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Taming Financial Development to Reduce Crises

by Sami Ben Naceur, Bertrand Candelon and Quentin Lajaunie

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Abstract

This paper assesses whether and how financial development triggers the occurrence of banking crises. It builds on a database that includes financial development as well as financial access, depth and efficiency for almost 100 countries. Through estimation of a dynamic logit panel model, it appears that financial development, from an institutional dimension and to a lesser extent from a market dimension, triggers financial instability within a one- to two-year horizon. Additionally, whereas financial access is destabilizing for advanced countries, it is stabilizing for emerging and low income ones. Both results have important implications for macroprudential policies and financial regulations.

Keywords: Financial Development, Banking crises, Regulation

JEL Classification Numbers: C33, G01, G18

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I. INTRODUCTION

Early writers have found that financial development has been associated with higher growth, lower inequality/poverty and reduced economic volatility (Levine, 2005). More recent literature has highlighted the vanishing effect of financial development on growth (Cecchetti and Kharoubi, 2012) and the existence of nonlinearities in the financial growth-nexus, showing that financial development starts lowering growth when a threshold of credit-to-private/GDP is crossed (Arcand et al., 2015).

This vanishing effect stems from financial deepening, rather than from better inclusion or higher efficiency (Sahay et al., 2015). Similarly, a large number of empirical studies have examined how financial development may generate future banking crises (cf. Demirguc-Kunt and Detragiache, 2005 or Cihak, 2007). The researchers all find that credit growth is the most important factor at the origin of banking crises. Still, these works are incomplete in two dimensions. First, contrary to the literature focusing on growth, these works include financial development through different aggregates or proxies, but they do not consider its different dimensions (depth, access and efficiency). Regulators are thus left with the option to limit or to facilitate financial development, enabling the precise targeting of which dimension (access, depth or efficiency) should be favored or limited. The practical implementation of optimal rules on financial development is thus impossible. Second, all these studies consider static binary models (probit/logit), whereas Kauppi and Saikkonen (2008) and more recently Candelon et al. (2014) have shown that this specification can be misleading if the banking crisis or the dependent variables exhibit persistence.

This paper aims to fill these two gaps. It considers a panel of 98 countries, for which the systemic banking crisis database of Leaven and Valencia (2013) has been extended to 2016. Following Svirydzenka (2016), the financial development variable is decomposed into 6 sub-indices, which measure depth, access and efficiency for both institutions and the market sector. Finally, the relationship between banking crises and the financial development indicators is analyzed using a dynamic panel logit model. It turns out that for the whole panel, financial development indeed increases the probability of the occurrence of a crisis. It can be via either financial institution development or to a lesser extent financial market development. Considering now three groups of countries clustered according to their degree of development, we observe that in advanced economies, depth (FID) and access (FIA) cause banking crises, whereas for least income developed countries (LIDC) and emerging markets (EM), only the financial institution's depth constitutes a leading indicator for future crises. In the latter case, access to financial services enhances financial stability, whereas it should be limited in developed countries.

These findings convey important messages to regulators. The results first confirm the potential destabilizing effect of financial development leading to systemic banking crises. The findings hence support the implementation of regulatory measures, such as capital requirements and access control to loans and deposits for financial institutions, in order to stabilize the system. Second, the results show that regulation should not be unique but that it should take into account the degree of development of the country. Whereas access to financial institutions is destabilizing for advanced countries (increasing, for example, the amount of nonperforming loans), it is stabilizing for other countries (of middle and low income) via the promotion of financial inclusion and the reduction of inequalities. Regulators should thus impose strict access control for financial intermediaries in advanced countries. In contrast, regulators should enhance its access, supporting for example, fintech industry and its financial innovations (mobile application payments, etc.) in low-income countries. The

paper is composed as follows. In Section II, a literature review is presented. Section III deals with the methodology. Section IV describes the database. Section V exhibits the empirical results for the whole sample of countries as well as for 3 clusters of countries. Section VI provides several robustness checks, and Section VII exposes the consequences for regulators and concludes.

II. LITERATURE REVIEW

The literature on financial development started with consideration of the relationship between financial deepening and economic growth. Three theoretical views dominated the debate: Schumpeter (1934), Goldsmith (1969), McKinnon (1973) and Shaw (1973) viewed finance as an engine of growth through the encouragement of innovation (the "supply-leading view"). Robinson (1952) argued that growth drives financial development by increasing demand for financial services (the "demand-following view"). Lucas (1988) described the contribution of financial development to growth as overstated. The endogenous growth theory has also attracted interest in the finance and growth nexus (see Greenwood and Jovanovic, 1990 and Bencivenga,1991 for the role of the financial system in fostering efficient allocation of resources; Saint-Paul, 1992 for the role of the financial sector in reducing risk; and Rousseau and Wachtel, 2000 for the exit mechanisms provided by stock markets).

The contribution of finance to growth has also received considerable attention empirically. Goldsmith (1969) was the first to document a positive correlation between financial intermediaries, development, and growth. A large number of empirical studies have followed, using a wide array of econometric techniques such as cross-sectional, time-series, panel, industry-level, and firm-level data and controlling for biases arising from omitted variables and endogeneity. The authors find that financial development (banks and stock markets) generates larger economic growth, consistent with the proposition of "more finance, more growth."[1]

Some recent studies, however, emphasize the nonlinearity of the relationship between finance and growth *demonstrating* that this relationship varies with the levels of income, financial development and inflation. Rioja and Valev (2004a) show that finance impacts growth positively and significantly in middle-income countries but weakly in high-income countries. Rioja and Valev (2004b) find that the effect of financial development on growth is positive only in the intermediate and very high financial development groups. Rousseau and Wachtel (2000) find that growth is not affected by financial development when inflation exceeds 13 percent.

