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Inflation Effects on Finance-Growth Link : A Smooth Transition Approach, Case study: Iran

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Abstract
In view of the importance of financial markets and role of the financial development in the economic growth and the effects of inflation on the economic growth we dealt with the study of the effects of the Iranian financial growth in various regimes during a period of time from 1975 through 2008. To this end we used the nonlinear regressions and LSTR model (Logistic smooth transition). The results of the approximation of LSTR model indicated that the effects of financial development on the economic growth are dependent on the various inflation regimes in such a way that in the low-rate inflation regime the effects of the financial development on the economic growth are constructive and positive. But in the high-rate inflation regime the effects of the financial development on the economic growth are negative. The amount of the threshold parameter has been 10.4 for inflation rate.
Key words:
Credits to non-governmental sector, economic growth, LSTR, Iran

1. INTRODUCTION

Theoretically, the relation between development of financial sector and economic growth has been addressed for several years by most economists. Economists such as Bagehot (1873), Schumpeter (1912), Shaw and Gurley (1955), Goldsmith (1969) and Mckinnon (1973) believe that in case the relation between financial sector and economic growth is ignored, the process of economic growth will not be understood completely.

There are many possible reasons why inflation might affect the finance-growth relationship. Intuitively, we know that when inflation rates are very high, the usefulness of money assets is eroded and there will be considerable uncertainty about future prices and interest rates. This uncertainty, in turn, may make financial intermediation – standing between lenders and borrowers - less efficient in allocating funds for investment, and may affect the ability of lenders to monitor projects. As a result, high inflation may weaken the link between finance and growth.

More precisely, inflation could alter the link between finance and growth in two key ways. First, inflation could affect the financial system's ability to accumulate capital - the amount of investment. In particular, when inflation is sufficiently high, the ability of financial intermediaries to raise capital may decrease, and thus the positive effect of financial development on capital accumulation may diminish. Second, inflation could affect the productivity of capital investment financed through the financial system. Intuitively, in high-inflation environments, even if the level of financing provided for capital investment is not affected, high inflation may decrease the productivity of accumulated capital, and this decrease will reduce the link between investment and economic growth.

In this paper, we examine the way in which the finance–growth relationship can vary according to the inflation rate. The non-linearity between finance and growth with respect to inflation might be connected to the fact that inflation negatively affects economic growth and thus results in financial repression.

2.THEORETICAL FRAMEWORK

Mckinnon (1973) and, Gurley and Shaw 1955, showed the importance of an efficient financial system in the economic development in their works. They argued that the restrictions imposed by government on the financial sector (such as control of interest rate, high rate of reserve with central Bank, allocation of bank credits, etc.) could cause some problems in the development of financial sector and as a result restriction of real sector.

While intensive studies have examined the relationship between finance and growth, very few efforts have been made to identify why a link exists between finance and growth. Empirical studies on the issue of

whether the finance-growth relationship is due to the "capital accumulation channel" or the "productivity channel" are mixed and surprisingly Scarce (min li,2009).
The previous studies have generally assumed a constant relationship between finance and growth. That is, they have not considered whether economic conditions, such as the rate of inflation, are associated with a stronger or weaker finance-growth relationship (min li,2009).
Only a few studies appraise the relationship between inflation, financial development and growth.Haslag and Koo (1999) and Boyd et al. (2001) show that inflation is associated with financial repression. Andres et al. (1999) pointed out that empirical studies have focused on either the finance-growth relationship or the inflation-growth relationship, but not linked the two. Rousseau and Wachtel (2002) identify an inflation threshold for the finance-growth relationship, finding that finance affects growth positively only when annual inflation can be held below a threshold that lies between 13 and 25 percent, depending on the measure of financial depth that is chosen. They also find that disinflations are related to strong positive effects of finance on growth. More recently, Rousseau and Yilmazkuday (2009) have extended the work of Rousseau and Wachtel (2002) through a trilateral graphic approach and threshold analysis. They find that small increases in the price level seem able to wipe out relatively large effects of financial deepening when the inflation rate lies between 4 and 19%, whereas the finance–growth relationship is less affected by inflation rates above this range.

3.RESEARCH METHODOLOGY

Smooth transition regression model is a non-linear time series model that can be considered as a more developed species of regression models with varying coefficients that has been introduced by Bacon and Wats (1971). For first time in time series literature, Grenger -Trasorta (1993) has described and suggested STR smooth transition model in their studies. PSTR model may be specified into either exponential smooth transition model (ESTR) or logistic smooth transition (LSTR) as following:

$$Y_t = \alpha + \beta_0 F_t + \beta_1 F_t G(q_t) + \delta Z_t + U_t \qquad (1)$$

