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Dale K. Osborne and Jeanne Wendel

October 1978

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On Banking Structure and Checking-Account Prices

Dale Osborne* and Jeanne Wendel**

> The shop seemed to be full of all manner of curious things. But whenever Alice looked hard at any shelf, to make out exactly what it had on it, that particular shelf was always quite empty.
>
> Lewis Carroll, *Alice in Wonderland*

Introduction and Summary

Of the several dozen published studies of market structure and performance in banking, ten have concerned the relation between concentration and checking-account prices. Of these ten, three reported statistically significant positive relations at the 5 percent level, the strongest relation being such that a ten-percent increase in concentration accompanies a two-percent increase in price. The other seven found positive but statistically insignificant relations. Nevertheless, the findings are generally viewed as support for Structure-Conduct-Performance theory from which the hypothesis of a positive relation derives [7]. (See [5] for a different view.)

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All ten of these studies use proxies of one kind or another in place of actual prices. Wondering, therefore, how much the findings owe to the proxies, we obtained the actual checking-account prices from 154 Texas banks. We found four things.

1. The correlation between proxy and price is so low that even the best proxy accounts for only 18 percent of the variations in price.

2. Within a town (which is always part of the "local market" hypothesized by the S-C-P theory) the highest price is from 1.76 to 2.62 times the lowest, depending on the town. The theory, however, implies that price is the same or nearly the same everywhere in a market, as all the banks there feel the same competitive forces, which the theory identifies with concentration.

3. Prices tend to a higher average in towns where they are more various. The theory, however, predicts the opposite; it attributes high prices to conscious collusion or "parallel action," which, if followed, would reduce rather than increase the price dispersion.

4. While regression analysis of the sample produces the usual positive but insignificant coefficients for the Herfindahl index when the proxies are used, it produces a negative (but still insignificant) coefficient when actual prices are used. Moreover, the R^2's and F-ratios of the price equations are substantially lower than those of the proxy equations while the coefficients (on control variables) that are statistically significant in the price equations are insiginificant in the proxy equations and vice versa.

1. Relations Between Price and Proxies

The service in question is the processing of n checks per month together with the associated bookkeeping and reporting. The price is the minimum cost that the depositor must pay for the service. At most banks it has an explicit and an implicit part. The explicit part consists of the purchase cost of blank checks, a per-item processing fee, and a monthly service charge. The third of these explicit costs, and at some banks the second as well, depends on the unused balance in the account. The monthly explicit cost is therefore a function of the number of checks and the unused balance, say $E(n,B)$, where B is the balance.

The implicit part of the price is the opportunity cost of maintaining the unused balance; it reflects the posttax yield obtainable from an investment of comparable risk and liquidity, here taken to be 4 percent per year or .33 percent per month.* The monthly implicit cost is therefore .0033B.

For a given value of n, the sum $E(n,B) + .0033B$ is minimized by a balance $\bar{B}(n)$. By definition, the price $P(n)$ is the minimum cost,

$$P(n) = E[n,\bar{B}(n)] + .0033\bar{B}(n). \text{ **}$$

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*In [6], which reports the prices from a part of the sample, the implicit cost rate was taken as 6 percent per year, the authors having overlooked the need to take its after-tax equivalent for proper combination with the explicit charge.

**See the appendix for an illustrative calculation.

We do not distinguish between minimum and average balances because the depositor could time his deposits and withdrawals so as to maintain a constant balance $\bar{B}(n)$, in which case the minimum and average balances coincide. The depositor may, of course, choose to allow his balance to fluctuate, permitting the average to differ from the minimum, in which case he might pay something for the extra services of convenience and storage. But these must be distinguished from the basic checking-account service, which is to process checks.

At only a few of the sample banks is price per check independent of the number processed. In general, each bank has a price schedule rather than a single price. Of course, only a small portion of this schedule is relevant to a given depositor, who, writing between 20 and 30 checks per month, for example, need not consider the prices associated with fewer than 20 or more than 30 checks.

Few depositors know exactly how many checks they will write in a month. This uncertainty may lead a depositor to keep an unused balance that proves, at the end of the month, to be too large or too small to minimize his cost. But his uncertainty lies in the amount of the service he will wish to buy, not in the price that he will pay for a given amount. The price is definite.

