THE JOURNAL OF THE KOREAN ECONOMY, Vol. 8, No. 2 (Fall 2007), 357-376

Exchange Rate Pass-through on Disaggregated Korean Export Prices: A Structural VAR Approach*

Won Joong Kim**

This paper analyzes the exchange rate pass-through on disaggregated Korean export prices using a structural VAR. The paper shows how the macro shocks affect disaggregated Korean export prices as well as the overall economy. After controlling for the endogeneity of the exchange rate, the paper measures the exchange rate pass-through on disaggregated Korean export prices from a structural VAR. The results show that the demand shocks and the money supply shocks generally have positive effects on disaggregated Korean export prices. The supply shocks have mixed effects on those prices. The exchange rate pass-through on Korean export prices reveals that Korean exporters generally use strategies toward the local-currency pricing.

JEL Classification: F3
Keywords: exchange rate pass-through, vector autoregressions (VAR)

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* Received July 20, 2007. Accepted October 31, 2007. The earlier version of this paper is presented at a conference on Korea and the World Economy VI, July 2-3, 2007, at University of Wollongong, Australia. The author thanks Dr. William D. Lastrapes, anonymous referees, and the seminar participants for their valuable comments and suggestions.

** Research Fellow, IT Industry Research Division, Korea Information Society Development Institute (KISDI), 1-1 Juam-dong, Gwacheon-si, Gyeonggi-do, 420-710, South Korea, E-mail: wjkim@kisdi.re.kr

1. INTRODUCTION

This paper introduces another way of measuring exchange rate pass-through using a structural VAR. It shows how to calculate the exchange rate pass-through (ERPT) from a structural VAR and discusses the difference between the ERPT from the structural VAR and the ERPT from a reduced-form regression.

Since Krugman (1987), many studies (treating exchange rate either endogenous or exogenous) theoretically show why import or export prices respond less when the exchange rate changes. Most of earlier empirical studies on exchange rate pass-through, however, measured it in a reduced form regression of import (export) price on the exchange rate which presumed that the latter is exogenous. Recently, using a two-country model, Kim (2007) showed the exchange rate pass-through after controlling for the endogeneity of the exchange rate. This paper closely follows Kim (2007) but is different in the following ways. First the focus of this paper is on the disaggregated Korean export prices and estimation methods are also different. Second the identification strategies are also different. Finally it is theoretically shown how exchange rate pass-through from the reduced-form regression can be biased.

The remainder of this paper is organized as follows. Section 2 discusses the model and identification strategy. Section 3 presents the estimation results. Concluding remarks are contained in section 4.

2. MODEL AND IDENTIFICATION STRATEGY

2.1. The Exchange Rate Pass-through from a Structural VAR

Let vector Δx_t contain stochastic variables in first differences that are generated by the following structural model,

$$A_0 \Delta x_t = A_1 \Delta x_{t-1} + A_2 \Delta x_{t-2} + \cdots + A_p \Delta x_{t-p} + u_t, \tag{1}$$

where u_t is a vector of mutually uncorrelated white-noise disturbances with $E_t u_t u_t' = I$. All variables are in logs. The variables are assumed to be stationary after first differencing. Since equation (1) is a structural VAR, it is not directly estimable and the model to be estimated is a reduced VAR representation given as

$$\Delta x_t = B_1 \Delta x_{t-1} + B_2 \Delta x_{t-2} + \cdots + B_p \Delta x_{t-p} + \varepsilon_t, \tag{2}$$

where $B_k = A_0^{-1} A_k$, $k = 1, \ldots, p$, $\varepsilon_t = A_0^{-1} u_t$, and $E_t \varepsilon_t \varepsilon_t' = \Sigma = A_0^{-1} \left(A_0^{-1} \right)' = D_0 D_0'$. From equation (1),

$$\begin{aligned} \Delta x_t &= \left(A_0 - A_1 L - A_2 L^2 - \cdots - A_p L^p \right)^{-1} u_t \\ &= \left(D_0 + D_1 L + D_2 L^2 + \cdots \right) u_t = D(L) u_t, \end{aligned} \tag{3}$$

and from equation (2),

$$\begin{aligned} \Delta x_t &= \left(I - B_1 L - B_2 L^2 - \cdots - B_p L^p \right)^{-1} \varepsilon_t \\ &= \left(I + C_1 L + C_2 L^2 + \cdots \right) \varepsilon_t = C(L) \varepsilon_t. \end{aligned} \tag{4}$$

$C(L)$ and Σ are obtained from the estimation of the reduced-from VAR in equation (2). The structural coefficients in equation (1) and (3) cannot be recovered from the reduced-form estimates without restriction on the structural system since the mapping from the structural form to the reduced form is not unique.

