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Impact of Financial Crises on Growth and Investment: An Analysis of Panel Data

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Abstract: This paper examines the impact of financial crises on GDP growth and investment. These relationships are analyzed through a dynamic panel model. The model also includes control variables that may explain variations in growth and investment. Our panel consists of twenty-five countries and the study period lasted from 1998 to 2009. This period can follow the changes in growth and investment over the last decade and make us understand the impact of financial crisis on them. The main results show that the presence of a financial crisis in one country has a negative and significant impact on GDP growth and its level of investment.

Keywords: Financial crisis, GDP Growth, Investment, Dynamic panel.

JEL Classification: C2, G1

1. Introduction

Recent years was characterized by emergence of financial crises. These crises have generated losses on financial markets, but also on the main economic aggregates like GDP growth and investment. Thus, several studies (Reinhart and Rogoff 2009; Cerra and Saxena 2005; Pindyck and Solimano 1993) showed that the presence of financial crises not only affect the financial sphere, but also other sectors, namely the economic sector. For example, the subprime crisis, which was generated by financial problems occurred on the United States housing market, constitutes a serious impact on the global economy, particularly growth and investment. The degradation of economic growth and investment levels may also produce catastrophic sequences on development and social peace in a given country.

The aim of this paper is to study the impact of financial crisis on economic growth and investment. The study covers twenty-five countries for a period from 1998 to 2009.
The methodology consists of using the technique of dynamic panel to identify the impact of financial crisis on economic growth and investment.

The originality of this research is to integrate a new measure of financial crises. This measure avoids the conventional use of the dummy variable (0,1) and permit to better quantify the financial crises. This paper integrates also the dynamic panel technique. This technique is the most appropriate for estimating such a model. In addition, we incorporated a new command 'xtabond2' of STATA supported by Baum (2006) and considered the most effective for estimating the dynamic panel (Roodman 2009; Ahoure 2008).

The rest of this paper is structured as follows. The next section shows previous work concerning impact of financial crises. In section 3, we present the data, particularly the measure of financial crisis. Section 4 introduces the methodology adopted and Section 5 displays our empirical results. Finally, Section 6 concludes.

2. Previous Work

2.1. Summary of historical events and stock market crises over the last decade

2.1.1. Period 1995 - March 2000: the formation of the Internet bubble

The sector of new Information and Communication Technologies (ICT) was developped considerably since the 70s. These years were characterized by the emergence of the micro-computer, optical fiber, IP (Internet Protocol) and the development of websites. Thus, a financial bubble has developed from the unconscious expectations about the capabilities of the Internet and led from 1995 to 2000 to an inflation of values called expansive TMT (Telecoms Media Technology). This technological development has been followed by significant increases recorded in the stock market. The NASDAQ index has been multiplied by five from 1000 in 1995 to over 5000 in 2000, the S&P 500 rose 35% between December 1998 and March 2000. Basing on observed increases in the period 1995-2000, and the cuts generated exceptional from the second quarter of 2000, several authors have described the period of speculative bubble.

2.1.2. Period March 2000 - end 2003: the bursting of the Internet bubble

Since the historic levels reached in early 2000, stock markets have collapsed. Between March 2000 and early February 2003, the CAC 40 lost 56% of its value, the DAX 65%, the S&P 500 44% and the NASDAQ 72%. The origins of falling stock markets are roughly identified. On the one hand, financial markets were faced with the movement of the bubble bursting of new technologies (Internet bubble). On the other hand, the outlook deteriorated growth, associated with increased risk aversion on the part of investors, has had this fall in stock prices (September 11). Finally, the crisis of confidence on the transparency of company accounts has added to the uncertainty in financial markets (case of Enron).

2.1.3. The year 2007: the beginning of the subprime crisis

The subprime crisis is a crisis affecting the U.S. mortgage industry and who contributed to the outbreak of the financial crisis of 2007 to 2009. According to Pascal Salin, the origin of this crisis is the extraordinary variability of U.S. monetary policy in recent years which means that the crisis arises from the public authorities and not determined by the market. Indeed, the interest rate rose from 6.5% in 2000 to 1.75% in late 2001 and 1% in 2003. During this period, financial institutions have tried to take advantage of this situation and have taken in the real estate sector. When interest rates return to their normal levels, the subprime crisis has arisen: is the bursting of the bubble in real estate sector.

2.2. Consequences of financial crises

Several researches are related to the study of the impacts of financial crises on growth and investment. Indeed, Pindyck (1991) and Pindyck and Solimano (1993) found that financial

crises reduce investment incentives, lower product demand and increased uncertainty about the returns on capital and on the risk premium. In addition, companies are faced with less favorable conditions for financing investment due to more stringent standards regarding the rising costs of borrowing and the limited supply of credit.

Bordo et al. (2001) studied the evolution of the duration and depth of different types of crises. This study extends over a long period (from 1880 to 1997). The results of this study can be summarized in the table1.

From this table, we can see that the impacts of crises on the duration and average depths vary not only according to the periods studied, but also according to crises types and number of countries.

We can also notice that from the year 1973, the impact of banking crises is higher than for currency crises and this in terms of duration and depth. During this period, the duration of the twin crises is superior to all other types of crises. In addition, the impacts of these crises on GDP are very high compared to other crises. The overall result shows that a crisis reduced GDP by 5 to 10% and that this decline lasts on average two to three years.

Barro (2001) studied the impact of a banking crisis on growth. These data concern 67 industrialized and emerging countries (five-year averages). The approach used is the panel. These results show that a banking crisis reduced GDP per capita growth rate of GDP of 0.6% per annum and the investment rate of 0.9%.

Cerra and Saxena (2005) showed that half of all economic crises are associated with political or financial crises, and that the high incidence of crises in countries with low income is a major reason for the divergent data on growth during the post-war period.

Becker and Mauro (2006) studied the frequency, duration and costs of various shocks. They find that financial shocks and macro-economic relations are more costly (in terms of annual losses on GDP per capita) for emerging countries and that trade-related shocks and interest rates are more destructive for developing countries.

Studies of the IMF and Reinhart and Rogoff (2009) support the idea that the negative impact of past financial crises on economic growth is long term. This result is also confirmed by the study of Claessens et al. (2009). This leads us to say that restoring levels of employment and GDP will slow if the financial structures are not rearranged and corrected quickly. Reinhart and Rogoff (2009) found, from a study with international crises, banking crises that have a greater impact (at least twice) that the ordinary crises on the level of production and employment.

