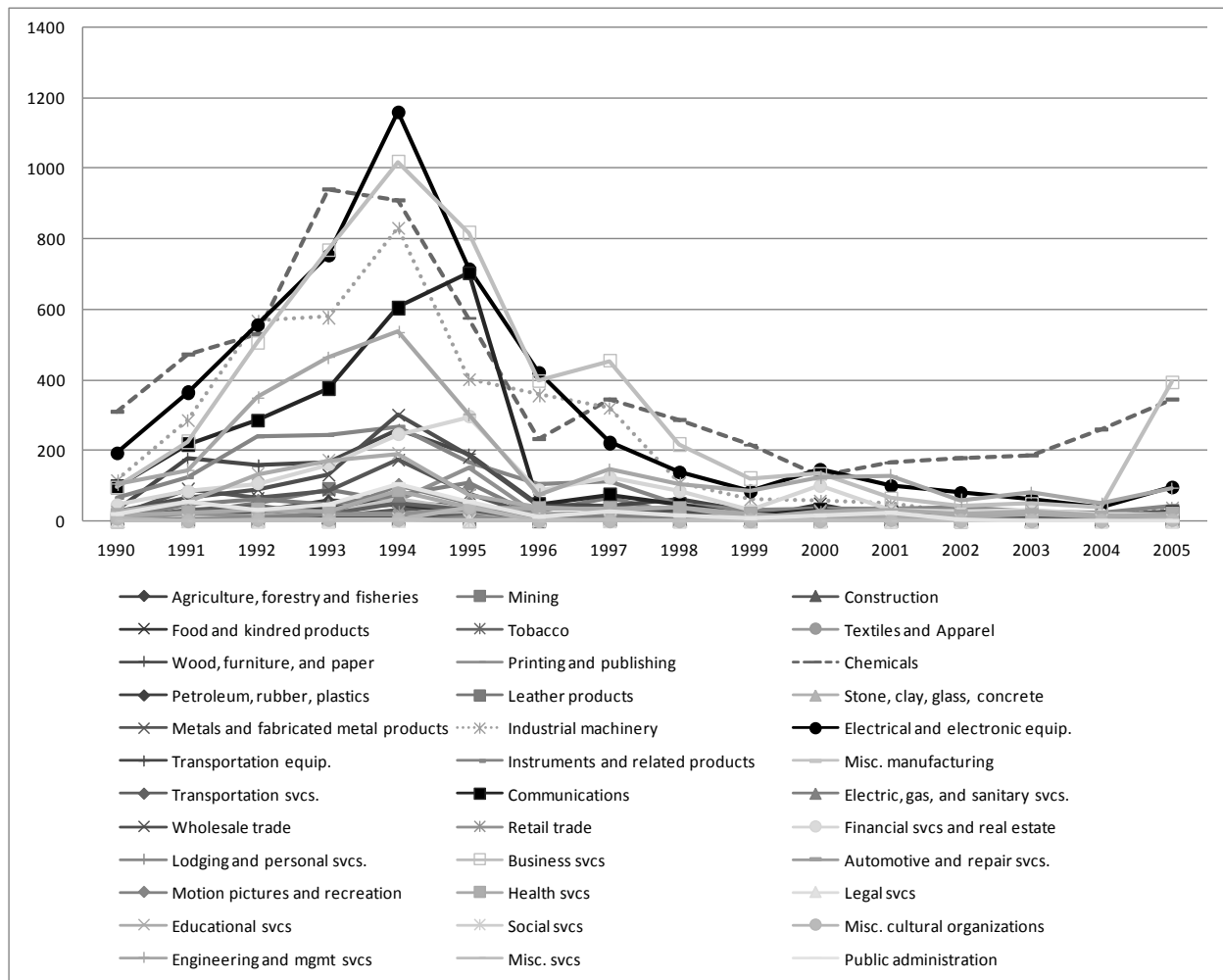


## Online Supplement

### A. Figure S1: Sectoral Decomposition of SDC Alliances, 1990-2005

A sectoral decomposition of the SDC alliances from 1990 to 2005 shows that a broad range of sectors exhibited the surge in alliance activity, though four of the sectors contributing most to the surge are IT-related industries: electronics and electrical equipment, business services (which is dominated by software), industrial machinery, and communications services.