The Global Financial Crisis of 2007–2008 has led both researchers and policymakers to question the prior conclusion of "more finance is better." Cecchetti and Kharoubbi (2012), Law and Singh (2014), and Arcand et al. (2015) uncover an inverted U-shaped relationship between financial development and growth, which shows a turning point (around 90 − 110% of GDP) where the effect of finance on growth stops being positive. These findings reveal that sizeable and fast-growing financial sectors may not necessarily be good for economic growth because they compete with the real sector for the same resources. Beck (2012) proposes several explanations for the nonlinearities and the vanishing effect of financial development on growth (Wachtel, 2011). First, the measures of financial development used in the literature might not capture the quality of the financial system and the non-

[1] see Levine (2005) for a review

intermediation activities of the financial sector. Second, when an economy catches up and comes close to the productivity frontier, the financial sector stops contributing positively to growth (Aghion et al., 2005). Third, Beck et al. (2012) find that only enterprise credit contributes to growth and that most financial development in high-income countries comes from household credit, which might explain the absence of a positive impact of finance on growth in advanced economies. Fourth, fast-growing and oversized financial sectors attract the brightest young talent to the detriment of the real sector (Philippon, 2010). Finally, an overly large and risky financial system resulting from an overgenerous financial safety net is prone to more frequent financial crises.

The previous literature on the finance-growth nexus overlooked the issue of whether a larger financial system is associated with a higher occurrence of economic crises. In the 1980s and 1990s, many developed economies and developing countries witnessed a wave of costly systemic banking crises. Since the mid-1990s, the prediction of financial crises has become the subject of a large number of studies. The literature has also offered a number of theories explaining why finance can lead to financial crises. Bernanke and Blinder (1988) and Kiyotaki and Moore (1997) argue that the quantity of credit in the economy is positively associated with the probability of a banking crisis. Minsky (1986) explains that an extended period of financial stability encourages excess borrowing which may lead to a banking crisis. Keeley (1990) and Dell'Ariccia and Marquez (2004) argue that financial liberalization comes with more competition and a lower standard of lending, which can lead to an increase in lending to lower quality borrowers and a higher probability of banking crises.

The empirical literature on early warning systems (EWS) for systemic banking crisis has come up with two main approaches: the signal approach and the binary regression approach. The signal approach identifies individual variables that best signal a threat to financial stability (Kaminski and Reinhart, 1999; Borio and Drehmann, 2009; Drehmann and Juselius, 2014). The second approach, the binomial or multinomial logit or probit, relates a binary banking crisis dummy to multiple explanatory variables to predict banking crises (Demirguc-Kunt and Detragiache, 1998, 2000, 2002; Davis et al., 2011; Schularick and Taylor, 2012; and Duca and Peltonen, 2013). Davis and Karim (2008a, 2008b) suggest that the logit approach outperforms the signaling approach because the former exhibits lower Type I (missed crises) and Type II (false alarms) errors compared to the latter. The literature has proposed various early warning indicators such as a high inflation rate, a large current account deficit, house price inflation, an increase in the real interest rate, and excessive domestic credit (see Kauko (2014) for a review). We will focus on the credit variables (measures of financial deepening) as banking crisis determinants, since our interest is to examine the impact of financial development on banking crises.

Two kinds of credit variables have often been considered as banking crisis early warning indicators, namely, the credit-to-GDP ratio and the credit growth rate. Demirguc-Kunt and Detragiache (1998, 2005) find that the level of the credit-to-GDP ratio and the growth rate of credit have a robust positive effect on bank crisis occurrences. Sahay et al. (2015) find that a faster pace of financial deepening increases financial instability when the financial system is weakly regulated and supervised. In contrast, Davis and Karim (2008), in replicating the Demirguc-Kunt and Detragiache (2005) analysis on a larger sample and a longer period, find that the credit-to-GDP ratio is not a good predictor of banking crises. This result was confirmed by Hahm et al.(2013) and von Hagen and Ho (2007). Rose and Spiegel (2011) also concluded that the ratio of credit relative to GDP was of no use as a predictor of the Global Financial Crisis of 2007–2008. In a recent paper, Mathonnat and Minea (2018) revisited these conflicting findings using a large sample of banking crises and five

financial development variables, finding that the level of the credit-to-GDP ratio jointly introduced with its growth and volatility does not affect significantly the occurrence of banking crises. The lagged value of the other credit variable, the growth rate of credit, has been tested as a bank crisis predictor. Jorda et al. (2011), Schularick and Taylor (2012), Demerguc-Kunt and Detrigriache (2005), Kaminski et al. (1998, 1999) and Bordo and Meissner (2012), among others, show that credit growth lagged two years and up is a good predictor of crises. Bunda and Ca'Zorzi (2010) and Barrell et al. (2011) conclude that credit growth lagged one year is of no use as a crisis predictor. Buyukkarabacak and Valev (2010) decompose private credit into household credit and enterprise credit. They find that a rapid expansion of household credit is a significant predictor of banking crises. Mathonnat and Minea (2018) used instead monetary aggregate growth and found that the growth of M3/GDP impacts positively and significantly the probability of a banking crisis. Drehmann et al. (2011) substituted the growth rate of credit by the trend deviation of the credit-to-GDP ratio and found evidence that this variable is the best of ten different potential variables to predict banking crises, confirming Borio and Lowe's (2002) initial conclusion suggesting that a credit-to-GDP trend deviation reaches its peak three years before the occurrence of a banking crisis.

III. METHODOLOGY: THE DYNAMIC PANEL LOGIT MODEL

The methodology employed in this paper builds on the dynamic panel logit version proposed by Kauppi and Saikkonen (2008) and Candelon et al. (2014).

Let us denote by $\{y_{i,t}\}_{t=1}^{T}$ the banking crisis binary variable for country i, $i \in \{1,2,...N\}$[2], which takes the value 1 during crisis periods and 0 otherwise. Similarly, $\{x_{i,t}\}_{t=1}^{T}$ represents the matrix composed of the k explanatory variables, which are the indicators of financial development and the macroeconomic control variables in our case.

The dynamic panel logit model has the following form:

$$\Pr(y_{it}=1) = F(\pi_{i,t}) = F(\alpha y_{i,t-1} + x_{i,t-1}\beta + \delta\pi_{i,t-1} + \eta_i), \text{ for } t = 1,2,...T, \text{ and } i = 1,2,..N, \quad (1)$$

where N is the number of countries; $\Pr_{t-1}(y_t = 1)$ is the conditional probability of observing a banking crisis given the information set we have at our disposal at time $t-1$; and π_t is the index at time t. F is the logistic c.d.f., which is preferred to the Gaussian one, as it is more appropriate for the study of extreme events such as crises. η_i is a country fixed effect for the control of unobserved heterogeneity and potential bias. The coefficient β informs us about the one-step-ahead causal relationship between the explanatory variables (financial development proxies and/or the macroeconomic variables) and the banking crises. If the sign is positive (resp. negative) it indicates that the probability of occurrence of a crisis in a horizon of one year will increase (resp. decrease). The dynamic of the crisis is captured by the coefficients α and π. α is associated with the lagged binary banking crisis variable, whereas π is linked to the lagged index. Both terms capture the persistence of the crisis and constitute the innovation proposed by Kauppi and Saikkonen (2008).

