MASTER THESIS BUSINESS AND ECONOMICS

Impact of income inequalities on credit growth:

Empirical evidence for advanced economies

and first results for emerging economies

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ABSTRACT

The most recent episodes of financial crises have put forward the idea that credit booms are the main reason for financial disequilibrium. Taking that into account, we will explore the track of income inequalities as a trigger for credit booms in both advanced and emerging economies. While a large literature on the subject gives evidence for a positive relationship between income inequalities and credit growth, we find no relationship between the two in advanced economies, except for the period of the Great Moderation. For emerging economies, income inequalities are not a determinant of credit growth. "Traditional" determinants of credit growth in advanced economies cannot be transposed to the case of emerging economies.
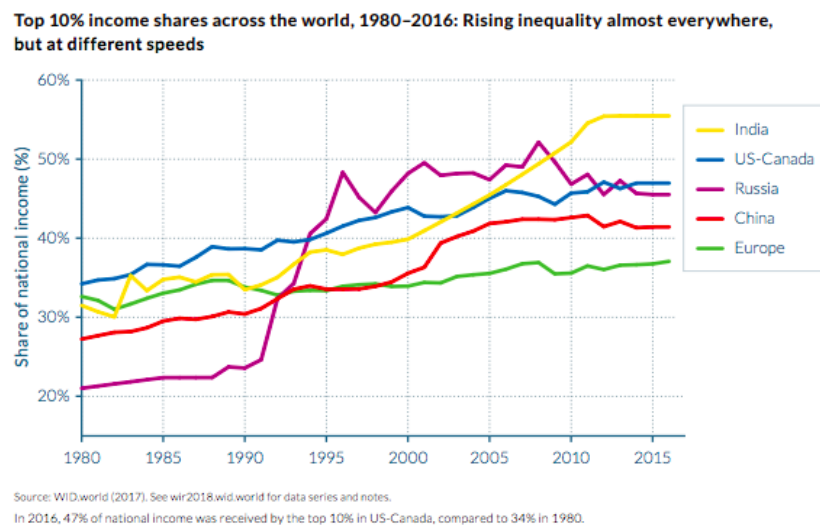
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1. Introduction

The most recent episodes of crisis of the 20th and 21th centuries have brought credit growth to the centre of attention. Crises, such as the subprime crisis, have put forward the idea that credit booms are a major threat for the world economy. Given the intensity and the spread of this economic crisis, a large literature on the subject has emerged over the last 10 years.

In the same period, another important phenomena has been spotted by economists of the world. In the most recent and complete report on inequalities, Alvaredo et. al (2018) give us a clear update of the current income inequalities situation. The following figure shows us that income inequalities have experienced an important rise in the last two decades in several regions of the world. The authors warn us against the enormous differences in inequalities across continents and the ultra-concentration of wealth in the hand of a very few. In 2014, a Credit Suisse Report on income inequalities was already claiming that 1% of the world population owns a half of world population's wealth.

Top 10% income shares across the world, 1980–2016: Rising inequality almost everywhere, but at different speeds

Source: WID.world (2017). See wir2018.wid.world for data series and notes.
In 2016, 47% of national income was received by the top 10% in US-Canada, compared to 34% in 1980.

Putting together these two statements, a few authors have started investigating the relationship between income inequalities and credit growth. If rising income inequalities are the source of credit growth, this could have a major impact on the way countries must tackle the issue of financial instability. The available literature on the subject remains mainly focused on the case of the United States. In 2010, in his book *Fault Lines*, Rajan highlights the role income inequalities have played in the recent economic crisis through the channel of credit growth. He stresses the absurdity of the educational system in the United States, which is according to

him, the greatest reason for persistency of income inequalities in the United States. He questions the way credit was allowed to the poorest in the pre-crisis period, and the way financial institutions have silenced the vices of the system.

Bordo and Meissner (2012) study the link between income inequalities and financial crises through the channel of credit growth. Their analysis is a novel approach to the subject, as they complete Kumkhof and Rancière (2010)'s paper with panel data analysis. Their conclusions and methodology diverge substantially and this is why we will try to give here new elements on the subject.

In this paper, we present an updated analysis of B&M[1] research. Using an updated version of their panel dataset (World Inequality Database (2018), Schularik and Taylor (2016)), we aim at investigating the relationship between income inequalities and credit growth in 14 advanced economies. We complete the analysis with a pioneer idea: investigate the relationship between income inequalities and credit growth in emerging economies. This innovative part of the research has been made possible thanks to the recent update of the World Inequality Database. This paper will be organised the following way: Section 2 reviews literature arguments for investigating the relationship between income inequalities and credit growth and present our hypothesis on the potential relationship of interest. Section 3 gives empirical evidence of this relationship for 14 advanced economies. Section 4 gives empirical evidence of this relationship for 10 emerging economies. Finally, Section 5 discusses results and highlights limitations of this paper.

2. Literature Review:

If we want to investigate the relationship between income inequalities and credit growth, it is because many authors believe credit booms are linked to financial crisis. Borio and White (2003), Mendoza and Terrones (2008), Elekdag and Wu (2011), Reinhard and Rogodd (2009), Schularik and Taylor (2012), Bordo and Meissner (2012) extensively test and analyse this relation of causality running from excessive level of debts and credit booms to financial crises. This relationship is found to be positive in all cases. In this context, and in order to find new responses to financial crisis, studying potential sources of credit growth seems necessary.

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[1] In this paper, references to Bordo and Meissner's paper (2012) will be written as follow: B&M.

2.1 Income inequalities and credit growth in advanced economies

We discuss here the different reasons why we believe income inequalities could be impacting credit growth in advanced economies. The starting point of this work is the paper from Bordo and Meissner (2012) from which we get another perspective of Khumkof and Rancière's work (2011). B&M brings a novel approach on the way to investigate the relationship between income inequalities and credit growth in advanced economies and finds no significant relationship.

