Does inflation impact on financial performance in the MENA region?

Samir GHAZOUANI
Laboratoire d'Econométrie Appliquée (LEA), and Institut Supérieur de Comptabilité & d'Administration des Entreprises (ISCAE), Campus Universitaire de Manouba, 2010 Manouba, Tunisia. ☎ : 216-71601890, Fax : 216-71602404, e-mail : samir.ghazouani@fsegt.rnu.tn.

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ABSTRACT
This study gives some issues concerning the relationship between inflation and the financial sector performances for some MENA region countries. The negative association is confirmed through the estimation of a dynamic panel model using the GMM methodology. On the other hand, a threshold effect is also identified in order to show that negative effect of inflation on financial sector becomes effective once the rate of inflation exceeds some threshold.

Key words: financial sector performances, inflation, dynamic panel data, MENA region.
I- Introduction

This study investigates the relationship between inflation and financial sector performance. Why the recent interest in inflation and finance? Two empirical findings are reported to be at the origin of this interest, that is a negative association between inflation and economic growth (Barro (1995)) and a positive relationship between the development of the financial system and economic growth. These two strands of the empirical literature (the finance-growth and inflation-growth relationship) have lived separate lives but one obvious link is that inflation might be affecting economic growth through the financial sector.

Huybens and Smith (1998,1999) argue that an increase in the rate of inflation could have at first negative consequences on financial sector performance through credit market frictions before affecting economic growth. In fact, market frictions entail the rationing of credit which reduce intermediary activity and capital formation. The reduction of capital investment impacts negatively both on long-term economic growth and equity market activity. However, Azariadis and Smith (1996) emphasize the importance of threshold level of inflation in the relationship between inflation and financial sector performance. The negative consequence of inflation on financial sector efficiency becomes effective once the rate of inflation exceeds some threshold. These models further suggest another threshold (Boyd and Smith (1988), Huybens and Smith (1998,1999)) over which additional increase of inflation will have no damaging impact on financial sector performance.

From these models, one can draw several empirically testable hypotheses on the impact of inflation on financial sector performance:

1- Higher rates of inflation are associated with less long run financial activity.

2- Once inflation exceeds a threshold level, increase in inflation may have no additional consequences for financial sector performance.

The purpose here is to evaluate these theoretical predictions with data on banking, financial market and inflation for 11 MENA countries over the period [1979-1999]. Consequently, we regress a measure of financial sector performance on inflation plus a set of control variables to account for other theories of the finance-inflation relationships. Besides, in some econometric specifications, we examine non-linearity in the association between finance and inflation by including threshold levels. Further, we also conduct a panel estimation to exploit the time-series dimension of the data and control for possible endogeneity and omitted variables pertaining to cross-sectional estimation. More specifically, we construct a dynamic panel model which will be estimated by the Generalized Method of Moments (GMM) proposed by Arellano and Bond (1991).
The empirical methodology is mainly inspired by the scarce empirical literature on the relationship between inflation and financial sector performance. As far as we are concerned, only Boyd et al. (2001) have investigated this relationship. They employ cross-country data on inflation and financial sector performance indicators. The evidence indicates that there is a significant and economically important negative impact of inflation on financial sector development that persists even if we control for simultaneity and omitted variables biases and exclude countries with extraordinary high-rates of inflation. Besides, the relationship is highly non-linear as inflation rises, the marginal impact of additional inflation on banking and stock market development diminishes rapidly. The main contribution is to extend the work of Boyd et al. (2001) to an explored region (MENA countries). Further, the GMM estimators will be used in the basic regressions not as a sensitivity method in order to exploit the time-series dimensions of the data, to control for potential simultaneity bias and country specific effects. Finally, a formal statistical technique to estimate the threshold level before moving to the regressions will be proposed.

The paper is organized as follows. Section II describes the data to be used. Section III outlines the adopted econometric methodology. Findings are reported in section IV and the paper concludes with some concluding remarks.

II- Data and variable definition

Data were extracted from various sources, especially the Arab Monetary Fund and the World Bank Indicators. The Arab Monetary Fund was a main source for financial data on Arab countries. We consult the capital market unit database to collect stock market indicators from 1994, and the economic and technical department database for other economic data series. As for the stock market data prior to 1994, we collect them from World Development Indicators and local stock markets. With regard to Iran and Turkey, World Development Indicators was the main source for both economic and stock market data.

