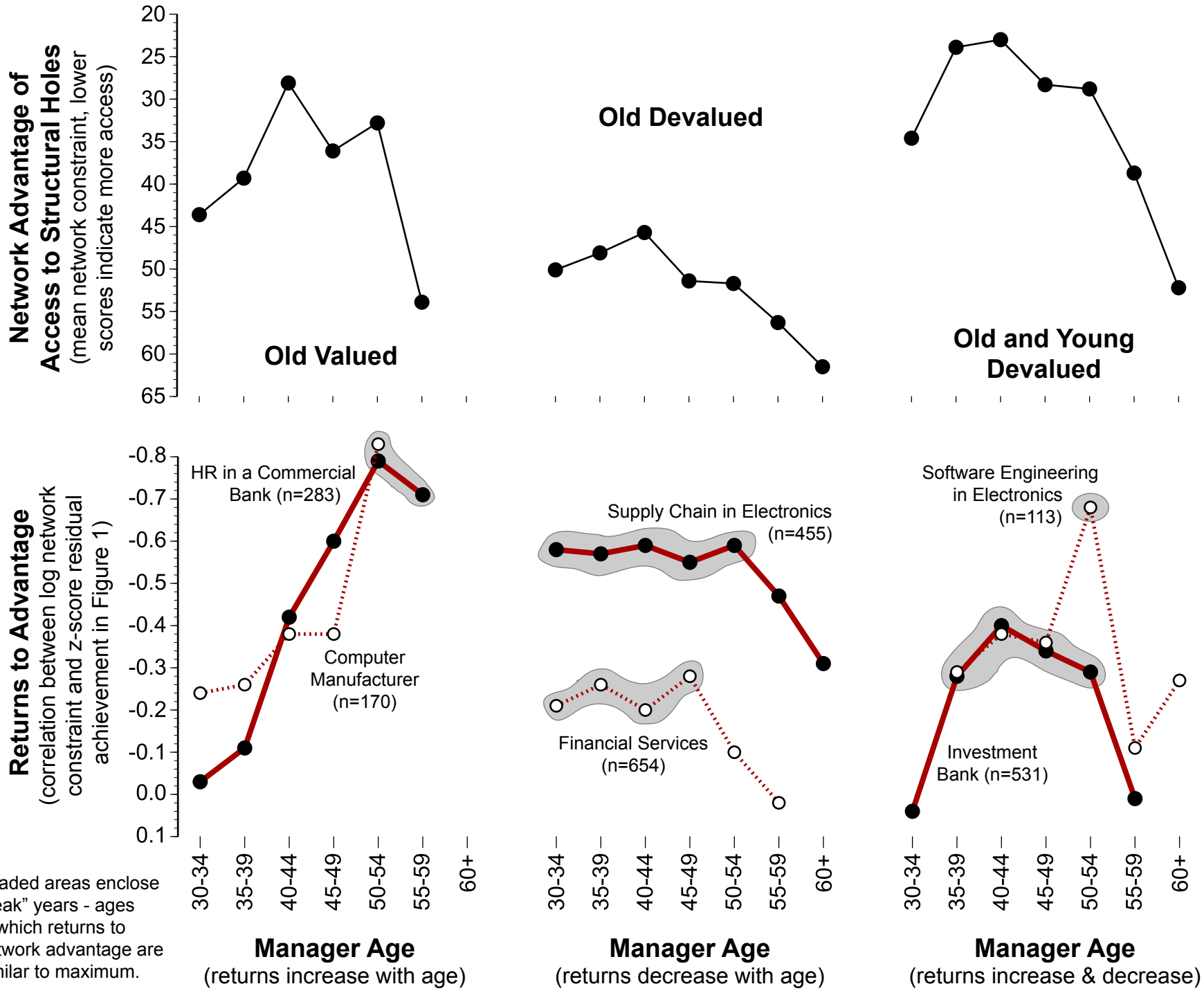


Figure 2.

Age-Dependent Network Advantage

Figure 3. Three Kinds of Organizations



Shaded areas enclose "peak" years - ages in which returns to network advantage are similar to maximum.

