DEPARTMENT OF ECONOMICS WORKING PAPER SERIES

ARE EUROPEAN BANKS IN ECONOMIC HARMONY? AN HLM APPROACH

James P. Gander

Working Paper No: 2012-03

June 2012

University of Utah
Department of Economics
260 S. Central Campus Dr., Rm. 343
Tel: (801) 581-7481
Fax: (801) 585-5649
http://www.econ.utah.edu

ARE EUROPEAN BANKS IN ECONOMIC HARMONY? AN HLM APPROACH

James P. Gander
Professor of Economics, University of Utah
e-mail: gander@economics.utah.edu

Abstract: A reduced-form equation relating the log of the capital account ratio to several micro and macro variables, particularly the profitability variable, for the commercial banks in nine European countries over eleven years, 1991-2001, was constructed. The equation consisted of a fixed-effects part and a random-effects part. The Hierarchical Linear Model (HLM) approach was used to test the harmonization hypothesis relating the capital account ratio to the profit rate across the countries and over the years. The statistical results indicated that while some differences in bank behavior as indicated by the intercept and slope deviations across countries and over years did exist, by and large, most of the differences or deviations from the fixed-effects means were not significantly different from zero. The harmonization hypothesis was accepted. European bank behavior gave evidence of being in harmony and uniform over countries and years. Some policy implications are discussed briefly.

***Keywords*:** Bank behavior; Profit; Capital account ratios, Harmonization
JEL classification: C23; C40; C51; G21; G28

1.Introduction

The purpose of this paper is to test the proposition or hypothesis, Are European banks in economic harmony with respect to the behavior of their capital accounts? The test involves using the Hierarchical Linear Model (HLM) with nine European countries' commercial banks over the years 1991-2001. Most of the countries are members of the European Union (EU). They represent a mix of large and small economies. The economies are quite diverse in terms of economic structure and policy, which if anything would suggest a lack of harmony. The time period chosen for the test was one of relatively stable economic conditions, compared to the unstable conditions presently in 2011-2012.

There is a decided effort today for banks to increase their capital accounts (see, WSJ, November 11, 2011),which if successful will result in a certain degree of harmony. But, for the purpose of this paper, the possibility of harmony is from the perspective of a more natural market-force-created type of harmony, rather than a crisis-imposed type of harmony. This is not to say that the presence of the EU and the Basel capital ratio guidelines did not have some role in creating such harmony. But, as to the Basel requirements, they are only a guideline and banks elect to agree with them. Also, the actual capital ratios are quite often more than the minimum guidelines, resulting in what is referred to as a buffer (see, for example, Jokipii and Milne, 2007). Further, this paper takes a quantitative approach to harmony (for a non-quantitative approach, see, Singer, 2004).

Finally, while there is literature on the use of various quantitative methods to analyze European banks and their capital accounts(for example, Jokipii and Milne, 2007 and Matejasak , Teply, and Cernohorsky, 2009), there appears to be no literature on using the HLM quantitative method for capital account analysis. Dong and Stettler (2011) have used the HLM approach to analyze corporate disclosure scores for 797 firms and 34 countries (some in the EU), but not to analyze capital account ratios.

In general, the HLM approach is ideal for testing the harmonization hypothesis. The key question is,Dobanks in a given country behave more similar in terms of their capital accounts than do banks in another country? Rather than run a standard cross-sectional time series regression with fixed-effects dummy variables for the nine countries and the eleven years, the HLM approach recognizes that the banks are nested within a country and that there may be within-country random effects and across-countries random effects and over-the-years random effects, in addition to fixed effects. A reduced-form equation is developed (the details will be given momentarily) with the capital account ratio as the dependent variable and micro and micro*macro interaction variables as independentvariables.

The focus is on the profitability variable for the banks and whether and to what extent the intercepts and the slopes (of profitability) vary randomly across countries and over the years. The harmonization test involves determining whether or not the random effect differences in the intercepts and slopes are significantly different from zero or not. The harmonization hypothesis implies they are not. To use an analogy, smart students are good academic performers regardless

of the course, the school, or the district. Banks behave harmoniously regardless of the country or time period.

In what follows, the reduced-form equation is developed in the next section. Then, the HLM is applied to the reduced-form equation in the third section. In the fourth section, the sample and data are discussed and the statistical results are analyzed. The last section contains a summary and conclusions.