Now consider the mapping from the structural form to the reduced form. Note from equation (4),

$$C(L) \varepsilon_t = C(L) A_0^{-1} u_t, \tag{5}$$

which implies that

$$D(L) = C(L)A_0^{-1};\ D_0 = A_0^{-1}. \tag{6}$$

Note from equation (6) that,

$$D(1) = C(1)D_0, \tag{7}$$

where

$$D(1) = \sum_{i=0}^{\infty} D_i. \tag{8}$$

Finally, using the fact that $E_t\varepsilon_t\varepsilon_t' = \Sigma = A_0^{-1}\left(A_0^{-1}\right)' = D_0\left(D_0\right)'$, then

$$D(1)\,D(1)' = C(1)\,D_0\,(D_0)'\,C(1)' = C(1)\Sigma C(1)'. \tag{9}$$

The objective is to identify $D(L)$, the dynamic multipliers showing the responses of the system variables to the different exogenous shocks. Equation (9) shows how the identification can be achieved by imposing the restrictions on $D(1)$. Note that the dynamic response of the *levels* of the endogenous variables is given by the accumulated response function $(\partial x_{t+k} / \partial u_k) = \sum_{i=0}^{k} D_i = D(1)$. These shocks are identified by imposing restrictions on how the macro variables respond to different shocks in the long run.[1)]

With appropriate identifying restrictions it is possible to identify the A_0 matrix. It is then possible to calculate the contemporaneous effect of a change in the exchange rate on the export price from the export price equation in the structural VAR. The measurement of exchange rate pass-through is the one from the structural VAR.

To understand what it means, suppose that $A_0\Delta x_t$ in equation (1) is given as

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[1)] The use of restrictions at the infinite horizon is pioneered by Blanchard and Quah (1988) and Shapiro and Watson (1988).

$$A_0 \Delta x_t = \begin{pmatrix} 1 & a_{12} & a_{13} \\ a_{21} & 1 & a_{23} \\ a_{31} & a_{32} & 1 \end{pmatrix} \begin{pmatrix} \Delta pex_t \\ \Delta s_t - \Delta p_t \\ \Delta m_t \end{pmatrix}. \quad (10)$$

where pex_t denotes nominal export price, $(\Delta s_t - \Delta p_t)$, denotes real exchange rate, defined as the nominal exchange rate divided by the domestic price level, and m_t denotes nominal money supply.

The exchange rate pass-through coefficient from a structural VAR can be found from real export price equation in (10). It measures the contemporaneous effect of a change in exchange rate on export price. Ceteris paribus, the first row of $A_0 \Delta x_t$ matrix in equations (1) and (10) can be written as

$$\Delta pex_t = -a_{12}\left(\Delta s_t - \Delta p_t\right) - a_{13}\Delta m_t \rightarrow \frac{\partial\left(\Delta pex_t\right)}{\partial\left(\Delta s_t\right)} = -a_{12}, \quad (11)$$

where $-a_{12}$ denotes the exchange rate pass-through coefficient from a structural VAR.[2)]

It is possible to interpret $-a_{12}$ in terms of local-currency pricing. Note that the Korean export price (pex_t) is, in log, the sum of the nominal exchange rate (s_t) and foreign price of Korean goods sold overseas (pm_t^*), i.e.,

$$pex_t = pm_t^* + s_t.$$

Taking differences and differentiating with respect to nominal exchange rate give

$$\frac{\partial\left(\Delta pex_t\right)}{\partial\left(\Delta s_t\right)} = \frac{\partial\left(\Delta pm_t^*\right)}{\partial\left(\Delta s_t\right)} + 1.$$

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2) This paper assumes a small country and the foreign variables are normalized to zero in logs.

Since $\partial(\Delta pex_t)/\partial(\Delta s_t) = -a_{12}$ in equation (11), the change in the foreign price of Korean goods sold to overseas with respect to a change in exchange rate is given as

$$\frac{\partial\left(\Delta pm_t^*\right)}{\partial\left(\Delta s_t\right)} = -a_{12} - 1.$$

If $a_{12} = 0$ or $\partial(\Delta pm_t^*)/\partial(\Delta s_t) = -1,$ the producer-currency pricing (PCP), i.e., a complete pass-through, occurs. If $a_{12} = -1$ or $\partial(\Delta pm_t^*)/\partial(\Delta s_t) = 0,$ the local-currency pricing (LCP), an incomplete pass-through, occurs. Therefore, depending on the magnitude, $-a_{12}$ in equation (11) can be interpreted in terms of LCP or PCP.

2.2. ERPT from a Structural VAR vs. ERPT from a Reduced-Form Regression

To see how the exchange rate pass-through from the structural VAR is related to the exchange rate pass-through from the reduced-form VAR, the model is further simplified. To do this the time-subscript is dropped in equation (1) and the focus is only on the contemporaneous relationship.

$$A\Delta x = u; \quad Euu' = I, \tag{12}$$

$$\begin{pmatrix} 1 & a_{12} & a_{13} \\ a_{21} & 1 & a_{23} \\ a_{31} & a_{32} & 1 \end{pmatrix} \begin{pmatrix} \Delta pex \\ \Delta s - \Delta p \\ \Delta m \end{pmatrix} = \begin{pmatrix} u_1 \\ u_2 \\ u_3 \end{pmatrix} \tag{13}$$

$$\begin{pmatrix} \Delta pex \\ \Delta s \\ \Delta m \end{pmatrix} = A^{-1}u = Du = \varepsilon, \; E\varepsilon\varepsilon' = \Sigma = DD', \tag{14}$$