Table 2. Estimates of the Cost to Being of an Age Outside the Peak Period in an Organization

	Returns to Network Increase with Age		Returns to Network Decrease with Age		Returns to Network Increase and Decrease	
Job Rank	.29 (10.3)	.28 (10.3)	.34 (12.4)	.33 (9.9)	.52 (9.6)	.51 (9.5)
Log Network Constraint	-1.08 (-8.0)	-1.08 (-4.4)	-.54 (-11.0)	-.64 (-6.9)	-.41 (-7.1)	-.46 (-7.8)
Years Away from Peak	.02 (2.9)		-.01 (-1.1)		-.02 (-1.0)	
Interaction Years Away and Log Network Constraint	.06 (5.9)		.02 (1.1)		.01 (0.4)	
Not Peak		-2.24 (2.5)		-.70 (-1.6)		-1.34 (-3.7)
Interaction Not Peak and Log Network Constraint		.74 (3.0)		.18 (2.9)		.35 (3.1)
R^2 N	.35 453	.31 453	.22 1109	.24 1109	.23 582	.25 582

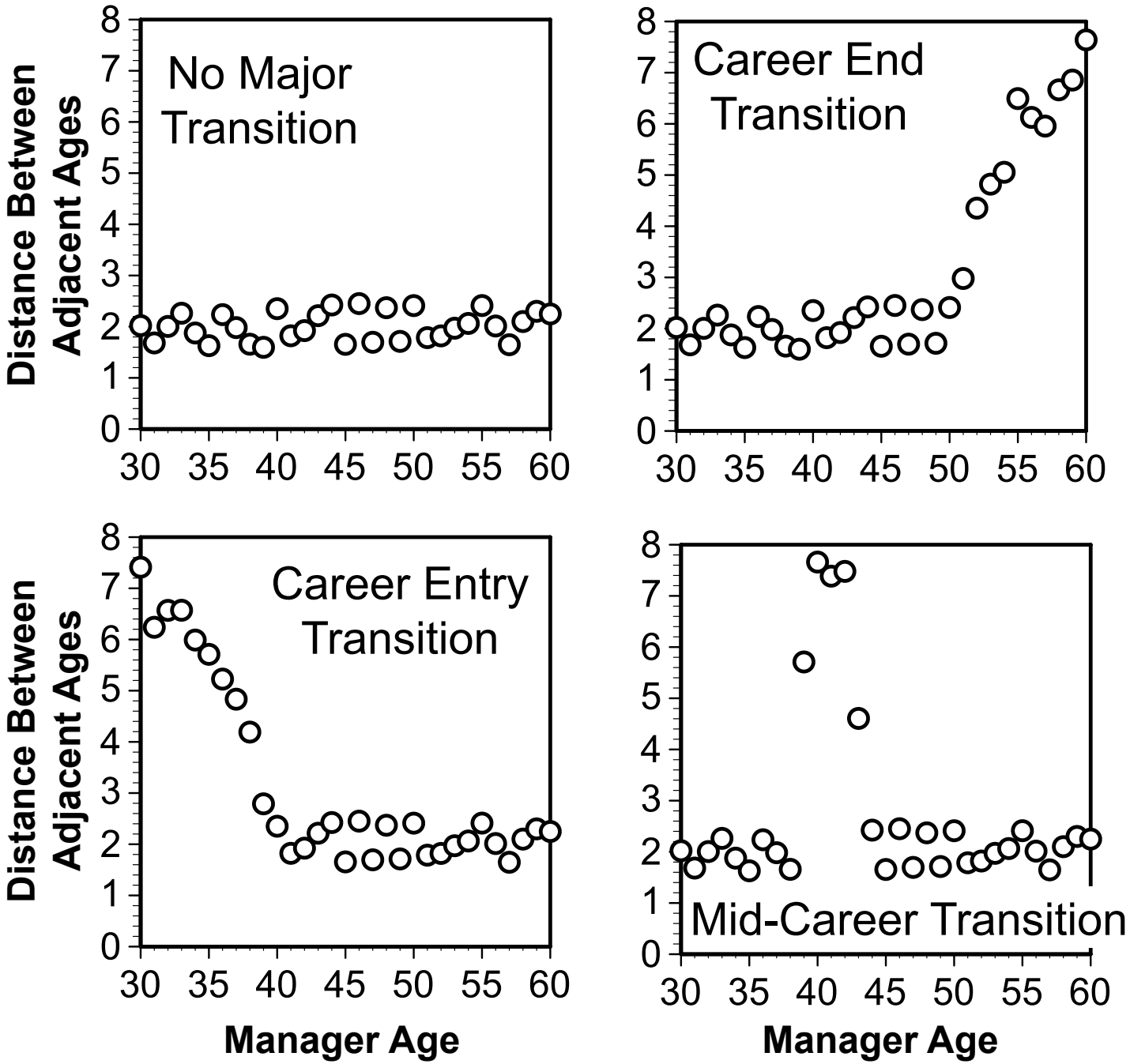
NOTE — These are ordinary least squares estimates predicting achievement (Figure 1) from network constraint within each of the three age-dependency patterns (Figure 3), with firm fixed-effects and a control for job rank (routine t-tests in parentheses). “Job Rank” is 1 for the highest rank in a population, one integer less for each lower rank. “Years Away” is number of years between a person’s age and the closest peak age. “Not Peak” is a dummy variable equal to 1 if a person’s age is outside the peak years for her organization. Interactions are defined for log constraint measured as the deviation from mean log constraint in the study population. Coefficients in second row measure achievement association with network constraint during peak years. Coefficients in the fourth and sixth rows adjust the association for ages outside the peak years.

