Price Stabilizing Effects of the FTAs*

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Abstract

This study empirically estimates how much FTAs affect domestic inflation rates. Most previous studies have been interested in the economic effects of FTAs such as the effects on economic growth, income distribution across industries, price competitiveness for international trade, trade volume, and the price of a commodity. The purpose of this study is an econometric estimation of the price stabilization due to FTAs and an analysis of how FTAs affect inflation rates based on panel data estimations.

The main results are summarized as follows. First, from an analysis on 72 detailed items which estimates the pricing equations for the 72 detailed items, calculates the but-for-price after FTAs started, and gets the weighted price index, we find that FTAs reduce the CPI inflation rate by 0.76%p at an annual basis from the second quarter of 2004 to the second quarter of 2015. Second, the aggregate data analysis estimates the effect of FTAs on the CPI inflation rate as -0.52%p and the effect of the global financial crisis on the CPI inflation rate as -0.47%p. Third, the panel data analysis for the OECD countries also shows a significant and consistent inflation reduction effect of FTAs, such effect is more significant than the effect of openness on inflation rates. The inflation reduction effect is more significant in countries with a low level of openness.

JEL classification: E31; F62; F15
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1 Introduction

In Korea, the annual average CPI growth rate had been 10.7% in the early 1960s and 14.0% in the 1970s, and lowered moderately to 7.8% in the 1980s and 5.6% in the 1990s. In particular, after the financial and currency crisis in Korea in 1997-1998, it reached a significantly lower inflation rate, 3.1% in the 2000s, but dropped to an even lower 2.1% per annum in 2010-2015. In 2013 ~2015, the average annual inflation rate has fallen to 1.1% which is well below the target band of the Bank of Korea's monetary policy operation, raising a concern of deflation.[1] The reasons for this decline in consumer price inflation are likely to include various structural factors, but the recent low inflation may be attributed to external factors such as stable commodity prices, falling crude oil prices, and a low inflationary pressure from the slowdown and the aging population in the Korean economy.

The recent low inflation is not a local phenomenon but rather a global phenomenon, in particular, it is worth investigating the role of international trade in contributing to the globally low inflation. In other words, the expansion of low-priced Chinese exports produced on the basis of cheap labor has contributed to the stabilization of global prices. Expansion of foreign trade means relatively low-priced imports of overseas goods, which stabilize domestic prices. On the contrary, the expansion of exports may have opposite effects on the prices of domestic goods. The institutional change that has made a decisive contribution to the expansion of such trade is the proliferation of free trade agreements. The main contents of bilateral or multilateral FTAs include the reduction of tariff rates and the easing or elimination of trade barriers, which could directly reduce the price of imported goods and contribute to the stabilization of consumer prices if imports were expanded.

This study attempts to estimate quantitatively how the expansion of free trade agreements affected the domestic consumer price inflation rate. Most previous studies related to free trade agreements have focused on the economic effects of free trade agreements, i.e., economic growth, income distribution across industries, export and import competitiveness, and the effect of expanding foreign trade. There have been a few studies to see how free trade agreements have affected the prices of specific industries or products, but they are limited to descriptive analysis or deals with limited areas (Ha et al., 2015; Hayakawa et al., 2013, 2015). This study will not only be an empirical study of one aspect of the benefits of the FTA, but it will also have an effect of estimating the normal level of inflation in the Korean economy in the future. In other words, it can play an important role in predicting the future trend of inflation rate by examining quantitatively how much the inflation rate stabilizes down due to the expansion of international trade through FTA expansion.

[1] Since July 2012 when the CPI inflation rate relative to the same month a year ago has fallen to 1%, it has been around 1% until end-2015, and has recorded by less than 1% in most of the period from December 2014 to the end of 2015. It recently rebounded to around 1.5% in 2017.

The main objectives of this study can be summarized as follows. First, it is a quantitative estimate of the size of the price stabilization that has been achieved by concluding an FTA with Korea. In other words, I would like to empirically estimate the direction of the CPI in comparison with the case where the FTA is not concluded. The results of this analysis include a quantitative analysis of how much annual consumer price inflation has fallen and how much the price level has been cumulatively lowered since the FTAs took effect. Second, we use panel data from 34 OECD countries to analyze how the expansion of FTAs affects the inflation rate of each country. This effect is to examine how much additional FTAs have affected the inflation rate in addition to the effect of trade dependence on prices, which has traditionally been analyzed. In order to analyze the effects of the FTA, it is possible to use a quantitative indicator of how many countries have concluded an FTA with each other. However, at each time point, The FTAs will be able to construct indicators related to FTAs. In this way, we will empirically estimate through the panel data analysis model the effect of the FTA on inflation.

The expansion of free trade is expected to affect domestic prices directly or indirectly. In principle, the abolition or relaxation of tariff cuts and import quotas in small-scale open economies can directly lower the domestic selling price of imports, and if the dynamic effects of imports are taken into account, the effect of lowering prices may expand in the mid- to long- . On the other hand, the expectation of the effect of the expansion of free trade on the domestic price of export goods differs from that of imports. If trade barriers such as closed economy or tariffs or quotas are removed, if free trade expands, the demand in the international market for exports will increase, which may lead to an increase in domestic prices. Therefore, the effects of export goods and import prices on domestic prices may be contradictory. However, these expectations are very theoretical and are likely to be established only in limited circumstances. Therefore, how the effect will actually appear is a problem to be grasped by empirical quantitative analysis using data.

Figure 1 compares the rising trend in the share of trade with the countries with FTAs and the CPI inflation rate in Korea. Since 2004, when the FTA first came into effect, consumer price inflation has been decreasing by 2015, and the share of trade with FTAs has been on the rise. From this, it can be inferred that the FTA is closely related to the decline in inflation rate. Figure 2 shows openness and the three FTA variables from 2004 to 2015. Openness, which is measured by the ratio of total trade (the sum of exports and imports) to GDP, increased significantly from 2004 to 2012, rising from 0.73 to 1.14, but then declining to 0.84 in the second quarter of 2015. On the other hand, the FTA variables increase consistently over time, regardless of how they are measured, either the ratio of trade with countries with FTAs to the total trade or the ratio of imports (exports) with countries with FTAs to the total imports (exports). Therefore, the recent decline in inflation rate may be more closely related to the FTA-related variables rather than the traditional openness variable.

This paper is structured as follows. In Section 2 we examine the previous studies on the economic effects of or the price stabilization effects of FTAs. Section 3 discusses the three estimation strategies to estimate the effect of FTAs on CPI, using the but-for-price estimation method, the time-series estimation with aggregate variable, and the panel data estimations with 34 OECD countries. Section 4 presents the empirical estimation results and tries to quantify the effects of FTAs on inflation and Section 5 concludes and discusses future research directions.

2 Literature Review on the Economic Effects of FTAs

The literature on FTAs has been widely accumulated as a policy document for estimating and forecasting the economic effects of FTA long before the negotiation process of FTA started. Some of the literature related to this study are as follows.

