Can Vietnamese upland farmers profit from high world market prices?
A price transmission analysis

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1   Introduction

World market prices of many agricultural commodities have been subject to vast fluctuations in recent years. The FAO food price index reached 213.5 in June 2008 and in January 2011 a new all time high of 231. Cereal prices in particular soared. The FAO cereal price index more than doubled in comparison with 2006, reaching a value of 274.3 in April 2008 and 245 in January 2011 (FAO, 2011). In general net food producers have been found to profit from such a trend, whilst net food consumers are disadvantaged (see e.g. IVANIC and MARTIN, 2006). However, the issue is more complex. The key question which needs to be answered is how prices transmit from the world market level to the rural markets as this is the precondition for shocks to affect rural households in a positive or negative way. This again depends to a large extend on the trade policy measures which are in place (e.g. tariffs, quotas, export subsidies) and the market structure. Thus, conclusions on how word market prices affect rural households can only be drawn for a specific country or region (WINTERS, 2002).

This study focuses on Viet Nam and here the mountainous northern region, where in the last years maize cropping has become the predominant source of income for rural households.

The further study is structured as follows: Section 2 describes the development of maize production and consumption over the last years. Section 3 introduces the research methods. A dual approach is followed, consisting of key-person interviews and econometrical price transmission analysis. In section 4 the results of the analysis are presented and finally section 5 offers some concluding remarks.

2   Maize production and consumption in northern Viet Nam

Agriculture is the main source of income for most of the population in the northern uplands of Viet Nam. The mayor staple crop in the country is paddy rice. Due to the mountainous terrain in the North, however, paddy production is limited. Thus, over the last years in these areas maize production has increased strongly.

Only about 10 % of the maize produced in Viet Nam is used for home consumption (DANG THANH HA, 2004). Most of the maize is instead utilized as the major ingredient for animal feed production. Almost all the total marketed production is used up by pig, poultry and fish feed producers. Each tonne of feed produced consists of 70 % maize as raw material (HOANG XUAN THANH and NEEFJES, 2005).

Due to the economic growth of the country over the last two decades demand for meat and thus demand for animal feed is constantly increasing. Meat consumption grew drastically since the beginning of the 1990s to an estimated annual average of 38.16 kg per capita (USDA, 2006).

This study is focused on the province of Son La, which is situated in the north-western uplands of Viet Nam. Here an increasing area of uplands rice has been substituted by maize production which has become a more and more economically attractive cash
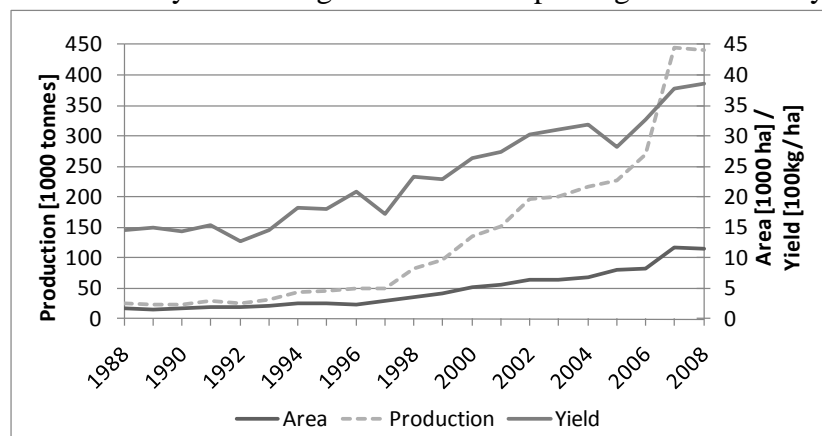
Figure 1: Maize Production in Son La province

Source: GSO, 1996; 2005; 2009a

crop (KEIL et al., 2008) as a result of an increased demand for animal feed in the country. Nowadays revenue from maize production is more than twice as high as that from upland paddy or soybean-production (TRAN DINH THAO, 2005). KEIL et al., (2008) found that 77.5 % of the uplands-area is now dedicated to maize production. In total, maize production increased

from 25,000 tonnes in 1988 to 441,000 tonnes in 2008 (Figure 1), which is more than in any other province in the North and about 10 % of the nationwide production. The maize produced in the uplands is then transported to the Red River Delta, around Hanoi, where most of the feed-factories and piggeries are located.