2. Reduced-Form Equation

The reduced-form equation is essentially a relationship between the bank's capital adequacy or account ratio and its micro and macro determinants, especially the micro profitability variable (or ratio). In symbolic terms it is given by

(1) $LOGCAPAST_{ijt} = a + b1*RGDPC + b2*NPROFEQ + b3*(NPROFEQ*RGDPC) + b4*ADMREV + e,$

where theLOGCAPAST is the log of the capital account to assets ratio for bank "i" in country "j" and year "t" (subscripts areleft off the labels for simplicity). The capital account can have several different definitions (for example, the tiers in the Basel definition), but the one used here is based on Standard & Poor's definition. It consists of the sum of long-term debt plus minority stock interests plus shareholder equity which includes reserves and retained earnings. This definition has the least number of missing values. All of the capital components provide the

bank with financial funds to hedge against the risk of default of primarily short-term customer loans (to households and businesses).

The RGDPC is real gross domestic product per capita in U.S. dollars (base year is 1995) for each country and year. The RGDPC macro variable is used as an economic condition indicator. It is expected to be positively related to the capital account ratio, although the literature is mixed on the relationship (see, for example, Jokipii and Milne, 2007). The NPROFEQ is the bank's profitability variable (net income after taxes and appropriations to untaxed reserves in the balance sheet relative to shareholder equity). All other things being equal, it is expected to be positively related to the capital account by virtue of its effect on retained earnings. The ADMREV is the ratio of total staff and administrative personnel and equipment and lease expenses to total bank revenue (interest received, fees, and returns on market investments). This variable is used to capture the effect of bank loan-making costs on the capital account. It is expected to be inversely related to the capital account, since as a cost, it is inversely related to net income. The (NEPROFEQ*RGDPC) is a micro*macro interaction variable and is expected to be positively related to the capital account. The e is the i,j,t residual. The variables are all ratios (with the exception of RGDPC which is in real U.S. dollars) to avoid having to convert local currency units to a common currency unit.Equation (1) is essentially the fixed-effect component of the HLM equation given next.

3. The HLM Equation

In general terms, the HLM equation can be given by (following SAS's notation):

(2) $y=X\beta + Zu + e$,

where u is the vector of random coefficients, Z is the design matrix (here, the NPROFEQ variable by country and by year plus the intercept by country for all years pooled), and the $X\beta + e$ is the fixed-effect part, equation (1). The countries are referred to as the subjects and the years as the groups. The banks are the units of observation. Specifically, for the present analysis, the expanded equation (1) is given by

(3) Equation (1) plus $u1_{jt} * NPROFEQ_{ijt} + u_{oj}$,

where u_{oj} is the random intercept for the country-specific equation for all years pooled and $u1_{jt}$ is the random slope effects by country and by year. The two class levels are country (values 1 to 9) and year (values 1 to 11). Both classes are used for the random slopes, but only the country level is used for the random intercepts. Econometrically, this design worked best. Using y for the dependent variable, the variance of y is given by $(Z'V(u)Z + R)$, where $R=\sigma^2 I_n$ is the variance of e for all observations, and V(u) also referred to as G is a block-diagonal matrix with nine blocks for the nine countries.

The assumption here is that the G matrix is unstructured, implying that the variances of the u's are possibly interdependent or co-variables. Since the focus is on the bank's profitability variable, NPROFEQ, it can vary across banks within a given country for a given year and across years for a given bank and country. These variances are at the core of the harmonization hypothesis. The banks are unique to a given country and identified by their gvkey (global vantage key). The fixed-effects equation estimates are the mean of the country-level intercepts

and the means of slopes for the X-variables for the country level equations. The intercepts and the slopes for each country-level equation can be compared for their random differences, to test whether they are significantly different from zero. It should be noted that the individual banks in a given country cannot be compared to the individual banks in another country. Only the means or averages can be compared. It should also be noted that the u's and e's are assumed to be normally distributed. A test on the logcapasst variable showed it to be normally distributed.

It is instructive to note that the estimates of β are given by $b=(X'V^{-1}X)^{-g}X'V^{-1}y$ (the –g indicates a generalized inverse) and the estimates of the random effects coefficients are given by $u=GZ'V^{-1}(y - X\beta)$, so all estimates are influenced by Z, X, R, and G. To estimate the intercepts and slopes, the restricted maximum likelihood method (REML) is used.