First, Nakajima (2004), Cho and Song (2009), and Cin (2010) have studied the FTA effects based on CGE (Computational General Equilibrium) models. Nakajima (2004) analyzes the economic effects of an FTA with East Asian countries including Japan and Korea in a CGE model and examines the economic effects of income subsidies for the agricultural sector as a policy response. Cho and Song (2009) attempt to develop a CGE model as a basic framework for estimating the effect of FTA between Korea and foreign countries, and Cin (2010) estimates the macroeconomic effects of an FTA between Korea, China, and Japan with a CGE model and finds an increase in real GDP and welfare. There is also a great deal of research that extensively analyzes the economic effects of FTAs between home and foreign countries. Cheong and Wang (1999) and Kiyota and Stern (2007) examine the economic effects of the FTA between Korea and the United States and their main interest is on distributional and employment effects of the FTA across industries and its welfare implications. Heng and Suu (2009) estimate that the FTAs between Singapore and Japan, US, Australia, and New Zealand had an impact on Singapore's imports and exports, and Williams et al. (2014) investigate the effects of the FTA between Korea and the US on some industries of interest such as the automobile industry and the agricultural sector. Matton et al. (2004) analyze the effects of the FTA between Australia and the United States, and focused on trade in agricultural commodities and estimated the economic effects and price changes of major industries based on a CGE model, in particular, estimated the effect on cattle price with the 3SLS method. Plummer et al. (2010) present several alternative models for evaluating the effects of FTAs. Most of the studies discussed above focus on GDP or welfare effects of FTAs when they examine the macroeconomic impacts of FTAs, or analyze the impact on major export or import industries. Some studies have analyzed the effects of FTAs on prices, most of which are limited to effects on the prices of some industries or commodities or differentiated effects across industries. Nakajima (2004) tried to estimate the changes in the prices of exports and imports by industry through the

simulation of the CGE model, but did not estimate the effect on the overall consumer price level. Hayakawa and Yang (2013) analyze the effect of the Korea-US FTA on cherry and grape prices, and examined the effect of China-ASEAN FTA on import prices by analyzing corporate data. Hayakawa et al. (2015) also estimate the impact of the FTA on Thailand's import prices by analyzing the cost cut factors using corporate data.

Most of the previous studies mentioned above have been limited to examining how the prices of imported goods have been reduced due to the factors such as tariffs and trade barriers that have been reduced or eliminated along with the conclusion of the FTA. Although some studies have examined the effects of price fluctuations in various industries through CGE models, they present the results of a hypothetical model through the simulation of the theoretical general equilibrium model and may be not sufficient to discuss what really happened to the economy as a follow-up analysis after the FTAs take effects. In addition, the empirical analysis on the effect of FTAs on individual industries is valuable to micro-level researchers but it is also interesting to analyze the macro-level (price index level) analysis of the effect of the FTA on prices. However, it is difficult to find a relevant study with a comprehensive estimate of the effect on CPI inflation in the perspective of consumers.

Finally, there is a strand of literature related to the empirical methodology adopted in this study, the concept of 'the but-for price' which is widely used in antitrust literature. The research method adopted in this study is to estimate the hypothetical prices of goods or the CPI that would have prevailed without the FTAs. For this purpose, we try to extract the effect of the FTA on the price index by using the concept of 'the but-for price' in antitrust cases brought against cartels, which is an estimate of the price that would have prevailed in the absence of there being a conspiracy or collusion designed to elevate prices above what they otherwise would have been and is often considered as a benchmark when the antitrust authority imposes a fine or a penalty for unfair advantage from collusion. Harrington (2004) and Sproul (1993) are examples of the theoretical and empirical studies on this subject and Kwon and Yoo (2007), Yoo (2010), and Jeon et al. (2012) also provide applications of this idea. To estimate a but-for price, one approach is to construct an econometric model that reliably predicts price variation during a benchmark period in which it is reasonable to assume conduct was not collusive, and then to use this model to predict what prices would have been during the period of collusion.

3 Estimation Methodology

3.1 Estimation with disaggregate data using the but-for price

In order to estimate the effect of the FTA on prices, it is necessary to estimate the price level that would have prevailed without the FTA, and then to compare the difference with the actual

price. To estimate the hypothetical price without FTAs, we will use the concept of 'the but-for price' as used in antitrust literature, as discussed in the previous literature review. Originally, the but-for price is used to mean an estimate of the price that would have existed if there was no collusion in order to capture the unfair benefits of collusion after the collusion was discovered.(Harrington et al., 2004; Sproul, 1993; Kwon and Yoo, 2010; Jeon, et al., 2012) In other words, it is generally used as a basis for calculating fines by determining the normal price level that would have existed if there was no collusion from the beginning of the collusion and taking unfair advantage as the difference between the estimated but-for price and the actual price. In this section, the method used to analyze the effects of FTAs on prices is based on the similar idea. In other words, we want to measure the magnitude of the price stabilization effect of FTAs by estimating the price level that would have existed if the FTA was not concluded and comparing it with the actual price.

First, it is necessary to determine when the FTAs take effects in influencing the price level. From Table 1 we assume that the second quarter of 2004 was the time separating the two periods before and after the FTAs take effect. Table 1 provides the information regarding Korea's FTA signing dates and effective dates with each of the counterpart countries. Korea's first FTA with Chile began to take effect on April 1, 2004 and has expanded persistently since then, with the trade volume of Korea with FTA countries in the second quarter of 2015 accounting for 44%.

The price level that would exist if an FTA was not concluded is based on an estimation of the pricing function before the FTA takes effect. In other words, the basic methodology is to estimate the pricing decision equation of a specific item and estimate it using the data before the FTA's entry into force. After the FTA takes effect, the actual values of the explanatory variables are used to calculate the predicted price level of each item, and the official weights used by the statistics department (Statistics Korea) for the CPI is applied to derive a hypothetical index of consumer prices. After all, the critical assumption of this methodology is that the pricing function that existed before the entry into force of the FTA, i.e., the relationship between explanatory variables and dependent variables, does not change after the FTA takes effect, which is a strong assumption.

$$\ln P_{i,t} = \beta_i' X_t + \gamma_i' D_t + \epsilon_{i,t}, \quad t = 1/4 \text{ 1985 through } 1/4 \text{ 2004}. \tag{1}$$

$P_{i,t}$ is the price level of item i at period t, X_t is a vector of the $I(1)$ explanatory variables cointegrated with the price level, and D_t is a vector of stationary explanatory variables. X_t includes the real GDP of Korea, the total real GDP of OECD countries reflecting the global economy, the Korean money supply (M2), the US dollar exchange rate of Korean won, and the international oil price (Brent) for all the estimation equations of the prices of individual items and various commodity prices such as international beef cattle prices, international corn prices, international wheat prices, international soybean prices, international coffee prices, in-

ternational orange prices, international wool prices, international cotton prices, US sugar prices, and US cheese prices, depending on the specific items.[2] M2 is included to capture the traditional transmission mechanism from money supply to price level, reflecting the neutrality of money, and the won-dollar exchange rate is expected to measure the effect on the prices of imported goods. In addition, international oil prices or various international commodity prices are designed to take into account the effect of supply-side inflation on the price of imported raw materials. Therefore, the coefficients for M2, international crude oil prices and various international commodity prices are expected to have positive signs and turn out to be the case.[3] The effect of real GDP on the price level is difficult to determine *a priori*. If the sources of fluctuations in real GDP is due to the demand shock, the effect on prices will be estimated to be positive, while if the supply side impact explains the fluctuations of real GDP, the increase in real GDP will have a negative impact on prices and the coefficient will be estimated as a negative number. If the aggregate demand shock is a major factor in real GDP change, the coefficient with a positive value can be interpreted as a form of the Phillips curve. In order to reflect the price effect of climate change, we use rainfall, temperature, humidity, and sunshine variables as the explanatory variables for each item of agricultural products after transforming the variables in a deviation percentage from its long-run average. It is important to note that if a variable may be affected by the FTAs, then it should be excluded from the explanatory variables since we attempt to measure a hypothetical price without FTAs. For example, variables such as volumes of exports or imports, export prices or import prices can be affected by FTAs and thus they can be used as explanatory variables only if the direct effects of the FTAs on these variables are removed but it is hard to distinguish the effects from its own fluctuations.

Since most variables show unit roots, the OLS estimation method may be biased or less effective. Therefore, the Fully Modified OLS suggested by Phillips and Hansen (1990), the Canonical Cointegrating Regression by Park (1992), and the Dynamic OLS method of Saikkonen (1992) and Stock and Watson (1993) are applied to estimate the cointegration relation but they are very similar to each other. This study will mainly focus on Fully Modified OLS estimation results. The coefficients for the variables with unit roots correspond to the cointegration vector, which can be interpreted as the long-term relationship between the variables.

From the second quarter of 2004, using the previous estimation equation, the hypothetical CPI for each item can be constructed by applying the weight for each item.

