Masters

Mathematical Finance

Master's Final Work

Dissertation

The resilience of higher education enrollment to banking crises: an exploratory empirical study

Carlota Fonseca de Oliveira

October - 2020

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Supervision:
Bruno Damásio
Bruno Rocha

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Resumo

O impacto das crises bancárias sistémicas tem efeitos severos na economia — tão severos ao ponto de por vezes não se observar sinais de recuperação. Será que este impacto afeta o sector da educação? Em princípio, durante uma recessão existem fatores que apontam para um aumento nas matrículas terciárias e outros que apontam para o contrário. Tanto quanto sabemos, não existem estudos que usam dados em painéis que investiguem o efeito médio de crises bancárias nas matrículas terciárias. A ambição deste estudo passa por investigar o efeito de crises bancárias sistémicas nas matrículas terciárias num painel de 80 países entre o período de 1980 e 2017. A metodologia adotada foi as projeções locais de Jordà (2005). Os resultados demonstram um efeito nulo, ou seja, as matrículas terciárias parecem "sobreviver"a um choque de grande magnitude. Como o nível de rendimento de um país é um fator que pode influenciar as matrículas terciárias, complementámos a nossa análise com a separação por níveis de rendimento i.e. países de baixo-, meio-, e alto-rendimento. Nos países de baixo-rendimento um choque de uma crise bancária provoca uma diminuição nas matrículas terciárias. As conclusões a que chegámos contribuem para a compressão do impacto de crises bancárias sistémicas na educação.

Abstract

The impact of systemic banking crises has severe effects on the economy — so severe that sometimes the economy shows no signs of recovery. Does this impact reach the higher education sector? In principle, during a recession there are factors that point to an increase of tertiary enrollments and others that point in the opposite direction. To the best of our knowledge, there are no studies using panel data that estimate the effect of banking crises on tertiary enrollment. The objective of this paper is to investigate the impact of systemic banking crisis on tertiary enrollments in a large panel of 80 countries between 1980 and 2017. The methodology adopted was local projections by Jordà (2005). The results show a null effect meaning that tertiary enrollment "survives" to a shock of great magnitude. As income level is a factor that may influence tertiary enrollments, we complemented our analysis by looking at different income level groups i.e. low-, middle- , and high-income countries. We find that in low-income countries a banking crisis shock leads to a decrease of tertiary enrollments. Our findings contribute to improve our understanding of the impact of systemic banking crises on tertiary education.

Contents

1 Introduction

In the last decades, education has increasingly been seen as an important, if not critical, factor for economic development; this has led, accordingly, to a greater propensity for public authorities, private corporations, and households to invest in the formation of human capital. Since the labor market has become progressively knowledge-based, the demand of high skills has been growing — in the OECD countries, for example, 35% of the population in the 25-34 age group held a tertiary degree in 2008; in 2018 that percentage was of 44%. The benefits of a higher education are often linked to higher salaries, lower expectation of unemployment — for example, according to OECD (2019) the employment rate is 9 percentage points higher for individuals with tertiary education compared with the adults with upper secondary education only —, more financial stability, personal development, *inter alia*.

During a banking crisis, households may be negatively affected through multiple channels. For instance, a direct impact of banking crises on households may operate through a reduction in wealth if losses are imposed on bank depositors. Brown (2013) studies the impact on households of recent banking crises in Europe and Central Asia and finds that the labor market tends to be the channel that, indirectly, affects individuals the most. Adjustments in the public sector and public policies are also channels through which banking crises may impact households (in particular if these coincide with sovereign debt crises).

Indeed, a macroeconomic negative shock can in principle affect the education sector, leading to changes in education institutions e.g. reductions in the number of maximum allowed enrollments, less research funding, dismissing staff, etc. Likewise, families may suffer a decrease in their wealth due to e.g. wage cuts, increased unemployment, and a decrease on the returns of their investments. However, it is generally thought that economic shocks can have both negative and positive effects on school enrollments — on the one hand, a decrease in family income may lead in many cases to the impossibility of paying tuition fees and other costs; yet, on the other hand, as unemployment increases, many individuals may have extra time and availability, and may wish to invest in the development of new competencies to become more high-skilled.

In fact, the existing literature provides mixed results. Mehrotra (1998), for example, shows that in Thailand a reduction in the household income generates a shift from private to public schools in well-to-do families, while in the poorest families children dropped out of school. Varghese (2020) provides an overview on the impact of the Asian 1997 crisis[1] on higher education. In Indonesia the growth of enrollments declined in both public and private universities. However, in Malaysia there was an increase in higher education enrollment during the crisis period; the same happened, to a limited extent, in Singapore[2].

This paper contributes to the clarification of the effect of macroeconomic shocks on higher education enrollment by analyzing the specific case of systemic banking crises, which are relatively rare events with large and long-lasting economic effects. The rest of this paper is organized as follows. Section 2 discusses briefly the definition, causes, and effects of banking crises. Section 3 discusses the benefits of a higher education degree and what economic conditions may affect tertiary enrollments. Section 4 describes the Local Projections methodology adopted in this investigation and the data we use. Section 5 presents our results. Section 6 concludes.

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[1] That spread to some countries in East Asia — Indonesia, Malaysia, Singapore and later Korea

[2] The increase in student enrollment was justified by the fall in the currency, especially in Malaysia. The reasons are two-folded: i)it became too expensive to live abroad so many national students returned to study in national universities and ii)Malaysia became attractive to foreigners because of the cheaper lifestyle.

2 Banking Crises

2.1 Definition and causes

There is no universal definition of systemic banking crises and in this paper we will adopt the one from Laeven and Valencia (2018). This is usually used as a standard reference on how to identify a banking crisis in the literature. According to these authors, a systemic banking crisis must meet two conditions — 1) when the banking system reveals considerable signs of distress and 2) significant banking policy interventions in response to the distress of the first condition. There can be an exception in this definition — banking crises can only meet the first condition when the losses are very severe, more precisely if *(i) a country's banking system exhibits significant losses resulting in a share of nonperforming loans above 20 percent of total loans or bank closures of at least 20 percent of banking system assets or (ii) fiscal restructuring costs of the banking sector are sufficiently high, exceeding 5 percent of GDP* (Laeven and Valencia (2018), p.5).