$$A^{-1}=\frac{1}{J}\begin{pmatrix}1-a_{23}a_{32} & a_{13}a_{32}-a_{12} & a_{12}a_{23}-a_{13}\\ a_{23}a_{31}-a_{21} & 1-a_{13}a_{31} & a_{13}a_{21}-a_{23}\\ a_{32}a_{21}-a_{31} & a_{12}a_{31}-a_{32} & 1-a_{12}a_{21}\end{pmatrix}=\begin{pmatrix}d_{11} & d_{12} & d_{13}\\ d_{21} & d_{22} & d_{23}\\ d_{31} & d_{32} & d_{33}\end{pmatrix}=D, \quad (15)$$

where $J=(1-a_{23}a_{32})-a_{12}(a_{21}-a_{23}a_{31})+a_{13}(a_{21}a_{32}-a_{31})$. The exchange rate pass-through from a structural VAR is, $-a_{12}$ as in equation (11).

From equation (15),

$$d_{11}=\frac{1-a_{23}a_{32}}{J};d_{12}=\frac{a_{13}a_{32}-a_{12}}{J};d_{13}=\frac{a_{12}a_{23}-a_{13}}{J}, \quad (16)$$

$$d_{21}=\frac{a_{23}a_{31}-a_{21}}{J};d_{22}=\frac{1-a_{13}a_{31}}{J};d_{23}=\frac{a_{13}a_{21}-a_{23}}{J}, \quad (17)$$

$$d_{31}=\frac{a_{32}a_{21}-a_{31}}{J};d_{32}=\frac{a_{12}a_{31}-a_{32}}{J};d_{33}=\frac{1-a_{12}a_{21}}{J}. \quad (18)$$

Then Δpex, $(\Delta s-\Delta p)$, and Δm can be solved in terms of u_1, u_2, and u_3.

$$\begin{aligned}\Delta pex&=\frac{u_1(1-a_{23}a_{32})+u_2(a_{13}a_{32}-a_{12})+u_3(a_{12}a_{23}-a_{13})}{J}\\&=u_1d_{11}+u_2d_{12}+u_3d_{13},\end{aligned} \quad (19)$$

$$\begin{aligned}(\Delta s-\Delta p)&=\frac{u_1(a_{23}a_{31}-a_{21})+u_2(1-a_{31}a_{13})+u_3(a_{21}a_{13}-a_{23})}{J}\\&=u_1d_{21}+u_2d_{22}+u_3d_{23},\end{aligned} \quad (20)$$

$$\begin{aligned}\Delta m&=\frac{u_1(a_{21}a_{32}-a_{31})+u_2(a_{12}a_{31}-a_{32})+u_3(1-a_{12}a_{21})}{J}.\\&=u_1d_{31}+u_2d_{32}+u_3d_{33}.\end{aligned} \quad (21)$$

It is also noted that the covariance matrix from the reduced-form VAR is given as

$$\Sigma = \begin{pmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} \\ \sigma_{12} & \sigma_{22} & \sigma_{23} \\ \sigma_{13} & \sigma_{23} & \sigma_{33} \end{pmatrix} = DD' = \begin{pmatrix} d_{11} & d_{12} & d_{13} \\ d_{21} & d_{22} & d_{23} \\ d_{31} & d_{32} & d_{33} \end{pmatrix} \begin{pmatrix} d_{11} & d_{21} & d_{31} \\ d_{12} & d_{22} & d_{32} \\ d_{13} & d_{23} & d_{33} \end{pmatrix} \quad (22)$$

$$= \begin{pmatrix} d_{11}^2 + d_{12}^2 + d_{13}^2 & d_{11}d_{21} + d_{12}d_{22} + d_{13}d_{23} & d_{11}d_{31} + d_{12}d_{32} + d_{13}d_{33} \\ d_{21}d_{11} + d_{22}d_{12} + d_{23}d_{13} & d_{21}^2 + d_{22}^2 + d_{23}^2 & d_{21}d_{31} + d_{22}d_{32} + d_{23}d_{33} \\ d_{31}d_{11} + d_{32}d_{12} + d_{33}d_{13} & d_{31}d_{21} + d_{32}d_{22} + d_{33}d_{23} & d_{31}^2 + d_{32}^2 + d_{33}^2 \end{pmatrix}.$$

The nominal import price equation in the reduced-form VAR is written as

$$\Delta pex = B_1 \left(\Delta s - \Delta p \right) + B_2 \Delta m + v, \quad (23)$$

$$B = \begin{pmatrix} B_1 \\ B_2 \end{pmatrix} = \begin{pmatrix} \sigma_{12} & \sigma_{13} \end{pmatrix} \begin{pmatrix} \sigma_{22} & \sigma_{23} \\ \sigma_{23} & \sigma_{33} \end{pmatrix}^{-1}$$

$$= \begin{pmatrix} \sigma_{12} & \sigma_{13} \end{pmatrix} \begin{pmatrix} \sigma_{33} & -\sigma_{23} \\ -\sigma_{23} & \sigma_{22} \end{pmatrix} \frac{1}{\sigma_{22}\sigma_{33} - \sigma_{23}^2},$$

$$\Delta pex = \frac{\sigma_{12}\sigma_{33} - \sigma_{13}\sigma_{23}}{\sigma_{22}\sigma_{33} - \sigma_{23}^2} \left(\Delta s - \Delta p \right) - \frac{\sigma_{12}\sigma_{23} - \sigma_{13}\sigma_{22}}{\sigma_{22}\sigma_{33} - \sigma_{23}^2} \Delta m + v, \quad (24)$$

