Exchange Rate Pass-Through: A Comparative Analysis of VAR and Input-Output Model Approaches

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1 Introduction

Exchange rate pass-through (ERPT) is the general term for the process by which changes in a currency's foreign exchange value are translated into changes in domestic inflation. Even though the relationship between exchange rate movements and local prices began to be examined in the 1960s, this issue is still an essential research question today since ERPT is one of the key determinants of monetary policy. The exchange rate is one of the most significant transmission channels from monetary to inflation. For this reason, comprehension of the impacts of exchange rate shocks is crucial in terms of adopting an optimal monetary policy.

Early studies tried to test whether the law of one price assumption holds and showed that ERPT is not complete as assumed by open-economy monetary models. The following works tried to understand the mechanism behind incomplete ERPT. The main findings of the literature indicate that there exist clear differences in terms of the magnitude and the speed of the ERPT across countries and sectors. While many issues such as structural vulnerabilities, stability in the economy, trust in monetary policy authorities, etc. explain the differences between countries, differences in market structure and strategic interdependence of firms' decisions are some of the reasons for the differences across industries. In addition, a downward trend throughout time is also observed for almost all economies. Changes such as the decrease in global inflation, the increase in inflation-targeting regimes, and the increasing popularity of multi-country production are some of the reasons for the decreasing ERPT.

Various methodologies and models have been deployed to show the size and the magnitude of the ERPT. Traditional Vector Auto Regression (VAR) approaches, for instance, have been a cornerstone in understanding the multifarious impacts of exchange rate movements. This framework allows for fundamental dynamic interrelationships between prices and other variables of interest at various stages of distribution. Additionally, it allows to track the dynamic reaction of prices to external shocks.

However, while the VAR approach offers useful insights, it also comes with its own set of limitations. One such limitation is that the VAR approach often assumes that the relationships between variables are linear and that these relationships remain constant over time. This assumption, however, might not hold in real-world scenarios, particularly in emerging economies and developing countries where economic structures can change rapidly. Additionally, VAR models typically consider aggregate data, which can mask considerable sectoral heterogeneities. Given these shortcomings of traditional VAR approaches, there is a growing impetus to employ alternative methodologies that offer a more nuanced understanding of the relationship between exchange rates and different sectors.

In light of these factors, it becomes evident that the limitations of VAR models in capturing the intricacies of ERPT have prompted the exploration of alternative methodologies. This paper adopts an Input-Output (IO) model to offer a more nuanced understanding of the relationship between exchange rates and various sectors. The IO model provides a detailed depiction of the interdependencies among different industries within an economy, capturing the flow of goods and services among sectors. This sector-specific approach offers deeper insights into the sensitivities of different sectors to exchange rate movements, addressing a key limitation of the VAR approach. By adopting an IO model, researchers can disentangle the intricate web of interactions among sectors and gain a more granular understanding of how exchange rate fluctuations affect specific sectors.

The goal of this paper, therefore, is to move beyond the aggregate analysis provided by traditional VAR models and also focus on a sector-specific approach utilizing the IO model. By doing so, we aim to enhance our understanding of the complex relationship between exchange rates and sectors and provide more accurate and detailed insights for policymakers and economists. Recognizing the pivotal role that exchange rates play in shaping the economic trajectory of countries, we believe that understanding the sector-specific sensitivities to exchange rate fluctuations can help policymakers formulate strategies to mitigate exchange rate risks and maintain economic stability. To our knowledge, this is the first paper which analyzes ERPT by two different methodologies for the same observation set.

The rest of the paper is organized as follows: Section 2 reviews the existing literature on ERPT to provide a theoretical and empirical foundation for our research. Section 3 describes the VAR analysis as the first analysis. Section 4 explains IO tables and the IO model. Section 5 discusses the results obtained from both models and compares the estimates derived from the two methodologies. Finally, Section 6 concludes the paper and offers insights for future research directions.

2 Literature

The interest in ERPT started in the 1960s when open economy monetary models used the absolute Purchasing Power Parity assumption to explain the effect of exchange rate behaviors. The main question of the early studies was whether the Purchasing Power Parity holds in the data. The results of these studies indicated that a complete pass-through hypothesis had very little evidence across countries (Ihrig, Marazzi, and Rothenberg (2006)).