There are other well-known papers that provide different definitions of banking crises. Reinhart and Rogoff (2009b) define a banking crisis as: 1) a run to the banks that leads to closing, merger or acquisition by the public sector of one or more financial institutions; 2) in the case of the non-occurrence of the events in 1), the closing, merger, acquisition or governmental assistance on a large scale of an important financial institution. The reason behind the adoption of the Laeven and Valencia (2018) definition lies essentially on its objectivity in comparison with other classifications, which leads to a lower probability of including minor episodes of financial distress i.e. non-systemic events. The objectivity of Laeven and Valencia (2018) is due to the fact that significance is defined in a quantitative perspective, for example concerning the interpretation of what are significant policy interventions. It is necessary that at least three of the following measures occur: *1) deposit freezes and/or bank holidays; 2) significant bank nationalizations; 3) bank restructuring fiscal costs (at least 3 percent of GDP); 4) extensive liquidity support (at least 5 percent of deposits and liabilities to nonresidents); 5) significant guarantees put in place; and 6) significant asset purchases (at least 5 percent of GDP);* (Laeven and Valencia (2018), p.5).

The solid functioning of the bank system is clearly fundamental for the economy. Banks provide financial services, more specifically deposits (banks' liabilities) and

credit (assets), to consumers and businesses. In this way, the insolvency of a bank comes from the fact that the value of the assets falls short of the value of the liabilities e.g. when loan losses (due to the fact of borrowers become unable to pay them) are superior to the capital and reserves of a bank. Since banking crises are commonly associated with the banking system encountering loan losses in excess of its capital, a question arises — what can provoke banking distress? Calomiris (2010) gives an understanding of the *two distinct phenomena associated with banking system distress: exogenous shocks that produce insolvency, and depositor withdrawals during 'panics'* (Calomiris (2010), p.17).

Throughout history there has been multiple banking crises. Reinhart and Rogoff (2009b) count 268 banking crises between 1800 and 2008 in more than 70 countries, whereas Laeven and Valencia (2018) identify 151 systemic banking crises during the period of 1970 until 2017 in 165 countries. The literature has identified some commonalities from the analysis of these events — many of them consist of an unavoidable burst of some form of asset bubble followed by government attempts to bring economic stability. Reinhart and Rogoff (2009b) find that banking crises are usually associated to a precedent period of credit booms or asset price bubbles connected to the fact that banks were exposed to a range of risks like credit, liquidity, and interest rate risk. Honohan (2000) identifies several factors that can lead to the onset of a banking crisis: macroeconomic circumstances, poor microeconomic management, and crises that are endemic to a government-permeated banking system[3]. In addition, Demirguc-Kunt and Detragiache (1998) suggest that crises are normally associated with a poor macroeconomic environment (low growth and a high inflation) and also find a positive association between high real interest rates and the occurrence of systemic banking crises.

2.2 Economic effects

By examining a sample of countries that have experienced banking crises, Lindgren et al. (1996) note that real GDP growth and economic efficiency[4] decreased. Bordo et al. (2001) estimates a loss of 6% of GDP associated to banking crises in the last quarter of the 20th century. Teulings and Zubanov (2014) investigate the

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[3]There are countries where the banking system is assured by the financing of government e.g. by direct lending and/or changing the taxes.

[4]In this context the authors consider that economic efficiency is the *output-to-capital ratio, calculated as GDP ate 1987 prices divided by capital stock at 1987 prices* (Lindgren et al. (1996), p.83).

effect of banking crises on GDP on 99 countries between 1974 and 2001 with Jordà (2005) methodology. The authors find that an average banking crisis generates approximately a 10% loss on GDP showing little sign of recovery. They also suggest that banking crises are more critical for African countries. Reinhart and Rogoff (2014) investigate the change of real per capita GDP in a sample of 100 systemic banking crises and conclude that, on average, it takes about eight years to reach the pre-crisis level of income (the median is about 6.5 years). Cerra and Saxena (2008) use a panel data of 190 countries and establish that banking crises have a considerable negative effect on GDP that last at least 10 years. The results of this paper were broken down by region and income level — in all groups it was verified an output loss of more than 6%, except on Latin America and lower-middle income countries where the loss was less severe.

Reinhart and Rogoff (2009a) examine the effects of systemic banking crises excluding emerging market countries from their sample. They show that systemic banking crises have severe and lasting effects — *unemployment rises and housing price declines extend out for five and six years, respectively* (Reinhart and Rogoff (2009a), p.471). More specifically for unemployment losses, Reinhart and Rogoff (2009a) estimate a 7 percentage point increase in the unemployment rate. Dijk et al. (2020) investigate the consequences of banking crises on unemployment by age groups. Their sample includes 38 developed countries and 41 banking crises between 1990 and 2014. They conclude that unemployment rises in the beginning of banking crises and continues to increase in the next five years for all age groups except 65+. A positive aspect is that unemployment recovers in the longer run — however, even 10 years after a crisis, unemployment does not meet pre-crisis levels.

3 The links between economic conditions and higher education

3.1 The benefits of education

At a general level, the economic benefits of education are usually associated to a decrease in unemployment, an upgrade in human capital in the long run, and to a decline in the poverty levels. A variety of variables have been used to measure education — Barro (1991), Mankiw et al. (1992) and Levine and Renelt (1992) made use of schools enrollments, Romer (1990) and Durlauf and Johnson (1995) investigated the change on education by considering adult literacy rate, Krueger and Lindahl (2001) and Hanushek and Woessmann (2008) the average years of schooling, Baldacci et al. (2008) considered education spending, Hanushek and Kim (1995), Hanushek and Kimko (2000) and Hanushek and Woessmann (2008) collected data on cognitive skills in mathematics and science. Although these authors found a positive relation between economic growth and education, there were studies, as Bils and Klenow (2000), that found a poor link between them and other studies like Pritchett (2001) that found no association.