If $\sigma_{23} = 0$,

$$\Delta px = \frac{\sigma_{12}}{\sigma_{22}} \left(\Delta s - \Delta p \right) + \frac{\sigma_{13}}{\sigma_{33}} \Delta m + v. \quad (25)$$

Note that $\sigma_{12} = d_{11}d_{21} + d_{12}d_{22} + d_{13}d_{23}$ and $\sigma_{22} = d_{21}^2 + d_{22}^2 + d_{23}^2$. Then the exchange rate pass-through from the reduced VAR is calculated as

$$\frac{\partial \Delta pex}{\partial \Delta s} = \frac{\sigma_{12}}{\sigma_{22}} = \frac{d_{11}d_{21} + d_{12}d_{22} + d_{13}d_{23}}{d_{21}^2 + d_{22}^2 + d_{23}^2}$$
$$= \Big[(1 - a_{23}a_{32})(a_{23}a_{31} - a_{21}) + (a_{13}a_{32} - a_{12})(1 - a_{13}a_{31}) + (a_{12}a_{23} - a_{13})(a_{13}a_{21} - a_{23})\Big]\Big/\Big[(a_{23}a_{31} - a_{21})^2 + (1 - a_{13}a_{31})^2 + (a_{13}a_{21} - a_{23})^2\Big]. \qquad (26)$$

If $a_{21} = a_{23} = a_{31} = a_{32} = 0$ is further assumed, then

$$\frac{\partial \Delta pex}{\partial \Delta s} = -a_{12}. \qquad (27)$$

Therefore, in a special case, the ERPT coefficient from the reduced-form VAR is equal to the ERPT coefficient from a structural VAR. In general cases, however, the ERPT from a structural VAR is not the same as the ERPT from a reduced-form VAR; exchange rate pass-through from a reduced-form regression is biased. If all the explanatory variables in the export price equation are exogenous, the ERPT from a structural VAR is the same as the ERPT from a reduced-form regression. If one of the explanatory variables is endogenous, the ERPT from a reduced-form regression is biased; only the ERPT from a structural VAR can capture the unbiased exchange rate pass-through.

2.3. Identification Strategy

To measure the exchange rate pass-through on disaggregated Korean export price from a structural VAR, identification restrictions are required. Following Clarida and Gali (1994), the paper assumes that the macro system consists of three variables: output, real exchange rate and the price level, respectively. Clarida and Gali (1994) show how 4 different equations (*IS* equation, price-setting equation, *LM* equation, and interest parity equation) can be re-expressed and ordered in terms of three variables: output, real exchange rate, and the price level. They also show how the shock from the output equation is called the supply shock, the shock from the real exchange rate equation is the demand shock, and the shock from the price equation is the money supply shock.

The long-run impulse response matrix, as in equation (8), is assumed to be

$$D(1) = \begin{pmatrix} . & 0 & 0 \\ . & . & 0 \\ . & . & . \end{pmatrix}, \tag{28}$$

where the first row denotes the output equation, the second row denotes real exchange rate equation, and the final row denotes the price equation.[3)]

The exchange rate pass-through on disaggregated Korean export price from a structural VAR measure needs further restrictions. Following Lastrapes (2006), it is assumed that macro variables are block exogenous to individual Korean export prices at any lags (block exogeneity) and that the individual Korean export prices are mutually independent of each other after conditioning on the common macro variables (diagonality). As shown in Lastrapes (2006), these restrictions imply that estimation of the VAR representation of the whole system and identification of the economic structure are straightforward. First the macro system is efficiently estimated as a self-contained VAR, separately from the system of individual Korean export prices with long-run identifying restrictions given as in equation (28). Second nominal Korean export price equations are efficiently estimated by separate regressions of each price on internal lags of the macro variables, and *contemporaneous* values of the macro variables.[4)]

[3)] For more details on the long-run identifying restrictions on output, real exchange rate, and the price macro system, see Clarida and Gali (1994).

[4)] See Lastrapes (2006) for detailed derivation of measuring the effects of macroeconomic shocks on individual prices.

3. ESTIMATION RESULTS

3.1. Data and Model Specification

Monthly data are obtained from the Bank of Korea and all variables are in the logs. The macro variables include output (proxied by industrial production), real exchange rate (nominal Won/Dollar exchange rate deflated by Korean CPI), and the price level (CPI). The disaggregated Korean export prices uses 13 basic group export indices from the Bank of Korea. The model includes deterministic variables such as West Texas Intermediate (WTI) oil price and seasonal dummies.

The sample period is 1980:1-2006:12, which includes 324 monthly observations.[5] After including seasonal dummies and WTI oil price, there are 262 degrees of freedom in each equation of the macro VAR, and 247 degrees of freedom in each equation of disaggregated Korean export price equations. Based on the stabilization patterns of the impulse responses, the paper truncates the forecasting horizon at 48 months (4 years).

