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in West Germany 1964-74*

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1 Introduction

Merger activity in West Germany remained at a low level in comparison with most industrialised countries until the late nineteen-sixties, but has increased very rapidly since then.¹ Mergers notified to the Federal Cartel Office under §23 of the 1958 Act Against Restraint of Competition (GWB) averaged around 40 per year up to 1968. The number then rose to a peak of 305 during a merger wave which occurred in 1969-71, contemporaneously with similar waves in a number of other countries and especially the USA. Thereafter, despite the introduction of merger controls under GWB from 1974, the merger rate has grown dramatically bringing the annual total to 554 in 1977, nearly twice the level of the previous, 1970 peak. Admittedly these statistics exaggerate the true increase in merger activity for two reasons. First, the coverage of the Cartel Office series is complete only after 1973, and was most incomplete before 1967, when serious discussion of merger controls began. Secondly, there has been a marked increase in the acquisition of smaller companies since 1973, due to the existence of a size threshold for immunity from control in the merger policy implemented by the 1973 amendment to GWB. Nevertheless it is clear that a significant increase in merger activity has occurred. This was viewed with some concern in the second report of the Monopolies Commission (MK),² and a revision of merger controls is expected in the forthcoming (fourth) amendment to GWB.³

Mergers are essentially a form of structural adaption in the

¹ For a more detailed account of the development of German merger activity and policy since 1958 see Cable (1979).

² Monopolkommission (1978).

³ Earlier amendments to the 1958 Act were made in 1966, 1973 and 1976.

economy, undertaken at private initiative. The question for public policy is whether mergers - either as a whole or of certain types - confer significant social gains via improved economic performance, (e.g. in responding to technological and trading imperatives for changes in industrial structure) or whether, for example, they merely serve to further the interests of certain groups (e.g. managers and shareholders) at the expense of others. While there is a good deal of (mostly negative) evidence on these matters for some countries, notably the US and UK,⁴ very few if any results exist for West Germany.

This paper reports the results of a series of statistical tests for merger determinants and effects (as discussed in the economics literature)⁵ across a sample of 55 mergers which took place in Germany between 1964 and 1974. On the determinants side we focus on the exploitation of scale economies, risk-pooling, and market power, while the merger effects are measured in terms of performance variables including the levels and growth of profits, sales, assets and employment.

To test the determinants hypotheses, we compare the characteristics of a sample of merging firms (acquiring and acquired) with those of a control group containing matched pairs of non-merging firms. Similarly, the effects hypotheses are tested by comparing the post-merger behaviour of merging firms with that of non-merging firms. In the effects cases, additional counterfactuals are employed, in the shape of comparison with

⁴ For the surveys of the U.S. evidence see Hogarty (1970) and Mueller (1978) and for recent U.K. results see Cowling *et al.* (1979) and Meeks (1977).

⁵ For a fuller discussion see D.C. Mueller, "Hypotheses about Mergers" (1978).

industry averages and with "predicted performance" (obtained by applying industry-average changes to the pre-merger performance levels of merging firms). Wherever possible the tests used data for the period from five years before the merger to five years after it, and it was this which determined our choice of the study period. In some cases data problems necessitated a curtailment to three years before and after the merger.

Details of the merger sample and of the control group are given in the following section. The specific tests carried out are described in sections 4 and 5, where the results obtained are also reported. Conclusions and policy implications follow in section 6.

2 Data Base

A satisfactory list of mergers taking place in the study period 1964-74 was available to us neither from the publications of the Federal Statistical Office (SB), which deals only with legal mergers,⁶ nor the Cartel Office (B Kart A), which began publishing merger lists only in 1973. The sample of merging firms therefore had to be compiled from press notices and reference works on the ownership of firms.⁷ 134 cases of economic mergers, defined as the acquisition of a 50 per cent interest or more in another firm, were identified in this way. Exclusion of non-AG companies;⁸ for which data problems were insuperable, reduced this number to around 100. Further problems of data availability with the AG firms

⁶ Legal mergers, with formal integration and one or both partners losing their separate identity, represent a small minority of all mergers in Germany. For every legal merger in the 1970's there have been around seven or eight economic mergers, in which the effective control of one company passes to another via the acquisition of a significant ownership interest.

⁷ Handbuch der Aktiengesellschaften (HdA) Hoppenstedt, annual series and Wer gehört zu Wem? Commerzbank, annual series.

⁸ Aktiengesellschaften include the largest German companies, of which there were 2,149 in 1977. Only AG companies may seek stock-market quotations. Disclosure requirements are minimal for the much more numerous (168,000) GmbH (Gesellschaften mit beschränkter Haftung) company type.

resulted in a final sample of 55 merger cases, equivalent to 3.1 per cent of all §23 GWB mergers during the period 1964-74. The merger cases entering the sample are listed in Appendix (i).

The time profile of the merger sample corresponds reasonably well to that of merger activity as a whole. Although cases in the sample represented 5.8 per cent of all §23 GWB mergers between 1964 and 1968 and only 2.6 per cent from 1969-74, it will be remembered that there was some systematic under-reporting in the GWB series in the earlier period. In absolute terms only 15 of the cases in the sample occurred before 1969, as against 40 during the later more merger-intensive years.

The industrial distribution of the merger sample also reflects that for all mergers fairly accurately. Since 1958 German merger activity has been heavily concentrated in four industrial areas: chemical products (together with mineral oil products), electrical engineering, machine tools and iron and steel.⁹ If anything these are slightly over-represented in the sample, with just over 55 per cent of merger cases (classified according to the industrial activity of the acquiring firms),¹⁰ compared with 45 per cent of all mergers between 1950 and 1977, and 50 per cent 1969-72.

The sample contains a mixture of merger cases occurring before and after a qualitative change which seems to have occurred in merger activity around 1970/71. Prior to this, fluctuations in merger activity tended to coincide with movements in GDP and gross fixed investment

⁹ For further details see Cable (1979).

¹⁰ In the absence of official classification numbers, merging firms were allocated to industries by reference to their principal activities as listed.

and lag share prices by one period. Thereafter it is mergers which lead the other economic indicators.¹¹ There are alternative hypotheses about the possible change in the nature of merger activity accompanying this shift in phasing, but these have yet to be tested. In any event, our sample contains approximately two-thirds 'old-style' and one-third 'new style' mergers.

In order to carry out the statistical tests reported in Sections III.4 and III.5, annual series for the following variables were extracted for each firm from published sources:

1.	Net of depreciation plant and equipment	(Sachanlagen)
2.	Total Assets	(Bilanzsumme)
3.	Equity Capital	(Eigenkapital)
4.	Retained Earnings	(Rücklagen, gesetzlich und frei)
5.	Total Revenue	(Umsatzerlöse)
6.	Before Tax Profit	(Jahresüberschuß)
7.	Manual and non-manual employment	(Zahl der Arbeiter und Angestellten)

For our control group of non-merging firms and the accompanying data we are indebted to Professor O. Poensgen at the University of the Saarland in Saarbrücken. The control group consists of 57 randomly chosen firms, which are listed in Appendix (ii). The pairings of merging firms with their respective control firms are given in Appendix (iii). Whenever possible matching was by reference to both size and industry. A merging firm which engaged in more than one merger is paired with the same control firm in each case. Nevertheless, because the merging firms (acquiring and acquired) out-

¹¹ See Cable (1979).

number those in the control group, it was sometimes necessary to use the same control firm for more than one merging firm. Such repeated use of certain control firms will in general not impart systematic bias provided that the firms used repeatedly are drawn randomly from the control group as a whole, or (given that the statistical tests mostly involve comparing group means and variances) the repeated firms have the same mean and variance as the control group itself. In our case the selection of firms from the control group is not necessarily random, but there is reason to suppose the 'bias' induced may correct for an existing bias in the original control group itself in that this under-represents large firms. Thus, the control group with repeats may actually be preferable to the original control group.¹²

3 Characteristics of Merging and Non-Merging Firms

Before proceeding to the empirical tests of merger causes and effects, it may be helpful to review in general terms the pre-merger characteristics of the merging and non-merging companies. Table 1 presents comparisons of group means for acquiring, acquired and control firms in terms of five variables.