Table 3.
Interaction Within and Between Ages

	30-34	35-39	40-44	45-49	50-54	55-59	60+	TOTAL
30-34	356 (140.5)							1018
35-39	263 (145.8)	583 (430.0)						1781
40-44	243 (280.9)	527 (491.4)	661 (561.4)					2035
45-49	101 (175.3)	263 (306.7)	322 (350.4)	281 (218.7)				1270
50-54	47 (113.2)	110 (198.0)	193 (226.2)	188 (141.2)	178 (91.2)			820
55-59	7 (47.5)	33 (83.1)	72 (94.9)	80 (59.2)	76 (38.2)	57 (16.0)		344
60+	1 (14.9)	2 (26.1)	17 (29.8)	35 (18.6)	28 (12.0)	19 (5.0)	6 (1.6)	108
TOTAL	1018	1781	2035	1270	820	344	108	7376

NOTE — These are citations between managers and colleagues summed across the three bold-line organizations in Figure 3 (HR, Supply Chain, and Investment Bank). For example, there are 356 citations connecting people age 30-34 with colleages age 30-34. The frequency expected if citations were independent of age is given in parentheses. Shaded cells indicate where the observed frequency is higher than expected.

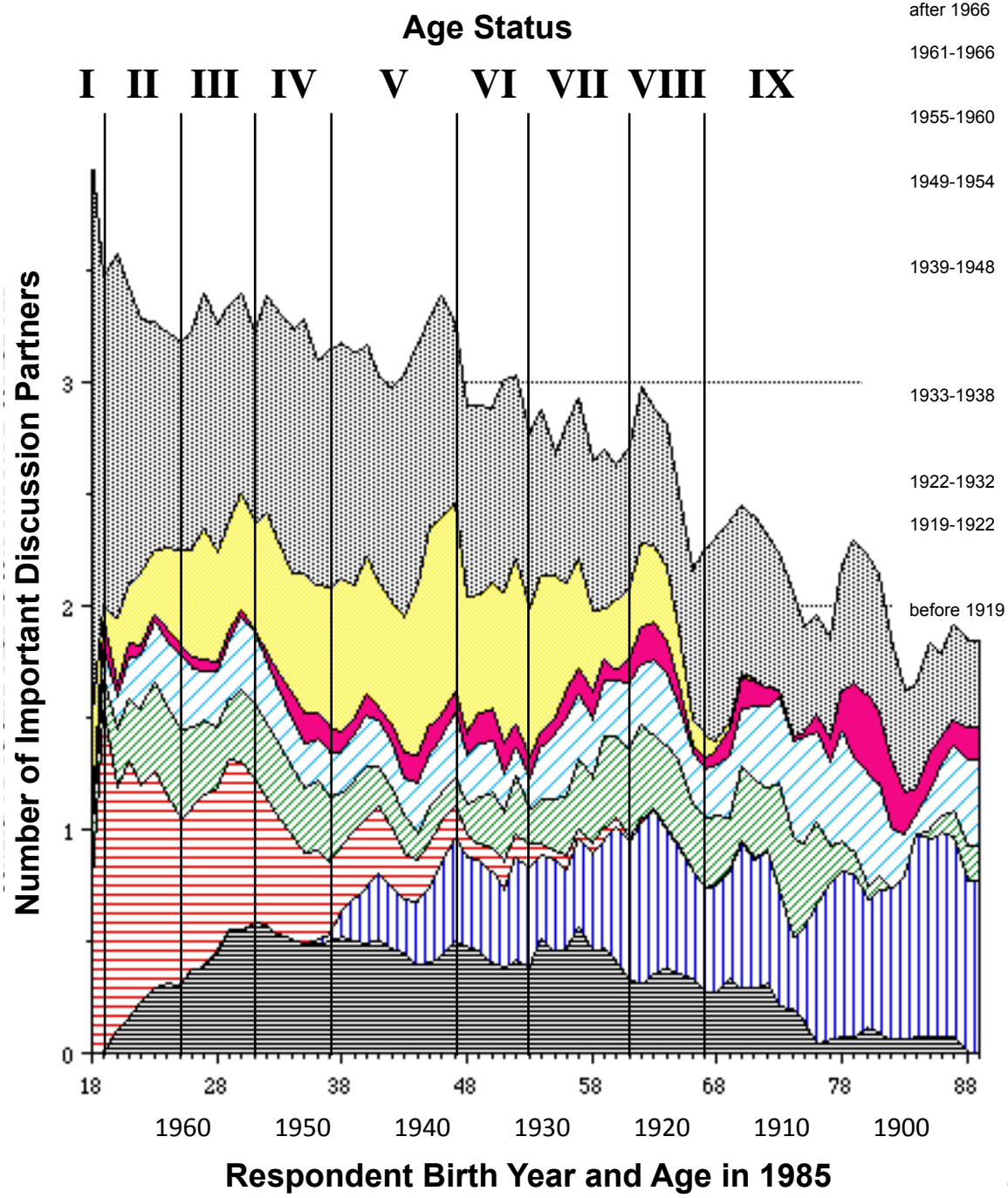
Figure 4. Detecting Age Transitions



To find structurally equivalent years, compute Euclidean distance between years i and j as the square root of the sum across columns of:

$$[f_{ik}/E(f_{ik}) - f_{jk}/E(f_{jk})]^2$$

where f_{ik} is the frequency of citations connecting managers age i with colleagues of age k.



Birth Dates	Age in 1985	Age Status	Characteristic Important Discussion Relations
after 1966	under 19	**I Children**	not included in national probability surveys
1961-1966	19 - 24	**II College**	large networks; frequent contact with parents, and age homophilous close & casual friends