The scenarios study of financial and economic crises may provide some useful insights. The study of crises series (bank or otherwise) for European countries shows, according to Koopman and Székely (2009), the results of the impact of crises on growth potential are mixed. They also add that half of countries generate an increase in the potential growth in the decade following the crisis period. Furthermore, the degradation of capital accumulation and the decrease in labour input significantly affect the level of potential output in the short to medium term, but not much on the long-term. On the other hand, growth in factor productivity appears to be an important factor explaining difference between countries in terms of changes in potential growth rates.

By adopting the method of Cerra and Saxena (2008), Furceri and Mourougane (2009) measure the impact of financial crises on GDP. The model is a panel whose GDP growth is a function of its history and dummy variables (relating to crises). On average, GDP fell by 1.5% to 2.4% following a crisis. The drop extends over five years.

Panizza, Cerra, and Saxena (2009) showed that the most open countries are those with amortization periods of crisis are slower. This may be due to the tax policy that is less effective in open economies.

Cecchetti, Kohler, and Upper (2009) found that only 20% of crisis has a permanent impact on the level of GDP. However, they noted that most systematic banking crises coincided with a marked decrease in growth and that this decline takes several years to recover their previous levels. All these studies converge towards a conclusion: the GDP will be affected over a long period.

The study by Koopman and Székely (2009) showed the very important policy decisions to escape quickly from the crisis. For example, in 1991, we found that the great crisis that has hit Sweden and Finland, did not persist and that the fall in potential growth rate was low and of short duration. This result is due largely to the immediate resolution of banking problems, with the favorable adjustment of exchange rates and the restructuring of their economies. Thus, both countries have taken advantage of their wealth to subvert their situations and rapidly accelerate the growth rate. In another sense, the Japanese government's response was insufficient to alleviate the crisis of the 90s. This crisis has been accompanied with pressures of competition from emerging economies which has caused a slowdown in the growth potential of long duration in Japan.

]Another finding may be inferred from past recessions is that relating to the establishment by the states of major restructuring in their economic activities. This restructuring is reflected through the extinction of some industries that have developed an unsustainably and by the emergence of new industries that tend to increase. Structural adjustment in the industry is crucial and plays an important role in creating a more suitable environment. Consequently, this led economists to register higher productivity and a high potential growth. However, occasionally economic growth repent, he should avoid taking short-term measures aimed at not letting the possibility of bankruptcy of some companies.

According to Christian Boissieu, there are several channels through which financial crises can affect growth:

- ✓ Banks: these have become more vulnerable and adopt a very strict approach in granting credits. This selection eliminates much of the small and medium enterprises (SMEs).
- ✓ The decrease in consumption: is the result of the decline in lending to individuals and which is an important component of demand and growth. This channel differs from one country to another depending on the availability of savings (non-existent in the United States but is between 15 and 16% in France). It can be seen as a first defense tool.

There are other channels through which financial crises can affect the economic sphere. Among these channels include:

- ✓ Investment costs: such as high interest rates and low levels of stock prices which may increase costs and reduce investment,
- ✓ risk aversion: increasing risk aversion leads to an increase in the risk premium,

✓ net worth of firms: lower prices of equity shares and reduce net worth companies and an increase in problems with adverse selection and moral hazard,
✓ Household net worth: as a company and following the fall in prices of capital and shares, the net worth of consumers and their credit ratings decline,
✓ exchange rates: variations in exchange rates and the reversal of capital flows have an impact on the volume of trade,
✓ confidence: the collapse of confidence among consumers and investors leads to a contraction of their activities and hence economic activity.

In summary, financial crises have negative effects not only on the financial sector, but also on the entire economy, that is to say about the real economy. Financial crises, especially the last subprime crisis, have a negative impact on the level of activity of major industrial countries, emerging countries and on developing countries. This decrease is due to reduced industrial production and international trade including the United States has brought with it the developed countries to the biggest recession since the end of the Second World War. The recession of the economies of developed countries has led to a decline in demand for raw materials and commodities. This affects the developing countries and exposes them to turn an economic crisis.

3. Data

3.1. Presentation of data

The data used are those that allow us to study the impact of financial crises on economic growth and investment. The observations are annual. Most data are extracted from database of the World Bank 'World Development Indicators (2010)'. The study period extends over twelve years, from 1998 to 2009. The sample consists of 25 countries, namely Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, France, Germany, Hong Kong, India, Indonesia, Italy, Japan, South Korea, Malaysia, Mexico, Netherlands, Singapore, Spain, Switzerland, Thailand, United Kingdom and United States.

The variables used in this study are: the financial crisis (CRIS), growth of GDP (GROWTH), investment (INV), trade openness (OPEN), population growth (POP), inflation (INF), public consumption (PUBCONS) and interest rates (INT). All these variables will be defined and analyzed subsequently. First, we begin by defining the measure of the financial crisis in each country and for each year. Then we define the endogenous variables (growth and investment) and we analyze their changes over the years. Finally, we will focus on the definition and interpretation of various control variables.

3.2. Defining the measure of the financial crisis

It seems reasonable to define a stock market crisis as a pointed and rapid decline in share prices or indices. The approach of Patel and Sarkar (1998) is to calculate an indicator denoted by $IMAX_{i,t}$ which detects the extreme level of the stock index by period (one year). This involves dividing the daily stock index by the maximum index observed during the period chosen that is to say for a year. Denote by $I_{i,t}$ the stock index of country i on day t. The indicator $IMAX_{i,t}$ is then defined by:

$$IMAX_{i,t} = \frac{I_{i,t}}{\max\left(I_{i,t}, I_{i,t-1}, ..., I_{i,t-n}\right)} \quad ; \quad n: \text{ number of working days during the year.}$$

This indicator varies between 0 and 1. Indeed, it is equal to 1 when $I_{i,t} = \max\left(I_{i,t}, I_{i,t-1}, ..., I_{i,t-n}\right)$. This is where the stock index reached during this year, the highest level especially after a period of steady increase. However, more the stock index collapse, more the indicator is lower and tends to 0. To define the measure of the crisis variable, a threshold is used to identify the days where $IMAX_{i,t}$ is abnormally low. The threshold used is equal to the average minus twice the standard deviation. The daily variable measuring crisis, denoted by $CRIS_{i,t}$, is defined as:

$$\begin{cases} CRIS_{i,t} = 1 \text{ if } IMAX_{i,t} < \overline{IMAX}_{i,t} - 2\sigma_{i,t} \\ CRIS_{i,t} = 0 \text{ otherwise} \end{cases}$$