Many studies analyse the reasons behind the incompleteness of ERPT. Krugman (1986) and Dornbusch (1987) try to explain this phenomenon by suggesting market pricing behavior in the case of an exchange rate shock. These papers indicate that the firms may choose to adjust their profit margins instead of reflecting the shock on prices to maintain market share. Hahn (2003) presents some reasons to change desired markups such as the variations in demand elasticity, the threat of new firms' entrance and the intertemporal profit maximization considerations. This approach can also be supported by Gust, Leduc, and Vigfusson (2010) since this study shows that lower trade costs, which are a result of international globalization, cause a decline in exchange-rate pass-through by increasing firms' profits and providing an opportunity for companies to adjust their profits.

The local currency pricing argument is another tool that was presented by Devereux and Engel (2001) and Bacchetta and van Wincoop (2003) as an explanation. These articles argue that if trade between two countries is denominated in domestic (importing) currency, changes in the exchange rate will not be reflected in import prices and other related prices.

Hegji (2003) puts forward a different argument and mentions the role of cross-border production to explain incomplete pass-through. This approach indicates that if several currencies take place throughout the production phase, the appreciation of some currencies against the domestic currency would not lead to a complete pass-through.

The impact of exchange rate devaluations on inflation was explained through consumer behaviors by Burstein, Eichenbaum, and Rebelo (2003). They show that flight from imports to lower-quality local goods is a key factor in terms of understanding the mechanism of price changes. The share of imported goods in the consumer basket determines the pass-through of exchange rates to consumer prices.

The studies in the literature also try to understand the differences between the size and degree of ERPT for different sets of countries. However, there exist many conflicting results to make a general assessment. For instance, Kreinin (1977) indicates that the pass-through coefficient is negatively associated with the size of the country whereas the findings of Khosla and Teranishi (1989) point out an opposite result. Similarly, an interest in a comparison between advanced and emerging economies arose. While some studies such as Devereux and Engel (2001) find that ERPT in emerging economies is higher than in developed economies, this is not the case always according to Devereux and Engel (2001). Other contradicting results are about the relationship between the level of inflation and the size of ERPT. Taylor (2000) focuses on the importance of inflation and finds that a low inflation level leads to lower ERPT. It is also stated that this is valid not only between countries but also over time. Nevertheless, Campa and Goldberg (2002) analyzes 25 OECD economies and finds that ERPT is largely uncorrelated with inflation.

The stability of the pass-through relationship has also been studied for a long time. Even though some early studies such as Lattimore (1988) and chandra Athukorala and Menon (1992) find that the ERPT is stable throughout the period, many papers present evidence about the decline in pass-through for almost all economies. Taylor (2000) explains this tendency as a product of a low-inflation environment. Gagnon and Ihrig (2001) observes the decrease in ERPT in 18 out of 20 countries from 1971 to 2003. It is also shown that the decline in the level or standard deviation of inflation brings about a larger fall in ERPT. This paper also underlines the anti-inflationary actions and credibility of monetary authorities regarding low pass-through success in the large real exchange rate depreciations in Sweden and the United Kingdom in 1992. Frankel, Parsley, and Wei (2005) uses data for 76 countries for the period from 1990 to 2001 and shows that developing countries have experienced a rapid downward trend. Ihrig et al. (2006) conducted a similar analysis for G-7 countries from late 70s to early 00s. The results signify a downturn in the pass-through coefficient in all countries except one during the specified period. The importance of this downward trend all over the world for monetary policy was discussed in Taylor (2000). This fall affects the forecasts of inflation and the impacts of changes in monetary policy on inflation. Moreover, the role of the inflation-targeting policy framework was also highlighted.

