Market concentration and the likelihood of financial crises

Author(s):
Bretschger, Lucas; Kappel, Vivien

Publication date:
2010-09

Permanent link:
https://doi.org/10.3929/ethz-a-006170992

Originally published in:
Economics Working Paper Series 10/138

CER-ETH – Center of Economic Research at ETH Zurich

Market concentration and the likelihood of financial crises

L. Bretschger and V. Kappel

Working Paper 10/138
September 2010

Economics Working Paper Series

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Market concentration and the likelihood of financial crises

Lucas Bretschger*, Vivien Kappel†

September 30, 2010

According to theory, market concentration affects the likelihood of a financial crisis in different ways. The "concentration-stability" and the "concentration-fragility" hypotheses suggest opposing effects operating through specific channels. Using data of 160 countries for the period 1970-2007, this paper empirically tests these indirect effects of financial market structure. We set up a simultaneous system in order to jointly estimate financial stability and the relevant channel variables as endogenous variables. Our findings provide support for the assumption of channel effects in general and both the concentration-stability and the concentration-fragility hypothesis in particular. The effects are found to vary between high and low income countries.

Keywords: Market Concentration, Financial Crisis, Systemic Crisis.
JEL classification: G01, G21, E32

*CER-ETH – Center of Economic Research at ETH Zurich, ZUE F 7 , CH-8092 Zurich, Switzerland, lbretschger@ethz.ch.

†CER-ETH – Center of Economic Research at ETH Zurich, ZUE F 9, CH-8092 Zurich, Switzerland, vkappel@ethz.ch.

1 Introduction

The recent financial crisis and the subsequent economic downturn have clearly shown the importance of financial stability. Since the onset of the slump in 2008, resolving strategies and regulatory measures aimed at preventing future crises have been on the top of the political agenda worldwide. However, given the high degree of complexity of the issue, the factors causing financial crises are hard to identify. The various financial crisis episodes during the 20th century suggest that many different determinants, such as particular institutional settings, policy failures, and structural peculiarities, may all have a crucial impact.

Among the different strands of literature, the role of market structure emerges as a crucial topic. More precisely, the impact of competition and market concentration on the probability of a financial crisis appears to be of primary interest. Remarkably, two opposing theories are currently debated. A positive relationship between market concentration and financial system stability is observed when more concentrated markets allow banks to earn higher profits, which serve as a buffer against unexpected shocks (concentration-stability hypothesis). On the contrary, higher market concentration is associated with lower financial stability when market power induces banks to charge higher interest rates to borrowers, so that borrowers take excessive risks and raise the risk of default and destabilization (concentration-fragility hypothesis).[1]

While the predictions of theory are ambiguous, the majority of recent empirical studies supports the concentration-stability hypothesis. Beck et al. (2006) is among the first and few studies that analyze the impact of market concentration on the likelihood of financial crises. The authors use data on 69 countries from 1980 to 1997 and find that countries with more concentrated banking systems are less prone to crises. Chang et al. (2008) study the impact of banking concentration on non performing loans, using Brazilian bank data for the period 2000 to 2005, and report similar results. In a study on the impact of deposit insurance on banking system stability, Demirgüc-Kunt and Detragiache (2002) also find that higher concentration is associated with a lower crisis probability. Evrensel (2008) uses data on 79 countries for the period 1980-1997 and shows that concentration in the banking sector enhances the survival time, i.e. the period during which a country is not experiencing a crisis. Ruiz-Porras (2008) investigates the relationship between banking competition and financial fragility, using data for 47 countries between 1990 and 1997. However, concentration turns out to be insignificant in this study.

With the current concern that banks have become too big ("too-big-to-fail"), these results are quite surprising. Moreover, all the studies estimate the *direct* effect of concentration on financial stability. Taking the theoretical literature seriously, however, means to scrutinize the *indirect* impact of concentration on financial stability, the effects which run via specific channels. According to theory, the two channel variables of returns in banking on the one hand and

[1] For a more detailed discussion of the different theoretical models, see for example Beck et al. (2006) and Beck (2008).

interest margins on the other hand need to be distinguished. In addition, the causal chains ranging from concentration to financial crises through the two different channels suggest using a systems approach for empirical estimation.

The present paper aims at bringing the empirical literature into agreement with the underlying theory. We set up a simultaneous system in order to jointly estimate financial stability and the relevant channel variables as endogenous variables. As it is common in the literature, we estimate financial stability using a binary variable indicating a financial crisis if it takes the value of one and zero otherwise. The main contribution of the paper is to provide a consistent empirical analysis of the two main hypotheses which are motivated by the theoretical literature. In particular, we investigate the *indirect* effects of market concentration on the likelihood of a financial crisis. We use a new database by Laeven and Valencia (2008) which covers data on financial crises between 1970 and 2007 and allows to adopt a panel approach.

We find that both channel effects from theory can be confirmed by the estimations. This suggests that a direct estimation of the effect of concentration is unlikely to give a precise result. Furthermore, once we control for the channel variables, there is no direct effect of market concentration on systemic crisis. The results of the two-stage and the GMM regressions show evidence of both the concentration-stability and the concentration-fragility hypothesis, though the results for the former are more significant. In order to take account of the differences between developed and developing countries, we split the sample and estimate the regressions separately. For developing countries, we find strong evidence for the concentration-stability hypothesis, but no evidence for the concentration-fragility hypothesis. In addition, in developing countries the results suggest that higher concentration is associated with lower net interest margins. In developed countries, the evidence for the concentration-stability hypothesis is significant. Furthermore, there is also evidence for the concentration-fragility hypothesis.

Our paper is closely related to the above-mentioned literature. In addition, it relates to a broader strand of studies on systemic risk and stability in the macroeconomic context.[2]

The remainder of the paper is organized as follows. Section 2 describes the channels through which concentration is supposed to affect financial stability in more detail. Section 3 outlines the data and explains the econometric methodology. Section 4 presents the results. Section 5 takes a closer look on the differences between developing and developed countries. Section 6 discusses the main results, and finally section 7 concludes.

2 Channel effects

We focus on two channels, motivated by the literature, through which concentration affects the probability that a financial crisis occurs. In particular, we want to test the "concentration-stability" and "concentration-fragility" hy-

[2]See for example Gai et al. (2007, 2008), Summers (2000), Rogoff (1999) and Reinhart and Rogoff (2009), amongst others.

potheses. According to the concentration-stability view, higher market concentration enhances the stability of the financial system. One line of argument suggests that, due to higher market concentration, firms have more market power and may therefore generate higher profits. In a similar way, it is stated that higher profits increase the franchise value of firms, see Chang et al. (2008). This will induce managers to take less excessive risks, which enhances the stability of the entire system and suggests a positive relationship between market concentration and financial system stability.[3]

On the contrary, the concentration-fragility hypothesis predicts that higher market concentration destabilizes the system and makes it more vulnerable. According to Boyd and De Nicoló (2005), banks in a more concentrated market (and with more market power) may charge higher loan rates to borrowers than under (more) competition. In this case, borrowers will take higher risks, which is a problem for system stability. Moreover, the "too-big-to-fail" property of some banks might lead to excessive risk taking in banking causing increased system instability.

