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The Effect of Trade Openness on Inflation: Panel Data Estimates from Selected Asian Economies (1976-2010)

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Abstract

This study empirically tests for the existence of a significant relation-ship between inflation and trade openness for selected Asian economies using panel data for the period of 1976 to 2010. The basic objective of this study is to examine Romer's hypothesis for five South Asian and three South East Asian economies with real agriculture value added, nominal exchange rate, real gross domestic product per capita growth, money and quasi money, real interest rate and trade openness as explanatory variables and inflation rate as a dependent variable. For this purpose, we have applied a general-to-specific modelling approach and selected a general model from many competing models by encompassing principle. The fixed effects and random effects estimation of the specific model shows that there is no relationship between inflation and trade openness, which rejects the existence of Romer's hypothesis for selected Asian economies.

Keywords: Inflation, Trade Openness, General to Specific Modelling, Encompassing Approach, Cross-sectional Dependence Tests, Fixed and Random Effect, Asia

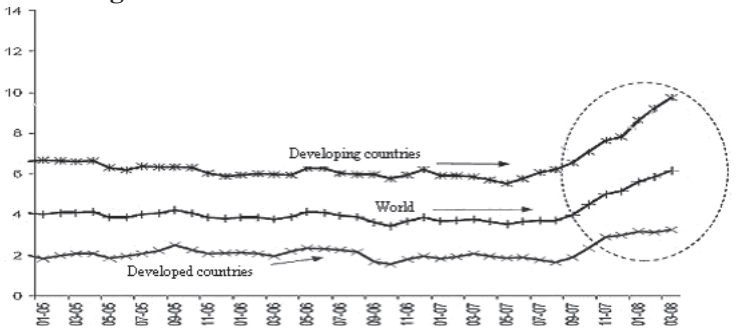
1. Introduction:

Research on growth-inflation, growth-trade openness and inflation-trade openness linkages have been inconclusive or at least not have reached a consensus. The last two topics have been central to free trade versus protectionism debate. The present paper attempts to explore relationship between inflation and trade openness in a panel of countries not considered previously.

Romer (1993) postulates an inverse relationship between inflation and trade openness which can be explained in two ways; firstly, trade openness creates competitiveness and hence reduces inflation. Secondly, trade openness leads to diversification which may lower the aggregate inflation by reducing the price shocks.

Figure 1.1 shows changes in inflation from first 3 months of 2005 to 2008. Inflation has a sharp increasing rate from 4-6% worldwide. This increase is due to a rapid increase in oil prices in the last few years, the global financial and mortgage crises, the reduction in the growth rate, the central banks' disabilities to stop the expected rise of and the increase in food prices (Mehmet, Esener and Darici, 2009).

Figure 1. General trends in inflation 2005-2008[2]



[2] Compiled from Erdem Basçi, (Inflation in Turkey and Worldwide) www.tcmb.gov.tr, (Consumer Inflation, Annual % Change).

1.1 Objective and Significance of the Study:

The focus of this study is to examine whether the Romer's Hypothesis (1993), showing the negative link between inflation and trade openness, holds for selected Asian countries. This study is important in the sense that it considers the region/countries which have not been studied under this relationship until now and this link will be better understood by group of developing countries because they have high inflation as compared to developed economies. The present study will fill the gap by including important variables like external debt, current account balance, claims on central government and domestic credit along with exchange rate depreciation and the role of money to our specification. These variables are important in the context of global financial crises of 2008-09 and the reduction in the growth rate of these economies.

2. Review of Literature

2.1 Theoretical Background:

According to the 'Monetarist School', fiscal deficit is the basic factor of inflation as it influences the money supply. They argue that "by decreasing the growth rate of money, the fiscal deficit of the government reduces and the inflation rate could be reduced".[3] On this issue, Friedman specifies "Inflation is always and everywhere a monetary phenomenon" (Friedman 1963, p. 17).

Iyoha (1973) is of the view that the degree to which domestic changes in demand are absorbed by movements in level of imports, rather than influencing the local prices, will be positively linked to the degree of trade openness in an economy. This hypothesis is established on basis of monetary theory of the balance of payments. (Kirkpatrick and Nixson 1977).

