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Working Paper

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SSE/EFI Working Paper Series in Economics and Finance, No. 611

Provided in Cooperation with:
EFI - The Economic Research Institute, Stockholm School of Economics

Suggested Citation: Hortlund, Per (2005) : The long-term relationship between capital and earnings in banking, SSE/EFI Working Paper Series in Economics and Finance, No. 611, Stockholm School of Economics, The Economic Research Institute (EFI), Stockholm

This Version is available at:
https://hdl.handle.net/10419/56201

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November, 2005

The Long-Term Relationship between Capital and Earnings in Banking[+]

Per Hortlund[*]

Contrary to received wisdom, some recent studies report a negative relationship between leverage and profitability in banking in the 1980s and early 1990s. This study presents new data on the leverage and profitability of Swedish commercial banks in 1870–2001, and explores the sign of the relationship in the long term. In the studied period, the capital-asset ratio decreased by a factor four, while return-on-equity more than doubled. The "leverage formula" postulates a positive linear relationship between return-on-equity and the debt-equity ratio. A strong positive linear relationship was found over the period 1871–1980, but not in 1980–2001. Thus, while supporting the results of the previous studies, a long-term "normal" positive relationship between leverage and profitability is also reaffirmed.

JEL codes: G21 N23 N24
Keywords: Return-on-equity, Leverage, Bank capital

[+] Financial support from the Jacob Wallenberg Foundation and the Torsten and Ragnar Söderberg Foundations is gratefully acknowledged. I have benefited from comments by Niclas Berggren, Magnus Henrekson, Dan Johansson, Henrik Jordahl, Håkan Lindgren, Mikael Stenkula, and Jan Wallander.

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1 Introduction

In banking as in any industry, it is common knowledge that higher leverage normally means higher returns (but also greater risk). Yet, two recent studies actually find a *negative* relationship between leverage and returns in banking. Berger (1995) reports a statistically significant positive relationship between return-on-equity (ROE) and the capital-asset ratio (CAR, the inverse of leverage) among American banks in the 1980s. Likewise, Demirgüç-Kunt and Huizinga (1999) study 80 countries in the years 1988–1995, and they also report a statistically significant positive relationship between capital and returns.

These results are indeed surprising. That leverage increases returns seems to follow directly from the very nature of business. In its strongest form, the "leverage formula" predicts that return-on-equity should increase linearly with the debt-equity ratio (DER). How can this be reconciled with the empirical results? Berger (1995) suggests that more capitalised banks were able attract higher earnings because of lower expected bankruptcy costs, which enabled them to pay lower interest on uninsured debt. In a similar vein, Flannery and Rangan (2002) also report a capital build-up among US banks in 1986–2000, and they attribute this build-up to an increasingly competitive environment in the last two decades, promoting banks to hold capital beyond legislative needs (market discipline). Another possibility is that the negative correlation between leverage and profitability could reflect special circumstances of the 1980s and early 1990s. The 1980s was a decade of financial liberalisation, and the early 1990s was a time of financial turmoil. In one decade

there is small variation in banks' leverage. The difference in leverage among banks, at least in Europe and in North America, is small. Conceivably, successful banks could tend to be both more capitalised and more profitable in the short run, which could obscure the fundamental positive correlation between leverage and returns.

It would therefore be of interest to see whether the reported relationship holds also in the long term. The long-term variation in bank leverage is large – capital-asset ratios were 15–20 percent at the turn of the 19th century, while they are about 5 percent today. Has this development had any influence on bank returns?

This paper uses industry-level data for Sweden in the years 1870–2001 to study this very question. The main result is that there is indeed a strong positive long-term relationship between leverage and profitability in banking. In accordance with the "leverage formula", return-on-equity increased linearly with the debt-equity ratio over the period. However, the relationship was not present in the 1980s and 1990s. Thus, while the study reaffirms a long-term "normal" positive relationship between leverage and profitability in banking, the results of the previous studies are supported.

Studies of the long-term (century-long) relationship between leverage and profitability in banking are rare. With regard to leverage, Berger *et al.* (1995) present data on the CAR of the US banking system in 1840–1990. Likewise, Saunders and Wilson (1999) compare changes in the CAR of the banking systems in Canada, the United States and the United Kingdom, 1893–1992. Capie and Billings (2001a, 2001b) report returns as well as capital-asset ratios for major

English banks in 1920–1968. Their work is further discussed below.