The most widely employed approach for assessing ERPT is the VAR model pioneered by McCarthy (2000). This model encompasses various key variables, including the nominal exchange rate, industrial production, import prices, oil prices, producer prices, and consumer prices. This framework was developed by Hahn (2003) by adding the interest rate to the interacting variables. These models allow for the straightforward monitoring of the transmission of exchange rate fluctuations to every level of the distribution chain within a unified framework. This methodology also brought some criticism since the VAR specification consists of linear equations with constant parameters, and its appropriateness may be compromised in the presence of nonlinearity or structural breaks in the series. For example, Gagnon and Ihrig (2001) argued that VAR models might be unsuitable for economies that have experienced significant macroeconomic instability, which could potentially disrupt the stability of relationships estimated within VAR models. Moreover, Towbin and Weber (2013) highlighted that VAR models might fail to adequately capture structural breaks and non-linearities that are characteristic of certain economies, thus leading to biased or inconsistent estimates of pass-through rates.

In response to these limitations, an emerging body of literature is exploring alternative approaches to the VAR methodology. These include the use of detailed micro-level data Gopinath and Itskhoki (2008), non-linear models Bussiere (2013), and IO tables.

This paper explores the effectiveness of utilizing an Input-Output (IO) approach to analyze price formation and the impact of exchange rate fluctuations on prices. While price dynamics and exchange rate interactions have been extensively studied, the application of IO analysis in this context remains a relatively unexplored area. We aim to address this gap by employing IO models to provide a novel perspective on ERPT.

The seminal work of Leontief (1937) and Leontief (1946) established the foundation for IO analysis. While its application to ERPT research has been limited Campa and Goldberg (2005); Hara, Hiraki, and Ichise (2015), Aydoğuş and Tintin (2018) offer a notable exception. Their study examined ERPT on consumer prices using IO tables, but their assumption of constant import prices neglects the documented high responsiveness of these prices to exchange rate changes Campa and Goldberg (2005); *Explaining the exchange rate pass-through in different prices* (2005); Ito and Sato (2008).

Our research addresses this limitation by incorporating dynamic import prices into the IO model. We leverage the UN COMTRADE database to compute sectoral import prices based on trade values and quantities. This innovation allows us to analyze the transmission of exchange rate changes from import prices to consumer prices through the latest available IO tables from the OECD (2018). This approach captures both direct and indirect impacts of exchange rate shifts on sectoral equilibrium prices, considering production interdependencies and the utilization of imported inputs.

Despite its potential, the application of IO models in ERPT research remains limited. This paper strives to bridge this gap by introducing sectoral import prices into the IO model, enabling a more comprehensive analysis of ERPT, employing the latest available IO tables (OECD, 2018) to offer a contemporary perspective, comparing and contrasting the IO model with the traditional VAR methodology, enriching the understanding of ERPT dynamics.

3 VAR Model

3.1 The Data

To be compatible with IO table analysis, the VAR analysis covers the period from the first quarter of 2011 to the last quarter of 2018, except that the analysis starts from 2013:Q1 for Turkey and ends in 2018:Q1 for Indonesia and in 2018:Q2 for Argentina due to lack of availability. It includes 26 countries, 17 of which are members of the OECD. While 14 of these countries are developing economies, the remaining are developed economies. We prefer to work on quarterly data series since monthly data are not available for some countries and yearly data have limitations to capture the fluctuations within a year.

The crude oil price, which is a quarterly average of monthly prices in nominal US dollars of Brent, Dubai, and WTI, is obtained from World Bank Commodity Price Data. As the interest rate variable, we use the central bank policy rate from the BIS Data Portal. The reel GDP data, which is not seasonally adjusted, come from the IMF IFS database. Since the unadjusted version of reel GDP data of Canada does not exist, we use seasonally unadjusted industrial production data from IMF IFS. We use nominal effective exchange rates from the BIS Data Portal to capture the fluctuations in exchange rates. As the import price index, which is gathered by weighting commodities by the ratio of imports to total commodity imports, we used the commodity import price index from IMF Access to Macroeconomic & Financial Data. Federal Reserve Economic Data was preferred for Mexico to access import price data. Because of the lack of this index, we use the unit value of import as a proxy for some economies such as Costa Rica, Iceland, India, Russia, Thailand and Turkey. These values were obtained from the data sources of national statistical institutions or central banks. Producer and consumer price indices were collected from IMF IFS.