[2] All the quantitaty variables and the price variables except the ratio, the weighted variable, and the dummy variable are taken the natural log before the estimation, and thus the coefficients indicate the elasticity of the dependent variable on the change of the explanatory variable. The same applies to the estimates using aggregate variables below.

[3] The specific estimation equations for the 72 item price indexes were not presented due to the space limit. In most cases, the coefficients of cointegration coefficient estimated by the Fully Modified OLS method have shown high significance and R^2 a value of 0.9 or higher.

$$CPI^*_{t+j} = \sum_{i=1}^{n} \omega_i P^*_{i,t+j}, \quad t = 2/4 \text{ 2004 through } 2/4 \text{ 2015.} \tag{2}$$

3.2 Estimation with aggregate data

The second way of estimating the effect of the FTAs on prices is to estimate the CPI equation by including FTA variables directly. As in the case of estimating the hypothetical price for each item as in the previous subsection, the cointegration relation among variables with unit roots is estimated. However, unlike the estimation of hypothetical prices for 72 detailed items, the FTA variables were directly included in the estimation equation as explanatory variables and estimated for the entire period instead of for the period before the FTAs take effect.

$$\ln P_{i,t} = \beta' X_t + \gamma' D_t + \epsilon_t, \quad t = 1/4 \text{ 1985 through } 2/4 \text{ 2015.} \tag{3}$$

The $I(1)$ variables X_t include the real GDP of Korea, the total real GDP of OECD countries, M2 of Korea, the Korean won-dollar exchange rate, and international oil price (Brent) and the stationary variables D_t include FTA-related variables such as FTA trade ratio, FTA import ratio, and FTA export ratio as explained in Figure 2, openness, and a global financial crisis dummy variable. As stated above, the Fully Modified OLS method of Phillips and Hansen (1990) was applied to estimate the cointegration relation.

In order to explicitly estimate the effect of the FTA, we have constructed variables that reflect the degree to which the FTAs take effect. First, the variable FTA represents the share of trade with the countries that entered into an FTA with Korea in the total trade of Korea. This variable is included to extract the effect of the FTA under the assumption that the effect of the FTA would directly affect the domestic prices by increasing the amount of the trade. The traditionally most often used trade index, openness ($OPEN$), which is measured as the ratio of the sum of exports and imports to GDP, is also included. To analyze the direct effects of lower import price on the CPI due to the FTAs, we use the share of the imports from the countries with an FTA with Korea in the total imports of Korea ($FTAIM$) as an explanatory variable. The share of the exports to the countries with an FTA with Korea in the total exports of Korea ($FTAEX$) is also used as an explanatory variable in the estimation equations. In addition, the product of the FTA variables and openness to measure an interaction effect is also included in the estimation equation. A dummy variable ($CRISIS$) is introduced to capture structural changes in the inflation rate that would have appeared after the global financial crisis, with a value of 0 until the third quarter of 2008 and then a value of 1. By estimating the FTA effects and the effects of the global financial crisis separately from the estimated equations, the estimates may be more accurate in terms of the quantitative size of the FTA effect on the CPI. After estimating the relationships among variables including the FTA variables for the entire period, we can obtain the hypothetical CPI with FTA effect excluded by substituting FTA

variables with zeros.

3.3 Estimation with cross-country panel data

There have been extensive literature examining various channels through which trade affect the economy, in particular, inflation, using international data. The following is a brief discussion on the existing literature on which variables to consider in estimating inflation. First, the existing literature has focused on the empirical analysis of the effect of the expansion of international trade on domestic prices. In Romer (1993), the relationship between trade openness and inflation is examined theoretically and empirically. He used the ratio of imports to GDP as an indicator of trade openness. Additional control variables include per capita GDP, regional dummy variables (OECD, South America, Central America, etc.), central bank independence index, and central bank governor replacement cycle. Sammi et al. (2012) examine the effect of expansion of openness on inflation rate by using various indexes reflecting foreign direct investment, tariff rate, etc. instead of the GDP-based imports index used in Romer (1993). Binici et al. (2012) also analyze the effect of trade openness on market competition and productivity growth by industry. The price-cost margin is used as a variable to reflect market competition, Additional control variables are GDP growth and M2 money supply growth. In particular, Kamin et al. (2004) focus on the importance of China factor to the domestic inflation rate and analyze the impact of China's export growth, i.e., the effect of the share of imports from China on the inflation rate of US prices and major trading partners. Alfaro (2005) also analyzes the effect of trade openness measured by the ratio of imports or exports to GDP and exchange rate on the inflation rate and use the ratio of fiscal deficit to GDP as a control variable. Auer and Mehrotra (2014) use the share of imports used in intermediate inputs as a key explanatory variable to estimate the impact of global factors of international interconnection through international trade on domestic prices.

Borio and Filardo (2007) construct an estimation model to explain the inflation gap with an output gap, based on the Phillips curve model. They include explicitly the domestic GDP gap and the foreign output gap weighted with import shares for each of the trading partner countries in the estimation equation. The additional control variables include import prices, oil prices, and unit labor costs. Ihrig et al. (2007) also analyze an empirical estimation model in explaining inflation in the context of the Phillips curve model, considering trade openness, import prices, grain prices, and energy prices.

This study conducts an empirical analysis focusing on the relationship between trade openness and inflation rate using the annual panel data of OECD 34 countries from 1980 to 2014. Unlike the previous literature focusing on the relationship between openness and inflation, we consider FTA related variables in addition to openness to separate the effects of trade liberalization on domestic inflation into two ways. We interpret the traditionally used openness

measure as a measure of trade liberalization in a quantitative dimension and the FTA-related measures as a measure of trade liberalization in a qualitative dimension since the FTAs typically involves many extensive institutional changes by eliminating various trade barriers such as tariffs, quotas, etc. We first include the conventional measure of openness as in Romer (1993) to test the hypothesis that the inflation rate is lower in countries with higher openness and then see any change of significance of the coefficients after the FTA-related variables are included additionally. We also try to estimated the interaction effect between openness and FTA variables in determining inflation.

In addition to the above-mentioned key variables, trade openness and FTA variables, panel data estimation equations also include M2 money supply growth rate, GDP growth rate, and the rate of unit labor cost growth as control variables to reflect the ideas of the neutrality of money, the Phillips curve model, and the cost-push inflation shock. The econometric models are in two forms, a static panel model and a dynamic panel model as follows.

(static panel data model)

$$\Delta \ln CPI_{i,t} = \beta_0 + \beta_1 OPEN_{i,t} + \beta_2 FTA_{i,t} + \beta_3 (OPEN_{i,t} \times FTA_{i,t}) + \beta_4' X_{i,t} + \mu_i + \epsilon_t + \nu_{i,t} \quad (4)$$

(dynamic panel data model)

$$\begin{aligned} \Delta \ln CPI_{i,t} = \beta_0 + \gamma_0 L.(\Delta \ln CPI_{i,t}) + \beta_1 OPEN_{i,t} + \beta_2 FTA_{i,t} + \beta_3 (OPEN_{i,t} \times FTA_{i,t}) \\ + \beta_4' X_{i,t} + \mu_i + \epsilon_t + \nu_{i,t} \end{aligned} \quad (5)$$

where $OPEN$ can be substituted as $OPENIM$ or $OPENEX$ and FTA can also be substituted as $FTAIM$ or $FTAEX$. $X_{i,t}$ is a vector of control variables such as M2 growth rate, GDP growth rate, and unit labor cost growth rate of country i at time t. The heterogeneity of individual countries was considered with country dummies μ_i and time dummies ϵ_t are sometimes included. In the static panel data model set out above, the selection between the Fixed Effects model and the Random Effects model is determined by the Hausman test. The static panel data model does not consider the possibility that the explanatory variables show an endogeneity problem generated with time lag. We thus set up a dynamic panel data model that includes the past lagged variables of the dependent variable into the model, following the generalized method of moments (GMM) model of Arellano and Bond (1991). The hypothesis that the higher the openness of trade is, the lower the inflation rate, and the hypothesis that the inflation rate decreases as the trade share of FTA countries increases can be tested as the following equations. The marginal effects of trade openness and FTA on inflation rate calculated as follows are expected to be negative if the two hypotheses are true.

$$\frac{\partial \Delta \ln CPI_{i,t}}{\partial OPEN_{i,t}} = \beta_1 + \beta_3(FTA_{i,t}). \tag{6}$$

$$\frac{\partial \Delta \ln CPI_{i,t}}{\partial FTA_{i,t}} = \beta_2 + \beta_3(OPEN_{i,t}). \tag{7}$$

Equations (6) and (7) represent the marginal effect of trade openness on inflation and the marginal effect of the FTA on inflation, respectively. If openness and FTAs lower inflation rate, then the coefficients, β_1 and β_2 will have a negative sign, and β_3 measures the interaction effect between openness and FTAs, which may be negative too.

