

# “The effects of openness on inflation: panel data estimates from selected developing countries”

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## The effects of openness on inflation: panel data estimates from selected developing countries

### Abstract

This study examines the relationship between openness and inflation in selected developing countries. For this purpose the annual data covering the period of 1980-2006 are used. In order to point the effect of openness; exchange rate, openness to foreign trade and foreign direct investment are used. In addition to this, GDP per capita is also included in the model by the thought of openness effect on economic growth and this effect may be inflationary. According to the estimation results obtained using panel data models, openness and, accordingly, GDP per capita have positive effects on inflation.

**Keywords:** inflation, developing country, openness, panel data method.

**JEL Classification:** E31, F21, C23.

### Introduction

The term 'inflation', which exists on the top of the discussion subjects in the literature of economics and which is shown as both the cause and the effect of economic instabilities in developing countries, has become more important on international basis after the crises in Mexico (1995) and in Asia (1997). Although, the causes of crises differ from country to country, the effects of crises after depression period usually brought high inflation rates and economic recessions for almost all countries of the developing world.

In the literature the inflation phenomenon is generally defined as *continuous* increase in general price level of an economy. This *continuous* increase in general price level is critical in terms of displaying inflation dynamics. Inflation is a dynamic term which depends on the relation of various components. The relations between money demand, wages and prices affect inflation and, as a result of these interactions, the differences occur (Karayakali, 2002). According to this, it is possible to imagine the inflation as a spiral. The increase in prices can continue as a self-nourishing period.

In other words, inflation is the continuous decrease in the real value of the money. Therefore, a decrease in the value of the related good shows itself as deadweight loss only for its producer and/or its seller. However, inflation is not a case like this; it is a socioeconomic problem which concerns the whole society (Orhan, 1995). When we consider this definition in terms of economic schools, according to classic and modern quantity theory, as the absolute increases in money level can not increase in short-term output level, it shows itself as an increase in the price; namely, in the inflation. According to Keynesian school, inflation is the case when aggregate demand exceeds aggregate supply where the full employment exists.

When we consider the inflation phenomenon in accordance with the causes, principally five approaches exist in theory. According to the *classical economics* view, inflation means the breakdown of monetary and real flow balance in favor of monetary flow where the economy is in full employment level. In this definition, the cause of the increase in general price level is the increase in money supply. From the perspective of the *new structuralist* view, inflation occurs because of the conflict between an employee and an employer. In this scope, distribution of wages, profits and structure of the existing labor force are important in determining the inflation. In *Pure Demand* models, price increases depend on the excess demand in the goods market, aggregate demand's being more than aggregate supply brings the inflation (Karras, 1993). Inflation phenomenon in *Pure Cost* model is explained with the attitudes of the syndicates in the labor force market and with the price policies of the firms which make production in missing competition conditions. From the perspective of *Mixed model*, supply and demand are discussed together in determining inflation. In this model, increase in the general price level usually depends on the actions of labor syndicates (labor unions). According to *rational expectations models*, collective agreements will increase expectations related to money's real value and, therefore, parallel to rational expectations, a continuous inflation spiral will survive (Rudd and Whelan, 2003). The models in which inflation is determined by expectations have similarities with traditional wage-price increase model.

Finally, *Structuralist model* associates the structural unemployment, the structure of demand and the distribution of unemployment between markets. If some markets expand, some straiten, and if the labor factor can not transfer easily from one producing area to another because of the deficiency of other production factors, high inflation and unemployment ratios can be seen together in the economy. This also means that there is an elasticity problem

in these markets' production structure and for that reason the cost-push inflation arises (Ataç, 1997). Structural inflation is the widespread inflation type, especially among developing countries. The pressure of rapidly increasing and urbanizing society on food prices, increasing balance of payments problems caused by the failures in the foreign trade and inflationary effects of price increases of imported goods – caused by devaluations – are important (Agenor and Montiel, 2008).

In the following part, in light of the information above, following a review of the literature on theoretical definitions and explanations on dynamics of inflation, which mainly focus on relation with openness, first, the process of inflation in developing countries<sup>1</sup> will be examined. Second, in the empirical part we mainly concentrate on the determinants of inflation given openness. To elaborate this effect, we investigate the effect of exchange rate, openness to foreign trade and foreign direct investment on inflation using the annual data for 11 developing countries, covering the period from 1980 to 2006<sup>2</sup>. Results from panel data models, namely fixed and random effects models, are utilized for the purpose of the study.