To protect the domestic meat industry from cheap imports and foster the aim to produce 56.6 kg meat per capita and year the import tariffs for beef and pig meat were increased to 33 % and 28 % respectively in March 2009 (MARD, 2008; 2009).

However, international trade of maize is largely deregulated: Today there are no tariffs or other trade restrictions on maize import in place (USDA, 2009). As domestic maize supply nowadays is not sufficient anymore to meet the demand of the feed-industry, Viet Nam only exports small quantities of maize in the peak of the harvest season to countries like Taiwan, China and Korea but since 1998 is a net importer of maize to an increasing extend (Figure 2).

The main import harbor in the North is Hai Phong, which is 60 km east of Hanoi. Mostly feed companies import directly, but sometimes also wholesalers and specialized import/ export businesses import and supply to the feed mills. Procurement managers of feed companies
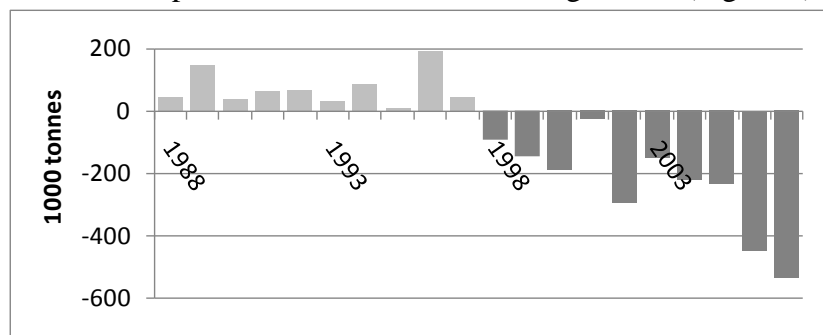

Figure 2: Maize import-export-balance 1988 – 2007 *Source: FAO, 2009a*

and big wholesalers compare prices of many markets and decide on a week to week basis from where to import if required. Alternatively they work in cooperation with specialized agencies within the country or from abroad for that purpose. Mainly maize is imported from Asian and South American countries, including India, Thailand, Brazil and Argentina.

3   Analytical Approach

To understand how far agricultural producers are affected from changes of world market prices, firstly, one has to understand how the trade of the produced commodities is organized and, secondly, to analyze econometrically how prices transmit from the world market to the single producer.

3.1   Key person interviews

To gain understanding about the functioning of the value added chain primary information is collected through personal interviews using a semi-structured questionnaire. The questionnaire is adapted to the particular interviewee (e.g. farmer, trader, feed wholesaler). The main objective of these rather qualitative interviews is to gain information about the general operation of the trade. More precisely information is collected on the main trade channels, the interactions between traders, barriers of price transmission and the prices at various levels. Also, some firsthand information is gathered regarding problems and adaptation strategies for price fluctuations for the different industry players. Additionally qualitative expert-interviews are conducted to obtain additional background information about policies, problems and other more specific issues connected to the trade of maize.

3.2   Econometric Time Series Analysis

The second focus of this study is to analyze price time series. We conduct a price transmission analysis in order to obtain statistical evidence on the extent to which fluctuations on the world market transmit to, and thus affect, rural households which are interpreted against the background of the political measures implemented. In order to obtain results on the interdependencies of two spatially separated markets, we first test whether the markets share a

long-run price equilibrium, that is, whether they are cointegrated. Second, we analyze of what form and intensity is the interaction between them, that is, to what extent price signals are transmitted between them.

For deciding on the existence of a long-run equilibrium by statistical means, each time series must first be analyzed at separately. In particular, it is of interest whether the series contain a unit root, i.e., they follow a stochastic trend and are integrated of order one I(1). For this purpose the Augmented Dickey-Fuller (ADF) test is applied (DICKEY and FULLER, 1979) by using the critical values suggested by DAVIDSON and MACKINNON (1993)[1].

Subsequently, the Johansen trace test (JOHANSEN, 1995) is carried out to answer the first question mentioned above[2]. Cointegration tests check for long-run relationships rather than for period by period equilibria. The underlying economic concept is that the usage of arbitrage opportunities by traders prevents prices from developing too far apart from each other.

The Granger representation theorem (ENGLE and GRANGER, 1987) states that for any set of I(1) variables cointegration and error-correction are equivalent notions, that is, if two variables are cointegrated at least one of them has to show error-correction. Hence, we estimate vector error-correction models (VECM) for cointegrated prices in order to obtain evidence on the second question mentioned above.

