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Inequality Indebtedness and Financial Crises

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Abstract

This work is an empirical contribution that investigates the presence of a relationship among income inequality, household indebtedness and the eruption of systemic banking crises (namely the I-I-C nexus). We test this hypothesis on a panel of 31 countries over the period 1980-2012 within four different scenarios. We find strong evidence of a statistically significant association between income inequality and systemic banking crises via household indebtedness (the I-I-C nexus) regardless of the specification and the estimation technique chosen. However, we find no evidence of a feedback effect of a systemic banking crisis on income inequality, at least in the short run. We also find that economies characterized by highly liberalized financial markets are more prone to experience such a nexus. These results suggest that reforming the architecture of financial regulation and supervision is still an important issues. However, it is a necessary but not sufficient condition in order to ensure financial stability.

JEL codes: F38, F62, D30
Keywords: Inequality Indebtedness Financial crisis Financial Regulation

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Introduction

At the end of 2007, the U.S. economy was severely hit by a financial crisis. Since the crisis originated in the heart of the capitalist system, it rapidly spread to other economies around the world. Yet the 2007 turmoil was only the last of several episodes that affected both developed and developing countries during the last 30 years. These crises almost always came as a surprise to institutions, economic agents and economists because of erroneous expectations during the period of economic boom. These beliefs were influenced by the widespread perceptions that contractual innovations and the new risk management strategies had significantly increased resilience to the shocks. Yet these innovations turned out to be a catalyst for crisis, increasing financial instability in respect of systemic risks through the expansion of credit and financial leverage (Krugman, 2012, Masciandaro and Quintyn, 2009). As a consequence, the global downturn renewed the debate on the fragility of highly liberalized and integrated economic and financial systems. Several issues, which seemed to have disappeared from the political agenda and the scientific debate during the "Great Moderation" period, have come back into fashion. The outbreak of the crisis stimulated the formulation of "new" hypotheses on the origin of the financial instability. Among these contributions, some authors have theorized the existence of a causal relationship between income inequality and crisis through the credit market (as an example Ranciere and Kumhof, 2011).

This work is an empirical contribution investigating this hypothesis. In particular, the aim of this study is to investigate the presence of an empirical association among income inequality, household indebtedness and the eruption of systemic banking crises (namely the I-I-C nexus). The study assesses this hypothesis for 31 countries over the period 1980-2012.

We find an indirect empirical association between inequality and systemic banking crisis via household indebtedness. In particular, estimating a recursive model, we find that the parameter associated with the Gini index when it is included as independent variable in the household indebtedness equation is always positive and statistically significant. Furthermore, we find that the household debt is likewise always positive and statistically significant when included as a covariate in the systemic banking crisis equation.These results are generally confirmed, considering a non-recursive model that "endogenized" the variables of interest when they are included as independent in another equation of the system. In this framework, we also test the presence of a feedback effect through the parameter associated with the banking crisis when the variable is included as an explanatory variable in the Gini equation. However, we find no evidence supporting the existence of this feedback effect, at least in the short run.

We think these conclusions are of interest for both economists and policy makers. In fact, according to our results, implementing policies oriented to pursue a

less unequal distribution of income within countries should be taken into account within the strategies adopted by national governments and international organizations to ensure financial and macroeconomic stability. On the other hand, the results show that highly financial liberalized economies are more prone to experience the I-I-C nexus. These findings fit within the strand of the literature that has renewed the debate about reform of the financial markets in the aftermath of the 2007 crisis (a few examples are Claessens et al. 2010, Griffith-Jones and Ocampo 2009, Porzecanski 2009). However, to the extent that financial instability also depends on income inequality, tighter regulation and stricter supervision of the financial markets is a necessary but not sufficient condition to prevent financial turmoil.

The rest of the paper is structured as follows: Section 1 presents the theoretical and empirical background from which this study starts. Section 2introduces our empirical approach. Section 3 describes the sources and strategy used to collect data. Section 4 shows the results of the estimation of the models. Section 5 is devoted to the discussion of the policy implications arising from these results. Section 6 concludes.

1. Theoretical background and empirical literature

The eruption of the 2007 crisis in the heart of the capitalist system probably represented a turning point in the scientific debate about the links among inequality, household indebtedness and the financial crisis. Most of the literature produced in the aftermath of the crisis refers specifically to the U.S. and includes contributions from several Nobel laureautes and gurus of economics, such as Fitoussi and Saraceno (2010), Fitoussi and Stiglitz (2009), Rajan (2011), Acemoglu (2011), Krugman (2012) and Stiglitz (2012). The main tenet of all these studies, although from different perspectives, is the increased concentration of income as a crucial determinant of financial instability. However, in what follows we have omitted the country-specific literature and instead focused the review on more general contributions, according to the purpose of this study.

The theoretical framework on which this study is based is proposed by Ranciere and Kumhof (2011) who has developed a Dynamic Stochastic General Equilibrium model (DGSE) with heterogeneous agents that formalizes the links among rising inequality, household indebtedness and crisis episodes (hereafter the I-I-C nexus). the classes that have experienced a reduction of income share have increased their indebtedness in a bid to maintain the previous level of real consumption.[1] At the

[1]The authors have based this assumption on the relative income hypothesis first proposed by Duesenberry (1949).

same time, the richest households have accumulated claims on these low-income households. The growth of credit endogenously encourages higher leverage in financial and household sectors, heightening the possibility of a systemic financial crisis. In particular, the simulation of a baseline model indicated that an increase in inequality in favor of the people at the top tail of income distribution is sustainable (does not increase the probability of a crisis) only when it is invested productively in the real economy. This is because the higher debt of the workers is supported by a higher income that keeps the leverage constant. Yet when investors do not invest in the real economy, the economic system will be permanently characterized by a high risk of crisis.