## 1. Review of literature

In the literature there have been a large number of theoretical and empirical studies on inflation. The subject of 'inflation' could not be put in a common frame as it has a wide area, naturally, as the price level is related to the most of the macroeconomic variables. In this part of the study, before review of the literature on inflation dynamics and openness, closed economy assumptions will be discussed shortly.

*Monetarist School* regards the inflation in the frame of the relation between money stock and nominal income. According to them, 'fiscal deficit' is the main reason of inflation process as it affects the Money supply. In this scope, decreasing the monetary growth ratio depends on reducing the fiscal deficit. In this subject, Friedman specified "*Inflation is always and everywhere a monetary phenomenon*". In the studies of Polak (1957) and Khan-Knight (1985), it is tested that the effects on inflation of fiscal deficits which are financed by monetary methods, are in such a way that Monetarist School told (Ashra, 2002). As for the '*Structural Approach*', it defends the inquisition of the structure of economies in order to ascertain the high inflation in them (Pinar, 2006). Struc-

tural School, in contrast to Monetary School, signified that the source of the increase in price level is structural instabilities and, especially in developing countries, this tough structure exists in the agriculture sector. Therefore, according to Structural School, inflation is not 'always and everywhere phenomenon'. According to this view, excess demand helps inflation process and increases general price level (Agenor and Montiel, 1996).

However, it is not possible to ignore the effect of openness in analyzing the inflation with the openness in economies and liberalization process. Therefore, this factor can not be ignored in this period when especially developing countries are affected by external factors and they became dependent upon outside finance. When we consider the open economy assumption, countries' 'openness levels' are another important variable. Openness includes various variables such as trade rate to GDP, average tariff barriers, import quotas, export supporting policies and administrative perspective to the foreign investments (Ashra, 2002).

When we consider the empirical studies about inflation process (including 'openness level' for open economies), Triffin and Grudel (1962) evidenced that open economies have lower levels of inflation. According to this study, openness is the 'safety valve' and it implants the potential inflation pressures that can occur in the country according to the level of openness. Iyoha (1973) has encountered direct contrary situation in his study which covers 33 underdeveloped countries. Conclusion of that study can be summarized as openness has some negative effects on inflation. In another study which was made by Kirkpatrick and Nixon (1977), it is specified that decreasing import level reduces export so it will have an inflation-increasing effect on countries.

Romer (1993) analyzed 114 countries and determined that the openness causes decreases in exchange rate, therefore, he explained the reasons why the voluntary politics should be intervened against unanticipated inflationist effects. According to this study, in small countries where the openness is relatively more, average inflation level is low. Romer advanced his test and he tried on countries where more independent central banks exist and which are stable in terms of politics. As a result of this study, in countries where politic fluctuations are high and central bank independencies are low, the negative relation between inflation and openness is stronger. Lane (1997) and Terra'da (1998)<sup>3</sup> tested the same model, as Romer, using different data set and found the same result.

<sup>1</sup> Developing countries, which are taken as basis for this study for the years 1980-2006 are: Argentina, Brazil, Bolivia, Chile, Colombia, Costa Rica, Mexico, Paraguay, Peru, Turkey and Uruguay.

<sup>2</sup> As years and degrees of openness of related countries differ from each other, generally 1980's is taken as basis for the commencement of openness and liberalization.

<sup>3</sup> In addition to this, Terra (1998) associated the negative interaction between inflation and openness with 'excessive indebtedness'.

Jin (2000) mentioned in his study – where the East Asia economies were taken as basis – that openness is an important variable for growth but fiscal policies and foreign price shocks are more important than openness. Ashra (2002) studied on developing countries and included ‘agricultural product output’ into his model to test the view of structural approach. The results of the study are: in addition to monetary growth which is mentioned by Monetarist School, agricultural product output is also important. Therefore, Ashra (2002) emphasizes that Structural School’s inflation dynamics are more valid for developing countries but are deficient in determining inflation alone.