In Khumkof and Rancière (2011 and 2015), an interesting hypothesis is made on the reason why we should find a positive relationship between income inequalities and credit growth: "*the key mechanism is that top earners, rather than using all of their increased income for higher consumption, use a large share of it to accumulate financial wealth in the form of loans to bottom earners.*" As a consequence, as income inequalities increase, credit growth should rise and the amount of debts from the poorest share of the income distribution should increase. RKR[2] develop a DSGE model to give a theoretical frame to their hypothesis. Using the Permanent Income Hypothesis, RKR model top earners with preferences for wealth. As top earners' wealth increase, top earners' savings increase by a certain amount. RKR shows that as savings increase, bottom and middle groups of earners' debt leverage increase by approximately the same amount. This is evidence for consumption smoothing effect among the different groups of earners.

B&M rethinks this analysis by introducing panel data, but still starts from RKR conclusions of a positive relationship between income inequalities and credit growth. Their results show no significant relationship. Our analysis starts from these conclusions.

Our hypothesis on the relationship between income inequalities and credit growth for advanced economies is as follow: We expect to find no significant relationship between income inequalities and credit growth.

We believe our updated data sample will help us understand better the relationship of interest. The implications of this research, whether it results in a significant relationship between

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[2] In this paper, references to Khumkof and Rancière's papers of 2011 and 2015 will be written as follow: RKR.

income inequalities and credit growth or not, are multiple: it will contribute to discussions on credit sources, and will help shape tomorrow's policies as well as facing financial challenges.

2.2 Income inequalities and credit growth in emerging economies

In the Kuznets curve[3], representing the relationship between inequality and income per capita, we can notice an interesting fact: as economies grow larger and countries more developed, inequalities stabilize themselves before decreasing again on the stage of advanced development. If advanced economies are believed to be located on the declining slope of the curve, emerging economies should be located on the middle of it. In reality, the relationship between income inequalities and the stage of development of a country is more complex than the one depicted in the Kuznets Curve (Piketty, 2005).

Emerging economies are known to have experienced great improvements in terms of income inequalities. The World Bank Portal on poverty[4] in emerging markets shows that poverty has decreased by more than 10% in the BRICS since the mid-1990s. However, these results remain more relevant for the case of China than for the rest of emerging economies. Despite improvements in terms of inequalities thanks to rapid growth, factors of inequalities persist and seem hard to dismantle: informality of labour's activity, barriers to social mobility, corruption.

In 2004, the World Economic Outlook report of the IMF[5] was claiming the urge for research on the sources of credit growth in emerging economies in order to improve policies and statistics. According to this report, credit booms are raising "*significant risks for emerging market countries*". The IMF highlights the link between credit booms and investment booms, current account deficits, increase in relative price of non-tradables. The subject of credit booms in emerging economies is all the more important that fast growth require credits.

The challenge underlined by these arguments is the following: should emerging economies concentrate public efforts on the reduction of income inequalities in order to limit risks of credit booms? In this paper, we will try to bring new evidence of identification of credit

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[3] First hypothesis of the Kuznets Curve advanced by Simon Kuznets in the 1950s.
[4] World Bank Poverty and Equity Data portal last updated in 2015.
[5] International Monetary Fund

booms sources in emerging economies through the analysis of the relationship between income inequalities and credit growth in 10 emerging economies.

Our hypothesis on the outcome is as follow: Income inequalities have an impact on credit growth in emerging economies.

3. Empirical evidence: 14 advanced economies :

3.1 Real credit growth determinants

As in B&M, we first start our analysis by plotting the two time series of interest: credit growth and top 10% income share. We use the first difference of the mean of total bank loans over GDP and the mean of top 10% income share of the 14 advanced economies[6] of interest.
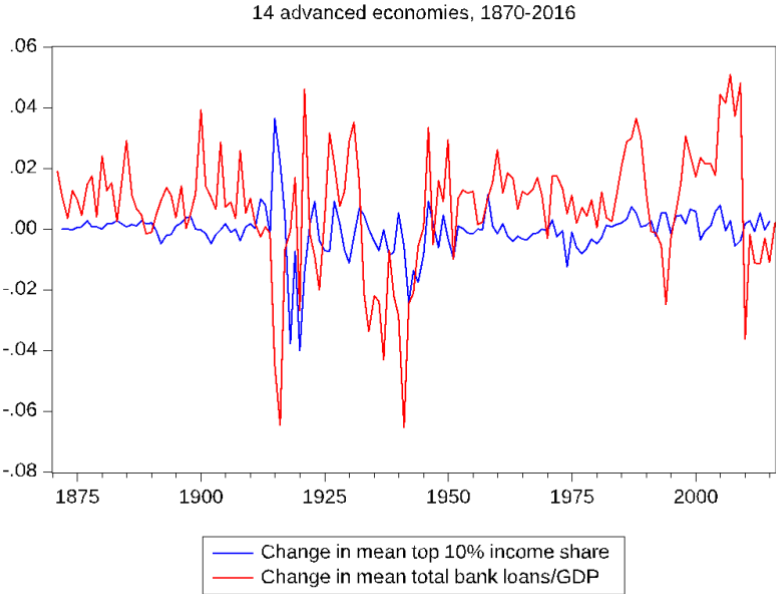
This graph shows us how plausible the idea of a positive relationship between the two variables is in practice. Both variables seem to be following the same trend with a few periods of difference. For instance, taking the period 1915-1930, it seems that a growth peak in top 10% income share is followed by a real credit growth peak of greater amplitude in the following period. Another example is the period going from 1995 to 2010 where the shapes of

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[6] The 14 advanced economies are: Australia, Belgium, Canada, Switzerland, Germany, Denmark, Spain, Finland, France, UK, Italy, Japan, Netherlands, Norway, Portugal, Sweden, USA.

the change in top 10% income share and of real credit growth seem to be the same. Again, the amplitude of change in real credit growth is greater than the top 10% income share one.

Nevertheless, the nature and the direction of this relationship remains uncertain since it also seems that we have evidence from these time series in favour of an inexistent relationship. Figure 1[7] shows us four individual time series plots. We clearly see on these graphs that some periods seem to be favouring the hypothesis of a positive impact of income inequalities on real credit growth, while others do not seem to depict any relationship between the two. For the case of Australia for instance, the period running from the late 1950s up to the late 1990s seem to be showing a positive relationship between our two variables of interest. Same for Sweden for the period 1950 - late 1960s.

