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Price Non-Stationarity and Import Demand for Milk in China

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Background

The consumption of milk in China has been increasing over past two decades. In 2011 the per capita milk consumption in China was 32.4 kg; which is an increase of 15.71% compared to 2008.

China does not produce enough milk domestically to meet increasing demand and consequently, large volume of milk is imported every year. This situation exacerbated due to food safety issue associated with raw milk in China in 2008, and as a result people's preference for imported milk grew even faster in recent years. United Nations reported that China imported $484 million worth of milk in 2011. Annual milk imports in China, on average grew by about 27% from 1992 to 2011.

We could find only very few studies investigating milk market in China. International competitiveness of China milk products were explored by Qiao (2003). Liu (2007) used a spatial equilibrium model to demonstrate the effect of the trade liberalization on dairy products trade in China. That being said, it is clear that China milk market is yet to be investigated comprehensively.

In this study, we explore import demand for milk in China using demand system approach modeled in error correction form. Recent studies in non-stationarity and cointegration opened a new approach for introducing dynamics in demand systems, which has made the almost ideal demand system (AIDS) of Deaton and Muellbauer (1980) in error correction form very attractive (Gil, *et al.*, 2004). Although, other models such as Armington's model and Rotterdam model have been used in the past to study import demand for various products (Babula, 1987; Seale *et al.*, 1992, among others), AIDS model is used more frequently due to its ease in estimation and flexibility in testing theoretical restrictions (homogeneity, symmetry and negativity). In this study, we go another step forward and estimate quadratic almost ideal demand system (QUAIDS) of Banks *et al.*, (1997) in error correction form, which nests the AIDS model and introduce more flexibility through non-linear Engle curves. In the past, Engle and Granger (1987) two-step procedure has been used to estimate cointegrated demand systems, although this approach has been criticized due to various estimation issues (Gil *et al.*, 2004). Recently, Pesaran and Shin (1999) have used Johansen (1988) approach to specify, estimate and test theoretical restrictions on cointegrated demand systems (Gil *et al.*, 2004).

In this study we use QUAIDS model in error correction form to investigate China milk import demand.

Objectives

(1) to analyze stochastic properties underlying data i.e. to determine the stationarity property of each series;

(2) to develop a vector error correction model (VECM) to test price homogeneity in the cointegration space (Sanjuan and Gil, 2001);

(3) to estimate QUAIDS model where prices are expressed in relative prices (assuming price homogeneity in cointegration space holds);

(4) to calculate import demand elasticities;

(5) to determine the long-run speed of adjustment from disequilibrium, gleaned from long-run matrix of coefficients of VECM.

Data

The data consists of annual import volume of milk (in pounds) to China from 1992 through 2011. Australia, New Zealand, United States and Rest of the World are considered as four major milk exporting regions to China. Likewise total value of imports (in U.S. dollars) from each region is collected for the same period. The data are collected from UN COMTRADE database. Import prices for each region are calculated taking the ratio of import value to quantities (this unit values are considered as proxies for prices).