## 2. Inflation in developing countries

In 1980s, in order to be protected from ‘second petrol shock’ inflationary effects, tight monetary policies and expanding fiscal policies were applied in developed countries. The effects of this situation on developing-countries were, *in contrast to the last period*, the increase in interest rates and the decrease in growth

rates. In other words, the fiscal policies which had been implied on the past became unsustainable for these countries (Agenor and Montiel, 1996).

In the beginning of 1990s, the increase in the oil prices by the effect of Gulf War, increased the import rates for all developing world. As a result, in financing budget deficits, high internal borrowing followed external borrowing for almost all developing countries (Sezer, 2003). Apart from this, some big portion of these countries had encountered other “local financial crises”, *from the mentioned period to the present*, which arises/occurs from their structural and economical matters. This also means that, new major changes in the economic rules must have been applied (like exchange regimes from crawling peg to floating exchange rate regime or vice versa). Examining the developing countries during the last decades will be helpful in terms of collective determination. In this scope, the annual inflation values for the selected developing countries are given in Table 1.

Table 1. Inflation in developing countries (1998-2007)

Inflation %	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Algeria	5,0	2,6	0,3	4,2	1,4	2,6	3,6	1,6	2,5	3,7
Argentina	0,9	-1,2	-0,9	-1,1	25,9	13,4	4,4	9,6	10,9	8,8
Bangladesh	8,6	6,2	2,5	1,9	3,7	5,4	6,1	7,0	6,5	8,4
Bolivia	7,7	2,2	4,6	1,6	0,9	3,3	4,4	5,4	4,3	8,7
Brazil	3,2	4,9	7,1	6,8	8,4	14,8	6,6	6,9	4,2	3,6
Bulgaria	18,7	2,6	10,3	7,4	5,8	2,3	6,1	6,0	7,4	7,6
Chile	5,1	3,3	3,8	3,6	2,5	2,8	1,1	3,1	3,4	4,4
Colombia	18,7	10,9	9,2	8,0	6,3	7,1	5,9	5,0	4,3	5,5
Ivory Coast	5,2	0,9	-0,4	4,2	5,1	1,3	0,6	4,2	5,0	2,1
Croatia	5,7	4,0	4,6	3,8	1,7	1,8	2,0	3,3	3,2	2,9
Ecuador	36,1	52,2	96,1	37,7	12,6	7,9	2,7	2,1	3,3	2,2
Egypt	5,0	3,7	2,8	2,4	2,4	3,2	8,1	8,8	4,2	11,0
India	13,2	4,7	4,0	3,8	4,3	3,8	3,8	4,2	6,2	6,4
Iran	18,1	20,0	12,8	11,3	15,7	15,6	15,3	10,4	11,9	17,5
Malaysia	5,3	2,7	1,6	1,4	1,8	1,1	1,4	3,0	3,6	2,1
Mexico	15,9	16,6	9,5	6,4	5,0	4,5	4,7	4,0	3,6	4,0
Morocco	2,7	0,7	1,9	0,6	2,8	1,2	1,5	1,0	3,3	2,0
Pakistan	7,8	5,7	3,6	4,4	2,5	3,1	4,6	9,3	7,9	7,8
Paraguay	11,6	6,8	9,0	7,3	10,5	14,2	4,3	6,8	9,6	8,1
Peru	7,3	3,5	3,8	2,0	0,2	2,3	3,3	1,6	2,0	1,8
Philippines	9,7	6,4	4,0	6,8	3,0	3,5	6,0	7,7	6,2	2,8
Romania	59,1	45,8	45,7	34,5	22,5	15,3	11,9	9,0	6,6	4,8
Russia	27,7	85,7	20,8	21,5	15,8	13,7	10,9	12,7	9,7	9,0
Serbia	30,0	41,1	70,0	91,8	19,5	11,7	10,1	17,3	12,7	6,8
South Africa	6,9	5,2	5,4	5,7	9,2	5,8	1,4	3,4	4,7	7,1
Syria	-1,0	-3,7	-3,9	3,4	-0,5	5,8	4,4	7,2	10,6	7,0
Tunisia	3,1	2,7	2,3	2,0	2,7	2,7	3,6	2,0	4,5	3,1
Turkey	84,7	64,9	55,0	54,2	45,1	25,3	8,6	8,2	9,6	8,8
Ukraine	10,6	22,7	28,2	12,0	0,8	5,2	9,0	13,4	9,0	12,8
Uruguay	10,8	5,7	4,8	4,4	14,0	19,4	9,2	4,7	6,4	8,1
Venezuela	35,8	23,6	16,2	12,5	22,4	31,1	21,7	16,0	13,7	18,7

Source: IMF, derived from “World Economic Outlook”, [www.imf.org](http://www.imf.org).