Our original intention was to cover all countries in the MENA region, but given that some countries have not yet established stock markets (for example Iraq, Libya, Sudan, Syria and Yemen), and other countries established stock markets only in the past couple of years (United Arab Emirates), the sample countries included only 11 countries, in which 9 countries are from the Arab world. Of course, data were not available for a uniform period for each country, and many countries have no stock market until recently. Consequently, it is expected that the number of observations varies across our sample countries leading to conduct estimations over an unbalanced panel data. The number of time observations ranges from five annual observations for Lebanon to 21 observations.
for Jordan. For the most other countries, the periods of observations cover mainly the
eighties and nineties.\(^1\)

The paper focuses mainly on the evaluation of the impact of inflation on stock
markets performance as well as on the banking sector development. For the first
relationship, the usually chosen dependent variable is the stock market capitalization \((mc)\)
defined as the total market value of all listed shares divided by GDP. It measures the
overall size of markets. For the second relationship, the adopted variable reflecting the
banking development is the domestic credit to private sector divided by GDP \((prvcredit)\).
Such variable is used in order to account for financial intermediary development. Indeed,
this measure of banking development emphasizes the allocation of capital between the
private and public sectors.

The central variable as a measure of inflation \((cpi)\) reflects changes in the cost to
the average consumer of acquiring a fixed basket of goods and services. The empirical
correlation over the overall panel among inflation and either credit to private sector or
market capitalization is negative recording, respectively, the values –0.206 and –0.28.

The available set of control variables includes two variables in order to control for
the level of development, that is a variable as a proxy of income and a variable reflecting
the level of education. Real per capita GDP, so considered, is the gross domestic product
converted to international dollars using purchasing power parity rates. For education, the
available information concerns the gross enrollment ratio at the secondary level,
regardless of age, to the population of the age group that officially corresponds to the
level of education shown. To take into account the influence of fiscal policy, the general
government final consumption expenditure as a percentage of GDP is also introduced. It
includes all government current expenditures for purchases of goods and services
(including compensation of employees) and most expenditures on national defense and
security, but excludes government military expenditures that are part of government
capital formation.\(^3\)

Our econometric investigations with panel data described in the next section use a
regression specification given by:

\[
y_{it} = \eta_i + \gamma cpi_{it} + \beta' X_{it} + \epsilon_{it} \quad i = 1, \ldots, n \quad t = 1, \ldots, T_i \tag{1}
\]

\(y_{it}\) is the dependent variable, that either market capitalization or credit to private sector in
the \(i\)th country for some period \(t\). \(cpi_{it}\) is the appropriate measure of inflation for the

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1 See annexe A1.
2 This definition of stock market development is used here rather than a composite index of stock market
development because it is a good proxy for general development and individual measures and indexes of
stock market development are strongly associated (Demirgüç-Kunt and Levine (1996)).
3 The three variables are noted, respectively, Real per capita GDP, Schooling and Government.
couple of observation \( i \). \( \mathbf{X}_{it} \) is the vector including the set of control variables. Finally, \( \eta_i \) is an unobserved country specific effect, and \( \varepsilon_{it} \) is the error term for each observation.

**III- Econometric modelling**

According to the available data, the treatment of incomplete panels is imperative. Indeed, the available panel data set for the 11 MENA region countries is unbalanced since each variable is observed over varying time length. On the other hand, differentiating equation (1) leads to the context of dynamic panel models where more efficient and consistent estimators are given through the Generalized Method of Moments (GMM). This technique, developed essentially by Arellano and Bond (1991), is more and more employed in macroeconometric and finance studies. It provides convergent estimators and derives from the instrumental variables principles. It also makes up for problem of correlation between the lagged dependent variable \( y_{it-1} \) included in the vector of control variables \( \mathbf{X}_{it} \), defined above, and the error term \( \varepsilon_{it} \) as well as between some explanatory variables and the unobserved country specific term \( \eta_i \).

