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The Conditional Nature of Embeddedness: A Study of Borrowing by Large U.S. Firms, 1973–1994

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SUPPLEMENT TABLE OF CONTENTS

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Section A:

Table S1. Spatial Regression Estimates of Corporate Borrowing, 1973–1994

Year	1973	1974	1975	1976	1977	1978	1979
Network Effect	.003	–.003	–.000	–.000	.004	–.000	.016
	(2.15)***	(–1.94)	(–.02)	(–.11)	(1.43)+	(–.14)	(3.24)***
Log Total Assets	.006	.007	.017	.005	.012	.007	.000
	(1.05)	(.92)	(2.57)*	(.79)	(1.98)*	(1.56)	(.03)
Recent Performance	1.138	–.203	–.032	.310	4.386	–.098	1.207
	(2.07)*	(–.41)	(–.06)	(.42)	(7.89)***	(–.18)	(2.87)**
Financial Directors	.003	–.002	.000	–.001	.000	.003	–.003
	(1.28)	(–.50)	(.12)	(–.19)	(.30)	(1.49)+	(–1.18)
Finance CEO	.009	.014	–.014	–.003	.013	.002	.007
	(.80)	(1.08)	(–1.09)	(–.23)	(1.07)	(.29)	(.79)
Log Debt Ratio (t-1)	–.030	–.050	–.039	–.005	–.024	–.010	–.001
	(–1.69)+	(–2.15)*	(–1.43)	(–.22)	(–1.19)	(–.63)	(–.07)
Retained Earnings	–.103	–.059	–.083	–.067	–.101	–.096	–.140
	(–2.39)**	(–1.16)	(–1.65)+	(–1.24)	(–2.10)*	(–2.23)*	(–3.94)***
Log Stock for Acq.	.009	.012	.007	.007	–.004	.013	.003
	(2.53)*	(2.59)*	(1.64)	(1.95)+	(–1.23)	(5.83)***	(1.83)+
Constant	.106	.040	–.003	.017	.035	.016	.303
	(2.13)*	(.56)	(–.05)	(.25)	(.57)	(.34)	(3.09)**
Observations	137	140	145	142	139	133	135

(continued)

Table S1. *(continued)*

Year	1980	1981	1982	1983	1984	1985	1986
Network Effect	.001	.014	.017	.001	.024	.009	.003
	(.42)	(3.56)***	(2.31)**	(.16)	(2.79)**	(2.06)*	(1.04)
Log Total Assets	.007	.003	.016	.017	–.004	.000	.020
	(1.31)	(.50)	(1.70)+	(3.04)**	(–.46)	(.03)	(2.01)*
Recent Performance	.807	.923	–1.005	–1.278	1.908	1.128	–1.893
	(2.09)*	(2.17)*	(–1.39)	(–2.72)**	(2.51)*	(1.37)	(–1.89)+
Financial Directors	–.001	–.001	–.001	–.005	–.008	–.004	–.015
	(–.47)	(–.37)	(–.26)	(–1.53)	(–1.47)	(–.56)	(–2.28)
Finance CEO	.012	.006	.008	.010	–.039	–.007	.035
	(1.22)	(.62)	(.51)	(.81)	(–1.88)	(–.26)	(1.48)+
Log Debt Ratio (t-1)	–.040	–.051	–.031	–.040	–.045	–.082	.007
	(–2.27)*	(–2.67)**	(–.99)	(–1.97)+	(–1.53)	(–2.71)**	(.24)
Retained Earnings	–.111	–.127	–.003	–.064	–.085	–.022	–.035
	(–3.15)**	(–3.47)***	(–.55)	(–1.67)*	(–1.67)*	(–.47)	(–.86)
Log Stock for Acq.	.007	.006	.005	.006	.007	.009	.006
	(2.76)**	(2.74)**	(1.49)	(1.91)+	(2.30)*	(2.16)*	(1.73)+
Constant	.094	.360	.152	–.035	.516	.293	–.049
	(1.72)+	(3.33)***	(1.02)	(.59)	(2.95)**	(2.82)**	(–.46)
Observations	139	131	130	126	119	116	111