According to most of the literature, the benefits of tertiary education for individuals appear to be clear and observable. That is, there is an association of higher education to better employment opportunities and higher earnings. Strauss and Maisonneuve (2007) present a study for 21 OECD countries and find that in 2001 the gross hourly wage premium after the completion of tertiary education is 55%, translating into a premium of approximately 11% per year[5]. Also, according to a more recent OECD (2019) report, in the OECD economies adults[6] with a tertiary degree earn on average 57% more in comparison with the individuals that only completed an upper secondary education.

Due to the benefits associated to a tertiary education, it is possible to observe a growth trend on tertiary enrollments over the years — for Chapman and Chien (2014) show that tertiary enrollments have been growing across Asia in the last two decades. According to OECD (2019) in 2017 for OCDE countries experienced the largest share of young adults attaining a bachelor's programmes (24%). Kimenyi

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[5]The lowest wage premium per annum is 6% (in Spain and Greece) and the highest is 14-18% (in the most of the Anglo-Saxon countries, Portugal and Hungary).

[6]Between 25 and 64 years old.

(2011) finds that higher education is a necessity for economic development. The author also adds that in developing countries, specially in Africa, higher education has only recently been seen as a priority. Bloom et al. (2014) investigated the impact of tertiary enrollment rates in Sub-Saharan Africa between 1975 and 2010. The authors conclude that there are both public and private channels through which higher education may yield economic development e.g. research and development or productivity improvements respectively.

3.2 Education during economic recession

It is interesting to observe the behavior of higher education during adverse situations i.e. if there is an effect on tertiary education enrollments during periods of economic recession and, in particular, of banking crises, as these financial-economic shocks typically lead to substantial GDP losses and are associated to slow recoveries (see the discussion above in section 2.2). On the one side, people could be motivated to enroll in college due to the lack of work. On the other side, they might not be able to fulfill that personal objective, as the relative cost of pursuing a degree may increase as their personal wealth decreases. To the best of our knowledge, there are no studies using multi-country panel data to estimate the average effect of banking crises on tertiary enrollment.

Brown and Hoxby (2014) studied the effect of the Great Recession on the enrollment rates of colleges in the United States by following the human capital framework[7]. The authors concluded that, while families experienced a decrease in their income, college's enrollments grew, especially in the states that were most affected by the recession[8]. Bell and Blanchflower (2011) concluded that enrollment increased mostly among 16-24 year-olds by cause of the lack of employment. Skrbinjek et al. (2018) studied the impact of the economic crisis during 2008 and 2012 in 30 countries using cluster analysis method. The authors used five variables (GDP per capita, real GDP growth rate, unemployment rate, fiscal surplus/deficit and gross debt) to

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[7]Relying on Becker (1964), the author assumes that college enrollment is explained by family background, income and home ownership and unemployment.

[8]To separate the most affected states from the less affected by the Great Recession, the authors consider two factors: the unemployment rate (the most affected states were those where the unemployment rate grew 6.5 percentage points or more) and home values (more precisely the Conventional Mortgage House Price Index (CMHPI) — if a state had more than 80 points then it was considered as an severely affected state). The states that were more affected were: Alabama, Arizona, California, Florida, Hawaii, Illinois, Maryland, Massachusetts, Michigan, Nevada, New Jersey, Rhode Island.

separate the countries in two groups and concluded that in the economically less affected countries demand for higher education was higher.

4 Empirical methodology and data

4.1 Empirical methodology

The aim of this paper is to study the impact of banking crises on tertiary enrollments (% gross) in a sample of 80 countries between 1980 and 2017. The choice of countries, period of analysis, and control variables were dependent on data availability[9]. The countries included in this study are listed in the Appendix. We estimate impulse response functions of enrollment to banking crises using local projections methods (Jordà (2005)). This method has been used to study the macroeconomic effects on banking crises e.g. Jordà et al. (2013), Furceri and Zdzienicka (2012), and da Rocha and Solomou (2015). Local projections are estimated with standard regression models. They are robust to misspecification, as the projections are local to each forecast horizon. When estimating cumulative impulse responses for panel data the general equation for country i, year t, lags s, and forecast horizon h is the following:

$$y_{i,t+h} - y_{i,t-1} = \alpha_i^h + \eta_t^h + \delta^h D_{i,t} + \boldsymbol{\lambda}^h \boldsymbol{X}_{i,t-s} + u_{i,t+h}^h \tag{1}$$

where the dependent variable is $y_{i,t+h} - y_{i,t-1}$ (since y is a ratio). The dummy variable $D_{i,t}$ equals 1 if the banking crisis starts in the i-th country and in year t, and 0 otherwise. The vector $\boldsymbol{X}_{i,t}$ contains the lags of the dependent variable, the lags of the explanatory variable, the set of control variables — currency crises, sovereign debt crises, log of GDP per capita, unemployment rate, expenditure on education (% GDP), domestic credit to private sector (% GDP), public Expense (% GDP), central government debt total (% of GDP), and a measure of the democracy level of each country — and, their respective lags[10]. We control for country and year fixed effects using α_i^h and η_t^h respectively. We restraint our forecast horizon to a maximum h of 6 i.e. the horizon of the analysis corresponds to half a decade.

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[9]We started by removing countries with a population inferior to one million. In addition, we excluded the countries that had less than 26 observations for tertiary enrollments — this corresponds to two thirds of observations for the period of 1980-2017

[10]For the dependent, explanatory, and control variables we consider no lags, lag=1 and lags=2.

4.2 Data

4.2.1 Banking crises

Systemic banking crises do not have a unique definition and therefore in this paper we adopt the classification of Laeven and Valencia (2018). These authors identify 151 systemic banking crises in 165 countries. Table A1 in the Appendix contains the dates of systemic banking crises between 1970 and 2017 for the 80 countries in study. Other databases of systemic banking crises, as for example Reinhart and Rogoff (2009b), were not taken into consideration in this paper as they include many minor events i.e. non-systematic banking crises.