Before the VAR is run, a unit-root test is performed using both the augmented Dickey-Fuller and the Phillips-Perron methods. The test results confirm that all the variables are stationary in first-differences. Also tested is the vector x_t for the presence of cointegration using the FIML techniques of Johansen with the small sample correction suggested by Reimers (1992). In running the tests, the estimated model allows for seasonal dummy variables to account for deterministic seasonality, and the lag length is twelve. The tests revealed no strong evidence for the existence of cointegrating vectors in the macro system. Thus, the model specification, in which the variables are first differenced and no error-correction terms are included, is reasonable.[6]

3.2. Impulse Responses

Three different macro economic shocks are identified respectively: output

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[5] Sample period begins in 1980 since KRW/USD exchange rate was fixed at 484.0 from 1974:1 until 1979:12.

[6] Detailed unit-root test results and cointegration test results will be provided by the author on request.

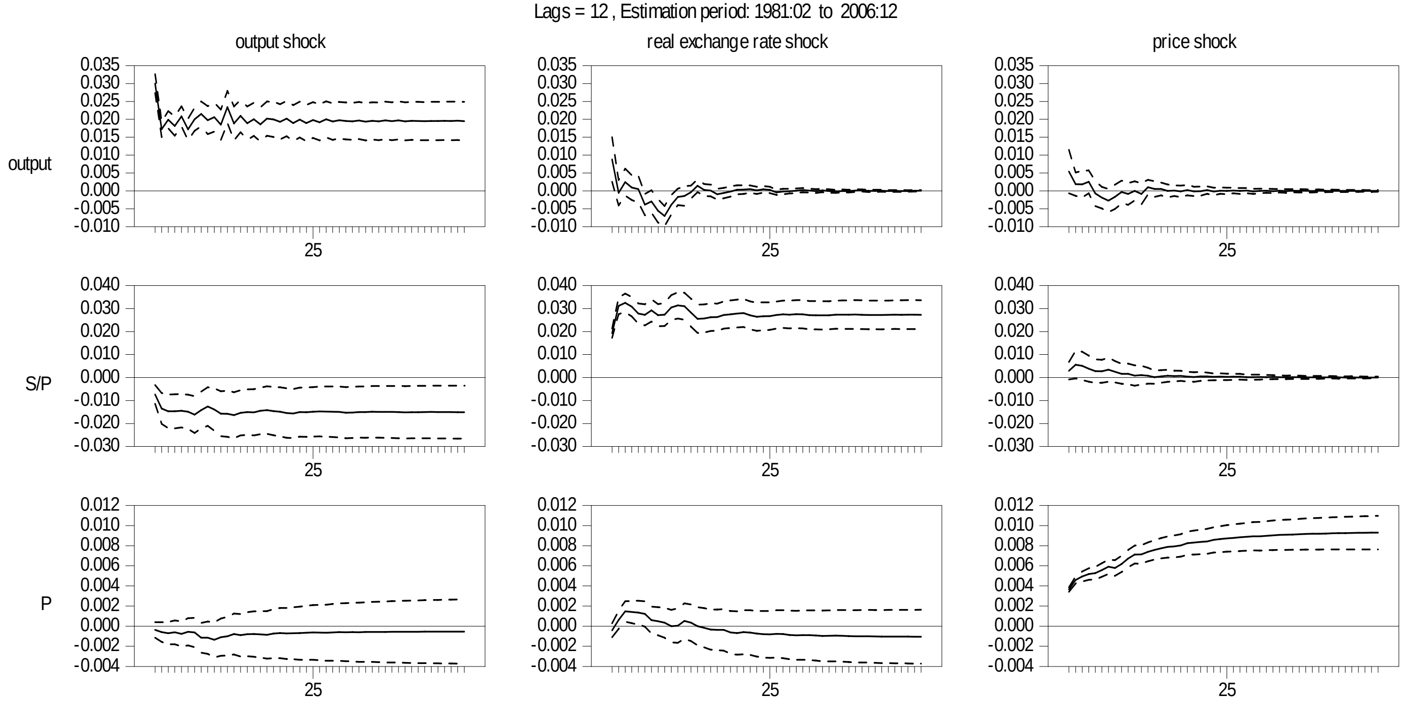
shocks, real exchange rate shocks, price shocks. The output shocks are interpreted as the supply shocks that increase domestic output (such as positive productivity shocks). The real exchange rate shock is interpreted as the demand shocks that cause the ratio of foreign country price level to domestic price level to rise (for example a fall in demand for domestic products). Finally, the price shocks are interpreted as the monetary shocks in that have temporary effects on real macro economic variables.

In figure 1, the accumulated responses are reported, which are interpreted as the response of the levels of the variables. The figure 1 also includes one-standard error band for each response, generated from a Monte Carlo integration simulation with 1000 replications.