All of the S-C-P studies have used proxies for prices.* The most popular proxy is the service-charge revenue per dollar of demand deposits, an easily obtained number that does not, however, share the conceptual

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*See [4] for detailed criticisms of all the proxies.

characteristics of price (for reasons explained by Boyd [1]). Since the S-C-P tradition willingly tolerates conceptual defects if they lead to empirical results, the implicit assumption must be that the proxy correlates well with price. In fact, however, it correlates poorly. The calculated correlation coefficient between this proxy and P(20), for instance, is -.04, with a 99 percent confidence interval of [-.25, .18]. The correlation is not significantly different from zero, and even if the true value lies at the upper bound of the confidence interval the proxy explains less than three percent of the variations in price.

A related proxy is the service-charge revenue per demand account. This shares the main conceptual defects of the first proxy and correlates even less well with price. The calculated correlation coefficient between it and P(20) is -.07, with a 99 percent confidence interval of [-.28, .14].

The best of the proxies is the explicit service charge for a checking account with specified characteristics--usually twenty debits and two credits per month, $200 average balance, and $100 minimum balance. The problem with this proxy is that the specified balance might not be optimal for depositors who write twenty checks. Indeed, at only thirteen of our 154 sample banks is it so. The proxy therefore misspecifies the prices of the remaining 141 banks. The calculated correlation coefficient between this proxy and P(20) is .42, with a 99 percent confidence interval of [.22, .57]. The correlation therefore differs significantly from both zero and one. Even if the true value were at the upper bound of .57, however, variations in the proxy would explain only about a third of the variations in price.

It is noteworthy that two of the three studies which obtained a statistically significant relation between concentration and price used as a proxy the service-charge revenue per dollar of deposits, for which the correlation with actual price is not significantly different from zero. The third used the service-charge revenue per account, which is even worse.*

On the fundamental econometric principle that no economic meaning can be attached to a statistical relation unless the underlying equation has been specified correctly, no conclusions about the structure-conduct-performance hypothesis can be drawn from these three studies. Indeed, the same is true of the seven studies that found no statistical significance. The proxy-based findings simply do not bear on the question. We therefore offer further analysis of our sample.

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*A recent article [3] reports statistical significance with the better proxy (explicit service charge on an account with specified characteristics) together with a new hypothesis about the relation between concentration and price: Concentration affects price only when it lies between lower and upper critical values, the latter of which was estimated to be .099 for the Herfindahl index. Because of this new hypothesis the findings deserve separate treatment, which one of us provides in another paper.

2. Intra-Market Price Variations

The structure-conduct-performance theory states that a given local market's prices are partially determined by the strength of its competitive forces as represented by concentration. Since on this view the competitive forces acting on all banks in one market are the same, the degree of competition operating in a market should relate to a market price, as opposed to individual bank prices. And indeed, studies using market variables obtain "better" results than those which take individual banks as the units of observation. If the underlying theory is sound, however, the prices charged by individual members of a banking market should cluster around a "market price", and the two approaches would yield consistent results.

A striking characteristic of the 23 Texas towns fully covered by our sample is the wide range of prices found within towns.* Although a town may not constitute a "local market", the empirical work has invariably identified local markets with political or geographic regions equal to or larger than a town, so that a town is always part of a market. Hence the intratown variations represent lower bounds for intra-market differences. Figure 1 illustrates how greatly prices can differ in a town. On the average in the 23 towns, the highest price for 20 checks

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*See [6] for examples.