The VECM takes the typical form:

$$\begin{pmatrix} \Delta p_t^A \\ \Delta p_t^B \end{pmatrix} = \begin{pmatrix} \alpha^A \\ \alpha^B \end{pmatrix} ect_{t-1} + \sum_{i=1}^{k} \Gamma_i \begin{pmatrix} \Delta p_{t-1}^A \\ \Delta p_{t-1}^B \end{pmatrix} + \begin{pmatrix} \varepsilon_t^A \\ \varepsilon_t^B \end{pmatrix}. \tag{1}$$

By substituting

$$etc_{t-1} = \beta^A p_{t-1}^A + \beta^{B*} p_{t-1}^B + \beta_0^* \tag{2}$$

the model can be written as:

$$\begin{pmatrix} \Delta p_t^A \\ \Delta p_t^B \end{pmatrix} = \begin{pmatrix} \alpha^A \\ \alpha^B \end{pmatrix} \left(\begin{pmatrix} \beta^A & \beta^{B*} \end{pmatrix} \begin{pmatrix} p_{t-1}^A \\ p_{t-1}^B \end{pmatrix} + \beta_0^* \right) + \sum_{i=1}^{k} \Gamma_i \begin{pmatrix} \Delta p_{t-1}^A \\ \Delta p_{t-1}^B \end{pmatrix} + \begin{pmatrix} \varepsilon_t^A \\ \varepsilon_t^B \end{pmatrix} \tag{3}$$

Δp_t^A and Δp_t^B denote the price changes between the current and the previous period in markets A and B, respectively ($\Delta p_t^A = p_t^A - p_{t-1}^A$; $\Delta p_t^B = p_t^B - p_{t-1}^B$). The variable ect$_{t-1}$ is the error-correction term, that is, the short run deviation from equilibrium ($ect_{t-1} = p_{t-1}^{actual} - p_{t-1}^{equ}$) and the vector $(\alpha^A \quad \alpha^B)'$ contains the adjustment parameters, which measure the speed of error–correction, i.e., the percentage of ect$_{t-1}$ corrected in the current period. Furthermore, β^A and β^B are the elasticities of price transmission from B to A and vice versa. β_0 denotes the long run trade margin between them. The coefficients $\Gamma_i = \begin{pmatrix} \gamma_{11}^A & \gamma_{12}^A \\ \gamma_{11}^{\mathbf{B}} & \gamma_{12}^B \end{pmatrix}$ measure the short run dynamics of the prices. Finally, $(\varepsilon_t^A \quad \varepsilon_t^B)'$ are Gaussian white noise residuals.

The VECM permits insights into the degree of price transmission between markets A and B[3]. By interpreting the price transmission elasticities, the percentage to which a price is transmitted from one market to the other in the long run is estimated. If β^A and β^B both equal unity in absolute terms, a one per cent price change in A leads to a one percent price change in B in the same direction (perfect price transmission).

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[1] A constant is included into the test as price fluctuates around a non-zero mean. As some of the monthly time series show seasonal patterns, seasonal dummies are included if a *t*-test suggests them to be significant. The optimal lag-length is determined by the Hannan-Quinn model selection criterion

[2] As for the ADF test, we also include constants and seasonal dummies (where appropriate) and use the Hannan-Quinn criterion. Besides the 5 % level of significance, we regard also the 10 % level in order to account for the partially poor data quality in the analysis.

[3] We specify the VECM including a constant term and seasonal dummies (where appropriate). Again, the optimal lag length is selected according to the Hannan-Quinn criterion.

The α-coefficients describe the short run dynamics of the markets. They can be used to calculate the so-called 'half lives', which quantify the time necessary for ceteris paribus correcting 50 % of any price shock. They are calculated as:

$$t_{1/2} = \frac{\ln(0.5)}{\ln(1-|\alpha|)} .$$ (4)

A Wald test is applied to check for restrictions on β. If H_0: $\beta^B = -1$ is accepted at the 5 % significance level, the VECM is estimated using a simple two step estimation as described in LÜTKEPOHL (2004). If the null hypothesis is rejected, estimation is carried out via the Johansen procedure as described in JOHANSEN (1995). Finally, residuals are tested for autocorrelation employing the Portmanteau test with 16 lags as well as the adjusted version of this test which is more applicable for smaller sample sizes. We analyze all time series in logarithmic form which has the advantage that the β-coefficients can be interpreted as elasticities. All quantitative analysis is conducted using JMulTi 4.24.