Between 1970 and 2017, for the 80 countries in this study we count 91 systemic banking crises. The year with most occurrences (18) was in 2008 i.e. at the start of the Great Recession and mainly on European countries. However, the decade with more crises was the 90s with 37 crises — some occurred in former-communist countries[11]. In 1995, 1997, and 1998 are the years with a higher frequency of events. Only two banking crises occurred after 2010 — Ukraine and Moldova, both in 2014. Ukraine and Argentina had three and four banking crises respectively between 1970 and 2017, while 54 countries had only one banking crisis, 15 countries had two, and only 9 countries had no banking crises.

4.2.2 Tertiary enrollments (% gross)

Higher education is defined as post-secondary education which includes university, training schools, and other post-secondary institutions. Gross tertiary enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to tertiary education. This variable was sourced from World Bank (2019) for the period of 1980-2017. In order to compare results, we also collected secondary enrollments (% gross) from World Bank (2019) for the same period and countries.

As we can see in Figure 1, there is a clear growth trend in tertiary enrollments over the years. Figure 1 also shows tertiary enrollments by income level — countries with higher incomes have the higher tertiary enrollments ratio too. In 1980 the

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[11]To some extent this may capture the shock of the collapse of the planned production system in the first half of the decade, going beyond what would be a simple banking crises — for more detail see da Rocha (2015) and Campos and Coricelli (2002).

Figure 1: Tertiary enrollments (% gross) by income level
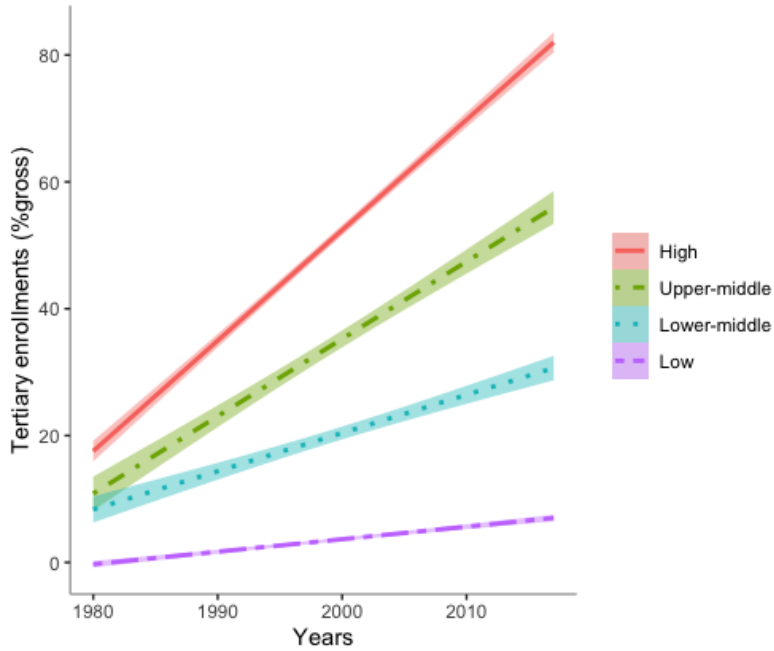
Note: The sample only includes the 80 countries in our study. Author's calculations using World Bank (2019) and World Bank Analytical Classifications (2020).

country with the highest enrollment was the United States with 53,6 followed by the Russian Federation with 45,2; the lowest ratio was that of Mozambique with 0,07. In 2017, the countries with the highest enrollments ratios were Greece (136,6) and next South Korea (94,4); the lowest was Mali, with a ratio of 4,5.
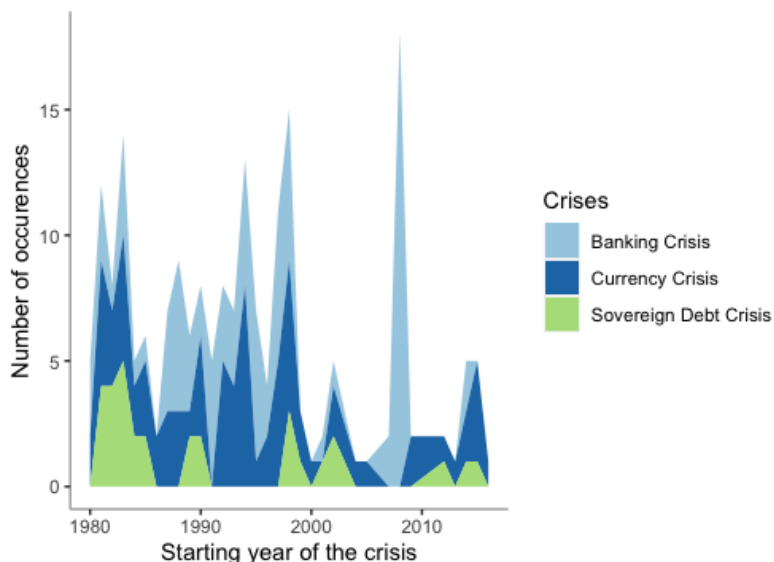
4.2.3   Control Variables

In section 4.1. we define a set of control variables in order to attenuate the possible endogeneity of banking crises. The inclusion of control variables increases the probability of estimating a casual effect since we try to avoid the occurrence of omitted variable bias. Indeed, most of the of the control variables chosen in this study may have an effect on tertiary enrollments and increase or decrease the probability of the occurrence of a banking crisis. We start by considering currency[12] and sovereign debt crises. The dates of these crises are also from Laeven and Valencia (2018)[13] — see Table A1 for the 80 countries considered in this paper: 99 currency

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[12]Currency crisis are defined as *a 'sharp' nominal depreciation of the currency vis-a-vis the U.S. dollar. We consider two thresholds for a depreciation to meet this definition: i) a year-on-year depreciation of at least 30 percent; and ii) of at least 10 percentage points higher than the rate of depreciation observed in the year before.* (Laeven and Valencia (2018), p.9).

[13]During the period of 1970 and 2017, Laeven and Valencia (2018) identify 326 currency crises and 74 sovereign crises in 165 countries

crises and 31 sovereign debt crises. Banking and sovereign debt crises sometimes
have a common start (see Figure 2), with spillovers from the banking system to
the public sector and/or vice versa. Regarding the co-occurrence of banking and
currency crises, this is usually associated to the possible negative effects of the sharp
depreciation of the currency on banks.