This paper contributes in two ways. First, it contributes to the methodological discussion initiated by Capie and Billings (2001a, 2001b) on how to measure capital in the presence of hidden reserves. Second it quantifies and tests the long-term relationship between leverage and profitability in banking, something that – to my knowledge – has previously not been done.

2 Measuring bank capital

The data are taken from the Summary of the Bank Reports (*Sammandrag af bankernas uppgifter*). Chartered banks were required to report monthly balance statements to the Swedish Bank Supervisory Authority (*Bankinspektionen*). I use aggregated income statements and end-of-year balance statements, for the years 1870–2001. Two problems make it difficult to get accurate and comparable measures of bank capital for the whole period. First, the Summary Reports do not show hidden reserves, and reservations made to them, particularly in the period 1948–1968. Second, corporate tax rates varied, from almost zero in the 19th century, to over 50 percent in the 1970s. How should profits and hidden reserves be "taxed" over the whole period? These two problems are discussed in this section.

2.1 Estimating hidden reserves

Capie and Billings (2001a, 2001b) discuss how to measure true profits and capital of the six major British banks in 1920–1968. The measurement problems of British banks were

similar to those of the Swedish ones, both in scope and in time. In Britain before 1969 (the year of "disclosure"), hidden reserves did not show up in official reports, since they were either netted away or hidden within deposit accounts. Similarly, in Sweden before 1968, Write-offs and Reservations (*Avskrivningar och Avsättningar*) were not separated in official reports. Before 1948, banks made reservations to so called delcredere accounts, which were hidden within ordinary deposit accounts. In 1948, banks instead started to make reservations to so called Valuation Reserve Accounts, VRAs. Before 1968, these were hidden in the reports within a large entry called Sundry Accounts. From 1968 they show up separately. From 1983 they are called Untaxed Reserves. The problem with these hidden reserves is a serious caveat. It becomes impossible to accurately calculate actual capital, as well as actual operating profits, and therefore impossible to calculate both leverage and profitability accurately. Since these reserves at the end of the 1960s were as large as reported equity, estimations of the CAR and ROE may be misleading. To get the actual values of reserves and reservations, as opposed to reported ones, it would be necessary to consult the internal accounts of each bank. To do this for the whole banking system is at worst impossible, and at best a Herculean effort beyond the time limits of this study. I will instead estimate reserves and reservations (and losses) for the years 1948–1968, as explained below. But before that, I discuss some previous estimates of hidden reserves in Swedish banking.

Delcredere accounts prior to 1948: Svenska Handelsbanken

An indication of the size and use of delcredere accounts may be had from Hildebrand (1971), who publishes various balance sheet data for Svenska Handelsbanken, one of the largest Swedish banks, for the period 1871–1970. Concerning write-offs, there are two periods when transactions to and from delcredere accounts are reported. In 1919–1920, report notes indicate that reservations were made to delcredere accounts, which were resolved in 1922. In 1936–1937, report notes indicate that sums from delcredere accounts were resolved. Although these notes cannot be said to be an exhaustive report of the use of delcredere accounts by the Svenska Handelsbanken, they nevertheless could be indicative. For banks with a dispersed set of owners, in particular joint stock banks like Svenska Handelsbanken, hidden reserves possibly did not play a large role until the time before and after the crises of 1922 and 1932. Hidden reserves were also probably depleted during these crises. Reservations to delcredere accounts may have increased in the immediate aftermath of the crises, but were partly resolved after some years when the crisis was thought to be over. The Summary Reports in the 1930s contain entries for "income from previously written-off claims" that indicate this. Reservations to delcredere accounts were probably more sporadic and less systematic than those made later to the valuation reserve accounts.

Hidden reserves 1945–1969: Stockholms Enskilda Bank

In Sweden, the only attempt at calculating hidden reserves is Olsson (1986, p. 216), who calculates hidden reserves for selected years 1945–1969 for Stockholms Enskilda Bank, one

of the largest Swedish commercial banks. Olsson's method is to compare the book value of the asset portfolio with its market value. The difference is treated as hidden reserves. Olsson thus incorporates potential, unrealised profits into the measure of capital. By this method, he finds that hidden reserves were about as large as visible equity for the whole period.