Methodology

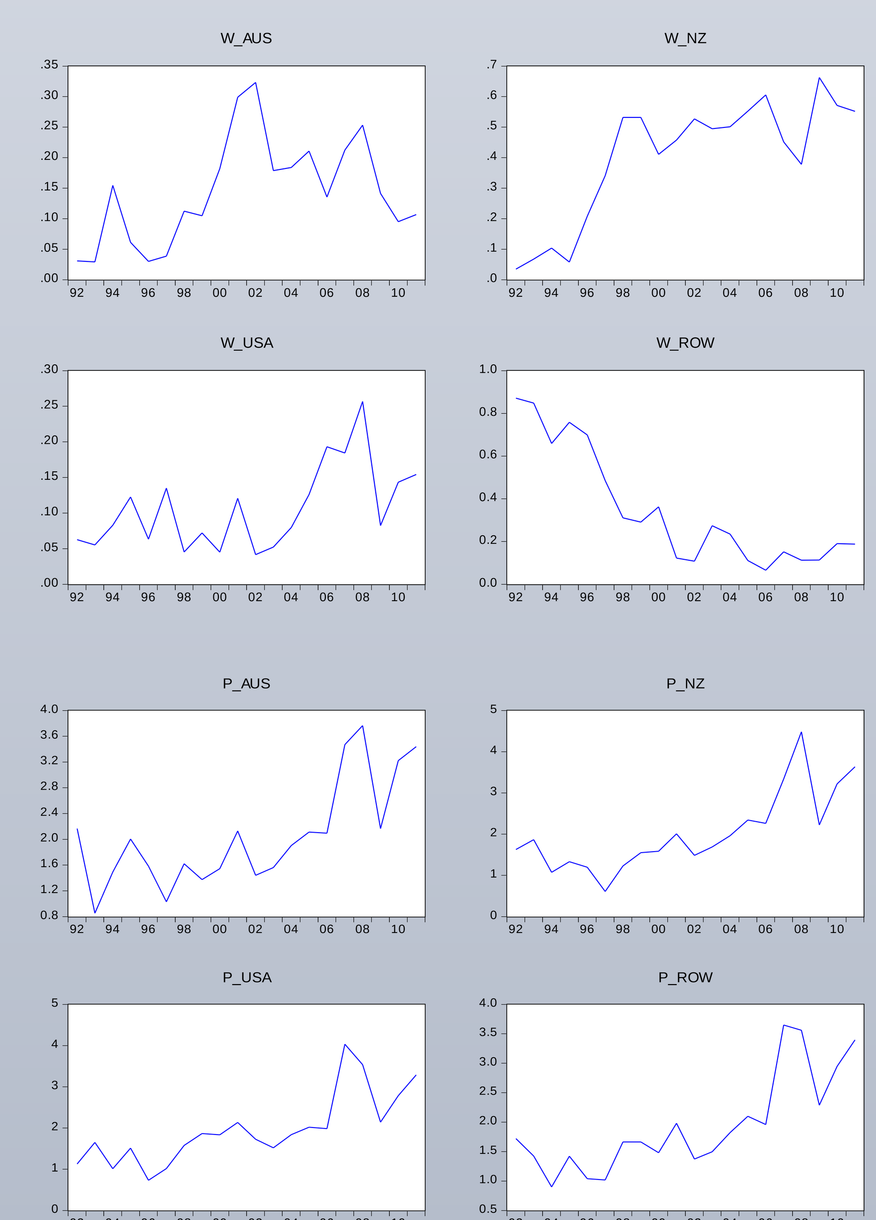
First, we test for stochastic properties of data to identify stationarity property of each series using Augmented Dickey-Fuller test (Dickey and Fuller, 1979).

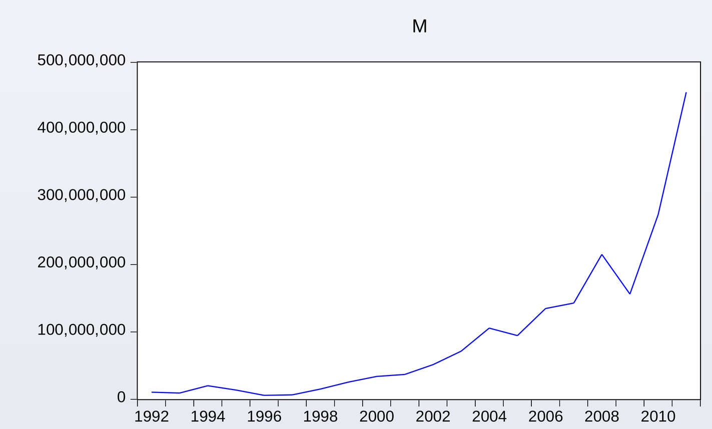
Once non-stationarity is identified, then we test for price homogeneity in the cointegration space modeled through VECM.