As it can be seen from Table 1 focusing on annual changes basis, between the years 1998-2003, inflation increases are differing from country to country. But in the same period, it can also be said that, Ecuador, Romania, Turkey and Venezuela are the

countries which had higher inflation problems than the other countries. After 2003, inflation seems to be reduced in most of these countries but until to 2007. This can be seen in the graph below which consists of the last three years.

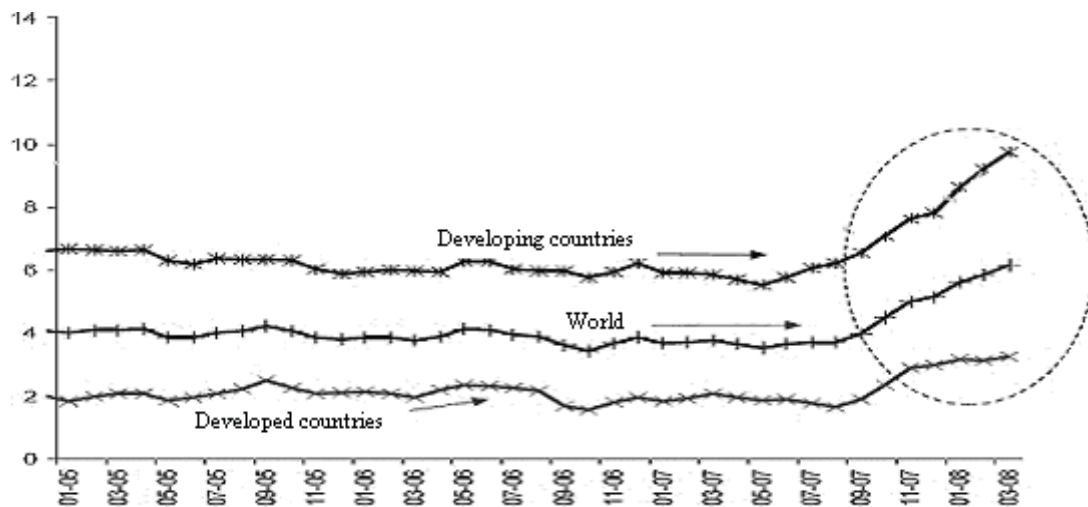


Fig. 1. General trends in inflation 2005-2008<sup>1</sup>

With the general situation given in Table 1, it is useful to focus on the period starting from 2005 to the last years. Figure 1 shows the changes in inflation from 2005 to the first 3 months of 2008. Further, it can be said that the inflation has a sharp increasing rate of 4-6% worldwide. When we consider the last quarter of 2007 and the first quarter of 2008, Figure 1 clearly shows the increase in inflation for the world. The rapid increase in oil prices in the last period, the global financial and mortgage crises, decreases in the growth rate, Central Banks' disability to stop the expectation of increase in inflation and the increases in food prices were effective in this result.

### 3. Econometric model

Panel data analysis is the estimation of economic relationships by using cross sectional time series data where we have repeated observations, i.e. time-series of observations, for each individual rather than aggregate level (Greene, 1997). The basic regression model is:

$$Y_{it} = \alpha + \beta' X_{it} + \varepsilon_{it}, \quad (1)$$

where  $X_{it}$  represents the explanatory variables,  $t$  shows time and  $i$  shows country dimension. In the literature, there are two common approaches to estimate panel data, namely fixed effects and random effects models (Baltagi, 2005; Baldemir and Keskiner, 2004). Let us now look at these models, in short.