The average and standard deviation of the indicator $IMAX_{i,t}$ are calculated over the study period. So, $\left(\overline{IMAX}_{i,t} - 2\sigma_{i,t}\right)$ is considered as the minimum threshold under which we can say that there is a severe drop in the stock index and then the beginning of a crisis.
Consider that the data used to determine the impact of financial crisis on growth and investment are annual, so we'll define an annual variable measuring financial crisis. This variable, denoted by $CRIS_{i,N}$, is equal to the number of working days during the year N, where the financial market is in crisis, that is to say the number of days where $CRIS_{i,t}=1$. So, the variable measuring the financial crisis is defined by:

$$CRIS_{i,N} = \sum_{t=1}^{t=k}(1)$$

$$\text{Where}: \begin{cases} CRIS_{i,N}: \text{ Measure of crisis in country i in year N.} \\ k \quad : \text{ Number of days where } CRIS_{i,t} = 1 \text{ in year N.} \end{cases}$$

We can see from Table 2, that years 2008 and 2009 were most severe in terms of financial crisis. The intensity of the crisis in 2008 varies from 0 in the case of Chile to 73 in China. In 2009, the intensity of the crisis has slightly decreased and the countries most affected are respectively Australia and United Kingdom. We also note, except for China, there is an almost absence of crisis for all other countries and this in the years 2004, 2005, 2006 and 2007. Table 2 presents descriptive statistics of variable $CRIS_{i,N}$. In other words, we calculate the average of variable $CRIS_{i,N}$ for all countries in each year, the standard deviation and minimum and maximum values.

Table 3 allows us to affirm that the subprime crisis was certainly the most catastrophic in terms of falling in stock market indices, especially in 2008. Indeed, the values recorded during this year (35.12 in average) are far superior to those in 1998 (12.48), in 2002 (11.76) and 2009 (18.8). In addition, the standard deviation is lower in 2008 than during those three years. This allows us to say that variations of the crisis between countries in 1998 and 2002 were larger than in 2008. Obviously, we reiterate that the crisis of 1998 and 2002 has not affected the majority of countries, so that subprime has affected all countries (except Chile).

Focusing on the impact of financial crisis on growth and investment, we can note that:
✓ financial crises disadvantage growth. Thus, the expected sign of this variable is negative,
✓ financial crisis disrupts this sector and obtain credit in this case becomes more difficult. Indeed, in the case of presence of crises, states are developing stricter regulations for granting credits, thereby reducing investment. Consequently, the impact of the crisis on investment will most likely negative.

3.3. Evolution of growth and investment

3.3.1. The growth

Growth is one key variable in our study. It will be used as an endogenous variable in the study of the impact of financial crisis on growth. This variable represents the growth of real GDP per capita. It is observed directly from the database 'WDI (2010)' and will be denoted by GROWTH. Table 4 presents descriptive statistics in growth rates of the twenty-five countries.

Considering all countries, we can clearly affirm that the prosperous years were the years 2000, 2004, 2006 and 2007 which exhibit average growth rates higher than 4%. However, periods of slow growth years are 1998 (0.72%), 2001 (1.68%) and 2009 (0.01%). We also note that the standard deviation is significantly higher in 1998 compared to other countries. This shows a great difference between the growth rates of countries during this year. In fact, according to the variable described above, there are few countries with a high crisis in 1998, but this crisis has not affected all countries. Graph 1 permits to visualize the evolution of growth rate of GDP.

3.3.2. The Investment

Our study will also focus on analyzing the impact of financial crises on domestic investment. The variable measuring the investment will be considered an endogenous variable and thereafter, a second equation is estimated in this study. This variable will be denoted by INV. It represents investment expenditure measured by the ratio of gross fixed capital formation as a percentage of GDP (investment rate). It is also obtained from the 'WDI (2010)' database.

Note that this variable is also used as an explicative of economic growth. Thus, investment in the first equation appears as an exogenous variable, and in the second as an endogenous. The Table 5 displays descriptive statistics on evolutions in investment rates from 1998 to 2009. In each year, we present the average, standard deviation and minimum and maximum values of all countries.

We note that year 2009 is where most countries have reduced their investments (21.08% on average). However, during the year 2007, the average investment rate has increased to 24.38%. We note also that 2008 had the most severe decline in terms of investment during this decade. These values can give us an idea about the negative impact of financial crises on investment. Regarding the variability of investment rates across countries, we can deduce that from the year 2005, there was a large difference between countries. This can be explained by large values of investment rate recorded by some countries. Indeed, after

2005, we noted some values that greatly exceed 40%. Graph 2 represents the evolution of average investment rate.

Graph 2 shows that after the fall of investment rates in 2000, the averages have increased during the period 2002-2007 before falling again in 2008 and 2009. The shape of this curve is similar to the indices in most countries.

3.4. Presentation of control variables

3.4.1. Trade openness (OPEN)

The rate of trade openness is measured by the sum of exports and imports as a percentage of GDP. This variable is used to explain variations in economic growth and investment rates. The expected sign is positive in both cases. In fact, an economy more open to international trade will achieve a growth rate higher than a relatively closed economy. This measure is in most cases used by the authors to calculate the opening rate. Graph 3 shows the evolution of the average trade openness for the twenty-five countries studied.

Graph 3 shows that on average, trade openness is increasingly high. In 1998 it was 86.5%. It peaked in 2008 (111.13%). This affirms that the world is becoming more open and that trades have become more important in recent years. However, during the year 2009, the trade concerning these countries confronted a decline of 7%.

3.4.2. The growth of population (POP)

This variable, derived from 'WDI (2010)', is regarded as an explicative of economic growth only. Indeed, an increase in the rate of population growth may be the cause of the decline in GDP per capita. In that case, we expect a negative relationship between population growth and growth in real GDP per capita (Barro 2000). The evolution of growth rates is shown in graph 4.

Graph 4 shows that average rate has increased from 0.94% in 1998 to 0.76% in 2003. The last rate was the minimum during this period. After 2003, the average growth of the population has steadily increased. It exceeds first threshold of 1% in 2008 (1.01%). However, it declined slightly in 2009 (0.96%).

3.4.3 The inflation rate (INF)

The inflation rate can give an idea about the stability of price level in a given country and beyond its macroeconomic stability. Obviously, a high inflation rate can be a handicap on the achievements of investment projects in the long term. Accordingly, the increase in the inflation rate has the effect of reducing investment. However, investment is an essential element of economic growth. Thus, we expect a negative relationship between inflation and growth. The chronological evolution of the average inflation rate is shown in graph 5.
The inflation rate was 5.44% in 1998, the highest during this period. Between the years 1999 and 2007, this rate ranged from 2.47% in 2000 and 3.31% in 2002. However, in 2008, the inflation rate has exceeded the threshold of 4% for the first time since 1998 and showing 4.02%. It has also increased in 2009 and exceeded 4.2%.