Since the concentration-stability hypothesis assumes that concentration affects system stability or, put differently, the probability of a financial crisis, through higher profits, we will refer to this channel as the *profitability* channel. The concentration-fragility view suggests that the effect of higher concentration works through higher loan rates. We will therefore denote this as the *interest rate* channel. Profitability is measured by the return on assets, a standard profitability measure in the literature. The most suitable measure to proxy for the interest rate channel would be the loan rate of banks. However, since data on loan rates are quite limited, we use net interest margin instead.[4]

The following equations summarize the idea of the channels and illustrate the link between the major variables formally. The probability of a financial crisis is a function (f) of the two channel variables, i.e. return on asset (roa) and net interest margin (nim), and a set of control variables X.

$$crisis = f(roa, nim, X) \tag{1}$$

The return on assets is determined by i) market concentration (the variable which is of most interest here) and ii) a set of other variables, summarized in Y.

$$roa = g(conc, Y) \tag{2}$$

Similar to the return on assets, net interest margin is determined by i) market concentration and ii) a set of other variables, denoted as Z.

$$nim = h(conc, Z) \tag{3}$$

[3]Another line of argument mentioned in Beck et al. (2006) in favor of the concentration-stability hypothesis is that a more concentrated system with fewer institutions is easier to monitor than a system with many banks.

[4]Net interest margin equals interest income minus interest expense divided by interest-bearing assets.

For the determinants of the channel variables we mainly follow the existing literature.[5] Similar to Athanasoglou et al. (2008), we include *bank* specific characteristics, such as the cost income ratio or bank size, *industry* related factors like market concentration or stock market turnover, and *macroeconomic* conditions, such as the per capita GDP growth or inflation.

The concentration-stability hypothesis suggests, ceteris paribus, a negative effect of market concentration on the likelihood of a systemic crisis. The channels further imply a positive link between concentration and return on assets and a negative relation between return on assets and the probability of a crisis. Formalized the concentration-stability hypothesis is:

$$\frac{\partial crisis}{\partial roa} < 0, \qquad \frac{\partial roa}{\partial conc} > 0 \qquad \Rightarrow \qquad \frac{\partial crisis}{\partial conc} < 0 \tag{4}$$

According to the concentration-fragility hypothesis market concentration enhances the probability of a systemic crisis. Further, the channel mechanism we look at suggests a positive link between concentration and net interest margin and a positive relation between net interest margin and the crisis probability:

$$\frac{\partial crisis}{\partial nim} > 0, \qquad \frac{\partial nim}{\partial conc} > 0 \qquad \Rightarrow \qquad \frac{\partial crisis}{\partial conc} > 0 \tag{5}$$

From 4 and 5 we see that the two effects of concentration on the probability of a financial crisis are indeed exactly opposite, which can only be detected in the data by using an appropriate system equation approach.

3 Data and Methodology

3.1 Data

Our sample covers 160 countries over 38 years in the period 1970-2007. Data on financial crises are taken from the database by Laeven and Valencia (2008), which contains data on *systemic banking crises*, *currency crises*, and *sovereign debt crises* for 1970-2007. We focus on systemic banking crises, which the authors describe as follows:

> "[...], in a systemic banking crisis, a country's corporate and financial sectors experience a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time. As a result, non-performing loans increase sharply and all or most of the aggregate banking system capital is exhausted. [...]"

Crisis data are given by a simple binary variable that equals one if a country i at time t experiences a financial crisis, and zero otherwise.[6] In total, the data cover 124 (systemic) banking crises, 208 currency crises, and 63 sovereign debt crisis episodes, where a subset of 42 are twin crises.[7] Financial data are mainly

[5] See for example Bourke (1989), Molyneux and Thornton (1992), Demirgüc-Kunt and Huizinga (1999) or Athanasoglou et al. (2008).

[6] Note that time t denotes the year when the crisis starts.

[7] For further details on the data, see Laeven and Valencia (2008).

taken from Beck et al. (2000, updated 2009). Macroeconomic data come from the World Bank's World Development Indicators (WDI) database.[8]

Table 1 presents the descriptive statistics of the main variables, including the number of observations, mean values, standard deviations as well as the value for the minimum and maximum.[9]

Table 1: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
sys_cris	6080	0.0203947	0.141358	0	1
roa	1999	0.0125097	0.0258641	-0.4331444	0.1618286
nim	1938	0.0540555	0.0385981	0.0066786	0.4204413
conc	1999	0.7064695	0.2054826	0.1483518	1

The sample has three peculiarities. First, the overall sample covers more developing countries than developed countries. However, due to the lack of data for some variables in developing countries, the included number of observations is not so different in both cases.[10] In order to account of the uneven size of sub-samples, we form sub-samples to run the regressions for different income groups separately. Second, the number of observations for systemic financial crisis is not very high. While the maximum number of included observations is 1938, which is the maximum number for the right-hand variables, 124 of the total number of observations refer to systemic financial crisis observations, i.e. they express that "a particular country faces a financial crisis in a specific point in time (year)." We also checked how data on financial crises are distributed among developed and developing countries. Of the 124 observations on systemic financial crises, 17 observations belong to developed countries, while the remaining 107 entries refer to crises in developing countries. A third issue is the variation in the number of observations. As usual in empirical studies in this field, the availability of data for the different variables varies quite remarkably. Macroeconomic indicators are available for most countries and time periods. Financial sector data such as return on asset, net interest margins, capital market turnover, financial sector average cost-income ratios or indicators on the degree of market concentration often are available either for a particular group of countries or for recent years, only. While the latter case simply leads to a smaller sample size, the former limitation may be more difficult to deal with. This is in particular the case if an increase in the number of explanatory variables changes the sample such that the ratio of developed and developing countries changes significantly. We will specifically consider this issue in selecting the specifications, which we discuss below.

Table 2 presents the correlations between systemic crisis, the channel variables and market concentration. As suggested by the system-stability hypothesis, the correlation between profitability (roa) and financial crisis is negative.

[8]Variables description and sources are given in the Appendix.

[9]The full descriptive statistics can be found in Table A.2 in the Appendix.

[10]Note that we refer to countries as developed countries if the World Bank income group is *high income*. All remaining World Bank income groups (low income, lower middle income, upper middle income) are subsumed in one group which we denote as *developing countries*.

In line with the concentration-fragility hypothesis, the correlation between net interest margins (nim) and the likelihood of a financial crisis is positive. Since we are interested in the effect of market concentration on the likelihood of financial crises, we must also consider the relation between the particular channel variables and market concentration. As we can see from the table, all the coefficients are positive, which is in line with the theoretical predictions that higher market concentration is associated with higher profits and higher interest rates charged to borrowers.

