SPATIAL INTEGRATION AND PRICE TRANSMISSION OF CHICKEN MARKETS IN CENTRAL JAVA, INDONESIA

PANJI DEORANTO

INTRODUCTION

Chicken in Indonesia

(Renstra, Annual Report 2007)

- Acceptable price, easy to access, high protein
- Highest meat consumption : 56%
- Estimated national demand : 3-5 million/day

Table 1. Consumption of Chicken in South East Asia in 2008

Country	Chicken Consumption per Capita (Kg)
Brunei	40
Malaysia	32
Thailand	10
Philippine	8
Indonesia	6

Source: Pefindo, 2009

INTRODUCTION

Broiler in Indonesia

(Renstra, Annual Report 2007)

- Total population: broiler 69%, native 21%, layer 7%.
- Most of broiler production: West Java (47 %),East Java(18 %), Central Java(7 %),North Sumatera(5 %).
- Broiler meat consumption : 824,000 tons
- Per capita consumption: 3.7 kg/capita/year

Table 2. Production and Consumption of Broiler and Chicken Meat, 2004-2006

Year	Production (000)ton		Consumption (kg/capita)	
	Native	Broiler	Native	Broiler
2004	269.47	813.16	0.69	2.08
2005	274.02	749.35	0.69	1.90
2006	293.44	918.25	0.73	2.30

Source: Central agency of Statistic

Table 3. Export and Import of Chicken Meat, Indonesia, 2004-2008

YEAR	EXPORT		IMPORT	
	Volume (ton)	Value US $ million	Volume (ton)	Value US $ million
2004	100.9	0.16	1,313.9	1.03
2005	20.1	0.09	3,978.4	3.80
2006	25.0	0.04	3,468.4	4,7
2007	0.0	0.0	4,675.2	7.1
2008	0.0	0.0	7,495.1	11.8

Source: Directorate General of Livestock Production of Ministry Agriculture, 2009

INTRODUCTION

- The disability of a market to perform and to develop its functions effectively and efficiently depends on the ease with which price changes and responses are transmitted spatially and temporally.
- Two different markets connected in commercial relations are shown to be spatially integrated when the difference in prices is influenced by each other.

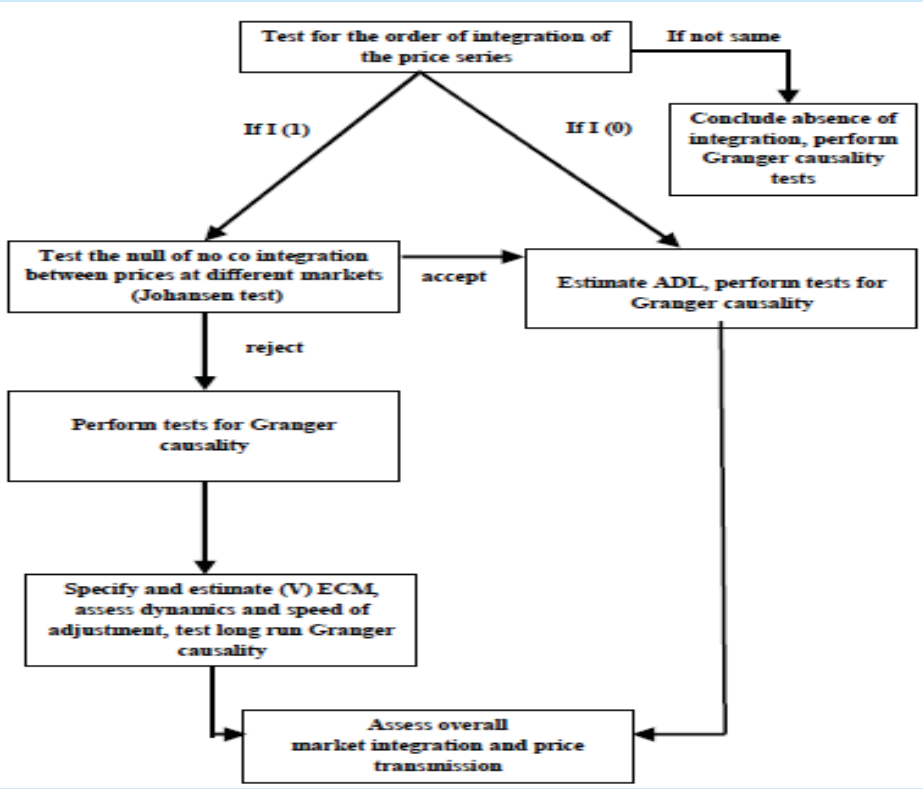
INTRODUCTION

- The introduction of imported products into the local markets affected the competitiveness in the prices of local products to decline.
- The government, in its effort to protect local price, has not been fully effective since the value of the imposed tariff is still low.
- This condition will result in a fluctuating price along market chains and could turn worst in time unless the causes could be identified and correctly solved.
- Prices can serve as effective indicators only if markets are perfectly integrated and are spatially price efficient.