4. The Sample Data and Statistical Results

The bank micro data are from the Standard & Poor's Compustat, Global Vantage (GV) file (2002) covering the period 1991-2001. The data are unbalanced panel data across time and across countries. The initial sample size was 1780 observations, which after accounting for missing values was reduced to 1641 observations over nine countries, eleven years, and some 251 banks. The nine countries are Portugal, Turkey, Germany, Spain, France, Italy, Austria, Greece, and Switzerland. The data are taken from the balance sheets and income statements of publicly trade depository commercial banks in Europe. For some of the predictor variables suggested by bank theory, see, for example, Allen and Santomero, 1997; and Freixas and Rochet, 1997; see also, Barnes, 1987; Damodaran, 1997; and Kallunki, Martikainen, and Perttunen, 1996.

The macro data are from the World Bank's World Development Indicators file. The macro variables considered in the initial analysis were real GDP per capita in U.S. dollars (RGDPC), its rate of growth, the ratio of M2 money supply to GDP, and the rate of growth of the M2 money supply. Real GDP per capita was in the final analysis the best macroeconomic indicator. As indicated at the outset, the macro variable is used as a stand-alone variable and also as a micro*macro interactive variable. If there is a perception of "good economic times," as indicated by the macro variable, then the bank may be more comfortable with a smaller capital adequacy ratio (given any legal requirement). If the opposite is the case, then a larger ratio may be preferred. Since bank assets are largely customers' loans, then variation in these will essentially affect the capital adequacy ratio.

The statistical results are recorded in Table 1. The fixed-effects coefficients are all significant at .002 or less. The positive sign for the RGDPC coefficient was unexpected, since a larger RGDPC implies an economically healthier economy and, therefore, less risk of loan defaults. As such, a lower capital account ratio should be expected. As indicated earlier, the literature is mixed on the direction of this relationship. The negative sign for the interaction effect is expected for the reason given before for the RGDPC effect. The negative sign for the ADMREV cost coefficient implies that as the cost of loan making increases, the capital account ratio will fall due to the effect of cost on the bank's net income (as explained earlier).

The main interest of the analysis of bank behavior relates to the harmony hypothesis as explained at the outset. The conclusion relevant to this hypothesis is suggested by the random effects (RE) results in the second part of Table 1. The second part records the mean deviations

of the random coefficients from the fixed-effects coefficients which are the overall means coefficients. As indicated in the notes to Table 1, a very small proportion of these deviations was statistically significantly different from zero at p =< 10 percent.Out of 108 random deviations (nine country intercept deviations and 99 NPROFEQ random-coefficient deviations over time and country), only 18 were significantly different from zero at p =< 10 percent. The table shows only 18 of these deviations (for constants and slopes) to save space (the author can e-mail the full set of deviations upon request).

In general, the conclusion is that for all banks in all nine countries over eleven years, the random deviations for all the intercepts and profit rate slopes are not significantly different from zero. Hence, banks very much all behave the same way in terms of their capital account-profit rate relationship, regardless of the country or year. The harmony hypothesis is, therefore, accepted. Theoretically, one could argue that this is the way a European-wide competitive market should be expected to behave, but it can also be argued that an integrated monopoly structure would also behave this way. Given the large number of banks in this analysis (251), the former argument seems more appropriate.

5. Summary and Conclusions

A reduced-form equation relating the log of the capital account ratio to several micro and macro variables, particularly the profitability variable, for the commercial banks in nine European countries over eleven years, 1991-2001, was constructed. The equation consisted of a fixed-effects part and a random-effects part. The HLM approach was used to test the

harmonization hypothesis relating the capital account ratio to the profit rate across the countries and over the years.

The statistical results indicated that while some differences in bank behavior as indicated by the intercept and slope deviations across countries and over years did exist, by and large, most of the differences or deviations from the fixed-effects means were not significantly different from zero. The harmonization hypothesis was accepted. European bank behavior gave evidence of being in harmony and uniform over countries and years.

In terms of present-day economic conditions in Europe and particularly in terms of the commercial banks behavior therein, harmonization is not only a desirable policy goal, but also one that is achievable. More research on the policy implications of the harmonization thesis is needed in the future. Suffice it to say at this time that if harmonization is a natural market determined phenomenon, as the evidence in this paper seems to suggest, then regulatory policy leaders should act as a catalyst to ensure that the harmonization process is realized (see, for a test of banks' positive responses to regulatory requirements (pressure), Matejasak, Teply, and Cernohorsky, 2009).

The evidence in the present paper does not imply that a-specific, country-level regulatory policy will not have a pro-active role in influencing the country's bank behavior, particularly in terms of banks' capital ratios. But, as is generally apparent from the news media, one-by-one each European country (at least some of those in this paper) is responding the same way (by

raising capital requirements, among other policy moves) to the European bank (and government) financial crisis, thus creating, in effect, harmonization (as Matejasak, et al., 2009 found).