From an econometric point of view, the GMM is based on a set of orthogonality conditions between the error terms and some instrumental variables. Estimation procedure is conducted in order to converge these orthogonality conditions to zero. The obtained estimator follows from a minimization of an appropriate quadratic form. Improvements are introduced like the two-step estimator developed by Arellano and Bond (1998) or the recent alternative procedure developed by Calderon, Chong and Loayza (2000). In comparison with the earlier procedures, the later reduces the dimensionality of the instruments which permits to avoid the over-fitting risk but still takes into account the presence of heteroscedasticity consistent standard errors. Formally, the model (1) is transformed into the following difference equation:

\[
(y_{it} - y_{it-1}) = \gamma(\text{cpi}_{it} - \text{cpi}_{it-1}) + \beta'(\mathbf{X}_{it} - \mathbf{X}_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \quad i = 1, \ldots, n \quad t = 2, \ldots, T_i \tag{2}
\]

In this specification, the country specific effect is dropped out, but a new kind of bias arises since \((y_{it-1} - y_{it-2})\) is correlated with the transformed error term \((\varepsilon_{it} - \varepsilon_{it-1})\). Hence, Arellano and Bond (1991) proposed the following moment conditions:

\[
E(\text{cpi}_{it-s} (\varepsilon_{it} - \varepsilon_{it-1})) = 0 \quad \text{for} \ s \geq 2 \ ; \ t = 3, \ldots, T_i \tag{3}
\]

\[
E(\mathbf{X}_{it-s} (\varepsilon_{it} - \varepsilon_{it-1})) = 0 \quad \text{for} \ s \geq 2 \ ; \ t = 3, \ldots, T_i \tag{4}
\]

---

4 See also Arellano and Bover (1995), and Blundell and Bond (1998).

5 Note that the vector \((\mathbf{X}_{it} - \mathbf{X}_{it-1})\) contains the component \(( y_{it-1} - y_{it-2})\).
With these conditions in mind, the so called difference estimator is provided after running two steps. In the first one the error terms are assumed to be independent and homoscedastic across countries and over time. The residuals retained at this step serve to construct consistent estimate for the variance-covariance matrix. Thus the difference estimator is asymptotically more efficient than the first step estimator.

Besides the estimation procedure, Arellano and Bond (1991) construct an interesting test in order to validate no second-order serial correlation for the error terms of the first-differenced equation given by expression (2). The importance of this test is due to the fact that the consistency of the GMM estimator depends on the assumption that \( E(\varepsilon_i \varepsilon_{i-2}) = 0 \). The appropriate statistic of the test is asymptotically standard normal under the null hypothesis and is defined as follows:

\[
N = \frac{\Delta \hat{\varepsilon}_{-2} \Delta \hat{\varepsilon}}{\sqrt{\Delta \hat{\varepsilon}}}
\]  

(5)

where \( \hat{\varepsilon}_{-2} \) is the vector of residuals lagged twice, and \( \hat{\varepsilon} \) is a vector of trimmed \( \hat{\varepsilon} \) to match \( \hat{\varepsilon}_{-2} \).

A Sargan specification test is also conducted which is a test of over-identifying restrictions. Under the null hypothesis, the Sargan statistic is asymptotically distributed as Chi-square with \( p-k \) degrees of freedom and is written down as:

\[
S = \Delta \hat{\varepsilon}' W \left( \sum_{i=1}^{n} W_i \Delta \hat{\varepsilon}_i \Delta \hat{\varepsilon}_i' W_i \right)^{-1} W' \Delta \hat{\varepsilon}
\]

(6)

\( W \) is the chosen matrix of instruments, \( p \) indicates the number of columns in \( W \), and \( k \) the number of parameters to be estimated.

In order to analyse the threshold effect, two steps are needed. Firstly, the optimal threshold must be identified according to the approach developed by Hansen (1999). Since it is unknown, it would be estimated. Second, when this parameter is estimated, we can return to the initial stage of estimation of the whole model according to GMM. To shed light on the existence of threshold effects in the relationship between inflation and financial sector performances, the initial model (expression (1)) must be written again as follows:

\[
y_{it} = \eta_i + \gamma_1 cpi_{it} I(cpi_{it} \leq \delta) + \gamma_2 cpi_{it} I(cpi_{it} > \delta) + \beta' X_{it} + \varepsilon_{it} \quad i = 1, \cdots, n \quad t = 1, \cdots, T_i
\]

(7)

See also Hansen (1999).
\(I(.)\) is the indicator function which permit to create two situations depending on whether the inflation rate \(cpi_{it}\) is smaller or larger than the threshold \(\delta\). After removing individual-specific means from equation (7), estimation by OLS gives estimate \(\hat{\beta}(\delta)\) for any given level of the threshold \(\delta\). From these estimations, the sums of squared errors \(S(\delta)\) are recovered. The least squares estimator of \(\delta\) if achieved by minimization of \(S(\delta)\). So we obtain the estimated threshold defined as follows:

\[
\hat{\delta} = \arg \min_{\delta} S(\delta) \quad (8)
\]