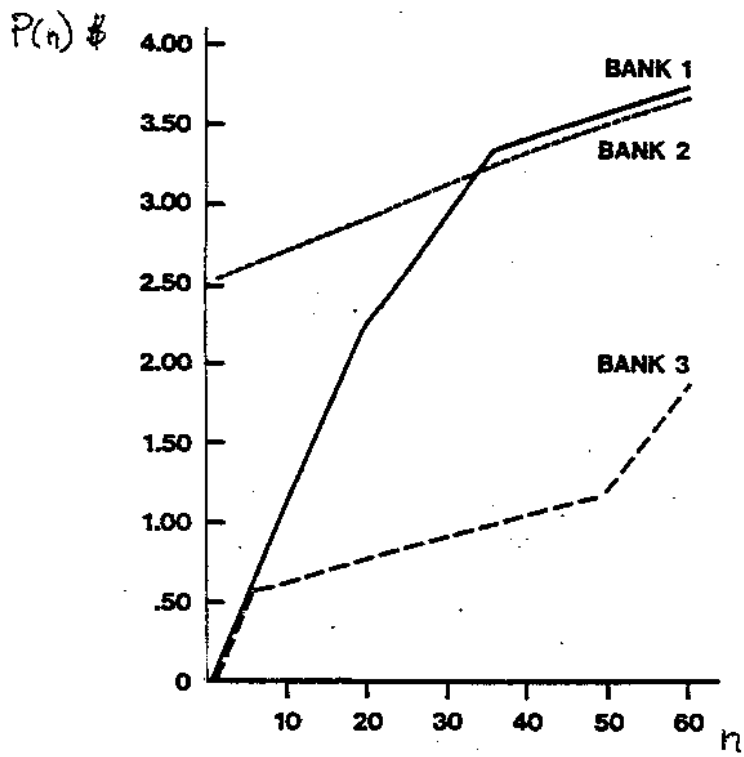

Fig. 1. Prices in a 3-bank town.

is 2.12 times the lowest. This factor ranges from 1.76 for 3-bank towns to 2.62 for towns with 6 to 10 banks. Such large differences in prices are inexplicable within the Structure-Conduct-Performance paradigm, which, moreover, cannot suggest a meaning for the concept of a market price when the differences exist. Is it the median? the mode? the arithmetic mean? the geometric or yet some other mean? In order to answer, the theory would need to predict the distribution of prices, and for this it would have to abandon the representation of competitive conditions by local-market concentration. That representation necessarily imputes identical competitive environments to all the firms in the market and so cannot predict a nondegenerate price distribution.

3. Relation between Means and Variances

The hypothesis that bank performance declines as concentration increases rests on the more fundamental hypothesis that banks in the more concentrated markets can more easily coordinate their actions, by tacit or explicit collusion, in order to keep prices high and realize greater profits. The poor performance, measured by high prices, is therefore a direct result of tacit or explicit collusion.

If high prices indeed indicated collusive agreement then they should be rather homogeneous; otherwise, it is hard to see wherein the agreement lies. Equally, if relatively homogeneous prices issued from collusion, they would tend to be high rather than low. According to the theory, then, prices should be more homogeneous--less variable--in those towns where their average is higher. That is, town means and variances should be negatively correlated.

Among the twenty-three towns fully covered by our sample, however, means and variances are positively correlated. The simple correlation coefficients pertaining to twelve, twenty-four, and thirty-six checks per month are respectively .52, .43, and .43. These relations are if anything strengthened by controlling for inter-town differences in wage rates, the main factor that might save the theory. The partial correlation coefficients (net of wage effects) are respectively .52, .56, and .52, all significantly above zero at the five percent level. (The *t* statistics, with twenty degrees of freedom, are respectively 2.71, 3.01, and 2.71.)

4. Regressions

Adherents of the S-C-P paradigm seem to believe that many small non-negative regression results must cumulate to an important positive relation between price and concentration. Since this relation could presumably be documented by suitably refined techniques, the existing body of evidence, weak though it is, is viewed as favorable to the theory. It is therefore interesting to find that the combination of our data with the empirical approach used in the best previous research yields *negative* coefficients on the concentration measure.

Heggestad and Mingo's study [2] is one of the better research efforts so we adopted their specification as a model--with two alterations. First, we deleted a variable (the percentage of demand deposits in accounts under $1,000) that is expensive to measure and for which they obtained only insignificant coefficients. Second, we added a variable to control for cost differentials between markets. For this purpose we used the wages of check-file clerks, proof-machine operators, and telephone operators in each market. The regressors used, in addition to a concentration measure, were therefore:

TD: Total deposits of the bank (thousands of dollars);

IG: ratio of 1974 to 1971 personal income in the market;

PI: per capita personal income in the market, 1974 (dollars);

DS: the bank's share of total deposits in the market (%);

RD: ratio of demand to total deposits in the bank (%);

WG: average low-skilled wage rate (dollars per year).