The most striking difference to appear is that the acquiring firms were several times larger than both the firms they acquired and the two

¹² For the merging n-firm group X we seek a true matching group Z, also with n members. In fact we have only Y with m < n firms. For the repeated use of certain members of group Y to be legitimate requires

(a) $\bar{Y}, \sigma_Y^2 = \bar{Z}, \sigma_Z^2$ for any variable used in the comparisons and

(b) the repeated firms Y_1 are drawn randomly from Y, or

$$\bar{Y}_1 = \bar{Y}, \sigma_{Y_1}^2 = \sigma_Y^2$$

In fact, inspection of firm size in the data suggests $\bar{Y} < \bar{Z}$ but $\bar{Y}_1 > \bar{Y}$.

Hence, means and variances for the control group with repeats may be closer to \bar{Z}, σ_Z^2 than are \bar{Y}, σ_Y^2 themselves.

control groups. There is also some suggestion that the acquiring firms had been growing faster than the acquired, for although the average growth rates are not significantly different at the normal confidence limits, positive differences were repeatedly found in eight out of the nine industries. Acquired companies, on the other hand, had been growing at little more than half the rate of their non-merging counterparts. This large difference is statistically significant, and is repeated in eight of the nine individual industries. Differences in profit performance among the groups were small and generally insignificant. Acquiring firms on average slightly outperformed acquired firms, but were themselves outperformed by the non-acquiring group, though the differences were not statistically significant nor was there a systematic pattern of differences across individual industries. The acquired firms performed least well of all groups, and significantly less well than their control group at the 10% confidence level. Stability of profit was significantly greater among acquiring than acquired firms, both across the sample as a whole and in all but one industry. The acquiring firms' profits were also less volatile than those of the non-acquiring control group, the (negative) difference being significant at 7% for the whole sample and consistently negative in eight of nine industries. Finally, there were essentially no significant and systematic differences in the degree of leverage with one exception, namely a significant positive difference between acquiring firms and their control group. However, even here, the result was not stable across industries.

Thus the general picture that emerges is of acquisitions of smaller by extremely large firms, with average to good profitability and growth records, significantly more stable profits than the other groups and higher leverage ratios than non-acquiring companies (though not the other groups). The acquired companies, though much smaller than their acquirers, were some-

what larger than non-merging firms, and possibly less profitable and certainly much slower-growing than non-acquired companies. Further interpretation of these observed differences is reserved for the two following sections in which the results of the statistical tests of alternative merger causes and effects are reported.

4 Statistical Tests on the Determinants of Mergers

Test 1 : Size Comparisons

Unless all firms are below minimum efficient scale, or smaller firms are prevented from merging by institutional barriers of one kind or another, the hypothesis that mergers take place to exploit scale economies suggest merging firms will be smaller than their non-merging counterparts. Table 2 reports the comparison of the geometric mean firm size of pairs of merging firms in the German sample and their matching, non-merging pairs. Geometric means are employed since most size variables will be positively skewed (i.e. approximate more nearly the lognormal than a normal distribution) so that the geometric mean is more appropriate for the statistical test applied. Three alternative size measures are used: sales, total assets and (net of depreciation) plant and equipment.

The comparison across all industries in the German sample shows that the merging firms are in fact significantly larger than the control firms, by a factor of between 3.6 and 5.4 depending on the size measure chosen. Moreover, the tendency for merging firms to be large is found consistently in each industry taken separately, as well as for the sample as a whole. While it may be that some individual mergers were undertaken for scale economies reasons, the evidence is inconsistent with the hypothesis that pursuit of scale economies is the general or overriding motive. On the other hand, the evidence is not inconsistent with a pursuit of a market power hypothesis, for in this case the larger the firms involved in a merger, the greater is the impact on market share.

Table I

Pre-Merger Characteristics of Merging and Non-Merging FirmsAcquiring (AG) vs Acquired (AD)

		Arithmetic Means		Difference $\bar{X}_1 - \bar{X}_2$	No. of Observations	t	Industries	
		AG \bar{X}_1	AD \bar{X}_2				Difference +ve	Total
I	SIZE (Assets)	1,776.6	202.8	157.4	50	5.85 ^{***}	9 ^{***}	9
II	GROWTH	9.3	7.0	2.3	47	1.6	5 ^{**}	9
III	PROFITABILITY (Profits/Assets)	0.04	0.03	0.01	47	1.4	7	9
IV	VARIABILITY OF PROFIT	2.2	3.1	-0.97	45	-2.1 ^{**}	1 ^{**}	9
V	LEVERAGE	0.63	0.63	-0.00	43	-0.06	3	8

Acquiring (AG) vs Matched Non-Acquiring (MAG)

		Arithmetic Means		Difference $\bar{X}_1 - \bar{X}_2$	No. of Observations	t	Industries	
		AG \bar{X}_1	MAG \bar{X}_2				Difference +ve	Total
I	SIZE (Assets)	1,820.1	73.9	1,746.2	51	6.72 ^{***}	9 ^{***}	9
II	GROWTH	9.5	8.1	1.5	46	1.19	-	9
III	PROFITABILITY (Profits/Assets)	0.04	0.05	-0.01	49	-1.36	3	9
IV	VARIABILITY OF PROFIT	2.2	3.5	-1.3	48	-1.85 [*]	1 ^{**}	9
V	LEVERAGE	0.62	0.56	0.07	45	2.75 ^{**}	1	9

Acquired (AD) vs Matched Non-Acquired (MAD)

		Arithmetic Means		Difference $\bar{X}_1 - \bar{X}_2$	No. of Observations	t	Industries	
		AG \bar{X}_1	MAD \bar{X}_2				Difference +ve	Total
I	SIZE (Assets)	192.7	77.5	121.9	54	1.80 [*]	5	9
II	GROWTH	6.5	12.0	-5.5	47	-2.59 ^{**}	1 ^{**}	9
III	PROFITABILITY (Profits/Assets)	0.03	0.04	-0.01	48	-1.75 [*]	3	8
IV	VARIABILITY OF PROFIT	3.1	2.9	0.2	41	0.47	-	9
V	LEVERAGE	0.63	0.64	-0.01	45	-0.29	3	8

*** denotes significant at 1% or better
 ** denotes significant at 5% or better
 * denotes significant at 10% or better

TABLE 2

DETERMINANTS : SIZE COMPARISONS IN MERGER YEAR

Variable	Company Type		Merger Type	ALL INDUSTRIES				NUMBER OF INDUSTRIES			t — Nn	Binomial Significance Level		
	1	2		No. of Companies	Mean Values	ACAD/ MAGMAD	t	Difference Positive	Total	Proportion Positive				
				1	2	1	2							
Geometric means of:														
1. Sales	AGAD	MAGMAD	All	48	48	272,218	59,928	4.54	7.08*	8	8	1.000	1.02	0.78%
2. Assets	AGAD	MAGMAD	"	52	52	229,027	42,066	5.44	7.66*	9	9	1.000	1.06	0.39%
3. Plant & Equipment	AGAD	MAGMAD	"	50	50	54,335	15,099	3.60	5.03*	8	8	1.000	0.71	0.78%

Test 2 : Risk Motives

2.1 Variation in Profits

Whenever two independent profit streams are combined, the variability of the combined profit stream will be less than that of the two independent streams, except in the highly unlikely circumstance that these are themselves perfectly correlated.¹³ Hence an effect of merger will invariably be to reduce the variability of profit of the merged entity. Insofar as a number of the factors giving rise to fluctuations in profit will affect firms in the same industry both simultaneously and to a similar extent, giving rise to positive covariance of their profits, this effect is likely to be less pronounced in horizontal than in other types of merger.

