Can Distribution Services Cost Explains Home Bias In Trade?

by

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Abstract

In this report I consider home bias in international trade. Particularly its causes and results. I refer to the earlier work in the trade literature on the relationship between terms of trade, which is the price of traded versus non-traded goods, and home bias in trade. In this report, I follow the methodology followed by Chaban (2011) and choose distribution services as a main factor that is included in terms of trade, and the national border effect that might resolve the home bias issue. The empirical results in the report illustrate that relatively high distribution costs can explain a large observed home trade bias even with low elasticity of substitution between domestically produced goods and foreign goods.

Dedication

This thesis is dedicated to my father, who taught me the best kind of knowledge to have is which learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

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Chapter 1 Introduction.

Obstfled and Rogoff (2001) introduced six major puzzles in International Macroeconomics. One of them is home bias in trade. According to Lee (2010, pg. 5), the home bias issue is “When international goods markets are much more sectionalized than would normally be expected, the proportion of foreign goods demanded by domestic consumers could not be supported by standard trade theory”. McCollum in his 1995 paper asks “what are the factors that cause that phenomenon and what are the results of home bias in trade?” He finds that the trade between Canadian provinces are 22 times more than the trade between Canadian provinces and the states of U.S. of the same size and distance. Home bias issue is not an isolated problem, it happens all around the world. Wei (1996) and McCollum (1995), proved that among the OECD countries, the intranational trade is two to three times the international trade. Volker Nitsch (2000) found that averaged over all EU countries, intranational trade is about ten times as high as international trade with an EU partner country of similar size and distance. Do they have the common causes? The most convictive theory is national effect. Wolf (2000) tried to interpret the national effect in two ways, one is formal trade barriers and the other is informal trade barriers. The results turned out to be: the home bias did exist due to national effect, however, the intranational trade is only three times bigger than international trade. This indicates that the trade barriers only explain a small portion of the influence of national term of trade effect. Trionfetti (2001), Lee (2014) and Bond (2011) all focus on the relationship between terms of trade, which is the price of traded versus non-traded goods, and home bias in trade. In this report, I choose an alternative factor that included in term of trade and national effect that might resolve home bias issue.

Chaban (2011) comes up with a unique idea that distribution services[1] might be an important reason that cause home bias in trade. He studied the influence of distribution services applied on intranational trade and international trade, proved that distribution services affect intranational trade the most. I will follow the idea that distribution services matter do explaining international trade, but I will not apply this assumption to intranational trade, meanwhile I will combine the terms of trade for further exploration of the subject. The distribution services costs are defined as the costs of moving goods from the location of production to the location of consumption. I consider a simple two country model, which will allow the short-term deviation in the terms of trade. This model has three basic assumptions: first, the substitution between domestic goods and foreign goods is not perfect, which could refer to Armington assumption; second, there is a home bias preference that allow domestic consumers purchase more domestically produced products; finally, the distribution services applied to foreign traded goods when they are imported from source country. Since distribution services cannot be isolated from trade, once they have been applied to the traded goods, they become non-traded. At the production level, Kei-Mu Yi (2010) proves that changes in the trade costs might cause changes in the country or region that produce the goods, but will not change the underlying nature of production. So the nature of traded goods is consistent even when they come from various countries. This

[1] Distribution services can be defined as services that help move products from domestic country to foreign country.

means that in my two-country model, it is possible to ignore all other factors except for the distribution services. I will not treat distribution services as middle input since there are a variety of middle inputs already included during production procedure. However, I will allow the low trade elasticity of substitution between domestic traded goods and foreign traded goods at the consumption level. This assumption is due to the distribution services, as well as treat rest of the final consumption goods as non-traded goods.

Those assumptions will reflect the influence of real shocks that applied to the terms of trade and the distribution costs. The export indices (FOB prices), are used to calculate the relative prices of traded goods in home country, the import indices are used to calculate the relative prices of non-traded goods in foreign country. Free on board (FOB) prices allow the exported traded goods to be free of the international distribution services costs, therefore should allow to capture the effects of home bias by studying the relative prices of traded goods. Meanwhile, home bias issue allows changes in the relative prices of traded goods by changing the price of domestically produced goods due to the customers' tastes. The customers' taste will be interpreted by a weight different weight given to the prices of domestic and foreign goods. The distribution services are required for moving the foreign traded goods throughout the home country. Since the distribution services are non-traded, once the foreign traded goods arrive to home country, they become non-traded. Many factors will cause changes in distribution costs. In my paper, I focus on the changes in the relative price of labor services, relative labor productivity (for instance, technology changes), oil price and real exchange rate. Those changes will be passed to consumers when they purchase foreign traded goods. In that case, fluctuation in exchange rate will affect the demand for foreign goods and distribution services. The effect of change in real exchange rate on trade costs has been illustrated by many authors. Jones and Purvis (1983), Kei-Mu Yi (2010) and Crucini et al (2005) all illustrated that on exchange rate fluctuations will lead to changes in trade costs. This paper uses Canada and Australia the example for a two country model, all the data that I used come from Statistics Canada and the Statistic Bureau of Australia. There are several reasons for me to choose this pair of countries. First of all, they are all well-developed small economies with matured industry base and a relatively big portion of their production are exported. Secondly, they cannot manipulate the world market, the price of their products are determined by global market. Therefore, it is possible to identify the real shocks to the terms of trade.

Chapter 2 Model and Hypotheses

Consider a two-country economy producing two types of goods. Let two countries be home and foreign. The two goods are one arbitrary tradable good and its distribution services as the second good which cannot be traded. I assume that domestically produced goods are not perfect substitutes with foreign produced goods. I also assume that domestic consumers have a preference for domestically produced goods. If foreign country wants to purchase traded goods from home country, the home country produced distribution services must be applied, and vice versa. Only the goods at production level are tradable; once a distribution service is applied to goods at production level, they become non-tradable. The average price level is denoted by p. The model relies on the work by Neary (1988).

The trade expenditure function E is the excess of home expenditure e over home income from production function (GNP)g:

$$\mathrm{E}(\mathrm{p}, u, \Phi) = e(\mathrm{p}, u, \alpha) - g(\mathrm{p}, \beta) - \gamma \tag{1}$$

where the scalar u measures home utility. The vector $\Phi = (\alpha, \beta, \gamma)$ consists of shift parameters. The parameter α includes non-numeraire factors as taste parameters; β represents the factors that could cause improvements of GNP, for instance technology changes; γ represents tax revenue transfers from abroad to domestic country. The following derivations are from Chaban (2011) and Neary (1988).