3.4.4. Public consumption (PUBCONS)

Government size is measured by public consumption as a percentage of GDP. More current consumption of the country is higher, more the risk of budget deficits is important and then investment will be less important. In this case, it would need resources to finance its future deficit. In summary, faced with the risk of budget deficits, investment will be smaller and thus the income per capita would decline. We expect that public consumption has a negative impact on growth and investment. The evolution of this variable is illustrated by graph 6.

We can notice that the average evolution of public consumption ranges between 15% and 16% during the period 1998-2006. In 2007, the average has reached the minimum threshold (14.67%). However, in 2008, average public expenditure has excessively increased and reached 17.28%. This increase is mainly due to public spending on financial crisis (example: injection of liquidity into financial markets, prevented banks from bankruptcy...). In 2009, these expenditures have fallen (16.07%), but still remain high compared to the last decade.

3.4.5. The interest rate (INT)

Normally, if interest rates decline, investment projects become profitable and eventually the volume of investment increases. We therefore expect a negative relationship between interest rates and investment. Graph 7 allows us to see the evolution of interest rates for all countries.

After the peak in 1999 (9.67%), the average interest rates has severely declined and reached 4.25% in 2004. In 2005 and 2006, this average has increased slightly. However, the rate fell again and reached its minimum in 2009 (3.83%).

4. Methodology

In our study, we adopt the panel data approach. This method allows analyzing the relationships between the variables taking into account both the variability between countries and the evolution of these relationships over time. This technique also allows taking into account country-specific effects (included in the error term in traditional models), thereby reducing coefficients estimated bias.

However, the use of panel model can integrate an endogeneity problem linked between endogenous and exogenous variables. Thus, it is imperative to use the dynamic panel model. The estimation of dynamic panel model assumes the existence of one or more lagged endogenous variables in addition to exogenous variables.

Thus, the dynamic panel model can be written as follows:

$$y_{i,t} = \alpha_0 + \sum_{j=1}^{k} \alpha_j y_{i,t-j} + \sum_{s=1}^{m} \beta_s x_{s\ i,t} + \mu_i + \nu_{i,t}$$

$i = 1,...,N$ (Number of groups (company, country...)).

$t = 1,...,T$ (Number of periods (days, years...)).

y: endogenous variable ; x: exogenous variable ; α_0: constant term.

(α_j, β_s): coefficients to estimate $(j = 1,...,k\ ;\ s = 1,...,m)$.

μ_i: individual heterogeneity $\left[\mu_i \square\ i.i.d\left(0, \sigma_\mu^2\right)\right]$; $\nu_{i,t}$: error term $\left[\nu_{i,t} \square\ i.i.d\left(0, \sigma_\nu^2\right)\right]$.

However, the dynamic panel model presents a problem. Indeed, the results of the estimate will be biased if we use traditional methods (specifically the MCO). This bias is due to presence of lagged endogenous variables which are correlated with the term of individual heterogeneity, μ_i. Thus, several methodologies (Anderson and Hsiao 1982; Arellano and Bond 1991; Blundell and Bond 1998) have been emerged with an aim of giving a consistent and effective estimation of panel dynamic model.

4.1. Method of Anderson and Hsiao (1982)

The Method of Anderson and Hsiao (1982) consists to eliminate the individual heterogeneity of the model. Thus, these authors applied the first difference to the initial model. We take the case where there is only one lagged endogenous variable and one exogenous variable.

The initial model is written as follows:

$$y_{i,t} = \alpha_0 + (\alpha \times y_{i,t-1}) + (\beta \times x_{i,t}) + \mu_i + \nu_{i,t}$$

The model of Anderson and Hsiao (1982) is written then:

$$(y_{i,t} - y_{i,t-1}) = \alpha \times (y_{i,t-1} - y_{i,t-2}) + \beta \times (x_{i,t} - x_{i,t-1}) + (\nu_{i,t} - \nu_{i,t-1})$$

This model always presents a problem, that of the correlation between ($y_{i,t-1}$- $y_{i,t-2}$) and the error term ($v_{i,t}$- $v_{i,t-1}$). In order to exceed the problem of correlation, Anderson and Hsiao (1982) used the technique of instrumental variables. The instrument used in this case is the second order lagged endogenous variable ($y_{i,t-2}$) or its first difference ($y_{i,t-2}$- $y_{i,t-3}$). These two instruments confirm the conditions of validity in the sense that they are correlated with the variable ($y_{i,t-1}$- $y_{i,t-2}$) and not with the error term ($v_{i,t}$- $v_{i,t-1}$).

However, their estimator is not effective for two reasons:
- using only first order lagged variables in the role of instruments,
- the not-take in account of the errors terms structure.

The estimator of Anderson and Hsiao (1982) is thus convergent, but not effective.
The insufficiencies of the method of Anderson and Hsiao (1982) are taken into account by Arellano and Bond (1991) and Blundell and Bond (1998) which used the method of generalized moments on dynamic panel (GMM) developed by Holtz-Eakin, Newey, and Rosen (1988) and Arellano and Bover (1995). The estimate of dynamic panel with GMM

method allow thus to eliminate the bias of simultaneity, reverse causality and the omitted variables problems. The 'dynamic' concept implies the existence of one or more lagged endogenous variable. This model also makes it possible to provide instruments from exogenous variables to the difference of the traditional methods, which is no easy to find.

Two tests are associated with GMM estimator:

- the test of overidentifying restrictions of Sargan/Hansen. This test makes it possible to conclude on the validity from the used instruments.
- The test of autocorrelation of Arellano and Bond (1991).

Thus, two estimators were defined: the 'GMM of difference' estimator of Arellano and Bond (1991) and that 'GMM system' of Blundell and Bond (1998).

4.2. The estimator 'GMM difference' of Arellano and Bond (1991)

The inspiration of Arellano and Bond (1991) method is to establish a difference equation to eliminate the bias of the omitted variables related to specific effects. Thus, the equation becomes:

$$\left(y_{i,t}-y_{i,t-1}\right)=\alpha\left(y_{i,t-1}-y_{i,t-2}\right)+\beta'\left(X_{i,t}-X_{i,t-1}\right)+\left(\nu_{i,t}-\nu_{i,t-1}\right)$$

This model can eliminate the individual effect, but not through on the correlation between the lagged error term ($v_{i,t}$-$v_{i,t-1}$) and lagged dependent variable ($y_{i,t-1}$-$y_{i,t-2}$). Arellano and Bond (1991) assume then that error terms are independent and they are not correlated with the exogenous variables. The model assumptions are then:

$$E\left[y_{i,t-s},\left(\nu_{i,t}-\nu_{i,t-1}\right)\right]=0\ ;\ \text{for } s\geq 2\ ;\ t=3,...,T.$$
$$E\left[X_{i,t-s},\left(\nu_{i,t}-\nu_{i,t-1}\right)\right]=0\ ;\ \text{for } s\geq 2\ ;\ t=3,...,T.$$

The two- step estimator is presented as follows:
- The first step: it consist transforming the model (first difference), selecting appropriate instruments (that is to say, correlated with the exogenous variables and not with the error term) and estimating the model. The error terms are assumed to be independent and homoskedastic. This step allows us to extract the residuals estimated after transformation.
- Second step: Arellano and Bond (1991) defined an estimator based on residuals estimated after transformation abundant both first step assumptions. Thus, this estimator is more efficient than that of Anderson and Hsiao (1982).