There are a number of reasons why it could be inappropriate to use Olsson's estimates as a measure of the hidden reserves of the banking system. First, the case of Stockholms Enskilda Bank can be said to be atypical. The Stockholms Enskilda Bank had a larger share of foreign business compared to other banks, which created greater opportunities to undervalue foreign assets (Olsson 1986). Also, this bank was exceptional in that it was much more of an old-fashioned banker's firm, rather than a modern joint stock bank (Lindgren 1987). It was controlled by one family and bookkeeping could therefore be more informal. In addition, as Olsson (1986, p. 226) writes, the Stockholms Enskilda Bank's policy of consolidation through hidden reserves was very much an outcome of the personality of Jacob Wallenberg, who was the bank's CEO in 1927–1946. According to Olsson, it was during this period that the hidden reserves were mainly accumulated.

Second, Olsson's method of incorporating unrealised profits into capital may be questioned. Capie and Billings (2001a, 2001b) reject this method. First, unrealised profits are hypothetical. Second, banks may not regard unrealised profits as part of their capital. Furthermore, unrealised profits calculated on the basis of market prices of assets may be deceptive. To assess a bank's financial safety, the most relevant

measure should be the liquidation value of the asset portfolio. In case of default, the liquidation value of a large bank's assets may be substantially lower than what is indicated by their market value during "normal" times. For these reasons, Capie and Billings adopt a "flow" concept of profits that excludes unrealised profits. Correspondingly, only actually existing reserve accounts, and not unrealised profits, are treated as hidden reserves.

Summing up, since hidden reserves prior to 1948 cannot be estimated in a meaningful way, I will follow the path of Capie and Billings (2001a, 2001b) and not try to give numbers to reserves that cannot be meaningfully estimated. I will also follow their methodology and not include potential, unrealised profits in the measure of capital. Hidden reserves before 1948 will therefore be assumed to be zero. Hence, reserves prior to 1948 are probably underestimated. This fact should however not interfere with the main finding of this paper, namely that of a secular decline in bank capital over the period 1870–2001. On the contrary, if capital in the early half of the studied period is underestimated, then "true" figures would act to enforce the secular decline.

Estimating VRAs 1948–1968

The valuation reserve accounts, or VRAs, were zero in 1947. Since they are reported in the Summary Reports from 1968 and onwards, aggregate credit losses (depreciation on financial assets) for 1948–1968 may be calculated by the formula

$$\text{Credit Losses}_{1948\text{–}68} = \text{Write-offs}_{1948\text{–}68} - \text{VRAs}_{1968}. \quad (1)$$

The Summary Reports contain specific entries for the write-offs of claims, bonds and stocks. VRAs exist for bonds, claims and currencies. Two complications make the use of formula (1) less straightforward. First, write-offs and VRAs do not match – how should write-offs on stocks be matched with VRAs for currencies? Second, there is the question of how to measure reserves in bonds. In the Summary Reports from 1968 and onwards, total reserves are calculated as VRAs for claims and currencies, plus *the excess value of the bond portfolio*. This entity is calculated as *market value* – (*nominal value* – VRA *for bonds*). The bond portfolio is in its turn reported "net" in the assets column of the balance statement, that is, in nominal value minus VRA for bonds.

This method has two shortcomings. First, it includes into the books *potential* but non-realised losses on bond sales. This would seem to distort the measure of operating profits. Second, reserves and thus book capital become sensitive to the market fluctuations of the bond portfolio. Since the market value of the bond portfolio is sensitive to the interest rate, book capital would become sensitive to the interest rate. This may create swings in ROE that may not reflect operating profitability.

I will therefore use the more straightforward method to treat the VRAs for bonds as hidden reserves. In the calculation of the CAR below, the gross measure of assets will consequently be used, that is, reported assets plus the VRA for bonds. Table 1 shows VRAs, write-offs and estimated losses, 1948–1968.