1955-1960	25 - 30	**III Young Adults**	fewer daily contacts; continuing age homophilous friends; spouses and coworkers enter
1949-1954	31 - 36	**IV Twilight Youth**	parents decline; last period of concentrated age homophilous relations (other than spouse) until old age
1939-1948	37 - 46	**V Middle-Age**	daily contact begins continuing steep decline; children a concentrated focus of relations; children begin to replace parents and siblings; coworkers prominent; minimum age homophily in relations with relatives, spouse, and contacts beyond family
1933-1938	47 - 52	**VI Older Adults**	continue changes begun in middle-age; transition to less differentiation between especially close and less close relations
1922-1932	53 - 60	**VII Senior Adults**	parents disappear; coworkers decline
1919-1922	61 - 66	**VIII Retiring Adults**	coworkers disappear; concentrated age homophilous relations reappear with relatives and and contacts beyond the family
before 1919	over 66	**IX Elderly**	small networks; declining friends beyond family; high proportion kin; equally close to all important discussion partners; declining friends beyond family

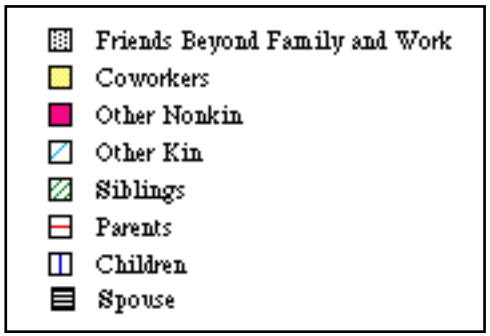


Figure 5.
American Age Statuses

Slide is from Figures 2-3, and Table 1 in Burt (1991). Age status is adjacent ages structurally equivalent in the broader network of contacts between ages. Data are from the 1985 General Social Survey. Age, cohort, and period effects are confounded.