### B. Further Analysis of Global Technology Collaboration Network Snapshots

The graphs of the global technology collaboration network reveal that the network is not organized into many separate groups that correspond to individual industries or regions. Instead, in many snapshots, the main component exhibits an interesting bi-lobal shape indicating that there are two main groupings of firms. Closer inspection of the data reveals that there are significant differences in industry representation

across the two groups. As illustrated here in in Figure S2a, one group is dominated by electronics-based industries (computer hardware and software, communication equipment and service, transportation equipment, etc.), which are colored orange in the graph, and the other group is dominated by chemical and medical-based industries (pharmaceuticals, chemicals, health services, medical equipment, etc.), which are colored blue in the graph.<sup>1</sup> This grouping also includes a large concentration of educational organizations (primarily universities), which are colored pink.<sup>2</sup> Scientific instruments firms, coded red, are distributed fairly evenly across the two groups. Organizations not falling into any of these categories (e.g., government, financial services, wholesale and retail, etc.) are coded gray. As the graphs vividly portray, connectivity *within* each group is much denser than *between* the groups. If the network is serving as a medium within which information and resources can be sought or exchanged, there is likely to be less exchange between the two groups than within them, and the exchange pathways that exist between the two groupings may be especially vulnerable to disruption if collaborative activity declines in a particular period. Consistent with this, in the graphs for the time periods of 1998-2000 and later (only components of 10 nodes or larger are shown for visual clarity), the electronics groupings were often disconnected from the chemical-medical groupings.

-----Insert Figure S2 About Here-----

As noted previously, the alliances include participants from 105 nations. Figure S2b depicts four representative snapshots with the organizations color-coded by continent. North American organizations are coded red, European organizations are coded blue, and Asian organizations are coded green (these are the regions for which the most organizations are represented) and the remaining are gray. These diagrams indicate that technology collaboration agreements are not constrained by regional boundaries. Though the large component in the first two diagrams is dominated by North American-based organizations, there are also large numbers of European and Asian organizations in the component, often in very central positions.

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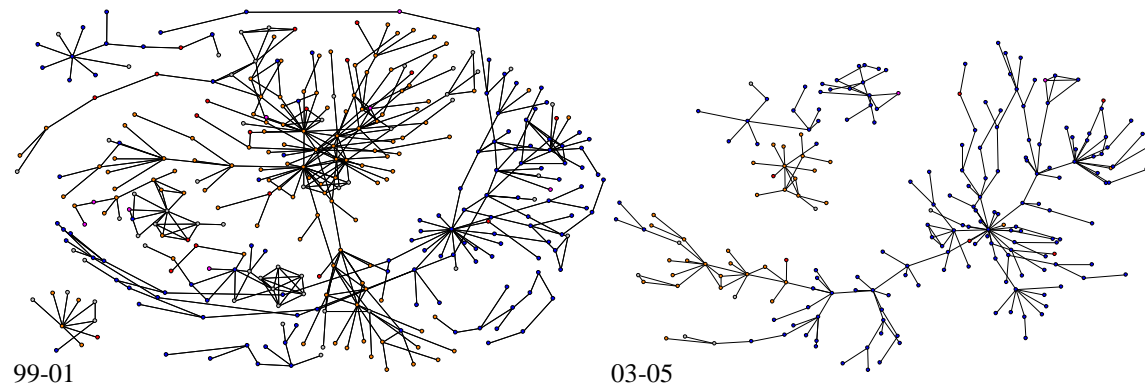
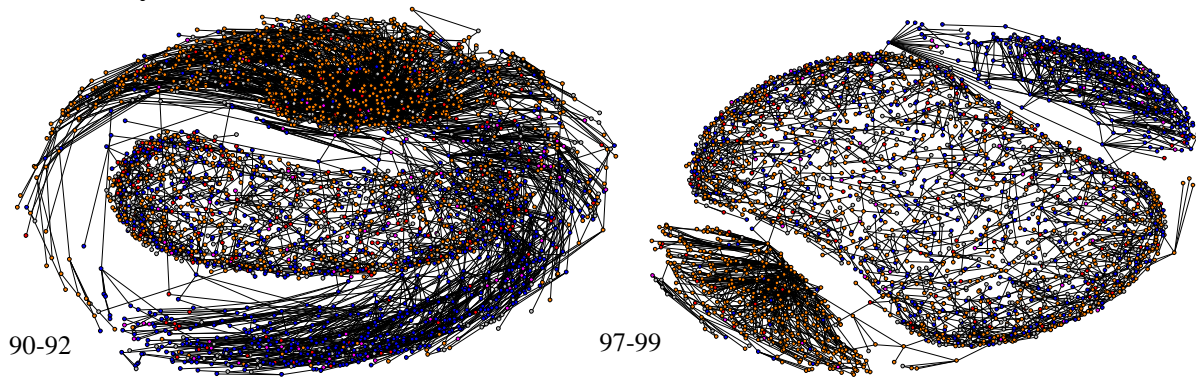
<sup>1</sup> The spring embedding algorithm uses random initial positions. Unfortunately, this means that each time the graph is drawn, the network may be oriented differently (e.g., in one picture the largest lobe may be near the top; in another it may be on the bottom).