[2] For ease of notation, the country index i is omitted hereafter.

If one of them is significantly different from 0, then it implies that the traditional static logit models are biased and that their interpretations may be misleading. Candelon et al. (2014) show that the different alternatives of this general model can be estimated under the same exact maximum likelihood (EML) framework.

To be more precise, the log-likelihood function has the following general form:

$$\mathrm{LogL}(\theta, \eta_i) = \sum_{i=1}^{N} \mathrm{LogL}_i(\theta, \eta_i) = \sum_{i=1}^{N} \sum_{t=1}^{T} [y_{it} \log(F_{it}) + (1 - y_{it}) \log(1 - F_{it})], \qquad (2)$$

where θ represents the vector of parameters.

The EML estimators have the desired large-sample properties. As shown in Candelon et al. (2014), 4 different models can be considered, each of which correspond to particular restrictions of the general log-likelihood function.

The first model is the static logit model. In such a case $\alpha = \pi = 0$. Only the exogenous macroeconomic variables affect the future occurrence of a banking crisis. The second and third models are dynamic and include either the lagged value of the binary dependent variable y_{t-1} or the lagged index π_{t-1}. Finally, the most complex dynamic model combines the two previous cases and includes both the lagged dependent variable y_{t-1} and the lagged index π_{t-1}. The best model is chosen as the one minimizing the Bayesian information criterion (BIC).

Finally, since we do not make any assumptions about the distribution of $\{\eta_i\}_{i=1}^{N}$, they are treated as parameters to be estimated, and our approach is a fixed effects one. In addition, we assume no cross-sectional dependence. In such a case, we follow Candelon et al. (2014) and implement a correction à la Carro (2007).

IV. DATA

For a long time, financial development has been measured by proxies such as the credit- to-GDP ratio or stock market capitalization (see Rajan and Zingales, 1998 or more recently Arcand et al., 2015). Still, financial development (FD) has evolved and is now multidimensional. In many countries, financial institutions (FI) have grown. Traditional players such as investment banks, insurance companies, mutual funds, pension funds, and venture capital firms are now in competition with many other types of nonbank financial institutions, which are now playing substantive roles. Additionally, it is possible to enter the markets bypassing these traditional institutions. Internet trading platforms allow you to directly invest your savings. This finance market (FM) is relatively important in the U.S. and developed countries, whereas so far it remains limited in low- and middle-income countries. An adequate index of financial development should encompass both of these dimensions. Recent studies (Cihak et al., 2012, Sahay et al., 2015) propose to disaggregate Financial development into different dimensions: depth (D), corresponding to the size and liquidity of the markets; access (A), measuring the ability of individuals and companies to access financial services; and efficiency (E), indicating the level of activity in capital markets and the ability of institutions to provide financial services at low cost and with sustainable revenues. We are thus left with 9 measures for financial development: the global one FD, composed of two sub- indices FI and FM,

which are each finally decomposed into 6 individual indicators FID, FIA, FIE, FMD, FMA, and FME. Cihak et al, (2012) explain in detail how indices are built. The first step consists in building the 6 sub-indices FID, FIA, FIE, FMD, FMA, and FME. Each sub-index depends on a set of specific variables. For example, Financial Institutions Depth (FID) is a composite indicator including Private-sector credit, Pension fund assets, Mutual fund assets, and Insurance premiums, life and non-life. Appendix 1 provides a list of the variables considered for each sub-indices. The weights of each variable in the composite index is obtained via a principal component analysis (PCA). In a second step, once the sub-indices are built, indices FI and FM are also constructed via a PCA approach based on the sub-indices. In a final step the FD index is built from FI and FM. Svirydzenka (2016) followed this methodology to set up a global database for 183 countries covering the period 1980−2015 at an annual frequency.

For the banking crisis dummy, we use the Leaven and Valencia (2013) database, which encounters systemic financial market failures. As the sample size only covers the period until 2011, we complete it for the period 2012−2016 with the database of Candelon et al. (2018).[3] The banking crisis database thus contains 100 countries from 1980 to 2016 on a yearly basis[4]

The macroeconomic control variables retained are the output growth rate and the interest rate spread built as the difference between the $10-year$ treasury rate and a $3-month$ monetary rate.[5] Both are yearly and extracted from the International Financial Statistics (*IFS*) database of the International Monetary Fund. In summary, our sample comprises 98 countries for the period 1980 – 2016.

V. RESULTS

Table (1) reports the estimates of model (3), where the dependent variable is the systemic banking crisis index explained by different indicators of financial development and macrovariables. In this first exercise, all the countries are considered for the period 1980–2016.

We first notice that model (2) i.e., the one with a lag binary variable, presents in each case the lowest BIC and thus is always selected.[6] This observation then confirms that considering a static logit model is not adequate and that the persistence should be introduced by the lagged binary variable, indicating that causality is nonlinear in essence.[7] Macroeconomic control variables are always significant and exhibit the expected signs. Indeed, an increase in the output growth rate reduces significantly the probability of occurrence of a banking crisis at a horizon of one year. Similarly, an inversion of the yield curve, i.e., the negative interest rate spread (built as the difference between the long and short interest rates), signals a higher risk of a banking crisis. When estimating

[3] They expand the sample to more countries and more years, up to 2016, using data from Harvard Business School (HBS) *http://www.hbs.edu/faculty/initiatives/behavioral−finance−and−financial− stability/Pages/global.aspx.*

[4] Appendix 2 provides a list of the countries as well as the date of banking crises. It also reports the country group they belong to.

[5] Several other control variables have been tested, as the concentration index in the financial sector (Lerner index). Besides being available only for a very restrictive number of countries, they turn out to be non-significant. For sake of space, they are not reported, but available from authors upon request.

[6] Results for models (1), (3) and (4) are not reported to save space but are available upon request from the authors.