Then QUAIDS model is estimated in relative prices and import demand elasticities are calculated. In estimating QUAIDS model, it is assumed that imports of milk is separable from other imports as well as demand for milk is separable from that coming from domestic production (Lin et al., 1991; Honma, 1993; Agcaoili-Sombilla and Rosegrant, 1994; Yang and Koo, 1994).

Additionally, the long-run speed of adjustment from disequilibrium is estimated using the long-run matrix of VECM.

Results and Discussion





Null Hypothesis: P_AUS has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.120806	0.9321
Test critical values:	1% level	-3.886751	
	5% level	-3.052169	
	10% level	-2.666593	

Null Hypothesis: P_NZ has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.055772	0.9162
Test critical values:	1% level	-2.708094	
	5% level	-1.962813	
	10% level	-1.606129	

Null Hypothesis: P_USA has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.726987	0.8623
Test critical values:	1% level	-2.708094	
	5% level	-1.962813	
	10% level	-1.606129	

Null Hypothesis: P_ROW has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.335025	0.9473
Test critical values:	1% level	-2.708094	
	5% level	-1.962813	
	10% level	-1.606129	

System: AIDS
Estimation Method: Seemingly Unrelated Regression
Date: 06/02/13 Time: 06:21
Sample: 1993 2011
Included observations: 20
Total system (balanced) observations 57
Iterate coefficients after one-step weighting matrix
Convergence achieved after: 1 weight matrix, 15 total coef iterations

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.114616	0.024453	4.687259	0.0000
C(2)	-0.006841	0.051601	-0.132570	0.8952
C(3)	0.034128	0.046532	0.733439	0.4674
C(5)	1.76E-07	2.74E-07	0.641716	0.5245
C(16)	0.491647	0.193424	2.541803	0.0148
C(6)	0.156122	0.051134	3.053186	0.0039
C(7)	0.003919	0.050323	0.077871	0.9383
C(8)	0.008351	0.045313	0.184287	0.8547
C(10)	-5.04E-07	2.70E-07	-1.868185	0.0687
C(17)	0.735790	0.149434	4.923862	0.0000
C(11)	0.572443	0.192537	2.973160	0.0049
C(12)	0.028209	0.075815	0.372075	0.7117
C(13)	-0.015156	0.070344	-0.215459	0.8305
C(15)	-2.45E-07	4.17E-07	-0.588248	0.5595
C(18)	0.852400	0.099937	8.529386	0.0000
Determinant residual covariance		6.18E-08		

Equation: W_USA = C(1) + C(2)*LNP_USA + C(3)*LNP_AUS + (0-C(2)-C(3)) *LNP_NZ + C(5)*X+ [AR(1)=C(16)]
Observations: 19

R-squared	0.138878	Mean dependent var	0.108208
Adjusted R-squared	-0.107157	S.D. dependent var	0.059447
S.E. of regression	0.062551	Sum squared resid	0.054778
Durbin-Watson stat	2.543017		

Equation: W_AUS = C(6) + C(7)*LNP_USA + C(8)*LNP_AUS + (0-C(7)-C(8)) *LNP_NZ + C(10)*X+ [AR(1)=C(17)]
Observations: 19

R-squared	0.513950	Mean dependent var	0.150107
Adjusted R-squared	0.375079	S.D. dependent var	0.085475
S.E. of regression	0.067569	Sum squared resid	0.063919
Durbin-Watson stat	1.790997		

Equation: W_NZ = C(11) + C(12)*LNP_USA + C(13)*LNP_AUS + (0-C(12) -C(13))*LNP_NZ + C(15)*X +[AR(1)=C(18)]
Observations: 19

R-squared	0.707613	Mean dependent var	0.421375
Adjusted R-squared	0.624074	S.D. dependent var	0.184202
S.E. of regression	0.112939	Sum squared resid	0.178574
Durbin-Watson stat	2.166961		

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