Testing for Banking Competition in Germany: Evidence from Savings Banks

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Abstract:

In this paper we adopt the Panzar-Rosse approach to assess the competitive conditions for German savings banks (*Sparkassen*) in the years 1993 – 2002. Using disaggregated annual data from more than 400 credit institutions the empirical results indicate monopolistic competition, the cases of monopoly and perfect competition are strongly rejected. It appears that by lending to small and mid-size enterprises as well as to private customers, the savings banks have found a niche wherein competitive pressure is rather modest. Small banks seem to enjoy even more market power. Furthermore, we find no significant evidence for a better performance of larger banks in our sample.

JEL classification: G21, L10

Keywords : banking, competition, market behaviour

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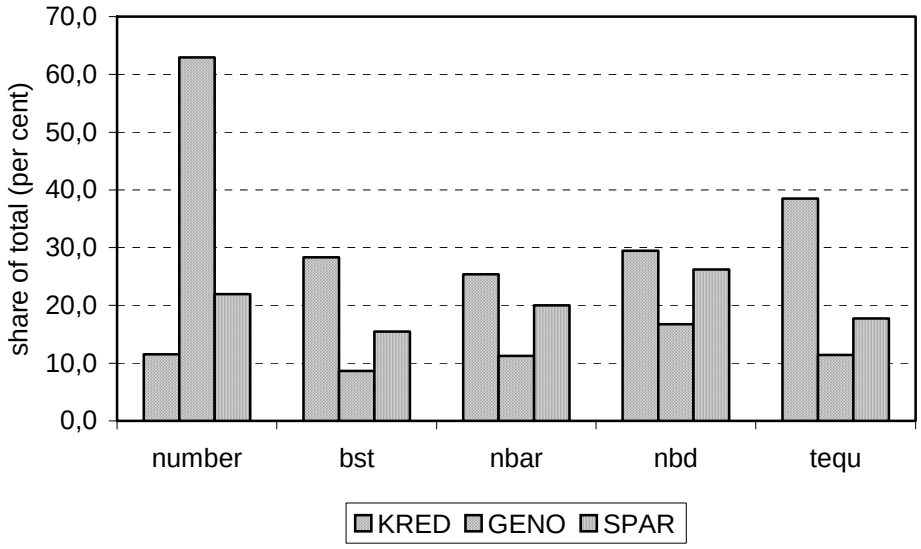
1. Introduction

The last few years have seen a dramatic decline in earnings and profits of Germany's private banks. The larger and well-known German banks listed on the stock market especially, but some of the so-called *Landesbanken* (publicly owned regional banks) also, reported tremendous annual losses exceeding 1 billion Euro. According to public pronouncements the Chairmen and CEOs of these banks did not believe, that these losses were caused by wrong business strategies or internal firm problems, but occurred due to "fierce competition" in the German banking market. These claims accompanied by the often-heard proposition that Germany was "overbanked" triggered our special interest in the topic.

Studies in the field of banking competition often concentrate on the analysis of large banks. While this may be a reasonable strategy for most countries, for Germany, we believe, it is not. Germany has more than 2,500 legally independent banking institutions, which can be (roughly) divided into three groups: private banks (with equity held by private investors), cooperative banks (capital held by their cooperative members) and savings banks (owned by municipalities and districts).

The most commonly known institutes like *Deutsche Bank* or *Commerzbank* are privately owned stock corporations whose shareholders are widely spread. Together with a couple of smaller and more customer specifically operating banks they constitute the section of *Kreditbanken [KRED]* where a number of almost 280 independent institutes are integrated. The second pillar of the German banking system is established by about 1,500 small and medium sized cooperative banks (*Genossenschaftsbanken [GENO])* with regionally limited business activity. The class of banks our paper is dealing with is called *Sparkassen [SPAR]* which are more than 500 economically independent savings banks owned and controlled by local authorities and which provide a huge countrywide network. Figure 1 gives a brief impression of some structural features of the German banking industry.