Table 2: Cross-correlation table

Variables	sys_cris	roa	nim	conc
sys_cris	1.000			
roa	-0.0419	1.000		
nim	0.0554	0.3215	1.000	
conc	-0.0178	0.1559	0.0683	1.000

3.2 Methodology

Most studies on the (direct) effect of market concentration on the probability of a systemic financial crisis use logit probability models (see for example Demirgüc-Kunt and Detragiache (1997) or Beck et al. (2006)). Unlike these studies, we investigate the *indirect* impact of concentration on the probability of a systemic financial crisis. This requires a different econometric approach. In a first step, we estimate the crisis probability according to eq.(1) in order to check whether the channels that we consider run in the expected direction, that is, whether the probability of a systemic crisis is significantly determined by the channel variables. Following the literature, we use a logit model, but we estimate also other models as robustness check. In a second step, we combine eq.(1) with eq.(2) and eq.(3) to estimate the effect of concentration on the likelihood of financial crises, via the considered channels. Tavares and Wacziarg (2001) follow a similar approach. They set up a simultaneous equations model, which they estimate by Three Stage Least Squares (3SLS). Given the dummy character of our dependent variable, we use a two stage approach to estimate the binary response model in which we endogenize the channel variables and in this way assess the indirect effect of concentration on financial system stability (fragility).

4 Results

The results are presented according to the described procedure. We first assess the explanatory power of the channel variables, and then turn to the two-stage regressions to estimate the indirect effect of market concentration and test for evidence on the concentration-stability and/or -fragility hypothesis.

4.1 One Stage estimates

Table 3: Systemic crisis

Dependent variable: systemic crisis	Probit	Logit	Cloglog	LPM	Probit	Probit
roa	-4.211**	-7.843***	-7.001***	-0.461*	-4.258**	-4.662*
	(1.635)	(2.983)	(2.403)	(0.271)	(1.715)	(2.545)
nim	4.120***	8.808***	8.458***	0.319***	3.068*	4.720*
	(1.411)	(2.966)	(2.818)	(0.110)	(1.639)	(2.627)
conc	-0.329	-0.921	-0.942	-0.0175	-0.155	-0.244
	(0.312)	(0.757)	(0.743)	(0.0159)	(0.361)	(0.428)
dep_ins					-0.536***	-0.483**
					(0.165)	(0.215)
gdp_cap						3.98e-06
						(1.00e-05)
turnover						0.121**
						(0.060)
acc_gdp						-0.0331**
						(0.0167)
Constant	-1.980***	-3.591***	-3.578***	0.0233**	-1.505***	-1.733***
	(0.231)	(0.543)	(0.531)	(0.0119)	(0.302)	(0.396)
No. of. obs.	1938	1938	1938	1938	1200	1003
Log likelihood	-203.665	-204.088	-204.217		-158.846	-121.838
Wald chi2(3;4;7)	14.46	15.32	16.88	9.57	20.77	18.63
Prob>chi2	0.0023	0.0016	0.0007	0.0225	0.0004	0.009
R^2				0.0098		

Notes: Cloglog denotes the complementary log-log model, LPM the linear probability model. *dep_ins*: Dummy variable on deposit insurance, equals one if there is a deposit insurance scheme, zero otherwise. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3 summarizes the findings of the non-instrumented regressions, using different binary response models. The results show that both channel variables - roa (return on assets) and nim (net interest margin) - affect the crisis probability significantly and in the direction suggested by the theory, irrespective of the particular estimation model.[11] We also use the complementary log-log model for comparison due to its characteristics to cope with unequally distributed data, which confirms these findings.[12] In line with the *concentration-stability* hypothesis, the negative coefficient on roa suggests that countries with more profitable banks, i.e. higher values of return on asset, are less prone to financial crises. At the same time however, we find that - supporting the *concentration-fragility* hypothesis - higher net interest margins are associated with a higher

[11] For the comparison of binary models and parameter estimates see for example Cameron and Trivedi (2009), chapter 14.

[12] In our case it concerns the few observations on crisis compared to non-crisis observations.

crisis probability.[13] Unlike previous studies, we find no evidence for a direct effect of market concentration on the likelihood of a systemic financial crisis. Taken together, we interpret these results as preliminary indication that concentration may have an indirect but not a direct effect on financial stability. In column 5 we add a binary variable for deposit insurance. Unlike other studies, our results suggest that countries with a deposit insurance scheme are less likely to experience a systemic crisis.[14] The standard moral hazard argument claims that the presence of a safety net such as a deposit insurance scheme enhances the riskiness of banks, which increases their default risk and therefore the likelihood of a systemic crisis. However, considering that previous studies usually use a composite "moral hazard" index, which takes on *higher* values the more generous a deposit insurance scheme is, our findings may not necessarily be conflicting with their results (see for example Beck et al. (2006) or Evrensel (2008)).

In the last column, we check for the robustness of our results, controlling for additional measures, such as the political and economic environment, or stock market conditions. The channel variables turn out to be quite robust against controlling for other determinants. While the coefficient on per capita income is insignificant, the results suggest that a higher stock market turnover is associated with a higher crisis probability. This indicates the strong integration of banks and stock markets. Finally, we find that countries with a higher current account balance to GDP ratio are less likely to be hit by a financial crisis. Taking this ratio as a proxy for economic stability, this result implies that governments may significantly contribute to financial stability.

Summing up, our results show that both channel variables significantly affect the likelihood of financial crises in the way suggested by the theory. Furthermore, we find no evidence of a direct effect of concentration on the crisis probability. In order to test the full stability and fragility hypotheses we need to endogenize the channel variables, i.e. accounting for the fact that market concentration determines the channel variables. In the next section, the results of the two stage model are presented.

4.2 Two Stage estimates

In order to estimate the indirect effect of market concentration on the probability of a systemic crisis we need to simultaneously estimate eq.(1), (2) and (3). To do this, we estimate a two stage probit and a two stage linear probability model. Results are summarized in Table 4.

From the results for the second stage it becomes evident that all coefficients are significant and have the expected sign. As in the one stage estimates, higher return on asset is associated with a lower crisis probability, whereas higher net interest margins enhance the likelihood of a systemic financial crisis. In recent

[13] Since the interpretation of parameter estimates is not straightforward in non-linear models, we calculate marginal effects (at the mean value of each corresponding regressor). They are reported in Table A.3 in the Appendix.

[14] See for example Demirgüc-Kunt and Detragiache (1998, 2002).