[7] See Candelon and others (2013) for a discussion on causality in binary dynamic models. Even if it is proposed in the case of multivariate model it can be easily translated to univariate ones.

the panel for the 98 countries over the period 1980–2016, financial development appears to increase financial instability, increasing the probability of occurrence of a crisis in a one-year period (see model (1)). It can be via either the financial institution (model (2)) or the financial market development (model (3)). Concerning financial market development (models (4) and (6)), we observe an opposite effect between the depth and the access dimension. Whereas the financial institution's depth is destabilizing, the access dimension actually reduces the future occurrence of a crisis. When a financial institution's efficiency has a negative sign, a banking crisis is not significantly affected. Similar results are observed for the indicators of financial market development: a positive sign for the depth and a negative sign for the access dimension. Nevertheless, almost all coefficients are not statistically different from 0, and thus, the impact of an improvement in financial institution or market efficiency is quite small.

Tables (2)–(4) report the estimates of model (3), where the dependent variable is the systemic banking crisis index explained by indicators of financial development and macrovariables, considering clusters of countries according to their financial market development.[8] Following Svirydzenka (2016), three clusters have thus been created: one for the least income developed countries (LIDC), one for the emerging markets (EM), and the last one for the advanced markets (AM). We observe that for all of them, financial institution development has a destabilizing impact. Even if the aggregate variables FD, FI and FM are only significant in the case of the advanced countries' cluster, sub-indices are significant for the three clusters. From the analysis of models (4) to (6), it appears that financial institution development is more important for predicting banking crises than financial markets are. This fact highlights the key role played by financial intermediates in the occurrence of banking turmoil. Still, the analysis of Tables (3) to (5) reveal important differences between the three groups of countries. In advanced economies, depth (FID) and access (FIA) are actually destabilizing and increase the probability of a future occurrence of a crisis. This result suggests that regulators in these countries should not only control the amount invested/borrowed or the efficiency of financial institutions, but also have a particular monitoring of the access to financial institutions. In contrast, for LIDC and EM, only the financial institution depth constitutes a leading indicator for future crises. The access to financial institutions increases financial stability and reduces the probability of financial crises a year ahead. Such a result is clearly linked to the problem of financial inclusion. In LIDC/EM countries, inequality in the access to indirect finance constitutes a constraint for the real economy and thus, increases the probability of occurrence of a banking crisis. A difference between the groups appears also with respect to the macro-fundamental variables. We observe that while term spread and output growth are important for the occurrence of future banking crises in advanced economies, only the last term matters in EM. Such a finding could be due to the low level of maturity in the least advanced countries. For LIDC, we do not include the spread term because of data availability, which is not very important as most of these countries are small open economies that are thus interest rate takers with unmature financial capital markets.

[8] See Svirydzenka (2016)

Table 1: Estimation Results

Model	(1)	(2)	(3)	(4)	(5)	(6)
constant	-3.122***	-3.166***	-2.927***	-3.235***	-2.970***	-3.197***
	(0.686)	(0.703)	(0.682)	(0.735)	(0.681)	(0.740)
lag binary	3.880***	3.904***	3.856***	3.840***	3.843***	3.815***
	(0.170)	(0.170)	(0.170)	(0.171)	(0.170)	(0.172)
			Financial development variables			
FD_{-1}	2.722***					
	(0.900)					
FI_{-1}		1.755*				
		(1.065)				
FM_{-1}			2.236***			
			(0.662)			
FID_{-1}				5.690***		5.144***
				(1.470)		(1.861)
FIA_{-1}				-2.700***		-2.784***
				(1.309)		(1.366)
FIE_{-1}				-1.370		-0.239
				(0.889)		(0.884)
FMD_{-1}					2.260***	1.482
					(0.954)	(1.045)
FMA_{-1}					-1.450	-1.911*
					(1.010)	(1.106)
FME_{-1}					0.704	0.836
					(0.557)	(0.565)
			Macro-control variables			
Spread	-0.062*	-0.0501	-0.066**	-0.069**	-0.069**	-0.075***
	(0.025)	(0.034)	(0.035)	(0.037)	(0.036)	(0.038)
Output growth	-0.101***	-0.099***	-0.123***	-0.100***	-0.106***	-0.105***
	(0.019)	(0.184)	(0.018)	(0.018)	(0.019)	(0.019)

Notes: This table reports the estimates obtained from the dynamic logit models (1) to (6) for the panel of 98 countries from 1980 – 2016. Standard errors are reported within brackets below the estimates. ***, ** and * report significance at 99%, 95% and 90%.

Table 2: Estimation Results - Advanced Economies

Model	(1)	(2)	(3)	(4)	(5)	(6)
constant	-7.471***	-10.408***	-5.533***	-8.381***	-5.358***	-6.222**
	(1.399)	(2.173)	(1.062)	(2.217)	(1.061)	(2.471)
lag binary	4.315***	4.428***	4.290***	4.257***	4.268***	4.156***
	(0.364)	(0.368)	(0.360)	(0.374)	(0.360)	(0.377)
			Financial development variables			
FD_{-1}	6.279***					
	(1.444)					
FI_{-1}		9.849***				
		(2.503)				
FM_{-1}			3.952***			
			(0.941)			
FID_{-1}				6.660***		2.363
				(2.146)		(3.127)
FIA_{-1}				5.892***		6.226**
				(2.286)		(2.586)
FIE_{-1}				-9.114**		-11.972***
				(3.710)		(4.065)
FMD_{-1}					2.958**	3.063*
					(1.473)	(1.717)
FMA_{-1}					-0.437	-1.162
					(1.527)	(1.752)
FME_{-1}					0.790	0.545
					(0.987)	(1.051)
			Macro-control variables			
Spread	-0.109	-0.099	-0.101	-0.148*	-0.118*	-0.184**
	(0.068)	(0.069)	(0.066)	(0.082)	(0.070)	(0.082)
Output growth	-0.149**	-0.131*	-0.156**	-0.109	-0.173**	-0.149**
	(0.070)	(0.070)	(0.070)	(0.073)	(0.072)	(0.075)

Notes: This table reports the estimates obtained from the dynamic logit models (1) to (6) for the panel of 23 countries from 1980 – 2016. Standard errors are reported within brackets below the estimates. ***, ** and * report significance at 99%, 95% and 90%.