<sup>2</sup> The data here indicate that over the time period studied, there were 296 universities engaged in technological collaborations. Some of the universities with the highest centrality indices include Stanford University, Massachusetts Institute of Technology, and Keio University in Tokyo, Japan.

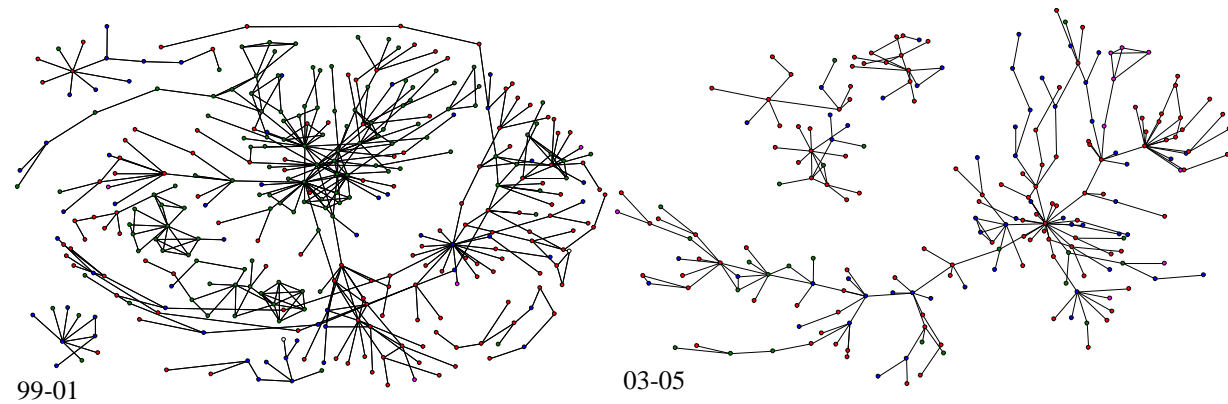
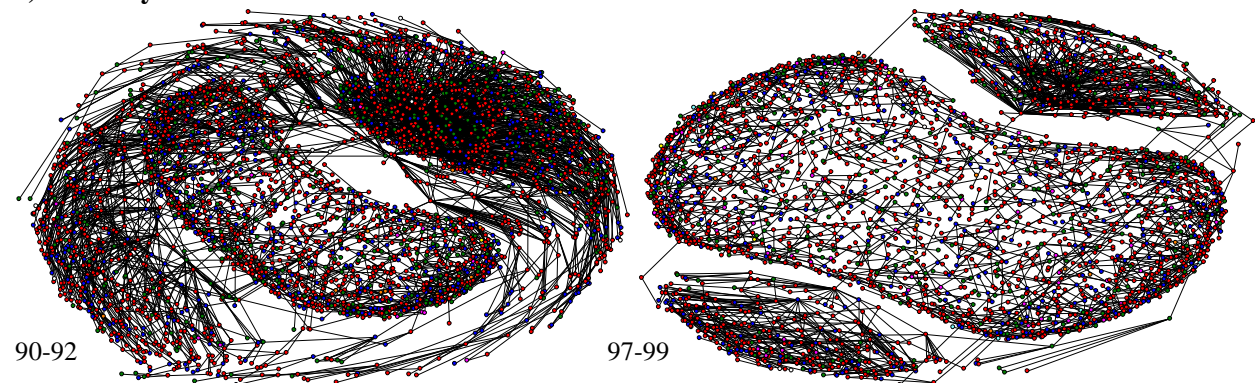
European firms play particularly central roles in the medical-chemical side of the graph due to the prominence of many large European pharmaceutical firms. Even in the more fragmented networks that follow the decline of alliance activity, components that are circumscribed by a single continent are the exception rather than the rule.