Table 4: Systemic crises - two stage estimates

Second stage *sys_cris*	Probit	LPM	Probit	LPM
roa	-10.319***	-1.066***	-12.824*	-1.000
	(3.905)	(0.524)	(7.371)	(0.694)
nim	4.167*	0.352*	13.132***	0.798***
	(2.391)	(0.190)	(4.112)	(0.259)
dep_ins	-0.478***	-0.042*	-0.384*	-0.041***
	(0.192)	(0.021)	(0.202)	(0.018)
Constant	-1.640***	0.057***	-2.195	0.034
	(0.233)	(0.022)	(0.349)	(0.023)
No. of obs.	1118	1118	1194	1194
Wald chi2(3)	15.18	9.35	23.39	33.00
Prob>chi2	0.0017	0.0250	0.000	0.000
R^2		0.0183		0.0181
First stage *roa*				
roa(t-1)	0.468***	0.468***		
	(0.0251)	(0.0251)		
nim(t-1)	0.0838***	0.0838***		
	(0.0212)	(0.0212)		
conc	0.0065*	0.0066*	0.011***	0.011***
	(0.0035)	(0.0035)	(0.038)	(0.038)
gdp_cap	5.62e-08	5.62e-08	-1.5e07**	-1.5e-07**
	(6.98e-08)	(6.98e-08)	(7.16e-08)	(7.16e-08)
gdp_growth	0.00053***	0.00053***	-0.00015	-0.00015
	(0.00019)	(0.00019)	(0.00017)	(0.00017)
cost_inc	-0.0275***	-0.0275***	-0.044**	-0.044**
	(0.00367)	(0.00367)	(0.0039)	(0.0039)
dep_ins	0.00006	0.00006	-0.0042*	-0.0042*
	(0.0019)	(0.0019)	(0.0021)	(0.0021)
Constant	0.0133***	0.0133***	0.039***	0.039***
	(0.00426)	(0.00426)	(0.0043)	(0.0043)
No. of obs.	1118	1118	1194	1194
$Adj.R^2$	0.3433		0.1066	
First stage *nim*				
roa(t-1)	0.0708***	0.0708***		
	(0.0197)	(0.0197)		
nim(t-1)	0.759***	0.759***		
	(0.0166)	(0.0166)		
conc	-0.00384	-0.00384	-0.0137***	-0.0137***
	(0.00271)	(0.00271)	(0.0047)	(0.0047)
gdp_cap	-4.07e-07***	-4.07e-07***	-1.58e-06***	-1.58e-06***
	(5.47e-08)	(5.47e-08)	(8.70e-08)	(8.70e-08)
gdp_growth	-0.00113***	-0.00113***	-0.0025***	-0.0025***
	(0.000149)	(0.000149)	(0.0002)	(0.0002)
cost_inc	-0.00824***	-0.00824***	-0.0039	-0.0039
	(0.00287)	(0.00287)	(0.0049)	(0.0049)
dep_ins	0.00151	0.00151	-0.0082***	-0.0082***
	(0.00156)	(0.00156)	(0.0026)	(0.0026)
Constant	0.0253***	0.0253***	0.0926***	0.0926***
	(0.00333)	(0.00333)	(0.0052)	(0.0052)
No. of obs.	1118	1118	1194	1194
$Adj.R^2$	0.7799		0.3067	

Notes: Standard errors in parentheses.
*** p<0.01, ** p<0.05,* p<0.1.

years, a few studies have shown that bank profits tend to be time-persistent.[15] Taking this into account, in the first two columns of Table 4, (on the first stage) we control for the one-period lagged values of the channel variables.[16] However, due to the two stage binary response structure of our model, the coefficients of the channel variables are being estimated by standard least squares and may therefore be biased and inconsistent. For this reason, we additionally i) run regressions without the lagged channel variables, and ii) estimate the first stage, i.e. the channel variables, separately, using a GMM model. The results are displayed in the second two columns of Table 4 and Table 5, respectively. As we see from Table 4, the results on the second stage remain largely unchanged, when we omit the lagged channel values. On the first stage, however, now concentration turns out to be significant.[17] The results of the GMM estimates can be found in Table 5. Interestingly, concentration turns out to have a highly significant effect on both channel variables, with the "correct" (positive) sign, as suggested by the theory.

In summary, we interpret our findings as strong support for the concentration-stability hypothesis and a somewhat weaker evidence for the concentration-fragility hypothesis.

Table 5: Channels - GMM estimates

	roa	nim
roa(t-1)	0.280***	
	(0.000626)	
nim(t-1)		0.473***
		(0.00107)
conc	0.0179***	0.00209***
	(0.000263)	(0.000278)
gdp_cap	-7.27e-07***	-1.08e-06***
	(2.96e-08)	(5.50e-08)
gdp_growth	0.000790***	-0.000646***
	(6.31e-06)	(7.25e-06)
cost_inc	-0.0353***	-0.0138***
	(0.000154)	(0.000150)
Constant	0.0234***	0.0458***
	(0.000343)	(0.000581)
Observations	1664	1612

Notes: Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

5 Income group effects

Many empirical studies on financial crises estimate samples that include both developed and developing countries. The state of economic development, however, may affect a country's susceptibility to financial crises. Though in our

[15] See for example Athanasoglou et al. (2008), Berger et al. (2000), Eichengreen and Gibson (2001), Goddard et al. (2004).

[16] Note that, in general, a dynamic estimation model, such as GMM, would be the appropriate econometric method, see for example Athanasoglou et al. (2008).

[17] However, the sign of the effect in the net interest margin estimation contradicts with the theoretical predictions.

estimates we control for the state of development by the per capita income-variable, in this section we split the sample into two sub-samples. Countries, which belong to the World Bank's *high income* group are classified as *developed* countries. All other countries, i.e. *low income*, *lower middle income*, and *upper middle income*, are grouped as *developing* countries.

5.1 Low income countries

Table 6 displays the results for low income countries. The first two columns summarize the results of the one stage estimates. The following columns display the results of the two stage estimates with and without the lagged values of the channel variables, respectively. Consistent with our previous findings, the parameters on the channel variables have the correct sign, and most of them are significant. However, the estimates on the return on asset are much more significant than the ones of net interest margin. As for the entire sample, deposit insurance is associated with a lower likelihood of systemic crises in developing countries, and we find no evidence of a direct effect of market concentration on the probability that a financial crisis occurs. On the first stage, as before, the parameter on concentration indicates that there is a positive effect on return on asset. The effect of market concentration on net interest margin is insignificant. One reason for this result may be that the net interest margin is being driven more by other factors than market concentration. In developing countries, financial systems are usually underdeveloped, too. Due to high transaction costs and missing economies of scale, lending rates are sometimes excessively high. Therefore, high net interest margins may arise rather due to existing inefficiencies rather than due to high market concentration. As before, we also estimate the channels separately, using GMM. The results are summarized in Table 7. The results indicate a strong effect of market concentration on both channel variables. As suggested by the theory, higher market concentration is associated with higher profitability, i.e. higher return on assets. Surprisingly, contrary to theoretical predictions, we find that higher market concentration is related to *lower* net interest margins. Possibly, net interest margin is a too weak proxy for testing the concentration-fragility hypothesis. Based on the argument that banks in concentrated markets have more market power and therefore charge their borrowers higher rates, which in turn leads borrowers to take higher risks and finally enhances the likelihood of default and of a crisis, the *lending rate* may be the appropriate "measure". However, data on lending rates are quite difficult to get. Other reasons that may drive this result are discussed in the following sections.