The balance of payments that at equilibrium.

$$\mathrm{E}(\mathrm{p}_T, p_N, u, \Phi) = 0. \tag{2}$$

Excess demand for final consumption goods should equal to zero since final consumption goods are nontraded goods.

$$E_T(\mathrm{p}_T, p_N, u, \Phi) = 0, \tag{3}$$

$$E_N(\mathrm{p}_T, p_N, u, \Phi) = 0. \tag{4}$$

The partial derivatives are represented as $E_T = \partial E/\partial \mathrm{p}_T$, $E_N = \partial E/\partial p_N$. Total differentiation Eq. (2) together with Eqs. (3) and (4), leads to:

$$du = -E'_{\emptyset} d\,\Phi = d\Phi \tag{5}$$

There unit of measurement for utility are chosen such that $E_U = e_u = 1$. The scalar parameter Ψ denotes aggregate effects of different exogenous shocks. Next, total differentiation of (3) and (4) leads to:

$$E_{TT} d\, \mathrm{p}_T + E_{TN} dp_N + E_{TU} du + E_{T\Phi} d\, \Phi = 0 \quad (6)$$

$$E_{NT} d\, \mathrm{p}_T + E_{NN} dp_N + E_{NU} du + E_{N\Phi} d\, \Phi = 0 \quad (7)$$

The solution for $d\, \rho_T$ and $d\rho_N$ is:

$$\begin{pmatrix} d\, \mathrm{p}_T \\ dp_N \end{pmatrix} = -\begin{pmatrix} E_{TT}\ E_{TN} \\ E_{NT}\ E_{NN} \end{pmatrix}^{-1} \begin{pmatrix} E_{TU} & E_{T\Phi} \\ E_{NU} & E_{N\Phi} \end{pmatrix} \begin{pmatrix} du \\ d\, \Phi \end{pmatrix} \quad (8)$$

Using (5),

$$\begin{pmatrix} d\, \mathrm{p}_T \\ dp_N \end{pmatrix} = -\begin{pmatrix} E_{TT}\ E_{TN} \\ E_{NT}\ E_{NN} \end{pmatrix}^{-1} \begin{pmatrix} E_{TU} + E_{T\Phi} \\ E_{NU} + E_{N\Phi} \end{pmatrix} (d\Phi). \quad (9)$$

Chanban (2011) assumes an inverse of the matrix above exits, and use K to denote the inverse of the first matrix on the right hand side. There are two diagonal matrices λ_T and λ_N which have the prices of traded and nontraded goods on their diagonals, respectively. That is the ith diagonal element of λ_T is the price of the *i*th traded good and correspondingly represent the price of the *i*th nontraded good in λ_N. Then,

$$d\, \mathrm{p}_T = \lambda_T \mathrm{K}_{ij}(\sigma_T - \mu_T)d\Phi + \lambda_T \mathrm{K}_{ij}(\sigma_N - \mu_N)d\Phi, \quad (10)$$

and

$$dp_N = \lambda_N \mathrm{K}_{ij}(\sigma_T - \mu_T)d\Phi + \lambda_N \mathrm{K}_{ij}(\sigma_N - \mu_N)d\Phi, \quad (11)$$

where $\mathrm{K}_{ij} = \lambda_T^{-1} \kappa_{ij} \lambda_T^{-1}$ for *i* = 1 and *j* = 1,2, K_{ij} contains the matrix of totally differentiated equation (1), the (i,i) element of λ_T^{-1} is the increase of price of the *i*th traded good. Similarly $\mathrm{K}_{ij} = \lambda_N^{-1} \kappa_{ij} \lambda_N^{-1}$ for *i* = 1 and *j* = 1,2, the (i, i) indicates the price of the *i*th non-traded good. Let vector $\sigma_T = \lambda_T E_{TU}$ denote the marginal propensity to consume the traded good, while $\mu_T = -\lambda_T E_{T\Phi}$ is the marginal propensity to produce the traded good. Similarly, $\sigma_N = \lambda_N E_{N\Phi}$ and $\mu_N = -\lambda_N E_{N\Phi}$ are marginal propensities to consume and produce non-tradable goods, respectively. The change in relative prices of traded goods are relative to the change in exogenous shocks and the difference between marginal propensities of consume and produce traded goods. The parameter $d\Phi$ denote to the change in exogenous shocks, and $(\sigma_T - \mu_T)$ denote the differences. Similarly, the change in relative prices of non-traded goods are determined by the change in exogenous shock, and the difference between marginal propensities to consume and to produce non-traded goods. Chaban (2011) interprets the equation (10) and (11) as the equations that reflect exogenous shocks. [2] Once there are any exogenous shocks, the changing of relative prices of traded goods and non-traded goods will be influenced by the balance of payment.

The next step is to define the prices of traded and non-traded goods and cost of distribution services. Let X represent the relative price of traded goods at production level, Y represent the relative price of consumption level , and the distribution services cost is C. The relative price of traded goods at production level is:

$$X = P_T \tag{12}$$

Where P_T is an approximately.,

$$P_T = P_X^{\omega} / P_X^{*1-\omega*}, \tag{13}$$

similarly, the relative price of non-traded goods at consumption level is

$$\text{Y} = P_N \tag{14}$$

$$P_N = P_M^{1-\omega} / P_M^{*\omega*}. \tag{15}$$

P_M And P_X are import prices index and the export prices index, respectively. Let me assume, $\text{Q} = \text{Q}(\text{C}, \text{X}, \text{Y})$ is the real exchange rate that is determined by distribution costs and

[2] See the details of Eq (1) and Eq (2) from Chaban M. Home bias, distribution services and determinants of real exchange rates. Journal of Macroeconomics. 2011;33(4):793-806.

relative price of traded and non-traded goods. The scalar P_T is the aggregate price index for traded goods at production level, P_N is the aggregate price index of non-traded goods.

2.1 Home Bias in Trade.

Home bias is related to the consumers' tastes, which generally prefer home produced goods over foreign produced goods.

Whalley (1985) used a numerical general equilibrium model to illustrate home bias. In his model, he captured the production differentiation by countries, price changes in world markets passed on to domestic good prices. He finds smaller impacts of trade globalization on trade volumes is smaller than would be in a comparable homogeneous goods trade model. Trelfer (2002) associate home bias in trade with missing trade, which is the difference between actual trade and the predicted trade via Hecksher-Ohlin-Vanek model. Finally, the work that is closest to my understanding of home bias in trade is Hillberry and Hummels (2002). They treat home bias as terms of trade flows rather than treating it as one characteristics of the model. As home bias could be represented by trade flows, it's easier to measure home bias by empirical approaches.

2.2 Distribution Service Effect

Chaban (2011) study distribution services effect by using it in both international trade and interprovincial trade. He finds that distribution services influence interprovincial trade more than international trade. However, in my model, I treat this effect as a specific term of trade effect between countries. Term of trade effect as a main issue has been studied for decades, among them is McCallum (1995). Canada-U.S term of trade effect is studied well, for instance, by Helliwell (1996), and Hillberry (2002). However, study of the term of trade effect between Canada and Australia is hard to find. That may be due to various reasons. First, most Canadians live at southern part of Canada, close to U.S. border. Secondly, according to the comparative advantage theory of David Ricardo (1817), some products are more conveniently imported from U.S rather than produced domestically. Finally, Canada is a small open economy, whereas U.S is a large open economy. Yet, study of the term of trade effect between Canada and Australia will provide more information about how this issue influence international trade since both countries are small economies, and there are limited number of methods to ship the cargos. I could obtain the most efficient results by collecting their import and export data.