Table 1 VRAs, write-offs and estimated losses 1948–1968 (MSEK).

	Claims	Bonds	Stocks	Currencies	Aggregate
VRAs 1968	1390	824	-	126	2341
Write-offs 1948–68	1733	853	83	-	2669
Losses 1948–68	474	29	83	–126	460

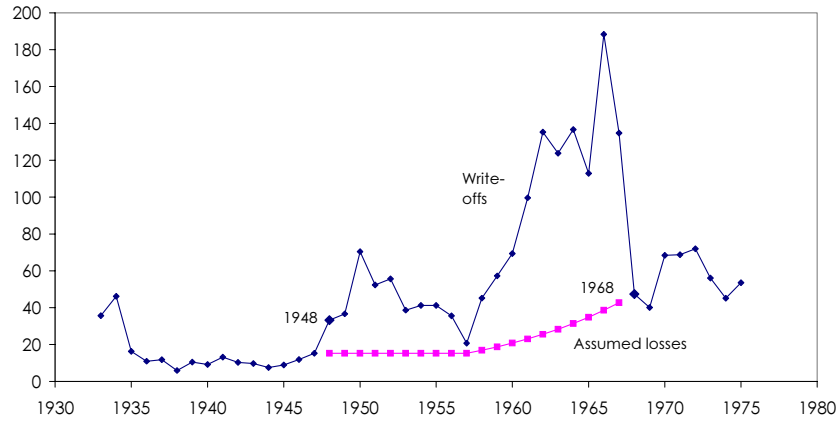
Source: Summary of the Bank Reports. Losses 1948–68 = Write-offs 1948–68 minus VRAs 1968. VRA 1968 for claims include inflow 1948–1968 of previously written-off claims, 132 million SEK.

Aggregate losses were approximately equal to the losses on claims. Losses on stocks and bonds could then approximately be set to zero. Write-offs on bonds and stocks may be treated as reservations made to the VRA for currencies. As a first approximation, then, aggregate losses are equal to the losses on claims.

The problem then becomes how to assess the time pattern of these losses. This act must necessarily be more or less arbitrary.[1] One possible pattern is given in Figure 1, where write-offs and estimated losses in 1933–1975 are shown:

[1] Since credit losses were very small, small fluctuations in their time pattern should not affect the results.

Figure 1 Write-offs and assumed losses on claims, 1933–1975 (MSEK).



Source: Summary of the Bank Reports. Write-offs 1968–1975 = "acknowledged losses" (*konstaterade förluster*).

Losses have been calculated so that aggregate write-offs in 1948–1968 minus aggregate losses in 1948–1968 will equal VRA for claims in 1968. I assume that losses were constant until the middle of the 1950s, and then they started to rise to the reported value of "acknowledged losses" in 1968.

2.2 Tax rates on profits and reserves

How should hidden reserves be treated from a fiscal point of view, that is, how much of them should be regarded as equity, and how much as unpaid taxes? In a long-term study of this kind, the question becomes important, since tax rates varied from zero at the turn of the 20th century, to almost 60 percent in the 1970s. Depending on assumptions, capital could drastically change from one year to another if the tax

rate is radically changed. For example, the corporate tax rate was raised from 16 to 40 percent in 1940. Historic Swedish corporate tax rates are presented in Hortlund (2005, Chapter III of this volume).

There is no definite answer to the question. One view is to treat untaxed reserves simply as deferred tax payments, wherefore they should be "taxed" at the going rate. According to a second view, untaxed reserves should not be "taxed" at all, since they will typically never be dissolved for taxation. In practice, they would only be dissolved to cover losses when profits are negative, in which case the tax rate would be zero. A third view takes a middle road between the two extremes. It acknowledges that reserves should not be fully "taxed", since they will never in practice be fully taxed. On the other hand, they should be somewhat "taxed", since the funds are not at the free disposal of the owners, and thus not at par with equity. Untaxed reserves could therefore be taxed at a rate that is lower than the going rate.