Summing up, in developing countries there is evidence of the concentration-stability hypothesis, but no evidence of the concentration-fragility hypothesis.

5.2 High income countries

The results for developed countries are summarized in Table 8. As in the previous section, the first two columns show the results for the one stage estimates. The remaining columns represent the two stage estimates with and without

Table 6: Low income countries - one and two stage estimates

Second stage						
sys_cris	Probit	LPM	Probit	LPM	Probit	LPM
roa	-3.556**	-0.449**	-9.685***	-1.099***	-16.790*	-1.393
	(1.820)	(0.216)	(4.209)	(0.389)	(9.278)	(1.129)
nim	2.023	0.221	3.729	0.371	22.184**	1.480***
	(1.920)	(0.177)	(2.527)	(0.236)	(10.689)	(0.566)
dep_ins	-0.536***	-0.055***	-0.519***	-0.052***	-0.449*	-0.049***
	(0.186)	(0.018)	(0.217)	(0.019)	(0.262)	(0.221)
conc	-0.046	-0.005				
	(0.463)	(0.039)				
Constant	-1.469***	0.075***	-1.570***	0.064***	-2.891***	-0.008
	(0.358)	(0.033)	(0.261)	(0.023)	(0.856)	(0.455)
No. of obs.	686	686	638	638	685	685
Wald chi2(3)	11.91	13.97	10.58	14.98	17.22	15.61
Prob>chi2	0.0180	0.0074	0.0142	0.0018	0.0006	0.00014
R^2		0.0201		0.0182		0.0114
First stage						
roa						
roa(t-1)			0.476***	0.476***		
			(0.034)	(0.034)		
nim(t-1)			0.087***	0.087***		
			(0.029)	(0.029)		
conc			0.008	0.008	0.017***	0.017***
			(0.006)	(0.006)	(0.007)	(0.007)
gdp_cap			2.63e-07	2.63e-07	1.15e-06	1.15e-06
			(6.48e-07)	(6.48e-07)	(7.38e-07)	(7.38e-07)
gdp_growth			0.0006**	0.0006**	-0.0003	-0.0003
			(0.0003)	(0.0003)	(-0.0002)	(-0.0002)
cost_inc			-0.030***	-0.030***	-0.053***	-0.053***
			(0.006)	(0.006)	(0.006)	(0.006)
dep_ins			-0.0003	-0.0003	-0.004	-0.004
			(0.003)	(0.003)	(0.003)	(0.003)
Constant			0.014**	0.014**	0.039***	0.039***
			(0.007)	(0.007)	(0.007)	(0.007)
No. of obs.			638	638	685	685
$Adj.R^2$			0.3404		0.1072	
First stage						
nim						
roa(t-1)			0.067***	0.067***		
			(0.026)	(0.026)		
nim(t-1)			0.729***	0.729***		
			(0.023)	(0.023)		
conc			-0.002	-0.002	-0.002	-0.002
			(0.005)	(0.005)	(0.008)	(0.008)
gdp_cap			1.45e-07	1.45e-07	8.27e-07	8.27e-07
			(5.04e-07)	(5.04e-07)	(8.59e-07)	(8.59e-07)
gdp_growth			-0.001***	-0.001***	-0.003***	-0.003***
			(0.0002)	(0.0002)	(0.0003)	(0.0003)
cost_inc			-0.013***	-0.013***	-0.114	-0.114
			(0.005)	(0.005)	(0.007)	(0.007)
dep_ins			0.002	0.002	-0.007**	-0.007**
			(0.002)	(0.002)	(0.003)	(0.003)
Constant			0.030***	0.030***	0.089***	0.089***
			(0.005)	(0.005)	(0.008)	(0.008)
No. of obs.			638	638	685	685
$Adj.R^2$			0.7010		0.1437	

Notes: Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Channels - GMM estimates

	roa	nim
roa(t-1)	0.284***	
	(0.00129)	
nim(t-1)		0.449***
		(0.000814)
conc	0.0263***	-0.00517***
	(0.000653)	(0.000434)
gdp_cap	2.28e-07**	-7.11e-06***
	(1.05e-07)	(1.53e-07)
gdp_growth	0.000890***	-0.000655***
	(7.56e-06)	(1.16e-05)
cost_inc	-0.0373***	-0.0190***
	(0.000363)	(0.000349)
Constant	0.0136***	0.0666***
	(0.000726)	(0.00110)
Observations	1131	1082

Notes: Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

the lagged channel variables, respectively. The one stage estimates do not differ fundamentally from our precedent findings.[18] The results of the two stage model instead show some remarkable differences. First, though the channel variables still have the correct sign, they are not significant. Second, concentration has the predicted sign and is highly significant in the regression for roa. The strong explanatory power of market concentration (for the return on asset) in developed countries may reflect the fact that in developed financial systems bank profits are determined to a much larger extent by market concentration, whereas in low developed countries other factors such as transaction costs are much more decisive. The loss of significance of the channel variables is most probably due to the skewness in the data: over the considered time period, our sample contains only 17 crisis observations. Table 9 summarizes the results of the GMM estimates for developed countries. It is shown that concentration enters with the predicted sign and is highly significant in both channel regressions. The results of the one stage estimates, according to which the channel variables are significant and support the theoretical predictions, together with the findings in the GMM estimates, can be interpreted as evidence for both the concentration-stability and the concentration-fragility hypothesis.

[18] However, deposit insurance is no longer significant.