From the equation (1) above, let μ_T represent the differences between the two countries in average propensity to consume foreign produced traded goods, and let σ_T stand for the difference in average propensity to produce traded goods. This effect will be passed on to the import prices since any factor that increase the distribution services in home country will increase the import costs of traded goods for foreign country. Therefore, if absolute value of μ_T becomes bigger, that means consumers in one country might not have home bias in trade. As I assumed that there are only two countries, the productions of either of them will be needed by the other, so σ_T will be small or close to zero. Furthermore, if the demand for foreign goods increase, the demand for distribution services will increase as well, and consequently the absolute value of μ_T will become larger. On the other hand, if the demand for home country's currency increases, income effect on home country will lead to higher demand for foreign goods and distribution services. There is a third factor called the substitution effect, which depends on whether domestically produced traded goods and distribution services are substitutes or complements with foreign country produced traded goods and distribution services respectively.

The next section tests the importance of home bias and distribution services empirically. I focus on the impact of the exogenous shocks to relative price of traded and nontraded goods. All relative prices and the real exchange rate are in logarithm. Therefore, $\mathrm{Q} = \mathrm{Q}(\mathrm{C}, \mathrm{X}, \mathrm{Y})$ becomes:

$$q = q(c, x, y) \tag{16}$$

Where q is the logarithm of the real exchange rate, x is the logarithm of relative price of traded goods, y is the logarithm of price of non-traded goods, and c is the logarithm of the relative cost of distribution services. Since I use time series data, consider first whether the relative prices of traded goods, non-traded goods and distribution services are non-stationary. The log relative price of traded goods is $\log x = logP_x - logP_X^*$. Assume that there are two traded goods, one produced at home and one produced abroad. The traded goods are not perfect substitutes. According to Eq. (13) and (15), the price of Canada (home country) produced good when sold in the Canadian market is P_X and when sold in the Australian (foreign country) market is P_M^*. The price of the Australia produced goods is P_X^* when sold in the Australian market and P_M when sold in the Canadian market. The assumption of home bias translates to $\omega > \omega^*$. Where ω is the weight of home country consumption of domestically produced traded goods, ω^* is the weight of foreign consumer purchase of foreign produced traded goods. Then Eq. (13) becomes:

$$x = \omega logP_X - (1-\omega^*)logP_X^* \quad (17)$$

similarly, the Eq. (15) becomes:

$$y = (1-\omega)logP_M - \omega^* logP_M^* \quad (18)$$

First I assume there is no home bias in trade, i.e. $\omega = \omega^*$, the relative distribution cost just equal to the differences between two countries' price indices. If home bias in trade exists, $\omega \neq \omega^*$, combined with Eq. (17) and (18) the relative price of traded goods could be determined by the distribution cost. Therefore, under home bias assumption the distribution cost is the main focus. If there are shocks to distribution costs, they will be passed on to the relative price of traded goods and to the consumers. The shocks to distribution costs can be exogenous due to global market or can be endogenous due to technology improvements at home. At the empirical part, the relative price of traded goods constructed using FOB prices will let distribution costs equal to zero. Therefore, the guess is that the relative price of traded goods constructed using FOB prices is nonstationary due to home bias. Next, relax the assumption that distribution costs are zero. Prices of traded goods are now measured at the consumption level. It is useful to regroup prices in (16) and (17)

$$c = \omega(logP_x - logP_M) + (1-\omega^*)(logP_X^* - logP_M^*) \quad (19)$$

if there are permanent shocks to distribution costs in one of the countries, there might be differences between $logP_M$ and $logP_M^*$. These deviations cannot be eliminated since they are due to nontraded distribution services. Permanent shocks to distribution costs can be driven by exogenous reasons (for instance shocks to crude oil prices). The relative price of nontraded and traded goods are expected to be nonstationary. Unit root and cointegration test are included in next chapter to support my predictions.

Chapter 3 Empirical Results

3.1 Variable settings

Chaban (2011), discusses the advantages and disadvantages of the four methods that used by Engel (1999) to construct the relative prices of traded and nontraded goods, which are (i) consumer price indices (CPI), (ii) output prices, (iii) personal consumption deflators, and (iv) producer price index. The first measure treats goods as tradable and services as nontradable. Prices for these components are taken from the CPI index. The second measure uses annual output prices by industries. The third measure uses national income accounts. Finally, the last method treats the overall PPI as an index of traded goods prices, and the overall CPI as an index of nontraded goods. Chaban (2011) treat CPI and personal consumption deflator as flawed since they contain too many nontraded factors like marketing, wholesale transactions, etc. He turned the output prices down since they are only in annul frequency which will not allow a dynamical study of his variables since what he has is a relatively short data stream. Finally, PPI seems to be the flawless for him and he uses the consumer prices and prices at the dock. However, what I did is slightly different. I give up the CPI data, use only import and export prices to construct my main model, since what concerns me is the international distribution costs but not the domestic distribution costs. Canadian crude oil price indices, real exchange rate, import and export price indices are obtained from Statistics Canada. The Australian import and export indices are obtained from Australian Bureau of Statistics. As a measure of the relative productivity in the tradable sectors, I used the relative labor productivity in all industries and relative labor productivity in all services. Data sources are again from Statistics Canada for Canada and Australian Bureau of Statistics for Australia. As a measure of output, I use real GDP. All variables are in logarithm and quarterly from 1997-2014.

3.2 Descriptive Statistics

According to Table 7 (see appendix), for each variable, it has 73 observations. The standard deviation of Y is 0.022, skewness value equal to 0.34 means the distribution has a long right tail. Variable X has standard deviation equal to 0.073, skewness value is 0.05 close to 0 means it is almost normally distributed. RLPRS has a standard deviation equal to 0.06, skewness value equal to -0.51 implies the distribution has a long left tail. For rest of the variables, skewness values prove they either have left tail or right tail.

3.3 Unit Root Tests

The augmented Dickey -- Fuller (ADF) test (Fuller and Dickey, 1979; and Said and Dickey, 1984) is applied to the non-trended data. The number of lags in the augmented regression is chosen according to the modified Akaike information criterion that is proposed by Perron and Ng (2001). The null hypothesis is that a unit root exists. I used the 5% significance level for all variables. It can be seen from Appendix Table 1 that the traded goods' relative price has unit root, which indicates that these series are non-stationary, but home bias, and distribution services series imply that X should be stationary. Since the test can not reject the null of a unit root in X, I treat this as evidence in the former models' favor.

Chaban (2011) indicates that if local currency data is used, then X should be stationary. However, the unit root test could not reject the null hypothesis at 10% level for all series. That would be a conflict for his price to market model, so he treats this as a potential evidence for home bias issue or due to costs of distribution services.