References

Allen, F., Santomero, A., 1997. The Theory of Financial Intermediation. **Journal of Banking & Finance** 21, 1461-1485.

Barnes, P., 1987. The Analysis and Use of Financial Ratios: A Review Article. **Journal of Business, Finance & Accounting** 14, 449-461.

Damodaran, A., 1997. Corporate Finance: Theory and Practice. New York: John Wiley & Sons.

Dong, M. and Stettler, A., 2011. Estimating firm-level and country-level effects in Cross-sectional analyses: An application of hierarchical modeling in corporate Disclosure studies. **The International Journal of Accounting** 46(3), 271-303.

Freixas, X., Rochet, J.-C., 1997. Microeconomics of Banking.Cambridge, Massachusetts: The MIT Press.

Jokipii, T. and Milne, A., 2007. The Cyclical Behaviour of European Bank Capital Buffers. **The Swedish Institute for Financial Research**, No. 56, July, 1-22.

Kallunki, J.-P., Martikainen, T., Perttunen, J.,1996. The Proportionality of Financial Ratios: Implications for Ratio Classifications. **Applied Financial Economics** 6, 535-41.

Matejasak, M., Teply, P. and Cernohorsky, J., 2009. The Impact of Regulation of Banks in the US and the EU-15. **Ekonomie a Management** 12 (3), 58-68.

Singer, D. A., 2004. Capital Rules: The Domestic Politics of International Regulatory Harmonization. **International Organization** 58 (3, Summer), 531-565.

Standard & Poor=s, 2002. Compustat, Global Vantage File. McGraw-Hill, Inc.

Wall Street Journal. "Heard on the Street: Europe's Drama is Far From Over," Comment #1, November 11, 2011.

World Bank Group. World Development Indicators database, CD-ROM, August 2003.

Table1. HLM Statistical Results for European Banks

Solution For Fixed Effects

Dep. Var.: LOGCAPAST

Coefficient	Mean Estimate	t-Value	p-Value
CONSTANT	-2.719	-10.05	<.0001
RGDPC	.000056	5.71	<.0001
NPROFEQ	1.275	3.13	.0018
NPRO*RGDPC	-.00004	-2.75	.0001
ADMREV	-1.152	-10.66	<.0001

Solution for Random Effects

Coefficient	Ctryinc	Year	Mean Deviation	t-Value	p-Value
CONSTANT	AUT	All	0.0983	0.52	0.604
NPROFEQ	AUT	1991	0.1924	0.07	0.946
CONSTANT	CHE	All	-0.8158	-2.97	0.003
NPROFEQ	CHE	1991	0.2917	0.22	0.826
CONSTANT	DEU	All	0.0715	0.38	0.705
NPROFEQ	DEU	1991	3.295	2.04	0.042
CONSTANT	ESP	All	-0.174	-0.96	0.335
NPROFEQ	ESP	1991	-1.506	-2.09	0.037
CONSTANT	FRA	All	-0.319	-1.81	0.070
NPROFEQ	FRA	1991	1.382	5.60	0.0001
CONSTANT	GRC	All	-0.126	-0.62	0.537
NPROFEQ	GRC	1991	0.000	0.000	1.000
CONSTANT	ITA	All	0.297	1.76	0.079
NPROFEQ	ITA	1991	-6.368	-5.50	0.0001
CONSTANT	PRT	All	0.060	0.30	0.766
NPROFEQ	PRT	1991	0.000	0.000	1.000
CONSTANT	TUR	All	0.907	3.41	0.001
NPROFEQ	TUR	1991	0.000	0.000	1.000

Notes: The mean coefficient estimates in the FE part of the table are averages across all countries and years and are all statistically significant. In the RE part of the table, the estimates are deviations from the FE means. The nine deviations for the country-specific constants (intercepts) sum to zero as expected. The NPROFEQ slope coefficients by country are only recorded for the year 1991 as an example, to conserve space. Of the nine intercept coefficients, each covering all eleven years, four are significant at <=10 percent, only two at <=.05 percent. Of the 99 slope deviations, only 14 are significant at <=10 percent. Of the 13 covariance parameter estimates (not recorded here), one for the overall intercept, eleven for the NPROFEQ slopes that vary across the nine countries for each year, and one for the residual, six are significant at the <= 10 percent. Of these six, five are not significant when p <= .05 percent is used. For each year, the covariance of the slopes across the nine countries in each year is an indication of the harmonization hypothesis. The sample size was 1641 observations. The method of estimation was the restricted maximum likelihood method (REML) using SAS.