In this study, all three approaches will be used. I use numbers for operating profits and reserves where they have been "taxed" at a three different rates, namely at the rate of zero, at the going rate, and at a uniform rate of 30 percent. With a uniform tax rate, operating profitability can be compared over time. 30 percent is chosen because it is roughly the current Swedish corporate tax rate.[2]

The diagrams presented below show return-on-equity and capital ratios where untaxed reserves and profits have been "taxed" with a uniform tax rate of 30 percent. However, regressions were also made with return-on-equity and capi-

[2] At the time of writing (November 2004), it is 28 percent.

tal ratios calculated on the basis of untaxed as well as going-rate taxed profits and reserves. It turns out that the results were not affected. In fact, as Table 4 below shows, the relationship between leverage and profitability seems to be even stronger for the latter two specifications.

3 Leverage and profitability of the Swedish commercial banks, 1870–2001

This section presents figures for the leverage and profitability of the Swedish commercial banks, 1870–2001. Figures for the capital-asset ratio, return-on-equity, and the (average) debt-equity ratio are presented. Variables are defined as in Table 2.

Table 2 Definitions of variables.

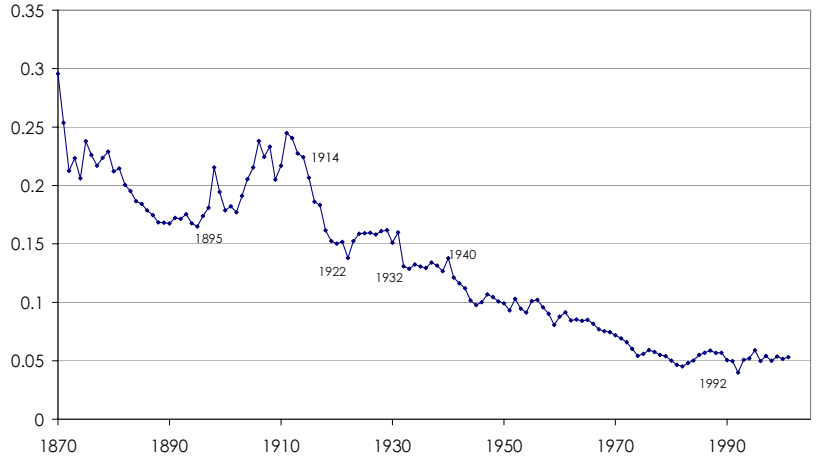
Variable		Definition
Untaxed Reserves		1948–1982: VRAs 1983– : reported values
Capital	C	Equity + 70 percent of Untaxed Reserves
Assets	A	Reported assets + VRA for bonds
Profits	P	70 percent of operating profits (revenues – costs – credit losses)
Capital-asset ratio	CAR_t	C_t / A_t
Return-on-equity	ROE_t	P_t / C_{t-1}
Debt-equity ratio	DER_t	$((A_t + A_{t-1}) / 2) / C_{t-1} - 1$

Note: VRAs and credit losses are estimated for 1948–1968.

3.1 The capital-asset ratio

Figure 2 shows the capital-asset ratio for the Swedish commercial banks in the period 1870–2001:

Figure 2 Capital-asset ratio of the Swedish commercial banks, 1870–2001.



Source: Summary of the Bank Reports.

In 1870–1895 the CAR decreased. This was a period when deposit banking rapidly expanded. Then an upward trend started that peaked in 1911. From 1895 to 1910, the number of banks grew from 45 to 80. The upward trend in the CAR therefore probably reflects an inflow of equity into the banking sector. From 1911, the CAR started to drop. It declined rapidly during WWI, reaching a minimum in the post-war recession in 1922. It then remained remarkably stable during the new gold period in 1924–1931. The CAR then sharply dropped in 1932 – the year of the Kreuger crash, when gold was abandoned and the Swedish crown was devalued. But