3.4. Tests for Cointegration

Since real exchange rate have been shown to be stationary, it is necessary to test if model variable have long run relationship. The biggest change is I add model four which includes all the variables into one model with Johansen methods (Johansen, 1996) to test for possible cointegration relation. See results in Appendix Table 2. Below I explain the models estimated.

Model 1: X, POIL, RLPM, RE

Where POIL is the price for crude oil, RLPM is the relative labor productivity in manufacturing. All the data used for testing are in logarithms. These variables may be cointegrated as follows from the assumptions and settings of Chapter 2. If the products has the same inherently nature and home bias exists, Eq. (17) implies that the relative price of traded goods should be cointegrated with factors that affect the logarithm of terms of trade $log\ P_X - logP_M$. Terms of trade in Canada versus Australia would be influenced by energy and productivity shocks. Hence, the relative price of traded goods is expected to be cointegrated with crude oil price, real exchange rate and the relative productivity.

Model 2 : X, POIL, RLPM, RLPRS, RE.

RLPRS is the relative labor productivity in all services. Since there is no way to separate the distribution service from general industry's service, this variable could be considered as a proxy.

Model 3 : Y; POIL, RLPM, RLPRS, RE.

I consider the case where relative price of nontraded goods is cointegrated with real shocks.

Model 4: Explore the cointegration relation among six variables. X, Y, POIL, RLPRM, RLPRS, RE.

The non-traded goods and the traded goods that are finally be consumed in foreign markets. Since the distribution services are the critical factors to both traded and non-traded goods. It is important to include all the variables in one model and check their long run relationship.

There is a trend contained in the cointegration tests and allow linear trends and constant in the variables. To determine how many lags does the model needs, I observe the cointegration ranks and cointegrating vectors from Vector-Autoregressive models (VAR) in levels. For a high dimensional system, Ho and Sorensen (1996) find that the Bayes Information criterion (BIC) is the best criterion. On the other hand, under system with large dimension, Gonzalo and Pitarakis (2002) find that the Akaike information criterion (AIC) is the best criterion. I used both criteria to pick the lag order for VAR models in Table 2a. The VAR models with the selected lag order are then used to find the cointegration ranks in Table 2b and 2c. The tables include, for each model and the selected lag order, trace test statistics, Maximum-Eigenvalue statistics and corresponding p-values.

Luutekpohl, H (2001) discusses the differences between Trace Statistics and Eigenvalue statistics. According to his work, there are two comparisons present the final results. First one is Local Power Comparison, asymptotic distribution under local alternatives are given. In that comparison, no major differences between Maxi – Eigenvalue and Trace tests are found. Second one is Small Sample Simulation Comparison, however, he finds that in some situations trace tests tend to have more heavily distorted sizes whereas their power performance is superior to that of the maximum eigenvalue competitors.

Since Chaban (2011) uses only trace tests in his paper, meanwhile my data is considered to be a small sample, I will mainly discuss the results in Table 2b.

Consider a prediction that the relative price of traded goods is cointegrated with real variables. The details could be found in Table 2b.

According to the table, we could reject the null hypothesis that there is no cointegration in model one and three, meaning that there is at most one cointegration equation at 5% level. For model two, the table indicates that there are at most two cointegration equations at 5% level.

Consider a prediction that the relative price of traded goods is supposed to be cointegrated with real variables. The details could be found in Table 2b. In Model 1, the rank of order one is not rejected against the hypothesis that the lag order equals 1, which means there are at least 2 error correction functions that need to be considered. For the same model, rank of order 0 cannot be rejected against lag order equals 2, indicates there exist at least 1 error correction functions. The difference between Model 2 and Model 1 is the additional RLPRS. Productivity in services is supposed to affect distribution services which could have long-term influence on the relative price of traded goods by passing the services' costs to foreign consumers and making it more likely that this relative price is cointegrated with real shocks. Turns out that Model 2 has the same number of rank when the lag order are same. For Model 3, when lag order equals 1, only two error correction equations exist. Only one error correction equation needs to be considered when lag order equal to 2. From Table 2b we can see, the results of Model 4 are similar to all the models' above. Meanwhile, according to Table 2c, there is one situation that there might not exist a cointegration relationship at all. I will leave this part for further discussion at the following section.

The first cointegrating relationship of interest is based on Model 1. Oil price change causes appreciation of the relative price of traded goods. This result is expected as higher commodity prices make domestic traded goods more expensive, since this is a transfer of wealth from abroad. An increase in wealth drives the demand for domestic products up due to home bias, appreciating the relative price of traded goods.

To illustrate all the assumptions and settings, I use the VECM and VAR model for regressions. According to what I mentioned before, under the same assumption that Canada and Australia has do not change the price of their goods, X, the relative price of traded goods, and Y, the relative price of non-traded goods should be treated as endogenous variables.

3.5 VECM Results

For Model 1, according to the assumptions from Chapter 2, positive energy shock should have negative influence on relative price of traded goods. Then the equation below should have β_2 <0

$$CoinEq1 = X(-1) + \beta_1 RLPRM(-1) + \beta_2 POIL(-1) + \beta_3 * RE(-1) + \varepsilon$$

D means first difference, (-1) means lagged for one period.

$$CoinEq1 = X(-1) + 0.3645 * RLPRM(-1) - 0.2705 * POIL(-1) - 0.1456 * RE(-1) - 1.4792$$

$$D(X) = -0.3077 * (X(-1) + 0.3645 * RLPRM(-1) - 0.2705 * POIL(-1) - 0.1456 * RE(-1) - 1.4792) + 0.3994 * D(X(-1)) + 0.1119 * D(RLPRM(-1)) - 0.0248 * D(POIL(-1)) - 0.0274 * D(RE(-1)) + 0.0016$$

The results show that I cannot reject the null hypothesis: the relationship between relative price of traded goods and price of oil is negative, since $\beta_2 = 0.27$ and statistically significant at 1% level (details for other CoinEqs can be found in appendix Table 3c).

For model 2, positive productivity shock on relative labor productivity of all services should cause relative price of trade good become lower, means β_4 <0

$$CoinEq2 = X(-1) + \beta_1 RLPRM(-1) + \beta_2 POIL(-1) + \beta_3 RE(-1) + \beta_4 RLPRS + \varepsilon$$

However, let look at the estimated regression equation

$$CoinEq2 = X(-1) + +0.3658 * RLPRM(-1) - 0.7517 * POIL(-1) - 0.5833 * RE(-1) + 1.7326 * RLPRS(-1) - 0.8001$$

$$D(X) = -0.1242 * (X(-1) + 1.7326 * RLPRS(-1) + 0.3658 * RLPRM(-1) - 0.5833 * RE(-1) - 0.7517 * POIL(-1) - 0.8001) + 0.2408 * D(X(-1)) + 0.2541 * D(RLPRS(-1)) + 0.1447 * D(RLPRM(-1)) - 0.0372 * D(RE(-1)) - 0.0068 * D(POIL(-1)) + 0.0011$$

I have to reject the null hypotheses that: the positive productivity shock should decrease relative price of traded goods.