As for the empirical literature, the number of studies on the I-I-C nexus on a panel of countries is still very small. To the best of our knowledge, there are only two contributions on this topic.

Atkinson and Morelli (2011) has analyzed the I-I-C nexus hypothesis through a descriptive analysis of a panel of 25 countries over more than 100 years (from 1911-2010). Paraphrasing the authors' words, even though almost all banking crises occurred before 1945 or after 1980 in correspondence with periods of high inequality, this does not appear to be the "smoking gun" allowing a firm conclusion about the causal relationship between these two phenomena. Conversely, the authors warn about the possibility that crisis and rises in inequality are co-incident that is, they may have other common causes

Bordo and Meissner (2012) has econometrically tested the I-I-C hypothesis on a panel of 14 developed countries from 1920 to 2000. The authors highlight that while inequality often ticks upwards in the expansionary phase of the business cycle, it does not appear to be a significant determinant of credit growth once conditioned on other macroeconomic aggregates. In particular, the results confirm that a credit boom increases the probability of a banking crisis episode, but the authors find no evidence that a rise in top income shares leads to credit booms. Instead, the the only two robust determinants of credit booms are low interest rates and economic expansions according to a traditional boom-bust pattern.

Therefore, Atkinson and Morelli (2011) and Bordo and Meissner (2012) find little support for the I-I-C nexus. Yet, it is worth noting that both authors based their analysis on a long panel starting before the 1930s, even though almost all the considered countries reformed their financial system from the 1980s. To the extent that the previous literature generally emphasizes that this relationship takes place within liberalized and globally integrated financial markets, testing this relationship outside of this context could lead to misleading conclusions.

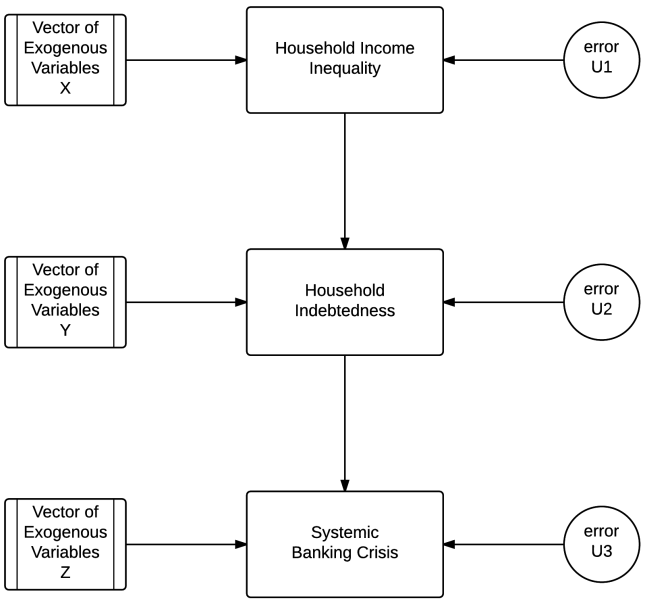
2. Methodology

In this paper we propose a new empirical approach to test the I-I-C nexus. Within this framework, we have hypothesized different scenarios for our baseline model, allowing or not allowing for the reciprocal causation and cross-equation residual correlation.

According to Studenmund (2011), specifying an econometric equation consists of three parts: the correct independent variables, the correct functional form, and the correct form of the stochastic error term. As for the first issue, the choice of the independent variables included in the model has been made on the basis of an extensive review of the literature concerning each dependent variables. This means that our identification strategy relies as much as possible on theory rather than on the use of statistical techniques. As for the other two issues, in this paper we have tested different scenarios in order to determine the robustness of the results to different specifications and their sensitiveness to different estimation techniques.

The baseline specification assumes a recursive model. In this framework, models are "hierarchical" that is, all the effects are unidirectional because the dependent variables are not reciprocally related, either directly or indirectly (figure 1).

Figure 1: The recursive model



Author's elaboration

These assumptions in our framework result in a system of three equations. The three dependent variables are the inequality index of households disposable income, household indebtedness, and a dummy variable identifying systemic banking crisis episodes. $X_{i,t-k}$, $Y_{i,t-k}$ and $Z_{i,t-k}$ are three distinct vectors of independent variables (in some case lagged). And $u_{1i,t}$, $u_{2i,t}$ and $u_{3i,t}$ are the error terms of each specific equation as in the equation (1) below.

$$\begin{cases} Inequality_{i,t} = \beta_0 + \beta_1 X_{i,t-k} + a_i + u_{1i,t} \\ Indebtedness_{i,t} = \beta_2 + \beta_3 Inequality_{i,t} + \beta_4 Y_{i,t-k} + a_i + u_{2i,t} \\ Crisis_{i,t} = \beta_5 + \beta_6 Indebtedness_{i,t} + \beta_7 Z_{i,t-k} + a_i + u_{3i,t} \end{cases} \tag{1}$$

