

# The pricing behavior comparison of Canada and Australia exporter in wheat international market using Pricing to Market (PTM) and Residual Demand Elasticity (RDE)

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**Abstract.** This paper try to identify and examined the degree of market power on wheat international market by 2 major exporting countries comprising Canada and Australia by using the Pricing to Market (PTM) method and Residual Demand Elasticity (RDE) method. The PTM method found that Canada impose noncompetitive strategy by applying price discrimination and apply market power to their importing. Different results come from Australian exporter as they are not using their market power to the importing. Conflicting result arise from estimation using RDE and PTM method suggest that the need to extend the theoretical model of both model by expand its economic and econometric model to have consistent expected result theoretically and empirically.

## 1. Introduction

Canada and Australia are two major wheat exporting countries. The export share of Canada is relatively declining but the market share of Australia is relatively stable over the years [1]. The change in export share of Canada could be because of the emerging of new wheat producing and exporting countries.

The wheat agriculture has been increasing over the years, shown by its increasing on wheat production and export [1]. The number of wheat producing countries has been increasing by two times from 1960 to 2011. However, the increase in world wheat production due to new wheat producing countries might change market competitive behavior in wheat international market. The new producing countries may reduce previous major exporting countries market share. In addition this development could result in more competitive wheat market. Whether the development in wheat agriculture may reduce uncompetitive behavior of major exporting countries is still a big question. The uncompetitive behavior is not also affected by crop production but also affected by other factors such as agreement, collusive behavior, etc.

Several agreements between importing and exporting countries such as FTA agreement between Australia and China may also give an effect to uncompetitive behavior. The Australian FTA with China may strengthen the market power of Australian exporter to wheat importing countries. Thus, it may result in uncompetitive pricing strategies from Australian exporter to other wheat importing countries. The same situation also may apply to other wheat major exporting countries.

All these facts are raising a question whether the wheat exporter countries have more competitive behavior upon world wheat production increasing. Though this topic is already being discussed by policy



makers, however there are not many literatures comparing the pricing strategies between major wheat exporting countries. As far as I know the current literature in pricing strategies is more concentrated on one specific major exporting country without try to compare with other major exporting countries.

Exporter countries with market power may determine their price above the marginal cost, however this will not result to substantial losing in its market share even though the exporter countries has downward demand sloping. This raises the ability of exporter firm to generate positive economic profit in the long run. Market power of exporter country may be developed by its market share in output market, made the exporter country with big market share has the power to determine the price in the market become as price maker and other exporter country from smaller exporting countries become price follower and take the price as their baseline. The market power ability provides the ability to the exporter firm to engage in non-competitive and collusion behavior.

The purpose of this study is to measure market power of Australia and Canada exporter in world wheat market. There are two methods that are going to be used such as Pricing to Market Power (PTM) methods and the elasticity of residual demand (RDE). The PTM method is used to observe the competitiveness behavior of major exporter. The Residual demand elasticity (RDE) method employs the [2] model to measure exporter power to importing countries. This paper also will analyze whether the PTM method has a consistent result with result from RDE method.

## 2. Methods

This study uses annual data of wheat export for Canada and United Kingdom which are provided by [1] FAO (2013). The official exchange rate of importer currency against the exporter currency, GDP (gross domestic product), CPI (consumer price index) were acquired from World Bank. In addition, data related with PPI (producer price index) wheat is obtained from importer statistic center. Canada data set include 231 annual cross section time series observation from 1991-2011 for 11 wheat importing countries. Australia data set include 189 annual cross section time series observation from 1991-2011 for 9 wheat importing countries.

This paper adopt the two way fixed effect model PTM method proposed by [3] and [4] shown by:

$$\ln p_{i,t}^x = \sum \alpha_i A_i + \sum \theta_i t_i + \delta_i \ln \left( \frac{e_{i,t}^x}{CPI_{i,t}} \right) + \gamma_i \ln \left( \frac{GDP_t}{CPI_t} \right) + \beta_i Oil_t + \vartheta_i PPI_t^x \varepsilon_{i,t} \quad (1)$$

where  $\alpha_i$  is a importing effect,  $\theta_i$  represents the specific time effect,  $p_{i,t}^x$  is wheat export price in country exporter price to importing country  $i$  in period  $t$ . The parameter on exchange rate variable which represents the elasticity of the domestic currency export price with respect to the exchange rate is denoted by  $\delta_i$ .  $e_{i,t}$  is the exchange rate in units of destination market currency per unit of the exporter's currency and  $CPI_{i,t}$  is the consumer price index for importing country  $i$ .  $GDP_t$  is the gross domestic product for exporting country,  $CPI_t$  is the consumer price index for exporting country and  $\varepsilon_{i,t}$  is the random disturbance with zero mean.  $Oil_t$  is the oil price at time  $t$  and  $PPI_t^x$  is the wheat producer price index (PPI) from exporting countries.