Table 3: Estimation Results - Emerging Markets

Model	(1)	(2)	(3)	(4)	(5)	(6)
constant	-2.386***	-2.256***	-2.696***	-2.367***	-2.763***	-2.791***
	(0.690)	(0.764)	(0.622)	(0.884)	(0.653)	(0.923)
lag binary	3.597***	3.590***	3.621***	3.579***	3.548***	3.527***
	(0.257)	(0.258)	(0.257)	(0.265)	(0.260)	(0.268)
			Financial development variables			
FD_{-1}	-2.223					
	(1.454)					
FI_{-1}		-1.861				
		(1.369)				
FM_{-1}			-1.693			
			(1.261)			
FID_{-1}				8.422***		11.339***
				(2.969)		(3.302)
FIA_{-1}				-10.139***		-9.247***
				(2.621)		(2.666)
FIE_{-1}				2.334*		2.338*
				(1.239)		(1.229)
FMD_{-1}					-1.020	-1.549
					(1.925)	(2.109)
FMA_{-1}					-2.818	-3.402*
					(1.727)	(1.964)
FME_{-1}					0.866	0.899
					(0.755)	(0.784)
			Macro-control variables			
Spread	-0.027	-0.036	-0.023	-0.048	-0.023	-0.030
	(0.050)	(0.049)	(0.050)	(0.053)	(0.053)	(0.056)
Output growth	-0.077***	-0.079***	-0.076***	-0.082***	-0.079***	-0.081***
	(0.023)	(0.023)	(0.023)	(0.024)	(0.023)	(0.024)

Notes: This table reports the estimates obtained from the dynamic logit models (1) to (6) for the panel of 46 countries from 1980 – 2016. Standard errors are reported within brackets below the estimates. $***$, $**$ and $*$ report significance at 99%, 95% and 90%.

Table 4: Estimation Results - Low-Income Countries

Model	(1)	(2)	(3)	(4)	(5)	(6)
constant	-2.349***	-2.443***	-2.644***	-1.479	-2.613***	-1.439
	(0.905)	(0.903)	(0.698)	(1.035)	(0.700)	(1.064)
lag binary	3.581***	3.583***	3.606***	3.347***	3.578***	3.331***
	(0.314)	(0.315)	(0.314)	(0.319)	(0.315)	(0.322)
			Financial development variables			
FD_{-1}	-5.216					
	(7.581)					
FI_{-1}		-2.292				
		(4.232)				
FM_{-1}			-7.839			
			(12.625)			
FID_{-1}				7.953		8.289
				(6.545)		(7.112)
FIA_{-1}				-66.472**		-64.489**
				(26.328)		(26.065)
FIE_{-1}				2.008		1.873*
				(1.625)		(1.641)
FMD_{-1}					-0.804	0.047
					(5.377)	(6.762)
FMA_{-1}					-42.402	-24.078
					(123.610)	(147.837)
FME_{-1}					-19.683	-19.087
					(19.790)	(22.410)
			Macro-control variables			
Model	(1)	(2)	(3)	(4)	(5)	(6)
Output growth	-0.112***	-0.112***	-0.111***	-0.101***	-0.107***	-0.099***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)

Notes: This table reports the estimates obtained from the dynamic logit models (1) to (6) for the panel of 29 countries from 1980 – 2016. Because of data availability, the term spread is not included for this group of countries. Standard errors are reported within brackets below the estimates. ∗ ∗ ∗, ∗∗ and ∗ report significance at 99%, 95% and 90%.

VI. ROBUSTNESS CHECKS

To assess our results, several robustness checks are proposed:

In the first three robustness checks, we consider a nonlinear model for which financial development interacts with the regimes of the nonperforming loans (*NPL*) and the capital account openness (*KAO*, measured here by the method of Chinn and Ito, 2006). These variables z_j , with j = 1, ..., 3, are included in the model via an index $\mathbb{1}_Z$, which takes the value of 1 for a particular year t and a particular country i if $z_{i,t} > median(z_i)$ and 0 otherwise. Model (1) takes the following form:

$$\Pr(y_{it} = 1) = F(\alpha.y_{i,t-1} + x_{i,t-1}\beta + \delta\pi_{i,t-1} + \gamma.x_{i,t-1}.\mathbb{1}(z_{j,i,t-1}) + \eta_i). \qquad (3)$$

A γ associated with z_{NPL} that is positive and significantly different from 0 indicates that a high amount of net performing loans would amplify banking instability brought by financial development. Similarly, a positive coefficient for the interactive term z_{KAO} suggests that the more open the capital account of a country is, the more destabilizing financial development is. We also consider the exchange rate regime (*Err*) measured via the method of Levy-Yeyati and Sturzenegger (2005), (2016). A dummy is then simultaneously introduced for fixed and flexible exchange rate regimes.[9]

Table (5) reports the results obtained for the previous robustness checks. It turns out that the introduction of interactive terms (*KAO* and *NPL*) does not affect the relationship between financial development and the banking crisis, as none of the coefficients associated with the interaction term are significantly different from zero at 99%. This result thus signifies that our previous findings hold whatever the degree of capital openness or the amount of nonperforming loans. Similar results are obtained for fixed exchange rates (third panel of Table 5). In contrast, it appears that the flexible exchange rate regime affects the previous results. Indeed, in this exchange rate regime, access to financial institutions becomes destabilizing, whereas financial deepening is stabilizing. This finding can be explained by capital movement on the foreign exchange markets. In this case, only the efficiency of financial institutions appears to decrease the occurrence of a banking crisis.

The model is re-estimated for the period before 2008 in order to check if the great crisis has structurally modified the relationship between finance and the crises. The results of the estimations are reported in Table (6) and do not show a major quantitative difference from those reported in Table (1). This observation thus signifies that the impact of financial development on future banking crises is not driven by the great crisis and is quite stable over time.

So far, models have been estimated for a one-lag horizon. In other words, the previous results show how financial development is improving or deteriorating the probability of occurrence of a banking crisis in the coming year. This last robustness check explores this relationship for a horizon of two years and considers hence the following model:
$Pr(y_{it} = 1) = F(\eta_i + \alpha y_{i,t-2} + x_{i,t-2}\beta + \delta\pi_{i,t-2})$. The results of the estimations are reported in Table

[9] The sum of the dummy variables for fixed and flexible exchange rates does not amount to one as it exists in some cases of undefined or intermediate exchange rate regimes.