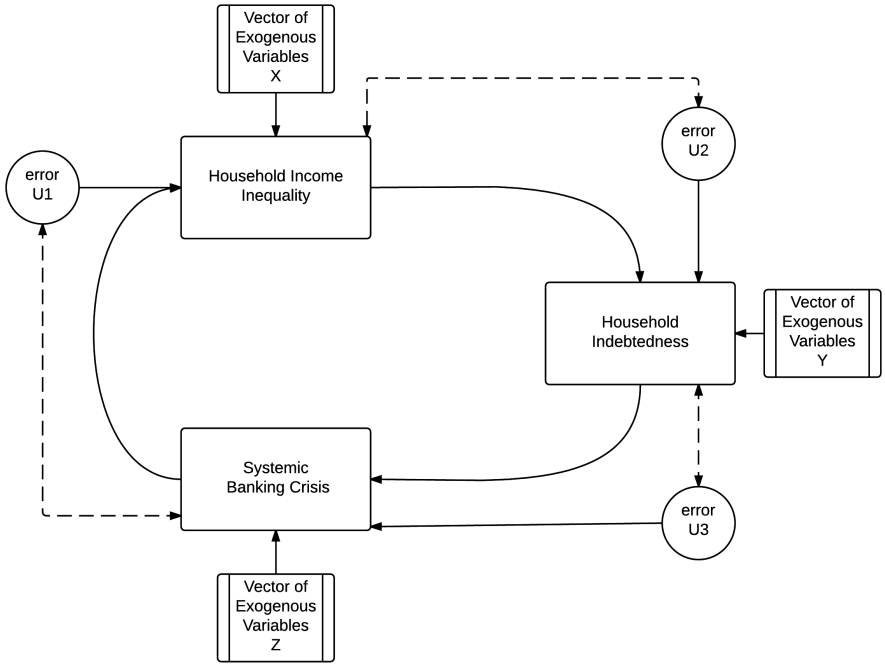
Given this specification, it is possible to assume either that all pairs of error terms in the model are uncorrelated or correlated. In the former case,we have consistently estimated each equation of the system fitting three different "*Fixed Effect Models*"[2] (1^{st} scenario). In the latter case, instead, we could improve the efficiency of our results by estimating the model simultaneously using a "*Seemingly Unrelated Regression Estimator*"(Zellner, 1962)and taking into account the country-specific time-invariant characteristics by means of country dummies (2^{nd} scenario)[3].

Thus, in a second specification we have relaxed the "hierarchical assumptions" in order to test the presence of a "feedback effect" in the I-I-C nexus. This means that we have abandoned the recursive hypothesis and we have included our model in a non-recursive framework, as in figure 2.

[2]Hereafter FE models.

[3]The Seemingly Unrelated Regression Estimator, hereafter SURE, assumes that the disturbance terms within each equation are independent and identically distributed (*i.i.d*). Therefore, it could be less efficient than a single equation estimation when the error term follows an heteroskedastic pattern.

Figure 2: The non-recursive model



Author's elaboration

From an econometric point of view, the "non-recursive" specification implies the inclusion of a dummy variable for the banking crisis episodes amongst the explanatory variables of the inequality equation, as in equation (2). Under this configuration, the inequality, indebtedness and systemic banking crisis variables became endogenous when they are included as right-side variables.

$$\begin{cases} Inequality_{i,t} = \beta_0 + \beta_1 Crisis_{i,t} + \beta_2 X_{i,t-k} + a_i + u_{1i,t} \\ Indebtedness_{i,t} = \beta_3 + \beta_4 Inequality_{i,t} + \beta_5 Y_{i,t-k} + a_i + u_{2i,t} \\ Crisis_{i,t} = \beta_6 + \beta_7 Indebtedness_{i,t} + \beta_8 Z_{i,t-k} + a_i + u_{3i,t} \end{cases} \tag{2}$$

Given the presence of such endogenous variables, the literature suggests dealing with them by finding at least as many exogenous instrumental variables in order to identify the model and obtain unbiased estimates. Many studies have explored the issues related to the choice of the proper set of instruments. According to Murray (2006), Staiger and Stock (1997), Stock et al. (2002), the choice of the

proper set of instruments raises several methodological issues. However, in this case the instrument identification strategy is inherent in the model. In fact, the best candidates for an instrumental variable for an endogenous right-hand side variable in the equation to be estimated are exogenous variables that appear in other equations in the model. This is because they are correlated with the endogenous variables in the model via the reduced-form equations, but they are not correlated with the error term in any equation. The proper set of instruments has been chosen in order to exclude the variables that could be suspected to be correlated with the disturbance term in the equation of interest. The joint validity of the instruments chosen has been tested using the robust version of the traditional Sargan test namely the Hansen J test. Also in this case the choice of the proper estimator depends on the assumption on the disturbance terms.

Firstly, when we assume that all the pairs of error terms in the model are uncorrelated (3^{rd} scenario), we have estimated each equation separately. To the extent that "*all instruments arrive on the scene with a dark cloud of invalidity hanging overhead*" (Murray, 2006), we have estimated the model either with "*Two-Stage Least Squares*" generalizations of simple panel data estimators for exogenous variables that rely on our identification strategy[4], or with a "*GMM system estimator*" that allows for including internal instruments along with the instrumental variables. In particular, we have used the GMM in a static panel model instrumenting the endogenous variable with its own lag [5].

Finally, we have taken into account the disturbance terms in each equation of the system that could be correlated. In this case (4^{th} scenario),), the efficiency of the results could be improved by estimating the equations simultaneously with a "*Three Stage Least Squares Estimator*" (Zellner and Theil, 1962) and including a set of country dummy variables in order to take into account the country-specific time-invariant effect[6].