For model 3, I want to show that positive productivity shocks in manufactory industry should have negative relationship with relative price of non-traded goods.

$$CoinEq3 = \ Y(-1) + \ \beta_1 RLPRM(-1) + \ \beta_2 POIL(-1) + \ \beta_3 RE(-1) + \ \beta_4 RLPRS + \varepsilon$$

Here is the estimated regression equation

$$\text{CoinEq3} \ = Y(-1) \ - \ 4.6839 * RLPRS(-1) \ + \ 0.2137 * RLPRM(-1) \ + \ 2.2107 * RE(-1) \ + \ 1.3348 * POIL(-1) \ - \ 3.888$$

$$D(Y) \ = \ 0.0290 * (\ Y(-1) \ - \ 4.6839 * RLPRS(-1) \ + \ 0.2137 * RLPRM(-1) \ + \ 2.2107 * RE(-1) \ + \ 1.334 * POIL(-1) \ - \ 3.888 \ ) \ + \ 0.1764 * D(Y(-1)) \ + \ 0.0529 * D(RLPRS(-1)) \ + \ 0.0758 * D(RLPRM(-1)) \ - \ 0.0432 * D(RE(-1)) \ + \ 0.0012 * D(POIL(-1)) \ + \ 0.0006$$

I have to reject the null hypotheses that: the positive productivity shock should decrease relative price of non-traded goods.

For model 4, it is necessary to test the relationship between relative price of traded good and relative price of non-traded goods. Since I assume home bias issue exist in my model, then relative price of traded goods should have negative relationship with relative price of non-traded goods. So the null hypotheses for model 4 is: $\beta_4 < 0$

$$CoinEq4 = X(-1) - 0.2778 * RLPRS(-1) + 0.4781 * RLPRM(-1) + 0.0925 * RE(-1) - 0.1786 * POIL(-1) - 0.3058 * Y(-1) - 1.049$$

$$D(X) = -0.4201 * (X(-1) - 0.3058 * Y(-1) - 0.2778 * RLPRS(-1) + 0.4781 * RLPRM(-1) + 0.0925 * RE(-1) - 0.1786 * POIL(-1) - 1.0495) + 0.5413 * D(X(-1)) - 0.0071 * D(Y(-1)) - 0.2144 * D(RLPRS(-1)) + 0.1788 * D(RLPRM(-1)) + 0.0034 * D(RE(-1)) - 0.0218 * D(POIL(-1)) + 0.0018$$

The estimated result above support my assumption, I cannot reject the null hypotheses.

3.6 Policy Implication

Many countries face home bias issue in consumption, many articles provide advice on how to resolve this issue by using fiscal or monetary strategies. From the monetary policy point of view, Ester Faia and Tommaso Monacelli (2006) show that home bias in consumption is a sufficient condition for inducing monetary policy-makers of an open economy to deviate from a strategy of strict markup stabilization and contemplate some (optimal) degree of exchange rate stabilization. Jian Wang (2010) show the extent that home bias has important implications for exchange rate policy results, which suggest a very loose stance against exchange rate stabilization. In particular, when the central bank does not take a strong stance against the inflation rate, the inclusion of the exchange rate into the monetary policy rule may induce significant welfare loss. On the other side, Giovannil Ganelli (2005) show how introducing home bias in public consumption in the redux model generates a quasi-neutrality result: temporary fiscal expansions increase domestic output on a one-to-one basis, without any effect on the other (domestic and foreign) macroeconomic variables. This study points out that policymakers, when assessing the international effects of fiscal policies, should take into account not only the level of public expenditure but also its composition.

Chapter 4 Conclusion

The results of this study show both long-term and short-term effects. First of all, let's focus on short-term effects.

According to the results in Table 3a (see appendix), The price of crude oil has negative relationship with traded goods, which means as crude price oil goes up, the demand for the traded goods will increase. If this parameter is statistically significant, might lead to greater home bias, in turn to increase the price of domestically produced goods. On the other hand, real exchange rate has negative relationship with relative prices of the non-traded and positive relationship with relative prices of traded goods, however neither of them is statistically significant. This is quite clear since exchange rate goes up, the appreciation of Canadian dollar will make Canadian people to have advantage to purchase foreign goods, which will lead to less home bias. In my model, the prices of Australian traded goods are on the denominator. As total demand goes up, the total prices of traded goods should go up. In the case of relative labor productivity in manufacturing has positive relationship with both X and Y, means if the home income goes up, the relative prices of traded goods will increase. The last variable I am going to talk about is relative labor productivity in service. As I mentioned before, distribution services could not be separated from the whole industry services, however, the changes in all services will reflect a portion of changes in distribution services. Hence, the negative relationship between distribution services and relative price of traded goods, as well as the relative price of non-traded goods, lead to the conclusion that, if the cost of distribution services get lower, consumer will seek to purchase foreign goods, which matches my assumptions.

Long-term effects reflect the cointegration between variables, which is the critical part of this study. From Table 3c, all variables in CoinEq1 (abbreviation for cointegration equation 1), except for real exchange rate, are statistically significant. Results in CoinEq1 imply that relative labor productivity in manufactory has positive long-run relationship with relative price of traded good, which means as GDP generated per labor become higher, the prices for traded goods become higher. This relationship is beyond my assumption, however, positive productivity shocks will lead to increase in labors' real income, and this influence will be passed to prices of traded goods. The other variable, price of oil, has negative relationship with relative price of traded goods. This effect could explained by the structure of Canadian economy. Canadian economy is much relying on price of oil. As price of oil dropped significantly in past three years, Canadian average inflation increased from 0.94% to 1.68%. For CoinEq2, all variables except for relative labor in productivity are statistically significant. Real exchange rate has significant negative effect on relative price of traded goods, which due to the appreciation of Canadian dollar will decrease the real price of Australian goods. Relative labor productivity in all services has positive relationship with relative price of traded goods, which I have explained above. For CoinEq3, all variables except relative labor productivity in manufactory has statistically significant long-run relationship with relative price of non-traded goods. Price of oil has positive effect on relative price of non-traded goods could be explained by the similar relationship between transportation costs and price of imported goods. If there is energy shock, transportation costs increase will lead to price of imported goods increase. Real exchange rate has positive relationship with relative price of non-traded goods, means once Canadian dollar appreciate, the real price of Canadian imported goods will increase. For the last CoinEq4, all variables exclude real exchange rate, are statistically significant. Relative price of non-traded goods has negative effect on relative price of traded goods. If there is home bias issue exists, demand for domestically produced goods will exceed the demand for foreign produced good, as demand become bigger, the price become higher.

Compared to the work of Chaban (2011), the results are different in the following senses:

First, model selection. Chaban sets up 3 different models in his paper to compare the differences of how relative price of traded goods are related to the real variables. The reason I add one more model is because the pair of countries I picked are different from his, add in addition, the variables I used are slightly different. So it is necessary to repeat the procedure one extra time.