3.2 Data

Our dataset on the 14 advanced economies is extracted from Jordà, Schularik and Taylor (2016). It is an updated version of the dataset from Schularik and Taylor (2012) used in B&M paper. This dataset includes data on total loans to non-financial private sector, real gross domestic product per capita, gross domestic product, investment-to-GDP ratio, consumer prices, broad money and short-term interest rate for 14 advanced economies. These variables are used in our analysis following B&M's work. The inclusion of other explanatory variables in the estimations of credit growth determinants allow us to get a more objective analysis of the relationship of interest. It reinforces the robustness of results (B&M). Details for the explanatory power of these variables can be found in Schularik and Taylor (2012). The household debt data is extracted from a report of the IMF (2018). Finally, and most importantly, the data for top 10% income share is taken from the newly published and updated World Inequality Database (2018) formerly called World Top Income Database (2011). In B&M, the latter is used. Our analysis therefore offers an updated study of the relationship between income inequalities and credit growth.

The choice of data particularly matters in this research since it seems to be determinant for the nature of the relationship. The use of bank loans to private sector as a proxy of credit growth comes from the motive of covering large periods of time including those of high deregulation (Elekdag and Wu, 2011). The definition of bank loans data can be found in Schularik and

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[7] Appendix.

Taylor (2012): *"Total lending of bank loans is defined as the end-of-year amount of outstanding domestic currency lending by domestic banks to domestic households and non-financial corporations."* This definition is important as it draws the frame of our variable of interest. One interesting point highlighted in Perugini et. al (2015) is the importance of dividing all variables by the same indicator. Whereas B&M creates ratios with CPI, we will create ratios with GDP. This similarity in expressing variables allow us to compare measures more efficiently (Malinen, 2013).

Concerning income inequalities, we have chosen to proxy the latter by using top 10% income share. The definition of top 10 % income share as given in the World Inequality Database (2018) is the following: *" Pre-tax national income share held by a given percentile group. Pre-tax national income is the sum of all pre-tax personal income flows accruing to the owners of the production factors, labour and capital, before taking into account the operation of the tax/transfer system, but after taking into account the operation of pension system."* As in B&M, we exclude other potential proxies of income inequalities such as the GINI coefficient for instance, or the 20/20 ratio. Indeed, we here focus on theoretical evidence in favour of a relationship between top 1, 5 or 10% income share and credit growth. Comparing to other data samples of other potential proxies of income inequalities, the World Inequality Database (2018) has the advantage of being more complex and more complete. Rajan's (2010) assumptions on the sources of credit booms in the late 20th century has helped us determine our choice on the range of income share to be analysed. In his book, Rajan explains how the 90/10 differential of the income distribution has experienced great movements in recent history due to college premium and why the 50/10 differential has not experienced such movements. The difference of wages between students with a college degree, and those with no college degree in the USA has consequently increased in the last 50 years, therefore widening the gap between social classes and increasing income inequalities in the country (Rajan, 2010). Analysing the changes in the top 10% income share of the income distribution therefore seems adequate. In Kumkhof and Rancière (2015), a similarity in pre-crisis periods is highlighted: a sharp increase in income inequalities. This phenomena is later explained by the fact that top earners, as their income increase, *"accumulate financial wealth in the form of loans to bottom earners"*. Therefore, studying the top share of the income distribution might lead us to interesting results in terms of impacts on the credit sphere.

Another difference with B&M's dataset is the introduction of household debt in our sample. In Kumkhof and Rancière (2010) a similar pattern is found between household debt to income ratios and top and low income groups in pre-crisis periods. We think that adding this new term might bring additional explanatory power to our estimations of real credit growth. It could be that household debt is more significant in explaining credit growth than top 10% income share.

3.3 Methodology

We are now going to investigate whether this relationship between income inequalities and credit growth exists. After having proceeded to unit root tests on all variables (Table 1[8]), we are able to estimate regressions of the following form:

$$\Delta \text{ (real credit)}_{it} = \alpha_t + \beta_i + \beta_1 \Delta \text{ real credit}_{i,t-1} + \beta_2 \Delta \text{ top10}_{i,t-1} + \beta_3 \Delta \text{ RGDP}_{i,t-1} + \beta_4 \Delta \text{ debt}_{i,t-1} + \beta_5 \Delta \text{ CPI}_{i,t-1} + \beta_6 \Delta \text{ ir}_{i,t-1} + \beta_7 \Delta \text{ money}_{i,t-1} + \beta_8 \Delta \text{ investments}_{i,t-1} + \varepsilon_{it}$$

This regression model is following B&M model. The dependent variable is the change in total loans to non-financial private sector/GDP. We fix period and country effects. The following variables are (following order of appearance) the lagged value of the changes : in real credit, top 10% income share, real GDP per capita, household debt/GDP, consumer price indices, short term interest rate, broad money/GDP, investments/GDP. The last term is an error term reflecting measurement errors. The time period runs from 1873 to 2016.

In the paper from Perugini et.al. (2015), the analysis is done on the level of domestic credit to the private sector as a percentage of GDP. We believe this analysis is biased by the non-stationary nature of variables, and as a consequence, our methodology follows B&M's using the change in bank loans as the dependent variable.

Following B&M, we expect the sign of interest rate and real GDP per capita to be positive, as well as the sign of the lagged value of the change in real credit. Indeed, we believe last period

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[8] Appendix

value of a variable has power in explaining next period value. For other variables, including top 10% income share, we expect insignificant result.

3.4 Results

Unit root tests

The unit root tests allow us to investigate whether a variable is stationary on the level or need to be differenced. As we can see in Table 1[9], all variables are I(1).

Correlation tests

We build a correlation matrix including all variables of interest (Table 2[10]). This matrix allows us to depict potential correlation within pairs of variables. In the following part, we will consider a correlation as significant if its value goes beyond 0.6 or below -0.6.