4   Results

4.1   Marketing Chain

In principal the marketing chain of maize produced in Son La can be described as follows: Farmers crop maize in the upland areas where no paddy production is possible. At harvest time (usually between September and December) local collectors gather the maize, primarily in the form of fresh or sundried cobs from farmers in their village or other communes which are mostly located close by. The collectors transport the maize to a central point, which is accessible by large trucks. Often but not always maize is threshed at this point to increase transportation efficiency.

The collectors mainly sell the maize to big traders, who mostly transport it to their large storage facilities. There it will be threshed if it has not been already done and sometimes also dried in large technical drying facilities. Finally, the traders transport the maize to the wholesale markets in the Red River Delta. The biggest of these markets is situated in Ha Tay province, 29 km outside of Hanoi.

If the maize has already been threshed by the collector it is sometimes also bought by owners of large trucks (carrying about 40 tonnes). Unlike traders, these truck operators are not necessarily specialized in maize trade and transport the maize without further storage or processing to the markets in the Red River Delta.

Many wholesalers of different size are located in the wholesale markets. They sometimes also act as traders and collect maize from the upland regions. Mostly however, they are not mobile and buy the maize that is delivered by upland traders. In this case they focus on drying the maize to a humidity level of 14-15 % and sell it on to the animal feed factories nearby or to large scale pig farmers directly.

The feed factories or their agents also account for the biggest part of the maize imports as their maize demand cannot be fulfilled by domestic production anymore.

Some traders in Son La province also collect maize from Lao provinces close to the border and import it informally. Prices in Laos are reported to be up to 50 % lower than in Viet Nam; however, also quality is considered to be lower and transportation costs are relatively high due to bad road conditions.

This trade chain is depicted in Figure 3. In some cases one of the players is left out, for example large traders also buy a considerable share from farmers directly. In other cases two players on the same level are active, for example smaller wholesalers quite often sell maize to large wholesalers before it is delivered to the feed factories, as their storage and drying facilities are not sufficient to provide the batch sizes requested by the feed mills. Finally, the feed factories produce animal feed which is mainly sold to domestic consumers via feed agencies.

According to DAO DUC HUAN et al. (2002), this prevailing marketing chain seen today for maize from Son La only developed about 10 years ago. Nowadays it is dominated by a large number of private entrepreneurs, especially on the supply side, and can be considered as being well integrated (own observations, HOANG XUAN THANH and NEEFJES, 2005).
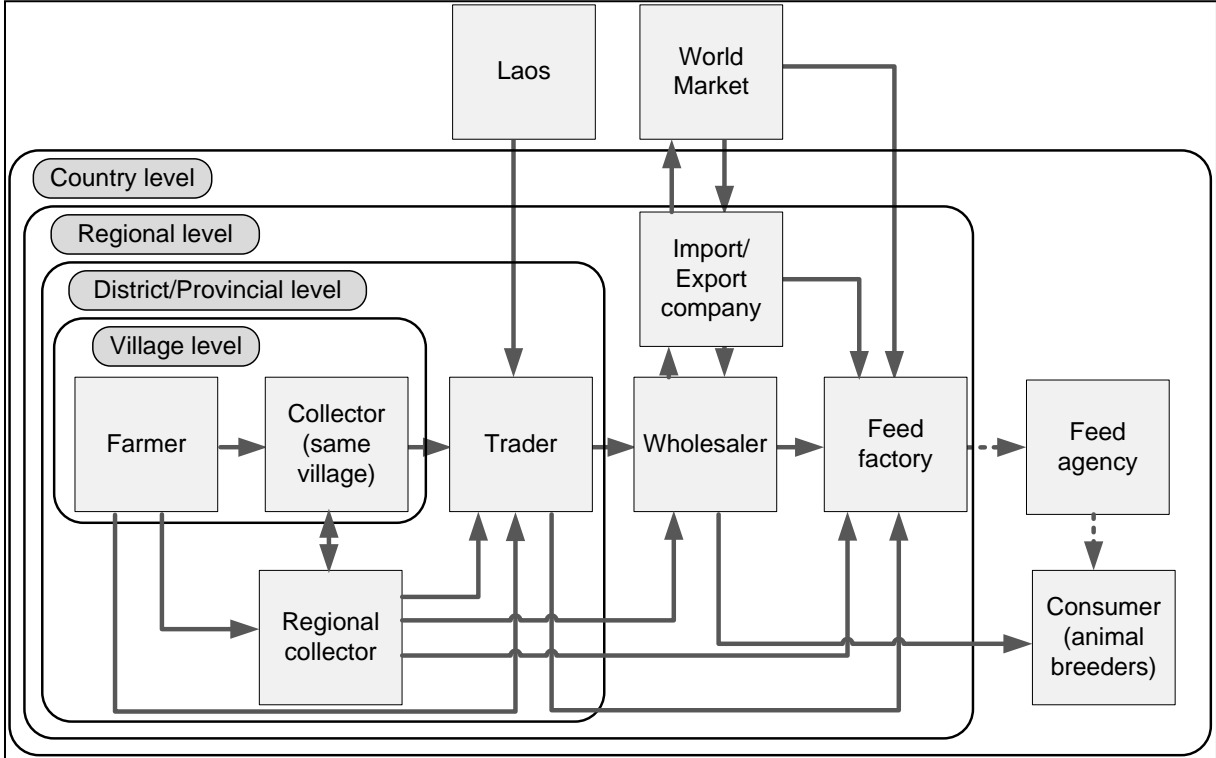