Once \(\hat{\delta}\) is obtained, the following model is finally estimated by GMM in order to take into account the threshold effects:

\[
y_{it} = \eta_{i} + \gamma cpi_{it} + \mu I(cpi_{it} > \hat{\delta}) + \theta I(cpi_{it} \leq \hat{\delta}) + \beta' X_{it} + \epsilon_{it} \quad i = 1, \ldots, n \quad t = 1, \ldots, T, \quad (9)
\]

**IV- Empirical results**

Several specifications of the dynamic panel model were estimated using the econometric methodology presented in the previous section\(^7\). Tables 1 and 2 report GMM estimates of these specifications.

\<INSERT TB 1 HERE>\n
Table 1 presents regression results when the dependent variable is the Private Credit over GDP as a measure of the banking sector performance. To appreciate adequately the strength of the relationship between finance and bank sector development, we include other variables in the regressions to account for level of development and fiscal policy. As indicated in Table 1, there is a statistically significant negative relationship between inflation and banking sector development even after controlling for the level of development and fiscal policy. As discussed in the introduction, some theoretical models suggest that there is a threshold level in the relationship between inflation and financial sector performance. Estimating this threshold regressions allows us to examine whether there is a significant modification of intensity in the finance/inflation relationship as inflation exceeds critical value of 22 percent identified previously. The regressions show that after allowing for threshold effects, the marginal impact of inflation on bank sector development is the same at all level of inflation. Furthermore, the partial correlation between inflation and bank sector performance essentially disappears when we account for those threshold levels.

Alternative “functional form” proposed by Boyd *et al.* (2001) is intended also to capture non-linearities in the relation between inflation and bank sector development. We

\(^7\) *An appropriate algorithm was written on STATA7 software.*
replace then the inflation rate \((cpi)\) by its inverse \((invcpi)\) which enters the Private Credit equation positively but not significantly. This suggests the absence of non-linearities in the association between inflation and bank sector performance.

\(<\text{INSERT TB 2 HERE}>\)

We now repeat our empirical procedures using the stock market performance data instead of the banking sector one. Table 2 shows that stock market development is significantly related to inflation but with less strength than the banking/inflation relationship. Furthermore, the threshold regressions involving market capitalization as an indicator of equity market development report no evidence of a threshold level in the inflation and stock market performance relationship. The observation that the relationship between stock market development and inflation “flattens” as inflation rises can be captured by using instead of \((cpi)\) in the regression its inverse \((invcpi)\). The inverse of inflation enters the stock market development equation positively but not significantly. This clearly illustrates the absence of non-linearities in the stock equity and inflation relationship.

V- Conclusion

This paper empirically assesses the impact of the rate of inflation on the financial sector performance. Boyd et al. (2001) show that there is a significant, and economically important, negative relationship between inflation and both stock market development and banking sector activity. Further, the relationship displayed is not linear. We extend then the work of Boyd et al. (2001) to the MENA region using dynamic panel data with the Hansen’s (1999) methodology to estimate threshold levels. Globally, we find that inflation has a negative and significant incidence on financial sector development but with no evidence of thresholds levels even after controlling for simultaneity and omitted variable biases. In other words, we show that a marginal increase of inflation is harmless to stock market performance and banking sector development whatever the rate of inflation.

All these results should be taken with some care. First of all, the sample includes several countries that witnessed very high and volatile level of inflation during the observation period. Further, these rather weak relationship could also be attributed to the use of annual data instead of data over five years which would have helped us to abstract from business cycle relationship. The short period of observation in our sample prevents us from using averaged data. In other words, annual data may have biased the relationship between financial development and inflation. Finally, the relatively weak relationship between inflation and stock market development compared to that find between inflation and banking sector performance should be attributed to the smallness of equity markets in the MENA region.
References


Annexe A1- Sample description

Bahrain  [1989-1999]
Egypt    [1981-1999]
Iran     [1993-1999]
Jordan   [1979-1999]
Kuwait   [1993-1999]
Lebanon  [1995-1999]
Morocco  [1983-1999]
Oman     [1989-1999]
Saudi Arabia [1992-1999]
Tunisia  [1987-1999]
Turkey   [1988-1999]

Table 1- GMM estimators of the relationship between stock markets performance and inflation; two-step results