(*continued*)

Table S1. *(continued)*

Year	1987	1988	1989	1990	1991	1992	1993	1994
Network Effect	–.001	.002	.005	.005	.010	.004	–.001	–.003
	(–.33)	(.48)	(1.75)*	(1.69)*	(2.27)*	(.97)	(–.34)	(–.92)
Log Total Assets	.032	.066	.039	.034	.062	.055	.028	.008
	(2.51)*****	(5.89)*******	(3.26)******	(2.28)*****	(3.10)******	(2.56)*	(2.91)**	(.87)
Recent Performance	–1.498	.049	1.638	–1.240	–2.954	2.014	–.195	–.586
	(–1.13)	(.06)	(1.32)	(–.52)	(–1.14)	(.78)	(–.27)	(–.80)
Financial Directors	–.007	.002	–.004	–.001	–.017	–.021	–.004	–.003
	(–.69)	(.20)	(–.56)	(–.08)	(–1.28)	(–1.21)	(–.47)	(–.42)
Finance CEO	–.032	–.007	–.026	–.009	–.037	–.068	.014	–.025
	(–1.09)	(–.24)	(–.95)	(–.23)	(–.73)	(–1.20)	(.56)	(–1.08)
Log Debt Ratio (t-1)	–.073	–.048	.000	.081	.164	.131	.022	.017
	(–2.24)*****	(–1.21)	(.01)	(2.12)*	(4.00)*******	(2.55)*	(1.08)	(.91)
Retained Earnings	–.110	–.307	–.012	–.219	–.254	–.302	–.082	–.082
	(–1.93)*****	(–5.24)*******	(–.22)	(–2.99)**	(–3.25)*******	(–3.12)******	(–1.84)*	(–1.95)*
Log Stock for Acq.	.014	.004	.009	–.004	.001	–.009	.002	.010
	(2.85)**	(.90)	(1.98)*	(.54)	(.12)	(–.89)	(.35)	(2.86)**
Constant	–.046	–.213	–.133	–.047	–.320	–.340	–.187	–.024
	(–.36)	(–1.76)+	(–1.05)	(–.30)	(–1.40)	(–1.49)	(–1.82)+	(–.27)
Observations	108	99	98	95	90	89	90	84

Note: z statistics in parentheses; +$p < .10$, *****$p < .05$, ******$p < .01$, *******$p < .001$; probabilities involving the network effect, retained earnings, financial directors, and finance CEO are one-tailed; all others are two-tailed; industry dummy variables are omitted to conserve space.

Section B:

Table S2. Means, Standard Deviations, and Correlations Among Variables in Time-Series Analysis (n = 22)

	Mean	SD	2	3	4	5	6	7
1. Network Effect (closeness)	5.02	7.163	.009	.319	.701	–.01	–.071	.044
2. Year	83.5	6.494		.756	.31	.989	–.976	.918
3. Network Density	.032	.004			.57	.748	–.786	.851
4. Standard Error	3.48	2.243				.327	–.391	.345
5. Firms with CFOs	.304	.215					–.954	.906
6. Pct financials on board	11.95	1.651						–.919
7. Mergers	2663.32	1248.7						

Note: The network effect is the ρ coefficient from the network autocorrelation regressions in Table 1. The standard error is that associated with each ρ.

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Section C:

Further Discussion of Time-Series Results from the Article's Table 2

In this Online Supplement we address an issue regarding the nature of the models in Table 2 of the published article. In our first hypothesis we predicted that the effect of interfirm network ties on firm financing would decline over time. We discussed a series of processes by which we believe that this hypothesized decline took place. These processes were all time-dependent, however. That is, all three exhibited strong over time trends that were highly correlated with the variable "year." Given the high correlations of our three substantive variables with year, it raises the question of whether our three variables are simple artifacts of time, as opposed to causal mechanisms.