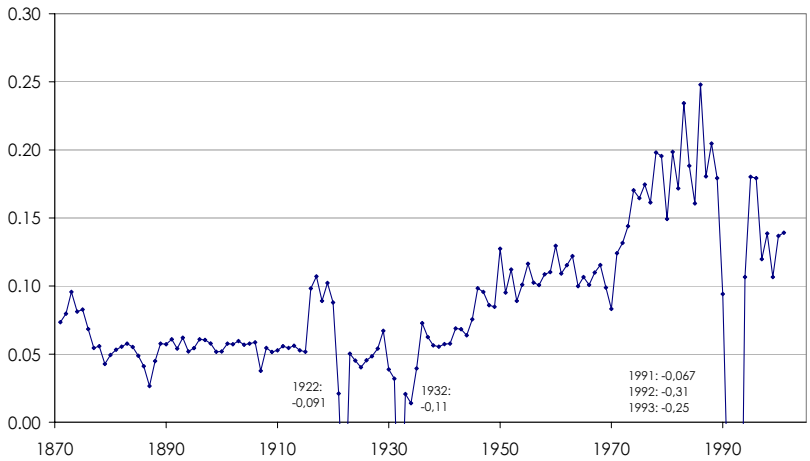
after this one-time drop, the CAR again remained stable through the rest of the 1930s. Then a period of secular decline followed that started in 1940. In this year, inflation took off, corporate taxes were raised, and foreign-exchange controls were imposed. The CAR dropped steadily between 1940 and 1980. Since the early 1980s, it has remained rather stable at about 6 percent.

One may compare Figure 2 with the figures of the CAR for the US, UK and Canada presented by Berger *et al*. (1995) and Saunders and Wilson (1999). The CAR of the Swedish commercial banks conforms to the pattern in these countries of a secular downward trend, with a particularly sharp drop during WWI. The upward trend in 1895–1911 seems unique for Sweden, however. Also, the long secular drop in 1940–1980 appears to be special for Sweden – the CARs of the other countries were stabilised after WWII.

3.2 Return-on-equity

Figure 3 depicts return-on-equity of the Swedish commercial banks for the years 1871–2001.

Figure 3 Return-on-equity of the Swedish commercial banks, 1871–2001.



Source: Summary of the Bank Reports.

The stability of the ROE during the classical gold standard – particularly in 1890–1914 – is eye-catching. During WWI there was a sharp rise in profitability, ending in a recession in 1922 when profits for the first time turned negative. Profitability then recovered to pre-war levels. Sweden readopted the gold standard in 1924–1931. Notice the increase in profits during tha latter half of the 1920s, peaking in 1929. From that date they dropped. In the ill-fortuned year of 1932 profits turned negative for the second time. Beginning in 1942, ROE began to increase secularly. It nearly doubled in the Bretton Woods period, compared to the levels of the classical gold standard. After Bretton Woods from 1971, ROE rose sharply – it doubled again. This era ended in 1991, when the largest banking crisis ever hit the banks. After the crisis profits have dropped

to levels more reminiscent of those during the Bretton Woods period.

Return-on-equity and inflation

Figure 3 shows returns in "nominal" terms, that is, disregarding inflation. It is widely held that inflation affects profits and this should be adjusted for. Table 3 shows average return-on-equity for selected time periods in "nominal" terms and in "real" terms, when the change in the Consumer Price Index have been deducted from ROE.

Table 3 Average "real" and "nominal" return-on-equity for the Swedish commercial banks, 1871–2001.

	1871-1915	1945–1970	1971–1990	1995–2001
Price inflation	1%	4%	8%	1%
"Real" ROE	5%	7%	13%	13%
"Nominal" ROE	5%	11%	22%	14%

Sources: Summary of the Bank Reports, Statistics Sweden.

Even in "real" terms, ROE was 160 percent higher in 1970–2001 than it was during the classical gold standard, and about 90 percent higher than during the period of the Bretton Woods system.