Feasibility considerations persuaded us to approximate markets by counties (which in our sample largely coincide with SMSA's where these exist) while the superior performance (in terms of R^2 and F) of the Herfindahl index over the other concentration indexes leads us to report only the regressions in which it was used.

Because of the nonlinear price schedules, the regressions were run using the price (in dollars per month) of writing n checks, for n = 6, 20, 42, and 84, as dependent variables. All estimates are obtained by ordinary least squares for comparability with previously published results.

As shown in Table 1, the R^2's are abysmal, even for studies of this type. It is noteworthy that while the R^2's for the regressions using actual price range from .04 to .16, they jump to .22 and .30 when

Table 1. Regression Coefficients and (In Parentheses) Their Standard Errors

Dependent Variable	Intercept	INDEPENDENT VARIABLES							R^2	F
		Herfindahl	TD	IG	PI	DS	RD	WG		
P(6)	.79 (.65)	-.67 (.46)	$2(10^{-7})$ $(6.6(10^{-7}))$	.52 (.41)	$4(10^{-5})$ $(6(10^{-5}))$	.23 (.40)	-.39 (.55)	$8.5(10^{-5})$ $(7(10^{-5}))$	.043	.943
P(20)	2.91** (.846)	-.786 (.595)	$-2.7(10^{-7})$ $(8.6(10^{-7}))$	-.350 (.534)	.0002** (.00008)	.942 (.526)	-1.14 (.720)	-.0003** (.00009)	.127	3.02**
P(42)	5.27** (1.34)	-1.01 (.940)	$-6.5(10^{-7})$ $(1.3(10^{-6}))$	-1.16 (.844)	.0004** (.0001)	1.31 (.831)	-1.96 (1.14)	-.0005** (.0001)	.156	3.86**
P(84)	8.19** (2.26)	-.750 (1.59)	$-7(10^{-7})$ $(2(10^{-6}))$	-2.17 (1.43)	.0007** (.0002)	1.12 (1.41)	-3.39 (1.93)	-.0007** (.0002)	.129	3.09**
Service-charge revenue per deposit dollar (a proxy)	-.03* (.015)	.004 (.011)	$-7(10^{-8})$** $(2(10^{-8}))$	.026** (.009)	$2.5(10^{-6})$ $(1.4(10^{-6}))$	-.004 .009	-.035** .012	$2.8(10^{-6})$ $(1.6(10^{-6}))$	.304	9.09**
Service-charge revenue per account (a proxy)†	-.030 (.023)	-.006 (.015)	$-7(10^{-8})$** $(2(10^{-8}))$	.030* .015	$6.5(10^{-7})$ $(2(10^{-6}))$	-.006 (.014)	-.030 (.019)	$4.8(10^{-6})$ $(2.5(10^{-6}))$	.216	5.24**

† 141 observations

* Significant at the 5% level

** Significant at the 1% level

the two proxies, service-charge revenue per deposit dollar and service-charge revenue per account, are used as the dependent variable. The increase in the R^2's is plainly a statistical artifact, because of the low correlation between proxy and price. Much the same can be said of the F-ratios.

A few other statistical artifacts may be noted. The market share (TD) coefficient is not significant in the equations for actual prices but is significant at the one percent level in the equations for proxies. Personal-income growth (IG) shows essentially the same effect. On the other hand, the coefficients of personal income (PI) and wages (WG), never significant in the proxy equations, are significant in three of the four real equations. Indeed, these are the only significant coefficients in those equations. Note, however, the unexpected sign of the wage coefficient. Such perversities are not at all unusual in this line of work.

The most interesting results concern the coefficients of the Herfindahl index. All of these coefficients, though insignificant as usual, are negative in the equations for actual prices. If we were to apply the reasoning used in support of the traditional hypothesis, that the insignificant results indicate the sign of a relationship which would be statistically (and economically) significant if we could refine our technique enough to capture it, we could conclude that competition varies directly with the Herfindahl index. This conclusion is not implausible since competition produces losers as well as winners and might therefore produce the unequal market shares reflected in large Herfindahl indexes. It does, however, reverse both the traditional assumption that concentration is positively related to price and the traditional causal sequence.