Figure 2: Banking, currency and sovereign debt crises

Note: The sample only includes the 80 countries in study. Source: Laeven and Valencia
(2018).

The choice of control variables reflects the discussion in Section 2 and data avail-
ability. There are many factors that may influence individuals to pursue a higher
education degree. We consider more control variables including unemployment rate
and GDP per capita (data from World Bank (2019)). In addition, we consider as
control variables the government expenditure on education (% of GDP), domestic
credit to private sector (% of GDP), public expense (% GDP) (data from World
Bank Indicators), central government debt total (% of GDP) (data from Inter-
national Monetary Fund International Monetary Fund (2019)) and polity2 (from
Marshall (2020)). If domestic credit to private sector (% of GDP) is high, then this
indicates that a financial shock (as a banking crisis) tends to propagate at a fast
pace and with higher force in the economy. The public expense indicates the weight
of a government in the economy and the central government debt helps to perceive
the amount of operational leverage that a government has in the event of macroe-
conomic shock. Finally, polity2 captures the democracy level of a country. The
indicator varies between 10 (representing a strong democracy) and -10 (meaning a
strong autocracy).

Table 1 Summary statistics of the dependent and control variables.

| Variables	Observations	Average	Min	Max	Std. Deviation	Median
Tertiary Enrollments (% gross)	2669	31,31	0,07	136,60	25,20	25,79
Currency crises (1 in case of occurrence 0 otherwise)	3002	0,03	0	1	0,16	0
Sovereign debt crises (1 in case of occurrence 0 otherwise)	3002	0,01	0	1	0,10	0
Unemployment (% of total labor force)	1947	8,25	0,05	38,80	5,85	7,54
GDP per capita (constant 2010 US$)	2776	12140,99	164,19	91565,73	17287,42	3605,69
Gov. expenditure on education (% of gov. expenditure)	1664	4,45	0,87	13,22	1,58	4,49
Domestic Credit to private sector (% GDP)	2343	47,73	0,19	206,67	41,85	33,41
Public expense (% GDP)	1747	28,41	7,59	79,14	11,43	28,55
Central Gov. Debt (% GDP)	2324	53,78	1,27	302,19	36,41	45,92
Polity2 (index from -10 to 10)	2876	3,34	-10	10	6,81	6

5 Empirical Results

5.1 Baseline

In this section, we present a set of local projections results based on equation 1 —
we estimate impulse response functions (IRFs) with no lags, lag=1 and lags=2 (of
the dependent, explanatory, and control variables) and, in addition, regressions with
different sets of control variables; we also estimate IRFs without control variables
as a way to maximize the number of available observations. The study considers a
horizon window of half a decade.

The first set of analysis on Table 2 examines the impact of banking crises on ter-
tiary enrollment (% gross) excluding control variables. Even though the estimate on
banking crises is not statistically significant, we can observe that the points estimate
are mostly positive. As we observe in Figure 3, the confidence bands show a large
uncertainty in the effect of the shock. This is in line with the discussion above about
the ambiguity of the effect of a banking crisis shock on tertiary enrollments. There
may be effects of opposite sign pointing to a null net effect — on average, tertiary
enrollment "survives" to macroeconomic shocks of great magnitude. However, in
the specification of lags=2 we find some evidence of a positive effect i.e. if there
are effects of opposite signs then the positive one seems to carry more weight. The
same conclusion can be taken when examining Figure 4 and Table A3 (available in
the Appendix) where, in order to keep a large number of observations, the control
variables are log of GDP per capita, polity2 and, currency and sovereign debt crises.

Figure 3: Impulse response function on tertiary education enrollment with no
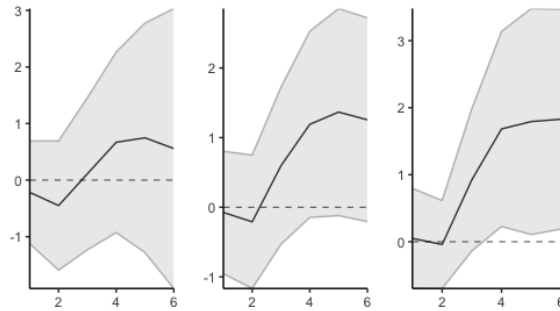control variables
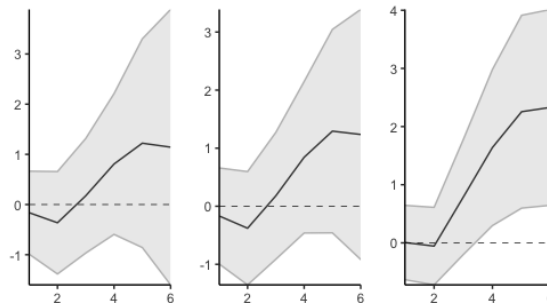
Note: Control variables excluded. Confidence bands of 95%. The first column is no lags,
the second is lag=1 and the third one is lags=2. The sample includes 80 countries and
2669 observations.

Table 2 Impulse response function with no control variables.

	h=0	h=1	h=2	h=3	h=4	h=5
1. No lags						
	-0,1627	-0,3636	0,1748	0,8077	1,2223	1,1431
	(0,4219)	(0,5208)	(0,5825)	(0,7156)	(1,0609)	(1,4002)
Number of Observations	2401	2308	2219	2134	2067	1986
2. Lag=1						
	-0,1680	-0,3787	0,1802	0,8434	1,2936	1,2363
	(0,4222)	(0,4977)	(0,5576)	(0,6655)	(0,8939)	(1,0985
Number of Observations	2401	2308	2219	2134	2067	1986
3. Lags=2						
	0,0062	-0,0557	0,7865	1,6399	2,2555	2,3306
	(0,3259)	(0,3401)	(0,5045)	(0,6850)	(0,8460)	(0,8589)
Number of Observations	2218	2115	2027	1951	1880	1807

Note: The estimations are based on Equation 1. No control variables are included. Country-based cluster-robust standard errors in parentheses. The sample includes 80 countries.