4 Return-on-equity and the debt-equity ratio

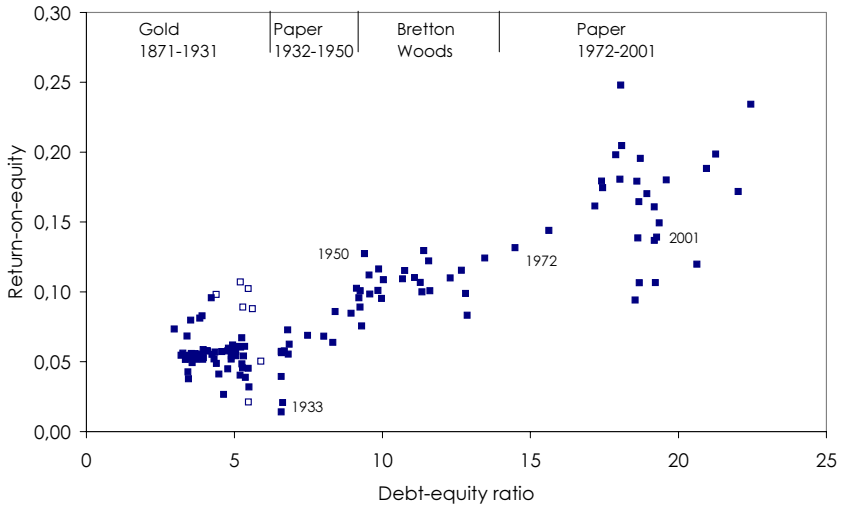
Now for the main event. Figures 2 and 3 revealed that in the period 1870–2001, ROE more than doubled, while the CAR decreased by more than half. This points to a positive long-term relationship between leverage and returns. The "leverage formula" states that there should be a positive *linear* rela-

tion between return-on-equity and the debt-equity ratio, according to the expression

$$ROE = l + (l - b) \cdot DER \,, \quad (2)$$

where l is return-on-assets, and $(l - b)$ is the rate gap (or margin) between return-on-assets and return-on-debt b.[3] Figure 4 shows ROE and the DER for the Swedish commercial banks, 1871–2001.

Figure 4 Return-on-equity and the debt-equity ratio of the Swedish commercial banks, 1871–2001.



Source: Summary of the Bank Reports. White dots mark WWI paper regime, 1915–1923. Negative returns in 1922, 1932, 1991–1993 not shown.

A linear pattern can be discerned. Because the DER increased rather steadily through time, it is possible to classify the dots

[3] See for example Brealey and Myers (2000, p. 481).

as belonging to certain monetary regimes. For a period of sixty years 1870–1930, points are clustered around profit levels of 6 percent and debt-equity ratios between 3 and 5 (disregarding some high- ROE points in the first half of the 1870s and during the WWI paper regime). Following the Kreuger crash in 1932, the DER jumps to a new level. In the early 1940s ROE begins to increase linearly with the DER. The trend continues when the Bretton Woods system is adopted in 1951. The trend continues also when the system is abandoned in 1971. Because of high leverage, the period 1972–2001 saw large fluctuations in ROE and the DER.

Estimation

The following model is estimated:

$$dROE = \beta_1 dDER + \beta_2 dPRICE + [crisis\ dummies] + u \quad , \tag{3a}$$

where

$$u_t = \rho_1 u_{t-1} + \rho_2 u_{t-2} + \varepsilon_t \ . \tag{3b}$$

Dependent variable is dROE, the change in return-on-equity. Independent variable is the change in the debt-equity ratio (dDER). The change in the inflation rate (dPRICE) is used as a control variable, in the spirit of section 3 – *ceteris paribus* an increase in the inflation rate should tend to increase the rate of returns. Also, dummy variables for financial crisis years (1922, 1932, 1991–1994) are used. Crisis years are defined as

years with negative profits (1922, 1932, 1991–1993). Since the crisis of 1993 will heavily affect the difference between ROEs in 1993 and 1994, a dummy for the year 1994 is also included. The crisis dummies are necessary for there to be a statistically significant relationship between leverage and returns.

Regressions are performed on differences rather than on levels. This is because the augmented Dickey-Fuller test for unit roots reveals that while ROE is stationary on levels, the DER is non-stationary. Both variables are stationary on differences. Moreover, because both autocorrelation and heteroscedasticity can be detected, I estimate the model (by maximum likelihood) with two lags in the disturbance term, and where Huber-White standard errors are used.

Table 4 shows regression results. It turns out that they are sensitive to the specification with regard to the dummies for 1991–1994. More exactly, whether a dummy for 1993 (CR93) is included or not. Although returns were strongly negative in this year (–0.25 percent), the difference in returns compared to those of 1992 is actually small. Although the coefficient for CR93 is statistically insignificant, its inclusion or exclusion affects the statistical significance of the coefficient for dDER. Therefore, regressions with and without CR93 is reported.

Table 4 Maximum likelihood estimation on differenced return-on-equity.