**3.1. Fixed effects model.** General formulation assumption of panel data model is the differences among units can be caught in differences in constant term (Greene, 1997). So, the panel data are estimated with the help of dummy variables (Pazarlioğlu, 2001). For example, when the panel data model is:

$$y_{it} = \beta_{1it} + \beta_{2it}x_{2it} + \beta_{3it}x_{3it} + e_{it} \quad (2)$$

$$I = 1, \dots, N \text{ ve } t = 1, \dots, T$$

$$\beta_{1it} = \beta_1; \beta_{2it} = \beta_2; \beta_{3it} = \beta_3$$

is assumed. Here, only the parameter changes, no time dimension is used in determining the constant term. This term is constant for all times. When we consider both cross-section and time, the model becomes:

$$y_i = x_i\beta_{1j} + X_N\beta_S + e. \quad (3)$$

In equation (3), different constants exist for different units.

**3.2. Random effects model.** If units are taken randomly or unit is taken from its population as representative, random effects model is more useful. Here, the units are randomly selected, so the differences in units are random. Random effects are result of sampling period. So, in equation (2),  $\beta_{1i}$  is the random variable and it can be modeled as:

$$\beta_{1i} = \bar{\beta}_1 + \mu_i. \quad (4)$$

When the parameter transformation model in equation (4) is put in model number 2:

$$Y_{it} = (\bar{\beta}_1 + \mu_i) + \beta_2x_{2it} + \beta_3x_{3it} + e_{it}, \quad (5a)$$

<sup>1</sup> Compiled from Erdem Başçı, "Dünyada ve Türkiye'de Enflasyon", (Inflation in Turkey and Worldwide) www.tcmb.gov.tr, Tüketici Enflasyonu-Yıllık % Değişim (Consumer Inflation, Annual % Change).

$$Y_{it} = \bar{\beta}_1 + \sum_{k=2}^K \beta_k x_{kit} + (e_{it} + \mu_i), \quad (5b)$$

equations are reached. The component in 5b is the general type of error component model.  $e_{it}$  shows all errors and  $\mu_i$  shows specific errors. They both form error component term. The second one, namely the specific errors connecting to one unit, shows the differences of the unit and the changes in units according to constant time (Baldemir and Keskiner, 2004).

Which one to be selected among fixed effect and random effect models, usually depends on the relation of effects and explanatory variables. If effects are not related to explanatory variables, random effects estimator is consistent and efficient, fixed effect estimator is also consistent but not efficient. If the effects are related to explanatory variables, fixed effects estimator is consistent and efficient, and random effects estimator is inconsistent. More formally, one can use the standard Hausman test in selecting between fixed effects and random effects. If one rejects the null hypothesis that “the conditional mean of the disturbances given the regressors is zero”, then one can select the fixed effect model, otherwise select the random effect model (see Baltagi et al., 2003).

#### 4. Data set, definitions of the variables and estimation results

In this study which examines the inflation in developing countries parallel to openness, the data used enclose 1980-2006 annually. The variables that take place in the model are orderly: “i” stands for the inflation, “open” stands for openness to foreign trade, “e” stands for the nominal exchange rate, “fdi” stands for the foreign direct investment, and “gdpc” stands for the GDP per capita. In calculating the external openness to foreign trade, (import+export/GDP) is used. Data used in this study are collected from databases of World Development Indicators and International Financial Statistics of IMF. The variables except GDP per capita, are important in terms of openness and they should also be used in analyzing the inflation. Apart from this, one of the most important reasons for openness is its *expected positive effect* on economic growth. To capture this effect, we used GDP per capita as an explanatory variable in the model.

$$i = \beta_0 + \beta_1 e_{it} + \beta_2 open_{it} + \beta_3 fdi_{it} + \beta_4 gdpc_{it} + v_{it}. \quad (6)$$

In equation (6) which is estimated by panel data method, the findings about determinant variables are as follows: With the increase in exchange rate “e”, an increase in inflation is expected. Likewise with an increase in openness to foreign trade, an increase in

inflation is also expected. With the existence and increase in openness, increase in economical activities and the supply part of the economy’s slow reaction in terms of flexibility will bring the increase in prices. According to the effects of GDP per capita and foreign direct investment, it is possible to think in two ways: First, it is possible to say that the economy is under full employment and in periods where total supply flexibility is high, the effect of the increase in foreign direct investment and in GDP per capita will not be inflationary and these two factors will increase the real growth. In this case, it is possible to say that the increase in these two variables will increase the inflation. However, the effects of the increase in GDP per capita and foreign direct investment, are not only observed on output (real growth) but also observed on inflation. There may be two reasons for the inflationary effect mentioned: these are low aggregate supply elasticity and full employment (high rates of economic expansion)<sup>1</sup>.