According to the New Growth Theory, trade openness is likely to affect inflation by affecting output. "This is operating through: a) increased efficiency, which reduces the cost through changes in composition of inputs used domestically and internationally, b) best use of resources, c) enhanced

[3] This occurs frequently due to monetization of fiscal deficits is the basic cause of large monetary broadness in developing economies with huge prices. However, if the fiscal deficit is financed by issuing non-monetary debt it need not be inflationary.

capacity utilization, d) increased foreign investment, which can raise output growth and ease pressures on prices" (Ashra 2002, pp: 4).

2.2 Empirical Literature:

Alfaro (2001) indicates that in the short run, there is no influence of trade openness on inflation and a fixed exchange rate is an important factor to reduce inflation. In the long run, however, a negative and statistically significant relation exists between trade openness and inflation. Temple (2002) indicates that the Phillips' curve will be more inclined in open economies, while, Ashra (2002) is of the view that inflation is affected by trade openness irrespective of the size of an economy or the extent of inflation. Chung-Shu Wu and Jin-Lung Lin (2006) use panel regression with andType equation here. without constant constraint and give different relationships between trade openness and inflation. With restricted constant terms, the results were similar to Romer's (1993). However, if these restrictions are relaxed, the empirical result do not show a relationship. This study shows that openness has a significant negative relationship with inflation for NIEs, but has mixed results for G7[4].

Berument, Dogan and Tansel (2008) suggest that an increase in export trade openness[5] reduces inflation volatility for all MENA[6] countries. However, an increment in import trade openness[7] reduces the price levels for Jordan and Morocco but increases them for Algeria and Turkey.

Mehmet, Esener and Darici (2009) examines the effect of trade openness on inflation for 11 developing countries from 1980 to 2006 and finds that openness have positive effects on inflation.

Evans (2011) proposes that trade openness enhances a country's incentive to create inflation and finds that trade openness was inflationary for a more developed subset of countries in which monetary policy can roughly

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[4] NIE (Newly Industrialized Economies) and G7 (Singapore, Hong Kong, Taiwan, Korea, Philippines, Mexico, Germany, United Kingdom, Canada, Italy, France, Japan, United States)

[5] Export-GDP ratio

[6] Middle East and North African

[7] Import-GDP ratio

be approximated by controlling for imperfect competition and inelasticity of labor supply within country. Binici, Lai and Cheung (2012) uses fixed and random effects models to assess the role of market competition and productivity in determining inflation for OECD countries. The results show that trade openness does not affect inflation when market competition and productivity are taken into account .

Samimi and Ghaderi (2012) applies fixed and random effect models on group of the MENA[8] countries and found a positive relationship between trade openness and inflation from 2000 to 2007. This relationship provides new opportunities to developing countries such as a higher access to the developed economies, technology exchange, which enhances productivity and improves living standards. This study also suggests that a positive relation opens up new challenges like increased inequality across and within the nation, volatility in the financial market structure and environmental deteriorations.

Thomas (2012) examines the relationship between inflation and trade openness for 8 Caribbean countries during the period of 1980 to 2009. The results show that trade openness positively affects inflation and validates the notion that the Caribbean countries are vulnerable to external shocks. This study also suggests that larger fiscal deficits and growth in per capita income result in higher inflation levels.

Kurihara (2013) examines the relationship between trade openness and inflation. The results show that there is generally a statistically significant correlation between openness and inflation both in the 1990s and 2000s.

3. Methodology

We have used GDP pc growth, interest rate, exchange rate, money and quasi money, agriculture value added, domestic credit, current account balance and claims on central government in the study as control variables, which also influence inflation positively and negatively.

[8] Group of Middle East and North African countries.

This study empirically tests the existence of Romer's Hypothesis:

H_0 = There is No relationship between Trade openness and Inflation.

H_1 = There is a relationship (Negative/Positive) between Trade openness and Inflation.

Inflation is a complex process and it is hard to find an empirical model that fully fits the situations of all the developing economies. However, it is possible to find the key factors which might affect the inflation in different countries. Therefore we have to establish an empirical model based on a theoretical framework for the concerned hypothesis and apply an econometric strategy to estimate that econometric models.