Figure 4: Impulse response function on tertiary enrollment with GDPpc, polity2, currency crises and sovereign debt crises as control variables

Note: Confidence bands of 95%. The first column is no lags, the second is lag = 1 and the third one is lags = 2. The sample includes 78 countries and 2430 observations.

In Figure 5, when the sample includes all of the control variables, we can observe that the confidence bands show a large uncertainty in the effect of a banking crisis shock on tertiary enrollments pointing to a zero effect in statistical terms. An important difference between the first two Figures (Figure 3 and Figure 4) and Figure 5 lies in the most complete specification — in the IRF that includes all

Figure 5: Impulse response function on tertiary education enrollment with all control variables
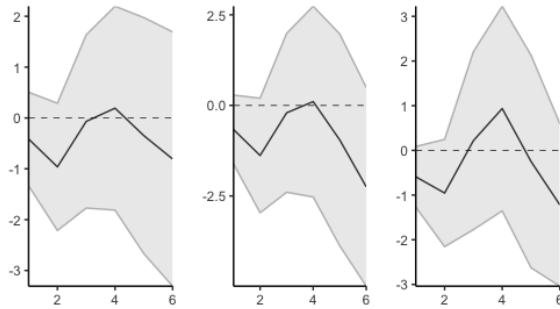
control variables and two lags (Figure 5) there is not an evidence of a stronger positive effect.

So far, the results offer compelling evidence for the ambiguity on the effect of a banking crisis on tertiary enrollments. For comparison purposes, we also extend our analysis to secondary enrollments (% gross) — see Figure A1 and Figure A2 in the Appendix. The confidence bands indicate a significant uncertainty. We can conclude that there is no effect of a shock of a banking crisis on the secondary enrollments. These results are not surprising, as in many countries secondary education is mandatory and, in addition, the costs of attending secondary school is much lower comparing to attending university.

5.2   Impulse response functions by income level

Our study provides further evidence on the effect of banking crisis shocks on tertiary enrollments. We estimate IRFs for different income level countries. We considered three distinct groups — low-, middle-, and high-income economies (see list in Table A2 in the Appendix[14]). It is interesting to note that there is a clear distinction between the shape of the different impulse responses. In the group of high- and middle-income countries, Figure 6 and Figure 7 respectively, we verify the zero effect mentioned above i.e. the confidence bands express a considerable uncertainty about the impulse responses conducting the conclusion to a zero effect in statistical terms. However, in the high-income economies, in the specification of lags=2, the IRF shows some evidence of a positive effect of a banking crises shock

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[14]The classification is from the World Bank Analytical Classifications (2020)

on tertiary enrollments.

Figure 6: Impulse response function on tertiary enrollment excluding control variables — high-income countries
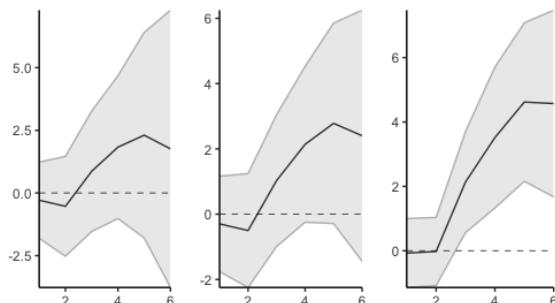
Note: Confidence bands at 95%. The first column is no lags, the second is lag=1 and the third one is lags=2. In $h = 0$ the sample includes 27 countries and 967 observations.

In Figure 8 (low-income economies) the IRFs are significantly negative for most of the horizons meaning that tertiary enrollments are negatively affected by these shocks. In order to confirm the low-income IRF result without losing too many observations, we re-estimate this IRF with the following control variables: log of GDP per capita, polity2, currency crises, and sovereign debt crises – see Figure 9. Figure 8 and Figure 9 show that in the low-income countries a banking crisis shock incites a negative change on tertiary enrollments.
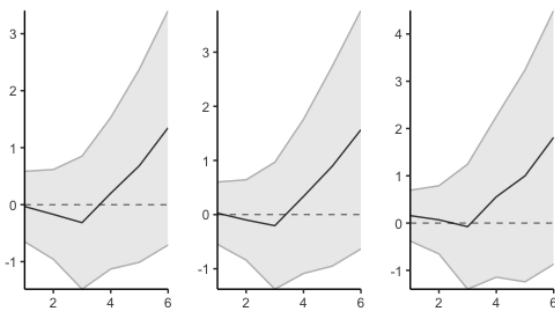
Figure 7: Impulse response function on tertiary enrollment excluding control variables — middle-income countries

Note: Confidence bands at 95%. The first column is no lags, the second is lag=1 and the third one is lags=2. The sample includes 40 countries and 1268 observations.

In a general way, a macroeconomic shock affects each family differently — there may be a critical reduction in the household income, mainly in the poorest families. In high-income countries there are a bigger state support (e.g. unemployment benefits, scholarships etc) in comparison with low-income economies. This lack of state support in the low-income countries together with a higher number of poor families

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may justify the decrease on tertiary enrollments. One limitation of our implementation is the small number of low-income countries so these results should be treated accordingly.

Figure 8: Impulse response function on tertiary enrollment excluding control variables — low-income countries

Note: Confidence bands at 95%. The first column is no lags, the second is lag=1 and the third one is lags=2. The sample includes 13 countries and 399 observations.

Figure 9: Impulse response function on tertiary enrollment with GDPpc, polity2, currency crises and sovereign debt crises as control variables — low-income countries
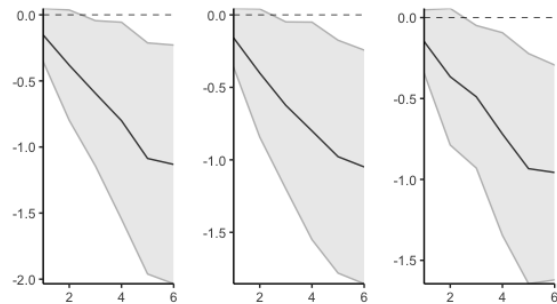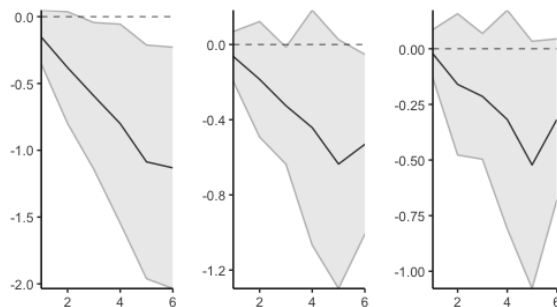

Note: Confidence bands at 95%. The first column is no lags, the second is lag=1 and the third one is lags=2. The sample includes 13 countries and 385 observations.