	Dependent variable dROE							
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Tax rate	0%	Going	30%	30%	30%	30%	30%	30%
dDER	**0.012**	**0.006**	0.007	***0.008***	0.004	***0.008***	0.004	***0.013***
	(0.049)	(0.040)	(0.055)	(0.002)	(0.15)	(0.000)	(0.55)	(0.002)
dPRICE	**0.21**	0.15	**0.15**	**0.15**	–0.11	–0.019	**–0.91**	0.15
	(0.015)	(0.059)	(0.011)	(0.013)	(0.22)	(0.78)	(0.028)	(0.13)
CR93	0.035	0.025	0.018		0.029	(o.s.)		(o.s)
	(0.53)	(0.44)	(0.67)		(0.69)			
AR (1)	**–0.50**	0.45	**–0.53**	**–0.53**	***–0.68***	***–0.61***	***–0.98***	–0.39
	(0.046)	(0.16**)**	(0.017)	(0.020)	(0.000)	(0.005)	(0.003)	(0.38)
AR (2)	–0.30	0.27	–0.31	–0.24	–0.35	–0.32	–0.46	–0.27
	(0.17)	(0.24)	(0.12)	(0.10)	(0.14)	(0.19)	(0.051)	(0.34)
Sample	1872–2001	1872–2001	1872–2001	1872–2001	1940–2001	1940–1980	1980–2001	1872–1980
Obs.	130	130	130	130	62	41	22	109
DW	2.04	2.02	2.03	2.03	2.01	1.83	1.91	1.96

Note: Huber/White standard errors. *p*-values in parentheses. Bold denotes statistical significance on the five-percent level, and bold-italics on the one-percent level. Dummies for the years 1922, 1932, 1991, 1992, 1993 (reported), and 1994. (o.s.) = "out of sample".

Columns (i–iii) show results for the basic full-sample regression with different tax rates on profits and reserves. Results are not greatly affected by the choice of tax rate – in fact, the relationship between ROE and the DER is slightly stronger both when profits and reserves are taxed at the going rate as well as when they are not taxed, compared to when they are taxed at 30 percent. Regressions (iii–iv) illustrate how the result is affected by CR93. Including the variable in the full-sample regression makes the coefficient of dDER well-nigh statistically significant at the 5 percent level: excluding it

makes the coefficient significant at the 1 percent level. This suggests that a positive long-term relationship between leverage and profitability can be found – but the relationship does not seem to be robust. However, regressions (v–viii) reveal how the result depends on the years 1980–2001. Regression (v) establishes that the dDER is not significant when the sample is 1940–2001. However, it *is* significant when the years 1980–2001 are excluded, as regression (vi) shows. Indeed, no relation between dROE and dDER can be found in 1980–2001 (regression vii). Regression (viii) drives home the point: when regressing on the almost full sample 1872–1980, the dDER is statistically significant at the 1 percent level.

In sum, a strong positive correlation between return-on-equity and the debt-equity ratio was found in 1872–1980. However, the correlation was not present in 1980–2001. In this sense, this study supports the previous results of Berger (1995), and Demirgüç-Kunt & Huizinga (1999). But these latter results could possibly reflect special conditions of the 1980s and 1990s. In the long term, the "normal" positive relationship between leverage and profitability holds, and does so strongly.

5 Conclusion

Two recent studies surprisingly found a negative relationship between leverage and profitability in banking. This study presented new data on the Swedish commercial banks in 1870–2001, and explored the sign of the leverage-profitability relationship in the long term. The capital-asset ratio decreased from levels around 20 percent at the turn of the 19th century, to levels around 5 today. The drop occurred particularly during WWI and in 1940–1980. In the same period, return-on-equity more than doubled, from about 5 to about 13 percent in "real" terms. The "leverage formula" postulates a positive linear relationship between return-on-equity and the debt-equity ratio. This was formally tested. Indeed, a strong positive linear relation was found to exist over the period 1871–1980, but not in the 1980s and 1990s. Results are therefore supportive of those of the previous studies. At the same time, a long-term positive relationship between leverage and profitability in banking is reaffirmed. Over the centuries, at least, the economic laws seem to be working.

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