SUPPLEMENTAL MATERIAL AND APPENDICES TO STRUCTURAL ROLE COMPLEMENTARITY IN ENTREPRENEURIAL TEAMS

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APPENDIX A: BASIC CAPITAL & FIRM SURVIVAL

An important concern is the extent to which *basic capital* represents the firms' economic performance, because *basic capital* itself is not a direct measure of a firm's performance. To this end, we examine the effects of raising greater *basic capital* on the firm's survival. In addition to the charters filed at the firms' foundings, data on the survival of those firms are provided by corporate directories of the publicly traded firms in Russia that were published in 1869, 1874, 1892, 1905, and 1914 (Owen 1992). A particular challenge with these data is that the directories were published at irregular time intervals, and the exact date of firm failure is unknown. In other words, when a firm is not documented in a directory, we infer that it failed at some point since the publication of the preceding directory. Therefore, these data are interval-censored because we know only the upper and lower bounds of the period in which a firm failure occurred. As is common to survival data, these data are also right-censored because many firms survived up to the publication of the last directory in 1914. As an alternative to semi-parametric Cox regression, we specify parametric accelerated failure time models, which better account for interval-censoring and right-censoring (Kleinbaum and Klein 2012). As compared to parametric proportional hazards models, accelerated failure time models represent an alternative parameterization in which the logarithm of survival time is regressed on the covariates. Positive coefficients therefore indicate longer survival times.

For the accelerated failure time analysis, we include only firms that appeared at least once in any of the directories, which reduces our original sample of entrepreneurial teams to 1,530 observations. To ensure that there were not systematic differences between the full sample and this sub-sample, we reanalyzed the multiple membership models predicting *basic capital* (as in Table 3, Model 4) using only the sub-sample included in the accelerated failure time model. When we limited analysis to the sub-sample of firms, the substantive effects of the predictor variables on *basic capital* remained largely consistent.

Of the 1,530 firms in the sub-sample, the directories indicate that 21% failed during the study period. Parallel to our earlier analysis of *basic capital*, we model failure time as a function of the same set of covariates in Model 4 of Table 3 excluding *brokerage role diversity*, *constraint mean,* and their interaction term, expecting that firms with greater initial capital will survive longer (Hillman and Aven 2011). The model we present assumes a Weibull distribution of failure times, but the substantive results are robust to the choice of distribution (log-normal and logistic distributions were evaluated as alternatives). The model omits founder-level random effects because multiple membership approaches for interval-censored accelerated failure time analysis are not well developed.[1]

Table A.1 presents the results and shows that *basic capital* significantly increases firm survival ($\beta = 0.33$). Therefore, *basic capital* represents an important performance indicator for new venture firms because it is positively associated with longer survival.

REFERENCES

Hillmann, H., Aven, B. L. 2011. "Fragmented Networks and Entrepreneurship in Late Imperial Russia." American Journal of Sociology, 117(2): 484-538.

Kleinbaum, D. G., Klein, M. 2012. Survival Analysis: A Self-learning Text. Springer-Verlag New York.

Owen, T. C. 1992. RUSCORP: A Database of Corporations in the Russian Empire, 1700– 1914. Ann Arbor, MI: Inter-University Consortium for Political and Social Research.

[1] As a robustness check, we reformatted the data as a discrete time event history model with a multiple membership structure, making the assumption that failures occurred at exactly the midpoint of each of the intervals. In the multiple membership models, we find that founder-level variance accounts for only 10% of the total variance. Thus, the inclusion of founder-level effects is unlikely to alter the interpretation of other parameters in the model.

TABLE A.1. Maximum Likelihood Estimates of Founding Team Failures, 1869-1913 (*n* = 1,530 teams)

	(1)
Intercept	2.790***
	(1.016)
Basic Capital in '000 Rubles (logged)	0.333**
	(0.101)
Team Size (logged)	-0.024**
	(0.149)
Joint-stock Organization	-0.975***
	(0.224)
Region controls (indicator coding)	Yes
Year controls (indicator coding)	Yes
Firm Industry controls (indicator coding)	Yes

Note: The model is an accelerated failure time model for interval-censored survival analysis. Intervals are based on corporate directores published in 1869, 1874, 1892, 1905, and 1914. The model assumes a Weibull distribution. The sample includes only corporations that were ever included in at least one corporate directory.