Objectives

- The general objective of the study is to analyze the extent of spatial integration of chicken markets in Central Java Province, Indonesia. Specifically, it aims to:
- provide an overview of the trends in chicken population, chicken production and consumption, and prices at the farm, wholesale and retail levels;
- determine the market integration relative to pricing behavior among spatially differentiated chicken markets;
- determine the factors that effect chicken retail prices; and
- propose policy directions to enhance market integration in the chicken market.

The conceptual framework of study on market integration and price transmission



Methodology

- Various Data for Overview of Chicken in Central Java
- Prices Data in Central Java

✓Farm-Wholesale-Retail for Broiler and Native

✓Monthly time series data:2007-2009

✓Monthly CPI : 2007-2009

- Prices Data in 6 Selected Districts

✓Farm-Wholesale-Retail for Broiler

✓Monthly time series data:2004-2009

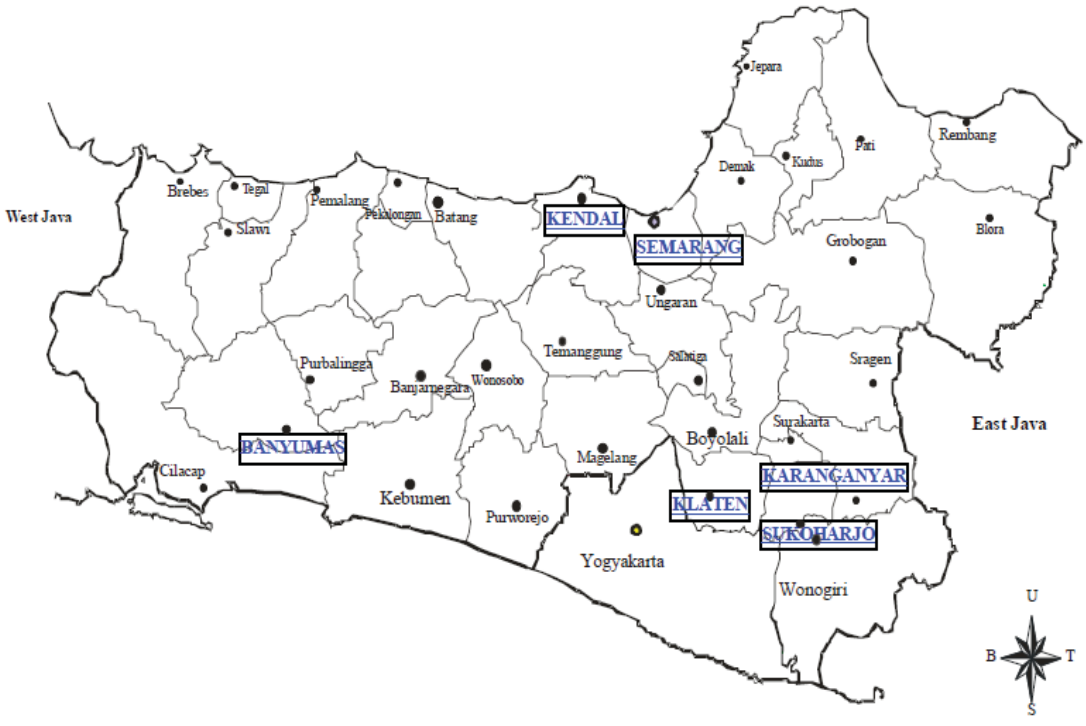


Figure 6. Map of Central Java Province, Indonesia

Methodology

- Price Volatility
- Augmented Dickey Fuller test was employed to check the stationary levels of all the time series using the Augmented Dickey-Fuller test.
- Augmented Dickey Fuller test was used to test the first differences of the variables which turned out to be stationary.
- Pearson correlation was employed to measure the relationship between two or more random experimental data values.
- Bi-variety co-integration test was used to test whether two or more time series were co-integrated or not.
- Granger- Causality test was applied to measure the causal relationship between the data values.

