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e-companion

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Electronic Companion—"The Performance Consequences of Ambidexterity in Strategic Alliance Formations: Empirical Investigation and Computational Theorizing" by Zhiang (John) Lin, Haibin Yang, and Irem Demirkan, *Management Science*, DOI 10.1287/mnsc.1070.0712.

Online Supplement

Appendix A. General Algorithm of the Simulation Model

Parameter Descriptions

—*YR*: Year of the network in the experiment. It can take a value from 1 to 30 in this study.

—*EU*: Environmental uncertainty measured as the volatility rate of the network. It is used to adjust yearly resources available to firms in the network. It can take a value around 0.003 or 0.04, in order to match the empirical data. For example, if the network faces a volatility rate of 0.04 in a particular year, then each firm within the network will have a resource adjustment by a factor of $(1 + 0.04)$, as further described below.

—*N*: Number of nodes (firms or actors) in a network. It can take a value of either 25 or 70.

—*RI*: Number of types of input resources for each node. It can take the value of 10.

—*RO*: Number of type of output resource for each node. It can take a value of 10.

—*MI*: Maximum amount of resources for each type in *RI*. It can take the value of 70. For each type of input resources, a randomly generated amount of resources in the range from 0 to *MI* can be generated. When the amount is 0, that type of input resources becomes non-existent and so the node will have one less type of input resources.

—*MO*: Maximum amount of resource for each type in *RO*. It can take the value of 35. For each type of output resources, a randomly generated amount of resources in the range from 0 to *MO* can be generated. When the amount is 0, that type of output resources becomes non-existent and so the node will have one less type of output resources.

—RI_{ik}: Amount of input units for node *i*'s type *k* resources. It is initialized using the following equation:

$$RI_{ik} = (\text{random generator MOD } (MI + 1)) \times (1.0 + EU),$$

where random generator MOD $(MI + 1)$ generates a random number between 0 to *MI*.

—RO_{jl}: Amount of output units for node *j*'s type *l* resources. It is initialized using the following equation:

$$RO_{jl} = (\text{random generator MOD } (MO + 1)) \times (1.0 + EU),$$

where random generator MOD $(\text{MO} + 1)$ generates a random number between 0 to *MO*.

—$\{MT_{ij}\}$: Resource match matrix representing the initial resource relationship among all the nodes in the network. The value for each cell MT_{ij} in the matrix is determined by the extent to which node *i*'s output resources match node *j*'s input resources across all possible types. For example, if node I has the following types of output resources that have non-zero amount: Type_2 (amount = 3), Type_3 (amount = 8), and Type_RO (amount = 23); and node *j* has the following types input resources that have non-zero amount: Type_1 (amount = 10), Type_2 (amount = 23), Type_3 (amount = 69), then there are two matches between node *i* and node *j*. Or, $\text{MT}_{ij} = 2$.

—$\{CT_{ij}\}$: Contact matrix representing the alliance relationships among all the nodes in the network. The value of each cell CT_{ij} is initially set to zero and can be incremented by 1 each time there is an actual resource exchange between node *i* and node *j*.

—$\{ST_{ij}\}$: Tie strength matrix representing the strength of relationships based on both the resource match and their actual contacts in the following dynamic relations among all the nodes in the network.

The value of each cell ST_{ij} is determined by the addition of MT_{ij} and CT_{ij}, in which CT_{ij} can be adjusted after each exchange among any two nodes.

—T: Total time units allowed for each node in each year, which is set at 50 units. Each node's search activity, resource exchange activity will take certain amount of time units. By assigning this number, the simulation allows the nodes to have sufficient time to conduct their alliance relations while not let the model go into infinite loops. The simulation results also show that 99.5% of the nodes can meet their resource needs within the time units allowed. In another study of ours, we have explored the effect of time pressure on organizations' efficiency of resource accumulations (Lin 2002).

Experiment Intializations

1. Set the maximum number of years YR (30) for the simulation; set the volatility rate of the network V, which is a randomly generated number around 0.003 or 0.04.
2. Generate N (25 or 75) nodes, each of which needs up to RI (10) types of input resources to produce up to RO (10) types of output resources. For each type of input resource, the amount is randomly generated with the range between 0 to MI (70), which is further adjusted by the volatility rate of the network V. For each type of output resource, the amount is randomly generated with the range between 0 to MO (35), which is also further adjusted by the volatility rate of the network V.
3. Calculate the resource match matrix $\{MT_{ij}\}$, which measures for each pair of nodes i and j, the extent to which node i's output resources match node j's input resources across all possible types.
4. Set up an initial contact matrix $\{CT_{ij}\}$ for all nodes that contains only zeros before interactions exist between each pair of nodes.
5. Calculate the initial tie strength matrix $\{ST_{ij}\}$ for all pairs of nodes, based on both the resource match matrix and the contact matrix.