Figure 3: Marketing chain of maize from Son La province   *Source: own elaboration*

4.2   Price transmission

To analyze the domestic price transmission, between producers in Son La province and the feed factories in the Red River Delta time series are selected as follows. The average price in Son La rural markets is chosen to represent the point of trade between farmers and collectors Most of the larger traders are situated in or close to Son La city, the provincial capital; this is why the price there is used as a reference for the second step of the domestic maize marketing chain. To represent the prices in the Red River Delta, time series of two provinces are chosen: Vinh Phuc urban markets to represent the price close to Hanoi, where many feed factories are located[4]. Also the time series of Hai Duong province is considered, as this province is close to the main maize import harbor of Hai Phong city[5].To enhance the data quality for Hai Duong an average over both rural and urban markets is formed.

As international references the US and Argentine f.o.b. price time series are selected, as these two countries are the biggest exporters of maize worldwide, supplying 52 % and 12 % respectively of the total amount internationally traded (FAO, 2009a).

Figure 4 shows the development of monthly maize prices for the selected provinces in Viet Nam compared to the US and Argentinean export prices. It is visible that in general the time series follow a similar trend. All series feature an extraordinary price increase in the time between 2006 and 2008, during which maize prices in Viet Nam almost doubled. With minor exceptions, over the whole period prices in Viet Nam are higher than the world market prices showing that Viet Nam is more of an importing than an exporting country.

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[4]Time series data of Ha Tay province, where the biggest wholesale market is located are not available, for a sufficient long period.
[5] Quality of data available for Hai Phong itself is not sufficient for econometric analysis.
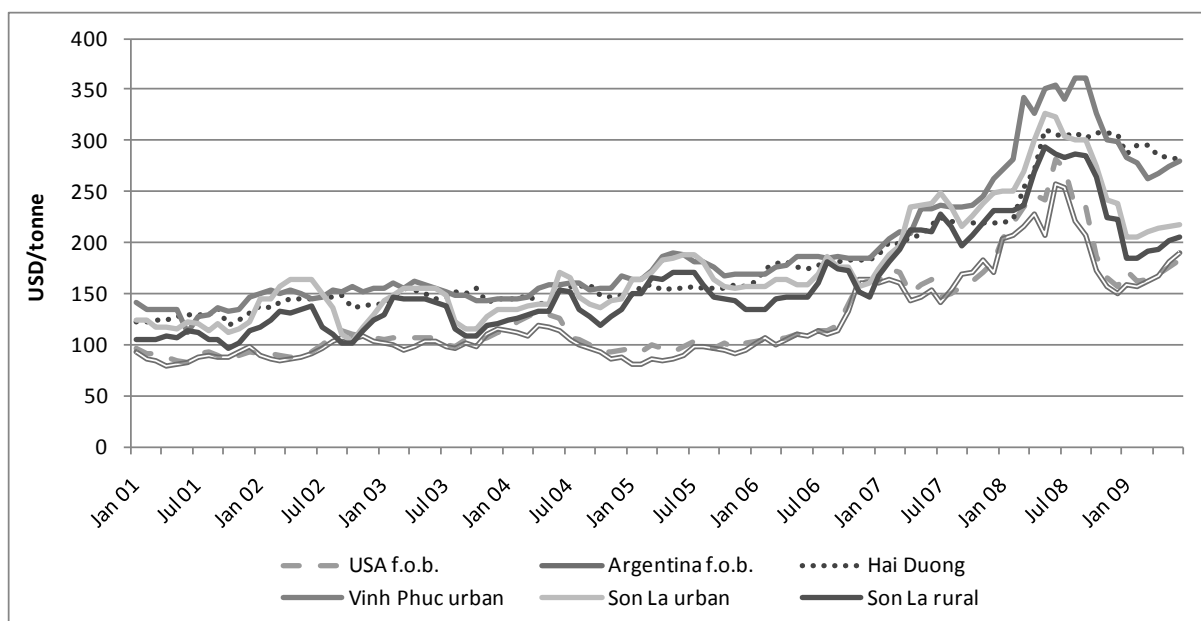
Figure 4: Monthly maize price of markets analyzed   *Source: FAO, 2009a; GSO, 2009b*