The RDE method is estimated using the SUR method and GMM non IV. The RDE model is being developed based on [2]. The econometric model of residual demand function can be written as formula below:

$$\ln p_{m,t}^x = \theta_m + \vartheta_m \ln Q_t^m + \rho_x \sum \ln \left( \frac{e_t^m}{e_t^x} \right) + \tau_x \sum \ln PPI_t^x + \varepsilon_t \quad (2)$$

$p_{m,t}^x$  is the price of export to importing country measured in domestic currency and divide by its CPI.  $Q_t^m$  is total of wheat quantity demanded by the importer. We also use PPI of competitor which are for Canada and Australia. In this model we also try to add more new covariates such as paddy price and PPI for wheat for China and Korea as we assume that the paddy is substitute product for wheat and wheat domestic product is substitute product for wheat export product means that the new covariates is suitable

to be used as demand shifter for wheat product. During the estimation we also try to see whether if there is conflicting result between model which we add new covariates with original model without new covariate or the result still the same with better estimation precision. If  $\vartheta_i = 0$  then the demand schedule for importing countries is flat and the exporter cannot change the export price to importing by changing its quantity exported. The residual demand elasticity has downward slope if  $\vartheta_i < 0$  indicate that exporter has market power over the importer countries. [2] mention that the highest the absolute value of  $\vartheta_i$  means that the exporter has more market power over the importer as demand schedule of importer is becoming more inelastic.

### 3. Result and Analysis

Result for pricing behavior of Canada wheat exporter are presented in table 1 As can be shown in table 1 with respect to the country effect that Algeria, China, Republic of Korea and United Kingdom has a significant country effect. Canada wheat exporter amplify the exchange rate effect on local price currencies to China, Colombia, Indonesia, Italy, Japan, United Kingdom, USA and Venezuela as shown by its positive exchange rate effect. However Canada Wheat Exporter USA offset the exchange rate effect to Algeria which means they applying the LCPS to that market. Canada wheat exporters behave as a competitive supplier in Philippines. For that country we cannot reject  $\alpha_i$  and  $\delta_i$  are zero means that we have competitive market without price discrimination across countries. There is also significant effect of oil price and wheat producer price index to the price export. The high R-squared value may imply that the Canada exporter may not apply the law of one price.

**Table 1.** PTM Estimation result for Canada wheat exporter 1991-2011

Country	Fixed effect	Exchange Rate	Other Variable
Algeria	-1.152**	-0.470**	
China	1.474***	0.954***	GDP= 0.030
Colombia	-0.314	0.615***	
Indonesia	0.00009	0.505**	
Italy	0.0311	0.504*	Oil Price = -0.337***
Japan	0.120	0.769***	
Philippines	-0.018	0.336	
Republic of Korea	0.776*	0.136	PPI=1.603***
United Kingdom	1.863**	0.808***	
USA	0.617	0.598**	
Venezuela	0.066	0.451**	R <sup>2</sup> =0.9409

\*10% significant, \*\*5% significant, \*\*\*1% significant

Result for pricing behavior of Australia exporter are presented in table 2. Australian wheat exporters behave as a competitive supplier in all of his import destination such as China, Egypt, Indonesia, Japan, Malaysia, New Zealand, Philippines, Republic of Korea and Thailand. For these countries we cannot reject  $\alpha_i$  and  $\delta_i$  are zero means that we have competitive market without price discrimination across countries.

**Table 2.** PTM Estimation result for Australia wheat exporter 1991-2011

Country	Fixed effect	Exchange Rate	Other Variable
China	2.282	0.35	GDP =0.032
Egypt	-1.701	-0.531	
Indonesia	-0.279	-0.519	Oil Price=-0.124
Japan	-1.119	-0.583	
Malaysia	-1.762	-0.560	PPI= 1.019
New Zealand	-0.535	-0.224	
Philippines	-2.128	-1.237	R <sup>2</sup> =0.4059
Republic of Korea	-1.585	-0.099	
Thailand	-1.221	-0.514	

\*10% significant, \*\*5% significant, \*\*\*1% significant

The RDE is estimated using SUR and GMM non IV with the assumption that there is no endogeneity problem in the model. There are 2 model using to estimate comprising model 1 which include new covariate PPI of paddy and wheat and model 2 which not include those covariates.

**Table 3.** Coefficient estimate of variable log quantity in RDE method

Country	Method	Model with PPI Paddy and Wheat		Model without PPI Paddy and Wheat	
		China	Republic of Korea	China	Republic of Korea
Canada	SUR	-0.019	-0.007	-0.041**	-0.0202
	GMM non IV	-0.014	0.009	-0.032**	-0.013
Australia	SUR	-0.044***	-0.896	-0.023	-0.903***
	GMM non IV	-0.044***	-0.871***	-0.019	-0.876***

\*10% significant, \*\*5% significant, \*\*\*1% significant

From table 3 we may see that there is consistent result between estimated parameter of log quantity using both SUR and GMM non IV for Canada case. However there is not consistent result for Australian export to Republic of Korea using model 2. There is consistent result for Canada export as we found that Canada have market power over China importer but do not have market power over Republic of Korea importer. The parameters of log quantity for Canada exporter to China importer are shown to be significantly negative but it is not significantly different than zero for Republic of Korean importer.