Processes

6. Start year Y_m.
7. If the exploitation/exploration mechanism is used, each node i in the network searches for another node j that has the next strongest/weakest tie with node i. Exchange resources between node j and node i. If node i's input resource needs are met or time has expired, go to 9. Otherwise, go to 7.
8. If the ambidextrous mechanism is used, each node j in the network alternatively searches for another node j that has the next strongest tie with node i and another node k that has the next weakest tie with node i. Exchange resources between node j and node i, and node k and node i. If node i's input resource needs are met or time has expired, go to 9. Otherwise, go to 8.

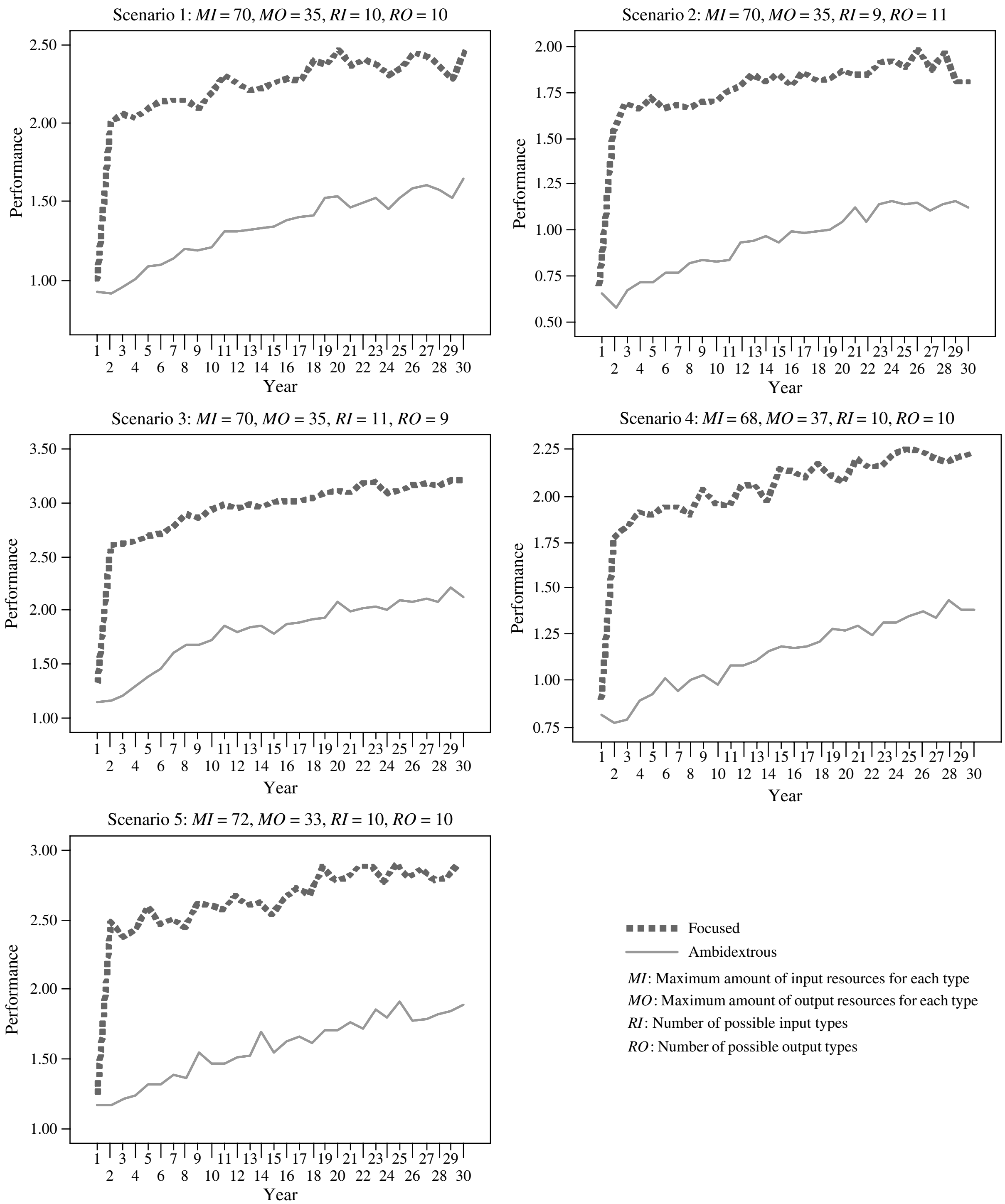
Adaptations

9. At the end of year, record resources generated and exchanged and number of alliance partners for each node.
10. Adjust resource input demand for all nodes and update the resource match matrix $\{MT_{ij}\}$ based on a new industry volatility rate V.
11. Update the contact matrix $\{CT_{ij}\}$ for each pair of nodes.
12. Update the tie strength matrix $\{ST_{ij}\}$ for each pair of nodes based on $\{MT_{ij}\}$ and $\{CT_{ij}\}$.
13. If year m is less than YR, go to 6. Otherwise, stop and print out outcomes.