As is now widely recognised in the economics literature risk pooling will nonetheless not constitute a motive for merger under the assumption of a perfect and frictionless markets for capital and other resources (including management). For in these conditions shareholders can achieve the same risk-reduction by holding shares of the two companies in proportion to their sizes, bankruptcy is costless, and the potential risk-reduction effected by merger will be fully reflected in the market values of the firms involved, leaving no scope for a merger gain. However, risk-pooling can (though will not always) constitute

¹³ Post-merger returns (Z) are the weighted sum of the two earnings streams:

$$Z = wx_1 + (1-w)x_2$$

where $w, (1-w)$ are the relative sizes of the two firms and x_1, x_2 are their profits. The expected post merger return (u_z) is:

$$U_z = wu_1 + (1-w)u_2$$

with total variance (σ_z^2):

$$\sigma_z^2 = w^2\sigma_1^2 + (1-w)^2\sigma_2^2 + 2w(1-w)\text{cov}(x_1x_2)$$

As long as there is imperfect correlation between x_1 and x_2 , the total post-merger variance is less than the sum of the individual variances. With negative correlation, variability of post merger profit is much reduced.

a merger motive in the presence of capital market imperfections, such as transactions costs leading to small portfolio size, and discontinuities in risk schedules where bankruptcy is costly.¹⁴ Where managerial skills are firm-specific the reduction in bankruptcy risk can constitute a managerial as well as a stockholder welfare motive for merger.

Our first test for the presence of risk-motives in German mergers involves a direct comparison of the (pre-merger) variability of profit in merging and non-merging firms. To normalise for size differences we compare coefficients of variation in profit $\sigma_{\Pi}^2/\bar{\Pi}$ rather than raw variances. The evidence would be not inconsistent with the presence of risk motives if either acquiring firms with unusually high variability of profit are observed to take over firms with unusually stable profits or if acquiring firms exhibit relative stability of profit, while acquired firms are volatile. In the first case the reasoning is straightforward: by combining with more stable firms, acquiring firms reduce their abnormal variability of profit. In the second case the rationale is that risky acquired firms, whose market value is determined by reference to risk reduction potential in relation to average firms, seem cheap to firms with below normal profit stability.

Table 3 reports the results of the empirical tests for the German sample. It should be remembered when interpreting them that the sample included mainly horizontal mergers, so that any evidence of risk motives is likely to be weak. The comparisons show that acquiring firms have significantly less variability of profit than their non-merging counterparts, both across all

¹⁴ See Levy and Sarnat (1970).

TABLE 3

(1) DETERMINANTS: Comparison of Coefficients of Variation of Profit 3-5 Years before Merger

Variable	Company Type		Merger Type	No. of Companies		Mean Values		Difference (Ratio)	t	Difference Positive	Total	Proportion Positive	$\frac{t}{\sqrt{N}}$	Binomial Significance Level
	1	2		1	2	1	2							
Coefficient of Variation of Profit:														
1. Arithmetic mean	AG	MAG	All	43	43	0.293	0.961	-0.668	-2.30**	1	9		-0.351	3.91
1. (a) Arithmetic mean	AG	AD	"	40	40	0.287	0.827	-0.540	-3.16**	0	9		-0.500	0.39
2. Arithmetic mean	AD	MAD	"	35	35	0.764	0.728	0.036	0.17	4	9		0.029	100.00
3. Geometric mean	ACAD	MAGMAD	"	30	30	2.639	3.788	0.697	-1.41	3	9	0.333	-0.258	50.78

industries and in eight of nine individual industries. They were also significantly less risky than the firms they acquired across the sample as a whole, and in all nine separate industries. This seems to accord with the second situation described above. However, acquired firms exhibited a degree of fluctuation in profit which was almost identical with that of the matched, non-acquired firms, and this fails to complete the picture. Not surprisingly, in view of these results, the (geometric mean) comparison between pairs of merging and non-merging firms show the merging pairs to have the more stable profits, though the differences are now not statistically significant. What we are observing here could well be not attributable to risk motives, but merely a side effect of the difference in size between merging (especially acquiring) and non-merging firms, given that size and variability are quite likely to be inversely related, as in some previous studies (e.g. Samuels and Smyth).¹⁵ A simple correlation between firm size (assets) and variability of profit for all (merging and non-merging) firms in our sample in fact yielded a very small negative coefficient, insignificant at the 5% level.

It can, however, be argued that the above test, which looks only at the overall variability of a firm's profits, may fail to detect risk motives that are actually present. This is because, if a firm is seeking to reduce its riskiness by merger, or to buy a firm which seems cheap to it given that firm's risk profile in relation to firms on average, the best firm to acquire will be not necessarily one with high or low variability of profit, but one in which fluctuations in profit run counter to those in the acquiring firm. As an additional test, we therefore investigated the relative covariance of profits between merging and non-merging firms. Here, we would interpret a significantly

¹⁵ Samuels and Smyth (1968).

smaller positive, or larger negative covariance of profit among merging than non-merging firms as evidence of the presence of risk motives.

Since our data series were on an annual basis, only a small number of observations could be used in calculating the relevant covariances.¹⁶ The results, bearing in mind this limitation, showed an identical degree of covariance of profit in merging and matched non-merging pairs of firms, to three decimal places (see Appendix (iv)).

2.2-2.6.

Leverage (Gearing) Ratio

The various hypotheses about differences in leverage ratios among firms which may lead to differences in risk (see e.g. Baumol and Malkiel)¹⁷ can be transformed into hypotheses concerning the determinants of mergers, if one assumes the differences in risks attributable to differences in leverage ratio can be a cause for merger activity. The hypothesis would in general be that firms with either relatively high leverage ratios or with relatively low leverage ratios will be more likely to engage in merger activity than firms with "normal" leverage ratios. For our purposes the leverage ratio (LEV) is defined as long term debt divided by the sum of long term debt and equity. This we approximate in the analysis of German mergers from the following variables:

$$LEV = \frac{\text{Total capital} - (\text{Equity} + \text{Reserves})}{\text{Total Capital}}$$

¹⁶ In each case we used the maximum number of observations available, going outside the maximum 5 year pre-merger period used in other tests.

¹⁷ Baumol, W.J. and Malkiel (1967).

Tests 2.2-2.6 make the following comparisons between merging and non-merging firms:

- 2.2 Leverage ratios are formed for the two merging and control group firms. The mean absolute values of the differences in leverage ratios are then compared. Absolute values are used because it does not seem on a priori grounds that it would matter whether the acquiring or acquired firm had the largest of the two leverage ratios. If avoiding leverage-created risks is an important determinant of mergers, then high leverage firms should seek out low leverage firms as merger partners, and vice versa.
- 2.3 The variance in leverage ratios for acquiring firms is compared with that of matched non-merging firms.
- 2.4 The mean leverage ratio for acquiring firms is tested against that for matched non-merging firms.
- 2.5 The variance in leverage ratios for acquired firms is compared with that of matched non-merging firms.
- 2.6 The mean leverage ratio for acquired firms is tested against that for matched non-merging firms.