Figure 1: Structural Features of the German Banking Industry in 2002



number:	number of banks
bst:	balance sheet total
nbar:	non-bank accounts receivable
nbd:	non-bank debts
tequ:	total equity

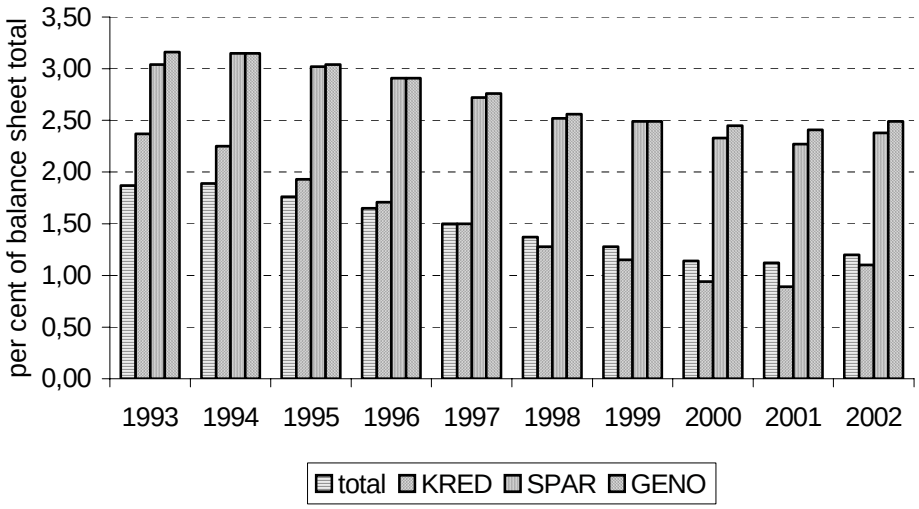
Source: Deutsche Bundesbank (2003a)

The sector of *Sparkassen* spans over the whole country, but only one of these institutes operates in a certain local area. Competition among these banks is not intended (except where it is unavoidable, e.g. electronic banking) and all institutes operate independently from each other (i.e. making credit decisions, settling prices and interest rates) but some activities like advertising, lobbying and legal issues are delegated to central organizations. The group of *Sparkassen* as a whole has a market share of roughly 20 per cent of both the lending and the deposit market, respectively. Their main customers are private households, small or medium sized enterprises and the local public sector. Because all their services are regionally limited, only institutes in adjacent areas have a competitive relationship towards each other. Regular competitors of *Sparkassen* are local branches of the large private banks or the *Genossenschaftsbanken*. For the most part *Sparkassen* are dominant firms in the local markets of rural areas.

In sharp contrast to the large German banks the *Sparkassen* reported relatively high profits in the last years. In this study we try to determine how strong the competitive pressure is in the German banking market from the perspective of the savings banks sector.

In the last decade the total number of legally independent banks in Germany declined from more than 4,000 in 1993 to about 2,500 in 2002. Mostly caused by mergers, the number of *Sparkassen* dropped by more than 25 per cent from 703 to 519 in the same period of time. The *Sparkassen* on average performed much better than most of their economic rivals. Figure 2 illustrates the development of the net interest rate margin in the different sectors of the German banking market.

Figure 2: Net Interest Rate Margin



Source: Deutsche Bundesbank (2003b)

Obviously the net earnings of the *Sparkassen* in 2001 were more than 2.5-times as high as those of the *Kreditbanken*, while in 1993 the net interest margin of the *Sparkassen* exceeded the net earnings in the section of the *Kreditbanken* by less than 30 per cent only. This development may be caused by less competitive pressure on *Sparkassen* compared to *Kreditbanken.*

Measuring the degree of competition has always been a problem in economics. The often used Structure-Conduct-Performance-Paradigm related the intensity of competition in a certain market to the market structure, i.e. the number and size of active market participants, neglecting the influence of potential competitors (by new entries) and ignoring the fact that some markets are doubtlessly characterised by hard competition with few competitors only (e.g. the market for CPUs for microcomputers with only 2 relevant participants, Intel Corp. and AMD), while on other markets with more competitors a “quiet live” seemed to be possible for the participants.