Methodology

- Econometric Model :
- The imposition of import tariff for QLC imposition of import tariff in Semarang as central market in Central Java. The regression model, adopted from Setiadi (2010).

$$PR_t = \alpha + PR_{t-1} + PW + PW_{t-1} + PF + PF_{t-1} + PF_{t-2} + D$$

where:

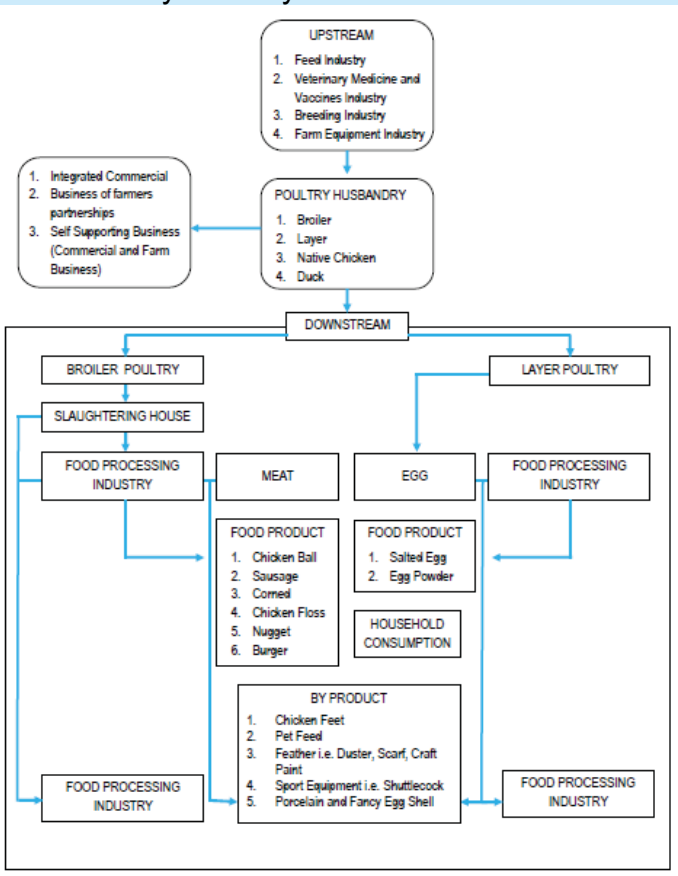
PR : Retail price of chicken (Rp/kg)
α : Constant
PR_{t-1} : Retail price of chicken (Rp/kg) during the previous month
PW : Wholesale price of chicken (Rp/kg)
PW_{t-1} : Wholesale price of chicken (Rp/kg) during the previous month
PF : Farm price of chicken (Rp/kg live weight)
PF_{t-1} : Farm price of chicken (Rp/kg live weight) during the previous month
PF_{t-2} : Farm price of chicken (Rp/kg live weight) lagged two months
D : Dummy variable:
0 = before (2004 – 2006)
1 = during imposition of the import tariff (2007 – 2009)

$$PR = \acute{\alpha} + PW + PF + RD$$

where:

PR	: Retail price of chicken (Rp/kg)
α	: Constant
PW	: Wholesale price of chicken (Rp/kg)
PF	: Farm price of chicken (Rp/kg live weight)
RD	: Road distance (km)