However, it is necessary to verify that $v_{i,t}$ terms are not autocorrelated. Arellano and Bond (1991) develop an autocorrelation test of the first and second order. The absence of autocorrelation in $v_{i,t}$ is confirmed if the test displays a negative and significant first order value and non-significant in second order. This test is normally distributed [N(0,1)]. To ensure the validity of the instruments, Arellano and Bond (1991) have recommended the Sargan test of overidentifying restrictions (elevated number of instruments). If the instruments are valid, the statistic S is expressed with a Chi-Squared Law ($S \sim \chi^2$) under the hypothesis H_0.

The two-step estimation of Arellano and Bond (1991) presumes that errors are independent and homoskedastic in the first step. Then, they use the residuals from this first step estimation to calculate a variance-covariance matrix and abandon the assumptions of the first step. According Kremp et al. (1999), the two-step approach allows both to solve the problems of heteroscedasticity, autocorrelation of errors, simultaneity bias and measurement mistakes. The robustness of 'GMM' estimator of Arellano and Bond (1991) is based on non-autocorrelation of difference equation errors and on instruments validity test.

However, technique of Arellano and Bond (1991) suffers from a problem, that the low efficiency of the instruments chosen by the first differences. Thus, Blundell and Bond (1998) use the 'GMM system' model. This system consists of an equation in first difference, the instruments of the latter are the same used by Arellano and Bond (1991). However, in the second equation (the equation in levels), the instruments are the first differences of endogenous and exogenous variables.

The Monte Carlo simulations carried out by Blundell and Bond (1998) indicates that if the variables are very persistent in time, then 'GMM first-difference' estimator is biased for small samples.

4.3. The 'GMM system' estimator of Blundell and Bond (1998)

The principle of this estimator is that it considers both the two equations: the level equation and difference equation.

$$y_{i,t} = \alpha_0 + \left(\alpha \times y_{i,t-1}\right) + \left(\beta' \times X_{i,t}\right) + \mu_i + \varepsilon_{i,t} \left(\text{level equation}\right)$$
$$\left(y_{i,t} - y_{i,t-1}\right) = \alpha\left(y_{i,t-1} - y_{i,t-2}\right) + \beta'\left(X_{i,t} - X_{i,t-1}\right) + \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\left(\text{difference equation}\right)$$

The instruments used in the first equation are the first differences of variables. Following Monte Carlo simulations, Blundell and Bond (1998) found that this estimator is more efficient than the 'GMM difference'. This efficiency can be summarized in the following points:

- Validity of the instruments.
- Non-autocorrelation of error terms.

Indeed, Griliches and Hausman (1986) indicate that the first difference estimator intensify biases caused by measurement errors.

Blundell and Bond (1998) use a 'GMM system' effective estimator for both equations in levels and difference. The instruments used for the first differences equation are ($y_{i,t-2}$, $y_{i,t-3}$,…, $y_{i,1}$) and ($x_{i,t-1}$, $x_{i,t-2}$,…, $x_{i,1}$) and for the level equation are D $y_{i,t-1}$ and D $x_{i,t-1}$.

This estimator is efficient if the instruments used are valid. This is verified by Sargan test of overidentifying restrictions. In addition, it is necessary to be ensured for the absence of autocorrelation in first and second order of first difference residuals. Thus, the error terms are uncorrelated if we reject the null hypothesis of no autocorrelation of second order.

The only disadvantage of GMM system method is that it eliminates at once individual fixed and temporal effects. Version 10.0 of STATA software allows using a new command

'xtabond2' advocated by Baum (2006) in estimating the dynamic panel. Roodman (2009) showed that the use of this command allows to take account the problem of endogeneity and exogeneity of variables. This command permits to avoid definitively the problem for the correlation between specific effects and lagged dependent variables. Baum (2006) indicates that this command is the best right now to estimate a dynamic panel.

Ahoure (2008) indicated that the estimation of dynamic panel with 'GMM system' two-step method of Blundell and Bond (1998), using the command 'xtabond2' is most effective. This command is an extension of the 'xtabond'. According Windmeijer (2005), the passage from 'xtaband' to 'xtaband2' corrects the covariance matrix for the small sample size and consequently eliminates the bias that may arise from the two-step estimation.

Accordingly, the estimate of the effect of financial crises on economic growth and investment is carried out with the new command 'xtabond2' of STATA that allows improving the use of Blundell and Bond (1998) method.

5. Results and Discussion

The estimation of the equations relating to the impact of financial crises and control variables on the growth and the investment are carried out with the command 'xtabond2' of STATA which is based on dynamic panel method of Blundell and Bond (1998).

5.1. Impact of financial crisis on growth

The model 1 presents the effect of crisis and other variables on the economic growth.

$$GROWTH_{i,N} = \alpha_0 + \underset{(+)}{\alpha_1 GROWTH_{i,N-1}} + \underset{(+)}{\alpha_2 INV_{i,N}} + \underset{(+)}{\alpha_3 OPEN_{i,N}} + \underset{(-)}{\alpha_4 POP_{i,N}} + \underset{(-)}{\alpha_5 INF_{i,N}} + \underset{(-)}{\alpha_6 PUBCONS_{i,N}} + \underset{(-)}{\alpha_7 CRIS_{i,N}} + \varepsilon_{i,N} \quad \text{(model 1)}$$

$i = 1, 2, ..., 25$: Country *i*.

$N = 1, 2, ..., 12$: Year *N*.

The results of the estimation of model 1 are summarized in table 6.

The results of this estimate are in the majority cases in conformity with the economic literature given that, among seven coefficients, five are statistically significant with the threshold of 5% and their signs are in conformity with the theories. Indeed, the lagged values of economic growth act positively on the current growth. This result means that if the growth rate of GDP at year T-1 increases, then the growth at the year T increases also and reciprocally. In other words, the endogenous variable does not present rupture in its evolution through this decade. This conclusion was confirmed for a long time. The prosperity economic periods are often accompanied by similar periods, in the same way in the cases of recessions. Thus, the rupture of a growth phase in a given country can be dangerous because this rupture could lead to a passage in a period of deceleration or decline in the economic activity.

