On-line Appendix for:

Csaszar and Siggelkow. "How much to Copy? Determinants of effective imitation breadth."

We studied the robustness of our findings regarding the value of different breadths of imitation (β) with respect to the four other parameters of the model (complexity, K; number of firms, M; dimensionality of the landscape, N; and similarity, S). In addition, we relaxed the assumption that managers can only perform local searches, and we explicitly modeled turbulence in the environment to show that our short-horizon results are indeed representative of turbulent environments.

Robustness with respect to K. While Figures 1 and 2 report results for K = 2 and K = 12, we ran these simulations for all possible values of K (0, 1, ..., 12) and found that the relationship between β and performance varies smoothly, essentially interpolating Figures 1 and 2. For short-horizons and low values of K (0, 1, 2) a monotone positive relationship exists between β and performance. Starting at K = 3, the relationship becomes S shaped, with a minimum at around $\beta = 2$ or 3, and a decline at very high levels of β . As K increases, the S-shape becomes increasingly pronounced. For long-time horizons, the inverted U-shape is present for all values of K except for K = 0 (when there is no relationship), and becomes increasingly inversely U-shaped as K increases. These results confirm our intuition that as the degree of interdependencies increases, the potential downfall of intermediately sized imitations (in the short-run) and the potential problem of premature lock-in for high levels of β in the long-run are increased.

Robustness with respect to M. One might surmise that as the number of firms increases, the problem of premature lock-in, which arises at high K, might decrease. With many firms, the highest-performing firm is likely to have found a very good peak on the landscape. As a result, completely copying this firm's set of activities should be a very good imitation strategy. Figures A1 (a) and (b) report results similar to Figure 2, when we set the number of firms, M, to 2, 5, 10, and 50. As expected, for high values of β , as M increases, performance increases. Yet even for M = 50 we do observe a declining relationship between β and performance, as β gets very large (Figure A1 (b)).¹

¹ Intriguingly, the detrimental short-term effect of copying intermediately-sized chunks is larger as M increases. This result is driven by the fact that when M is small, fewer firms are engaged in detrimental copying. For instance, for M = 2, only half the firms, i.e., the second-highest performers, are engaged in imitation. Since intermediately sized imitation is detrimental, the fewer do it, the higher the reported average performance of all firms.

Robustness with respect to N. To test how our main findings, the short- and long-horizon results of Figure 2, would change as the dimensionality of the landscape varies, we simulated two further landscapes with different levels of N and relatively high values of K; in particular, N = 8 and K = 6, and N = 16 and K = 12. Figures A2 (a) and (b) (and Figure 2, as the middlecase with N = 12 and K = 10) show that as N increases, the range of β for which intermediatesized imitation is detrimental in the short-run becomes broader. Similarly, for long-time horizons, the most effective β increases. In this sense, the relationship between β and performance seems to be "stretched" as N increases, while the general shape remains the same.

Robustness with respect to S. Similar to the results with respect to K, the relationship between β and performance changes smoothly as S changes. We replicated Figure 7 for all values of S (0, 1, ..., 12) and found that as S increased, the performance lines slowly pivoted upward around the $\beta = 0$ point (which always generates the same performance, since no imitation takes place). In all cases, the relationship switched from a negative relationship to a positive relationship at values of S around 7.

Relaxing the assumption of strictly local search. In our model, imitation is the only way that firms are able to change more than one practice at a time. While at the end of Section IV.2 we reported results when firms are able to make random long jumps when they are stuck, here we modify our model with respect to the off-line search that firms are engaged in until they get stuck. In particular, we allow managers to evaluate and change alternatives that differ from the statusquo set in up to two decisions. In Panel (a) of Figure A3, we report results when managers are able to evaluate 12 alternatives in each period (i.e., the same number of alternatives that they evaluate in our main simulation). In Panel (b) of Figure A3, we report results when managers are able to evaluate all 78 alternatives that differ in the status quo in one or two practices.² In either case, the basic shapes of the relationships between β and performance is similar to those reported in Figure 2. In the short-run, we observe a U-shape; in the long-run we observe an inverted U-shape. As expected, the "maximum" of the long-run curve is shifted to the right: if managers are able to search non-locally themselves, it takes a longer jump for a firm to escape its current set of practices.

Explicit modeling of turbulence. Following Siggelkow and Rivkin (2005), we modeled a turbulent environment by replacing every 10 periods each contribution value $c_i(\cdot)$ with a new

² There are 12 alternatives that differ in one practice from the status quo, and there are $\binom{12}{2} = 66$ alternatives that differ in two practices from the status quo.

contribution value equal to $0.2c_i(\cdot) + 0.8u$, where *u* is a new random draw from a uniform distribution over [0, 1]. Figures A4 (a) and (b) show the performance of firms that live in such turbulent environments at T = 99. The relationship between β and performance is very similar to those reported for T = 10 in Figures 1 and 2 of the paper.

Reference:

Siggelkow, N. and Rivkin, J. W. 2005. Speed and search: Designing organizations for turbulence and complexity. *Organization Science* **16**: 101-122.



Figure A1: Robustness to varying the number of firms.

Figure A2: Robustness to varying the dimensionality of the landscape.





Figure A3: Relaxing the assumption of strictly local search

Figure A4: Explicit modeling of turbulence.