Poultry Industry Tree in Indonesia



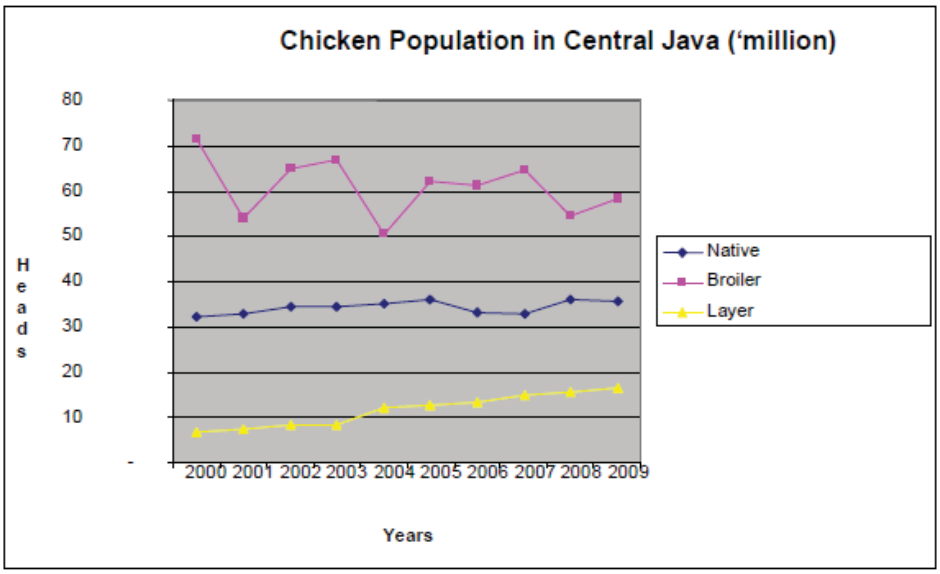


Figure 8. Chicken Population, Central Java, 2000-2009

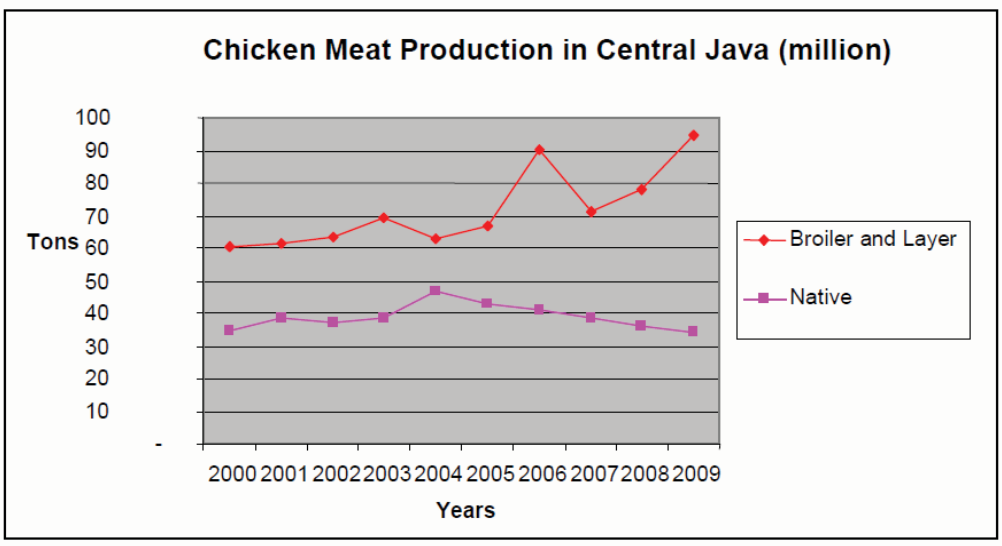


Figure 10. Chicken Meat Production, Central Java, 2000-2009

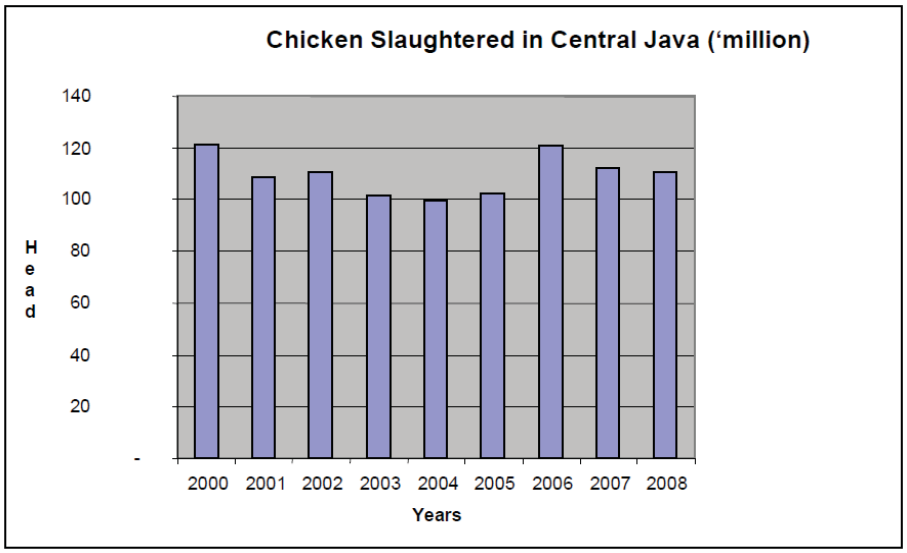


Figure 14. Chicken Slaughtered, Central Java, 2000-2008

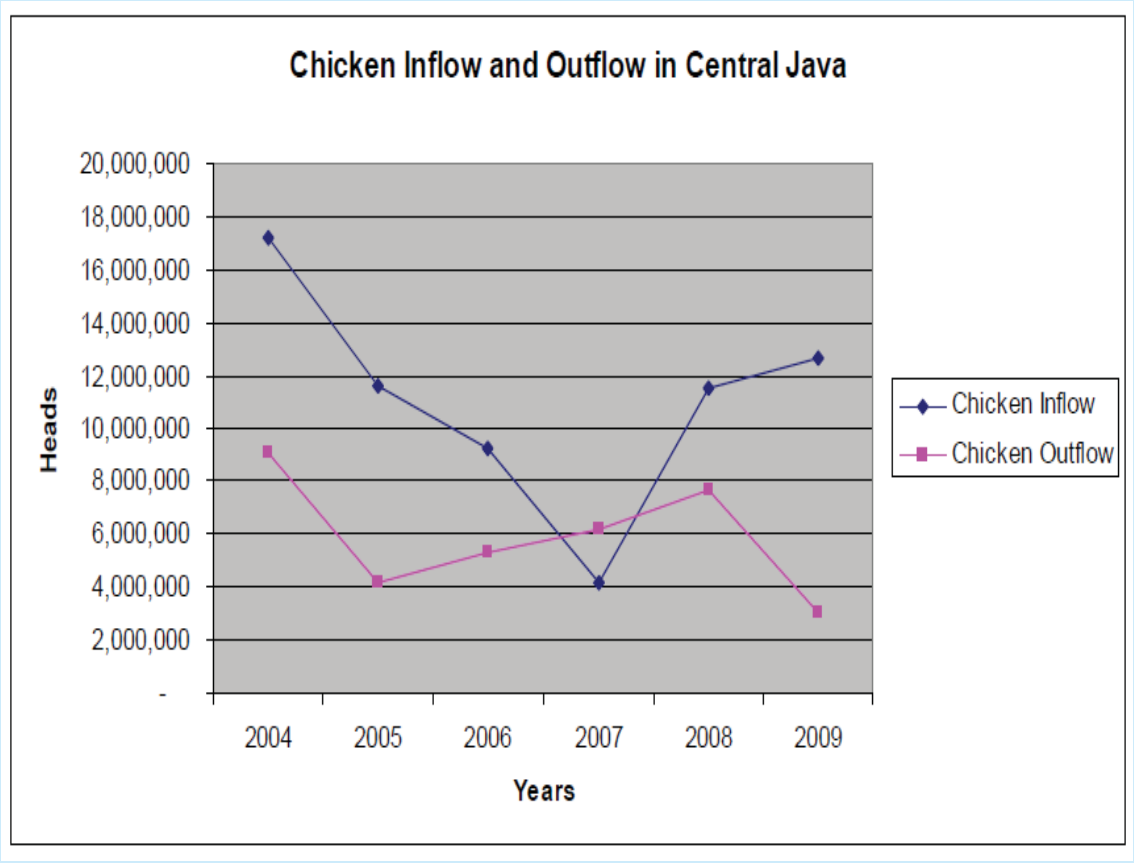


Table 5 Average Chicken Farm Price and Price Volatility, Central Java, 2007-2009

PRICE	*MINIMUM*	*MAXIMUM*	*AVERAGE PRICE*	*STD. DEVIATION*	*CV %*
	Rp/kg				
Farm Price	6,667	14,167	10,830	2,008.2	18.54
Wholesale Price	7,700	14,367	11,581	1,951.4	16.85
Retail Price	8,344	15,427	12,470	1,914.3	15.35