3. Data

According to Atkinson and Morelli (2011), "the study of crises poses a major challenge with regard to distributional data". In fact, building a dataset containing the macro variables required to test the I-I-C nexus for a large panel of countries

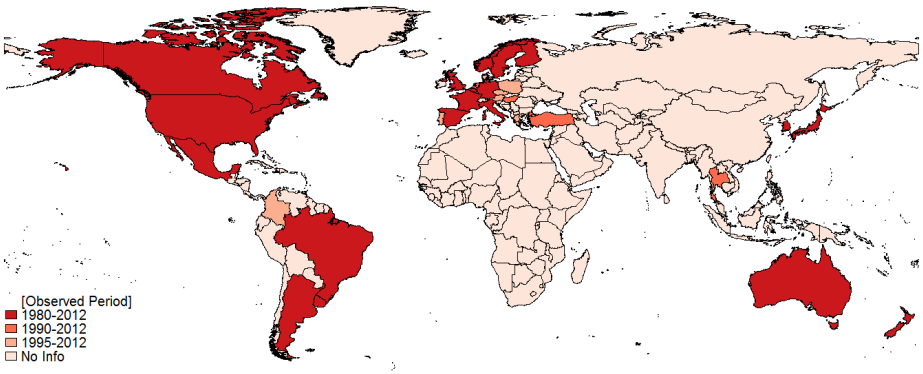
[4]Hereafter IV-FE.

[5]Hereafter IV-GMM.

[6]The Three-Stage Least Squares estimator, hereafter 3SLS, assumes that the disturbance terms within each equation are independent and identically distributed (*i.i.d*). Therefore, when this assumption does not hold, the results could be less efficient than a single equation estimation.

is a highly challenging and time-consuming task. For this study, we have drawn up a new dataset collecting information on several economies at different stages of development. All the details about the variables included in this dataset and their respective sources are summarized in Appendix A. It was intended for the dataset to include information for all the countries with a sufficiently developed financial system from 1980 up to the most recent available data. However, due to the partial or complete lack of reliable data on several countries, it has not been possible to completely fulfill this original purpose. The data shortage problem has forced us to deal with the discontinuities present in each specific time series, merging the information from different sources and correcting it when it is not homogeneous. Furthermore, we have used the linear interpolation technique when possible. During this process, the main concern has been ensuring consistency over time and between different statistical sources. In the end, we have been able to collect data on 31 countries covering, often only partially, the period 1980-2012 (see figure 3).[7] This dataset contains a maximum set of 1,309 observations and includes 24 variables, either macroeconomic and financial. The descriptive statistics of all the variables included in our model are summarized in Appendix B.

Figure 3: Dataset Geographical Coverage



Author's elaboration

[7]The countries included in our dataset are: Argentina, Australia, Austria, Belgium, Brazil, Canada, Colombia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Republic of Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Singapore, Spain, Sweden, Thailand, Turkey, United Kingdom, United States and Uruguay. Data concerning Hungary, Netherlands, Singapore, Thailand and Turkey are available from 1990. Information on Austria, Colombia, Czech Republic, Denmark, Greece, Poland and Portugal is available from 1995.

4. Empirical analysis

So far, our empirical strategy consists of estimating the four models presented above in order to test the I-I-C nexus within four different scenarios. According to the assumptions in each of them, we have chosen, from time to time, the proper estimator.

Before proceeding with the estimation procedure, it is worth highlighting that we have tested several hypotheses inherent in the models. In particular, we have first tested the presence of the typical unobserved effect across countries that usually characterize a macro panel with a long time series. The "*Breusch-Pagan Lagrange multiplier test for random effects*"(Breusch and Pagan, 1979)[8] strongly rejects the null hypothesis suggesting the presence of an individual unobserved effect at the country level, which supports the inclusion of n adjunctive parameters in our baseline model. Afterwards, we have tested whether this individual effect is time invariant or not. In this case, the Hausman test (Hausman, 1978) null hypothesis rejection[9] allows us to consider the individual effect as time invariant, supporting the choice for a fixed effect model regression.

Moving to the estimation results, table 1 below reports only the estimated coefficient related to the variables of interest in order to compare the results from different scenarios and estimators.[10]

[8]The statistic tests whether the variance across countries (the cross-sectional dependence) is equal to zero.

[9]The statistic tests whether the unique errors (u_i) are correlated with the regressors.

[10]Complete results are available upon request.

Table 1: Estimated results from the baseline model (4 scenarios)

Specification:	*Scenario* 1	*Scenario* 2	*Scenario* 3		*Scenario* 4
***Estimator*:**	**FE**▲	**SURE**▲	**IV-FE**♠★♣	**IV-GMM**♠★	**3SLS** ▲★
INEQUALITY	0.363**	0.979***	4.030***	1.724**	2.235***
Eq. *Indebtedness*	(0.564)	(0.190)	(1.324)	(0.679)	(0.519)
INDEBTEDNESS	0.009***	0.013***	0.018***	0.003***	0.012***
Eq *Banking Crisis*	(0.002)	(0.001)	(0.003)	(0.001)	(0.003)
BANKING CRISIS	-	-	−1.124	−0.820	−0.747
Eq *Inequality*			(0.726)	(1.708)	(1.338)

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively;

▲ Standard errors are in parentheses;

♠ Cluster-robust standard errors are in parentheses;

★ The Hansen J test always fails to reject the null hypothesis, supporting the joint validity of the overidentification restrictions;

♣ The Kleibergen-Paap rk LM statistic always rejects the null hypothesis, providing evidence that the excluded instruments are relevant, meaning correlated with the endogenous regressor. The Anderson-Rubin Wald test always rejects the null hypothesis, confirming the significance of the endogenous regressor in the main equation even when instruments are weak.