(7). Again, the results obtained are similar to those reported in Table (1). These findings, as well as the previous one (for the pre-crisis period), support the idea that the link obtained between financial development and the probability of a banking crisis is structural: this holds whatever the sample and the horizon considered. This outcome clearly calls for structural regulation policies, which should be independent of the business cycle or a specific temporary event.

Table 5: Estimation Results - Kaopen - NPL - Exchange Rate

	Kaopen				NPL				Exchange Rate							
Model	(1)	(2)	(3)	(6)	(1)	(2)	(3)	(6)	(1)	(2)	(3)	(6)				
constant	-3.137***	-3.188***	-2.933***	-3.235***	-27.041	-25.981	-23.552	-26.870	-3.176***	-3.303***	-2.899***	-3.699***				
	(0.687)	(0.706)	(0.681)	(0.756)	(6487.027)	(6655.876)	(6498.003)	(6433.435)	(0.696)	(0.712)	(0.693)	(0.759)				
lag binary	3.859***	3.896***	3.832***	3.783***	3.99***	3.645***	3.990***	3.980***	3.898***	3.925***	3.876***	3.843***				
	(0.179)	(0.179)	(0.179)	(0.184)	(0.486)	0.438	(0.481)	(0.530)	(0.180)	(0.179)	(0.179)	(0.187)				
	Financial development variables															
FD_{-1}	3.040***				21.155***				4.399***							
	(1.063)				(4.469)				(1.124)							
FI_{-1}		1.849				10.690**				3.369***						
		(1.213)				(4.375)				(1.240)						
FM_{-1}			2.517***				14.436***				3.472***					
			(0.792)				(3.060)				(0.919)					
FID_{-1}				4.305**				-1.630				8.852***				
				(2.002)				(6.079)				(2.355)				
FIA_{-1}				-1.331				1.408				-7.423***				
				(1.537)				(4.468)				(2.021)				
FIE_{-1}				-0.329				1.999				0.944				
				(0.978)				(4.590)				(1.008)				
FMD_{-1}				0.931				12.491***				3.333**				
				(1.145)				(4.293)				(1.684)				
FMA_{-1}				-1.147				-1.863				-1.507				
				(1.227)				(3.918)				(1.468)				
FME_{-1}				0.947				4.717**				0.531				
				(0.686)				(1.934)				(0.774)				
	Macro-control variables															
Spread	-0.059*	-0.049	-0.065*	-0.061	-0.114	-0.144	-0.113	-0.161	-0.070*	-0.059*	-0.073**	-0.088**				
	(0.035)	(0.034)	(0.035)	(0.037)	(0.097)	(0.092)	(0.102)	(0.107)	(0.037)	(0.035)	(0.037)	(0.044)				
Output growth	-0.092***	-0.091***	-0.094***	-0.098***	-0.323***	-0.259***	-0.329***	-0.355***	-0.099***	-0.096***	-0.102***	-0.102***				
	(0.019)	(0.019)	(0.019)	(0.019)	(0.094)	(0.088)	(0.095)	(0.107)	(0.019)	(0.019)	(0.019)	(0.020)				
	Dummy-control variables															
TypeofRate									Fix	Float	Fix	Float	Fix	Float	Fix	Float
$FD_1.z_{-1}$	-0.617				-0.376				-0.115	-1.018						
	(0.750)				(0.627)				(0.557)	(0.751)						
$FI_1.z_{-1}$		-0.077				-0.184					0.230	-0.837				
		(0.623)				(0.559)					(0.450)	(0.605)				
$FM_1.z_{-1}$			-0.803				-0.948						-0.214	-1.083		
			(0.829)				(0.675)						(0.648)	(0.888)		
$FID_1.z_{-1}$				-1.456				6.591*							-1.064	-3.842*
				(2.501)				(3.504)							(2.389)	(2.032)
$FIA_1.z_{-1}$				-3.049*				2.542							-1.437	6.235***
				(1.736)				(2.560)							(2.275)	(1.610)
$FIE_1.z_{-1}$				1.163				1.687							0.106	-2.211***
				(0.731)				(2.857)							(0.784)	(0.839)
$FMD_1.z_{-1}$				4.246**				-6.346*							-0.405	-0.796
				(2.153)				(3.656)							(2.303)	(1.812)
$FMA_1.z_{-1}$				-2.544				-3.403*							1.342	0.170
				(1.870)				(1.975)							(2.233)	(1.356)
$FME_1.z_{-1}$				0.306				-1.794							-0.109	-0.091
				(1.166)				(1.619)							(1.342)	(0.911)

Notes: This table reports the estimates obtained from the dynamic logit models (1), (2), (3), and (6) for the panel of: 88 countries from 1980 – 2016 - Kaopen, 61 countries from 2001 – 2016 - NPL, 93 countries from 1980 – 2013 - Exchange Rate. Standard errors are reported within brackets below the estimates. ***, ** and * report significance at 99%, 95% and 90%.

Table 6: Estimation Results 1980 – 2008

Model	(1)	(2)	(3)	(4)	(5)	(6)
constant	-2.938***	-3.186***	-2.652***	-3.433***	-2.747***	-3.471***
	(0.674)	(0.695)	(0.667)	(0.726)	(0.669)	(0.733)
lag binary	3.437***	3.415***	3.420***	3.408***	3.437***	3.416***
	(0.195)	(0.195)	(0.194)	(0.197)	(0.195)	(0.198)
			Financial development variables			
FD_{-1}	4.131***					
	(1.086)					
FI_{-1}		4.132***				
		(1.341)				
FM_{-1}			2.730***			
			(0.761)			
FID_{-1}				9.694***		9.234***
				(2.077)		(2.342)
FIA_{-1}				-4.337**		-3.652
				(2.209)		(2.248)
FIE_{-1}				0.348		0.244
				(0.929)		(0.924)
FMD_{-1}					3.423***	2.217*
					(1.142)	(1.250)
FMA_{-1}					-1.274	-2.538*
					(1.122)	(1.304)
FME_{-1}					0.047	-0.063
					(0.643)	(0.666)
			Macro-control variables			
Spread	-0.100**	-0.085**	-0.102**	-0.110**	-0.107**	-0.112**
	(0.044)	(0.043)	(0.044)	(0.053)	(0.046)	(0.054)
Output growth	-0.090***	-0.084***	-0.092***	-0.089***	-0.095***	-0.093***
	(0.019)	(0.018)	(0.019)	(0.019)	(0.019)	(0.019)

Notes: This table reports the estimates obtained from the dynamic logit models (1) to (6) for the panel of 98 countries from 1980 – 2008. Standard errors are reported within brackets below the estimates. $***$, $**$ and $*$ report significance at 99%, 95% and 90%.