In our opinion the degree of competition can only be determined by analysing the *behaviour* of agents. Non-structural measures of competition were developed in the models of Iwata (1974) and Bresnahan (1982). These models require the estimation of market demand and supply functions.[1] Empirical applications of both models are scarce (especially for Iwata) due to high information requirements.[2] Panzar and Rosse (1987) developed a method to determine the intensity of competition faced by market participants by comparative static properties of reduced-form revenue equations of these firms. They defined a statistic PR as the sum of elasticities of revenue R to n factor prices w_i:

$$PR = \sum_{i=1}^{n} \frac{\partial R}{\partial w_i} \frac{w_i}{R} .$$

The PR-statistic answers the question: How do firms react to variations in factor prices? Panzar and Rosse show that monopolists behave in a different way than competitive firms.[3]

In the Panzar-Rosse approach the degree of competition is directly determined by the competitive behaviour of the firms in question. The information requirements are weaker than in the models of Iwata and Bresnahan. These properties of the Panzar-Rosse approach make it perfectly applicable to the banking industry. No information is needed about output prices and output amounts. Revenues and input prices can be extracted from the balance sheet, the earnings statement and some additional information.

Panzar and Rosse showed that the statistic can be interpreted as follows:

$PR = 1$	Perfect competition
$0 < PR < 1$	Monopolistic competition
$PR \leq 0$	Monopoly (or perfectly collusive behaviour).

It is necessary for the interpretation of the statistic that the market is in a long-run-equilibrium.[4]

[1] See Iwata (1974), Bresnahan (1982) and Lau (1982) for details.
[2] For a recent application of Bresnahan's model see Bikker (2003), which also gives further references. Nakane (2002) used a dynamic version of Bresnahan's model to test for competition in Brazil's banking industry.
[3] See Panzar and Rosse (1987) for a formal derivation of the statistic.
[4] However the assumption is not needed in the monopoly case – see Panzar and Rosse (1987), p. 446.

Only a limited number of studies implemented the Panzar-Rosse approach to assess the competitive conditions in the German banking market, mostly in a framework of a multi country study. These studies vary widely in the functional form of the estimation equation, the definition of the endogenous and exogenous variables, the estimation method and the data set used. Most studies have had only access to publicly available data and thereby a focus on (large) private banks, investigating the competitive conditions in the time period between the late 1980s and mid-1990s. The estimated Panzar-Rosse statistics also varied widely (mostly between 0.4 and 0.9) but were often consistent with monopolistic competition.[5]

In our study we specialize in the German market with a focus on the *Sparkassen* sector. We intend to match the original concept of Panzar and Rosse as closely as possible, regarding definitions of variables and the functional form of the estimation equation. Fortunately, we had access to data not available to the general public.

The paper is structured as follows: section 2 describes the data and the data sources we employed and presents some descriptive statistics. Information about our estimation methodology is given in section 3 and section 4 presents the results obtained. The paper closes with conclusions given in section 5.

2. Data sources and data description

The data set, kindly made available to us by the *Deutsche Sparkassen- und Giroverband* (a central institution of the German *Sparkassen* sector), spans over the time period from 1993 to 2002 and covers the whole area of West Germany[6]. It contains 428 credit institutes[7], resulting in a balanced sample with 4280 observations. Table 1 supplies descriptive statistics of the data set.

[5] An exception is the study of Molyneux, Lloyd-Williams and Thornton (1994). Using yearly cross-sectional estimates they obtained PR-statistics ranging from -0.04 in 1986 to 0.05 in 1988 but jumping to 0.47 in 1989. Such a strong change in the competitive conditions within a short period of time seems somewhat unreliable.
[6] Strictly speaking the whole area of the former Federal Republic of Germany, except of West-Berlin, is included.
[7] One institute was dropped, because no staff data were available for most of the time span.