3.2 VAR Analysis

We applied the models of McCarthy (2000) and Hahn (2003), the most popular VAR models in the literature, to observe and compare the ERPT effect across countries. The VAR model consists of seven variables. The first one is the oil price index (Oil_t) to capture supply shocks in the economy. The order is followed by the short-term interest rate (i_t) to observe the effects of changes in monetary policy on the degree of ERPT. The next variable is the reel GDP ($RGDP_t$) which identifies the demand shocks. The fluctuations in the nominal effective exchange rate ($NEER_t$) reflect the external shocks. The last three variables in our specification are the import price index (IPI_t), producer price index (PPI_t), and consumer price index (CPI_t) which were listed according to the pricing chain.

We use Cholesky decomposition, which imposes n(n-1)/2 zero restrictions to the variance-covariance matrix of the reduced form residuals. By using this methodology and order, we ensure that while the variables listed in the first stages can contemporaneously affect the variables later in the list, they begin to affect the variables before them with one period lag. This is the reason why we include the oil price shocks as the most exogenous variable in the first order. Thus, the changes in the oil price index have the potential to affect all variables contemporaneously whereas the same argument does not hold for the opposite direction of the relation. According to the order of our model, the short-term interest rate should be placed in the second order since the monetary policy authorities would observe the supply shock and use interest rates as instruments to reduce its impact on production and price levels. Then, we observe the contemporaneous impact of demand shock, which was contemporaneously affected by supply and policy shocks, on the value of the domestic currency against a weighted average of several foreign currencies and on the price levels. By placing the nominal effective exchange rate next, we allow exchange rate dynamics to influence all prices in the economy contemporaneously. Lastly, we order the price variables according to the pricing chain. Equation (1) gives the relationship between the reduced form residuals, e_t, and the structural shocks, ϵ_t as a result of the Cholesky decomposition.

$$\begin{bmatrix} e_t^{oil} \\ e_t^{i} \\ e_t^{RGDP} \\ e_t^{NEER} \\ e_t^{IPI} \\ e_t^{PPI} \\ e_t^{CPI} \end{bmatrix} = \begin{bmatrix} S_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ S_{21} & S_{22} & 0 & 0 & 0 & 0 & 0 \\ S_{31} & S_{32} & S_{33} & 0 & 0 & 0 & 0 \\ S_{41} & S_{42} & S_{43} & S_{44} & 0 & 0 & 0 \\ S_{51} & S_{52} & S_{53} & S_{54} & S_{55} & 0 & 0 \\ S_{61} & S_{62} & S_{63} & S_{64} & S_{65} & S_{66} & 0 \\ S_{71} & S_{72} & S_{73} & S_{74} & S_{75} & S_{76} & S_{77} \end{bmatrix} \begin{bmatrix} \epsilon_t^{oil} \\ \epsilon_t^{i} \\ \epsilon_t^{RGDP} \\ \epsilon_t^{NEER} \\ \epsilon_t^{IPI} \\ \epsilon_t^{PPI} \\ \epsilon_t^{CPI} \end{bmatrix} \tag{1}$$

This structural setup makes the order of the variables in the VAR model crucial. Although we do not have a clear theoretical rule as to how this ranking should be, we know that various rankings are appropriate. Hahn (2003) and Ca' Zorzi, Hahn, and Sánchez

(2007) tested whether different rankings significantly changed the outcome and observed that there were no critical differences for the set of observations they examined. As a robustness check, we used an alternative order as suggested by McCarthy (2000): the interest rate policy changes might be listed last since the monetary policy authorities may choose to intervene after observing the changes in inflation as a result of the inflation-targeting framework. The findings of this alternative approach indicate that the results were not affected much except for some economies. The results of the new method applied are given in Appendix.