Tests 2.2, 2.4 and 2.6 compare sample means using a standard t-test, whereas in tests 2.3 and 2.5, which deal with differences in variances, an F-test is employed. The results of the leverage tests are set out in Table 4.

Taken together, the test results are not consistent with the presence

TABLE 4 Comparison of Leverage Ratios, Pre-Merger Year

Variable	Company Type		Merger Type	No. of Companies		Mean Values		Difference	t	Difference Positive	Total	Proportion Positive	$\frac{t}{\sqrt{n}}$	Binomial Significance Level
	1	2		1	2	1	2							
Leverage Ratios:														
2.2 Absolute Differences (Arith.means)	AGAD	MAGMAD	All	39	39	0.118	0.153	-0.035	-1.654**	2	9		-0.265	17.97
2.3 Variances	AG	MAG	"	49	49	0.016	0.015		F=1.069	3	6	0.50		100.00
2.4 Arithmetic Means	AG	MAG	"	49	49	0.625	0.574	0.056	2.193**	4	9		0.313	100.00
2.5 Variances	AG	MAD	"	42	42	0.018	0.014		F=1.206	4	6	0.67		68.75
2.6 Arithmetic Means	AD	MAD	"	42	42	0.654	0.654	-0.0004	-0.01	4	9		-0.003	100.00

of leverage-created-risk reducing motives for merger. The two tests comparing variances 2.3 and 2.5 are wholly insignificant. Some support for the risk motive hypothesis is suggested in 2.4, which shows that acquiring firms were significantly more highly geared than their control group partners, across the sample as a whole. However, this result may be due to the presence of some dominating extreme values, since in five of nine industries the reverse was true. Moreover the situation seems to be more that the matched acquiring firms had 'abnormally' low leverage ratios, than that the acquiring firms were abnormally high. Thus the mean for the MAG firms is the lowest of all groups, and in fact the acquiring firms took over firms (AD) with slightly higher leverage ratios than themselves, which in turn were identical with those for the matching non-acquireds. Had reduction in leverage been the motive for merger the AG firms should have been seeking partners from among their matching non-merging group, or firms similar to them (assuming this were possible). In any event they should not have been acquiring firms with higher leverage ratios than themselves. And if average increase were intended, we should have observed higher than normal leverage ratios among the acquired firms.

The result for the absolute values test 2.2, which indicates a negative absolute difference in leverage ratios between merging firms and non-merging pairs of firms, just fails to achieve significance at the 10 per cent level, and is consistent with the ranking of the various groups in terms of mean leverage ratios.¹⁸

¹⁸ Thus we have
$$\begin{array}{ccc} \text{AG} & > & \text{MAG} \\ (0.63) & & (0.57) \end{array}$$

and
$$\begin{array}{ccc} \Delta\text{D} & = & \text{MAD} \\ (0.65) & & (0.65) \end{array}$$

but
$$\begin{array}{ccc} |\text{AG} - \Delta\text{D}| & < & |\text{MAG} - \text{MAD}| \\ (-.02) & & (-.08) \end{array}$$

5 Statistical Tests of Merger Effects

Among the most important effects of mergers from a community viewpoint are those arising from increases in the market power of the acquiring firm on the one hand, and efficiency gains leading to reductions in its costs on the other. This is especially true of horizontal (as opposed to vertical and conglomerate) mergers, which are predominant in the German sample. These two consequences can in turn be divided into income changes for the factor owners (shareholders, management and workers) and welfare gains and losses to customers stemming from price and quality changes. To investigate these effects fully requires data on input and output prices, costs, real output, productivity etc., which is unpublished and obtainable only by detailed case-studies, which were beyond the resource limits of this study.¹⁹ It is, however, possible to draw certain inferences about the existence, if not the precise magnitude, of market power vs efficiency effects from the kind of published data which was available to us.²⁰

We begin by observing that a merger which affects neither costs nor market power will leave profit-maximising price unchanged. Post-merger output and profits of the combined firm will equal the sum of those for the two previously independent firms, and the rate of return on capital and sales will be unchanged.

Where, however, there is an efficiency gain but no market power increase, price should fall and output expand. In the short run (before entry

¹⁹ For a recent such study of UK mergers see K.Cowling, et al. (1979).

²⁰ The following discussion is set out in more detail in Mueller (1978).

of new firms occurs) total profits and the rate of return on capital and sales should all increase, (assuming the capital-labour ratio remains roughly constant)

Finally, consider a merger which increases market power and leaves costs unchanged. Profit maximising price will rise and output will fall. Profits too will increase absolutely and as a percentage of both capital and sales.

Evidently the type of merger cannot be distinguished by examining either the change in profits or profit rates; both market power and efficiency increases should raise these variables. The direction of change of price would be decisive, but is not readily observable. But the fact that a profit maximising firm always operates in the elastic portion of its demand schedule ensures that sales will increase for a merger which improves only efficiency, and decrease for a merger which increases only market power. We thus have an unambiguous test of the type of merger undertaken. In practice both market power and efficiency effects may be present simultaneously - the tradeoff situation analysed by Williamson.²¹ In this case we observe the net impact of the two effects.

Thus far we have not considered the possibility of a decline in profits. Since merger can hardly decrease market power, a ceteris paribus post-merger fall in profit must reflect a rise in cost due to e.g. (i) managerial miscalculation (ii) non-profit motivation of mergers (iii) temporary cost increases (adjustment costs). This latter case can be allowed for in some cases where both the long run profitability of the merger and its short-run costs are perceived in the capital

²¹ O.E. Williamson (1968).

market. Then, although the return on assets is reduced in the short-run, the per share return on equity \underline{r} ²² should increase, due to a rise in the price of the acquiring firm's shares at the time of the merger.

Table 5 summarises the direction of change in observable variables due to mergers with different effects, and the appropriate conclusions in each case. Unfortunately we were unable to observe \underline{r} on a per share basis in the analysis of the German merger sample, and so would be unable to discriminate between cases 4 and 5. As it turned out, however, in the German tests, there were no cases where $\Delta(\Pi/K) < 0$.

Because the tests of merger effects involve comparison of post- with pre-merger variables, it is necessary to remove the influence of events and developments other than the merger. The problem is one of choosing the most appropriate counterfactual: what the merging firms would have achieved if the merger had not occurred. In each of the following tests we use three different counterfactuals. Thus we compare the difference in post and pre-merger performance for the merging firms with that over the same period of (a) the matching pairs of non-merging firms (b) the average performance of all firms in the relevant industry (c) the "projected performance" of the merging firms, obtained by applying year by year the relevant industry growth rates of relevant variables to the levels of those variables obtaining in the merging firms.

²² The return on equity r is defined as

$$r_1 = \frac{D_1 + (P_1 - P_0)}{P_0}$$

where D_1 = dividends per share in year 1 and P_1, P_0 = share price in years 1 and 0.

TABLE 5. Changes in Observable Variables as a Result of Merger and Appropriate Conclusions.