From this correlation matrix, we can see a clear positive correlation between real credit growth and real GDP per capita. This result goes in the same direction than B&M's findings, and support our hypothesis of a possible explanatory power of real GDP per capita for real credit growth. Two other clear positive correlations can be highlighted: CPI with RGDP per capita , and broad money with RGDP per capita. These positive correlations will later be a motive for dropping variables from some part of the estimations. The correlation direction must be going from independent variables to the dependent variable and not from independent variables to others. The other correlations we can find in the matrix are not powerful enough.

This correlation matrix also confirms the fact that we should expect a positive sign for real GDP per capital.

Estimation of credit growth determinants

Using the equation described in part 3.3, we obtain results of Table 3.

Table 3 shows the details of our investigation on the determinants of credit growth in 14 advanced economies. The first column consists in an estimation taking into account all variables available. The time period for the first column is the largest given our dataset. The

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[9] Appendix
[10] Appendix

lagged value of real credit growth, of real GDP per capita, of CPI and of investments/GDP seem to be playing an important role in explaining credit growth in this sample. For a 22% increase in investments, we have a 10% increase in credit growth. In the second column, we exclude variables that are positively correlated with real GDP per capita. What we observe is a high significance of the significant variables from column 1, and top 10% income share becomes significant at a 90% confidence rate. This interval of confidence being moderate, we will discuss later the relevance of the result.

The time period for the remaining columns of Table 3 is voluntarily reduced following literature on the Great Moderation period. The Great Moderation period is known to be a period of great decline in the volatility of aggregate economic activity (Davis et. al. 2008). GDP or residential investment for instance (Davis et. al. 2008) have known a relative stability since the 1980's. From column 1 and 2, we have seen that these two determinants seem to be playing an important part in estimating real credit growth. Therefore, by controlling for the period of the Great Moderation (from 1980 until today), we hope to see more clearly the impact of income inequalities as it is a period of relative stability in investments and GDP. Column 3 (year 1873 to 1980) shows no particular explaining power of our variables of interest. This result was expected as it is a period for which the data sample is more limited. On the other hand, Column 4 (1980-2014) depicts some interesting results: at a 95% confidence rate, we can say that in this period, when top 10 % income inequalities decrease, credit growth increases. In other words, as incomes of the richest part of the population of the 14 advanced economies decrease, credit growth increases. This result is in contradiction with RKR and B&M initial hypothesis. Indeed, for the first time here, it seems that income inequalities and real credit growth have a negative relationship.

The 5th column of Table 3 show results for the period 1980-2016. The same variables than in column 2 are dropped as they could be biasing our analysis, in addition to household debt which showed no significance in the previous columns. Results are similar to those of column 4: the lagged value of real credit growth, of top 10% income share, of real GDP per capita, of short term interest rate and of investments/GDP are significant at a 95% confidence rate at least. We believe they are strong factors of credit growth increase. An increase in real credit growth at t-1 will lead to an increase of real credit growth at time t. The negative relationship between top 10% income share and real credit growth seems to be confirmed once again for the Great Moderation period.

The detailed interpretation of these results will be discussed in part 5 of this paper.

4. Empirical evidence: 10 emerging economies

4.1 Credit growth determinants in emerging economies

As shown for advanced economies, it is important to start our analysis of the relationship between income inequalities and credit growth by analyzing the way both variables of interest evolve through time. As for advanced economies, data for emerging economies allows us to study the changes in total bank loans/GDP and the changes in top 10% income share.
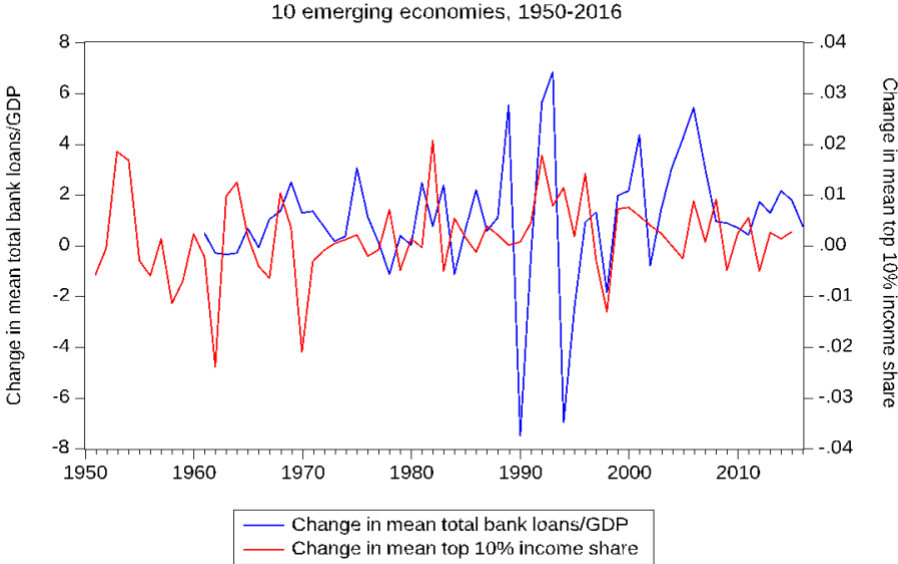
On this graph, we can see that at some point in times, the two variables seem to be following the same trend. If we take the period going from the late 1970s to the late 1980s, changes in both variables seem to be almost identical. The direction of the relationship remains therefore uncertain. However, from the 1990s onwards, it rather seems that changes in top 10% income share follow changes in total bank loans/GDP.

If we look at Figure 2 [11], we can observe the same results. Taking the case of India for instance, we see that while from 2000 onwards it is obvious that income inequalities are not driving real credit growth, the trends of both variables in the 60s or the 90s seem to be

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[11] Appendix

showing us the contrary. On the graph displaying trends for China, the same conclusion can be drawn: while in the 1990s it seems that income inequalities could be driving real credit growth, in the 2000s the contrary seems obvious. Finally, the case of Russia on a shorter time period confirms this analysis.

4.2 Data

The data used in this paper finds its roots in several sources. Given the relatively short amount of data available for emerging countries, only 10 emerging countries were selected for the analysis: the BRICS (Brazil, Russian Federation, India, China and South Africa), and 5 other countries selected from the "next eleven" [12] (Egypt, Indonesia, Iran, Turkey, Republic of Korea).