4 The Estimation Results

4.1 Data

The data used in this study consist of the price index and the variables that are considered to affect the price index. First, in the method of estimating the but-for price for 72 detailed items, the price indexes of items in 72 detailed categories are obtained from Statistics Korea for the period from the first quarter of 1985 to the second quarter of 2015. We think quarterly frequency is more appropriate for our analysis even though the data are available at monthly frequency, since monthly data may be subject to noisy factors that are not easily controlled. The weights of items in detailed category for constructing CPI have been changed (updated and adjusted) every five years to reflect the change in the composition of expenditure of households.

The base year is also changed every five years to convert the new base year's CPI to 100, and all past CPI changes according to the changed base year. In order to build a new price index - for example, a hypothetical price index that would have prevailed if there were no FTAs - it would be necessary to build all of the past weights in all the past base year. The total weight of 1,000 items is currently allocated to 481 items, but 72 items are analyzed for the empirical analysis for keeping consistency in the data.[4] In addition, in the aggregate variable estimation method, the CPI index is used to estimate the hypothetical situation, that is, the price index when there is no FTA.

The following variables were used as the explanatory variables to estimate the hypothetical price of 72 items, that is, the price that would have existed if there was no FTA. As the aggregate variables, we used GDP, the sum of real GDP of OECD countries, M2 of Korea, the US dollar exchange rate, and the international oil price (Brent oil), and the international beef price, international corn price International wheat prices, international soybean prices, international coffee prices, international orange prices, international wheat prices, international cotton prices,

[4]The 72 categories of items and weights are given in Appendix.

US sugar prices, US cheese prices, and US fruit prices. Climate variables are used for agricultural commodities. Rainfall, temperature, humidity, and sunshine were used as explanatory variables after transforming in a percentage deviation from their quarterly averages.[5]

The variables used in the estimation method with the aggregate variables are the real GDP of Korea, real GDP of OECD, M2, US dollar exchange rate, international oil price and FTA-related variables. FTA is defined as the share of trade with the countries that have signed the FTA among total trade, and FTA variables for export and import are defined similarly. $FTAIM$ is the share of imports from the countries that have signed the FTA among total imports and $FTAEX$ is the share of exports to the countries that have signed the FTA among total exports. All the trade data are obtained from the IMF Direction of Trade Statistics (DOTS). Finally, we included the dummy variables that divide the period until the third quarter of 2008 and beyond to control the low level of inflation in Korea after the international financial crisis.

The variables used in the OECD country panel analysis are the same list of variables for each country used in estimating the time series model with the Korean aggregate variables. The CPI growth rates of the 34 OECD countries for the period 1980 to 2014 are the dependent variable and the explanatory variables are openness, FTA variables, M2 growth rate, GDP growth rate, and unit labor cost. The data used in the analysis are collected through IMF's International Financial Statistics (IFS), Direction of Trade Statistics (DOTS), OECD's Main Economic Indicators and Economic Outlook, and World Bank database. Table 2 shows the sources, definitions, and basic statistics of the variables used for country panel data analysis. Table 3 shows the correlation coefficients between each pair of the variables.

4.2 Estimation results with disaggregate 72 items

As described above, the estimating method estimates the cointegration relations from the first quarter of 1985 to the first quarter of 2004 for each of the 72 items, calculates the predicted values for the subsequent period (that is, out-of-sample forecasts). The background of this estimation method is based on a somewhat strong assumption that the FTA with Chile started to take effect in the second quarter of 2004 and affected the price level of each item. In other words, it assumes that the price level of the items that would have existed if there was no FTA was the price level when the structural cointegration relation estimated from the first quarter of 1985 to the first quarter of 2004 was maintained. The main interest is how the CPI as an aggregate index will be compared with the actual CPI when the CPI total index is constructed with the estimated value instead of the actual value of the 72 items constituting the CPI.

Figure 3 shows the hypothetical CPI obtained by weighting using the predicted values of each item according to the 72 item estimation equations compared with the actual CPI. The

[5]The detailed data sources are provided in Appendix.

dotted line is the hypothetical CPI using the predicted value without FTA. Assuming that the structural relationship among the variables until the first quarter of 2004 has persisted, the CPI for the second quarter of 2015 is 119.52, which is 8.57% higher than the actual value of 109.71. In other words, the stabilization effect of the FTA is 8.57% in a cumulative term from the second quarter of 2004 to the second quarter of 2015, which is about 0.76% point decrease per year. The actual annual average consumer price inflation rate during the same period is 2.49%, and it can be estimated that the consumer price inflation rate using the forecast is 3.25%, which is an annual average of 0.76% point reduction due to the FTA.[6]

Figure 4 shows the difference and the FTA variables in order to see whether the difference between the predicted value using the hypothetical prices of 72 items and the actual value is related to FTA. It can be seen that the difference between the forecast and the actual value tends to move along with the FTA variables with some time lags. The three variables related to FTA showed the correlation coefficient of around 0.8 with the difference between the CPI predicted and the actual value obtained by estimating 72 items.

From this analysis, it can be concluded that the FTAs lowered the total index, CPI , even though they had a different effect across items in each category. Since the argument that the change in the relationship between the variables for the price level of 72 individual items can be explained only by the FTA is based on a very strong assumption, the price stabilization effect of the FTA obtained by this model can be regarded as the upper limit.

4.3 Estimation results with aggregate data

The second method estimates directly the impact of FTA-related variables on inflation using the CPI aggregate index. The cointegration relationship is estimated similarly to the estimation for 72 individual items, and the results for this estimation model are summarized in Table 4.

In the estimation equation (I) of Table 4, it can be seen that the relationship between the variables shows signs consistent with economic intuition. When GDP increases, inflation also increases, and the positive relationship between the CPI and M2, exchange rate and Brent oil price is significant. However, OECD countries' GDP, which represents global economic condition, has a negative relationship with domestic prices. This can be interpreted as a negative impact of an expansion of the world economy on the world price level and a negative impact on the Korean price level if the global economic fluctuations are caused by the supply side. This relationship is consistent with all of the estimation models (I) to (VIII). Also, the coefficient of M2 is consistently estimated positive in all models. In other words, if M2 increases

[6]Of course, as noted above, there is a lack of reason to assume that this structural change after the second quarter of 2004 is solely due to the FTA. However, it is possible to compare the results of the FTA effect and the global financial crisis effect directly from the time series estimation model with aggregate data below. From the comparison, it is reasonable to state that the FTA effect of the inflation rate reduction may be somewhat overestimated.

by 1%, CPI is estimated to rise by about 0.2 ~0.3% in the long run. There is a tendency in the cointegration relationship between I (1) variables with unit roots that the exchange rate and Brent oil price are not significant when the trend is included (estimation models (II) to (VIII)).