Case	$\Delta \left(\frac{\Pi}{K} \right)$	ΔS	Δr	Conclusions
1	none	none	none	Merger with neutral market power and efficiency effects. Some other motive. Managers gain?
2	+	+	+	Improvement in efficiency, consumers and owners (managers) gain.
3	+	-	+	Increase in market power, owners benefit, consumers lose.
4	-	-	-	Consumers and owners both worse off. Managers erred or pursued other goals.
5	-	?	+	Temporary decline in profits due to adjustment costs. Owners benefit in the long run.

Tests 5-7: Post- vs Pre-Merger Rates of Return on Assets, Equity and Sales

Tests 5, 6 and 7 examine the post-merger profit performance of merging firms relative to the non-merging matched firms, industry performance, and projected own performance respectively. The full test results will be found in Appendix (iv) and the main features are summarised in Table 6.

At the conventional confidence levels, none of the differences in profit performance, measured in three different ways, between merging firms and the various counterfactuals are statistically significant. However, in all nine comparisons the sign of the difference is positive; the merging firms did better. Their relative superiority is least marked in comparison with matched

non-merging firms, followed by the comparison with projected performance. In relation to industry performance, merging firms avoided the decline in industry profits experienced by firms as a whole, though bearing in mind the tendency for merging firms to be relatively large, this could have little to do with merger per se but rather be due to large firms doing better than the industry average over the relevant periods. Nevertheless, bearing in mind the effect of small sample size on the t-test, and the possibility of downward bias in post-merger profitability of merging firms due to adjustment costs, it seems reasonable to conclude that the results give some, if slight, suggestion of increased profit rates due to merger. Certainly, although not significant within the normal limits, the results are more suggestive of an increase in rates of return after a merger than of a decrease.

To attempt to determine whether the slight increase in profitability arose from market power or efficiency effects we turn to a comparison of post- with pre-merger firm size. The comparison is in terms of geometric means, for the reasons discussed in relation to the earlier test 1.

Tests 5B-7B Post- vs Pre-Merger Size Levels (Geometric Means)

The main problem in comparing post- and pre-merger lies in the choice of size variable. Ideally we should use a measure of real or physical output. But this is neither directly available, nor can it be derived from sales revenue, in the absence of data on prices at firm level. The problem is therefore to choose from the available alternatives the best proxy measure for real output.

Observed changes in sales revenue will of course reflect changes in

TABLE 6 : Post- vs Pre-Merger Profitability ^{1/} (Tests 5-7)

Profit Rate Variable	Comparison with:											
	Matched non-merging firms (test 5)				Industry Performance (test 6)				Projected Performance (test 7)			
	Merging Firms ACAD	Non-Merging Firms MACMAD	Difference	t	Merging Firms ACAD	Industry	Difference	t	Merging Firms ACAD	Projected Performance	Difference	t
Return on Assets	-0.003	-0.006	.003	0.18	0.005	-0.013	0.017	1.10	0.043	0.036	.007	0.65
Return on Equity	0.063	0.028	.035	0.35	0.132	-0.016	.148	1.12	0.297	0.230	.066	0.68
Return on Sales	0.025	-0.002	.027	0.79	0.020	-0.010	.030	1.16	0.040	0.036	.004	0.55

^{1/} Rates of return are 3 (minimum) to 5 year averages.

real output, but also include price effects. These are positive in the market power case and negative in a pure efficiency case. Hence if sales revenue is used to proxy real output changes, the expected changes are both biased towards zero. A total assets measure is less likely to be affected by the price effects of merger. However its relationship to real output will change if the merger leads to changes in either the utilisation rate of the firm's capital, or to changes in technology involving more or less capital-intensive techniques, either of which could happen as a result of efficiency changes. An increase in in the utilisation rate would result in an understatement of the true output change (i.e. impart negative bias) while a change to more capital intensive methods leads to positive bias. A total assets measure is also prone to (upward) revaluation of assets following merger, which also introduces positive bias. Similar problems arise in the case of equity and plant-and-equipment measures. Thus there is no completely satisfactory solution, though the sign of the likely biases is to some extent predictable.

Results of the post- vs pre-merger size level tests are reported in Table 7 for all available size measures. Again, none of the differences is significant at the normal (five per cent) level. But in contrast to the profitability tests, we here observe a mixed sign pattern. If randomly distributed amongst the various tests and size measures, this would be consistent with the hypothesis of no significant differences either way. However, all the differences in terms of assets (and equity) are positive (and significant at around 7% in the AGAD/MAGMAD comparison), whereas for sales revenue they are consistently negative. Bearing in mind that there are more sources of positive than of negative bias on the assets measure,

TABLE 7 : Post- vs Pre-Merger Size Levels (Tests 5B-7B) (Geometric Means)

Size Variable	Comparison with:											
	Matched non-merging firms (Test 5B)				Industry Performance (Test 6B)				Projected Performance (Test 7B)			
	Merging Firms ACAD	Non-Merging Firms MACMAD	Difference	t	Merging Firms ACAD	Industry	Difference	t	Merging Firms ACAD,000,000	Projected Performance	Difference	t
Assets	1.84	1.66	1.11	1.83*	1.76	1.65	1.07	1.58	2.21	2.07	0.24	0.24
Plant	1.15	1.63	0.71	-1.29								
Equity	1.39	1.36	1.02	0.35	1.33	1.26	1.06	0.88	0.33	0.31	1.06	0.20
Sales	1.54	1.59	0.97	-0.37	1.54	1.61	0.95	-0.71	2.56	2.69	0.95	-0.15

whereas the tendency will be for the sales revenue changes to be pulled towards zero, there are some grounds for suspecting a tendency for output to fall. But clearly the results of tests 5B-7B will support only the most tentative of conclusions.

Tests 8-10: Post vs Pre-Merger Growth Rates of Plant and Equipment, Assets, Equity and Sales

The statistical tests on merger effects are taken a further step in tests 8-10, where we consider post-merger changes in the growth rates (i.e. first-differences) of four size variables : assets, plant and equipment, equity and sales. Once again, the three counterfactuals used in tests 5-7 are employed.

As in the previous tests, the measured differences between the actual performance of merging firms and that which could have been expected are statistically insignificant in all cases save one. The exception is the markedly less great fall in the growth rate of sales as between merging firms and their relevant industries (test 9), which is significant at just over 6%. Taking the tests as a whole, we again observe a mixed sign pattern. Nine of the fourteen differences are negative, including all three in the comparison against projected performance (test 10). However, in contrast with the size level tests, the sign pattern is not consistent across tests for any given size variable, and the results seem to be rather sensitive to sample size, which varies across tests. In general tests 8-10 increase rather than reduce the tentativeness of any conclusions which can be drawn about post-merger changes in size (output). The ambiguity of test outcomes is, of course, to be expected if, as is not unlikely, the sample contains individual instances in which both market power and efficiency effects predominate.

6 Conclusions

The results of our statistical tests for alternative merger causes and effects in West Germany do not suggest significant community gains. The fact that the merging firms are very much larger than non-merging firms appears to rule out the pursuit of scale economies as the overriding motive. By this elimination, the alternative, monopolisation explanation gains indirect support. Nor does it appear from the results that the German mergers can be interpreted as a strategy calculated to improve the risk-bearing capacity of the productive system. As far as post-merger performance is concerned no statistically significant changes due to merger were observed in the relevant performance variables. Strictly this implies that while mergers do not demonstrably do great harm, nor do they appear to do positive good. When, however, we look at the overall pattern of results, observing the numbers and distribution of positive and negative signs, the suggestion is less one of exploited efficiency improvements and output gains, and more indicative of increased market power.