Source: Fieldwork, 2010

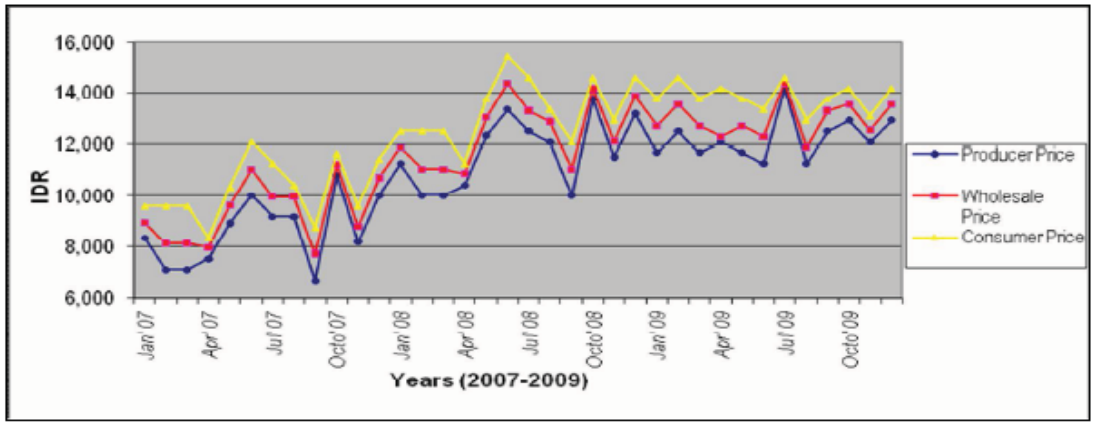


Figure 17. Broiler Price Series, Central Java, 2007-2009 (IDR is Indonesian currency)

Table 6. Average Farm Chicken Price and Price Volatility in Central Java, 2007-2009

DISTRICT/MARKET	*MINIMUM*	*MAXIMUM*	*AVERAGE PRICE*	*STD. DEVIATION*	*CV %*
	Rp/kg				
Semarang	6,900	14,500	9,738	1,996.37	20.50
Kendal	5,500	17,500	9,526	2,880.24	30.24
Banyumas	5,500	17,200	9,337	3,056.45	32.73
Klaten	6,000	16,700	9,770	2,562.73	26.23
Sukoharjo	5,500	15,000	9,898	2,251.20	22.74
Karang anyar	3,850	15,000	9,795	2,693.51	27.50

Table 11. Average Wholesale Chicken Price and Price Volatility in Central Java, 2007-2009