Table 2. Estimation results: Fixed effects model

Variable	Coefficient	Standard error	Significance
e	0.01	0.002	0.00
Open	2.43	0.269	0.00
fdi	0.19	0.060	0.00
gdpc	1.90	0.203	0.00
F(10, 273) = 15.61 Prob > F = 0.0000			

Note: \* Related coefficients and standard errors are scaled in order to see the result clearly. Thus, GDP per capita and foreign direct investments are multiplied with 1/1000000; openness is multiplied with 1000000.

Table 3. Estimation results: Random effects model

Variable	Coefficient	Standard error	Significance
e	0.01	0.002	0.00
Open	1.23	0.195	0.00
fdi	0.24	0.057	0.00
gdpc	1.46	0.184	0.00
Hausman test statistics: 41.57 (Prob>chi2 = 0.0000)			

Note: \* Related coefficients and standard errors are scaled in order to see the result clearly. Thus, GDP per capita and foreign direct investments are multiplied with 1/1000000; openness is multiplied with 1000000.

Estimation results of equation (6) using both fixed and random effects models are presented in Table 2 and Table 3, respectively. As can be seen from the tables, both specifications yield similar results. F-test under fixed effects model shows that there are statistically significant individual effects. Thus, pooled OLS regression is not appropriate. Further, Hausman test results show that fixed effects model is the appropriate one.

Estimation results are in accordance with prior expectations, and the parameters are statistically significant. When we consider these findings with the

<sup>1</sup> Here, the main considered effect is the effect of both foreign direct investment and GDP per capita on aggregate demand.

explanations about the variables, the following can be stated: Between the years 1980 and 2006 in the related countries (Argentina, Brazil, Bolivia, Chile, Colombia, Costa Rica, Mexico, Paraguay, Peru, Turkey, Uruguay) with openness; exchange rate, openness to foreign trade and foreign direct investment inputs also affect the inflation positively. Similarly, in the related period, GDP per capita has also a positive effect on inflation<sup>1</sup>. In this context, it is possible to say that, in developing countries, with the openness, the factors – to be integrated – of international economic system and economic expansion have also inflationary effects.

## Conclusion

Examining the inflation period in developing countries in the patterns of mentioned hypothetical models and/or fixing the inflation to a specific source are far from being realistic approaches. As mentioned in the theoretical part, *according to the inflation dynamics and determinants*, rather than a consensus in the literature, new and/or different ideas can be easily seen. In this context, the main aim of this study is to investigate the effects of openness, i.e. exchange rate, openness to foreign trade, foreign direct investment, and GDP per capita, on inflation. For this purpose,

we used cross-sectional time series data, spanning from 1980 to 2006, on to these developing countries.

In developing countries (Argentina, Brazil, Bolivia, Chile, Colombia, Costa Rica, Mexico, Paraguay, Peru, Turkey and Uruguay), it is found that, the openness has significant effect on inflation. As reflecting to this effect, exchange rate, openness to foreign trade and foreign direct investment variables are used, and the estimation results show that these variables are all statistically significant and have positive effects on inflation. A further finding is that increase in per capita GDP, which shows the economic growth formed by openness, is also statistically significant and has positive effect on inflation. To overcome the positive effect of openness on inflation the policymakers would generate some policies which increase the elasticity of aggregate supply curve as well as increase the aggregate supply (i.e. shift the aggregate supply curve to the right). Such policies may include reduction in corporate as well as income tax, increase in investment on education (i.e. human capital), infrastructure and technology. Further, policymakers would develop new strategies to increase the competition in the labor and goods markets, to increase the productivity, to promote the investment in the regions where unemployment rate is high.

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<sup>1</sup> In this study which used the panel data analysis, estimation results are evaluated only in terms of the effects of direction, rather than the degree of the effect.

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