Table 1: Descriptive statistics of variables (all values in current millions of €, unless otherwise indicated)

Variable	Mean	Std. Dev.	Min	Max	5th Perc.	95th Perc.
TA	1,686.80	2,244.79	34.10	32,875.58	182.18	5,234.21
EQ	73.86	107.71	1.65	1,712.34	8.13	225.31
D	1,494.97	1,980.65	29.92	28,917.85	160.34	4,636.05
R	105.72	135.53	2.91	1,837.84	12.15	329.73
IE	62.19	81.33	1.48	1,135.63	6.46	197.57
PE	20.70	24.86	0.61	324.22	2.54	61.65
OE	11.44	16.22	0.27	266.56	1.19	34.44
FA	28.51	37.50	0.49	580.70	2.80	89.46
FTES (number)	462.82	504.27	18.20	5,581.60	59.15	1,351.70

The variables are defined as follows:

TA Total assets
EQ Equity capital
D Sum of all (short-term and long-term) deposits from private and commercial customers and other banks
R Interest revenues
IE Interest expenses
PE Personnel expenses
OE Operating expenses
FA Fixed assets
FTES Number of full-time equivalent staff

All balance sheet variables as well as the number of staff employed are calculated as annual averages from monthly data. The number of staff employed has been adjusted to reflect the actual number of hours worked per week. For example, a person who worked full-time for half a week and a person who worked half-time for the whole week would both be counted as one half of a staff member. This number of staff employed, therefore, is not just the number of all people on the payroll at a certain point in time, but rather it is a measure of full-time equivalent staff. To the best of our knowledge, this is the first study to use this exact measure of labour input. As a result, there is no need to use a (noisy) proxy to calculate the labour price (see below).

During the time period from 1993 to 2002 bank mergers among the *Sparkassen* occured. The merging banks are treated as one bank throughout the entire period, thereby creating a

balanced sample. We do not expect any relevant influence on the results by this kind of treatment.[8]

As already mentioned, the PR statistic sums up the elasticities of revenue with respect to factor prices. We use the following factor prices:

FP1 Interest expenses to deposits
FP2 Personnel expenses (in fixed 1995 prices) to number of full-time equivalent staff
FP3 Operating expenses to fixed assets

Personnel expenses are deflated using the GDP deflator (source: OECD) for measuring the labour price. Because FP1 and FP3 are ratios of two nominal values, there is no need to additionally account for inflation. We use an additional variable RL defined as the ratio of accounts receivables from private and commercial customers to the balance sheet total, i.e. the proportion of presumably more risky loans (loans to the government sector as well as loans to other banks are excluded) to total assets. Table 2 gives descriptive statistics of these variables.

Table 2: Descriptive statistics of factor prices and the ratio of potentially risky loans to total assets

Variable	Mean	Std. Dev.	Min	Max	5th Perc.	95th Perc.
FP1	0.042	0.007	0.028	0.065	0.034	0.056
FP2*	43.110	3.730	33.103	64.967	37.613	49.540
FP3	0.433	0.170	0.127	2.128	0.236	0.735
RL	0.571	0.075	0.200	0.861	0.443	0.691

* (in 1,000s € of 1995)

3. Estimation Methodology

The following estimation equation is applied to the data set:

$$(1) \qquad \ln R_{it}^{r} = \sum_{j=1}^{3} \alpha_j \ln FP_{it}^{j} + \beta_1 \ln EQ_{it}^{r} + \beta_2 \ln RL_{it} + \gamma + \varepsilon_{it} \; .$$

[8] It is implicitly assumed that the back-counted values of the newly formed institute are representative equivalents for the two (or more) original banks. Since most mergers took place among small banks operating under similar conditions this should not lead to greater deviations.

Subscripts i and t refer to bank i at time t, superscript r indicates real values (i.e. nominal values deflated by the GDP deflator). All variables are defined as described in section 2, γ is a constant and ε_{it} stands for the stochastic error term.