DISTRICT/MARKET	*MINIMUM*	*MAXIMUM*	*AVERAGE PRICE*	*STD. DEVIATION*	*CV %*
	Rp/kg				
Semarang	6,950	14,555	9,808	1,988.05	20.27
Kendal	5,545	17,555	9,597	2,872.07	29.93
Banyumas	5,525	17,245	9,408	3,048.51	32.40
Klaten	6,100	16,745	9,841	2,553.21	25.94
Sukoharjo	5,550	15,050	9,969	2,242.10	22.49
Karang anyar	3,900	15,045	9,866	2,688.93	27.25

Table 17. Average Retail Chicken Price and Price Volatility in Central Java, 2007-2009 RETAIL

District/market	*MINIMUM*	*MAXIMUM*	*AVERAGE PRICE*	*STD. DEVIATION*	*CV %*
	Rp/kg				
Semarang	8,000	20,300	12,486	3,459.16	27.70
Kendal	7,000	21,000	12,107	3,613.74	29.85
Banyumas	5,800	21,000	12,379	3,850.51	31.10
Klaten	5,000	19,000	12,145	3,019.72	24.86
Sukoharjo	7,000	18,560	11,792	3,300.39	27.99
Karang anyar	4,200	19,000	11,434	3,480.16	30.44

Table 8. Augmented Dickey Fuller test of prices at farm level, Central Java, 2004-2009.

NO.	MARKET DISTRICT	LEVEL	FIRST DIFFERENCE
1	Semarang	-1.70	-9.08**
2	Karanganyar	-3.11	-7.97**
3	Banyumas	-1.47	-9.41**
4	Kendal	-1.82	-9.64**
5	Klaten	-2.30	-9.57**
6	Sukoharjo	-2.43	-9.91**

Notes: ** : Significant at 5 levels.

Table 14. Augmented Dickey Fuller test of broiler price series at wholesale level, Central Java, 2004-2009.

NO.	MARKET DISTRICT	LEVEL	FIRST DIFFERENCES
1	Semarang	-1.700	-9.167*
2	Karanganyar	-3.137	-8.021*
3	Banyumas	-1.470	-9.450*
4	Kendal	-1.830	-9.710*
5	Klaten	-2.320	-9.670*
6	Sukoharjo	-2.44	-9.970*

Notes : * : Significant at 10% level.

Table 20. Augmented Dickey Fuller test for broiler price series at retail level, Central Java, 2004-2009.

NO.	MARKET DISTRICT	LEVEL	FIRST DIFFERENCES
1	Semarang	-1.230	-8.900*
2	Karanganyar	-2.760	-8.510*
3	Banyumas	-2.290	-10.380*
4	Kendal	-1.890	-9.190*
5	Klaten	-1.640	-14.200*
6	Sukoharjo	-1.160	-9.090*

Notes: * : Significant at 10% levels.

Table 7. Pearson correlation between broiler price series at farm level, Central Java, 2004-2009.

MARKET	SEMARANG	KARANGANYAR	BANYUMAS	KENDAL	KLATEN	SUKOHARJO
SEMARANG	1.00					
KARANGANYAR	0.67	1.00				
BANYUMAS	0.79	0.75	1.00			
KENDAL	0.84	0.72	0.91	1.00		
KLATEN	0.86	0.65	0.90	0.87	1.00	
SUKOHARJO	0.79	0.85	0.82	0.84	0.77	1.00

Source : Fieldwork, 2010

Table 13. Pearson correlation between broiler price series at wholesale level, Central Java, 2004-2009.

MARKET	SEMARANG	KARANGANYAR	BANYUMAS	KENDAL	KLATEN	SUKOHARJO
SEMARANG	1.00					
KARANGANYAR	0.66	1.00				
BANYUMAS	0.79	0.75	1.00			
KENDAL	0.83	0.71	0.91	1.00		
KLATEN	0.86	0.65	0.90	0.87	1.00	
SUKOHARJO	0.79	0.85	0.82	0.84	0.77	1.00

Source : Fieldwork, 2010

Table 19. Pearson correlation between broiler price series at consumer level, Central Java, 2004-2009.

MARKET	SEMARANG	KARANGANYAR	BANYUMAS	KENDAL	KLATEN	SUKOHARJO
SEMARANG	1.00					
KARANGANYAR	0.73	1.00				
BANYUMAS	0.86	0.81	1.00			
KENDAL	0.80	0.68	0.81	1.00		
KLATEN	0.64	0.60	0.68	0.73	1.00	
SUKOHARJO	0.75	0.79	0.78	0.68	0.62	1.00