The data on top 10% income inequalities has the same source than the one used in the previous analysis: the World Inequality Database (2018). The definition of top 10% income share is therefore the same than previously.

The data for broad money, consumer price index, real credit growth, lending interest rate and net investment was extracted from a unique source: The World Bank Open Data. The definitions of broad money, CPI and net investment are the same than the ones in the analysis for 14 advanced economies. However, the definitions of real credit growth and lending interest rate differ from the previous analysis. The real credit growth, instead of the domestic credit to non-financial private sector, is now defined as the domestic credit to private sector. This implies a small difference in the way credit growth is perceived. The lack of data for emerging economies justifies this broader definition. Concerning lending interest rate, the definition differs with the one from the previous analysis since it is now taking into account both short and medium term interest rates. Once again, the definition is broader and can be justified by the lack of data.

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[12] "The next eleven" is a term used to make reference to 11 countries which are prone to account for the world's largest economies of the 21th century together with the BRICS and the USA + EU + Japan. This list of eleven countries was published in 2005 by Goldman Sachs Investment Bank and realised on the basis of multiple economic criteria (such as macroeconomic stability, investment policies etc.).

4.3 Methodology

The equation used for estimating the determinants of real credit growth in emerging economies follows the model of B&M for advanced economies. After having analysed the stationarity of all variables (Table 4[13]), we have come to the following estimation equation of real credit growth in emerging countries:

$$\Delta \, (\text{real credit})_{i\,t} = \alpha_t + \beta_i + \beta_1 \Delta \, \text{real credit growth}_{i,t\text{-}1} + \beta_4 \Delta \, \text{top10}_{i,t\text{-}1} + \beta_5 \, \Delta \, \text{RGDP}_{i,t\text{-}1} +$$
$$\beta_6 \, \Delta \, \text{RGDP}_{i,t\text{-}2} + \beta_7 \, \Delta \, \text{RGDP}_{i,t\text{-}3} + \beta_8 \, \Delta \, \text{CPI}_{i,t\text{-}1} + \beta_9 \, \Delta \, \text{ir}_{\,i,t\text{-}1} + \beta_{10} \, \Delta \, \text{money}_{\,i,t\text{-}1} +$$
$$\beta_{11} \Delta \, \text{investments}_{\,i,t\text{-}1} + \varepsilon_{it}$$

The dependent variable is the change in total loans to private sector/GDP. We control for country and period fixed effects. The following variables are (following order of appearance in the equation above) the lagged values of the changes in: real credit growth (3 lags), top 10% income share, real GDP per capita, consumer price indices, lending interest rate, broad money/GDP, investments/GDP. The last term is an error term reflecting measurement errors. The time period of the estimation runs from 1950 to 2016. This data sample is consequently shorter than the data sample for advanced economies.

From this estimation equation, we expect to find a positive sign for real GDP per capita as it seems to be the most natural factor of credit growth. The sign of top 10% income share is also expected to be found positive as explained in part 2. For other variables, the doubt remains. This equation allows us to examine the relationship of interest but also to what extend the interpretation of significant determinants of real credit growth in advanced economies can be transposed to the case of emerging economies. Indeed, if determinants are found to have no significance here, it could mean that emerging economies have a totally different credit system dynamic than advanced economies.

4.4 Results

Unit root tests

The unit root tests allow us to investigate whether a variable is stationary on the level or need to be differenced. As we can see in Table 4, all variables are I(1) except CPI which is I(2).

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[13] Appendix

Correlation tests

We build a correlation matrix for all variables of interest in order to explore the correlation within pairs of variables. Once again, a correlation is said to be significant if it is beyond 0.6 or below -0.6.

This correlation matrix shows a positive correlation between real credit growth and both broad money/GDP and real GDP per capita. This result confirms our hypothesis on the relationship between real GDP per capita and real credit growth. A positive correlation is also found between real GDP per capita and broad money.

Estimation of credit growth determinants in 10 emerging economies

The results of estimated equations following the model described in part 4.3 can be found in Table 6[14].

This table displays results for only a short period of time. The number of observations is also very limited. In the first column (1980-2016), we can see that only the change in real GDP per capita seems to be determinant in explaining real credit growth. The top 10% income share variable shows no sign of significance and seems to be far from being important in the determination of real credit growth in this sample.

In the second column (1967-2016), we have dropped insignificant variables except for broad money which is meant to have a positive correlation with real credit growth according to the correlation matrix. Lending interest rate is also kept as it is intrinsically linked to the definition of credit. As an intent to give more power to our estimation, we add 2 lagged values of real GDP per capita. The result is as predicted: all variables show signs of a relationship with credit growth. As lending interest rate decreases, real credit growth increases. On the other hand, as real GDP per capita and broad money increases, real credit growth increases.

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[14] Appendix

5. Discussion

5.1 Discussion of results

Advanced economies

In this first part, we discuss results from our data sample on 14 advanced economies.

The first noticeable result we can highlight from table 3 is the fact that the Great Moderation period appears as a special period for our relationship of interest. Almost all variables, including top 10% income share, seem to be significant in explaining credit growth in this period of Great Moderation. This result means that in a period of weaker uncertainty and of monetary policy control (target inflation, stable growth, new technology etc.), sources of credit growth are easier to identify. In terms of policy direction, this result is promising as it could mean that efforts made to reduce risks of credit booms have more chances to be efficient.

Second of all, we can observe that while "traditional" determinants of credit growth[15] included in these estimations (RGDP per capita, short term interest rate, CPI, lagged value of dependent variable) are not surprisingly significant in explaining credit growth, top 10% income share on the other hand is found to have a rather unexpected relationship with credit growth: a significant negative relationship (column 4 of Table 3). Although the level of confidence of these results remains moderate, it is interesting to highlight it as it brings a new point of view on the dynamic of the relationship between income inequalities and credit growth in advanced economies. It is found that as top 10% income share decreases, credit growth increases. In other words, as the richest part of the income population becomes poorer, the supply of credits increases. This result is in contradiction with conclusions from RKR and B&M, and our initial hypothesis. Rather than supposing that increasing income of top income share of the distribution is the reason why more credits can be allowed to the bottom share of the distribution, it seems here that credit supply only increases if incomes of the richest decrease. This result is unexpected. Following these results, in order to limit the risk of credit burst, it seems important to focus on the stability of incomes of top earners, while trying to

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[15] Determinants are called "traditional" as they have already been identified as consistent determinants of credit growth in Schularik and Taylor (2012).

increase incomes of bottom earners. Reducing income inequalities must stay a priority for reducing threats of credit booms.