Table 7: Estimation Results with two lags 1980 - 2016

Model	(1)	(2)	(3)	(4)	(5)	(6)
constant	-2.517***	-2.608***	-2.293***	-2.741***	-2.352***	-2.683***
	(0.573)	(0.585)	(0.571)	(0.613)	(0.571)	(0.618)
lag binary	2.165***	2.214***	2.134***	2.107***	2.113***	2.069***
	(0.146)	(0.145)	(0.147)	(0.171)	(0.147)	(0.149)
			Financial development variables			
FD_{-2}	3.137***					
	(0.719)					
FI_{-2}		2.261***				
		(0.855)				
FM_{-2}			2.502***			
			(0.531)			
FID_{-2}				6.903***		5.953***
				(2.128)		(1.524)
FIA_{-2}				-3.184***		-3.254***
				(1.079)		(1.122)
FIE_{-2}				-0.053		-0.132
				(0.713)		(0.708)
FMD_{-2}					2.708***	1.849**
					(0.763)	(0.834)
FMA_{-2}					-1.285	-1.771**
					(0.801)	(0.890)
FME_{-2}					0.403	0.484
					(0.450)	(0.456)
			Macro-control variables			
Spread	-0.068**	-0.055*	-0.072**	-0.080**	-0.078**	-0.088**
	(0.030)	(0.029)	(0.031)	(0.037)	(0.032)	(0.036)
Output growth	-0.096***	-0.093***	-0.099***	-0.093***	-0.101***	-0.098***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)

Notes: This table reports the estimates obtained from the dynamic logit models (1) to (6) for the panel of 98 countries from 1980 – 2016. Standard errors are reported within brackets below the estimates. ∗ ∗ ∗, ∗∗ and ∗ report significance at 99%, 95% and 90%.

VII. Conclusion and Policy Implications

This paper assesses whether and how financial development triggers the occurrence of banking crises. This question clearly fits the literature evaluating whether more finance is always good for growth and financial stability. The innovation of the paper is twofold: First, it considers a database, decomposing financial development into its main components, i.e., access, depth and efficiency, and covering most of the world's economies (98 countries). Second, this study relies on a dynamic logit panel model, which includes past crisis observations in order to obtain unbiased estimators as well as a fixed effect to address unobserved heterogeneity. It appears that financial development, from an institutional dimension and to a lesser extent a market dimension, increases the probability of occurrence of a crisis within a one- to two-year horizon. The explosion of the fintech industry (mobile payment, cryptocurrency, and offshore banking, to quote a few) is a matter of concern for regulators and supervisors, who should adjust their macroprudential rules accordingly. Going deeper, the paper indicates that the destabilizing dimension of financial development is different in advanced and emerging/low income countries. For advanced countries, we observe that financial access and depth are destabilizing, whereas efficiency reduced the future occurrence of a banking crisis. In contrast, for emerging countries, financial access is stabilizing, and depth/efficiency is not. We thus observe that the impact of financial development on stability is not homogeneous; rather, it varies with its component and the country under consideration. These findings have important consequences for macroprudential policies. First, financial stability assessments (such as the Financial Sector Assessment Program, FSAP, jointly conducted by the IMF and the World Bank) should include a shock associated with financial development (as well as with each of these components: access, depth and efficiency). By doing so, the financial sector's vulnerabilities would be better assessed, particularly in front of the surge of financial innovations. Second, financial regulation (in particular, the Basel agreements for the banking sector) should take into account the specificities of emerging markets compared to advanced countries. For example, higher capital requirements should be imposed on banks in advanced economies to smooth the increase in financial access and depth, whereas this should not be the case for emerging markets' financial institutions. Similarly, regulators should encourage higher efficiencies in the financial institutions.

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APPENDIX I – FINANCIAL DEVELOPMENT INDICATOR CONSTRUCTION

Table 8: Variable use for building the Financial Development Index

Category	Indicator	Index
Financial Institutions		FI
Depth	- Private-sector credit to GDP - Pension fund assets to GDP - Mutual fund assets to GDP - Insurance premiums, life and non-life to GDP	FID
Access	- Bank branches per 100,000 adults - ATMs per 100,000 adults	FIA
Efficiency	- Net interest margin - Lending-deposits spread - Non-interest income to total income - Overhead costs to total assets - Return on assets - Return on equity	FIE
Financial Markets		FM
Depth	- Stock market capitalization to GDP - Stocks traded to GDP - International debt securities of government to GDP - Total debt securities of financial corporations to GDP - Total debt securities of nonfinancial corporations to GDP	FMD
Access	- Percent of market capitalization outside of top 10 largest companies - Total number of issuers of debt (domestic and external, nonfinancial and financial corporations)	FMA
Efficiency	- Stock market turnover ratio (stocks traded to capitalization)	FMD

Sources: Sahay et. al (2015) and Svirydzenka (2016)