All variables were used in natural logarithmic form except for interest rate. As a result of limited observation for each country, the results of different unit root tests are not compatible with each other. Thus, to increase the robustness of the stationary decision, we used four different tests and considered a variable to be stationary if it was found to be stationary in at least 3 out of 4 tests. These tests are ADF, PP, DF-GLS, and KPSS. We used dummies to capture seasonalities. The AIC was used to decide the optimal lag in the model specifications. In addition, the LM test results indicate that no residual auto-correlation problem exists for any country. Lastly, we checked model stability for each VAR analysis and found that all the eigenvalues lie inside the unit circle.

The size of the impact of a standard deviation shock on a variable on other variables is measured by the impulse response function (IRF). Even though the effect of exchange rate changes on consumer price indexes lasts for a longer period in some economies, we use 4-quarters changes for all to have a better comparison with IO table results. By using the outcomes of the IRFs, we can calculate the cumulative elasticity of the consumer price index with respect to the shocks in the exchange rate as follows:

$$ERPT_s = \frac{\Delta\%CPI_{t,t+s}}{\Delta\%NEER_{t,t+s}} \qquad (2)$$

where the nominator of the right-hand side of the equation gives the cumulative change in CPI s periods after the shock and the denominator is the cumulative change in NEER for the same period after the shock. The results of the VAR analysis are given in section 5.

4 The IO Table Analysis

The model described is a cost-push Input-Output (IO) price model, utilized to determine the pass-through effect within an economy. In this economy, there are 'n' producing sectors and two fundamental inputs: labor (L) and capital (K), which encompasses all other factors of production. Labor is compensated through wages and salaries (W), while capital earns the operational surplus (V).

In the context of a multi-sector economy, the equilibrium price system can be described by the equation:

$$p_j = \sum_{i=1}^{n} a_{ij} \cdot p_i + e \cdot \sum_{i=1}^{n} m_{ij} \cdot p_i^* + v_j \quad \text{for} \quad j = 1, \ldots, n$$

where each p_j represents the price of output j. The coefficient a_{ij} captures the direct domestic input, determined by the ratio of the price and quantity of output i to that of output j. The nominal exchange rate e reflects the conversion rate between domestic and foreign currency. Import prices, denoted as p_i^*, are transformed into domestic currency using $p_i^f = e \cdot p_i^*$. Additionally, m_{ij} represents the direct imported input coefficient, calculated based on the price and quantity of imported intermediate use M_{ij} relative to output j. Unit labor costs (w_j) and unit operational surpluses (v_j) are determined by the total labor costs (W_j) and total operational surplus (V_j) for sector j, respectively, relative to the output quantity.

This equation can also be written in matrix format as below:

$$\mathbf{p} = \mathbf{A}^T\mathbf{p} + \mathbf{M}^T\mathbf{p}^f + \mathbf{w} + \mathbf{v}.$$

Here, $\mathbf{p}$ denotes the array of commodity prices, $\mathbf{p}^f$ signifies the array of import prices in domestic currency, where $\mathbf{p}^f$ is determined as $e\mathbf{p}^*$, with $\mathbf{p}^*$ representing the array of import prices in foreign currency. The scalar $\mathbf{e}$ represents the nominal exchange rate. Moreover, $\mathbf{v}$ stands for the array of unit operational surpluses (unit capital costs), while $\mathbf{w}$ represents the array of unit labor costs. Additionally, $\mathbf{A}^T$ denotes the transpose of the matrix of direct domestic input coefficients, represented as $\mathbf{A}$, and $\mathbf{M}^T$ signifies the transpose of the matrix of direct imported input coefficients, denoted as $\mathbf{M}$.

We reduce the model to the below form for calculation purposes:

$$\mathbf{p} = (\mathbf{I} - \mathbf{A}^T)^{-1}(\mathbf{M}^T\mathbf{p}^f + \mathbf{w} + \mathbf{v})$$

Then we take total differentials:

$$\Delta\mathbf{p} = (\mathbf{I} - \mathbf{A}^T)(\mathbf{M}^T\Delta\mathbf{p}^f + \Delta\mathbf{w} + \Delta\mathbf{v})$$

Here, we re-write the equation under the assumption of constant domestic and direct imported input coefficients and basic input costs. However, note that we don't assume import prices are constant, so the impact of a small exchange rate change on prices is shown as

$$\Delta\mathbf{p} = (\mathbf{I} - \mathbf{A}^T)^{-1}(\mathbf{M}^T\mathbf{p}^* d\mathbf{e})$$