LSTR : $G(q_t) = 1/((1+\exp\{-\gamma(q_t - c)\}))$

ESTR : $G(q_t) = 1-1/((1+\exp\{-\gamma(q_t - c)^2\}))$

Where Yt is real gross domestic production (Real Gdp) without oil as an index for economic growth, α is intercept, F_t is the financial development indicator (we used the credits allocated to private sector as a share of GDP as the proxy of financial development), and Z_t is vector of control variables (used control variables such as capital, oil revenue, labor and sum of exports and imports as a share of GDP to capture the degree of openness of an economy) . In this specification, the coefficients of explanatory variables are not constant and are functions of q_t standing for inflation rate, namely, transition or threshold variable. $G(q_t)$ is transition function, c is threshold parameter and γ>0 is smooth parameter. The transition function is between zero and one. This function is mainly dependent on transition variable (q_t), threshold parameter (c) and the smooth parameter (γ).
The above specification indicates that model can be interpreted as a linear model with stochastic time-varying coefficients. For LSTR model, coefficients of $\beta_0 + \beta_1 G(q_t)$ change monotonically as function of q from β_0 to $\beta_0 + \beta_1$ (when q_t moves from -∞ to +∞). But at ESTR function, coefficients change symmetrical about middle point c from β_0 to $\beta_0 + \beta_1$ (when q_t moves from c toward ±∞). Thus LSTR model is able to model symmetrical behavior of variables. For example, this model is proper where boom periods show different behaviors from depression ones and transition from one regime to another regime takes place smoothly. On the other hand, the ESTR model is appropriate in situations in which the local dynamic behavior of the process is similar at both large and small values of q_t and different in the middle. When smooth parameter is γ=0, the transition function will be $G(q_t) = 1$ and thus STR model will change into a linear model. On the other hand, when γ→ ∞, the LSTR model will change into regression model with 2 discrete regimes. At ESTR model, if γ→ ∞ in fact it leads to a linear model.

The null hypothesis of linearity for model (1) can be expressed as $H_0 : \gamma = 0$ against $H_1 : \gamma \succ 0$ or as $H_0 : \beta_1 = 0$ against $H_1 : \beta_1 \neq 0$.

This indicates an identification problem, since the model is identified under the alternative but not identified under the null hypothesis. The likelihood ratio test, the Lagrange multiplier and the Wald test do not have their standard asymptotic distributions under the null hypothesis and one cannot use these tests for a consistent estimation of the parameters *c* and β. To deal with this problem, we apply Luukkonen, Saikkonen and Teräsvirta (1998) method, which is based on a third-order Taylor approximation about $\gamma = 0$:

$$Y_t = \alpha + \beta_0 F_t + \sum_{j=1}^{3} \beta_j F_t q_t^j + U_t^* \qquad (2)$$

The linearity test is identical to testing the joint restriction that all nonlinear terms are zero as in the following null hypothesis :

$H_0 : \beta_1 = \beta_2 = \beta_3 = 0$

Finally, one possible way to identify the appropriate model between LSTAR and ESTAR models is through a sequence of tests on parameter values from equation (2).

Thus, we consider a sequence of the null hypotheses as follows:

$$H_{01} : \beta_3 = 0$$

$$H_{02} = \beta_2 = 0 \mid \beta_3 = 0$$

$$H_{03} = \beta_1 = 0 \mid \beta_2 = \beta_3 = 0 \qquad (3)$$

We would select the LSTR model if H_{01} is rejected. If H_{01} is not rejected but H_{02} is rejected, we would adopt the ESTR model. If both H_{01} and H_{02} are not rejected but H_{03} is rejected, then we selected the LSTR model.

4. EXPERIMENTAL RESULTS

4.1 Test for linearity and Selection of STAR models

Table 2 indicates the null hypothesis of linearity ($H_0 : \beta_1 = \beta_2 = \beta_3 = 0$) can be rejected at the 10% level of significance and Table 2 also report the results tests regarding the choice between the LSTR and the ESTR models. By examining the test statistics for various hypotheses in Table 2, we conclude that the LSTR model is a more appropriate model.

Table 2. Result of Linearity Test and Model Selection (P-values)

	H_0	H_1	H_2	H_3
F statistics (P-values)	0.032	0.005	0.482	0.134
Chi-square Statistics (P-values)	0.05	0.009	0.535	0.156

4.2 Estimate of LSTR model

After confirming the existence of non-linear relationship between economic growth and inflation on financial development, we estimate non-linear regressions by LSTR model. The results of the approximation are indicated in table 3.

The results of the approximation of LSTR model indicate that threshold paranter of inflation is equal to 10.4 in the relationship between economic growth and financial development. In view of the approximation of the parameter of β_0 and β_1 we can say that in the low-rate inflation regime the effects of the financial development on the economic growth are constructive and positive. But in the high-rate inflation regime the effects of the financial development on the economic growth are negative. As a result we can say that in the Iranian economy the effectiveness of the financial development on the economic growth is dependent on the economic conditions and lying in the high-rate or low-rate inflation.

Table 3. Parameter estimates for the LSTR model

	coefficient	*t-values*
Intercept	14.54	2.23**
Parameter β_0	0.24	2.27*
Parameter β_1	-4.2E+115	-1.74***
Threshold Parameter (c)	10.4	
Smooth Parameter (γ)	19.9	
Control variables		
Log(capital)	0.54	4.29*
Log(labor)	-0.93	-1.62
Log(Inflation rate)	-0.46	-2.71*
Log(Openness to trade)	0.16	2.11**
Diagnostic Test Statistics		
R-Squared: 0.97	**SSR: 0.065**	
Adjusted R-squared: 0.96	**DW: 1.77**	

Note**:*,** ** and *** Represents significance at1%, 5 % and 10% level of significance

Moreover the results of the estimation in table 3 indicate that capital and openness to trade left positive effects on the economic growth but labor and inflation rate leave negative effects on the economic growth.

CONCLUSION

In this paper we investigated the effects inflation on Relationship of financial development on the economic growth of Iran in 1975-2008. We considered financial development index as the credits awarded to the nongovernmental sector.

To this end we used the nonlinear models. In view of the results the LSTR model was selected as the appropriate model. The results of the approximation of LSTR model indicated that the effects of financial development on the economic growth are dependent on the various inflation regimes in such a way that in the low-rate inflation regime the effects of the financial development on the economic growth are constructive and positive. But in the high-rate inflation regime the effects of the financial development on the economic growth are negative.

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