In the estimation equations (III) to (VIII), the FTA variables are included. In these models, the significance of Korea's real GDP becomes lower. The traditional view based on the Phillips curve model on how real GDP relates to price levels may be right only if aggregate demand shocks are a major factor of fluctuations. If a major source of macroeconomic fluctuations comes from the supply side, a negative relationship between real GDP and the price level can also occur.[7] FTA variables are all significant even when OPEN is included in the equation. Both of the coefficients of openness and FTA variables are negative, implying that both FTA expansion and increase in openness tend to lower prices. The interaction term between openness and FTA variable shows a negative, which implies that for countries where openness is already higher, the effect of FTA expansion is relatively small. On the other hand, for countries with many FTAs already concluded, a rise in openness contributes a relatively small to the stabilization effect of inflation. Based on the estimation results of the estimation equation (IV), if the trade share with the FTA-contracting countries increases by 1% point without changing openness measure, the CPI is reduced by about 0.20%. On the other hand, if openness increases by 1% point without changing the trade share with the FTA signatories, the CPI increases by about 0.19%. The estimates of the coefficients are very similar when $FTAIM$ and $FTAEX$ are used in the analysis. The effect of the expansion in FTA on the CPI, -0.20% is calculated with the average openness of the first and the second quarters of 2015, 0.86 and the effect of the increase in openness on the CPI, 0.19% is calculated with the trade share with FTA countries in the two quarters, 0.436.

The dummy variable $CRISIS$ included to take into account the recent global financial crisis is very significant. When $CRISIS$ is included, the significance of openness and the interaction term between openness and the FTA variable was lowered while the Brent oil price recovers its significance. From the estimation results based on the estimation equation (VIII), if the share of the trade with the FTA member countries in the total trade is 1% point higher, the CPI is estimated to decrease by about 0.13%, and the global financial crisis lowered the CPI by 5.3%.[8]

Using these estimates, the effect of the FTA and the magnitude of the effects of the global financial crisis can be calculated as shown in Figure 5. Figure 5 shows the actual CPI, the

[7]The results of the panel data model analyzed for OECD countries will be discussed again. However, there have been some studies in which the relationship between real GDP and prices has been estimated as negative, as well as positive and not significant . This implies that the effect of real GDP on prices is dependent on the aggregate demand shock or aggregate supply shock, which is identified by the structure of the estimation model.

[8]The effect of the global financial crisis is estimated as the coefficient of the dummy variable, which means that the CPI level after the global financial crisis is 5.3% lower than the level before the global financial crisis. The effect of the global financial crisis was estimated as a level effect, but it is assumed that it appears over a long period of time and it is calculated as a decline in the consumer price inflation rate.

hypothetical CPI without FTAs, the hypothetical CPI when there is no global financial crisis, and the hypothetical CPI when there is no global financial crisis and no FTA at all. As expected from the estimation results, if there was no FTA or no international financial crisis, the CPI would have been higher than the actual value. The average annual growth rate of the CPI from the second quarter of 2004 to the second quarter of 2015 was 2.49%. If the FTA was not concluded at all and the global financial crisis had occurred, the annual average growth rate is estimated to be 3.00%. In the same way, if the FTA expanded as it was and if the global financial crisis did not occur, the CPI would have been 2.96%, and if the FTA was not concluded and the international financial crisis did not occur, it would have been 3.47%. In other words, the effect of dropping the average annual inflation rate due to the FTA concluded during the same period was 0.52% point yearly, 0.47% point yearly due to the global financial crisis, and 0.98% point yearly by both effects. From this model, it can be inferred that the recent low inflation rate is due to a combination of the recession caused by the global financial crisis and the price stabilization effect of the FTAs.

4.4 Panel data estimation results

According to the static panel data estimation results shown in Table 5, the FTA variables have a more powerful and significant effect on the CPI inflation rate than openness in most of the estimation equations. Therefore, it seems that the FTAs may have a qualitatively different effect on the economy from the traditional measure of openness simply defined as the ratio of the sum of exports and imports to GDP. There is no significant difference between the two cases of considering the exports and the imports together and the imports only in constructing FTA variables. It can be interpreted that the effect of qualitative expansion, such as tariff reduction and service market opening, rather than quantitative expansion of trade, is more important in explaining the recent low inflation. Other control variables also show reasonable signs, showing that the money growth rate and unit labor cost growth rate show a positive effect on the inflation rate as expected.

However, the interaction term between FTA variables and openness turns out be positive, which is different from the initial expectation. It indicates that the effect of FTA-related trade increases on inflation rates is more pronounced in countries with lower openness than those with already higher openness. Considering the possible endogeneity of variables, the dynamic panel data model is more appropriate than the static panel model. The dynamic model of the panel model using the system GMM method is shown in Table 6. From Table 6, it is clear that openness variables lose significance consistently throughout all of the dynamic panel models while FTA variables show high significance in most of the specifications. This is the same when the FTA variables and openness variables are constructed as imports only. As in the static panel data model, other control variables such as money growth rate and growth rate of unit

labor cost maintain their positive signs and significance of the coefficients. The M2 money growth rate has a positive effect on the inflation rate, implying that the neutrality of money holds. The growth rate of unit labor cost also shows a negative effect on inflation rate with high significance, which is in consistent with the idea of cost-push inflation. The coefficient of GDP growth rate is still negative but sometimes insignificant, which is different from what the Phillips curve relation predicts. The negative relationship between the growth rate of real GDP and the inflation rate can be interpreted as an evidence of supply factors driving economic fluctuations.[9] As in the static panel data model, the interaction term between FTA variables and openness shows a negative sign, implying the inflation stabilizing effect of FTAs is larger in countries with less openness.

Similar to the estimation of the effects of FTAs from the Korea's time series estimation, we can estimate how much the inflation rate has been reduced due to an expansion of FTAs in the OECD panel data estimation model. Since there is an interaction term, the effect of the FTA on inflation rate, as shown in Equation (7), depends on the levels of FTA and $OPEN$ of a specific countries and at a specific time point. To calculate the effect of the FTA on the inflation rate in 2014 for the case of Korea, it is necessary to consider the effect of a change in the inflation rate in the previous period. Thus, we need to calculate consecutively all the effects of FTAs on the CPI inflation from the start of FTA in the second quarter of 2004 when the first FTA began to take effect. Based on the estimation equation (III) or estimation equation (VII) in Table 6, the effect of FTA on inflation rate is calculated -0.21% point for the case of Korea in 2014. In other words, if the panel data estimation results for OECD countries are applied to Korea, it is estimated that the effect of the FTA on the inflation rate change is -0.21% point. This value is not small considering the recent low inflation rate.

5 Summary and Future Research

An FTA is a factor that directly reduces the tariff rate or the barriers to trade, thereby lowering the price of imports. The expansion of trade also leads to a change in domestic prices by exporting products with comparative advantage. From this point of view, the recent low inflation rate is likely to have something to do with the expansion of FTAs.

In this study, we examined quantitatively how FTAs have contributed to the change of domestic inflation rate. Estimating the effect of the FTA on the prices of the 72 items in detailed categories, calculating the hypothetical value of the FTA by exploiting the concept of

[9] In the existing literature, the sign of the relationship between real GDP and prices is not consistently estimated.

A negative relationship is found in Lane (1997) and Samimi et al. (2012) (2007), and Romer et al. (2007), while Biney et al. (2012) find a positive relationship. Alfaro (2005), Ihrig et al. (2007), and Romer (1993) show different signs across countries and Auer and Mehrotra (2014) and Borio and Filardo (2007) find no significance in the relationship. We think the estimation of the relationship is closely related to the identification issue.

the but-for price, and estimating the effect of the FTA on the aggregate index by applying the weights of items, it is estimated that the CPI growth rate in the second quarter of 2004 to the second quarter of 2015 has been reduced by the annual average of 0.76% point. From the second time series estimation method, both the effect of the FTA and the effect of the global financial crisis on the CPI are found to be consistently negative. The effect of the FTA on the annual average inflation rate was -0.52% point, The drop in inflation rate due to the global financial crisis was -0.47% point, making the total of -0.98% point. From the cross-country panel data analysis for 34 OECD countries, FTAs show a significant negative effect on the CPI inflation, which is clearly more apparent than the traditionally used openness measure. The FTA effect of lowering inflation rate is higher for countries with low level of openness. When the OECD panel estimates are applied to the case of Korea in 2014, the FTA cuts inflation rate by 0.21%.