6 Conclusions

This work has led us to conclude that on average the effect of banking crises on tertiary enrollments is essentially zero. The confidence bands highlighted a considerable uncertainty on the impulse responses showing an absence on the effect. In general, these results suggest that there is no evident effect of a banking crisis shock on tertiary enrollments. In addition, for comparison purposes, we extended our research to secondary enrollments where we found that the impact of a systemic banking crisis has, as expected, a zero effect on secondary school enrollments.

The apparent ambiguity in the correlation between banking crises and tertiary enrollments can be attributed to the fact that there are aspects that contribute to a positive relation and others that promote for the opposite. In this way, the zero effect may be justified by a sum of factors of opposite sign.

This paper extended the analysis for different income level countries. In the middle- and high-income countries the estimated IRFs, once again, confirmed a general absence of an effect. However, there is an interesting exception: in the high-income countries the IRF of lags=2 presents some evidence of a positive relation between tertiary enrollments and a banking crisis shock. In low-income countries, banking crises appear to have a negative impact on the tertiary enrollments for at least half a decade. This result may be the consequence of a critical reduction in the household income and a small state support.

The average lack of correlation between banking crises and tertiary enrollments pose a challenge to perceive if there are factors of opposite sign that cancel the effect or if simply there are an absence on the impact of a banking crisis on the tertiary enrollments. In addition, it would be useful to develop a more detailed study for the low- and high-income countries and understand if the contrast between high and low economies lead to the null effect in the complete sample.

There is a long debate over the most efficient way of aiding the less developed economies. The low-income countries show a negative effect that could extend for a longer period of time. These results make a small contribution in the selection of the right policies — they could be useful to protect higher education students in low-income countries.

Appendix

The countries included in this study are the following: Albania, Algeria, Argentina, Austria, Bangladesh, Belarus, Belgium, Benin, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Chile, China, Colombia, Czech Republic, Denmark, Arab Republic of Egypt, El Salvador, Estonia, Ethiopia, Finland, France, Greece, Guinea, Honduras, Hungary, India, Indonesia, Ireland, Israel, Italy, Jordan, Republic of Korea, Kyrgyz Republic, Lao PDR, Latvia, Lesotho, Lithuania, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mexico, Moldova, Mongolia, Morocco, Mozambique, Nepal, Netherlands, North Macedonia, Norway, Panama, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Slovenia, Spain, Sweden, Switzerland, Syrian Arab Republic, Tajikistan, Tanzania, Thailand, Togo, Tunisia, Uganda, Ukraine, United Kingdom, United States, Uruguay, Uzbekistan and Vietnam.

Table A1 Banking, Currency and Sovereign crises dates.

Countries	Banking	Currency	Sovereign
Albania	1994	1997	1990
Algeria	1990	1988, 1994	
Argentina	1980, 1989, 1995, 2001	1975, 1981, 1987, 2002, 2013	2014
Armenia	1994		
Austria	2008		
Bangladesh	1987	1976	
Belarus	1995	1997, 2009, 2015	
Belgium	2008		
Benin	1988	1994	
Bulgaria	1996	1996	1990
Burkina Faso	1990	1994	
Burundi	1994		

Table A1 Banking, Currency and Sovereign crises dates. (cont.)

Countries	Banking	Currency	Sovereign
Cambodia		1971,1992	
Cameroon	1987, 1995	1994	1989
Chile	1976, 1981	1972, 1982	1983
China	1998		
Colombia	1982, 1998	1985	
Croatia	1998		
Czech Republic	1996		
Denmark	2008		
Egypt, Arab Rep.	1980	1979, 1990, 2016	1984
El Salvador	1989	1986	
Estonia	1992	1992	
Ethiopia		1993	
Finland	1991	1993	
France	2008		
Greece	2008	1983	2012
Guinea	1985, 1993	1982, 2005	1985
Honduras		1990	1981
Hungary	1991, 2008		
India	1993		
Indonesia	1997	1979, 1998	1999
Ireland	2008		

Table A1 Banking, Currency and Sovereign crises dates. (cont.)

Countries	Banking	Currency	Sovereign
Israel	1983	1975, 1980, 1985	
Italy	2008	1981	
Jordan	1989	1989	1989
Korea, Rep.	1997	1998	
Kyrgyz Republic	1995	1997	
Lao PDR		1972, 1978, 1986, 1997	
Latvia	1995, 2008	1992	
Lesotho		1985, 2015	
Lithuania	1995	1992	
Madagascar	1988	1984, 1994, 2004	1981
Malawi		1994, 2012	1982
Malaysia	1997	1998	
Mali	1987	1994	
Mauritania	1984	1993	
Mexico	1981, 1994	1977, 1982, 1995	1982
Moldova	2014	1999	2002
Mongolia	2008	1990, 1997	
Morocco	1980	1981	1983
Mozambique	1987	1987, 2015	1984
Nepal	1988	1984, 1992	
Netherlands	2008		

Table A1 Banking, Currency and Sovereign crises dates. (cont.)

Countries	Banking	Currency	Sovereign
North Macedonia	1993		
Norway	1991		
Panama	1988		1983
Peru	1983	1976, 1981, 1988	1978
Philippines	1983, 1997	1983, 1998	1983
Poland	1992		1981
Portugal	2008	1983	
Romania	1998	1996	1982
Russian Fed.	1998, 2008	1998, 2014	1998
Slovenia	1992, 2008		
Spain	1977, 2008	1983	
Sweden	1991, 2008	1993	
Switzerland	2008		
Syrian Arab Republic		1988	
Tajikistan		1999, 2015	
Tanzania	1987	1985, 1990	1984
Thailand	1983, 1997	1998	
Togo	1993	1994	1979
Tunisia	1991		
Uganda	1994	1980, 1988	1981

Table A1 Banking, Currency and Sovereign crises dates. (cont.)