3.1 A General Dynamic Model for Inflation:

General-to-specific modeling has extraordinary features for model selection;[9] Hoover and Perez (1999a) were the first to assess the performance of general-to-specific modeling as a general approach to econometric model building.[10] The general-to-specific modeling approach is linked to the encompassing theory which means one model encompasses others if it covers all of the information given by the other models.[11] Four models are selected from literature which are already estimated for different data sets and will be tested here for encompassing by applying non-nested hypothesis tests. It is necessary but not a sufficient condition for an encompassing that the standard error of regression is lower than every specification that it encompasses.

The first model used is from Mukhtar (2010) excluding budget deficit because of data unavailability in our sample of countries. This model is preferable because it takes all the relevant variables in a model. Mukhtar (2010) uses budget deficit in the sense that it affects inflation only if it is monetized, thus there is a need to enhance the monetary base of the economy.

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[9] For general discussion on encompassing, see, for example; Mizon (1984,1995), Hendry and Richard (1987) and Hendry 1988,1995, ch. 14)

[10] Hoover and Perez (1999a, pp:168)

[11] See Hendry (1995) pp: 365.

$$\Pi_{it} = \alpha_0 + \alpha_1 LnTO_{it} + \alpha_2 LnER_{it} + \alpha_3 GDPpc_{it} + \mu_{it}$$

Model …1

The second model is based on Badinger (2007) because it includes effect of external debt stock, which is a major problem in Asian economics. Badinger (2007) uses trade openness with financial market openness, country size and inflation as given in the following model.

$$\Pi_{it} = \beta_0 + \beta_1 LnFMO_{it} + \beta_2 LnED_{it} + \beta_3 LnTOT_{it} + \varepsilon_{it}$$

Model …2

The third model is based on Hanif and Batool (2006). It takes the difference of real agricultural value added in place of wheat support prices because of data unavailability on wheat support prices.

$$\Pi_{it} = \gamma_0 + \gamma_1 LnAgrVal_{it} + \gamma_2 IR_{it} + \gamma_3 LnM2_{it} + \tau_{it}$$

Model …3

The fourth model we obtained from the determinants of inflation l iterature and is based on Leonor Coutinho (2012). The following model is used with the difference that it includes claims of central government in place of debt to GDP ratio as an external debt in model 2.

$$\Pi_{it} = \delta_0 + \delta_1 LnDC_{it} + \delta_2 LnCA_{it} + \delta_3 LnCCG_{it} + \omega_{it}$$

Model …4

The present study has employed feasible generalized least square instead of ordinary least square regression because it has a problem with random effect model due to violation of its assumptions. After using the feasible generalized least square analysis (FGLS), the estimated standard errors are 4.9262, 4.9707, 4.6545 and 4.4989 for model 1, 2, 3, and 4 respectively. We obtain the lowest standard error of regression from model 4. We take its residuals as a dependent variable and regress it on the determinants of the remaining three models one by one to obtain the naive model through encompassing approach.

The F-statistic probability value from model 1, 2 and 3 are as 0.0060*, 0.2035, and 0.0000* respectively. Model 1 and 3 are significant at 1% level while, model 2 is insignificant which shows that this model is already encompasses model 4.

Model…5

Finally, we consider model 5 which has six explanatory variables that differ across time and cross-sections. By combining time series of cross section observations, we get panel data that give more information, more reliability, less co-linearity among variables, more degree of freedom and efficiency. Moreover, it enables us to study more complex models such as economies of scale and technological differences Table 3.1 in the appendix gives detailed description of variables used in the present study.

3.2 Cross-Sectional Dependence Test in Panel Data:

The impact of cross-sectional dependence in estimation relies on various instruments, such as the magnitude of correlations across cross-sections and the nature of cross-sectional dependence. According to Baltagi (2005), cross-sectional dependence is a problem in macro panels with long time series (over 20-30 years). If $T > N$, the Breusch and Pagan (1980) Lagrange Multiplier (LM) test is used.[12] The null hypothesis in the Breusch and Pagan (1980) Lagrange Multiplier (LM) test of independence states that residuals across entities are not correlated. Under the null hypothesis, μ_{it} is assumed to be independent and identically distributed over cross-sectional units against the alternative hypothesis.