The estimation equation given above appears to us as a natural choice, consistent with the concept of Panzar and Rosse. The PR statistic is measured as the sum of all alphas. A different specification using the ratio of revenues to total assets as dependent variable is often used in the literature. We agree with Vesala (1995) that this provides no longer a revenue equation, but a price equation whose general behaviour is unknown.[9]

In addition to the factor prices, equity capital and the proportion of risky loans to total assets are included in the estimation equation for economic reasons. Due to capital adequacy rules equity limits the extend of credit outstanding and thereby the opportunities of receiving interest revenues. The second variable added might influence the dependent variable, because a higher proportion of risky loans in the banking portfolio should lead to higher interest revenues.

The fixed effects (within) panel estimator is used for estimating equation (1). Therefore, the last term in (1) is assumed to have the following structure:

(2) $\varepsilon_{it} = u_i + e_{it}$.[10]

This model specification allows for differences across units. The u_is are bank-specific constants that do not vary over time but vary between different banks. They reflect unobserved variables, that shift the (logarithmic) revenue function of a bank. These variables may or may not correlate with variables included in the estimation equation. The fixed effects estimator is robust to any such correlation. The remaining error term is given by e_{it}.

Applying the fixed effects estimator, α_i and β_i are identified by individual deviations from the individual mean occurring in the course of time. This captures the behaviour of a bank after a change in, e.g., factor prices.

[9] See Vesala (1995), p. 75.

[10] Note, the restriction $\sum_i u_i = 0$ is imposed to avoid perfect multicollinearity.

4. Results

The results of estimating equation (1) are shown in Table 3.[11] We present t and p-values for ordinary and robust estimation[12]. Although allowing for heteroscedastic errors the results remain valid. All factor prices have a significant influence on the dependent variable (at least at a 5 per cent level). The resulting Panzar-Rosse statistic is mainly driven by the price of deposits, the labour price plays only a weak role while the price of fixed capital is nearly negligible. The additional variables show the expected sign, but the proportion of risky loans is insignificant.

The empirical results are consistent with monopolistic competition, the cases of monopoly and perfect competition are strongly rejected. Compared to previous results in the literature the obtained PR statistic is rather low, but, as mentioned before, a correct comparison is difficult due to different estimation techniques.

Table 3: Estimation Results

	Coef.	t	p-value	t**	p-value**
FP1	0.356	30.75	0.000	20.08	0.000
FP2	0.062	2.41	0.016	2.04	0.041
FP3	0.016	3.18	0.001	2.45	0.014
EQ^r	0.246	27.09	0.000	13.08	0.000
RL	0.011	0.66	0.507	0.42	0.673
Γ	9.366	104.77	0.000	64.78	0.000
F of Regression		233.65	0.000	86.34	0.000
PR	0.434	13.33	0.000	11.66	0.000
PR=0*		177.77	0.000	135.88	0.000
PR=1*		302.40	0.000	231.14	0.000

*F and p-value for test that sum of all FPs equals zero or unity, resp.
**Robust estimates.

[11] Detailed estimation results can be found in the appendix. All results were obtained by using Stata 8.
[12] Reported robust t and p-values were obtained from the Huber-White estimator, which produces consistent standard errors even if the residuals are heteroscedastically or nonnormally distributed

We also tried to determine whether the results vary with respect to the size of banks. We therefore defined three groups depending on the average of real equity capital of a bank during the sample period. We chose real equity capital as an indicator of firm size instead of the balance sheet total, because the latter can be inflated by interbank lending and borrowing and therefore does not reflect a bank's real economic activity. Table 4 gives information about the groups.

Table 4: Groups

Group	Equity capital (on average, in mill. of 1995 €s)	number of banks	proportion in whole sample
Small	< 30	146	34.1 %
Medium	≥ 30 to ≤ 100	202	47.2 %
Large	> 100	80	18.7 %

To detect possible differences the regression mentioned above is run with interaction terms for the small and large banks. Thereby we are able to test for the significance of the differences of small banks and large banks compared to medium-sized banks. Table 5 shows the estimation results as well as the PR statistics.