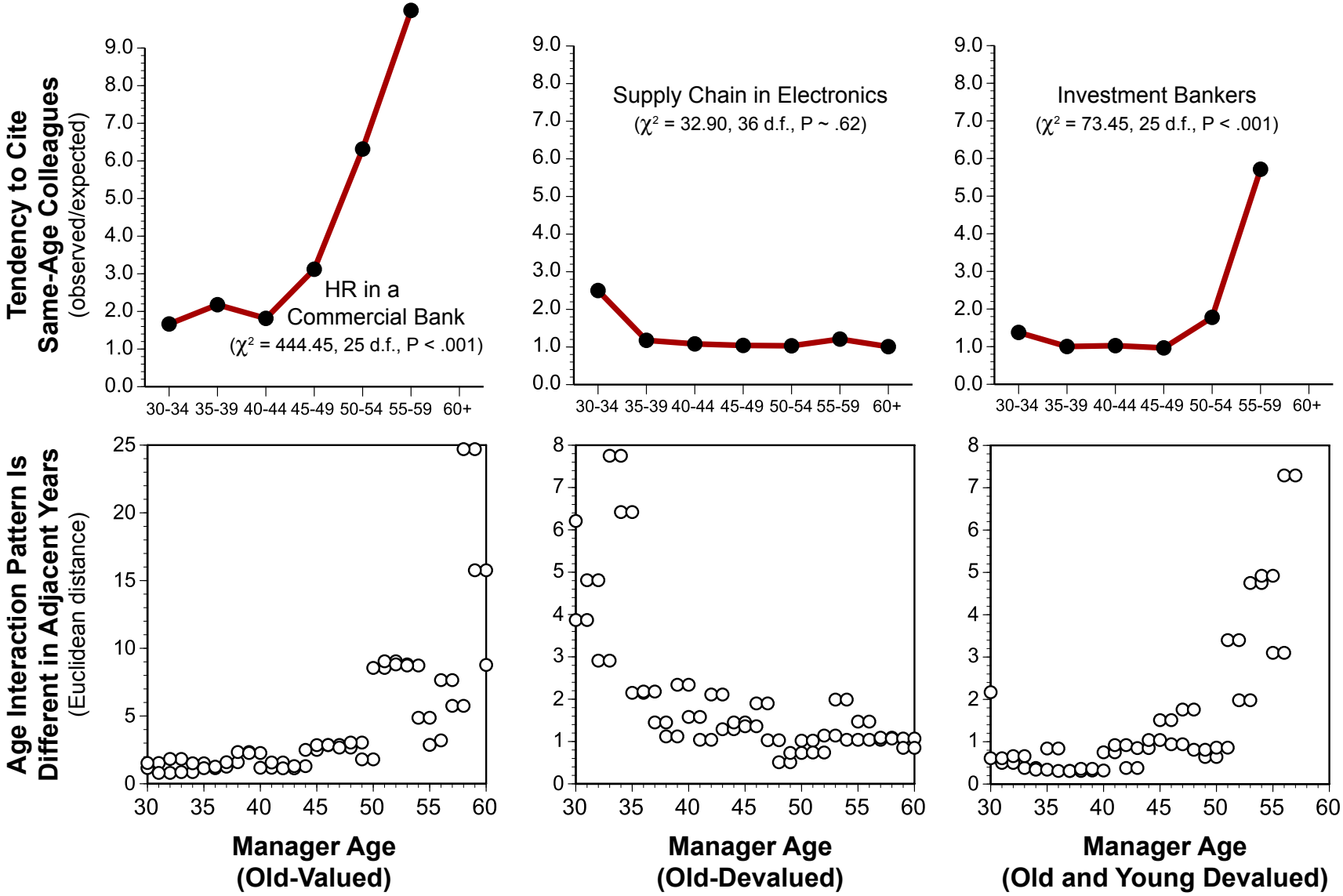


Figure 6. Change in Age Interaction Patterns

NOTE — In the top panel, the vertical axis is the citation frequency observed in the diagonal cells of Table 2 for each of the bold-line organizations in Figure 3 (HR, Supply Chain, and Investment Bank), divided by the frequency expected if citations were independent of manager and colleague age. Chi-square statistics describe the extent to which citations are independent of age across the whole table, but the primary deviations happen down the diagonal and adjacent cells. Excluding citations to the manager's supervisor does not change the relative magnitudes of the chi-square statistics. Managers in the supply chain organization are older than in the other two organizations, so there are observations in all seven age categories, creating 36 degrees of freedom versus 25 in the other two organizatons. If the supply-chain chi-square statistic is computed just for the six age categories observed in the other two organizations, citations are more independent of manager and colleague age (χ^2 = 17.77, 25 d.f., P ~ .85). In the bottom panel, vertical axis is the Euclidean distance at each age to the age interaction pattern in the previous and subsequent year, as illustrated in Figure 4.