Countries	Banking	Currency	Sovereign
Ukraine	1998, 2008, 2014	1998, 2009, 2014	1998, 2015
United Kingdom	2007		
United States	1988, 2007		
Uruguay	1981, 2002	1972, 1983, 1990, 2002	1983, 2002
Uzbekistan		2000	
Vietnam	1997	1972, 1981, 1987	1985

Table A2 Countries by income level.

Countries	Income
Albania	Upper-middle
Algeria	Upper-middle
Argentina	Upper-middle
Armenia	Lower-middle
Austria	High
Bangladesh	Lower-middle
Belarus	Upper-middle
Belgium	High
Benin	Low
Bulgaria	Upper-middle
Burkina Faso	Low
Burundi	Low
Cambodia	Lower-middle
Cameroon	Lower-middle
Chile	High
China	Upper-middle
Colombia	Upper-middle
Croatia	Upper-middle
Czech Republic	High
Denmark	High
Egypt, Arab Rep.	Lower-middle
El Salvador	Lower-middle

Table A2 Countries by income level (cont.)

Countries	Income
Estonia	High
Ethiopia	Low
Finland	High
France	High
Greece	High
Guinea	Low
Honduras	Lower-middle
Hungary	High
India	Lower-middle
Indonesia	Lower-middle
Ireland	High
Israel	High
Italy	High
Jordan	Lower-middle
Korea, Rep.	High
Kyrgyz Republic	Lower-middle
Lao PDR	Lower-middle
Latvia	High
Lesotho	Lower-middle
Lithuania	High
Madagascar	Low
Malawi	Low

Table A2 Countries by income level (cont.)

Countries	Income
Malaysia	Upper-middle
Mali	Low
Mauritania	Lower-middle
Mexico	Upper-middle
Moldova	Lower-middle
Mongolia	Lower-middle
Morocco	Lower-middle
Mozambique	Low
Nepal	Low
Netherlands	High
North Macedonia	Upper-middle
Norway	High
Panama	Upper-middle
Peru	Upper-middle
Philippines	Lower-middle
Poland	High
Portugal	High
Romania	Upper-middle
Russian Federation	Upper-middle
Slovenia	High
Spain	High
Sweden	High

Table A2 Countries by income level (cont.)

Countries	Income
Switzerland	High
Syrian Arab Republic	Lower-middle
Tajikistan	Lower-middle
Tanzania	Low
Thailand	Upper-middle
Togo	Low
Tunisia	Lower-middle
Uganda	Low
Ukraine	Lower-middle
United Kingdom	High
United States	High
Uruguay	High
Uzbekistan	Lower-middle
Vietnam	Lower-middle

Table A3 Impulse response function with GDPpc, Polity2, Currency Crises and Sovereign debt crises as control variables.

|	h=0	h=1	h=2	h=3	h=4	h=5
a) No lags	-0,2163	-0,4495	0,1124	0,6889	0,7480	0,5586
	(0,4625)	(0,5826)	(0,6855)	(0,8138)	(1,0344)	(1,2622)
Number of						
Observations	2239	2146	2060	1978	1907	1833
b)Lag=1	-0,0749	-0,2092	0,5960	1,1906	1,3665	1,2559
	(0,4484)	(0,4886)	(0,5751)	(0,6819)	(0,7585)	(0,7464)
Number of						
Observations	2217	2124	2040	1957	1886	1814
c)Lags=2	0,0503	-0,0408	0,9248	1,6836	1,7935	1,8286
	(0,3803)	(0,3349)	(0,5414)	(0,7426)	(0,8602)	(0,8363)
Number of						
Observations	2042	1945	1862	1788	1719	1649

Note: The estimations are based on Equation 1 — the dependent variables is school enrollment on tertiary education (% gross), the shock is banking crises defined by Laeven and Valencia (2018) and the control variables are GDPpc, Polity2, Currency crises and Sovereign debt crises. Country-based cluster-robust standard errors in parentheses. The sample includes 78 countries.

Figure A1: Impulse response function on secondary enrollment excluding control variables
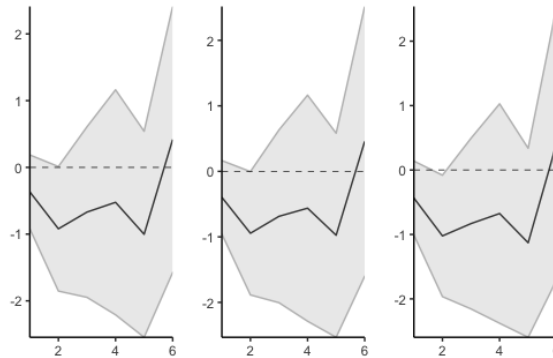
Note: All control variables excluded. Confidence bands of 95%. The first column is no lags, the second is lag = 1 and the third one is lag = 2. In h = 0 the sample includes 79 countries and 2487 observations.

Figure A2: Impulse response function on secondary enrollment including all control variables
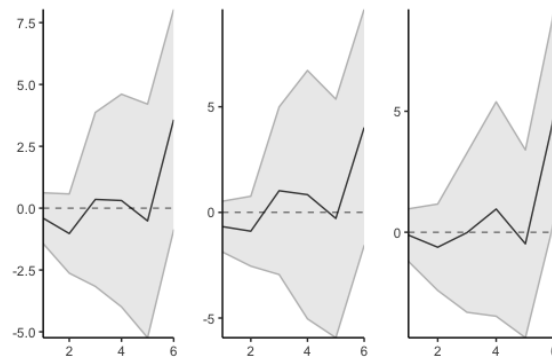
Note: All control variables included. Confidence bands of 95%. The first column is no lags, the second is lag = 1 and the third one is lag = 2. In h = 0 the sample includes 58 countries and 755 observations.

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