TABLE I.—ESTIMATE OF TECHNOLOGICAL PROGRESS FOR NEW CHEMICAL DRUGS, 1945–65

Year	Total new chemical drugs (I)	Estimate of the number representing product differentiation (II)	Estimate of the number representing technological progress (III)	Col. III as a percent of col. I (IV)
1945	3	2	1	0.33
1946	16	14	2	.13
1947	16	11	5	.31
1948	14	10	4	.29
1949	28	21	7	.25
1950	25	23	2	.08
1951	21	17	4	.19
1952	22	21	1	.05
1953	38	33	5	.13
1954	35	33	2	.06
1955	27	24	3	.11
1956	27	26	1	.04
1957	38	35	3	.08
1958	41	37	4	.10
1959	52	46	6	.12
1960	34	28	6	.18
1961	18	16	2	.11
1962	20	19	1	.05
1963	16	14	2	.13
1964	16	15	1	.06
1965	21	20	1	.05
Total	528	465	63	.12

Industry figures for new chemical drugs are available for the period 1951–61.[3] Comparing these figures with those in Column I indicates that the industry data exceeds the sample data by a yearly average of 10.8 drugs. In part this discrepancy is due to differences in the year of introduction reported for certain drugs and perhaps due in part to differences in the definition of new chemical drugs used by the industry and the AMA. It seems likely however, that if any of these innovations reported by the industry were important they would have been reported to the medical profession through the AMA's publications. The effect of including the industry data here would be to reduce the proportion of total innovation that represented technological advancement.

Beginning in the late 1940's there is a persistent increase in the number of drugs marketed each year until 1959, followed by a marked decline up through 1964. The series representing technological progress, Column III, however fails to increase appreciably. For the period 1945–50 the average ratio of innovations to advances is 5 to 1, while for the period after 1950 this ratio increases to an average of 10 to 1. Both series exhibit a decided break appearing in 1960 and 1961 respectively.

These broad movements can in part be explained by a combination of structural factors internal to the industry and external institutional factors. For the 1945–50 period the industry engaged in a process of forward vertical integration. The objective of this integration was better control over prices through the elimination of the firms solely engaged in packaging. The major example was set by Parke Davis and Lederle, the innovators of the first broad spectrum drugs. Both of these firms were fully integrated into the retail pharmacy and hospital markets and held strong patents on their innovations. In refusing domestic licenses on these products the traditional marketing pattern in the industry was altered. With the elimination of the packagers, direct control over price became possible. This example of the use of the patent and forward integration was undoubtedly a factor in Merck's merger with Sharp and Dohne as well as Pfizer's entry by internal expansion.

The structural change in the industry suppressed one form of competition—imitation from packagers or from integrated firms under license agreements. The alternative avenue open was to invent around the patent to produce a close substitute. Thus the increase in the proportion of innovations which represented product differentiation was partly in response to the closing of one method of competition.

[3] Pharmaceutical Manufacturers Association, *Prescripting Drug Industry Fact Book* (Washington, PMA), 1963, pp. 2–5.