Table 8: High income countries - one and two stage estimates

Second stage *sys_cris*	Probit	LPM	Probit	LPM	Probit	LPM
roa	-28.197***	-1.624***	-26.589	-0.928	-23.250	-1.067
	(10.144)	(0.571)	(17.149)	(0.734)	(28.675)	(1.705)
nim	17.059*	1.236***	-2.914	0.198	7.923	0.794
	(8.619)	(0.482)	(11.655)	(0.449)	(38.014)	(3.099)
dep_ins	-0.313	-0.016	-0.611*	-0.012	-0.619	-0.019
	(0.446)	(0.024)	(0.349)	(0.012)	(0.837)	(0.063)
conc	-0.306	-0.008				
	(0.645)	(0.295)				
Constant	-1.987***	0.015	-1.283**	0.032*	-1.594	0.023
	(0.731)	(0.036)	(0.569)	(0.019)	(1.884)	(0.155)
No. of obs.	514	514	480	480	509	509
Wald chi2(3)	11.22	14.18	1.86	10.88	2.61	4.49
Prob>chi2	0.0242	0.0067	0.6019	0.0124	0.4555	0.2134
R^2		0.0271		0.0198		0.0261
First stage *roa*						
roa(t-1)			0.284***	0.284***		
			(0.041)	(0.041)		
nim(t-1)			0.099***	0.099***		
			(0.036)	(0.036)		
conc			0.006***	0.006***	0.007***	0.007***
			(0.002)	(0.002)	(0.002)	(0.002)
gdp_cap			4.18e-08	4.18e-08	-2.83e-08	-2.83e-08
			(4.45e-08)	(4.45e-08)	(4.44e-08)	(4.44e-08)
gdp_growth			0.0005***	0.0005***	0.0004***	0.0004***
			(0.0001)	(0.0001)	(0.0001)	(0.0001)
cost_inc			-0.026***	-0.026***	-0.029***	-0.029***
			(0.0024)	(0.0024)	(0.002)	(0.002)
dep_ins			0.0007	0.0007	-0.003***	-0.003***
			(0.0017)	(0.0017)	(0.001)	(0.001)
Constant			0.013***	0.013***	0.025***	0.025***
			(0.003)	(0.003)	(0.003)	(0.003)
No. of obs.			480	480	509	509
Adj.R^2			0.3714		0.2461	
First stage *nim*						
roa(t-1)			0.012	0.012		
			(0.028)	(0.028)		
nim(t-1)			0.789***	0.789***		
			(0.024)	(0.024)		
conc			0.0006	0.0006	0.001	0.001
			(0.0013)	(0.0013)	(0.002)	(0.002)
gdp_cap			-1.02e-07***	-1.02e-07***	-5.00e-07***	-5.00e-07***
			(3.04e-08)	(3.04e-08)	(5.51e-08)	(5.51e-08)
gdp_growth			-0.00002	-0.00002	-0.0004*	-0.0004*
			(0.0001)	(0.0001)	(0.0002)	(0.0002)
cost_inc			-0.002	-0.002	0.006**	0.006**
			(0.0016)	(0.0016)	(0.003)	(0.003)
dep_ins			0.0001	0.0001	-0.014***	-0.014***
			(0.0012)	(0.0012)	(0.002)	(0.002)
Constant			0.008***	0.008***	0.047***	0.047***
			(0.002)	(0.002)	(0.004)	(0.004)
No. of obs.			480	480	509	509
Adj.R^2			0.7951		0.2965	

Notes: Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Channels - GMM estimates

	roa	nim
roa(t-1)	0.147***	
	(0.00817)	
nim(t-1)		0.512***
		(0.0186)
conc	0.00616**	0.00519***
	(0.00255)	(0.000419)
gdp_cap	2.64e-07***	-4.69e-07***
	(6.03e-08)	(8.01e-08)
gdp_growth	0.000166***	-1.95e-05
	(5.45e-05)	(1.86e-05)
cost_inc	-0.0292***	-0.00234***
	(0.000890)	(0.000654)
Constant	0.0164***	0.0210***
	(0.00226)	(0.00195)
Observations	533	530

Notes: Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

6 Discussion

One of our main findings is the lack of a direct effect of market concentration on systemic crises, once we control for the channel variables. Higher profitability of banks enhances the stability of the financial system; on the contrary, higher net interest margins expose the system to an increased probability of a financial crisis. Our results indicate that there are different channels through which higher market concentration on the one hand enhances financial stability, but on the other hand reduces stability. The net effect of these two opposing effects is therefore ambiguous. Due to the complex system that we estimate - a two stage binary response model with a dynamic panel structure in the first stage - significance levels are volatile and vary. However, given the results, we conclude to have evidence on both the concentration-stability and the concentration-fragility hypothesis, which supports the theory.

We find significant differences between developed and developing countries. In particular, in developing countries higher market concentration is associated with lower net interest margins, while the opposite is true for developed countries. We find two possible explanations for this result. First, we measure market concentration by the ratio of the assets held by the three largest banks to total assets. Quite reasonably, in financial systems in developing countries there are fewer banks (possibly only a handful) than in developed countries. Therefore, the concentration ratio may be high not because of the high market power of the three largest firms, but rather because there are no or only a few competitors. Hence, market concentration only loosely grasps market power of firms. A second reason for this counterintuitive finding may be that it is driven by institutional factors we have not controlled for yet. Future research on financial crises should explicitly consider the differences between developed and developing countries by controlling for differences in institutional and regulatory structures. There may be significant interactions between those measures and the performance of financial systems. Finally, net interest margin may be

a weak proxy for testing the concentration-fragility hypothesis, since in developing countries high margins may particularly reflect inherent inefficiencies due to high transaction costs and missing economies of scale, respectively.

Finally, we want to point to the related, but separate literature dealing with the interaction between concentration, competition and stability.[19] Matutes and Vives (1996) suggest that concentration is not a consistent signal of competition. Beck (2008) states that the market structure measures that are used to measure competition, such as different concentration ratios, the number of banks or the Herfindahl index, describe the competitive behavior between banks inappropriately. Beck et al. (2006) investigate the effect of market concentration on financial stability, controlling for different competition measures. They show that higher concentration and higher competition at the same time have a positive effect on system stability. They conclude that market concentration may reflect something else than market power. Demirgüc-Kunt et al. (2004) stress that though many studies use concentration as a signal of competitiveness, its interpretation may be more complex. They suggest that concentration reflects other factors such as regulatory restrictions on competition, efficient-structure forces, and market power by banks. Future research should take account of these broader aspects to get a better understanding of the interaction between market concentration, competition and the channels through which they affect the stability of the system.

7 Conclusions

The theoretical literature on the relationship between market structure and financial crises claims that market concentration affects the occurrence of financial crises through specific channels, which suggest two opposing hypotheses. We test the significance of two particular channels regarding the return on assets and the net interest margins empirically. We use one- and two stage binary response models to assess the significance of the channel variables and the indirect effect of concentration (via the channel variables) on the likelihood of systemic crises. We complement the results with GMM regressions in order to take account of the time persistent character of the channel variables.

Evidence for the concentration-stability and/or concentration-fragility hypothesis requires that i) the channel variables significantly affect the crisis probability and ii) market concentration is a significant determinant of the channel variables. Our results suggest that the significance of the channel variables is given. In all our estimations, the channel variables have the correct sign, and in most cases are statistically significant. The results hold for different econometric models, and they are robust against controlling for other determinants. The results on the effect of concentration on the channel variables are weaker. Our findings show that higher concentration is associated with higher return on assets, as suggested by the theory. However, we find only weak support for a significant effect of market concentration on net interest margins.

[19] A good literature overview is given in Berger et al. (2004).