Therefore, the effect of the exchange rate on sectoral equilibrium prices is expressed as:

$$\frac{\partial \mathbf{p}}{\partial \mathbf{e}} = (\mathbf{I} - \mathbf{A}^T)^{-1}(\mathbf{M}^T \mathbf{p}^*)$$

After computing changes in sectoral equilibrium prices, the change in the general price level, π, is computed as a weighted average of sectoral price changes:

$$\pi = \sum_{i=1}^{n} \alpha_i \left(\frac{\partial p_i}{\partial e} \right)$$

where α_i indicates the share of commodity i in aggregate consumption expenditures.

5 Results

In this section, we give the results of both analyses and compare them according to some criteria. Table 1 shows the findings of the models with respect to the country's development level. The developed economies were listed on the left side while the right side is reserved for developing countries. The results of the models show striking differences for countries in different classes. The estimations of ERPT by the VAR analysis for developed countries are lower than the IO table results. Moreover, the differences between the findings are remarkably enormous except for the USA. Another interesting result is the negative ERPT for some countries (Finland, France, Korea). These findings indicate that a depreciation of the domestic currency leads to a decrease in CPI. The other side of the table has a different story. The results imply that in 10 of the 14 countries observed (Hungary, Mexico, Turkey and South Africa are the exceptions), VAR results are higher than IO results. While the gap between the outcomes is negligible for some, such as Indonesia and Thailand, it is large enough for several economies, such as Costa Rica and Bulgaria.

It is also possible to make a comparison between OECD member and non-OECD member countries. While 17 of the 26 countries in the observation set are members of the organization, the remaining 9 are not. Except for Poland and Costa Rica, IO results appear to be higher than VAR results in all OECD countries. On the other hand, VAR results appear to be greater than IO results in non-member countries with the exception of South Africa.

The results of the two models can be considered together with other variables thought

Country	**VAR**	**IO**	**Country**	**VAR**	**IO**
Austria	0.032	0.156	Costa Rica	0.438	0.123
Canada	0.029	0.123	Hungary	0.146	0.227
Finland	-0.040	0.147	Mexico	0.031	0.123
France	-0.031	0.120	Poland	0.235	0.178
Germany	0.018	0.122	Turkey	0.086	0.133
Iceland	0.050	0.149	Argentina	0.244	0.072
Ireland	0.052	0.237	Bulgaria	0.585	0.214
Italy	0.070	0.116	India	0.174	0.109
Korea	-0.076	0.164	Indonesia	0.110	0.103
Sweden	0.050	0.129	Romania	0.253	0.154
UK	0.000	0.117	Russia	0.137	0.092
USA	0.058	0.062	Saudi	0.152	0.118
			South Africa	0.046	0.129
			Thailand	0.224	0.217

Table 1: ERPT coefficients by two approaches

to be determinants of ERPT. Firstly, the degree of a country's openness to the outside world should impact the pass-through coefficient. As suggested by McCarthy (2000) and Goldfajn and Werlang (2000), in a more open economy, characterized by a substantial volume of imports and exports, a depreciation would exert a more pronounced influence on prices. Figure 1 displays the visual comparison of the relationship between countries' openness levels and ERPT estimations by VAR and IO analyses. As we can see, IO results show the effect of openness more clearly than VAR results.

The share of intermediate imports is also an important determinant of ERPT. María-Dolores (2008) underlines the importance of intermediate import dependency empirically. Thus, a substantial reliance on imported intermediates makes us suspect higher ERPT. In Figure 2, where x-axis is the ratio of imported intermediate goods to total imports, the positive relationship between the rate of imported intermediate goods and the level of ERPT can be observed better for the results of IO analysis.