Table 5: Results of Estimation with different Groups

	Coef.	t	p-value	t*	p-value*
FP1	0.388	22.40	0.000	11.89	0.000
FP2	0.087	2.15	0.032	1.65	0.099
FP3	0.015	1.97	0.049	1.29	0.198
PR	0.490	9.86	0.000	8.66	0.000
DsFP1	-0.111	-4.32	0.000	-2.75	0.006
DsFP2	-0.040	-0.72	0.472	-0.56	0.576
DsFP3	-0.012	-1.12	0.263	-0.81	0.416
DsPR	-0.163	-2.30	0.021	-1.93	0.053
DlFP1	0.015	0.45	0.651	0.34	0.736
DlFP2	-0.011	-0.15	0.884	-0.16	0.876
DlFP3	0.024	1.60	0.109	1.55	0.121
DlPR	0.027	0.29	0.773	0.32	0.747
RL	-0.054	-2.13	0.033	-1.15	0.251
DsRL	0.069	1.88	0.060	1.16	0.244
DlRL	0.166	3.36	0.001	2.73	0.006
EQ^r	0.247	17.38	0.000	6.51	0.000
$DsEQ^r$	-0.004	-0.19	0.846	-0.09	0.930
$DlEQ^r$	-0.017	-0.61	0.541	-0.36	0.722
γ	9.353	102.60	0.000	64.35	0.000

*Robust estimates.

The estimated PR statistic for medium-sized banks (0.49) does not differ much from the previous result for the overall sample (0.43), which, of course, is not surprising since medium-sized banks dominate the sample. Small Banks have a PR statistic, that is 0.16 lower than for medium-sized banks. This difference is significant at the 5 per cent level in the ordinary regression, in the robust regression it is more or less “on the edge“. With respect to the PR statistic large banks do not deviate from medium-sized banks. Looking at the additional variables, no differences in the influence of equity capital seem to exist. Interestingly, large banks have a significantly higher coefficient for the proportion of risky loans in their portfolio. This may indicate a risk-adjusted pricing of loans. For small and medium-sized banks it remains unclarified whether they do not employ a risk-adjusted price setting or their

loans to commercial and private customers are in fact not riskier as loans to other banks and the government, probably because of a strictly risk limiting lending policy.

5. Concluding Remarks

We have presented a modern empirical test for assessing the intensity of competition in the German banking market. By analysing the data of more than 400 West German *Sparkassen*, we stated that the competitive behaviour is far away from being perfectly competitive, but also far away from being completely collusive. It appears, that by lending to small and mid-size enterprises as well as to private customers, the *Sparkassen* have found a niche, wherein the competitive pressure is not immoderately high. Small banks seem to enjoy even more market power. The economic performance of the *Sparkassen* within the last years also indicates that this is a quite profitable niche. It also appears as if the economic problems of the large private banks are not the result of fierce competition in the German banking market as a whole but the result of a deliberate choice for a more difficult market segment (financing large enterprises and international corporate groups, which are endowed with a lot of outside options, e.g., direct capital market financing).

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Appendix

Regression with ordinary standard errors

Number of obs = 4280 Number of groups = 428
F(5, 3847) = 233.65
Prob > F = 0.000
dep. var. lnR

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
lnFP1	0.3562	0.0116	30.75	0.000	0.3335	0.3789
lnFP2	0.0622	0.0258	2.41	0.016	0.0116	0.1129
lnFP3	0.0155	0.0049	3.18	0.001	0.0060	0.0251
lnEQr	0.2461	0.0091	27.09	0.000	0.2283	0.2639
lnRL	0.0111	0.0167	0.66	0.507	-0.0217	0.0438
const	9.3656	0.0894	104.77	0.000	9.1903	9.5408

F test that all u_i=0 (fixed effects vs. OLS):
F(427, 3847) = 78.05
Prob > F = 0.000