In order to take account of the differences between developed and developing countries, we split the sample and estimate the regressions separately. For developing countries, we find strong evidence for the concentration-stability hypothesis, but no evidence for the concentration-fragility hypothesis. In addition, in developing countries the results suggest that higher concentration is associated with *lower* net interest margins. It may be that net interest margin is only a weak proxy for testing the concentration-fragility hypothesis. Based on the argument that banks in concentrated markets have more market power and therefore charge their borrowers higher rates, which in turn leads borrowers to take higher risks and finally enhances the likelihood of default and of a crisis, the *lending rate* may be the appropriate "measure". However, data on lending rates are quite difficult to get. In developed countries, the evidence for the concentration-stability hypothesis is significant. Furthermore, there is also evidence for the concentration-fragility hypothesis.

In summary, our findings provide support for both the concentration-stability and the concentration-fragility hypothesis. The results for the concentration-stability hypothesis are clearly more significant than for the concentration-fragility hypothesis. The significance of our results vary among the different estimates, which is largely due to the complex structure of the underlying theory.

References

Allen, F. and D. Gale (2004), "Competition and financial stability", *Journal of Money, Credit and Banking*, 36, 453-480.

Athanasoglou, P., S. Brissimis and M. Delis (2008), "Bank-specific, industry-specific and macroeconomic determinants of bank profitability", *International Financial Markets, Institutions and Money*, 18, 121-136.

Beck, T. (2008), "Bank competition and financial stability: friends or foes?", *Policy Research Working Paper Series 4656*, The World Bank.

Beck, T., A. Demirgüc-Kunt and R. Levine (2000), "A New Database on Financial Development and Structure", *World Bank Economic Review*, 14, 597-605 (update version May 2009).

Beck, T., A. Demirgüc-Kunt and R. Levine (2005), "Bank concentration and fragility: impact and mechanics", *NBER Working Paper Series, Working Paper 11500*, National Bureau of Economic Research.

Beck, T. and L. Laeven (2006), "Resolution of Failed Banks by Deposit Insurers - Cross Country Evidence", *World Bank Policy Research Working Paper 3920*, The World Bank.

Beck, T., A. Demirgüc-Kunt and R. Levine (2006), "Bank concentration, competition, and crises: First results", *Journal of Banking & Finance*, 30, 1581-1603.

Beck, T., A. Demirgüc-Kunt and R. Levine (2009), "Financial Institutions and Markets across Countries and over Time - Data and Analysis", *World Bank Policy Research Working Paper 4943*, The World Bank.

Berger, A., S. Bonime, D. Covitz, and D. Hancock (2000), "Why are bank profits so persistent? The roles of product market competition, informational opacity, and regional/macroeconomic shocks", *Journal of Banking and Finance*, 24, 1203-1235.

Berger, A., A. Demirgüc-Kunt, R. Levine and J. Haubrich (2004), "Bank Concentration and Competition: An Evolution in the Making", *Journal of Money, Credit and Banking*, 36(3), 433-451.

Bourke, P. (1989), "Concentration and other determinants of bank profitability in Europe, North America and Australia", *Journal of Banking and Finance*, 13, 65-79.

Boyd, J.H. and G. De Nicoló (2005), "The Theory of Bank Risk taking and Competition Revisited", *The Journal of Finance*, 60(3), 1329-1343.

Cameron, A.C. and P.K. Trivedi (2009), "Microeconometrics Using Stata", A Stata Press Publication, StataCorp LP, College Station, Texas.

Chang, E., S. Guerra, E. Lima and B. Tabak (2008), "The stability-concentration relationship in the Brazilian banking system", *International Financial Markets, Institutions, and Money*, 18, 388-397.

Demirgüc-Kunt, A. and E. Detragiache (1998), "The determinants of banking crises in developing and developed countries", *IMF Staff Papers*, 45:1, 81-109.

Demirgüc-Kunt, A. and H. Huizinga (1999), "Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence", *World Bank Economic Review*, 13(2), 379-408, Oxford University Press.

Demirgüc-Kunt, A. and E. Detragiache (2002), "Does deposit insurance increase banking system stability? An empirical investigation", *Journal of Monetary Economics*, 49, 1373-1406.

Demirgüc-Kunt, A. and E.J. Kane (2002), "Deposit Insurance around the Globe: Where Does It Work?", *The Journal of Economic Perspectives*, 16(2), 175-195.

Demirgüc-Kunt, A., L. Laeven and R. Levine (2004), "Regulations, Market Structure, Institutions, and the Cost of Financial Intermediation", *Journal of Money, Credit and Banking*, 36(3), 593-622.

Demirgüc-Kunt, A., E.J. Kane and L. Laeven (2007), "Determinants of Deposit-Insurance Adoption and Design", *Journal of Financial Intermediation*, 17(3), 407-438.

Eichengreen, B. and H. Gibson (2001), "Greek banking at the dawn of the new millennium", *CEPR Discussion Paper 2791*, London.

Evrensel, A. (2008), "Banking crisis and financial structure: A survival-time analysis", *International Review of Economics and Finance*, 17, 589-602.

Gai, P., N. Jenkinson and S. Kapadia (2007), "Systemic risk in modern financial systems: analytics and policy design", *Journal of Risk Finance*, 8(2), 156-165.

Gai, P., S. Kapadia, S. Millard and A. Perez (2008), "Financial innovation, macroeconomic stability and systemic crises", *The Economic Journal*, 118, 401-426.

Goddard, J., P. Molyneux and J.O.S. Wilson (2004), "The profitability of European banks: a cross-sectional and dynamic panel analysis", *The Manchester School*, 72(3), 363-381.

Laeven, L. and F. Valencia (2008), "Systemic Banking Crises: A New Database", *IMF Working Paper No. 08/224*, 1-78.

Matutes, C. and X. Vives (1996), "Imperfect competition, risk taking and regulation in banking", *European Economic Review*, 44, 184-216.

Molyneux, P. and J. Thornton (1992), "Determinants of European bank profitability: A note", *Journal of Banking and Finance*, 16, 1173-1178.

Reinhart C.M. and K.S. Rogoff (2009), "The Aftermath of Financial Crises", *American Economic Review*, 99(2), 466-472.

Rogoff, K.S. (1999), "International Institutions for Reducing Global Financial Instability", *The Journal of Economic Perspectives*, 13(4), 21-42.

Ruiz-Porras, A. (2008), "Banking competition and financial fragility: Evidence from panel data", *Estudios Económicos*, El Colegio de México, Centro de Estudios Económicos, 23(1), 49-87.

Summers, L.H. (2000), "International Financial Crises: Causes, Prevention, and Cures, *The American Economic Review*, 90(2), 1-16.

Tavares, J. and R. Wacziarg (2001), "How democracy affects growth", *European Economic Review*, 45, 1341-1378.