APPENDIX II – DATA DESCRIPTION

Table 9: Country Data

Country	IMF Region	Country Group	Banking Crisis
Algeria	Middle East and Central Asia	EM	1990, 1991, 1992, 1993, 1994
Angola	Africa	EM	
Argentina	Western Hemisphere	EM	1980, 1981, 1982, 1989, 1990, 1991, 1995, 2001, 2002, 2003
Australia	Asia and Pacific	AM	
Austria	Europe	AM	2008, 2009, 2010, 2011
Bahamas, The	Western Hemisphere	EM	
Bangladesh	Asia and Pacific	LIDC	1987
Barbados	Western Hemisphere	EM	
Belgium	Europe	AM	2008, 2009, 2010, 2011, 2012, 2013, 2014
Belize	Western Hemisphere	EM	
Benin	Africa	LIDC	1988, 1989, 1990, 1991, 1992
Bolivia	Western Hemisphere	LIDC	1986, 1994
Botswana	Africa	EM	
Brazil	Western Hemisphere	EM	1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998
Burkina Faso	Africa	LIDC	1990, 1991, 1992, 1993, 1994
Burundi	Africa	LIDC	1994, 1995, 1996, 1997, 1998
Cameroon	Africa	LIDC	1987, 1988, 1989, 1990, 1991, 1995, 1996, 1997
Canada	Western Hemisphere	AM	
Chad	Africa	LIDC	1983, 1992, 1993, 1994, 1995, 1996
Chile	Western Hemisphere	EM	1981, 1982, 1983, 1984, 1985
Colombia	Western Hemisphere	EM	1982, 1998, 1999, 2000
Congo, Dem. Rep.	Africa	LIDC	1983, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998
Congo, Rep.	Africa	LIDC	1992, 1993, 1994
Costa Rica	Western Hemisphere	EM	1987, 1988, 1989, 1990, 1991, 1994, 1995
Cote d'Ivoire	Africa	LIDC	1988, 1989, 1990, 1991, 1992
Denmark	Europe	AM	2008, 2009, 2010, 2011, 2012, 2013, 2014
Dominican Republic	Western Hemisphere	EM	2003, 2004
Ecuador	Western Hemisphere	EM	1982, 1983, 1984, 1985, 1986, 1998, 1999, 2000, 2001, 2002
Egypt, Arab Rep.	Middle East and Central Asia	EM	1980
El Salvador	Western Hemisphere	EM	1989, 1990
Fiji	Asia and Pacific	EM	
Finland	Europe	AM	1991, 1992, 1993, 1994, 1995
France	Europe	AM	2008, 2009, 2010, 2011, 2012, 2013, 2014
Gabon	Africa	EM	
Germany	Europe	AM	2008, 2009, 2010, 2011
Ghana	Africa	LIDC	1982, 1983
Greece	Europe	AM	2008, 2009, 2010, 2011, 2012, 2013, 2014
Guatemala	Western Hemisphere	EM	
Guyana	Western Hemisphere	LIDC	1993
Honduras	Western Hemisphere	LIDC	
Hungary	Europe	EM	1991, 1992, 1993, 1994, 1995, 2008, 2009, 2010, 2011, 2012, 2013, 2014
Iceland	Europe	AM	2008, 2009, 2010, 2011, 2012, 2013, 2014
India	Asia and Pacific	EM	1993
Indonesia	Asia and Pacific	EM	1997, 1998, 1999, 2000, 2001
Ireland	Europe	AM	2008, 2009, 2010, 2011
Israel	Europe	EM	
Italy	Europe	AM	2008, 2009, 2010, 2011, 2012, 2013, 2014
Japan	Asia and Pacific	AM	1997, 1998, 1999, 2000, 2001
Kenya	Africa	LIDC	1985, 1992, 1993, 1994

APPENDIX II – DATA DESCRIPTION (CONTINUED)

Country	IMF Region	Country Group	Banking Crisis
Korea, Rep.	Asia and Pacific	EM	1997, 1998
Kuwait	Middle East and Central Asia	EM	1982, 1983, 1984, 1985
Lesotho	Africa	LIDC	
Luxembourg	Europe	AM	2008, 2009, 2010, 2011
Madagascar	Africa	LIDC	1988
Malawi	Africa	LIDC	
Malaysia	Asia and Pacific	EM	1997, 1998, 1999
Mali	Africa	LIDC	1987, 1988, 1989, 1990, 1991
Mauritius	Africa	EM	
Mexico	Western Hemisphere	EM	1981, 1982, 1983, 1984, 1985, 1994, 1995, 1996
Morocco	Middle East and Central Asia	EM	1980, 1981, 1982, 1983, 1984
Nepal	Asia and Pacific	LIDC	1988
Netherlands	Europe	AM	2008, 2009, 2010, 2011, 2012, 2013, 2014
New Zealand	Asia and Pacific	AM	
Nicaragua	Western Hemisphere	LIDC	1990, 1991, 1992, 1993, 2000, 2001
Niger	Africa	LIDC	1983, 1984, 1985
Norway	Europe	AM	1991, 1992, 1993
Oman	Middle East and Central Asia	EM	
Pakistan	Asia and Pacific	EM	
Panama	Western Hemisphere	EM	1988, 1989
Papua New Guinea	Asia and Pacific	LIDC	
Paraguay	Western Hemisphere	EM	1995
Peru	Western Hemisphere	EM	1983
Philippines	Asia and Pacific	EM	1983, 1984, 1985, 1986, 1997, 1998, 1999, 2000, 2001
Poland	Europe	EM	1992, 1993, 1994
Portugal	Europe	AM	2008, 2009, 2010, 2011, 2012, 2013, 2014
Romania	Europe	EM	1990, 1991, 1992
Rwanda	Africa	LIDC	
Senegal	Africa	LIDC	1988, 1989, 1990, 1991
Seychelles	Africa	EM	
Sierra Leone	Africa	LIDC	1990, 1991, 1992, 1993, 1994
Singapore	Asia and Pacific	EM	
South Africa	Africa	EM	
Spain	Europe	AM	1980, 1981, 2008, 2009, 2010, 2011, 2012, 2013, 2014
Sri Lanka	Asia and Pacific	EM	1989, 1990, 1991
St. Vincent and the Grenadines	Western Hemisphere	LIDC	
Sudan	Africa	LIDC	
Sweden	Europe	AM	1991, 1992, 1993, 1994, 1995, 2008, 2009, 2010, 2011
Switzerland	Europe	AM	2008, 2009, 2010, 2011
Thailand	Asia and Pacific	EM	1983, 1997, 1998, 1999, 2000
Togo	Africa	LIDC	1993, 1994
Trinidad and Tobago	Western Hemisphere	EM	
Tunisia	Middle East and Central Asia	EM	1991
Turkey	Europe	EM	1982, 1983, 1984, 2000, 2001
United Kingdom	Europe	AM	2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014
United States	Western Hemisphere	AM	1988, 2007, 2008, 2009, 2010, 2011
Uruguay	Western Hemisphere	EM	1981, 1982, 1983, 1984, 1985, 2002, 2003, 2004, 2005
Venezuela, RB	Western Hemisphere	EM	1994, 1995, 1996, 1997, 1998
Zambia	Africa	LIDC	1995, 1996, 1997, 1998