The results of dynamic panel estimation prove also that domestic investment is an important factor for reviving economic activity. In fact, the coefficient for the variable INV (α_2) is positive and significant at 1%. This result is not surprising since investment is one

of the important supports that can increase the GDP growth in a given country. Certainly, the low investment rates are often accompanied by falling GDP and subsequently their growth. Thus, the impact of domestic investment on growth can differ from one country to another only in terms of amplitude.

The studies describing the impact of opening on the growth did not converge towards a single result. Indeed, the advantages and the disadvantages of the commercial opening constituted one of the principal debates for the economists, especially concerning his effect on GDP growth. However, these problems are more and more loosing their importance. This is due to the very fast development of the communication sector. Thus, the economies became increasingly opened and this can be observed through graph 3. The released result of this estimation confirms the strategy of opening adopted by the majority of the countries during the period 1998-2008. Indeed, the sign relating to the rate of commercial opening (α_3) is positive and statistically significant (with the threshold of 5%) suggesting a positive relation between the degree of commercial opening and the economic growth. In fact, this is the most open countries who contribute more to their GDP growth.

If we interest in the effect of the population growth on economic growth, we observe a negative and significant coefficient with the threshold of 10%. We cannot thus affirm with certainty which the demographic growth is an explicative factor of economic growth. Indeed, several studies showed that population growth affects negatively and significantly economic growth (Bekaert, Harvey, and Lundblad 2005). These authors showed that a reduction in population growth rate can generate a rise of the GDP per capita, and thereafter of the GDP growth.

Concerning the inflation rate, we indicated that the inflationary periods are often accompanied with crises situations, and coincide with falls of the levels of GDP. Table 6 shows that the coefficient relating to inflation rate (α_5) is negative. However, this coefficient is not significant. Thus, we cannot confirm the existence of a negative effect of this variable on the economic growth.

The released results also show that public expenditure also contributes in the explanation of economic growth. The sign relating to this variable is negative and significant with the threshold of 1% (α_6 = -0.13). Indeed, this coefficient is in harmony with the results of Barro, Mankiw, and Sala-I-Martin (1995). These authors explained why several non-productive aspects of governmental expenditure such as political corruption can constitute an explanatory considerable factor of the reduction of growth. On another side, the increase in the public expenditure can be perceived as a sign of preparation of the country to a passage towards a crisis period, and thereafter this increase will be accompanied by a slowdown in economic activity.

We are interested now in the effect of crises (CRIS variable) on GDP growth. Thus, considering all financial crises in the past twelve years in all countries, we found that the coefficient of financial crisis is negative (-0.038) and statistically significant (z = -15.4) at the 1% level. This permit to reaffirm the effectiveness choice of method used to detect the presence of financial crises (Patel and Sarkar 1998). The result reached is consistent with most of the work already cited. Consequently, the integration of financial crises (defined by a severe drop in the stock index) in this dynamic panel can explain the reduction of GDP growth. This result can be interpreted as: the decrease of the stock index due to falling equity values of listed companies, can lead to a decline in profits for these

companies, or even their bankruptcies. This may cause the reduction of the added values provided by these companies and thereafter the reduction of GDP and its growth.

Several parameters can be derived from this estimate. Indeed, we can say that model 1 is globally significant at 1% level (Chi-square = 3627.02). Thus, the variables selected are adequate in explaining the endogenous variable: the GDP growth.

The presence of lagged endogenous variable requires the elimination of an observation (one year) in each country. In this way, the number of observations per group will be equal to eleven. The total number of observations is equal 275.

We have exposed that the estimator of Blundell and Bond (1998) is effective only after checking the conditions of validity of instruments and the non-autocorrelation of residuals in first difference. The Hansen test of overidentifying restrictions (p = 0.759) accepts the hypothesis H_0 of validity of lagged variables in differences as instruments. The instruments used in this estimation in both equations (level and difference equation) are valid. The Hansen test is more robust than the Sargan test. For example, the Sargan test is not distributed according to a Chi-square under the hypothesis of heteroscedasticity in contrast to Hansen test.

Arellano-Bond test in first-order (p=0.013) and second order (p=0.106) accept the null hypothesis of no second order autocorrelation. We can then affirm the absence of residuals autocorrelation of model 1.

5.2. Impact of financial crisis on investment

Model 2 (dynamic panel) examines the effect of crisis and control variables on investment.

$$INV_{i,N} = \alpha_0 + \underset{(+)}{\alpha_1 INV_{i,N-1}} + \underset{(+)}{\alpha_2 OPEN_{i,N}} + \underset{(-)}{\alpha_3 INT_{i,N}} + \underset{(-)}{\alpha_4 PUBCONS_{i,N}} + \underset{(-)}{\alpha_5 CRIS_{i,N}} + \varepsilon_{i,N} \quad \text{(model 2)}$$

$i = 1, 2, ..., 25$: Country i.

$N = 1, 2, ..., 12$: Year N.

In Model 2, the dependent variable is domestic investment (INV). The retained explicative variables of investment are those of the first equation, except for of population growth (POP) and inflation (INF) which were replaced by the interest rate (INT). Indeed, the theories of determinants of investment have not raised the population growth, but they emphasized the role of interest rates in explaining the variation in domestic investment.

The results obtained from estimation model 2 by Blundell and Bond method demonstrate the effectiveness of this method. Indeed, the estimation shows that all coefficients are significant and their signs are consistent with our expectations with the exception of trade openness. The model is globally significant at 1% level (Chi-square = 5944.01). Moreover, these results meet the two conditions already mentioned: validity of instruments and absence of second order autocorrelation in residuals in first difference. In fact, Hansen test of overidentifying restrictions is not significant (p = 0.698). This result allows us to accept the null hypothesis (H_0) that the instruments used are valid. In addition, the Arellano-Bond autocorrelation first order test in first difference is negative and significant (p = 0.018). However, the second order test is not significant (p = 0.400) and accepts the null hypothesis of no autocorrelation of residuals in first difference.

The number of observations equals 275. Indeed, each country is observed for 11 years because of the existence of lagged investment variable.

Focusing on the lagged investment, it has a positive coefficient (0.995) and significant at 1%. Indeed, during a year, gross fixed capital in a country encourages more investments in next year. This builds confidence in this country.

However, the results of model 2 did not conclude on the expected role of trade openness in increasing the level of domestic investment. Our results indicate that trade openness acts negatively and significantly on domestic investment. This result can be explained by capital flight and consequently increasing the cost of money. Indeed, more one country is opened, more of capital came out to higher profitability, and more the investment rate is low. Frimpong (2010) showed that trade openness significantly reduces domestic investment.