Interesting result come from Australian case as when we use SUR, we found that model 1 shows Australia exporter has market power over China importer but do not have market power over Republic of Korean importer. However different result come from when we use model 2 as we found that Australia has market power over Republic of Korean importer but do not have market power over China importer. When we use GMM non IV we found that in model 1, Australia exporter has market power over both countries but in model 2 it has only market power over Republic of Korea. These results also contradict with what we found using PTM as we expect that Australia do not have market power over those two countries (see table 2).

Contradicting result between PTM model result and RDE model result is likely to be happened as similar result also found in market power of German beer industry [5]. [5] suggest that the theoretical PTM and RDE model need to be extended to consistently match the observed market solution.

In table 4 we found that in model 1, cost shifter for Canada export to China importer is statistically significant using both SUR and GMM non IV for variable; GDP, time trend, both importer currency to

competitor, both PPI competitor and PPI wheat China. Similar result also occur in Republic of Korean import, the difference is only it has not significant result in PPI wheat Korea variable using SUR model but the other cost shifter variable is significant. Not significant result found in PPI paddy Korean variable using GMM non IV model but the other cost shifter variable is statistically significant. Positive significant result of PPI competitor means that if Australia reduce the cost then Canada must decrease the export price. Positive significant result on PPI on exchange rate of china currency to Australia, following by positive PPI Australia imply that Australia plays important role for restricting Canada market power to China and Korean market.

**Table 4.** Estimation of RDE for Canada using SUR and GMM IV

Variable	SUR		GMM non IV	
	China	Republic of Korea	China	Republic of Korea
LnQ	-0.019	-0.007	-0.014	0.009
LnGDP	0.684**	-1.307**	0.718***	-1.204***
Time trend	-0.067**	0.039**	-0.064***	0.038***
ln (Importer currency/Australia)	1.361***	0.428*	1.454***	0.409*
ln PPI Australia	0.989***	0.570***	1.058***	0.616***
ln PPI Paddy	0.082	0.701***	0.044	0.675***
ln PPI Wheat	-0.528***	-0.455	-0.542***	-0.468
Constant	135.651	-66.356**	129.508***	-64.57***
Breusch-Pagan Statistic	5.095, Pr=0.024		2,216 Pr=0.1366	

According to table 5 we found statistically significant result in model 1 for Australia using SUR method to all cost shifter variables in China import market. However in Korean import market only GDP, PPI paddy Korean and PPI Wheat Korean is statistically significant. Using GMM no IV method to model 1 in China import market give us statistically significant result to all cost shifter variable except GDP. Table 5 gives different result to Korean import market using GMM non IV on model 1 as we have more significant variable compare to estimation result using SUR. According to SUR and GMM non IV estimation result we found that Canada has restrictive power to influence Australia market power in China and Korean Market.

**Table 5.** Estimation of RDE for Australia using SUR and GMM IV

Variable	SUR		GMM IV	
	China	Republic of Korea	China	Republic of Korea
LnQ	-0.044***	-0.896	-0.044***	-0.871***
LnGDP	0.184	-3.565*	0.103	-2.959***
Time trend	-0.059*	-0.0474	-0.053***	-0.074***
ln (Importer currency/Canada)	2.791***	0.0378	2.754***	0.434
ln PPI Canada	1.234***	0.009	1.222***	0.018
ln PPI Paddy	0.235***	1.393***	0.269***	1.419***
ln PPI Wheat	-0.278*	4.379***	-0.330**	4.411***
Constant	121.442**	129.982	109.418***	175.654***
Breusch-Pagan Statistic	4.512, Prob = 0.0337		4.812, Prob=0.0283	

#### 4. Conclusion

This paper tries to identify and examined the degree of market power on wheat international market by 2 major exporting countries comprising Canada and Australia. Canada wheat exporter amplify the exchange rate effect on local price currencies to China, Colombia, Indonesia, Italy, Japan, United Kingdom, USA and Venezuela. However Canada Wheat Exporter offset the exchange rate effect to Algeria. Surprisingly the PTM method shows Australian wheat exporters behave as a competitive supplier in his entire import destination. I assume this behavior is due to its smaller market share in world wheat market compare to USA and Canada.

The RDE result shows consistent result for Canada export as we found that Canada have market power over China importer but do not have market power over Republic of Korea importer. Not consistent result found in Australian export using SUR model as we found that model 1 shows Australia exporter has market power over China importer but do not have market power over Republic of Korean importer. However different result come from when we use model 2 as we found that Australia has market power over Republic of Korean importer but do not have market power over China importer. The GMM non IV estimation shows that in model 1, Australia exporter has market power over both countries but in model 3 its only has market power over Republic of Korea. This result also contradict with what we found using PTM as we expect that Australia do not have market power over those two countries. The Contradict result between PTM and RDE method suggest that we need to extend the theoretical model of both model by expand its economic and econometric model to have consistent expected result theoretically and empirically.

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