It must be remembered, however, that although the merger sample reflected both the time profile and industrial pattern of German merger activity, it was biased towards large mergers, where it could be argued that the scope for scale-economy gains may be untypically small. Unfortunately, systematic analysis of all mergers, including those involving GmbH companies, is virtually precluded by the minimal information disclosure rules applicable to these companies.

It should also be borne in mind that there are some indications of a qualitative shift in German merger activity around 1970/71. Assuming such a change did occur, the merger sample contained a mixture of 'old-' and 'new-style' mergers. Whether the change, if it did occur, was for the

better or worse must remain a matter for future enquiry.

This and a number of other questions about mergers in Germany require investigation before final conclusions are drawn for public policy towards merger in Germany.²³ Meanwhile, on the evidence of the results reported here, there appears to be very little that could be put forward against an outright merger ban or some similarly strong policy, based on this premise. The existing German policy towards mergers is very far from being a strong one, in at least two respects. First, as has been stressed elsewhere, a very large part of merger activity falls outside the scope of the controls, because of the laxly drawn escape clauses. Secondly, the widespread occurrence of partial rather than full, legal mergers argues that, unless the majority of mergers are mere portfolio investment exercises with no attempt to co-ordinate firms behaviour, which seems unlikely, the effective constraints on inter-firm co-ordination via the cartel laws must be weak. While some tightening of the legal provisions in the first area is in prospect, there is no indication of a parallel move in the second. Finally, there is a good case that can be made for policy change in the adjacent area of company information disclosure. As is widely recognised and our experience in carrying out this study confirms, it is extraordinarily difficult to obtain the information necessary to evaluate the performance of German companies, whether involved in mergers or not. Measures to increase the public accountability of firms, especially GmbH companies, would serve many social purposes, as well as permitting a more definitive assessment of the origins and social purposes of mergers.

²³ These are discussed further in Cable (1979).

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Appendix (i)

LISTE DER UNTERNEHMENSZUSAMMENSCHLÜSSE +

Lfd.Nr.	Fusionsjahr	übernehmende Firma	übernommene Firma
1	1964	33 Hoechst AG, Frankfurt	318 Chemische Werke Albert, Wiesbaden-Biebrich
2	1964	343 Salzgitter AG, Salzgitter	118 Buessing Automobilwerke, Braunschweig
3	1965	179 AEG-Telefunken, Frankfurt	187 Kabelwerk Duisburg, Duisberg
4	1965	179 AEG-Telefunken, Frankfurt	57 F. Küppersbusch & Söhne AG, Gelsenkirchen.
5	1965	7 BASF AG, Ludwigshafen	312 Glasurit-Werke M. Winkelmann, AG, Hamburg
6	1966	255 Fichtel & Sachs AG, Schweinfurt	256 Zweirad Union AG, Nürnberg
7	1967	7 BASF AG, Ludwigshafen	292 Dr. Beck & Co AG, Hamburg
8	1967	22 Continental Gummi Werke AG, Hanover	306 Kötitzer Ledertuch und Wächstuch Werke AG, Göppingen (Württ)
9	1968	179 AEG-Telefunken, Frankfurt	316 Hartman & Braun AG, Frankfurt
10	1968	7 BASF AG, Ludwigshafen	314 Herbol-Werke Herbig-Haarhaus AG, Köln
11	1968	32 Bayer AG, Leverkusen	328 Wolff Walsrode AG, Walsrode
12	1968	15 Brown, Boveri & Cie. AG, Mannheim	254 Metrawatt AG, Fabrik elektrischer Meßgeräte, Nürnberg
13	1968	23 Daimler Benz AG, Stuttgart	310 Ernst Heinkel AG, Stuttgart

Lfd. Nr.	Fusionsjahr	übernehmende Firma	übernommene Firma
14	1968	33 Hoechst AG, Frankfurt	320 Reichhold-Albert-Chemie AG, Hamburg
15	1968	20 Klöckner-Humboldt-Deutz AG, Köln	338 Maschinenfabrik Fahr AG, Gottmadingen
16	1969	179 AEG-Telefunken, Frankfurt	250 Kabelwerk Rheydt AG, Rheydt
17	1969	179 AEG-Telefunken, Berlin	180 Steatit-Magnesia AG, Lauf (Pegnitz)
18	1969	347 Adolff, J.F. AG, Backnang (Württ.)	348 Spinnerci und Webereien Zell-Schönau AG, Zell (Wiesental)
19	1969	7 BASF AG, Ludwigshafen	240 Wintershall AG, Kassel
20	1969	15 Brown, Boveri & Cie. AG, Mannheim	182 Busch-Jäger, Dürener Metallwerke AG, Ludenscheid
21	1969	359 IBAG Internationale Maschinenbau, Neustadt/Weinstraße	362 Mannheimer Maschinenfabrik, Mohr & Federhoff AG, Mannheim-Rheinau
22	1969	20 Klöckner-Humboldt-Deutz AG,	248 Westfalia Dimmendahl Gröppel AG, Wedag Bochum
23	1969	115 Metallgesellschaft AG, Frankfurt	246 Stolberger Zink AG für Bergbau und Hüttenbetrieb, Aachen
24	1969	116 "Sachtleben" AG für Bergbau und chemische Industrie, Köln	94 Schramm Lack und Farbenfabriken AG, Offenbach (Main)
25	1969	84 Schering AG, Berlin	252 Asche, C.F. & Co., AG, Hamburg

Lfd Nr.	Fusionsjahr	übernehmende Firma	übernommene Firma
26	1969	149 Vereinigte Deutsche Metallwerke AG, Frankfurt	242 Westfälische Kupfer- und Messingwerke AG, Ludenscheid
27	1969	98 Volkswagenwerk AG, Wolfsburg	178 NSU Motorenwerke AG, Neckarsulm
28	1969	183 Wilkens Bremer Silberwaren AG, Bremen	184 Bremer Silberwarenfabrik, Bremen
29	1970	16 Büttnerwerke AG, Krefeld	170 Schilde AG, Krefeld
30	1970	289 C.M.Hutschenreuther-Porzellan AG, a.d. Eger	290 Porzellanfabriken Lorenz Hutschenreuther, Selb.
31	1970	105 Flachglas AG Delog-Delay, Fürth	172 Deutsche Libby-Owens-Gesellschaft, Gelsenkirchen
32	1970	33 Hoechst AG, Frankfurt	17 Cassella Farbwerke Mainkur AG, Frankfurt
33	1970	173 Zellstofffabrik Waldhof, Mannheim	174 Aschaffener Zellstoffwerke, Aschaffenburg
34	1971	51 August Thyssen Hütte AG, Düsseldorf	222 Blohm und Voss AG, Hamburg
35	1971	153 Braun AG, Frankfurt	154 Gebrüder Koelisch AG, Nürnberg
36	1971	72 Dyckerhoff Zementwerke AG, Wiesbaden	219 Elsa Zement- und Kalkwerke AG, Neubeckum
37	1971	115 Metallgesellschaft AG, Frankfurt	224 Schlesische AG für Bergbau und Zinkhüttenbetrieb, Braunschweig
38	1971	225 Westfälische Union AG für Eisen- und Drahtindustrie, Hamm	226 Berkenhoff & Drebes AG, Aßlar (Kr. Wetzlar)
39	1971	149 Vereinigte Deutsche Metallwerke AG, Frankfurt	150 Haendler & Nattermann AG, Hannov.-Münden