We find strong evidence that an increase in the Gini index is positively associated with an increase in the household indebtedness, on the one hand; and an increase in the household indebtedness is positively associated with an increase in the probability of a systematic banking crisis episode, on the other hand. The estimated coefficients are always positive and statistically significant (meaning they are statistically different from zero) regardless of the scenario (i.e. the model specification) and the corresponding estimator. However, we find no evidence of a feedback effect from the systemic banking crisis episodes and the increase in inequality.

In particular, in the first two scenarios we assume a hierarchical model and *i.i.d.* disturbance terms (once we have controlled for unobserved individual fixed effects). The difference in the estimated parameters arises from the fact that in the second specifications we allow for the correlation between the contemporaneous disturbance terms across the equations. Although the post-estimation diagnostic (Hausman test) highlights the presence of endogeneity, meaning that these coefficients are biased, we have presented these results anyway in order to directly compare them with those from Bordo and Meissner (2012). As mentioned above in Section 1, to the best of our knowledge, Bordo and Meissner (2012) is the only panel data analysis aimed at testing the empirical relationship between inequality and crisis. In contrast to the findings of this paper, the authors show that a credit boom heightens the probability of a banking crisis, but they find no evidence that

a rise in inequality (measured as an increase of top income shares) leads to a credit boom. In our opinion, these differences depend on the characteristics of the panel. In fact, we conjecture that the I-I-C nexus only works in a financially liberalized country. Nevertheless, from the "Great Depression" in the 1930s to the 1980s, the financial markets were partially repressed in almost all the advanced economies. Therefore, considering a long panel, such as that in Bordo and Meissner (2012), could produce misleading results even without taking into account the bias arising from the endogeneity of the regressors.

Since the Hausman test highlight the presence of endogeneity, in the further two scenarios we have abandoned the hierarchical assumptions, allowing for reverse causality among the variables of interests. As for the third scenario, our specification assumes no correlation between the disturbance terms across the equation. In this framework, we have used two different estimators in order to deal with the fact that the instruments are weak.[11] Moreover, we have relaxed some assumptions on the error terms' variance, allowing for the heteroskedasticity of the disturbance terms within each countries by estimating the cluster-robust standard error. It is also worth highlighting that the Hansen J test and the Kleibergen-Paap LM statistic always confirm the joint validity of all the instruments and the identification of the model respectively. The general interpretation of the results does not change, although the coefficients from the IV-GMM are considerably smaller than those from the IV-FE. The estimated parameters highlight that the results from FE and SURE are severely downward biased, although the signs and the statistical significance are coherent with the previous scenarios. Furthermore, the non-recursive model assumption allows us to test for the presence of a feedback effect of systemic banking crisis on inequality. Nevertheless, we find no evidence of the presence of such a feedback effect. This is probably because of the use of a static panel model, while the empirically association may be dynamic. In fact, the previous literature on this topic highlights that the crisis is likely to affect the income distribution in a longer period through the slowdown of the economic activities, the relative price changes, public policies implemented in order to protect the investors and the financial system in the aftermath of a crisis, and the fiscal retrenchment aimed at budgetary consolidation in subsequent periods Baldacci et al. (2002), Ferreira and Litchfield (1999). However, our model allows us to control only for the short-term distributional effects of a systemic banking crisis.

Unfortunately, the 3SLS estimator assumes by construction that the i.i.d. disturbance term (that is, the greater efficiency related to the simultaneous regres-

[11] However, the Anderson-Rubin Wald test highlights that the IV-FE inference is robust even with weak instruments.

sions) comes at the cost of potentially downward biased standard errors in case they are not homoskedastic. The estimated parameters from the 3SLS are in the middle between FE and IV-FE and confirm again the interpretation of the previous specification.

The estimation of the baseline model has been important to test the existence of the I-I-C nexus and to exclude, at least in the short run, the possibility of a vicious circle among the variables of interest. These results prove to be robust to different specifications and different estimation techniques. However, the panel of reference includes very different countries, in particular referring to the financial market characteristics. Even if we have controlled for the unobserved individual effect at a country level, it could be useful to test the I-I-C nexus on two subgroups of countries clustered on a financialization index. The hypothesis to test is that the I-I-C nexus is stronger in the highly financialized countries and weaker or statistically equal to zero in the other countries.

Abiad et al. (2010) proposed an index for financial liberalization based on eight dimensions (credit controls and reserve requirements, aggregate credit ceilings, interest rate liberalization, banking sector entry, capital account transactions, banking sector privatization, security market development and banking sector supervision). The normalized version of this index is calculated until 2005 and allows us to divide our panel into two sub-samples:[12] On the one hand the "highly financially liberalized countries"[13] are characterized by an average index in the considered period that is higher than 0.66. On the other hand, we have classified all the remaining economies as "partially financially repressed countries".[14] Interestingly, the classification clusters the Anglo-Saxon countries, Northern Europe and the former Soviet Eastern European economies plus Spain, Japan and Singapore in the former group, and the Latin American countries, Mediterranean Europe countries (except Spain), the Republic of Korea, Thailand and Turkey in the latter one. It is worth highlighting that all the considered countries have increasingly liberalized their financial market from 1980. This means that the average value on which we have clustered the economies is always smaller relative to the last panel occurrence in 2005. However, taking into account the last observed value of the index, the

[12]Since the index is calculated until 2005, we cannot include it in the model as an explanatory variable. However, in the model we include some variables that control for specific dimensions of the index.

[13]Australia, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Japan, Netherlands, New Zealand, Norway, Poland, Singapore, Spain, Sweden, United Kingdom, United States.