Nevertheless, considering the short time period of significance of these results, we fail to completely reject B&M conclusions on the relationship between income inequalities and credit booms. If income inequalities might have an impact on credit growth on the current period of Great Moderation, it remains clear that income inequalities had no impact on credit growth in older time periods.

The significance of the relationship between real credit growth and real GDP per capita, short term interest rate and investments confirms B&M conclusions. Once again, these variables are shown to be strong determinants of real credit growth in advanced economies.

Emerging economies

In this second part, we discuss results from our 10 emerging economies data set.
These results being the first of their kind bring no clear conclusion on the relationship between income inequalities and credit growth in emerging economies. Rather, these results allow us to clarify the pertinence of the transposition of advanced economies' determinants of credit growth to the case of emerging economies.

Following our analysis, it is impossible to admit that advanced economies' determinants of credit growth can be applied to the case of emerging economies. Only the changes in real GDP per capita, of lending interest rate and of broad money are significant in explaining credit growth in emerging economies. All other determinants fail to explain credit growth. We believe this outcome can be the result of several factors. First, emerging economies differ substantially in their degree of financial integration. Periods of credit growth are more rapid and more regular than in advanced economies. Some emerging countries are more financially integrated than others (Prakash et. al., 2017). In order to give a clearer panel data analysis on the relationship between income inequalities and credit growth in emerging economies, a broader data set is required as well as a consistent analysis on the determinants of real credit growth in emerging economies. New variables depicting social mobility or the level of corruption for instance could bring additional power to the estimation of real credit growth determinants in emerging economies.

5.2 Limitation of the analysis

A few limits of this analysis can be highlighted.

The first limit of our analysis concerns the measure of income inequalities. In this report, we have chosen to proxy income inequalities with the top 10 % income share following Rajan (2010), B&M, RKR. However, as stated by Atkinson et.al (2010), this measure of the top income share does not take into account the evolution of inequality in the remaining distribution of incomes. Indeed, if top 1, 5 or 10% income share increase or decrease, we do not necessarily expect lower shares of the income distribution to follow the same evolution. If top 10% income share increases at a period, it could be that the following 30% also increases. Even though some authors, like Rajan (2010), put forward the fact that the bottom 50% income share has not experienced important changes in the last century, we could argue that the lack of representation of the income distribution could have biased our analysis. Today, too little data can be found on the bottom 50% income share (or wealth) of our 14 advanced economies and 10 emerging economies of interest.

The greatest drawback concerning income inequalities relies on its definition. Indeed, the biggest issue of our data on income inequalities is the diversity of definitions of tax legislation between countries. There is some important cross-country comparability issues regarding changes in tax legislation (Atkinson et. al., 2010) and pension systems. If we take a closer look to the definition of top 10 % income share in WID (2018), we can see that a close attention was given to the problem. The income distribution is calculated on the basis of pre-tax income, before any operation of taxation or transfer, but after pensions distribution. Theses pensions substantially differ from one country to the other, especially between emerging economies. This drawback makes it more difficult to lead an objective cross country analysis. However, even if divergence in pension distribution systems reduce power in explaining household's consumption habit, this definition of income inequalities still allow us to limit the problem of differences in tax legislation between countries.

Finally, the third limit concerns our data on emerging countries. This dataset is poor and does not cover a large period of time. Therefore, any conclusion on the relationship between potential credit growth determinants and credit growth in emerging countries could be biased by the fact that we are missing data. An updated version of the definition of the BRICS could

also have lead us to choose other countries for investigating the relationship in emerging economies. Further research should be done in the upcoming years on this relationship for new emerging economies using a broader sample with more data and more countries. Maybe variables that are more significant in explaining credit growth in emerging economies should be added to the estimation of credit growth determinants as we have seen above. Also, if this relationship between income inequalities and credit growth is effectively insignificant for emerging economies until now, it could be that as they become larger, more influential and interconnected economies, this relationship changes.

6. Conclusion

Throughout this paper, we have investigated the relationship between income inequalities and credit growth in both advanced and emerging economies. In the first part, we have reviewed literature on the subject of credit growth and income inequalities in regions of the world. In the second part, we have investigated the relationship of interest in advanced economies. In the third part, we have investigated the relationship of interest in emerging economies. Finally, in the fourth part of this paper, we have discussed results and put forward the limits of our analysis. Results for advanced economies are following Bordo and Meissner (2012)'s conclusions but differ for the current Great Moderation period as more data is included in our analysis. New conclusions from our analysis brings new debate concerning the way issues of income inequalities should be tackled in order to reduce risks of credit booms. On the other hand, conclusions of our analysis on emerging economies does not allow us to give consistent recommendations in the way credit growth issues should be tackled. Further research on the case of both emerging and advanced economies must be realised in the upcoming decades, especially when consistent works of retrospection on the Great Moderation period will be feasible.