**Figure S2: Global Technology Collaboration Network, selected three-year snapshots**

**a) Color by Sector**



**b) Color by Continent**



**C. Table S1: Sectoral Breakdown of Firms and Patents**

<b>Sectors</b>	<b>Firms</b>	<b>Patents from 1993-2005</b>	<b>Average</b>
Transportation Equipment	16	17605	1100.31
Construction & Materials	19	8371	440.58
Food & Textiles	5	218	43.60
Pharma, Biologics, and Medical Equipment	171	30712	179.60
Information Technology (Hardware & Software)	200	194061	970.31
Industrial Machinery (except IT)	77	57222	743.14
Chemicals, Plastics & Oil	31	22271	718.42
Misc. Mfr & Svcs.	16	627	39.19

**D. Table S2: Structural Equation Models with Robust Clustered Errors (clustered on Firm ID)**

Direct Effects		t+1	t+2	t+3	t+4	t+5
LN(Patents)←						
	Technology shock index <sub>t</sub>	.08**	.06**	.07**	.05**	.04*
	LN(Number of alliances) <sub>ti</sub>	.08**	.10**	.12*	.14*	.15*
	LN(distance-weighted reach) <sub>ti</sub>	.04	.08**	.09*	.08*	.06
	LN(sales)	.02	.03*	.05**	.07**	.08**
	LN(R&D)	.05	.05	.04	-.03	.04
LN(Number of alliances)←						
	Technology shock index <sub>t</sub>	.23**	.22**	.20**	.16**	.12**
LN(distance-weighted reach) <sub>ti</sub> ←						
	LN(Number of alliances) <sub>ti</sub>	.69**	.69**	.69**	.68**	.68**
Indirect Effects						
LN(Patents)←						
	Technology shock index <sub>t</sub>	.03**	.03**	.04**	.03**	.02**
	LN(Number of alliances) <sub>ti</sub>	.03**	.06**	.06**	.06**	.04**
LN(distance-weighted reach) <sub>ti</sub> ←						
	Technology shock index <sub>t</sub>	.16**	.15**	.14**	.11**	.08**
Equation-Level R-squared						
Dependent Variables						
	LN(Patents)	.87	.82	.76	.71	.67
	LN(Number of alliances) <sub>ti</sub>	.05	.05	.04	.02	.01
	LN(distance-weighted reach) <sub>ti</sub>	.47	.47	.46	.45	.85
	Overall	.88	.82	.77	.71	.66
Mediation						
	% of total technology shock effect mediated by alliances	27%	33%	40%	38%	33%
	% of total alliance effect mediated by network reach	27%	38%	33%	32%	21%

† p<.10; \* p<.05; \*\*p<.01; industry dummies and constant omitted to conserve space

**Path Model based on Structural Equation Models with Robust Clustered Errors**

Coefficients shown for five lag periods (bold indicates significant at p<.05); controls omitted