[14]Argentina, Austria, Brazil, Colombia, Greece, Italy, Republic of Korea, Mexico, Portugal, Thailand, Turkey,Uruguay.

composition of the two groups of countries does not change. below summarizes the main results for the variables of interest. Table 2 below summarizes the main results for the variables of interest.[15] Since the specifications and the estimators are identical to the baseline model, in what follows we will comment only on the differences of the estimated parameters between the two panels of countries.

Table 2: Estimated results from the sub-sample models (4 scenarios)

Specification:	*Scenario* 1	*Scenario* 2	*Scenario* 3		*Scenario* 4
***Estimator*:**	**FE**▲	**SURE**▲	**IV-FE**♠★♣	**IV-GMM**♠★	**3SLS** ▲★
	HIGHLY FINANCIAL LIBERALIZED COUNTRIES				
INEQUALITY	0.547*	1.774***	9.898**	4.001**	6.484***
Eq. *Indebtedness*	(0.332)	(0.327)	(4.149)	(1.636)	(1.331)
INDEBTEDNESS	0.007***	0.011***	0.016***	0.004**	0.012***
Eq *Banking Crisis*	(0.001)	(0.001)	(0.003)	(0.002)	(0.003)
BANKING CRISIS	-	-	−0.662	1.459	−3.589
Eq *Inequality*			(0.980)	(1.747)	(2.573)
	PARTIALLY FINANCIAL REPRESSED COUNTRIES				
INEQUALITY	0.369*	0.815***	2.650**	0.282	0.831*
Eq. *Indebtedness*	(0.197)	(0.200)	(0.820)	(0.372)	(0.476)
INDEBTEDNESS	0.016***	0.021***	0.036***	0.0007	0.0007
Eq *Banking Crisis*	(0.002)	(0.002)	(0.007)	(0.001)	(0.014)
BANKING CRISIS	-	-	−1.081	−0.819	−24.375
Eq *Inequality*			(1.040)	(1.708)	(88.545)

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively;
▲ Standard errors are in parentheses;
♠ Cluster-robust standard errors are in parentheses;
★ The Hansen J test always fails to reject the null hypothesis, supporting the joint validity of the overidentification restrictions;
♣ The Kleibergen-Paap rk LM statistic always rejects the null hypothesis, providing evidence that the excluded instruments are relevant, meaning correlated with the endogenous regressor. The Anderson-Rubin Wald test always rejects the null hypothesis, confirming the significance of the endogenous regressor in the main equation even when instruments are weak.

[15] Complete results are available upon request.

As expected, we find strong evidence that the I-I-C nexus arising from the baseline model estimates is even stronger when we restrict the sample to the highly financially liberalized countries. In fact, even if the sign and the statistical significance of the estimated parameters do not change, the coefficients are always greater than or approximatively equal to the relatively to the baseline model. Conversely, the results of the partially financial repressed group of countries, when statistical significant, are always smaller than or approximately equal to baseline model. These findings suggest that the I-I-C nexus is stronger and more likely to occur in these economies that have strongly reformed their financial markets toward thinner regulation and supervision, the complete privatization of financial institutions, and the full liberalization of capital account transactions. On the other hand, within the economies characterized by higher reserve requirements, ceilings on expansion of bank credit, an effective role of the governments in determining the interest rate, restrictions on the entry of new foreign banks into the domestic market and transnational capital flows, the state property of a portion of the banking sector, and tighter supervision, the I-I-C nexus is weaker and in some specifications (namely the IV-GMM and the 3SLS) even statistically not different from zero.

5. Discussion and policy implications

In the aftermath of the greatest global economic crisis since the 1929, the problem of financial instability has become prominent. Before then, the literature often considered the financial crisis as a purely financial problem. From this point of view, tighter regulation and better supervision of the financial system would be a sufficient condition to ensure its stability.

However, this study shows that increased income inequality affects the probability of systemic banking crises through household indebtedness. This means that financial stability is not only a financial matter and that the recent banking crises are deeply rooted in the real economy. In particular, our results show that an increase in income inequality, in particular within an highly financial liberalized country, is generally associated with an increase in household debt. In line with Duesenberry (1949) and Stiglitz (2012), we explain this findings by conjecturing that households penalized by the higher inequality borrow money in a bid to maintain their relative level of real consumption. In turn, increasing household indebtedness heightens the probability of a banking crisis. According to Bordo and Meissner (2012), a large amount of recent research confirms this relationship empirically. However, it is worth noting that many, but not all, credit booms are followed by banking crises (Mendoza and Terrones, 2008). This means that increased household indebtedness, in and of itself, is not likely to be the source of

a negative shock to the economy (Debelle, 2004). Rather, the primary macroeconomic implication of increasing will be to amplify shocks to the economy coming from other sources, particularly those that affect household incomes. As an example, using this interpretative framework in the real world is useful to explain why several emerging economies, traditionally characterized by high financial instability (as an example the Latin American countries), have been less affected by the great crisis that from 2007 hit the advanced economies (Claessens et al., 2010, Griffith-Jones and Ocampo, 2009, Porzecanski, 2009).

Furthermore, the analysis on two sub-samples of countries shows that the I-I-C nexus is stronger and more likely to occur in highly liberalized financial markets where there are no ceilings on expansion of bank credit and no barriers to the capital account transaction. This imply that reforming the global financial architecture in the sense of tighter regulation of these markets is a necessary but not sufficient condition to prevent financial turmoil. In order to ensure financial and macroeconomic stability, a major challenge for policy makers, national governments and international organizations is implementing policies oriented to to pursue a less unequal distribution of income within the countries (Ranciere and Kumhof, 2011).