<table>
<thead>
<tr>
<th>Variables</th>
<th>GMM regression without threshold</th>
<th>GMM regression with threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real per capita GDP</td>
<td>-18,448 (-1.67)</td>
<td>-8.1 (-0.55)</td>
</tr>
<tr>
<td></td>
<td>-3,832 (-0.93)</td>
<td></td>
</tr>
<tr>
<td>Schooling</td>
<td>18,534 (4.37)</td>
<td>-27,526 (-0.5)</td>
</tr>
<tr>
<td></td>
<td>25,556 (2.33)</td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>0.092 (1.66)</td>
<td>0.0781 (0.84)</td>
</tr>
<tr>
<td></td>
<td>0,092 (1.66)</td>
<td>0.0781 (0.84)</td>
</tr>
<tr>
<td>Invcpi</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.867 (1.27)</td>
<td></td>
</tr>
<tr>
<td>Cpi</td>
<td>-0.167 (-1.56)</td>
<td>-0.195 (-0.29)</td>
</tr>
<tr>
<td></td>
<td>(-0.167)</td>
<td>(-0.29)</td>
</tr>
<tr>
<td>Ccpi</td>
<td>0.092 (-0.03)</td>
<td>-0.0294 (-0.03)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.0294 (-0.03)</td>
</tr>
<tr>
<td>Thcpi</td>
<td>4.28 (0.17)</td>
<td>4.28 (0.17)</td>
</tr>
<tr>
<td>Constant</td>
<td>2,401 (3.29)</td>
<td>3,0951 (1.88)</td>
</tr>
<tr>
<td></td>
<td>1,0417 (2.51)</td>
<td></td>
</tr>
<tr>
<td>Nb. observations</td>
<td>109</td>
<td>109</td>
</tr>
<tr>
<td>Statistic F</td>
<td>9.76</td>
<td>3.4</td>
</tr>
<tr>
<td>Sargan test (Statistic S)</td>
<td>5.81</td>
<td>2.84</td>
</tr>
<tr>
<td>Serial correlation test (Statistic N)</td>
<td>-1.15</td>
<td>-0.88</td>
</tr>
<tr>
<td></td>
<td>-1.01</td>
<td></td>
</tr>
</tbody>
</table>

- Student are in parentheses.
- Real per capita GDP and Schooling are expressed in logarithm.
- For Sargan test, the null hypothesis is that the instruments used are not correlated with the residuals.
- For the test for autocorrelation, the null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.
Table 2- GMM estimators of the relationship between banking development and inflation; two-step results

<table>
<thead>
<tr>
<th>Variables</th>
<th>GMM regression without threshold</th>
<th>GMM regression with threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real per capita GDP</td>
<td>40,146 (1.01)</td>
<td>-28,777 (-0.35)</td>
</tr>
<tr>
<td>Schooling</td>
<td>62,366 (3.11)</td>
<td>69,653 (2.92)</td>
</tr>
<tr>
<td>Government</td>
<td>0.25 (3.14)</td>
<td>0.432 (2.09)</td>
</tr>
<tr>
<td>Invcpi</td>
<td>70,501 (2.41)</td>
<td>72,702 (2.84)</td>
</tr>
<tr>
<td>Cpi</td>
<td>-0.122 (-2.94)</td>
<td>-0.0826 (-0.19)</td>
</tr>
<tr>
<td>Ccpi</td>
<td></td>
<td>0.0971 (-0.17)</td>
</tr>
<tr>
<td>Thcpi</td>
<td></td>
<td>-3.781 (-0.4)</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.329 (-0.97)</td>
<td>-2.398 (-2.1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.0375 (-0.01)</td>
</tr>
<tr>
<td>Nb. observations</td>
<td>109</td>
<td>109</td>
</tr>
<tr>
<td>Statistic F</td>
<td>46.52</td>
<td>21.01</td>
</tr>
<tr>
<td>Sargan test (Statistic S)</td>
<td>1.63</td>
<td>2.34</td>
</tr>
<tr>
<td>Serial correlation test (Statistic N)</td>
<td>0.22</td>
<td>-0.54</td>
</tr>
</tbody>
</table>

* t-Student are in parentheses.
* Real per capita GDP and Schooling are expressed in logarithm.
* For Sargan test, the null hypothesis is that the instruments used are not correlated with the residuals.
* For the test for autocorrelation, the null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.