Job rank	18.44	18.38
Network Constraint	-14.92	-14.78
NonPeak, All		
Level	-4.60	
Slope	4.63	
NonPeak, Old Valued		
Level		-1.51
Slope		2.99
NonPeak, Old Devalued		
Level		-4.39
Slope		4.19
R^2	.23	.24

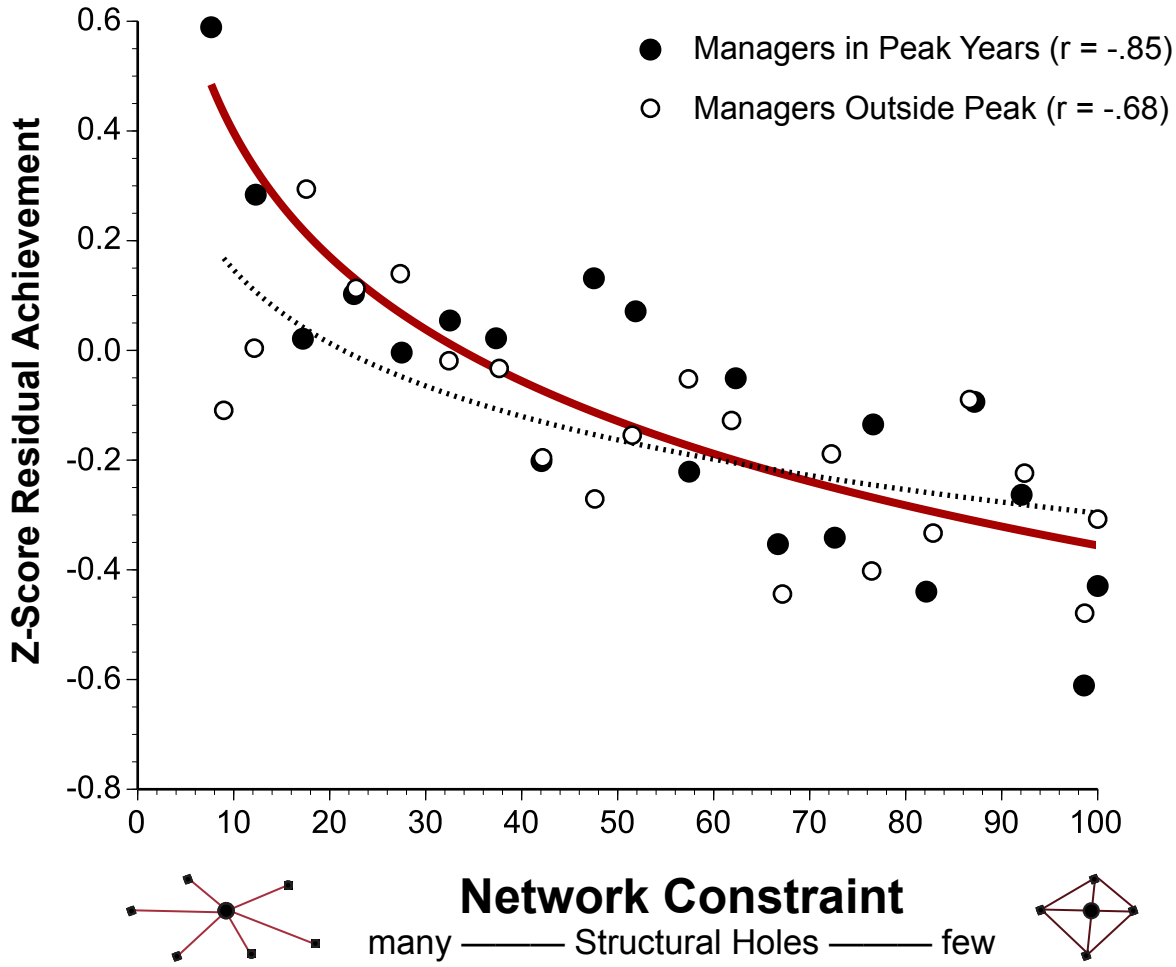


Figure 7. Network Advantage in Peak and Not-Peak Years

The graph displays associations between achievement and network constraint for managers at peak ages in their organization versus managers outside the peak ages. The graph is constructed in the same way as the graph in Figure 1. Correlations are computed from data in the graph. The table to the left contains t-tests for regression models predicting, for 2,144 individuals, the vertical axis in the graph using a person's job rank and log network constraint, with firm fixed-effects and level and slope adjustments for managers outside the peak age in their organization (first for everyone outside peak age, then separating non-peak in the two Figure 3 organizations in which old is valued from non-peak in the four organizations in which old is devalued).