Second, coefficients of same variables are different. Chaban uses the same model with "real prices", the CPI prices. By using retail prices he obtains more significant results compare to my results. For example, last period oil price has 2.2% influence on relative price of trade goods when dock prices are used (Appendix Table 3a), while more that 6% when retail prices are used.

Finally, cointegration problem. Chaban proves that there isn’t any cointegration relationship with retail prices. However, with dock prices, I cannot reject the rank of order one by using Trace method, the rank of order zero can be rejected with Maximum Eigenvalue. So, unlike how Chaban (2011) manipulate his data, I use dock price for both VECM and VAR models.

On the other hand, Chaban (2011) and I have similar results with respect to the same variables. For instance, the relative labor productivity in manufacturing (RLPRM) in the trade sectors is found insignificant.

From the theory part, it is widely recognized that national borders drive a wedge between international and domestic trade costs, generating a home bias in trade. The question of whether national borders and other geographic factors provide a full explanation, however, continues to be open. Inspired by the acknowledgment that border-related trade barriers may contain more influence factors than they appear, I develop a two-country model in which individuals face distribution costs when they move goods from production's location to their consumption location. Since a transaction cost generates additional costs to international trade, the distribution cost in my model, which plays an important role in explaining home trade bias. Empirical results are also provided to support predictions of my model for home trade bias, traded goods' relative price is affected by productivity shocks and by commodity shocks.

The potential importance of substitution and investment goods is ignored in my model between foreign and home intermediate inputs. Nevertheless, it clearly demonstrates how relatively high distribution costs can explain a large observed home trade bias even with low elasticity of substitution between domestically produced goods and foreign goods.

Even though I prove that home bias in trade does exist in international trade between Canada and Australia, consumers' home bias preference could benefit home country's economy.

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Appendix

Table 1 Unit Root Test (at level base, with intercept and trend)

Null Hypothesis: variable has a unit root

Alternative Hypothesis: variable does not has a unit root

Variable	Lag order (Determined based on AIC)	t-statistics	5% level critical value	p-value
POIL	2	-2.45	-2.58	0.35
RE	0	-4.80	-2.58	0.0002
RLPRM	0	-1.70	-2.58	0.43
RLPRS	1	-2.70	-2.58	0.08
X	2	-1.42	-2.58	0.56
Y	1	-2.87	-2.58	0.0531

Table 2 Testing Cointegrating Relationships Using Johansen Procedure. Bold P-values Correspond to The Rejection of The Null Hypothesis That Cointegration Rank Is Zero At 5% Significance Level.

Table 2a: Lag Order Selection

Model	AIC	BIC
1	2	1
2	2	1
3	2	1
4	2	1

Table 2b: Trace Test

Trace statistics	Model	Lag	H_0: conintegration rank is zero	Trace	p-value

1	1	1	18.77	0.0154
1	2	0	29.96	0.0380
2	1	1	29.77	0.0072
2	2	0	59.13	0.0031
3	1	1	48.24	0.0460
3	2	0	83.45	0.0027
4	1	1	54.43	0.0106
4	2	0	74.39	0.0218

Table 2c: Maximum Eigenvalue Result

Maximum Eigenvalue statistics	Model	Lag	H_0: conintegration rank is zero	Trace	p-value
	1	1	0	17.34	0.1508
	1	2	Cannot reject	34.10	0.0063
	2	1	0	23.79	0.0206
	2	2	Cannot reject	29.64	0.2068
	3	1	0	41.27	0.0055
	3	2	Cannot reject	38.21	0.1119
	4	1	0	30.59	0.0199
	4	2	Cannot reject	38.71	0.0718

Each model contains an intercept and trend. AIC and BIC criteria are used to find an optimal number of lags for VAR in levels models. The selected lag orders are reported in (a).

Table 3a Vector Error Correction Model

Cointegrating Eq:	CointEq1
X(-1)	1.000000
Y(-1)	-0.305867 (0.09560) [-3.19947]
RLPRS(-1)	-0.277847 (0.12277) [-2.26317]
RLPRM(-1)	0.478166 (0.05434) [8.79966]
RE(-1)	0.092596 (0.05219) [1.77414]
POIL(-1)	-0.178632 (0.03132) [-5.70262]
C	-1.049580

Error Correction:	D(X)	D(Y)	D(RLPRS)	D(RLPRM)	D(RE)	D(POIL)
CointEq1	-0.420136 (0.09974) [-4.21216]	-0.040939 (0.07897) [-0.51844]	-0.029328 (0.02870) [-1.02185]	-0.121005 (0.08745) [-1.38362]	0.120761 (0.31984) [0.37757]	0.357765 (0.54584) [0.65544]
D(X(-1))	0.541305 (0.17129) [3.16013]	0.283375 (0.13561) [2.08963]	0.068809 (0.04929) [1.39603]	-0.043967 (0.15019) [-0.29274]	-0.111331 (0.54926) [-0.20269]	0.768760 (0.93739) [0.82011]

D(Y(-1))	-0.007175	0.015243	-0.136756	-0.304003	-0.590013	-3.699424
	(0.29999)	(0.23750)	(0.08632)	(0.26303)	(0.96194)	(1.64168)
	[-0.02392]	[0.06418]	[-1.58427]	[-1.15578]	[-0.61336]	[-2.25344]
D(RLPRS(-1))	-0.214468	-0.315545	0.053552	0.428134	0.840084	2.616492
	(0.41793)	(0.33087)	(0.12026)	(0.36644)	(1.34011)	(2.28708)
	[-0.51317]	[-0.95369]	[0.44532]	[1.16838]	[0.62687]	[1.14403]
D(RLPRM(-1))	0.178849	0.098293	0.122978	0.376693	0.011583	0.221362
	(0.13316)	(0.10542)	(0.03832)	(0.11676)	(0.42700)	(0.72874)
	[1.34307]	[0.93235]	[3.20942]	[3.22628]	[0.02713]	[0.30376]
D(RE(-1))	0.003476	-0.019051	0.021874	0.039405	-0.414768	-0.119808
	(0.03686)	(0.02918)	(0.01061)	(0.03231)	(0.11818)	(0.20169)
	[0.09430]	[-0.65293]	[2.06257]	[1.21940]	[-3.50962]	[-0.59402]
D(POIL(-1))	-0.021811	0.004977	-0.021142	-0.013968	0.064964	0.122039
	(0.02797)	(0.02214)	(0.00805)	(0.02452)	(0.08968)	(0.15306)
	[-0.77983]	[0.22479]	[-2.62699]	[-0.56961]	[0.72437]	[0.79735]
C	0.001845	0.001070	0.002684	-0.000847	-0.002738	-0.002648
	(0.00185)	(0.00147)	(0.00053)	(0.00162)	(0.00594)	(0.01014)
	[0.99578]	[0.72911]	[5.03353]	[-0.52144]	[-0.46078]	[-0.26112]
R-squared	0.482444	0.221271	0.268408	0.343767	0.192785	0.175791
Adj. R-squared	0.424938	0.134746	0.187120	0.270852	0.103095	0.084213
Sum sq. resids	0.009242	0.005792	0.000765	0.007105	0.095026	0.276772
S.E. equation	0.012112	0.009589	0.003485	0.010620	0.038837	0.066281
F-statistic	8.389415	2.557299	3.301944	4.714643	2.149450	1.919565
Log likelihood	216.8632	233.4479	305.3058	226.1983	134.1335	96.18242
Akaike AIC	-5.883471	-6.350644	-8.374811	-6.146431	-3.553056	-2.484012
Schwarz SC	-5.628521	-6.095694	-8.119861	-5.891481	-3.298106	-2.229062
Mean dependent	0.002530	0.000965	0.002782	-4.52E-05	-0.000604	0.004127
S.D. dependent	0.015972	0.010308	0.003866	0.012437	0.041009	0.069262