6. Conclusions

In this study, we have successfully tested, on a panel of 31 countries for the period 1980-2012, the existence of an empirical association between income inequality and systemic banking crises via household indebtedness (namely the I-I-C nexus). According to Ranciere and Kumhof (2011), this means that the recent financial crises are deeply rooted in the real economy. On the other hand, our findings highlight that economies that more heavily liberalized their financial market are more prone to experience the I-I-C nexus. These results suggest that a tighter regulation and a stricter supervision of financial markets are still important issues. However, they are a necessary but not sufficient condition in order to ensure financial stability.

It is important to bear in mind that our conclusions are conditioned on several methodological drawbacks that characterize the empirical analysis. These limitations do not allow for the causal interpretation of these empirical associations. Yet this study is a first attempt to cast light on a topic that is still too much unexplored. Nevertheless, these findings are still of substantial interest for both economists and politicians. The former should further investigate the existence of the I-I-C nexus using "cleaner" data and more sophisticated econometric techniques. While the latter should consider the that an increasingly unequal income distribution, within a highly liberalized and globally integrated financial system, could undermine fi-

nancial and macro stability. These considerations further support the need to implement research and policies oriented to the reduction of income inequality, not only for ethical reasons but also to ensure financial stability.

Appendix A.

Table A.3: Variables and Statistical Sources

Economic Concept	**Variable**	**Transformation**	**Source**
Inequality	Gini Index		All the Ginis database, SILC, OECD, SEDLAC
Education	% Pop. attended secondary school	% tot. pop. more than 25 years old	Barro and Lee (2013)
Industrialization	% Workers employed in secondary sector	(% tot. of workers)	WDI
Iper-Inflation	Dummy variable	=1 if $\Delta CPI > 20$; 0 otherwise	WDI
Remittances	Remittances inflow	% of GDP	Čihák et al. (2012)
Natural Resources Rent	Natural Resources Rent	% of GDP	WDI
Economic Globalization	Koof Index (insieme a)		Dreher et al. (2008)
Economic Liberalization	Fraser Index (chain 5)		Economic Freedom of the World data system
Household Indebtedness	Credit from financial institution to household	% of GDP	BIS e tavole di contabilit nazionale
Investments	Investments	% of GDP	World Economic Outlook Database
Financial Depth	M3	% of GDP	WDI
Banking Sector Liquidity	Banking Credit to Deposit ratio	%	Čihák et al. (2012)
Capital Account Openness	Kaopen Index		Chinn and Ito (2008)
Systemic Banking Crisis	Dummy variable	1 if in the year t a crisis is identified; 0 otherwise	Laeven and Valencia (2013)
Fiscal Cost	Fiscal cost of a crisis episode	% of financial sector total assets	Laeven and Valencia (2013)
Real Economy Recession	Dummy variable	1 if in a year of crisis $\Delta PIL < 0$; 0 otherwise	Laeven and Valencia (2013)
Share of Debt Liabilities	Total external debt to total external liabilities ratio	%	Lane and Milesi-Ferretti (2007)
Net Foreign Assets	NFA	% of GDP	Lane and Milesi-Ferretti (2007)
Foreign Exchange Reserves	Foreign Exchange Reserves	Logarithm	Čihák et al. (2012)
Inflation	Δ CPI	Δ % change respect to $t-1$	World Economic Outlook Database
Currency Union	Dummy variable	1 if a country is in a currency union in t; 0 otherwise	Shambaugh (2004)
Pegged Exchange Rate	Dummy variable	1 if the country have a fixed peg in t; 0 otherwise	Shambaugh (2004)

Appendix B.

Table B.4: Descriptive Statistics

	N	Mean	Standard Deviation	Min	Max
Gini Index	888	35.34	8.77	22.40	62.50
Secondary Education	997	38.84	17.45	4.60	87.50
Industrialization	917	27.41	5.68	10.30	42.90
Iper-Inflation	1023	0.13	0.33	0.00	1.00
Remittances Inflow	840	0.82	1.11	0.00	9.15
Natural Resources Rent	1008	2.41	3.34	0.00	21.91
Economic Globalization	979	65.52	16.33	24.17	97.63
Economic Liberalization	1013	6.51	1.26	2.06	8.78
Household Indebtedness	899	43.47	28.38	0.09	146.02
Investments	1004	22.82	5.02	10.78	46.95
Financial Depth	936	67.33	37.27	6.81	239.20
Banking Sector Liquidity	904	110.65	40.11	12.79	313.18
Capital Account Openness	994	1.16	1.46	-1.88	2.42
Systemic Banking Crisis	1023	0.15	0.36	0.00	1.00
Fiscal costs of bailout	1010	1.91	9.18	0.00	102.60
Share of Debt Liabilities	977	0.70	0.17	0.25	1.00
Net Foreign Assets	977	-0.21	0.42	-1.66	2.56
Foreign Exchange Reserves	977	9.44	1.38	4.70	12.77
Inflation	1006	29.24	190.66	-1.38	3079.46
Currency Union	1009	0.09	0.28	0.00	1.00
Pegged Exchange Rate	1009	0.30	0.46	0.00	1.00

References

Abiad, A., Detragiache, E., and Tressel, T. (2010). A new database of financial reforms. *IMF Staff Papers*, 57(2):281–302. Palgrave, Macmillan, Basingstoke.