3.2.1. Responses of macro variables to macro shocks

Figure 1 presents the dynamic impulse responses of macro variables to macro shocks. In response to supply (output) shocks, the output instantly rises by 3% and in the long run stabilizes at 1.95%. The domestic price level, although statistically insignificant, shows negative responses to output shocks. There is an initial 0.73% real appreciation (fall) of the Korean Won and the appreciation stabilizes at 1.51% to output shocks. This result seems inconsistent with what the Mundell-Fleming model predicts. A fall in domestic price to a supply shock will drive a real exchange rate toward the depreciation of the Korean Won. The magnitude of negative response of the nominal exchange rate of KRW/USD is greater than that of a negative response of the domestic price level. As a result, the real exchange rate of the Korean Won appreciates. Similar results are reported in Clarida and Gali (1994) and Shambaugh (2007). While Clarida and Gali (2994) showed negative responses of the real exchange rate (real depreciation of the domestic U.S. currency) for U.S.-Japan and U.S.-Canada, they found positive responses of the real exchange rate (real appreciation of U.S. dollar) for U.S.-Germany and U.S.-U.K. Using a similar method, Shambaugh (2007) investigated the responses of the real exchange rates to supply shocks for 17 different countries and found that the responses of the real exchanges rates to

Figure 1 Reponses of Aggregate Variables to Aggregate Shocks



Solid curves show actual responses; dotted curves show standard error bands for each response supply shocks differ by country. He found that the overall (pooled) responses of the real exchange rates to supply shocks were negative (appreciation of U.S. dollar). He also found that, while the real exchange rate rises (depreciates) for the industrialized countries, it falls (appreciates) for the developing countries.

In response to demand (real exchange rate) shocks, output instantly rises by 0.88% and falls 5 to 12 months following the shocks. The real exchange rate initially depreciates (rises) by 1.93% and the depreciation rate stabilizes at 2.73% in the long run. The price level shows positive responses in the short run and negative responses in the long run.

In response to monetary (price) shocks, output, although not statistically significant, rises in the short run. The real exchange rate instantly depreciates (rises) by 0.3% following the shock. The price instantly rises by 0.36% and its rise stabilizes at 0.93% in the long run.

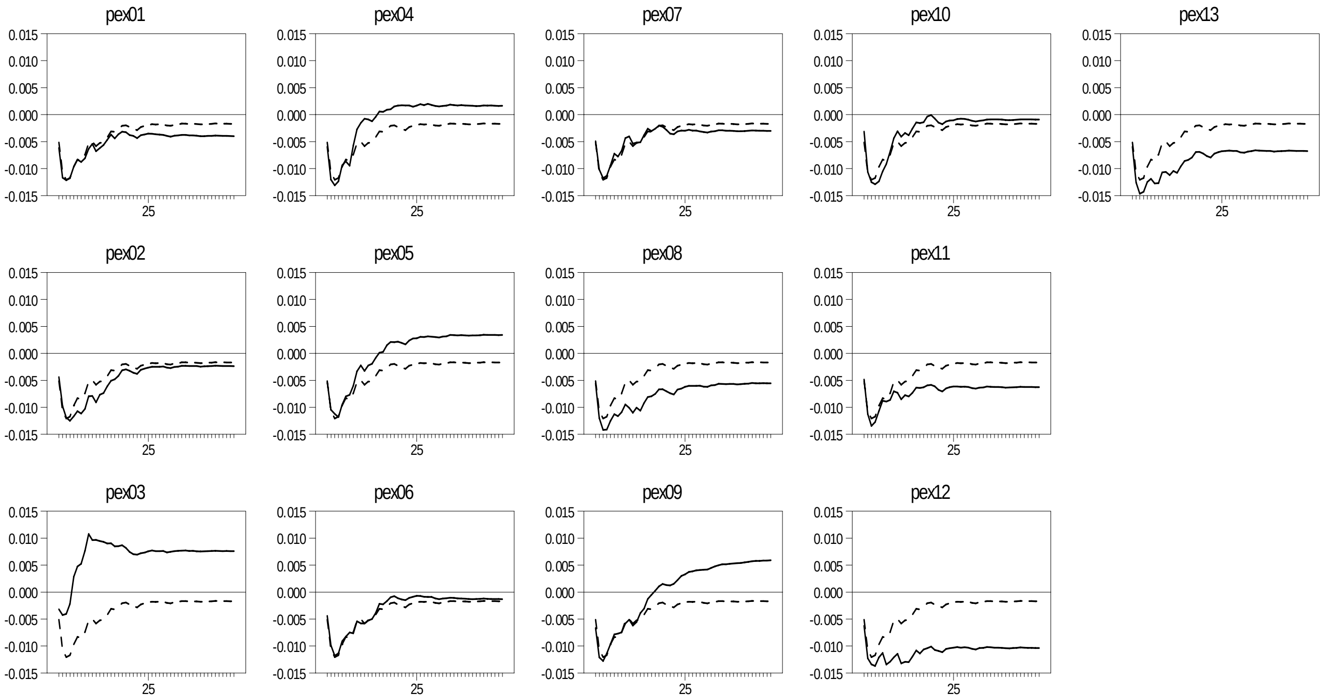
3.2.2. Responses of Korean export prices to macro shocks

The focus now is on the responses of disaggregated Korean export prices to macro shocks. In figures 2-4, solid curves show actual responses to different shocks and dotted curves show the mean response of 13 different Korean export prices.