Determinant resid covariance (dof adj.)	2.01E-23
Determinant resid covariance	9.81E-24
Log likelihood	1276.265
Akaike information criterion	-34.42999
Schwarz criterion	-32.70908

Table 3b Vector Auto-regression Model

	DX	DY	DRLPRS	DRLPRM	DRE	DPOIL
DX(-1)	0.759555	0.304642	0.084044	0.018892	-0.174063	0.582910
	(0.18338)	(0.12852)	(0.04700)	(0.14417)	(0.52001)	(0.88949)
	[4.14189]	[2.37045]	[1.78832]	[0.13104]	[-0.33473]	[0.65533]
DY(-1)	-0.693887	-0.051672	-0.184693	-0.501786	-0.392629	-3.114657
	(0.28285)	(0.19822)	(0.07249)	(0.22237)	(0.80206)	(1.37193)
	[-2.45321]	[-0.26068]	[-2.54797]	[-2.25655]	[-0.48952]	[-2.27027]
DRLPRS(-1)	-0.252023	-0.319204	0.050931	0.417318	0.850879	2.648472
	(0.46931)	(0.32890)	(0.12027)	(0.36896)	(1.33080)	(2.27635)
	[-0.53701]	[-0.97053]	[0.42347]	[1.13107]	[0.63937]	[1.16347]
DRLPRM(-1)	0.202409	0.100589	0.124622	0.383479	0.004811	0.201300
	(0.14944)	(0.10473)	(0.03830)	(0.11749)	(0.42376)	(0.72484)
	[1.35446]	[0.96048]	[3.25409]	[3.26406]	[0.01135]	[0.27772]
DRE(-1)	-0.023500	-0.021680	0.019991	0.031635	-0.407014	-0.096836
	(0.04077)	(0.02857)	(0.01045)	(0.03205)	(0.11560)	(0.19774)
	[-0.57646]	[-0.75884]	[1.91346]	[0.98706]	[-3.52087]	[-0.48973]
DPOIL(-1)	0.031809	0.010202	-0.017399	0.001475	0.049552	0.076380
	(0.02797)	(0.01960)	(0.00717)	(0.02199)	(0.07932)	(0.13568)
	[1.13717]	[0.52045]	[-2.42713]	[0.06706]	[0.62472]	[0.56296]
C	0.001725	0.001058	0.002676	-0.000882	-0.002704	-0.002546
	(0.00208)	(0.00146)	(0.00053)	(0.00164)	(0.00590)	(0.01010)
	[0.82868]	[0.72534]	[5.01660]	[-0.53906]	[-0.45808]	[-0.25215]
R-squared	0.336688	0.217949	0.256283	0.323826	0.190959	0.170171
Adj. R-squared	0.274502	0.144632	0.186559	0.260434	0.115111	0.092375
Sum sq. resids	0.011844	0.005817	0.000778	0.007321	0.095241	0.278659
S.E. equation	0.013604	0.009534	0.003486	0.010695	0.038576	0.065985
F-statistic	5.414241	2.972681	3.675701	5.108360	2.517662	2.187388
Log likelihood	208.0547	233.2967	304.7222	225.1356	134.0533	95.94117
Akaike AIC	-5.663512	-6.374555	-8.386541	-6.144665	-3.578965	-2.505385
Schwarz SC	-5.440431	-6.151474	-8.163460	-5.921584	-3.355884	-2.282304
Mean dependent	0.002530	0.000965	0.002782	-4.52E-05	-0.000604	0.004127

S.D. dependent	0.015972	0.010308	0.003866	0.012437	0.041009	0.069262

Determinant resid covariance (dof adj.)	4.20E-23
Determinant resid covariance	2.26E-23
Log likelihood	1246.720
Akaike information criterion	-33.93577
Schwarz criterion	-32.59728

Table 3c Error Correct Equation for Each Model

Model	Error Correction:	X(-1)	Y(-1)	RLPRM(-1)	POIL(-1)	RE(-1)	RLPRS(-1)
1	1	1		0.364519	-0.270547	-0.145629	
				(0.11455)	(0.02266)	(0.12548)	
				[3.18210]	[-11.8683]	[1.20299]	
2	2	1		0.365855	-0.751787	-0.583319	1.732603
				(0.22376)	(0.12961)	(0.21208)	(0.50198)
				[1.63501]	[-5.80042]	[-2.75049]	[3.45156]
3	3		1	0.213715	1.334890	2.210755	-4.683913
				(0.47860)	(0.26270)	(0.45480)	(1.04142)
				[0.44654]	[5.08144]	[4.86091]	[-4.49764]
4	4	1	-0.305867	0.478166	-0.178632	0.092596	-0.277847
			(0.09560)	(0.05434)	(0.03132)	(0.05219)	(0.12277)
			[-3.19947]	[8.79966]	[-5.70262]	[1.77414]	[-2.26317]

Table 4a VEC Residual Portmanteau Tests for Autocorrelations

Included observations: 70

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	26.58400	NA*	26.96927	NA*	NA*

2	34.88315	NA*	35.51252	NA*	NA*
3	59.46957	0.8111	61.19983	0.7644	70
4	73.82548	0.9472	76.42578	0.9189	95
5	97.75205	0.9322	102.1929	0.8786	120
6	125.7755	0.8736	132.8436	0.7566	145
7	139.7429	0.9567	148.3628	0.8831	170
8	173.6557	0.8619	186.6515	0.6536	195
9	198.1439	0.8523	214.7527	0.5872	220
10	212.0125	0.9373	230.9327	0.7317	245
11	224.1633	0.9807	245.3489	0.8568	270
12	246.8610	0.9809	272.7428	0.8193	295

*The test is valid only for lags larger than the VAR lag order.