[12] which is available in Stata using the command xttest2

Table 1: Cross-Sectional Independence Test Results:

Model with cross-sectional independence test	Result
inf lnto lner gdppc lnagrval ir lnm_2 (fixed effect)	F-Stat F(6,266) = 14.74 Prob > F = (0.0000)*
Breusch and Pagan Lagrangian multiplier test of Cross-Sectional independence	chi2(28) = 108.982 Prob > chi2(28) = (0.0000)*
inf lnto lner gdppc lnagrval ir lnm_2 (random effect)	Wald chi2(6) = 84.49 Prob > chi2 = (0.0000)*
Breusch and Pagan Lagrangian multiplier test for random effects	chibar2(01) = 6.02 Prob > chibar2 = (0.0071)*

Table 1 reports Breusch and Pagan (1980) Lagrange Multiplier (LM) results which show that there exists cross-sectional dependence that implies the use of second generation panel unit root tests.

3.3 Second Generation Panel Unit Root Tests:

The main difference between unit root tests in time series and panel data is the presence of heterogeneity in the panel data. In the time series, heterogeneity is not an issue since the unit root hypothesis is tested in a given model but situation is not same in a panel data scenario. The main difference between tests of two generations lies in the cross-sectional independence assumption. First generation tests assume that all cross-sections are independent and second-generation tests relax this assumption (Hurlin, 2004).

Applying the second generation panel unit root test, under the null hypothesis that unit root exists (non-stationary) against the alternative hypothesis that unit root does not exists (stationary). We reject the null hypothesis of unit root at levels in case of inflation, GDP pc, M_2 and interest rate. While we do not reject the alternative hypothesis at 1st difference in case of trade openness, agricultural value added and nominal exchange rate.

3.4 Estimation:

Combining cross sectional and time series data makes it possible to incorporate a much larger number of explanatory variables in carrying out the empirical evidence. The present study uses fixed effect and random effect models (Greene, 1997, Johnston and Di Nardo, 1997); these models are used by Alfaro (2001), Sachsida, Carneiro and Loureiro (2003), Sachsida (2006), Al Naseer and Sachsida (2009), Samimi and Ghaderi, et al (2012), Mehmet, Esener and Darici (2009), and Binici, Lai and Cheung (2011). We prefer to use these models because they involve unobserved individual effect for countries, time span and for both.

$$\Pi_{it} = \alpha_0 + \alpha_1 LnTO_{it} + \alpha_2 GDPpc_{it} + \alpha_3 LnER_{it} + \alpha_4 IR_{it} + \alpha_5 LnM2_{it} + \alpha_6 LnAgrVal_{it} + \varepsilon_{it}$$

$$\underline{i = 1,2,.....,7} \qquad t = 1,2,.....,34$$

The empirical analysis is based on panel data for selected Asian economies including Bangladesh, India, Nepal, Pakistan, Sri Lanka, from South Asia; and China, Philippines and Thailand from South East Asia from 1976 to 2010.

4. Empirical Results & Analysis

Results of both Fixed and Random Effects Models are summarizing in table by estimating model 5, using data of eight countries from 1976 to 2010.

Table 2: Fixed and Random Effects Results:

	Fixed Effects Results Coefficient (Std. Error)	Random Effects Results Coefficient (Std. Error)
GDPpc	0.0185403 (0.09698) [0.854]	0.1507312 (0.1154515) [0.192]
LnTO.Z1	1.996231 (2.6075) [0.469]	1.859176 (2.419615) [0.442]
LnER.Z1	8.152818 (3.203146) 0.038*	11.00035 (3.1568) 0.000*
IR	-0.2332656 (0.1399) 0.139	-0.2767343 (0.10096) 0.006*
LnM2	-4.651298 (2.20290) 0.073*	-3.595359 (1.789482) 0.045*
Ln AgrVal.Z1	10.65015 (4.9914) 0.070*	9.316434 (5.066811) 0.066*
_Cons	26.119 (8.9193) 0.022*	21.69745 (7.432266) 0.004*

*Note: - Z1 stands for First Differences, Values with * and [ ] shows Probability*

To select which model to use (fixed or random effects), we apply a Hausman test where the null hypothesis is that the preferred model is the random effects and the alternative is the fixed effects (see Green, 2008, chapter 9). Null hypothesis of Hausman test states that the errors (u_i) are not correlated with the regressors and alternative is otherwise. Results of Hausman Specification show that Prob>chi2 = 0.0624, which is greater than 0.05. Hence, we cannot reject null hypothesis and use Random Effect model.

$$\Pi_{it} = 21.7 + 1.9LnTO_{it} + 0.15GDPpc_{it} + 11LnER_{it} - 0.28IR_{it} - 3.6LnM2_{it} + 9.32LnAgrVal_{it}$$

The result given in table 4.2 shows that there is no relationship between trade openness and inflation. The findings of the present study prove that Romer's (1993) hypothesis does not hold for selected Asian economies. It means that trade openness is not a basic reason for high inflation for these countries.