5. Conclusion

The actual prices of checking accounts at 154 Texas banks contradict the proxy-based evidence that is often cited in support of the structure-conduct-performance hypothesis. First, the proxies bear little relation to actual prices. Second, actual prices vary within towns to a degree that obscures the concept of a market price affected, according to the theory, by market concentration. Third, the variance of price is not negatively correlated with average price as the hypothesis predicts. Fourth, regressions using actual prices yield much lower R^2's than those obtained with the use of price proxies, showing that better variables weaken rather than strengthen the statistical relation. Finally, the coefficients on the Herfindahl index are negative in all the regressions, thus underlining the fallacy in thinking that the numerous small and positive but mostly insignificant results obtained thus far indicate the sign and causal direction of an economically important relation.

Appendix

Illustrative Price Calculation. The following offering is typical except in price (there is no typical price). The bank offers two kinds of checking accounts to the general public. For the "special" account it charges $2.25 for 200 blank checks and ten cents for each check processed, imposing no minimum balance requirement and levying no fixed monthly fee. The depositor writing n checks per month on this special account therefore pays s(n) dollars per month, where

$$s(n) = .111n.$$

For the "regular" account, the bank charges the same $2.25 for 200 blank checks but imposes processing and service charges according to the minimum balance, as shown by the following table:

Minimum Balance	Fixed Monthly Service-charge	# of Free Checks	Charge per Additional Check
below $400	$2.00	20	$.06
$400-$499	$1.50	20	$.06
$500-$599	$1.00	20	$.06
above $599	0	unlimited	----

Assuming a yearly opportunity cost rate of 4 percent, whence each hundred dollars of unused balance implicitly costs 33 cents a month, to write n checks per month on this regular account would cost r(n,B) dollars per month when the minimum balance is B dollars:

$$r(n,B) = .0033B + .011n + \begin{cases} 2 + .06(n-20) & \text{if } B < 400 \\ 1.5 + .06(n-20) & \text{if } 400 \leq B < 500 \\ 1 + .06(n-20) & \text{if } 500 \leq B < 600 \\ 0 & \text{if } 600 \leq B \end{cases}$$

To minimize his cost for this account the depositor chooses $B = \overline{B}(n)$ such that

$$r[n,\overline{B}(n)] \leq r(n,B) \quad \text{for } B \geq 0.$$

Evidently,

$$\overline{B}(n) = 600 \text{ for } n \geq 0,$$

whence the lowest cost for the regular account is

$$r[n,\overline{B}(n)] = 1.98 + .011n.$$

The price, $P(n)$, is then the minimum cost,

$$P(n) = \min \{s(n), r[n,\overline{B}(n)]\}$$

$$= \min \{.111n, 1.98 + .011n\}$$

$$= \begin{cases} .111n & \text{if } n < 20 \\ 1.98 + .011n & \text{if } n \geq 20. \end{cases}$$

A depositor writing fewer than 20 checks per month at this bank should use the special account, thus keeping no unused balance, while one writing 20 or more should use the regular account keeping a $600 minimum balance.*

Data Sources. All but the prices come from the usual sources. The prices come from the following Texas banks:

Amarillo

Amarillo National Bank
American National Bank of Amarillo
Bank of the Southwest
North State Bank
Tascosa National Bank
Texas Bank of Amarillo[a/]
Western National Bank

Austin

Bank of Austin
North Austin State Bank

Beaumont

Allied Union Bank
American National Bank of Beaumont
Beaumont State Bank
Central Bank
Citizens National Bank
First Security National Bank
Gateway National Bank
Lamar State Bank
Parkdale Bank
Texas Bank of Beaumont

Beeville

Commercial National Bank of Beeville
First National Bank of Beeville
State Bank and Trust Co.