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Appendix

Figure 1. Changes in total bank loans/GDP and top 10% income share for 4 advanced economies over time
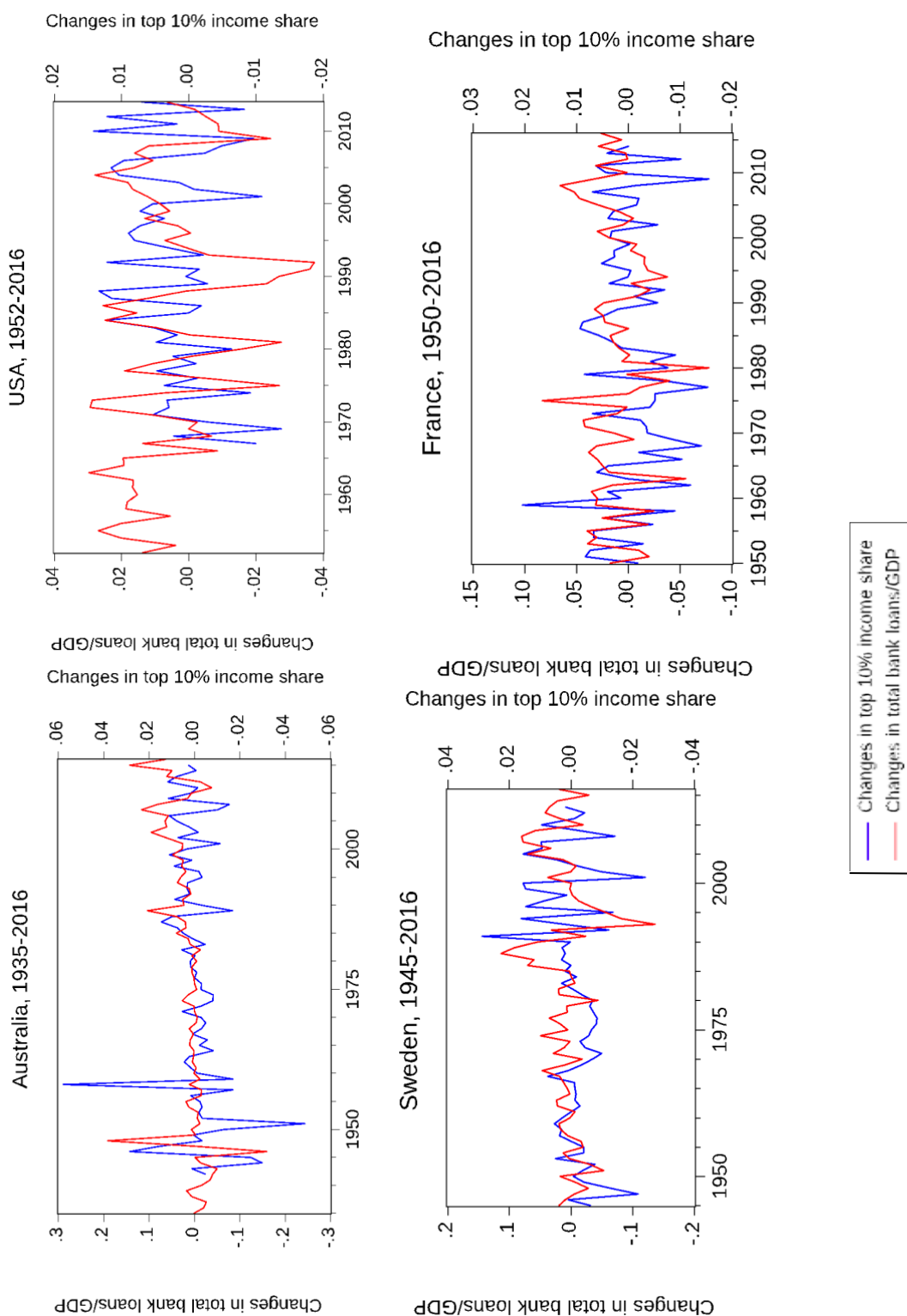
Figure 2. Changes in total bank loans/GDP and top 10% income share for 3 emerging economies over time

China, 1975-2016

Russian Federation, 1995- 2016

Change in mean total bank loans/GDP
Change in mean top 10% income share
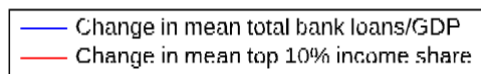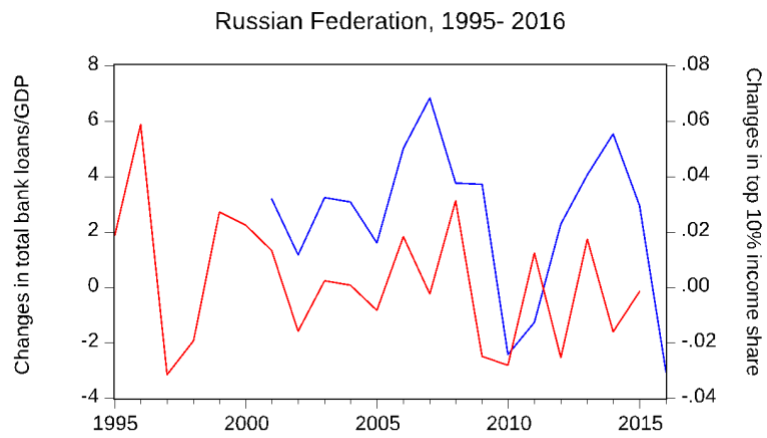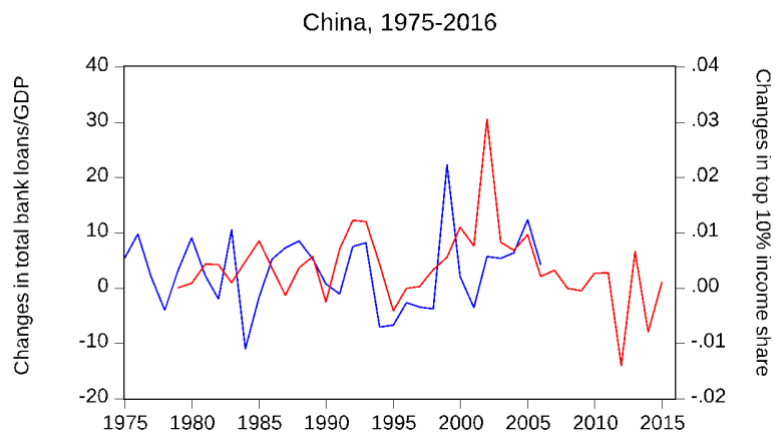
Table 1: Unit root tests for advanced economies dataset variables