df is degrees of freedom for (approximate) chi-square distribution

Table 4b VAR Residual Portmanteau Tests for Autocorrelations

Null Hypothesis: no residual autocorrelations up to lag h

Included observations: 71

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	13.02142	NA*	13.20744	NA*	NA*
2	60.14819	0.0070	61.70020	0.0049	36
3	84.65120	0.1462	87.28422	0.1060	72
4	112.3474	0.3680	116.6340	0.2684	108
5	149.9649	0.3498	157.1012	0.2151	144
6	174.5086	0.6015	183.9105	0.4053	180
7	198.9234	0.7916	210.9957	0.5834	216
8	241.6228	0.6696	259.1172	0.3655	252
9	264.2623	0.8388	285.0432	0.5382	288
10	290.7632	0.9077	315.8885	0.6160	324
11	311.0404	0.9706	339.8831	0.7701	360
12	340.6617	0.9794	375.5290	0.7632	396

*The test is valid only for lags larger than the VAR lag order.

df is degrees of freedom for (approximate) chi-square distribution

Table 5a VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Included observations: 71

Joint test:

Chi-sq	df	Prob.
218.8859	180	0.0254

Individual components:

Dependent	R-squared	F(12,58)	Prob.	Chi-sq(12)	Prob.
res1*res1	0.267016	1.760719	0.0771	18.95815	0.0895
res2*res2	0.208051	1.269752	0.2611	14.77161	0.2542
res3*res3	0.091440	0.486438	0.9146	6.492212	0.8893
res4*res4	0.183206	1.084115	0.3902	13.00766	0.3685
res5*res5	0.230796	1.450220	0.1703	16.38653	0.1742
res2*res1	0.219506	1.359329	0.2120	15.58496	0.2110
res3*res1	0.112719	0.614017	0.8216	8.003017	0.7849
res3*res2	0.080116	0.420952	0.9491	5.688227	0.9310
res4*res1	0.260380	1.701555	0.0901	18.48699	0.1017
res4*res2	0.240342	1.529178	0.1400	17.06428	0.1472
res4*res3	0.220610	1.368095	0.2076	15.66329	0.2071
res5*res1	0.385569	3.033023	0.0023	27.37540	0.0068
res5*res2	0.395089	3.156822	0.0016	28.05131	0.0054
res5*res3	0.149249	0.847921	0.6022	10.59667	0.5638
res5*res4	0.081571	0.429276	0.9453	5.791542	0.9262

Table 5b VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Included observations: 71

Joint test:

Chi-sq	df	Prob.

330.5567	252	0.0006

Individual components:

Dependent	R-squared	F(12,58)	Prob.	Chi-sq(12)	Prob.
res1*res1	0.529344	5.436014	0.0000	37.58340	0.0002
res2*res2	0.285893	1.935026	0.0484	20.29840	0.0616
res3*res3	0.074929	0.391488	0.9613	5.319925	0.9464
res4*res4	0.184929	1.096623	0.3803	13.12999	0.3597
res5*res5	0.178366	1.049257	0.4186	12.66402	0.3939
res6*res6	0.214644	1.320985	0.2320	15.23969	0.2286
res2*res1	0.459443	4.108056	0.0001	32.62043	0.0011
res3*res1	0.236274	1.495292	0.1524	16.77548	0.1582
res3*res2	0.175396	1.028067	0.4364	12.45312	0.4100
res4*res1	0.151684	0.864229	0.5864	10.76956	0.5488
res4*res2	0.193576	1.160205	0.3327	13.74390	0.3174
res4*res3	0.145085	0.820253	0.6291	10.30107	0.5896
res5*res1	0.414822	3.426259	0.0008	29.45235	0.0034
res5*res2	0.314076	2.213125	0.0226	22.29941	0.0343
res5*res3	0.298967	2.061251	0.0344	21.22663	0.0472
res5*res4	0.093776	0.500156	0.9062	6.658127	0.8794
res6*res1	0.395407	3.161024	0.0016	28.07389	0.0054
res6*res2	0.289073	1.965302	0.0446	20.52419	0.0578
res6*res3	0.208672	1.274545	0.2582	14.81573	0.2517
res6*res4	0.074040	0.386477	0.9632	5.256865	0.9488
res6*res5	0.143489	0.809716	0.6393	10.18772	0.5995

Table 6a VEC Residual Normality Tests

Orthogonalization: Cholesky (Lutkepohl)

Null Hypothesis: residuals are multivariate normal

Included observations: 71

Component	Skewness	Chi-sq	df	Prob.
1	-0.537810	3.422663	1	0.0643
2	0.222291	0.584724	1	0.4445
3	-0.648506	4.976623	1	0.0257
4	0.541509	3.469918	1	0.0625
5	-0.114349	0.154729	1	0.6941

Joint		12.60866	5	0.0273

Component	Kurtosis	Chi-sq	df	Prob.
1	4.168035	4.036073	1	0.0445
2	4.002882	2.975411	1	0.0845
3	6.078065	28.02868	1	0.0000
4	6.323377	32.67430	1	0.0000
5	3.129268	0.049435	1	0.8240
Joint		67.76390	5	0.0000

Table 6b VAR Residual Normality Tests

Orthogonalization: Cholesky (Lutkepohl)

Null Hypothesis: residuals are multivariate normal

Included observations: 71

Component	Skewness	Chi-sq	df	Prob.
1	-0.616472	4.497110	1	0.0340
2	0.520262	3.202954	1	0.0735
3	-0.704588	5.874591	1	0.0154
4	0.415163	2.039597	1	0.1533
5	1.153790	15.75290	1	0.0001
6	-0.298281	1.052829	1	0.3049
Joint		32.41998	6	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	4.454991	6.262790	1	0.0123
2	3.846888	2.121776	1	0.1452
3	6.446790	35.14608	1	0.0000
4	6.141280	29.19176	1	0.0000
5	9.072859	109.1022	1	0.0000
6	3.251427	0.187013	1	0.6654
Joint		182.0116	6	0.0000

Table 7 Descriptive Statistics

	Y	X	RLPRS	RLPRM	RE	POIL
Mean	2.015238	1.917582	0.270105	0.616803	-0.177327	2.545298
Median	2.010138	1.918626	0.284344	0.626047	-0.176468	2.607816
Maximum	2.063878	2.050573	0.351029	0.702563	-0.017910	2.899485
Minimum	1.977672	1.802081	0.147290	0.524529	-0.257528	2.063934
Std. Dev.	0.022183	0.073688	0.058899	0.045859	0.041420	0.215867
Skewness	0.343784	0.051168	-0.510295	-0.375634	0.811178	-0.594394
Kurtosis	2.065873	1.630056	2.030146	2.141355	5.435610	2.436593
Jarque-Bera	4.092088	5.740293	6.029258	3.959262	26.04955	5.264045
Probability	0.129245	0.056691	0.049064	0.138120	0.000002	0.071933
Sum	147.1124	139.9835	19.71763	45.02662	-12.94489	185.8068
Sum Sq. Dev.	0.035429	0.390957	0.249777	0.151417	0.123525	3.355089
Observations	73	73	73	73	73	73

APPENDIX II

CURRICULUM VITAE or *CV*

Candidate's full name: Yunlu Liu

Universities attended: Shangdong Financial and Economics University, 06-2013, Bachelor in Economics
University of New Brunswick, 05-2016, Master of Arts in Economics

Publications: None

Conference Presentations: None