* $p < .05$; ** $p \leq .01$; *** $p \leq .001$

APPENDIX B: PLAUSIBLE EXOGENEITY APPROACH

Here we describe the results of two approaches by Conley et al. (2012) which relax the exclusion restriction of the instrumental variable analysis presented in Table 5. First, we assume that the direct effect of property restrictions on *basic capital*, γ, is uniformly distributed and δ is the estimated standard deviation of γ. Next, we vary δ to determine how much of a violation of exclusion restriction could exist for the positive effect of *brokerage role diversity* on *basic capital* to remain significant at the 10% level. We present both the Union of Confidence and Local-to-Zero approaches for the full and coarsened exact matched samples in the figures below; the specifications for each figure are based on the respective 2SLS models in Table 5. The dotted lines represent the Union of Confidence Intervals approximation, which provides the most conservative confidence intervals, while the Local-to-Zero approach, represented by the dashed lines, permits greater specification of the distribution for γ.

For the full sample, the effect *brokerage role diversity* is still significantly different from zero at the 10% level if $\gamma \lesssim 0.10$ based on the Union to Confidence approach and requires that $\gamma \gtrsim 0.14$ to nullify the statistical significance of the IV results at the 10% level for the Local-to-Zero approach. Given the reduced-form effect of property restrictions on *basic capital* (0.246), the effect of the property restrictions would have to be greater than 41% to render the *brokerage role diversity* estimates non-significant. In Figure B.1, which presents the CEM results, the effect of *brokerage role diversity* is still significantly different from zero at the 10% level if $\gamma \lesssim 0.075$ based on both the Union to Confidence and the Local-to-Zero approaches. That is, 33% or more of the reduced-form effect on *basic capital* (0.228) for the CEM estimates would have to go through channels other than *brokerage role diversity* to undermine the statistical significance of the second-stage results. Therefore, our IV estimates for *brokerage role diversity* for both samples remain relatively robust despite potentially large violations of the exclusion restriction.

REFERENCES

Conley, T. G., Hansen, C. B., Rossi, P. E. 2012. "Plausibly Exogenous." The Review of Economics and Statistics, 94(1), 260–272.

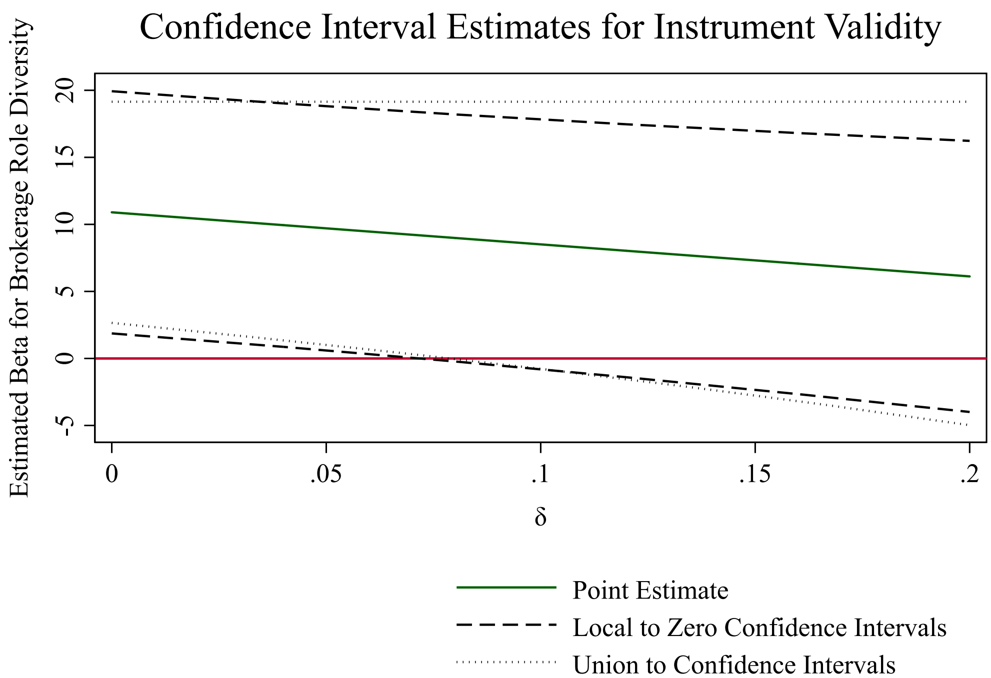

Figure B.1 CEM Sample (*N*=1,035)

SUPPLEMENTAL TABLES

TABLE S.1. Generalized Linear Model Regression Estimates of Basic Capital Raised By Founding Teams (n = 2,446 teams)