Test for Var(u_i)=0 (r.e. vs. OLS):
chi2(1) = 8847.27
Prob > chi2 = 0.000

Hausman-Test (fixed vs. random effects):
chi2(5) = 9184.49
Prob>chi2 = 0.000

Regression with robust standard errors

F(5, 3847) = 86.34 R-squared = 0.9970
Prob > F = 0.000 Adj R-squared = 0.9967

dep. var. lnR

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
lnFP1	0.3562	0.0177	20.08	0.000	0.3214	0.3910
lnFP2	0.0622	0.0305	2.04	0.041	0.0025	0.1220
lnFP3	0.0155	0.0063	2.45	0.014	0.0031	0.0279
lnEQr	0.2461	0.0188	13.08	0.000	0.2092	0.2830
lnRL	0.0111	0.0262	0.42	0.673	-0.0403	0.0625
const	9.3656	0.1446	64.78	0.000	9.0821	9.6490

Regression with size dummies and ordinary standard errors

Number of obs = 4280 Number of groups = 428
F(15,3837) = 84.45
Prob > F = 0.000
dep. var.: lnR

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
lnFP1	0.3881	0.0173	22.40	0.000	0.3541	0.4220
lnFP2	0.0867	0.0403	2.15	0.032	0.0077	0.1658
lnFP3	0.0149	0.0076	1.97	0.049	0.0001	0.0297
lnEQkr	0.2474	0.0142	17.38	0.000	0.2195	0.2753
lnRL	-0.0542	0.0255	-2.13	0.033	-0.1042	-0.0043
DslnFP1	-0.1107	0.0257	-4.32	0.000	-0.1610	-0.0604
DslnFP2	-0.0404	0.0562	-0.72	0.472	-0.1505	0.0697
DslnFP3	-0.0118	0.0105	-1.12	0.263	-0.0325	0.0089
DslnEQkr	-0.0038	0.0198	-0.19	0.846	-0.0426	0.0349
DslnRL	0.0687	0.0365	1.88	0.060	-0.0029	0.1403
DllnFP1	0.0146	0.0322	0.45	0.651	-0.0485	0.0777
DllnFP2	-0.0111	0.0762	-0.15	0.884	-0.1606	0.1384
DllnFP3	0.0239	0.0150	1.60	0.109	-0.0054	0.0533
DllnEQr	-0.0166	0.0271	-0.61	0.541	-0.0698	0.0366
DllnRL	0.1665	0.0496	3.36	0.001	0.0693	0.2637
const	9.3529	0.0912	102.60	0.000	9.1742	9.5316

Regression with size dummies and robust standard errors

F(15,3837) = 44.54 R-squared = 0.9971
Prob > F = 0.000 Adj. R-squared = 0.9968
dep. var.: lnR

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
lnFP1	0.3881	0.0326	11.89	0.000	0.3241	0.4521
lnFP2	0.0867	0.0525	1.65	0.099	-0.0162	0.1897
lnFP3	0.0149	0.0116	1.29	0.198	-0.0078	0.0376
lnEQkr	0.2474	0.0380	6.51	0.000	0.1729	0.3220
lnRL	-0.0542	0.0472	-1.15	0.251	-0.1468	0.0383
DslnFP1	-0.1107	0.0402	-2.75	0.006	-0.1895	-0.0319
DslnFP2	-0.0404	0.0722	-0.56	0.576	-0.1820	0.1012
DslnFP3	-0.0118	0.0145	-0.81	0.416	-0.0402	0.0166
DslnEQkr	-0.0038	0.0434	-0.09	0.930	-0.0890	0.0813
DslnRL	0.0687	0.0590	1.16	0.244	-0.0470	0.1843
DllnFP1	0.0146	0.0432	0.34	0.736	-0.0701	0.0993
DllnFP2	-0.0111	0.0713	-0.16	0.876	-0.1509	0.1287
DllnFP3	0.0239	0.0154	1.55	0.121	-0.0063	0.0542
DllnEQr	-0.0166	0.0466	-0.36	0.722	-0.1079	0.0747
DllnRL	0.1665	0.0611	2.73	0.006	0.0467	0.2862
const	9.3529	0.1453	64.35	0.000	9.0679	9.6378