Probabilities are computed using asymptotic Chi-square distribution

Variable	Stationarity
Consumer Prices Index	Δ
Household Debt / GDP	Δ
GDP	Δ
Investments/GDP	Δ
top 10% income share	Δ
broad money/GDP	Δ
short term interest rate	Δ
real GDP per capita	Δ
real credit growth	Δ

Methods used: Im, Pesaran and Shin W-stat, ADF and PP (Fisher Chi-Square) test

Notes: unit root tests with individual intercept, and Schwartz Info Criterion

Δ stands for first difference, and log for logarithm

Table 2: Correlation matrix for advanced economies dataset variables

Correlation Probability	top 10% income share	real GDP per capita	real credit growth	broad money/GDP	investments/gdp	household debt/gdp	consumer price index	short term interest rate
top 10% income share	1.000							
	(.)							
real GDP per capita	-0.207	1.000						
	(0.000)	(.)						
real credit growth	-0.008	0.673	1.000					
	(0.800)	(0.000)	(.)					
broad money/GDP	0.237	0.316	0.547	1.0000				
	(0.000)	(0.000)	(0.000)	(.)				
investments/gdp	-0.205	0.283	0.190	0.338	1.0000			
	(0.000)	(0.000)	(0.000)	(0.243)	(.)			
household debt/gdp	-0.157	0.012	0.002	-0.369	0.237	1.0000		
	(0.000)	(0.700)	(0.942)	(0.261)	(0.000)	(.)		
consumer price index	-0.099	0.936	0.394	0.394	0.223	-0.035	1.0000	
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.274)	(.)	
short term interest rate	-0.417	-0.019	-0.237	-0.237	0.224	0.071	-0.082	1.0000
	(0.000)	(0.559)	(0.000)	(0.000)	(0.000)	(0.028)	(0.011)	(.)

Probability t = 0 in parenthesis

Table 3 : OLS estimations of real credit growth determinants for 14 advanced economies

Variable / Time period	(1) 1873 - 2016	(2) 1873 - 2016	(3) 1873 - 1980	(4) 1980 - 2014	(5) 1980-2016
Δ real credit t-1	0.435***	0.212***	0.173***	0.400***	0.392***
	(0.031)	(0.030)	(0.064)	(0.047)	(0.045)
Δ top 10% income share t-1	- 0.213	-0.206*	0.121	- 0.443**	- 0.425**
	(0.119)	(0.119)	(0.180)	(0.178)	(0.184)
Δ real GDP per capita t-1	0.000***	0.000***	0.000*	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ Household debt/GDP t-1	0.011	0.007	0.012	-0.457	–
	(0.030)	(0.030)	(0.027)	(0.372)	
Δ CPI t-1	0.001**	–	0.002	0.000	–
	(0.000)		(0.003)	(0.001)	
Δ short term interest rate t-1	- 0.001*	-0.001**	0.000	- 0.003**	-0.002**
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Δ broad money/GDP t-1	0.036	–	0.081*	- 0.063	–
	(0.032)		(0.046)	(0.072)	
Δ investments/GDP t-1	0.229***	0.216***	0.097	0.516***	0.493***
	(0.067)	(0.067)	(0.079)	(0.183)	(0.181)
r squared	0.28	0.28	0.50	0.49	0.49
number of observations	819	819	371	459	459

Notes: The independent variable is real credit growth, which is total bank loans/GDP. Both period and cross country fixed effects are included. Standard errors are written in parenthesis.

*** p< 0.01, ** p<0.05, * p<0.1

Table 4: Unit root tests for emerging economies dataset variables

Variables	Stationarity
Consumer Prices Index	Δ log
GDP	Δ
Investments/GDP	Δ
top 10% income share	Δ
broad money/GDP	Δ
lending interest rate	Δ
real GDP per capita	Δ
real credit growth	Δ

Methods used: Im, Pesaran and Shin W-stat, ADF and PP (Fisher Chi-Square) test

Notes: unit root tests with individual intercept, and Schwartz Info Criterion

Table 5: Correlation matrix for emerging economies dataset variables

Correlation probability	consumer price index	real credit growth	investments/GDP	lending interest rate	broad money/GDP	real GDP per capita	top 10% income share
consumer price index	1.000000						
	-----						
real credit growth	0.467607	1.000000					
	(0.000)	-----					
investments/GDP	-0.056293	-0.016859	1.000000				
	(0.566)	(0.8638)	-----				
lending interest rate	-0.561860	-0.222838	-0.272428	1.000000			
	(0.000)	(0.0217)	(0.004)	-----			
broad money/GDP	0.505625	0.824552	0.190903	-0.362576	1.000000		
	(0.000)	(0.0000)	(0.050)	(0.000)	-----		
real GDP per capita	0.495122	0.813082	0.099712	-0.206623	0.828323	1.000000	
	(0.000)	(0.0000)	(0.309)	(0.033)	(0.000)	-----	
top 10% income share	0.551868	0.560651	-0.092746	-0.249828	0.552442	0.352686	1.000000
	(0.000)	(0.0000)	(0.344)	(0.009)	(0.000)	(0.000)	-----

Probability t = 0 in parenthesis

Table 6: OLS estimations of real credit growth determinants for 10 emerging economies

	(1)	**(2)**
Variable / Time period	**1980-2016**	**1967-2013**
Δ real credit *t*-1	**0.221**	-
	(0.199)	
Δ top 10% income share *t*-1	**-37.918**	-
	(41.778)	
Δ real GDP per capita *t*-1	**0.003****	**0.004*****
	(0.001)	(0.001)
Δ real GDP per capita t-2	-	**0.001**
		(0.001)
Δ real GDP per capita t-3	-	**-0.004*****
		(0.001)
Δ *ln* CPI *t*-1	**0.216**	-
	(0.282)	
Δ lending interest rate *t*-1	**-0.078**	**0.195***
	(0.246)	(0.128)
Δ broad money/GDP *t*-1	**0.001**	**0.195****
	(0.183)	(0.079)
Δ investments/GDP *t*-1	**1.017**	-
	(1.101)	
r squared	0.49	0.15
number of observations	96	224

Notes: The independent variable is real credit growth, which is total bank loans/GDP.

Both period and cross country fixed effects are included.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$