The results from the above three empirical estimation models show consistently that the FTAs have lowered the CPI inflation. However, the results of this study have the following limitations. First, the analysis of the FTA effect by estimating the but-for-price of 72 items is based on a strong assumption that any structural change in the relationship among variables is solely due to FTAs but it may not be the case. Therefore, it is necessary to further analyze and identify the pure FTA effect on inflation. Second, theoretical models such as DSGE models with simulation exercise may help understanding the channel through which the FTAs lower domestic consumer price inflation rate.

Table 1: Korea's FTA Signing and Effective Dates

Counterpart Country	Signing Date	Effective Date
Chile	February 2003	April 1, 2004
Singapore	August 2005	March 2, 2006
EFTA	December 2005	September 1, 2006
ASEAN	August 2006	January 1, 2007 (different across countries)
India	August 2009	January 1, 2010
EU	October 2010	July 1, 2011
Peru	March 2011	August 1, 2011
U.S.	June 2007	March 15, 2012
Turkey	August 2012	May 1, 2013
Australia	April 2014	December 14, 2014
Canada	September 2005	January 1, 2015
New Zealand	March 2015	December 20, 2015
Vietnam	May 2015	December 20, 2015
China	June 2015	December 20, 2015
Colombia	February 2013	July 15, 2016

Source: http://rtais.wto.org/UI/PublicAllRTAList.aspx.

Table 2: Descriptive Statistics for OECD Panel Data

Variable	Source	Mean	Overall Standard Deviation	Between Standard Deviation	Within Standard Deviation	Min	Max	Obs.
$\Delta \ln CPI$	IFS	0.07	0.14	0.07	0.12	-0.05	1.88	1,106
$\Delta \ln M2$	World Bank	0.12	0.18	0.09	0.15	-0.33	2.22	1,025
$OPEN$	IMF, DOTS	0.58	0.33	0.34	0.13	0.11	1.80	1,076
FTA	IMS, DOTS	0.45	0.33	0.23	0.24	0	0.89	1,068
$OPENIM$	IMF, DOTS	0.30	0.16	0.17	0.06	0.05	0.93	1,076
$FTAIM$	IMF, DOTS	0.43	0.32	0.23	0.23	0.00	0.94	1,069
$\Delta \ln ULC \times 100$	OECD	4.38	6.37	3.00	5.59	-9.02	58.33	881
$\Delta \ln GDP \times 100$	OECD	2.69	3.04	1.24	2.79	-14.72	13.24	1,111
List of Countries (N=34)	Australia, Austria, Belgium, Canada, Czech Republic, Chile, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Luxembourg, Iceland, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Slovakia, Slovenia, Turkey, UK, US							

Notes: CPI, $M2$, $OPEN$, FTA, $OPENIM$ $FTAIM$, ULC, and GDP indicate Consumer Price Index, M2 money supply, the total amount of trade relative to GDP (openness), the share of trade with countries with FTAs in total trade, the ratio of total imports to GDP, the ratio of total imports to FTA countries, unit labor cost, and gross domestic product.

Table 3: Cross-correlations between Variables in OECD Countries

	$\Delta \ln CPI$	$\Delta \ln M2$	$OPEN$	FTA	$OPENIM$	$FTAIM$	$\Delta \ln ULC$	$\Delta \ln GDP$
$\Delta \ln CPI$	1							
$\Delta \ln M2$	0.7672	1						
	[0.0000]							
$OPEN$	-0.1551	-0.1000	1					
	[0.0000]	[0.0016]						
FTA	-0.31	-0.2955	0.3243	1				
	[0.0000]	[0.0000]	[0.0000]					
$OPENIM$	-0.1191	-0.0633	0.9775	0.3022	1			
	[0.0001]	[0.0457]	[0.0000]	[0.0000]				
$FTAIM$	-0.3077	-0.294	0.2929	0.9889	0.2737	1		
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]			
$\Delta \ln ULC$	0.8867	0.4746	-0.0785	-0.2309	-0.0181	-0.2274	1	
	[0.0000]	[0.0000]	[0.0246]	[0.0000]	[0.6041]	[0.0000]		
$\Delta \ln GDP$	0.0123	0.1977	0.0692	-0.1453	0.0805	-0.1508	-0.0357	1
	[0.6872]	[0.0000]	[0.0254]	[0.0000]	[0.0092]	[0.0000]	[0.2898]	

Notes: Refer to the Notes in Table 2 for variables. The values in parentheses are standard errors.

Table 4: CPI Estimation with Korean Aggregate Time Series Data (Dependent Variable: $\ln CPI$)

Explanatory Variables	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
$\ln GDP$	0.229^{**}	0.174^{**}						
	(0.099)	(0.079)						
$\ln OECD$	-0.299^{**}	-0.213^{*}	-0.357^{**}	-0.341^{**}	-0.353^{**}	-0.331^{***}	-0.814^{***}	-0.923^{***}
	(0.131)	(0.114)	(0.156)	(0.140)	(0.143)	(0.138)	(0.176)	(0.194)
$\ln M2$	0.240^{***}	0.209^{***}	0.246^{***}	0.235^{***}	0.236^{***}	0.235^{***}	0.254^{***}	0.275^{***}
	(0.035)	(0.022)	(0.014)	(0.019)	(0.019)	(0.018)	(0.015)	(0.014)
$\ln EX$	0.039^{*}		-0.028					
	(0.022)		(0.018)					
$\ln BRENT$	0.043^{***}			0.013	0.014	0.013	0.021^{***}	0.031^{***}
	(0.010)			(0.010)	(0.010)	(0.010)	(0.008)	(0.008)
FTA			-0.134^{**}	-0.755^{***}			-0.519^{***}	-0.131^{***}
			(0.065)	(0.231)			(0.186)	(0.048)
$OPEN$				-0.093^{***}	-0.091^{***}	-0.095^{***}	-0.034	
				(0.033)	(0.033)	(0.033)	(0.029)	
FTA				0.650^{***}			0.387^{**}	
$\times OPEN$				(0.223)			(0.18)	
$FTAIM$					-0.775^{***}			
					(0.245)			
$FTAIM$					0.655^{***}			
$\times OPEN$					(0.237)			
$FTAEX$						-0.733^{***}		
						(0.220)		
$FTAEX$						0.640^{***}		
$\times OPEN$						(0.212)		
$CRISIS$							-0.043^{***}	-0.053^{***}
							(0.015)	(0.015)
Trend	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.997	0.998	0.998	0.998	0.998	0.998	0.998	0.998
Obs.	117	117	117	117	117	117	117	117

Notes: Refer to Table 2 for variables. $OECD$, EX, $BRENT$, and $CRISIS$ are the sum of real GDP of OECD countries, the exchange rate, the brent oil price, a financial crisis dummy variable having a value of 0 before the fourth quarter of 2008 and 1 after then. The values in parentheses are the standard errors, and $***$, $**$, and $*$ indicate that the estimates are significant at the 1%, 5% and 10% significance levels, respectively.