Lfd Nr.	Fusionjahr	übernehmende Firma	übernommene Firma
40	1972	7 BASF AG, Ludwigshafen	120 Phrix Werke AG, Hamburg
41	1972	109 Dürrwerke AG, Ratingen bei Düsseldorf	110 Maschinenbau-AG Balcke, Bochum
42	1972	82 Kammerei Döhren AC, Hannover	296 Bielefelder Webereien AG, Bielefeld
43	1972	80 Ruetgerwerke AG, Frankfurt	214 Ruberoidwerke AG, Hamburg
44	1972	343 Salzgitter AG, Salzgitter	346 Howaldtwerke - Deutsche Werft AG, Hamburg und Kiel
45	1973	15 Brown, Boverie & Cie. AG, Mannheim	294 Calor-Emag Elektrizitäts AG, Ratingen bei Düsseldorf
46	1973	309 Elster AG, Mainz	308 Kromschröder, G., AG., Osnabrück
47	1973	61 Mannesmann AG, Düsseldorf	38 Demag AG, Duisburg
48	1973	61 Mannesmann AG, Düsseldorf	114 Stahlkontor Hahn AG, Ratingen bei Düsseldorf
49	1973	115 Metallgesellschaft AG, Frankfurt	116 "Sachtleben" AG für Bergbau und chem. Ind., Köln
50	1973	361 Nordciment AG, Hannover	364 Portland-Cementfabrik Hardeggen AC, Hardeggen
51	1973	11 Süddeutsche Zucker-AG, Mannheim	34 Appel, H.W., Feinkost AG, Hannover
52	1973	1 Varta AG, Frankfurt	212 Milupa AG, Friedrichsdorf (Tannus)
53	1974	51 August Thyssen Hütte AG, Düsseldorf	151 Rhein Stahl AG, Essen
54	1974	101 Manufaktur Koechlin Baumgartner & Cie. AG,	102 Gabriel Herosé AG, Konstanz
55	1974	1 Varta AG, Frankfurt	182 Busch-Jäger Dürener Metallwerke AG, Lüdenscheid

LIST DER NICHT FUSIONIERENDEN FIRMEN
(Kontrollgruppe)

Lfd.Nr.	Branchen- kennziffer	Name	Ort
1	20	15 MARGARET ASTOR AG	MAINZ
2	20	10 BEHRINGWERKE AG	MARBURG/LAHN
3	20	11 BEIERSDORF AG	HAMBURG 20
4	20	12 BOHLEN INDUSTRIE AG	ESSEN
5	20	14 CHEMISCHE FABRIKEN OKER AG	OKER
6	20	28 GOEDECKE AG	BERLIN 10
7	20	29 TH.GOLDSCHMIDT AG	ESSEN
8	20	31 A.HAGEDORN & CO. AG	OSNABRUECK
9	20	45 RESART 1 IHM AG	MAINZ
10	20	49 RUHRCHEMIE AG	OBERHAUSEN - HOLTEN
11	20	51 SALINE LUDWIGSHALLE AG	BAD WIMPFEN
12	20	52 SANDOZ AG	NUERNBERG
13	20	56 STADA - ARZNEIMITTEL AG	DORTELWEIL
14	20	57 SÜD - CHEMIE AG	MUENCHEN
15	23	71 DECOTRIC AG	HAMBURG 19
16	23	6 GEBR. BOEHLER & CO. AG	DUESSELDORF-OBERKASSEL
17	23	35 MANNESMANNROEHREN-WERKE AG	DUESSELDORF
18	23	41 RHEINSTAHL HUETTENWERKE AG	ESSEN
19	23	45 H.B. SEISSENSCHMIDT AG	PLETTENBERG
20	23	54 VEREINIGTE SCHLUESSELFABRIKEN AG	SOLINGEN
21	23	57 DOEHNER AG	LETMATHE
22	24	71 ROTH ERDE-SCHMIEDAG AG	HAGEN/WESTF.
23	24	17 BUTZKE-WERKE AG	BERLIN 61

Lfd.Nr.	Branchen- kennziffer	Name	Ort
24	24	22 DEUTSCHE WOERNER - WERKE AG	HEIDELBERG-PF AFFENGRUND
25	24	46 JAGENBERG-WERKE AG	DUESSELDORF 1
26	24	50 KOCHS ADLER AG	BIELEFELD
27	24	65 MASCHINENBAU DAMME AG	LEMFO ERDE
28	24	71 MASCHINENBAU HARTMANN AG	OFFENBACH
29	24	97 SAMSON APPARATENBAU AG	FRANKFURT/MAIN
30	24	109 WEIGELWERK, AKTIENGESELLSCHAFT	ESSEN
31	24	135 MAPAG MASCH-FABRIK AG AUGSBURG	AUGSBURG
32	24	148 SCHLOEMANN AG	DUESSELDORF
33	25	3 BAUGES. FUER ELEKTRISCHE ANLAGEN	DUESSELDORF - BENRATH
34	25	9 DEUTSCHE CARBONE AG	WALBACH BEI FRANKFURT
35	25	10 GARBE, LAYMEYER UND CO.AG	AACHEN
36	25	11 DEUTSCHE CALORWAY AG	STARNBERG
37	25	15 FELTEN U.GUILLEAUME DIELEKTRA AG	PORZ
38	25	19 HIMMELWEK AG	TUEBINGEN
39	25	22 KRAECKER AG	BERLIN 42
40	25	28 NORDDEUTSCHE SEEKABELWERKE AG	NORDENHANN
41	25	34 C.THEODOR WAGNER AG	WIESBADEN
42	25	35 EMKA METALLWARENFABRIK AG	LUEDENSCHEID
43	25	39 HEEMAF S.K.A. - MOTORENWERK AG	DORTMUND
44	25	47 NILFISK AG	RELLINGEN
45	25	49 RUSSEL, SCHWARZ UND CO. AG	WIESBADEN
46	25	57 TRANSFORMATOREN UNION AG	STUTTGART
47	27	3 AG FUER SEILINDUSTRIE	MANNHEIM
48	27	11 BIELEFELDER WEBEREI AG	BIELEFELD

Lfd.Nr.	Branchen- kennziffer	Name	Ort
49	27	27 GOLD-ZACK-WERKE AG	METTANN
50	27	34 PAUL HARTMANN AG	HEIDENHEIM
51	27	41 KAMMGARN-SPINNEREI BIETIGHEIM	BIETIGHEIM (WUERTT)
52	27	52 MECH.BAUMWOLL-SPINNEREI U.WEB.	AUGSBURG 2
53	27	134 SIMONS & FROWEIN AG	LEICHLINGEN
54	27	135 WILH.SCHLOCHAUER NACHF.AG	HAMBURG-BILLBROOK
55	28	3 APPOLINARIS BRUNNEN AG	BAD-NEUENAUHR-AHRWEILER
56	28	5 AG BAD SALZSCHLIRF	BAD SALZSCHLIRF
57	28	26 MINERALBRUNNEN UEBERKINGEN AG	BAD UEBERKINGEN
58	28	52 HAGESUED AG	STUTTGART-FEUERBACH

Appendix (iii) Merging and Non-Merging Firms; Matching Firm Numbers

<u>Acquiring Firms (AG)</u>	<u>Matched Non-Acquiring Firms (MAG)</u>
1	25019
7	20029
11	28026
15	25028
16	24050
20	24046
22	28003
23	24097
32	20049
33	20011
51	23006
61	23006
72	23074
80	20052
82	27052
84	20049
98	24097
101	27003
105	28026
109	24071
115	23054
116	20057
149	23054
153	25003
173	27027
179	25010
183	25009
225	23045
255	24022
289	20045
309	25009
343	23045
347	27034
359	24017
361	20005
<u>Acquired Firms (AD)</u>	<u>Matched Acquired Firms (MAD)</u>
17	20029
34	28003
38	24046
57	25015
94	20045
102	27034
110	24050
114	20057
116	20028
118	24048
120	20011
150	23045
151	23054
154	25009
170	24097
172	28003