The coefficient relating to interest rate is negative and significant at the 1% level. This finding seems obvious in the sense that the interest rate is the border between profitable and failures projects. Thus, investment projects would be profitable only if the economic return on capital exceeds the real interest rate. If the interest rate increases, investors will abandon the projects which their returns fall below the interest rate. Instead, the decrease in interest rates makes it profitable projects that their returns will exceed the interest rate. In summary, reductions in interest rates are increasing domestic investment, and their increases are reflected by declines in investment.

Regarding the effect of public spending on investment, we note that coefficient α_4 is negative and significant at 5% level. According to Keho (2005) study, there is a debate in relationship between public and private investment. The origin of this debate is reflected in the nature of public investment in a given country. The author has shown that if public spending is oriented in infrastructure (that Mills and Quinet 1992 call 'future costs'), they can encourage private investment. Indeed, Blejer and Khan (1984) have shown that if public investments are related to economic infrastructure (roads, telecommunications, etc ...), they can improve productivity and subsequently reduce production costs of private domestic investment projects. However, public spending is not always invested in infrastructure. These may be targeted for example in the acquisition of military equipment or other equipment that are not attractive to the private sector. Public expenditure can also be intended to protect institutions that may go bankrupt as the banks during the subprime crisis. In this case, public investment and private investment are complementary and not substitutable. The effect of public spending will be negative: this is the case of countries in our sample during these twelve years.

We now analyze the effect of crises on domestic investment. The results show the existence of a negative and very significant (at 1% level) relation between financial crisis and investment. Indeed, the sharp drop in equity indices, and later in the course of companies, introduces uncertainty in financial markets and rising risk aversion among investors. Accordingly, the presence of a financial crisis can cause investors to extract their funds and place them in other countries. Domestic investment decreases therefore in the case of presence of crisis.

6. Conclusions

The aim of this paper is to study the impact of financial crisis on growth and investment. The study of these relationships has been conducted on a panel of twenty-five countries over the period 1998 to 2009. To achieve this goal, we firstly put forward a theoretical study in which we have focused on earlier work on the effects of financial crises on growth and investment.

Most of these studies found a negative relationship between crises and growth and between crises and investment. These studies also showed that the duration and depth of the crisis differ depending on the nature of crises and also across countries (developed countries, emerging countries and countries in early development). The decrease in international trade (imports and exports) mainly in the U.S. in 2007 caused an economic slowdown in all regions of the world and particularly on emerging and developing countries.

Focusing on the transmission channels of crisis from financial sector to the economy sector, we have noted that banks, reduced consumption, investment costs, risk aversion, exchange rates and the confidence can be the origin of this transmission.

The empirical study focused on analyzing the evolution of variables used in this study, the presentation of dynamic panel data technique, the presentation of results and interpretations of the models estimations for the effect of financial crises on growth and investment. After defining the measure of financial crisis as a severe drop in the stock market, we presented descriptive statistics on the crisis, growth of GDP, investment as well as control variables.

The technique used in models estimation is the dynamic panel. However, there are several methods for estimating this model. Indeed, analyzing the different methods, we showed that the estimation of dynamic panel with the 'GMM system' two-step Blundell and Bond (1998) method, using the command xtaband2 of STATA software, is the more efficient now. This approach was used in the estimation of two models: growth and investment.

The results found showed the relevance of this method. Indeed, on one hand the instruments used in both equations are valid (Hansen test) and secondly we have noted an absence of residual autocorrelation in first differences.

We have also identified significant coefficients in most cases. Their signs are consistent with theories. Indeed, the financial crisis negatively affects growth and investment. This affirms the right choice of method for measuring the financial crisis. In the first equation, we selected a positive effect of investment and trade openness, but also a negative impact of public spending on growth.

The trade openness appears as an important factor in reducing domestic investment (second equation). Moreover, increases in interest rates and public spending are considered as constraints to the establishment of investment projects.

Endnotes

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Table 1. Evolution of the duration and depth of crises

	1880 - 1913	1919 - 1939	1945 - 1971	1973-1997 (21 countries)	1973-1997 (56 countries)
	Average duration of crises (years)				
Currency crises	2.6	1.9	1.8	1.9	2.1
Banking Crises	2.3	2.4	-	3.1	2.6
Twin crises	2.2	2.7	1.0	3.7	3.8
All crises	2.4	2.4	1.8	2.6	2.5
	Average depth of crises (cumulative loss of GDP)				
Currency crises	8.3	14.2	5.2	3.8	5.9
Banking Crises	8.4	10.5	-	7.0	6.2
Twin crises	14.5	15.8	1.7	15.7	18.6
All crises	9.8	13.4	5.2	7.8	8.3

Source: Bordo et al. (2001)

Table 2. Evolution of financial crisis

Country / Year	$CRIS_{i,N}$												Average
	98	99	00	01	02	03	04	05	06	07	08	09	
Argentina	5	0	0	45	0	0	0	0	0	0	28	35	9.41
Australia	0	0	0	0	0	0	0	0	0	0	42	44	7.16
Austria	3	0	0	0	0	0	0	0	0	0	40	38	6.75
Belgium	4	0	0	0	21	4	0	0	0	0	42	14	7.08
Brazil	10	7	0	0	0	38	0	0	0	0	28	1	7
Canada	6	0	0	6	1	0	0	0	0	0	40	14	5.58
Chile	62	33	0	0	0	47	0	0	0	0	0	0	11.83
China	0	0	0	0	0	0	0	0	21	34	73	0	10.66
France	4	0	0	7	45	1	0	0	0	0	40	7	8.66
Germany	1	0	0	7	61	14	0	0	0	0	34	6	10.25
Hong Kong	4	14	0	5	0	0	0	0	0	1	37	31	7.66
India	0	0	0	0	0	25	0	0	0	0	36	24	7.08
Indonesia	10	4	0	0	0	0	0	0	0	0	36	26	6.33
Italy	7	0	0	25	13	0	0	0	0	0	42	4	7.58
Japan	0	0	3	6	0	0	0	2	0	0	38	2	4.25
South Korea	55	23	38	0	0	0	0	0	0	0	14	0	10.83
Malaysia	78	19	0	0	0	0	0	0	0	0	35	0	11
Mexico	8	20	0	0	0	0	0	0	0	0	12	28	5.66
Netherlands	3	0	0	2	62	1	0	0	0	0	40	17	10.41
Singapore	36	26	0	0	0	0	0	0	0	0	37	37	11.33
Spain	5	0	0	3	11	0	0	0	0	0	36	31	7.16
Switzerland	11	0	0	6	21	7	0	0	0	0	29	12	7.16
Thailand	0	0	41	9	2	0	0	0	0	0	40	30	10.16
United Kingdom	0	0	0	6	33	1	0	0	0	0	40	40	10
United States	0	0	0	4	24	22	0	0	0	0	39	29	9.83