Figure 2 reports the dynamic response functions for each of 13 nominal Korean export prices to supply shocks. In response to positive supply shocks, the Korean export prices (on average) show negative responses both in the short run and in the long run. They fall by 0.51% and stabilize at –0.17%. Although the majority of disaggregated export prices show negative responses to supply shocks both in the short run and in the long run, some prices show positive responses at least in the long run. For example, *paper products (pex03)*, *petroleum, chemical & rubber products (pex04)*, *nonmetallic mineral products (pex05)*, and *electrical machinery (pex09)* show positive price responses to supply shocks.

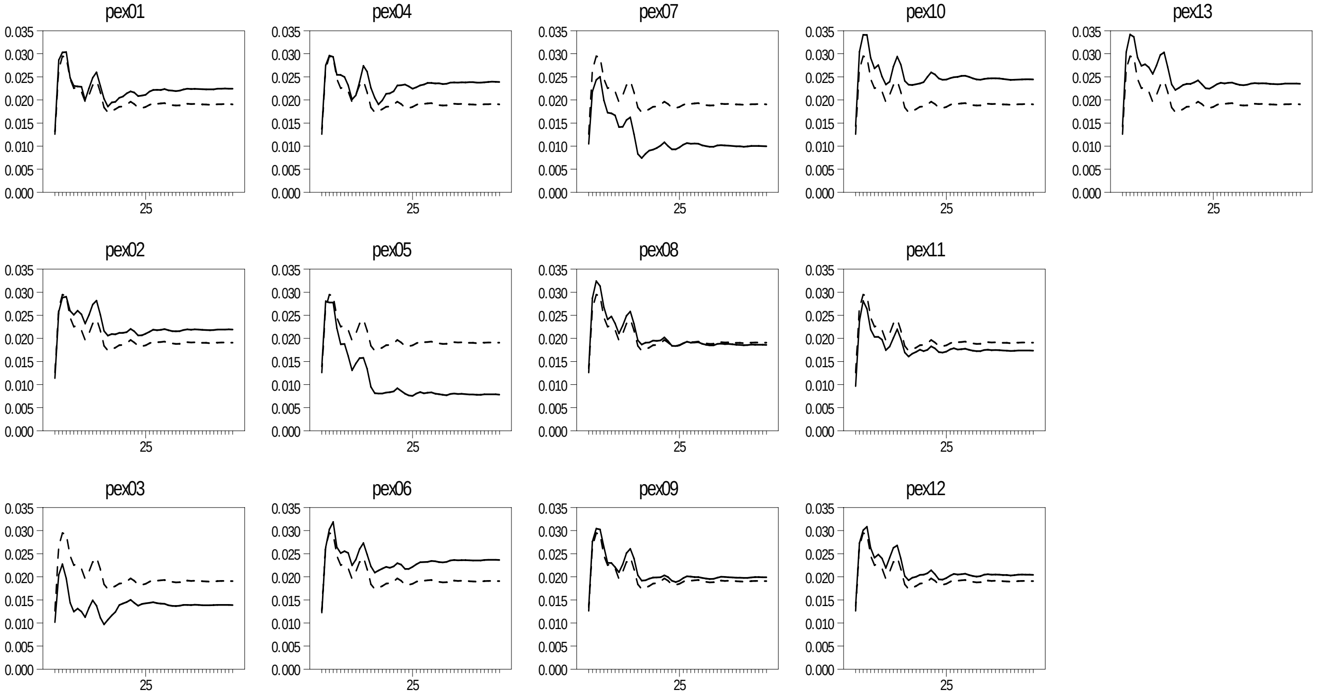
In response to demand shocks, all of the Korean export prices show positive responses both in the short run and in the long run. On average they rise by 1.26% and by 1.91% in the long run, as shown in figure 3.

Figure 2 Reponses of Disaggregated Korean Export Prices to Output (supply) Shocks