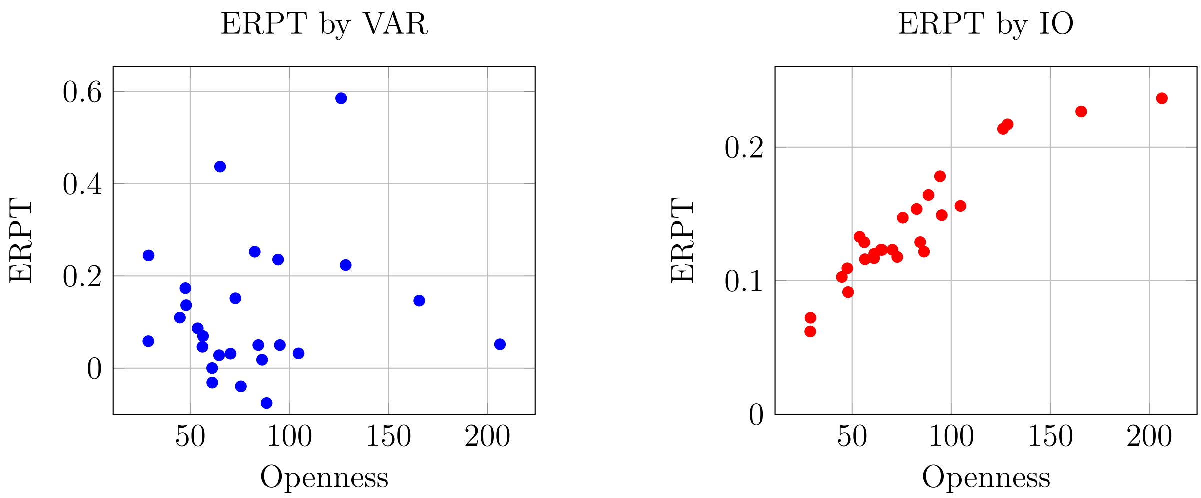

Figure 1: Openness

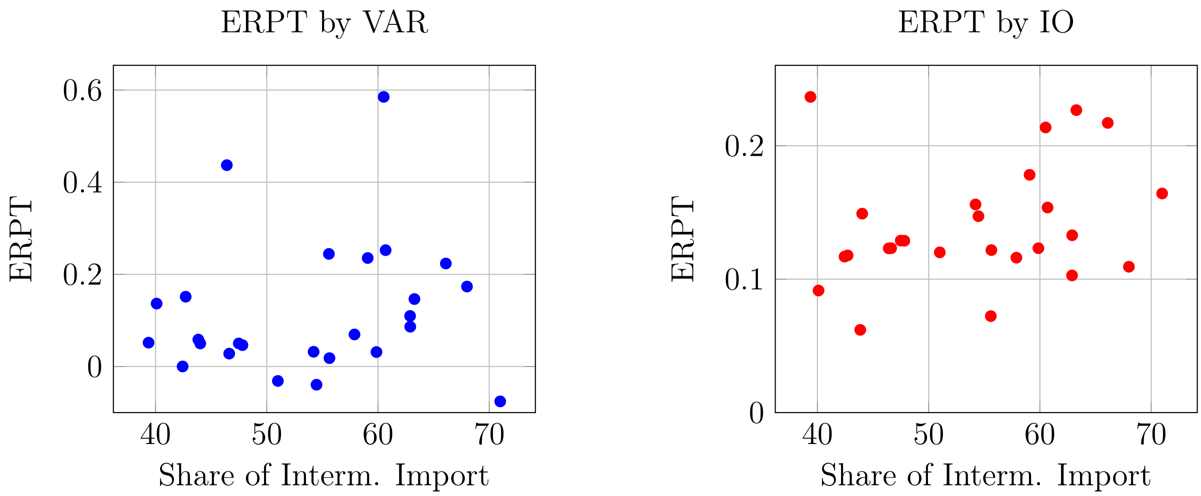

Figure 2: Relation between share of Interm. import and ERPT

The import content of exports is the last comparison subject we will examine in this section. Similar to the share of imported intermediate goods in total imports, the ratio of imported products in the export structure of an economy is among the factors that determine the level of ERPT. If an economy's exports, and therefore its foreign trade balance, include imported products to a high degree, fluctuations in the exchange rate will effectively affect domestic prices. Therefore, Figure 3 shows the ERPT estimates of both models with the import content percentages of exports. The figure on the right indicates that the positive impact of import content of export on ERPT can be supported by the findings of IO results. This hypothesis contradicts the results of VAR analysis.