Table 3. Evolution of the financial crisis (all countries)

Year	Number of countries	$CRIS_{i,N}$			
		Average	Standard deviation	Min	Max
1998	25	12.48	26.81	0	78
1999	25	5.84	20.79	0	33
2000	25	3.28	10.72	0	41
2001	25	5.24	9.71	0	45
2002	25	11.76	19.04	0	62
2003	25	6.4	12.66	0	47
2004	25	0	0	0	0
2005	25	0.08	1.04	0	2
2006	25	0.84	4.23	0	21
2007	25	1.4	6.74	0	34
2008	25	35.12	13.87	0	73
2009	25	18.8	14.77	0	44

Table 4. Descriptive statistics of growth rate

Year	Number of countries	GROWTH (%)			
		Average	Standard deviation	Min	Max
1998	25	0.72	5.41	-13.12	7.80
1999	25	3.51	2.95	-3.38	9.48
2000	25	4.88	2.35	-0.78	10.06
2001	25	1.68	2.39	-4.40	8.30
2002	25	2.14	3.54	-10.89	9.10
2003	25	3.15	2.87	-0.21	10.00
2004	25	4.74	2.61	1.05	10.10
2005	25	4.08	2.75	0.55	10.40
2006	25	4.65	2.53	1.84	11.60
2007	25	4.67	2.72	1.45	13.00
2008	25	2.66	2.52	-1.00	9.00
2009	25	0.01	2.84	-3.78	7.45

Table 5. Descriptive statistics of the evolution of investment rates

Year	Number of countries	INV			
		Average	Standard deviation	Min	Max
1998	25	23.16	4.59	16.77	37.10
1999	25	22.66	5.04	11.36	36.74
2000	25	23.68	4.51	16.19	35.11
2001	25	22.57	4.33	14.17	36.26
2002	25	21.79	4.90	11.96	37.86
2003	25	22.09	5.52	15.13	41.20
2004	25	23.09	5.73	17.05	43.26
2005	25	23.52	6.28	16.20	44.01
2006	25	24.02	6.21	16.88	44.54
2007	25	24.38	6.08	17.93	43.30
2008	25	22.66	6.26	16.94	40.37
2009	25	21.08	5.82	15.75	37.55

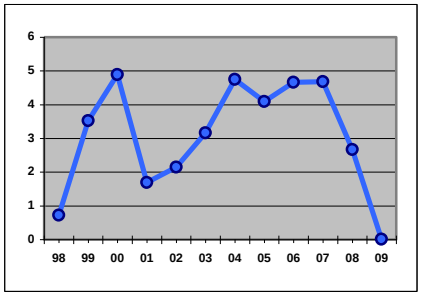
Table 6. Estimation of crisis effect on growth

ENDOGENOUS VARIABLE: GROWTH						
EXOGENOUS VARIABLES				Other parameters		
	Coeff	z	Prob			
α_0	-0.119	-0.080	0.939	Number of observations		275
α_1	0.340	9.750	0.000	Number of groups		25
α_2	0.205	5.400	0.000	Observations per group	min	11
α_3	0.002	2.150	0.032		avg	11
α_4	-0.275	-1.780	0.075		max	11
α_5	-0.033	-1.530	0.126	Wald chi2 (7) (Prob)		3627.02 (0.000)
α_6	-0.130	-3.070	0.002			
α_7	-0.038	-15.400	0.000			
Arellano-Bond test for AR(1) in first differences						z = -2.490 (0.013)
Arellano-Bond test for AR(2) in first differences						z = 1.630 (0.106)
Hansen test of overidentifying restrictions						chi2(53) = 45.474 (0.759)

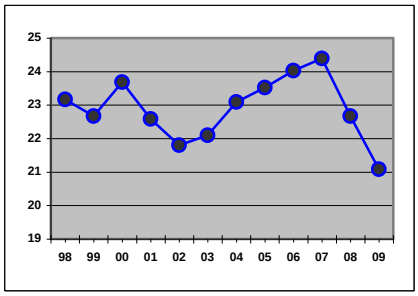
Table 7. Estimation of effect of crisis on investment

ENDOGENOUS VARIABLE: INV						
EXOGENOUS VARIABLES				Other parameters		
	Coeff	z	Prob			
α_0	1.300	1.410	0.157	Number of observations		275
α_1	0.995	33.830	0.000	Number of groups		25
α_2	-0.003	-7.890	0.000	Observations per group	min	11
α_3	-0.035	-5.530	0.000		avg	11
α_4	-0.032	-2.060	0.040		max	11
α_5	-0.044	-34.480	0.000	Wald chi2 (5) (Prob)		5944.01 (0.000)
Arellano-Bond test for AR(1) in first differences						z = -2.360 (0.018)
Arellano-Bond test for AR(2) in first differences						z = 0.840 (0.400)
Hansen test of overidentifying restrictions						chi2(53) = 47.211 (0.698)

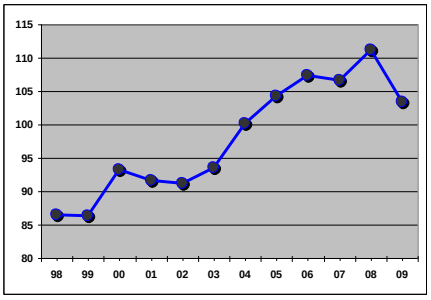
Graph 1. Evolution of average growth rates



Graph 2. Evolution of average investment rate



Graph 3. Evolution of average trade openness (in %)



Graph 4. Evolution in population growth (in %)

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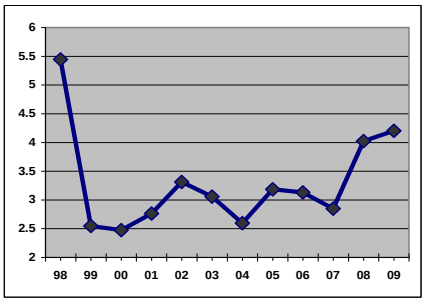
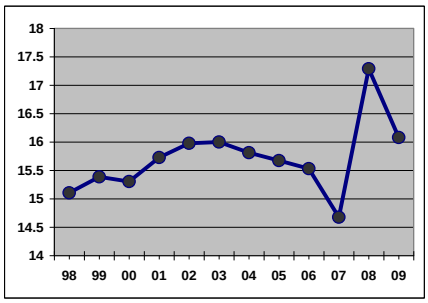
Graph 5. Evolution of inflation rates (in %)



Graph 6. Evolution of public consumption (as% of GDP)



Graph 7. Evolution of interest rates (in %)