Acemoglu, D. (2011). Thoughts on inequality and the financial crisis. Technical report, AEA Meeting, Denver. ¡http://economics.mit.edu/files/6348¿.

Atkinson, A. B. and Morelli, S. (2011). Economic crises and inequality. Human Development Research Paper November, 2011, Human Development Report Office (HDRO), United Nations Development Programme (UNDP).

Baldacci, E., de Mello, L., and Inchauste, G. (2002). Financial crises, poverty, and income distribution. *Finance & Development*, 39(2):24.

Barro, R. J. and Lee, J. W. (2013). A new data set of educational attainment in the world, 19502010. *Journal of Development Economics*, 104(0):184 – 198.

Bordo, M. D. and Meissner, C. M. (2012). Does inequality lead to a financial crisis? *Journal of International Money and Finance*, 31(8):2147–2161.

Breusch, T. S. and Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica*, 47(5):1287.

Chinn, M. D. and Ito, H. (2008). A new measure of financial openness. *Journal of Comparative Policy Analysis*, 10(3):309–322.

Čihák, M., Demirgüç-Kunt, A., Feyen, E., and Levine, R. (2012). Benchmarking financial development around the world. Technical report, Policy Research Working Paper 6175,World Bank, Washington DC.

Claessens, S., Ayhan Kose, M., and Terrones, M. E. (2010). The global financial crisis: How similar? how different? how costly? *Journal of Asian Economics*, 21(3):247–264.

Debelle, G. (2004). Macroeconomic implications of rising household debt. BIS Working Papers 153, Bank for International Settlements.

Dreher, A., Gaston, N., and Martens, P. (2008). *Measuring globalisation: Gauging its consequences*. Springer, New York.

Duesenberry, J. S. (1949). *Income, saving, and the theory of consumer behavior*. Harvard University Press, Cambridge, Massachusetts.

Ferreira, F. H. and Litchfield, J. A. (1999). Calm after the storms: Income distribution and welfare in Chile, 1987–94. *The World Bank Economic Review*, 13(3):509–538.

Fitoussi, J.-P. and Saraceno, F. (2010). Inequality and macroeconomic performance. Technical Report No.13, Documents de Travail de lOFCE. ¡http://www.ofce.sciences-po.fr/pdf/dtravail/WP2010-13.pdf¿.

Fitoussi, J.-P. and Stiglitz, J. (2009). The shadow GN: The ways out of the crisis and the building of a more cohesive world. Technical report, Observatoire Français des Conjonctures Économiques (Paris). ¡http://ofce.sciences-po.fr/pdf/dtravail/WP2009-17.pdf¿.

Griffith-Jones, S. and Ocampo, J. A. (2009). The financial crisis and its impact on developing countries. No.53. ¡http://www10.iadb.org/intal/intalcdi/PE/2009/03664.pdf¿.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, 46(6):1251.

Krugman, P. (2012). *End this depression now!* WW Norton & Company, New York.

Laeven, L. and Valencia, F. (2013). Systemic banking crises database. *IMF Economic Review*, 61(2):225–270.

Lane, P. R. and Milesi-Ferretti, G. M. (2007). The external wealth of nations mark ii: Revised and extended estimates of foreign assets and liabilities, 1970–2004. *Journal of International Economics*, 73(2):223–250.

Masciandaro, D. and Quintyn, M. (2009). Regulating the regulators: the changing face of financial supervision architectures before and after the crisis. *European Company Law*, 6(5):187–196.

Mendoza, E. G. and Terrones, M. E. (2008). An anatomy of credit booms: evidence from macro aggregates and micro data. Technical Report No. 14049, National Bureau of Economic Research. ¡ http://www.nber.org/papers/w14049.pdf¿.

Murray, M. P. (2006). Avoiding invalid instruments and coping with weak instruments. *Journal of Economic Perspectives*, 20(4):111–132.

Porzecanski, A. C. (2009). Latin america: The missing financial crisis. Technical report, Munich Personal RePEc Archive, University Library of Munich. ¡http://eclac.cl/noticias/paginas/3/35143/Porzecansky_2009.pdf¿.

Rajan, R. G. (2011). *Fault lines: How hidden fractures still threaten the world economy*. Princeton University Press, Princeton, Oxford.

Ranciere, R. and Kumhof, M. (2011). Inequality, leverage and crises. Technical report, Society for Economic Dynamics, Washington, DC. `https://economics.indiana.edu/home/about-us/events/conferences-and-workshops/2011/files/2011-04-14-01.pdf`.

Shambaugh, J. C. (2004). The effect of fixed exchange rates on monetary policy. *Quarterly Journal of Economics*, pages 301–352.

Staiger, D. and Stock, J. H. (1997). Instrumental variables regression with weak instruments. *Econometrica*, 65(3):557.

Stiglitz, J. E. (2012). *The price of inequality: How today's divided society endangers our future*. WW Norton & Company, New York.

Stock, J. H., Wright, J. H., and Yogo, M. (2002). A survey of weak instruments and weak identification in generalized method of moments. *Journal of Business & Economic Statistics*, 20(4):518–529.

Studenmund, A. H. (2011). *Using econometrics: A practical guide*. The Pearson Series in Economics. Addison-Wesley, Boston, U.S., 6th ed. edition.

Zellner, A. (1962). An efficient method of estimating Seemingly Unrelated Regressions and tests for aggregation bias. *Journal of the American Statistical Association*, 57(298):348–368.

Zellner, A. and Theil, H. (1962). Three-Stage Least Squares: Simultaneous estimation of simultaneous equations. *Econometrica*, 30(1):54–78.