Appendix

Table A.1: Variable description and sources

Variable	Description	Sources
sys_cris	Systemic financial crisis (dummy (0,1) variable)	Laeven and Valencia (2008)
roa	Average return on assets (net income/total assets)	Beck et al. (2000)
nim	Net interest margin	Beck et al. (2000)
conc	Market concentration (assets of 3 largest banks to total assets)	Beck et al. (2000)
gdp_cap	GDP per capita	World Development Indicators
gdp_growth	GDP per capita growth	World Development Indicators
infl	Inflation	World Development Indicators
acc_gdp	Current account balance to GDP	World Development Indicators
dep_ins	Deposit insurance (dummy (0,1) variable)	Laeven and Valencia (2008), Demirgüc-Kunt et al. (2007)
overhead	Overhead costs (to total assets)	Beck et al. (2000)
cost_inc	Cost income ratio	Beck et al. (2000)
market_cap	stock market capitalization to GDP	Beck et al. (2000)
turnover	stock market turnover ratio	Beck et al. (2000)
val_traded	stock market value traded to GDP	Beck et al. (2000)

Table A.2: Full descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
sys_cris	6080	0.0203947	0.141358	0	1
roa	1999	0.0125097	0.0.258641	-0.4331444	0.1618286
nim	1938	0.0540555	0.0385981	0.0066786	0.4204413
conc	1999	0.7064695	0.2054826	0.1483518	1
gdp_cap	5180	5389.492	8291.519	-30.73989	56189.01
gdp_growth	5157	1.955738	6.640281	-50.48989	90.06702
infl	4572	45.91569	578.5301	-21.67503	24411.03
acc_gdp	4090	-3.176644	10.2795	-240.4958	86.2235
dep_ins	2920	0.4660959	0.4989346	0	1
overhead	1964	0.0458568	0.0293596	0.0017692	0.2697982
cost_inc	1984	0.6723418	0.2096135	0.1828	1.91685
market_cap	1799	0.4154728	0.5417437	0.0001253	5.005284
turnover	1866	0.402254	0.7091961	0	16.7806
val_traded	1889	0.2277678	0.4758368	0	4.435691

Table A.3: *Marginal effects*

	Logit dy/dx	Probit dy/dx	Cloglog dy/dx
roa	-0.2036	-2.623	-0.184
	(0.082)	(0.107)	(0.067)
nim	0.157	0.189	0.149
	(0.085)	(0.101)	(0.081)

Standard errors in parentheses.

Working Papers of the Center of Economic Research at ETH Zurich

(PDF-files of the Working Papers can be downloaded at www.cer.ethz.ch/research).

10/137 M. T. Schneider and R. Winkler
Growth and Welfare under Endogenous Lifetime

10/136 V. Hahn
Sequential Aggregation of Verifiable Information

10/135 A. Bommier, M.-L. Leroux and J.-M. Lozachmeur
On the Public Economics of Annuities with Differential Mortality

10/134 A. Bommier, A. Chassagnon and F. Le Grand
Comparative Risk Aversion: A Formal Approach with Applications to Saving Behaviors

10/133 A. Bommier and B. Villeneuve
Risk Aversion and the Value of Risk to Life

10/132 L. Bretschger and S. Valente
Endogenous Growth, Asymmetric Trade and Resource Taxation

10/131 H. Gersbach and N. Surulescu
Default Risk in Stochastic Volatility Models

10/130 F. Schwark
Economics of Endogenous Technical Change in CGE Models - The Role of Gains from Specialization

10/129 L. Bretschger, R. Ramer and F. Schwark
Long-Run Effects of Post-Kyoto Policies: Applying a Fully Dynamic CGE model with Heterogeneous Capital

10/128 M. T. Schneider, C. Traeger and R. Winkler
Trading Off Generations: Infinitely-Lived Agent Versus OLG

10/127 V. Kappel
The Effects of Financial Development on Income Inequality and Poverty

10/126 M. T. Schneider
The Larger the Better? The Role of Interest-Group Size in Legislative Lobbying

10/125 A. Ziegler
Individual Characteristics and Stated Preferences for Alternative Energy Sources and Propulsion Technologies in Vehicles: A Discrete Choice Analysis

10/124 P. F. Peretto and S. Valente
Resource Wealth, Innovation and Growth in the Global Economy

09/123 H. Gersbach and M. T. Schneider
Tax Contracts and Elections

09/122 V. Hahn
Why the Publication of Socially Harmful Information May Be Socially Desirable

09/121 A. Ziegler
Is it Beneficial to be Included in a Sustainability Stock Index? A Panel Data Study for European Firms

09/120 K. Pittel and L. Bretschger
The Implications of Heterogeneous Resource Intensities on Technical Change and Growth

09/119 E. J. Balistreri, R. H. Hillberry and T. F. Rutherford
Trade and Welfare: Does Industrial Organization Matter?

09/118 H. Gersbach, G. Sorger and C. Amon
Hierarchical Growth: Basic and Applied Research

09/117 C. N. Brunnschweiler
Finance for Renewable Energy: An Empirical Analysis of Developing and Transition Economies

09/116 S. Valente
Optimal Policy and Non-Scale Growth with R&D Externalities

09/115 T. Fahrenberger
Short-term Deviations from Simple Majority Voting

09/114 M. Müller
Vote-Share Contracts and Learning-by-Doing

09/113 C. Palmer, M. Ohndorf and I. A. MacKenzie
Life's a Breach! Ensuring 'Permanence' in Forest Carbon Sinks under Incomplete Contract Enforcement

09/112 N. Hanley and I. A. MacKenzie
The Effects of Rent Seeking over Tradable Pollution Permits

09/111 I. A. MacKenzie
Controlling Externalities in the Presence of Rent Seeking

09/110 H. Gersbach and H. Haller
Club Theory and Household Formation

09/109 H. Gersbach, V. Hahn and S. Imhof
Constitutional Design: Separation of Financing and Project Decision

09/108 C. N. Brunnschweiler
Oil and Growth in Transition Countries

09/107 H. Gersbach and V. Hahn
Banking-on-the-Average Rules

09/106 K. Pittel and D.T.G. Rübbelke
Decision Processes of a Suicide Bomber – Integrating Economics and Psychology

08/105 A. Ziegler, T. Busch and V.H. Hoffmann
Corporate Responses to Climate Change and Financial Performance: The Impact of Climate Policy

09/104 S. Valente
Endogenous Growth, Backstop Technology Adoption and Optimal Jumps

09/103 K. Pittel and D. Rübbelke
Characteristics of Terrorism

09/102 J. Daubanes
Taxation of Oil Products and GDP Dynamics of Oil-rich Countries

09/101 S. Valente
Accumulation Regimes in Dynastic Economies with Resource Dependence and Habit Formation

08/100 A. Ziegler
Disentangling Specific Subsets of Innovations: A Micro-Econometric Analysis of their Determinants

08/99 M. Bambi and A. Saïdi
Increasing Returns to Scale and Welfare: Ranking the Multiple Deterministic Equilibria

08/98 M. Bambi
Unifying time-to-build theory

08/97 H. Gersbach and R. Winkler
International Emission Permit Markets with Refunding

08/96 K. Pittel and L. Bretschger
Sectoral Heterogeneity, Resource Depletion, and Directed Technical Change: Theory and Policy