The coefficient of nominal exchange rate[13] carries a positive sign and statistically significant at 1 percent level of significance, which shows that a 1 percent increase in nominal exchange rate brings about 11.00035 percent increase in inflation rate. A nominal depreciation of a country's currency in comparison to major currencies is supposed to increase inflation because imports become more expensive. When exchange rate increases it depreciates home currency, which have positive effect on price level under flexible exchange rate regime.

The coefficient of real agriculture value added carries a significant positive sign at 5 percent level of significance and shows that a 1 percent increase in real agriculture value added brings about 9.3164 percent increase in inflation rate. This finding is in line with Ashra (2002) that growth rate of agricultural output has statistically significant impact on the local inflationary process.

The present study finds significant negative influence of interest rate on inflation as the coefficient has negative sign with value of 0.2767 at 1 % level of significance. These findings are in line with Kim and Beladi (2005) that developing countries shows negative effect of interest rate on inflation. The result obtains from this study proves that the interest rate would be effective to control inflation.

The coefficient of money and quasi money carries a negative sign and statistically significant at 1 percent level of significance, which shows that a 1 percent increase in money and quasi money brings about 3.5953 percent decrease in inflation rate. The coefficient of M_2 is small; therefore it seems that money and quasi money decreases inflation in Asian Economies. According to the demand side of Monetary Transmission Mechanism, governments must change its monetary policies from easy to tight, a rise in interest rate will

[13] (local currency units relative to the U.S. dollar)

decrease the money supply, therefore the aggregate demand will decrease and ultimately the price level will decrease.

GDP per capita growth does not show any significant influence on inflation rate with this data set which is also supported by literature (Sidrauski, 1967; Johanson, 1967; Thirlwall, 1974; Blanchard and Quah, 1989; Sarel, 1996; Boyd et al., 2001; and Faria and Carneiro, 2001). As recommended by Romer (1993), GDP per capita growth as a general proxy measure of economic development can be useful in capturing a variety of factors influencing inflation, including a country's aversion to inflation and possible inflation tax considerations (Campillo and Miron, 1997; Phillips, L. 1997; Katharine S. Neiss, 2001).

5. Conclusion & Discussions

The present study tests the existence of Romer's hypothesis in selected Asian countries by combining the determinants of inflation from inflation-trade openness literature and determinants of inflation from inflation modelling literature using encompassing principle. The results show that there exists no significant relationship between inflation and trade openness in the selected Asian countries in the given time period. This result is consistent with Binici et al. (2012) where it shows that trade openness does not affect inflation for OECD countries. Since there are many factors affecting inflation, trade openness becomes insignificant when some of the channels through which inflation is affected are included in the model. The hypothesis that trade-openness negatively affect inflation is rejected in favor of no effect of trade openness on inflation. This and similar findings for other regions attenuate argument for trade openness, and hence has significant implications for trade policy of the countries considered.

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Appendix

Table 3.1: Variables with data sources

Variables & Codes	Data Sources
Real Agriculture Value added (AgrVal) % of GDP	WDI
Nominal Exchange Rate (ER)	IFS
GDP Per Capita Growth (GDPpc) Annual (%)	WDI
Trade Openness (TO) % of GDP	GDF
Inflation Rate (Annual % Δ in CPI) Index Number with base 2005	GDF
Money & Quasi Money (M2) % of GDP	IFS
Real Interest Rate (IR) Per Annum	GDF
Financial Market Openness (FMO) % of GDP	IFS
External debt stocks (ED) % of GNI	GDF
Net barter terms of trade index (TOT) 2000=100	Trade and Development Handbook of Statistics
Claims on central government, etc. (CCG) % of GDP	GDF
Current Account Balance (CA) % of GDP	GDF
Domestic credit to private sector (DC) % of GDP	IFS