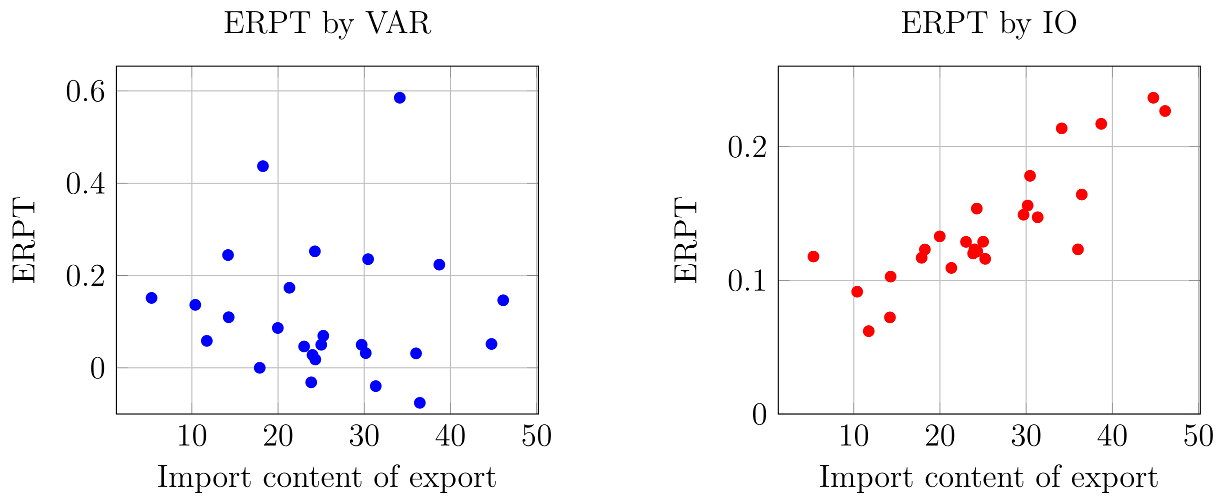

Figure 3: Import content of export and ERPT

In summary, there are notable differences between the ERPTs of the countries in our observation set estimated through two different models. These differences are similar depending on the characteristics of the countries (whether they are members of the OECD or not, developed/developing economy). The IO model used in this article suggests that the ERPT coefficient in developed economies is higher than the results of the VAR model, which is the most widely used in the literature, while it shows that there are overestimated results by VAR for developing economies. On the other hand, when we examine the ERPT results of OECD member and non-OECD countries, we see that the IO model results for member countries mostly suggest a higher ERPT effect than the VAR results.

Considering the role of some variables shown in the literature as determinants of the ERPT effect and evaluating them with the results of the models may allow us to better compare the model results. As explained above, the findings show us that while the relationship between ERPT and some variables is revealed more strikingly by the IO table results, VAR results are not compatible with these theories.

6 Conclusion

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Appendix A

Country	VAR	Alternative VAR	Country	VAR	Alternative VAR
Austria	0.032	0.060	Costa Rica	0.438	0.408
Canada	0.029	0.038	Hungary	0.146	0.201
Finland	-0.040	-0.028	Mexico	0.031	0.036
France	-0.031	-0.049	Poland	0.235	0.237
Germany	0.018	0.013	Turkey	0.086	0.081
Iceland	0.050	0.046	Argentina	0.244	0.188
Ireland	0.052	-0.015	Bulgaria	0.585	0.634
Italy	0.070	0.038	India	0.174	0.188
Korea	-0.076	-0.034	Indonesia	0.110	0.126
Sweden	0.050	0.009	Romania	0.253	0.253
UK	0.000	0.006	Russia	0.137	0.218
USA	0.058	0.076	Saudi	0.152	0.161
			South Africa	0.046	0.071
			Thailand	0.224	0.230

Table 2: Results of VAR models with different orders