Source : Fieldwork, 2010

Summary Bi-variate co-integration test at farm, wholw sale and retail level

NO	MARKET PAIR	TRACE TEST		
		FARM	WHOLESALE	RETAIL
1	Semarang-Karanganyar			
	none	19.10*	19.11*	19.21*
	at most 1	1.91	1.877	0.770
2	Banyumas-Karanganyar			
	none	18.10*	18.197*	19.70*
	at most 1	0.76	0.736	2.06
3	Banyumas-Kendal			
	none	10.90	10.864	12.99
	at most 1	0.89	0.860	3.052
4	Kendal-Klaten			
	none	22.44*	22.338*	16.63*
	at most 1	0.96	0.905	0.64
5	Klaten-Sukoharjo			
	none	23.33**	23.090*	8.56
	at most 1	2.45	2.355	0.77
6	Semarang-Klaten			
	none	7.13	7.033	12.48
	at most 1	2.13	2.040	0.49
7	Banyumas-Sukoharjo			
	none	11.58	11.410	14.98*
	at most 1	0.72	0.708	1.52
8	Semarang-Kendal			
	none	9.78	9.76	11.003
	at most 1	1.47	1.18	1.12
9	Kendal-Sukoharjo			
	none	10.99	10.876	8.39
	at most 1	0.71	0.707	0.76

Notes: **, *: Significant at 5% and 10% levels, respectively.

Tabbel 9. LOP Impostition on farm price

COINTEGRATING VECTOR	LOP IMPOSITION
1	Semarang=Karanganyar+c1
2	Banyumas=Karanganyar+c2
3	Kendal=klaten+c3
4	Klaten=Sukoharjo+c4

Table 15. Lop imposition on wholesale

COINTEGRATING VECTOR	LOP IMPOSITION
1	Semarang=Karanganyar+c1
2	Banyumas=Karanganyar+c2
3	Kendal=Klaten+c3
4	Klaten=Sukoharjo+c4

Table 20. LOP Imposition on consumer price

COINTEGRATING VECTOR	LOP IMPOSITION
1	Semarang=Karanganyar+c1
2	Banyumas=Karanganyar+c2
3	Kendal=Klaten+c3
4	Banyumas=Sukoharjo+c4

Summary Granger- Causality test at farm, wholesale and retail level

NO	MARKET PAIR	TYPE		
		FARM	WHOLESALE	RETAIL
1	Karanganyar-Semarang	No Granger Causality	No Granger Causality	Unidirectional
	Semarang-Karanganyar	Unidirectional	Unidirectional	No Granger Causality
2	Karanganyar-Banyumas	No Granger Causality	No Granger Causality	No Granger Causality
	Banyumas-Karanganyar	Unidirectional	Unidirectional	No Granger Causality
3	Kendal-Banyumas	No Granger Causality	No Granger Causality	No Granger Causality
	Banyumas-Kendal	No Granger Causality	No Granger Causality	No Granger Causality
4	Klaten-Kendal	No Granger Causality	No Granger Causality	No Granger Causality
	Kendal-Klaten	Unidirectional	Unidirectional	Unidirectional
5	Sukoharjo-Klaten	No Granger Causality	Unidirectional	No Granger Causality
	Klaten-Sukoharjo	No Granger Causality	No Granger Causality	No Granger Causality
6	Klaten-Semarang	No Granger Causality	No Granger Causality	No Granger Causality
	Semarang-Klaten	Unidirectional	Unidirectional	Unidirectional
7	Sukoharjo-Banyumas	No Granger Causality	No Granger Causality	Unidirectional
	Banyumas -Sukoharjo	Unidirectional	Unidirectional	No Granger Causality
8	Kendal-Semarang	No Granger Causality	No Granger Causality	No Granger Causality
	Semarang-Kendal	No Granger Causality	No Granger Causality	No Granger Causality
9	Sukoharjo-Kendal	No Granger Causality	No Granger Causality	No Granger Causality
	Kendal-Sukoharjo	No Granger Causality	No Granger Causality	No Granger Causality

Table 25. Result of the t-test analysis on the effect of the tariff policies in Semarang, Central Java 2004-2009

PERIOD	NOMINAL RETAIL PRICE (Rp/kg)	REAL RETAIL PRICE
Before imposition of Import Tariff	10,290	8,155
After imposition of Import Tariff	14,682	11,625
Difference	4,392***	3,470***

*** Significant at 1% probability level

Table 26. Result of the t-test analysis on the production of chicken before and after the import tariff policy, Central Java, 2004-2009

PERIOD	PRODUCTION (m ton)	GROWTH (%)
Before imposition of Import Tariff	72.7	
After imposition of Import Tariff	74.7	2.75
Difference	2.0ns	

ns: Not Significant

Table 27. Result of the t-test analysis on the demand of chicken before and after the import tariff policy, Central Java, 2004-2009

PERIOD	DEMAND (000 Heads)	GROWTH (%)
Before imposition of Import Tariff	21,431	
After imposition of Import Tariff	20,141	-6.02
Difference	-1,290*	

* Significant at 10% probability level

Table 28. Results of regression analysis on the retail price in the Central Market (Semarang), Central Java, 2004-2009

VARIABLE	COEFFICIENT	S.E
Dependent Variable	Retail Price (PRT)	
Constant	957.184	932.02
PRt-1	0.661***	0.11
PW	0.026	0.23
PWt-1	0.009	0.14
PF	0.190	0.27
PFt-1	0.015	0.11
PFt-2	0.041	0.13
Dummy (Import Tariff)	746.698*	408.93
R2 0.80		

*** Significant at 1% probability level

* Significant at 10% probability level

Table 29. Road Distance among market pairs, Central Java, 2004-2009.