Table 5: Effect of FTA on CPI Inflation in a Static Panel Model (Dependent Variable: $\Delta \ln CPI$)

Explanatory Variables	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
FTA	-0.152^{***}	-0.077^{***}	-0.052^{***}	-0.008				
	(0.021)	(0.025)	(0.009)	(0.006)				
$OPEN$	-0.096^{***}	-0.043	-0.019^{*}	0.016^{***}				
	(0.027)	(0.030)	(0.010)	(0.006)				
FTA	0.104^{***}	0.055^{*}	0.035^{***}	-0.011				
$\times OPEN$	(0.030)	(0.032)	(0.011)	(0.009)				
$FTAIM$					-0.140^{***}	-0.059^{**}	-0.049^{***}	-0.010^{*}
					(0.022)	(0.025)	(0.008)	(0.006)
$OPENIM$					-0.157^{***}	-0.059	-0.028	0.027^{***}
					(0.047)	(0.052)	(0.017)	(0.010)
$FTAIM$					0.157^{***}	0.059	0.056^{***}	-0.015
$\times OPENIM$					(0.056)	(0.060)	(0.020)	(0.016)
$\Delta \ln M2$	0.455^{***}	0.446^{***}	0.036^{***}	0.044^{***}	0.462^{***}	0.449^{***}	0.036^{***}	0.044^{***}
	(0.017)	(0.017)	(0.010)	(0.010)	(0.017)	(0.017)	(0.010)	(0.010)
$\Delta \ln ULC$			0.006^{***}	0.006^{***}			0.006^{***}	0.006^{***}
			(0.000)	(0.000)			(0.000)	(0.000)
$\Delta \ln GDP$	-0.006^{***}	-0.009^{***}	0.000	-0.001^{***}	-0.006^{***}	-0.009^{***}	0.000	-0.001^{***}
(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	
Constant	0.126^{***}	0.050^{**}	0.039^{***}	0.012^{**}	0.117^{***}	0.040^{*}	0.036^{***}	0.013^{**}
(0.015)	(0.024)	(0.006)	(0.006)	(0.014)	(0.022)	(0.006)	(0.006)	
Time dummies	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	965	965	745	745	966	966	746	746
Countries	34	34	31	31	34	34	31	31
R^2	0.569	0.617	0.769	0.834	0.571	0.619	0.773	0.835
Hausman	405.45	275.52	33.51	32.98	378.47	268.58	29.38	30.51
[p-value]	[0.00]	[0.00]	[0.00]	[0.66]	[0.00]	[0.00]	[0.00]	[0.77]
Fixed/ Random Effects	FE	FE	FE	RE	FE	FE	FE	RE

Notes: Refer to the Notes in Table 2 for variables. A static panel model the period of 1980∼2014 was estimated with 34 OECD countries using Fixed Effects and Random Effects method. The selection of model estimation method is based on Hausman test results. The values in parentheses are the standard errors, and $***$, $**$, and $*$ indicate that the estimates are significant at the 1%, 5% and 10% significance levels, respectively.

Table 6: Effect of FTA on CPI Inflation in a Dynamic Panel Model (Dependent Variable: $\Delta \ln CPI$)

Explanatory Variables	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
FTA	-0.033^{*}	-0.016	-0.010^{**}	-0.009^{**}				
	(0.017)	(0.019)	(0.004)	(0.004)				
$OPEN$	-0.023	-0.013						
	(0.021)	(0.023)						
FTA	0.026	0.017	0.007^{**}	0.008^{**}				
$\times OPEN$	(0.024)	(0.028)	(0.003)	(0.004)				
$FTAIM$					-0.029^{*}	-0.013	-0.011^{***}	-0.010^{**}
					(0.016)	(0.019)	(0.004)	(0.004)
$OPENIM$					-0.027	-0.008		
					(0.036)	(0.041)		
$FTAIM$					0.033	0.018	0.016^{**}	0.017^{**}
$\times OPENIM$					(0.044)	(0.052)	(0.007)	(0.008)
$\Delta \ln CPI_{-1}$	0.417^{***}	0.407^{***}	0.392^{***}	0.384^{***}	0.417^{***}	0.405^{***}	0.391^{***}	0.384^{***}
	(0.084)	(0.081)	(0.070)	(0.094)	(0.084)	(0.081)	(0.070)	(0.091)
$\Delta \ln M2$	0.318^{***}	0.323^{***}	0.030^{*}	0.037^{**}	0.318^{***}	0.323^{***}	0.029^{*}	0.037^{**}
	(0.102)	(0.098)	(0.016)	(0.016)	(0.102)	(0.098)	(0.016)	(0.016)
$\Delta \ln ULC$			0.004^{***}	0.004^{***}			0.004^{***}	0.004^{***}
			(0.001)	(0.001)			(0.001)	(0.001)
$\Delta \ln GDP$	-0.003^{**}	-0.004^{***}	0.001	-0.001	-0.003^{**}	-0.004^{***}	0.001	-0.001
(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	
Constant	0.027^{*}	0.054^{**}	0.007^{***}	0.012^{**}	0.023	0.035^{*}	0.007^{***}	0.012^{**}
	(0.015)	(0.022)	(0.002)	(0.006)	(0.015)	(0.020)	(0.002)	(0.006)
Time dummies	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	942	942	728	728	943	943	729	729
Countries	34	34	31	31	34	34	31	31
AR(1)	-2.31	-2.48	-2.57	-2.60	-2.30	-2.48	-2.57	-2.60
[p-value]	[0.02]	[0.01]	[0.01]	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]
AR(2)	-0.91	-1.14	0.18	-0.32	-0.89	-1.13	0.17	-0.33
[p-value]	[0.36]	[0.25]	[0.86]	[0.75]	[0.37]	[0.26]	[0.86]	[0.75]
Hansen	31.65	0.00	30.16	0.00	32.26	0.00	30.35	0.00
[p-value]	[1.00]	[1.00]	[1.00]	[1.00]	[1.00]	[1.00]	[1.00]	[1.00]

Notes: Refer to the Notes in Table 2 for variables. $\Delta \ln CPI_{-1}$ is CPI inflation rate in the previous period. A dynamic panel model for the period of 1980∼2014 was estimated with OECD countries using the system GMM method. The values in parentheses are the standard errors, and $***$, $**$, and $*$ indicate that the estimates are significant at the 1%, 5% and 10% significance levels, respectively.

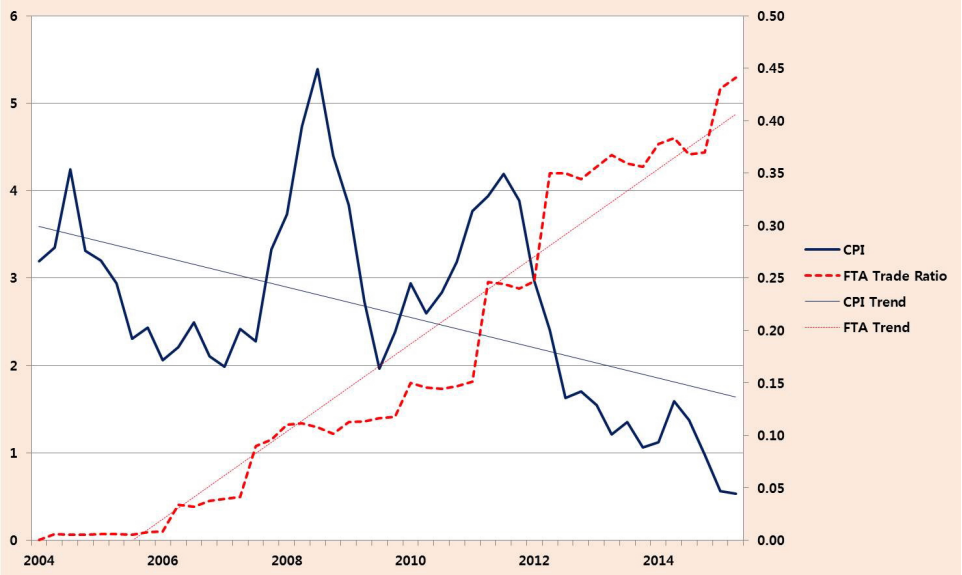

Figure 1. Inflation and FTA Trade Ratio

Note: CPI refers to the consumer price inflation rate (left axis, %), FTA Trade Ratio refers to the share of trade with the countries with an FTA among the total trade amount, and the two straight lines refer to trends of the two series.