<u>Acquired Firms (AD) cont.</u>	<u>Matched Acquired Firms (MAD) cont.</u>
174	20049
178	24050
180	27011
182	23006
184	25003
187	25028
212	28026
214	20051
219	27072
222	24046
224	28005
226	23054
240	23041
242	23045
246	25028
248	24097
250	25015
252	20051
254	25009
256	20071
290	20014
292	20031
294	25010
296	27003
306	24022
308	25019
310	24071
312	20057
314	20052
316	25015
318	20010
320	20052
328	20029
338	24054
346	24046
348	27052
362	24097
364	25003

Appendix (iv) Results of Merger Effects Tests

Test 5 : Post- vs Pre-Merger Profitability; Comparison with Matched Non-Merging Firms (Arithmetic Means)

Variable	Merging Firms AGAD	Non-Merging Firms MAGMAD	Difference	No. of Observations N	t	Number of Industries Differences +ve	Total	$\frac{t}{\sqrt{N}}$	Binomial Significance Level (%)
Return on Assets	-0.003	-0.006	0.003	17	0.18	2	7	0.04	45.31
Return on Equity	0.063	0.028	0.035	17	0.35	1	7	0.08	12.50
Return on Sales	0.025	-0.002	0.027	16	0.79	2	6	0.20	68.75

Test 6 : Post- vs Pre-Merger Profitability; Comparison with Industry Performance (Arithmetic Means)

Variable	Merging Firms AGAD	Industry Performance	Difference	No. of Observations N	t	Number of Industries Differences +ve	Total	$\frac{t}{\sqrt{N}}$	Binomial Significance Level (%)
Return on Assets	0.005	-0.013	-0.013	23	1.10	3	4	0.23	62.50
Return on Equity	0.192	-0.016	0.148	23	1.12	3	4	0.23	62.50
Return on Sales	0.020	-0.010	0.030	22	1.16	2	4	0.25	100.00

Test 7 : Post- vs Pre-Merger Performance; Comparison with Projected Performance (Arithmetic Means)

Variable	Merging Firms AGAD	Projected Performance	Difference	No. of Observations N	t	Number of Industries Differences +ve	Total	$\frac{t}{\sqrt{N}}$	Binomial Significance Level (%)
Return on Assets	0.043	0.036	0.007	16	0.65	3	4	0.16	62.50
Return on Equity	0.297	0.230	0.066	16	0.68	2	4	0.17	100.00
Return on Sales	0.040	0.036	0.004	16	0.55	2	4	0.14	100.00

Appendix (iv) (continued)Test 5B : Post- vs Pre-Merger Size Levels; Comparison with Non-Merging Firms (Geometric Means)

Variable	Merging Firms AGAD	Non-Merging Firms MAGMAD	Ratio	No. of Observations N	t	Number of Industries Difference +ve	Total	$\frac{t}{\sqrt{N}}$	Binomial Significance Level (%)
Assets	1.84	1.66	1.11	22	1.83*	5	7	0.39	45.31
Plant	1.15	1.63	0.71	21	-1.29	1	6	-0.28	21.88
Equity	1.39	1.36	1.02	22	0.35	4	7	0.07	100.00
Sales	1.54	1.59	0.97	21	-0.37	2	6	-0.08	68.75

Test 6B : Post- vs Pre-Merger Size Levels; Comparison with Industry Performance (Geometric Means)

Variable	Merging Firms AGAD	Industry Performance	Ratio	No. of Observations N	t	Number of Industries Difference +ve	Total	$\frac{t}{\sqrt{N}}$	Binomial Significance Level (%)
Assets	1.76	1.65	1.07	27	1.58	4	4	0.30	12.50
Equity	1.33	1.26	1.06	27	0.88	2	4	0.17	100.00
Sales	1.54	1.61	0.95	25	-0.71	2	4	-0.14	100.00

Test 7B : Post- vs Pre-Merger Size Levels; Comparison with Projected Performance (Geometric Means)

Variable	Merging Firms AGAD	Projected Performance	Ratio	No. of Observations N	t	Number of Industries Difference +ve	Total	$\frac{t}{\sqrt{N}}$	Binomial Significance Level (%)
Assets	2.21	2.07	1.07	27	26	4	4	0.04	12.50
Equity	0.33	0.31	1.06	27	26	2	4	0.04	100.00
Sales	2.56	2.69	0.95	25	24	2	4	-0.03	100.00

Appendix (iv) (continued)Test 8 : Post- vs Pre-Merger Growth Rates; Comparison with Non-Merging Firms (Arithmetic Means)

Variable	Merging Firms AGAD	Non-Merging Firms MAGMAD	Difference	No. of Observations N	t	Number of Industries Difference +ve	Number of Industries Total	$\frac{t}{\sqrt{N}}$	Binomial Significance Level (%)
Assets	2.535	0.743	1.792	21	0.54	4	7	0.12	100.00
Plant	6.738	5.130	1.608	19	0.24	3	6	0.05	100.00
Equity	1.545	-3.552	5.097	21	0.845	6	7	0.18	12.50
Sales	1.165	2.911	-1.746	20	-0.39	2	6	-0.09	68.75

Test 8A : Post- vs Pre-Merger Growth Rates; Comparison with Non-Merging Firms (Geometric Means)

Variable	Merging Firms AGAD	Non-Merging Firms MAGMAD	Ratio	No. of Observations N	t	Number of Industries Difference +ve	Number of Industries Total	$\frac{t}{\sqrt{N}}$	Binomial Significance Level (%)
Assets	1.120	0.921	1.217	16	0.49	3	6	0.12	100.00
Plant	1.130	2.173	0.520	9	-0.88	1	4	-0.29	62.50
Equity	0.213	0.659	0.323	5	-0.67	1	2	-0.30	100.00
Sales	1.007	1.362	0.739	10	-0.83	1	4	-0.26	62.50

Test 9 : Post- vs Pre-Merger Growth Rates; Comparison with Industry Performance (Arithmetic Means)

Variable	Merging Firms AGAD	Industry Performance	Difference	No. of Observations N	t	Number of Industries Difference +ve	Number of Industries Total	$\frac{t}{\sqrt{N}}$	Binomial Significance Level (%)
Assets	1.207	2.513	-1.307	26	-0.67	1	4	-0.13	62.50
Equity	0.201	2.950	-2.799	24	-0.63	2	4	-0.13	100.00
Sales	-0.801	-6.037	5.237	24	1.960*	2	4	0.40	100.00

Test 10 : Post- vs Pre-Merger Growth Rates; Comparison with Projected Performance (Arithmetic Means)

Variable	Merging Firms AGAD	Projected Performance	Difference	No. of Observations N	t	Number of Industries Difference +ve	Number of Industries Total	$\frac{t}{\sqrt{N}}$	Binomial Significance Level (%)
Assets	10.045	19.932	-9.877	17	-1.45	2	4	-0.35	100.00
Equity	6.553	10.034	-3.480	11	-0.53	1	3	-0.16	100.00
Sales	11.425	21.701	-10.276	16	-1.09	2	3	-0.27	100.00