On one hand we believe that this concern is unnecessary. The variable year may allow us to predict the patterns of the network effect, but time by itself has no theoretical content. Only by specifying the mechanisms by which the network effect shifted over time can we develop a theoretically meaningful account. By showing that the proliferation of chief financial officers, the decline in the number of financial representatives on firm boards, and an increase in the number of mergers were all associated with a decline in the effect of interfirm networks, we have specified the processes by which this over-time decline occurred. Beyond our substantive explanation, however, there is evidence that even statistically, our processes played a role, independent of time.

Consider the variable "mergers," which has a correlation of .918 with year (see the Table 2 supplement in Section B, above). If we include both mergers and year in an equation simultaneously (along with density and the standard error), the tolerance for mergers is only .094, meaning that less than 10 percent of the variance in mergers remains after controlling for the other three variables, and the tolerance for year is only .154. Yet despite the almost certain existence of severe multicollinearity (enough to render the effect of year non-significant), the effect of the number of mergers remains significantly negative ($T = -2.30$, $p = .017$). In other words, the negative effect of mergers predicted by Hypothesis 4 is strong enough that the effect maintains itself even with the inclusion of a variable with a .92 correlation. Moreover, it is the mergers variable that holds its significance while the effect of year disappears.

A similar, albeit not as powerful, result occurs when we compute an equation that simultaneously includes year and the proportion of firms with CFOs. These two variables have a correlation of .989, meaning that it is nearly impossible to compute partial coefficients for both of them in the same equation. Yet even under these conditions, the T-statistic for CFOs remains negative, and is nearly statistically significant ($T = –1.29$, $p = .107$), while the coefficient for year is null (and even slightly positive). Again, the effect of our substantive variable exceeds that of year when the two are included in the same equation. The variable for financial board representation, which is correlated –.976 with year, does not approach significance when the two variables are included simultaneously. In this case, both variables exhibit clearly null effects. Taken as a whole, however, the fact that two of our three substantive variables largely hold their effects even when controlling for year, and that they do this despite the small number of observations and the relatively large number of variables in the equation, suggests that these measures are more than mere artifacts of time.

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Section D:

Further Discussion of the Results in Equation 3 of the Article's Table 3

In this Online Supplement we provide additional discussion of the finding, in Equation 3 of Table 3, that the statistical significance of the mergers*network interaction effect disappears once we control for the year*network interaction. As we note in the text, the most likely reason for the disappearance of the mergers*network effect interaction is collinearity. Both year and mergers are time-varying covariates that are constant within years, and that have a correlation of .924 in the firm-year data set.

In the time-series analysis of our aggregate year-level data (in Table 2 of the published article), the effect of mergers on the network effect trumped the effect of year: When the two were included simultaneously, the mergers effect remained significant while that for year did not. In the firm-year data, analyzed in Table 3, the reverse occurs: The effect of year on the network effect trumps that of mergers. Although this latter finding appears to call Hypothesis 4 into question, we believe that rejection of the hypothesis on the basis of this finding is unwarranted, for two reasons. First, because of the problems with the spatial OLS model that generated these equations (described in the paper), we should be cautious before rejecting any finding that runs counter to those from our aggregate time-series analysis, which, although based on a small sample, was drawn from models with known statistical properties. Second, and more important, is what the measures that generated these findings represent. The basis for Hypothesis 4 was our argument that an increase in the level of volatility within the business world during the 1980s led firm managers to rely increasingly less on their interfirm social networks for advice and information about financing strategies. We used the number of mergers as a proxy to represent this changing environment, but we also emphasized that the primary historical event that precipitated this change was the merger wave of the 1980s. As we note in the paper, in this sense, the variable "year" could serve as a proxy for the increased volatility that occurred in the later years of our data, just as could the number of mergers.