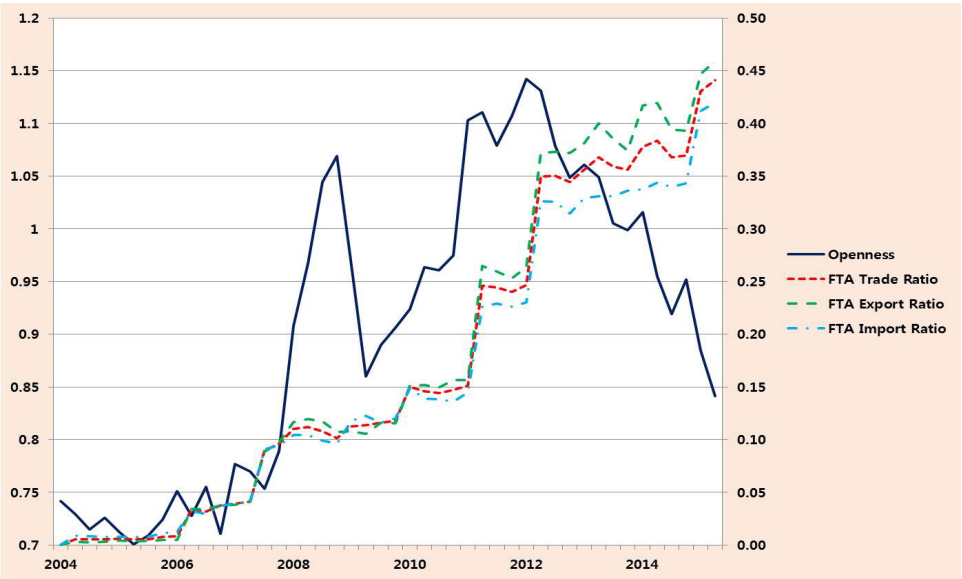

Figure 2. Openness and FTA Ratios

Note: Openness is defined as the ratio of the sum of exports imports relative to GDP, (left scale) FTA Trade Ratio refers to the share of trade with the countries with an FRA among the total trade amount,and FTA Export (Import) Ratio refers to the share of exports (imports) with the countries with an FTA among the total exports (imports). (right scale)

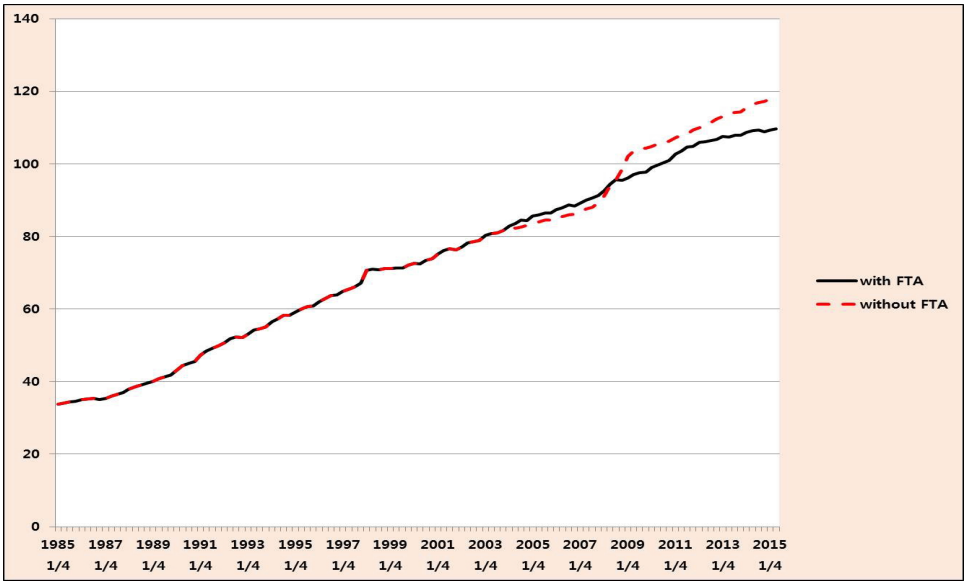

Figure 3. Actual CPI and Out-of-Sample Forecast of CPI

Note: The solid line is the actual CPI and the dotted line is the out-of-sample forcast CPI based on the estimation of Equation (1) for 72 items.

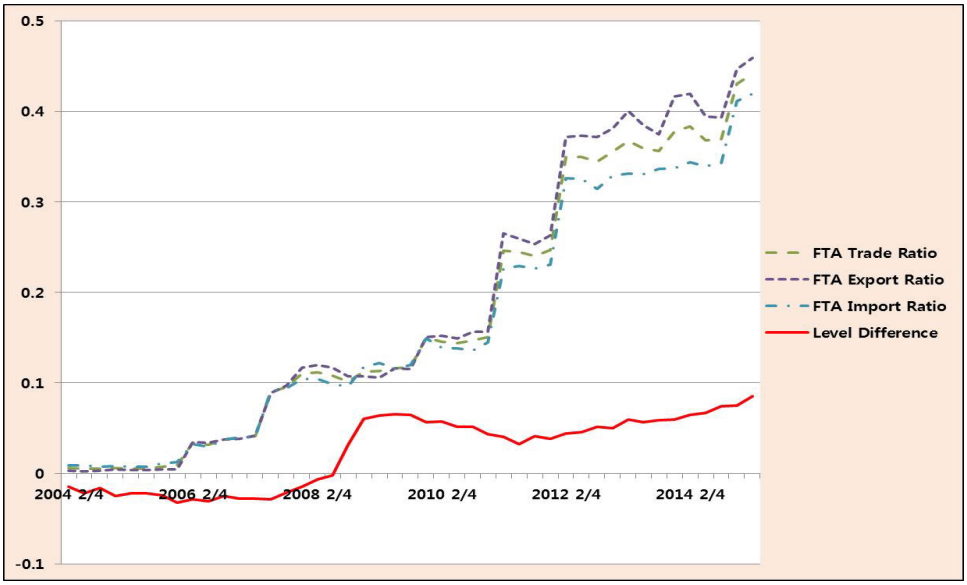

Figure 4. FTA Ratios and Difference between Actual CPI and Out-of-Sample Forecast of CPI

Note: Refer to the Notes in Figure 2 for FTA ratios. Level Difference is the difference between the actual CPI and the hypothetical out-of-sample CPI estimate constructed by Equation (1).

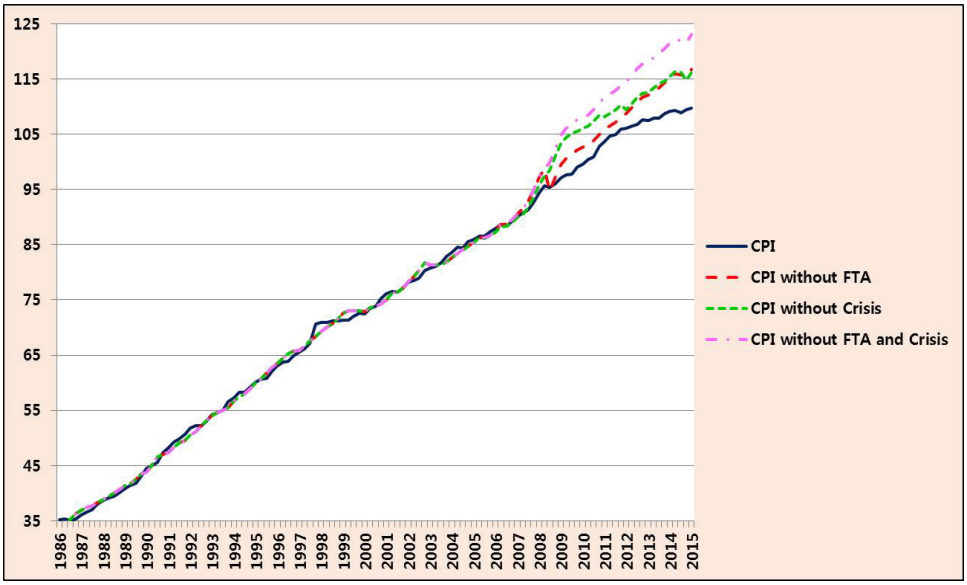

Figure 5. Effects of FTAs and Global Financial Crisis on CPI

Note: 'CPI without FTA (Crisis or FTA and Crisis)' is the fitted valuie of CPI from Equation (3) assuming FTA=0 (Crisis=0 or FTA=Crisis=0).

Appendix

A.1 72 Detailed Categories and their Weights in CPI

To be added.

A.2 Data Sources

To be added.

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