	(1)	(2)	(3)	(4)
Intercept	6.689***	6.731***	6.561***	6.782***
	(0.024)	(0.093)	(0.234)	(0.350)
Brokerage Role Diversity	1.048***	3.991***	4.186***	4.040***
	(0.186)	(1.048)	(1.083)	(1.060)
Constraint Mean		-0.052	-0.152	-0.046
		(0.100)	(0.173)	(0.168)
Brokerage Role Diversity x Constraint Mean		-4.503**	-5.087***	-4.933***
		(1.508)	(1.503)	(1.469)
Team Size (logged)			-0.068	-0.117
			(0.069)	(0.068)
Joint-stock Organization			0.540***	0.525***
			(0.045)	(0.051)
Region controls (indicator coding)	No	No	No	Yes
Year controls (indicator coding)	No	No	No	Yes
Firm Industry controls (indicator coding)	No	No	No	Yes
AIC	7379.542	7371.523	7232.596	7043.279

Note: The dependent variable is the logged basic capital of firms, standardized and deflated to the 1913 ruble. Models are estimated with the identity link function.

* $p < .05$; ** $p \leq .01$; *** $p \leq .001$

TABLE S.2. Generalized Linear Model Regression Estimates of Basic Capital Raised By Founding Teams (*n* = 2,446 teams)
Extended Models

	(5)	(6)	(7)	(8)	(9)
Intercept	6.918***	6.912***	6.582***	6.971***	6.884***
	(0.351)	(0.355)	(0.365)	(0.406)	(0.442)
Brokerage Role Diversity	4.130***	5.187**	4.396**	4.366**	4.585**
	(1.057)	(1.578)	(1.572)	(1.571)	(1.629)
Constraint Mean	-0.063	-0.082	0.204	0.248	0.239
	(0.168)	(0.178)	(0.188)	(0.189)	(0.189)
Brokerage Role Diversity x Constraint Mean	-5.032***	-6.390**	-5.556**	-5.801**	-6.172**
	(1.465)	(2.061)	(2.059)	(2.060)	(2.186)
Team Size (logged)	-0.124	-0.092	0.017	-0.020	-0.024
	(0.068)	(0.079)	(0.084)	(0.086)	(0.086)
Joint-stock Organization	0.545***	0.544***	0.526***	0.524***	0.524***
	(0.051)	(0.051)	(0.051)	(0.050)	(0.051)
Ethnic Diversity	-0.240***	-0.238***	-0.228***	-0.232***	-0.231***
	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)
Degree Centrality Standard Deviation		-0.005	-0.036	-0.043*	-0.044*
		(0.017)	(0.018)	(0.019)	(0.019)
Degree Centrality Mean		-0.006	-0.013	-0.010	-0.010
		(0.010)	(0.010)	(0.010)	(0.010)
Firm Team Degree Centrality Standard Deviation x Firm Team Degree Centrality Mean		-0.000	0.000	0.001	0.001
		(0.000)	(0.000)	(0.000)	(0.000)
Total Experience			0.111***	0.094***	0.101***
			(0.026)	(0.027)	(0.030)
Percent of Serial Founders			0.255	0.042	0.022
			(0.166)	(0.193)	(0.197)
Firm Constraint				-0.193*	-0.075
				(0.089)	(0.249)
Firm Constraint Dummy					-0.136
					(0.268)
Region controls (indicator coding)	Yes	Yes	Yes	Yes	Yes
Year controls (indicator coding)	Yes	Yes	Yes	Yes	Yes
Firm Industry controls (indicator coding)	Yes	Yes	Yes	Yes	Yes
AIC	7030.081	7033.907	6997.911	6995.080	6996.813

Note: The dependent variable is the logged basic capital of firms, standardized and deflated to the 1913 ruble. Models are estimated with the identity link function.
* $p < .05$; ** $p \leq .01$; *** $p \leq .001$

TABLE S.3. Multiple Membership Estimates Estimates of Basic Capital Raised By Founding Teams, 1869-1887 (*n* = 659 teams)

	(1)
Intercept	7.288***
	(0.511)
Brokerage Role Diversity	4.150**
	(1.762)
Constraint Mean	-0.464
	(0.327)
Brokerage Role Diversity x Constraint Mean	-7.854**
	(2.537)
Team Size (logged)	-0.369**
	(0.136)
Joint-stock Organization	0.547***
	(0.092)
Number of Jewish Members	0.025
	(0.039)
Number of Foreigner Members	0.044
	(0.027)
Region controls (indicator coding)	Yes
Year controls (indicator coding)	Yes
Firm Industry controls (indicator coding)	Yes
Random Effects	
Founders	0.246
	(0.209)
Residual	0.776
	(0.071)
DIC	1788.738

Note: The dependent variable is the logged basic capital of firms, standardized and deflated to the 1913 ruble.

* $p < .05$; ** $p \leq .01$; *** $p \leq .001$