MARKET	SEMARANG	KARANGANYAR	BANYUMAS	KENDAL	KLATEN	SUKOHARJO
SEMARANG	0					
KARANGANYAR	115	0				
BANYUMAS	196	106	0			
KENDAL	26	149	175	0		
KLATEN	113	49	97	142	0	
SUKOHARJO	113	24	104	190	47	0

Source: Fieldwork, 2010

Table 30. Results of the regression analysis showing the effect of road infrastructure on the retail price, Central Java, 2004-2009

VARIABLE	COEFFICIENT	S.E
Dependent Variable	Retail Price (PRT)	
Constant	2820.105***	581.46
PW	0.247*	2.94
PF	0.650	2.93
Road Distance (km)	3.851**	1.86
R^2 0.47		

*** Significant at 1% probability level
** Significant at 5% probability level
* Significant at 10% probability level

Conclusion

- Prices for both broiler and native chickens in Central Java were increasing especially during religious activities, Idul fitri, Natal (Christmas day) as well as New Year's Eve.
- Prices of broiler at the farm level fluctuated more than wholesale and retail levels as shown by the coefficient of variation (CV).
- The farm price variations can be explained by the factors that affect production considering that chicken is a biological commodity. Wholesale and retail market prices had lower values of the CV, indicating that the prices are more stable than at the farm level.

- Augmented Dickey Fuller (ADF) test results show that there was sufficient evidence to accept the null hypothesis of non-stationarity of the chicken price in all market locations at farm and wholesale levels. It means that prices are integrated at process I(0) at the level. However, differencing all prices at the first level resulted in a stationary process.
- Pearson correlation test showed that there was strong correlation between markets. At farm and wholesale levels, the highest values were observed between Banyumas-Kendal, while at the retail level it was observed between Banyumas-Semarang. At all market levels, the lowest value was observed between Klaten-Karanganyar. The road distance between each market pairs and road infrastructure condition strongly influenced correlation levels between market pairs.

- Among the 18 chicken market pairs, there were 13 pairs where the markets had no Granger Causality at the farm level, 12 and 14 pairs at wholesale and retail levels, respectively showing no Ganger Causality. This condition shows that a price change in one market was not caused by the price change in the other market and vice versa.
- Unidirectional relations were, however, found in the market pairs of Karanganyar-Semarang, Kendal-Klaten, Semarang-Klaten and Sukoharjo-Banyumas, which means that price in one market influenced the other market pairs otherwise other market pairs could be influenced.

- The effect of the imposition of import tariff was found significant in increasing chicken prices at the retail level at 1% probability level. Before the imposition of the import tariff policy, the retail price of chicken was 10,290 Rp/kg. This, however, increased to 14,682 Rp/kg after the imposition of the tariff. This policy also encouraged chicken production by about 2.75% but was found insignificant. The policy also had a negative impact on consumption as it increased retail prices.
- The result of regression analysis also showed significant effect of the import tariff policy (as dummy variable) on chicken price at retail level. The road distance has also a significant positive influence on chicken price at retail level. This means that the longer distance between market pairs, the price at retail level tends to go higher.

- In order to achieve greater market integration, the construction of more asphalted roads as well as repair of damaged ones should be given priority for faster delivery of chicken from the farms to the markets. The conversion of district roads to provincial roads will give more access to a much greater number and type of transportation that can pass through since district roads are narrow and are limited only to smaller types of vehicles.

RECOMMENDATIONS

- **Monitor prices in the chicken markets especially at the farm level.** Proper monitoring on the part of the government can provide indicator whenever price volatility exceeds tolerable levels. Then, government can institute policies that can possibly reduce price volatility.
- **Faster and efficient dissemination of information to increase integrations across markets and transmit prices efficiently across markets.** The government should give priority in developing media for market information for fast and efficient dissemination to all stakeholders.
- **Building and improving road infrastructures, especially in the rural areas, for better linkage between markets so that chickens are transported effectively to other market.** Priority of constructing asphalted roads should be considered with the existing gravel and earth roads converted into asphalted roads.
- **Increase in import tariff to be considered carefully by the government as it affects retail prices and consumption.** Although using the import tariff gives protection to domestic producers, the level should be more acceptable to all stakeholders.

I AM GONNA MISS YOU

I AM SURE, ONE DAY, WE WILL MEET AGAIN