Bellaire

First State Bank of Bellaire

Brownsville

Brownsville National Bank
First National Bank at Brownsville
National Bank of Commerce
Pan American Bank

Conroe

American Bank
Commerce National Bank of Conroe[a/]

Corpus Christi

Corpus Christi Bank and Trust

Dallas

Bank of the Southwest of Dallas
Buckner State Bank
Inwood National Bank
Texas Commerce Bank--Campbell Centre NA

Denison

Citizens National Bank of Denison

El Paso

First International Bank in El Paso NA[a]
University Bank

Farmers Branch

Central Bank and Trust Co.

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*The effect of bank pricing on the demand for money obviously cries out for investigation.

Fort Worth

City National Bank
Union Bank

Galveston

American Bank
Bank of Galveston NA
Bank of the West
First Hutchings Sealy National Bank
Moody National Bank of Galveston
United States National Bank
University National Bank

Harlingen

First National Bank of Harlingen
Harlingen National Bank
Harlingen State Bank
Plaza National Bank

Harris City

Cypress Bank

Houston

Allied Memorial Bank
Community Bank
Fannin Bank
First City Bank--Fondren South[a/]
First City Bank--Gulfgate[a/]
First City Bank--Medical Center NA
First City Bank--Northeast NA[a/]
First International Bank in Houston[a/]
First State Bank and Trust Co. of Houston
Gessner Southwest Bank and Trust[a/]
Greater Houston Bank
Hillcroft Bank
Interstate Bank
King State Bank[a/]
Reagan Commerce Bank
Western Bank

Kilgore

Allied Citizens Bank
Kilgore First National Bank

Kirbyville

Allied Kirbyville Bank

Laredo

City National Bank of Laredo
International Bank of Commerce of Laredo
Laredo National Bank
Union National Bank of Laredo

Linden

First National Bank of Linden

Longview

American Bank
East Texas Bank and Trust Co.
Commercial National Bank of Longview
First National Bank of Longview
Longview Bank and Trust Co.
Longview National Bank

Lubbock

American State Bank
Bank of the West
First National Bank at Lubbock
Lubbock National Bank
Plains National Bank of Lubbock
Security National Bank of Lubbock
Texas Commerce Bank NA
Texas Bank

Lufkin

First Bank and Trust
Lufkin National Bank
Texas National Bank of Lufkin

Marshall

First National Bank of Marshall
Marshall National Bank
Peoples State Bank

Midland

Commercial Bank and Trust Co.
First National Bank of Midland
The Midland National Bank
Western State Bank

Newton

First National Bank of Newton

Orange

County National Bank
First City National Bank of Orange
Orange Bank

Port Arthur

Allied Merchants Bank
First National Bank of Port Arthur
Sabine Bank

Ralls

Security State Bank and Trust Co.

San Angelo

Central National Bank of San Angelo
First National Bank of San Angelo
San Angelo National Bank of San Angelo
Southwest Bank of San Angelo a/
Texas State Bank
West Side National Bank

San Antonio

Central Park Bank
First National Bank of San Antonio
Highland Park State Bank
Main Bank and Trust

Sulphur Springs

City National Bank of Sulphur Springs
Peoples National Bank of Sulphur Springs
Sulphur Springs State Bank

Temple

Citizens National Bank of Temple
First National Bank of Temple
Temple National Bank
Texas Bank and Trust of Temple

Tyler

Citizens First National Bank
Heritage National Bank
National Security Bank a/
Peoples National Bank of Tyler
Southside State Bank
Tyler Bank and Trust Co.

Vernon

Bank of Vernon
Herring National Bank of Vernon
Waggoner National Bank of Vernon

Victoria

American Bank of Commerce
Bank of Victoria
First Victoria National Bank
Victoria Bank and Trust Co.

Waco

The American Bank of Waco
Citizens National Bank of Waco
Community State Bank
First National Bank of Waco
Lake Air National Bank
Texas National Bank of Waco
Westview National Bank

Waxahachie

Citizens National Bank in Waxahachie
Ellis National Bank a/
Waxahachie Bank and Trust Co.

Wichita Falls

American National Bank a/
City National Bank in Wichita Falls
First-Wichita National Bank
Parker Square State Bank
Texas Bank and Trust Co. in Wichita Falls
Southwest National Bank of Wichita Falls

[a] Because of data problems, these banks were not used in the final regression shown in Table 1.

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