Appendix B. Sensitivity Analysis Results

We have conducted systematic sensitivity analyses on experimental parameters (RI, RO, MI, MO) to examine how their small variations (with systematic changes of one and two units in either direction for each parameter) may alter the main, aggregated outcomes across the years. The general patterns of those results have remained consistent statistically ($p < 0.001$), in particular with regard to the significant differences between the performance outcomes based on either focused or ambidextrous approaches across all event years. We did not conduct further sensitivity analyses on other variables as they were being theorized to have effects on the outcomes. Figure EC.1 has shown some of the main sensitivity analysis results as a result of one unit changes for parameters RI, RO, MI, and MO.

Figure EC.1 Main Sensitivity Analysis Results



Appendix C. Interaction Plots

Figure EC.2 Interaction Between Ambidexterity and Firm Size

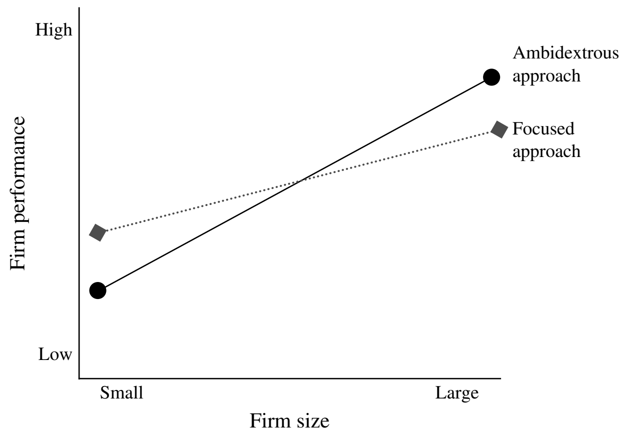


Figure EC.3 Interaction Between Ambidexterity and Environmental Uncertainty

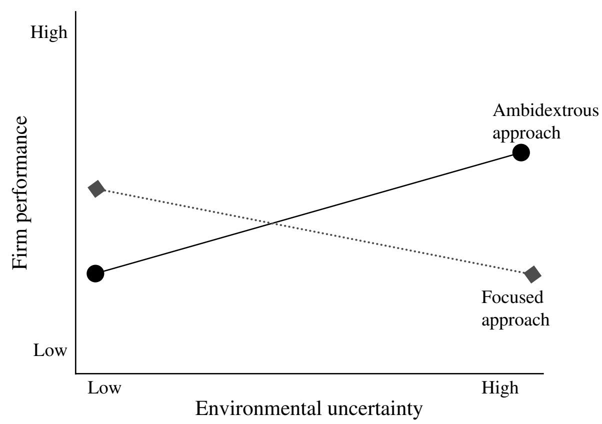


Figure EC.4 Interaction Between Ambidexterity and Firm Centrality

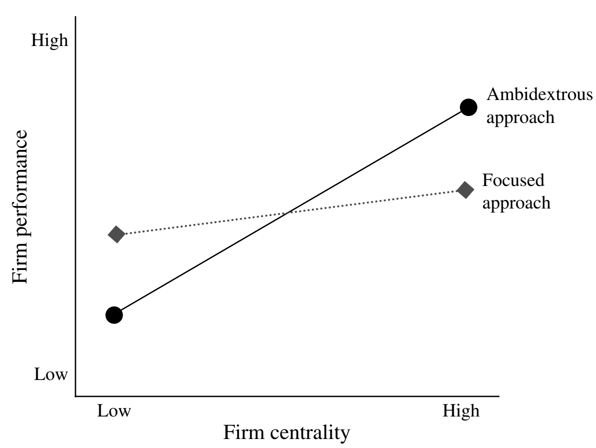


Figure EC.5 Interaction Between Ambidexterity and Structural Holes

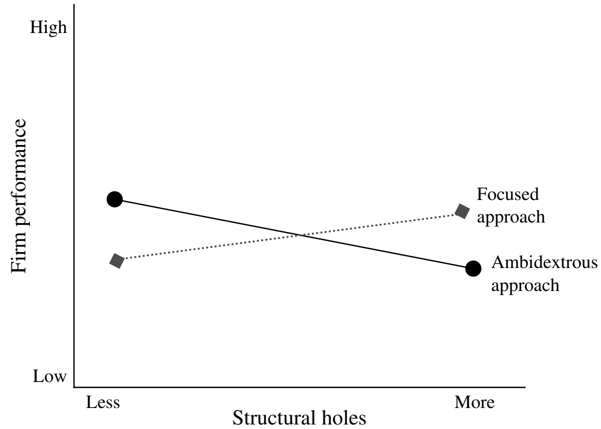


Figure EC.6 Interaction Between Ambidexterity and Alliance Event Year (Year ≤ 9)