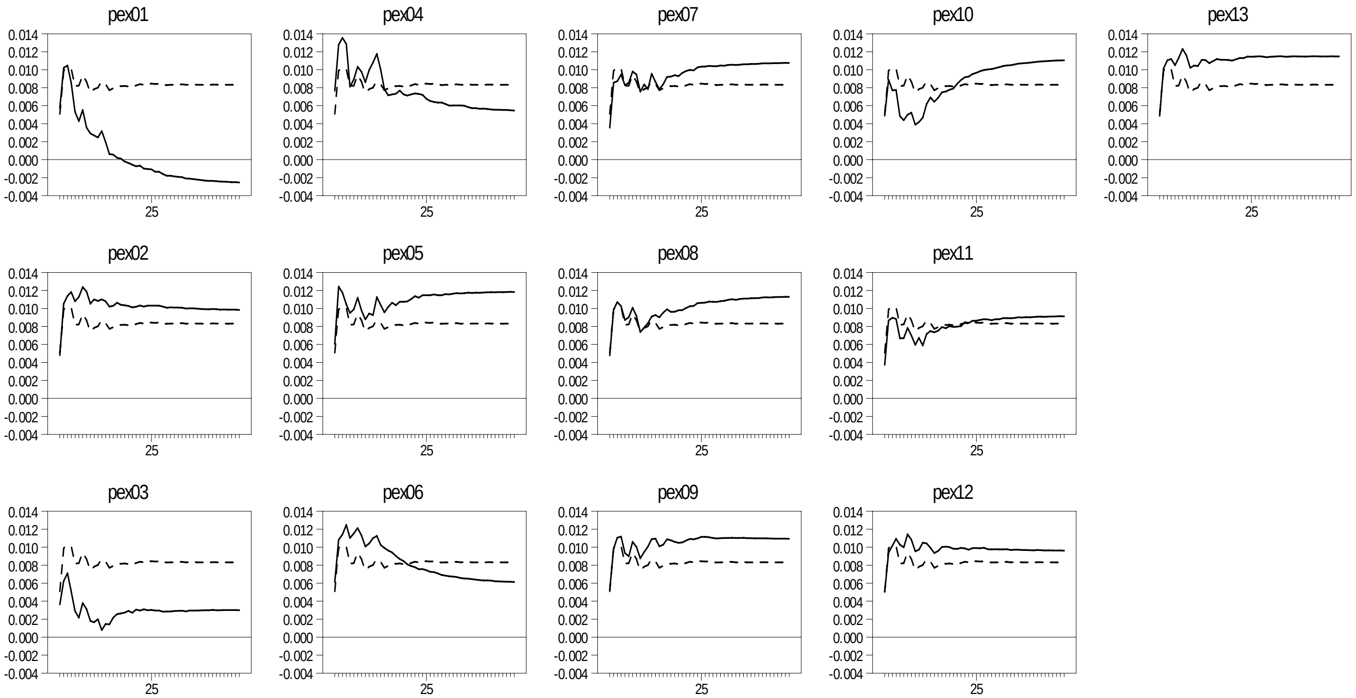
Solid curves - disaggregated Korean export responses; dotted curves - mean responses

Figure 3 Reponses of Disaggregated Korean Export Prices to Real Exchange Rate (demand) Shocks



Solid curves - disaggregated Korean export responses; dotted curves - mean responses

Figure 4 Reponses of Disaggregated Korean Export Prices to Nominal Prices (money) Shocks



Solid curves - disaggregated Korean export responses; dotted curves - mean responses

Figure 4 presents the dynamic impulse responses of the Korean export prices to monetary shocks.[7] In response to monetary shocks, 12 of 13 Korean export prices rise both in the short run and in the long run. On average, Korean export prices rise by 0.51% and by 0.83% in the long run. Only *processed food (pex01)* shows negative price responses in the long run.

The results show that the demand shocks and the monetary shocks have positive effects on disaggregated Korean export prices. The supply shocks have mixed effects on those prices.

3.3. Exchange Rate Pass-through from a Structural VAR

Previously, the paper has shown how disaggregated Korean export prices respond to macro shocks. It now presents the estimation results of the exchange rate pass-through on disaggregated Korean export prices as discussed in section 2.1.

Table 1 ERPT on Korean Export Prices from a Structural VAR

	ERPT
Processed Foods (*pex10*)	0.7120
Textile, Apparel & Leather Products (*pex02*)	0.6023
Paper & Paper Products (*pex03*)	0.5263
Petroleum & Chemical & Rubber Products (*pex04*)	0.7429
Nonmetallic Mineral Products (*pex05*)	0.7367
Basic Metal Products (*pex06*)	0.6471
Fabricated Metal Products (*pex07*)	0.5639
General Machinery & Equipments (*pex08*)	0.7181
Electrical Machinery & Apparatus (*pex09*)	0.7322
Sound, Image & Communication Equipment (*pex10*)	0.7209
Precision Instruments (*pex11*)	0.5265
Transportation Equipment (*pex12*)	0.7342
Other Manufacturing Industry Products (*pex13*)	0.7553

[7] Note that, although money neutrality assumption is imposed on the real, macro variables, it is not imposed on the nominal, industry-level export prices.

Table 1 reports the estimation results of the exchange rate pass-through on disaggregated Korean export prices. As discussed in section 2.1, if the estimate is close to 1, the local currency pricing (LCP) occurs. If the estimate is close to 0, the producer currency pricing (PCP) occurs. Table 1 reveals that the Korean exporters use pricing strategies toward the LCP.

The structural ERPT is the lowest in the *paper products (pex03)* and the highest in the *other manufacturing products (pex13)*.

As robustness checks, the WTI oil price is first dropped from the model. The results show little differences in the magnitude, in the sign of responses, and in the structural ERPT. To control for the Asian financial currency crisis period, the dummy variables is included. The result shows that the responses of the variables and the exchange rate pass-through show little differences. Finally, replacing consumer price index with producer price index makes little difference, at least in terms of signs of responses of the variables to different shocks.

4. CONCLUSION

This paper shows how the exchange rate pass-through from the reduced-form regression can be biased. It also shows how the macro shocks affect disaggregated Korean export prices as well as the overall economy. After controlling for the endogeneity of the exchange rate the exchange rate pass-through is measured on disaggregated Korean export prices using a structural VAR.

The results show that the demand shocks and the monetary shocks generally have positive effects on disaggregated Korean export prices. The supply shocks, however, have mixed effects on those prices. The exchange rate pass-through on Korean export prices reveals that Korean exporters generally use strategies toward the local-currency pricing.

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