In particular in Son La province, the maize price follows a seasonal pattern. With beginning of the harvest period in August the price drops by up to 50 USD and increases again, reaching a maximum between June and July of each year. In recent years, however, these fluctuations have been overlaid by the overall increasing trend. On the other side, the price in Red River Delta provinces does not show such a distinct seasonal fluctuation. Here the price is buffered in the offseason: When no maize from the North is available it is substituted by imports from other regions or countries.

Augmented Dickey-Fuller (ADF) Test

To analyze the price series econometrically firstly an ADF test is performed. The results for logarithmized prices in USD and deflated VND are presented in Table 1 for monthly price data over the period from January 2001 to June 2009. Time series are tested for seasonality and seasonal dummies are included if their significance is indicated by a t-test. These results are stated additionally.

For the level data of most time series the null hypothesis that the observed variables have a unit root (H_0: t-value > critical value) cannot be rejected at the 5 % significance level. However, the time series of Son La province in VND show different characteristics, exclusive and inclusive seasonal dummies: without dummies no unit root can be found, including dummies the null hypothesis cannot be rejected. In all other series for which seasonal dummies are found significant it does not change the result of the ADF test.

Furthermore, the results of the ADF test for first differentiations are depicted. In this case the null hypothesis always has to be rejected in favor of the alternative hypothesis, implying that all series for which a unit root is found are integrated at the order I (1).

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Table 1: ADF test for monthly maize prices, January 2001 - June 2009 (102 observations per market)

Market	Currency	Levels			First differences		
			t-value			t-value	
		Optimal lag	Exclusive dummies	Inclusive dummies	Optimal lag	Exclusive dummies	Inclusive dummies
USA f.o.b.	USD	1	-1.17	-	0	-7.91	-
Argentina f.o.b.	USD	0	-0.66	-	0	-8.55	-
Hai Duong	USD	1	-0.20	-	0	-9.98	-
	VND	0	-1.49	-	0	-9.48	-
Vinh Phuc urban	USD	0	-0.39	-0.27	1	-6.14	-5.43
	VND	0	-1.55	-1.32	0	-11.52	-10.88
Son La urban	USD	1	-1.85	-1.43	0	-7.08	-7.63
	VND	1	-3.44	-2.47	0	-7.25	-7.67
Son La rural	USD	1	-1.76	-1.45	0	-7.16	-7.74
	VND	1	-3.28	-2.51	0	-7.40	-7.88
Critical value 5 % level			-2.86	-2.86		-2.86	-2.86

Source: own calculations, based on data provided by FAO (2009a); GSO (2009b)

Johansen Trace Test

After indicating the existence of unit roots, the Johansen Trace Test is conducted to test for the presence and number of cointegration relationships.

The results of the Johansen Trace Test are summarized in Figure 5. Cointegration relationships are found at the 5 % significance level for the international export markets (USA and Argentina), as well as within Son La province (urban and rural markets). Additionally evidence for cointegration at the 10 % significance level is found along the maize marketing chain within Viet Nam. If no seasonal dummies are included Hai Duong and Vinh Phuc urban markets are also cointegrated at the 5 % significance level.

However, no cointegration relationships can be found when one step in the domestic marketing chain is left out. Neither the international markets are found to be cointegrated with Vinh Phuc and Son La urban markets, nor is Hai Duong found to be cointegrated with Son La urban markets.
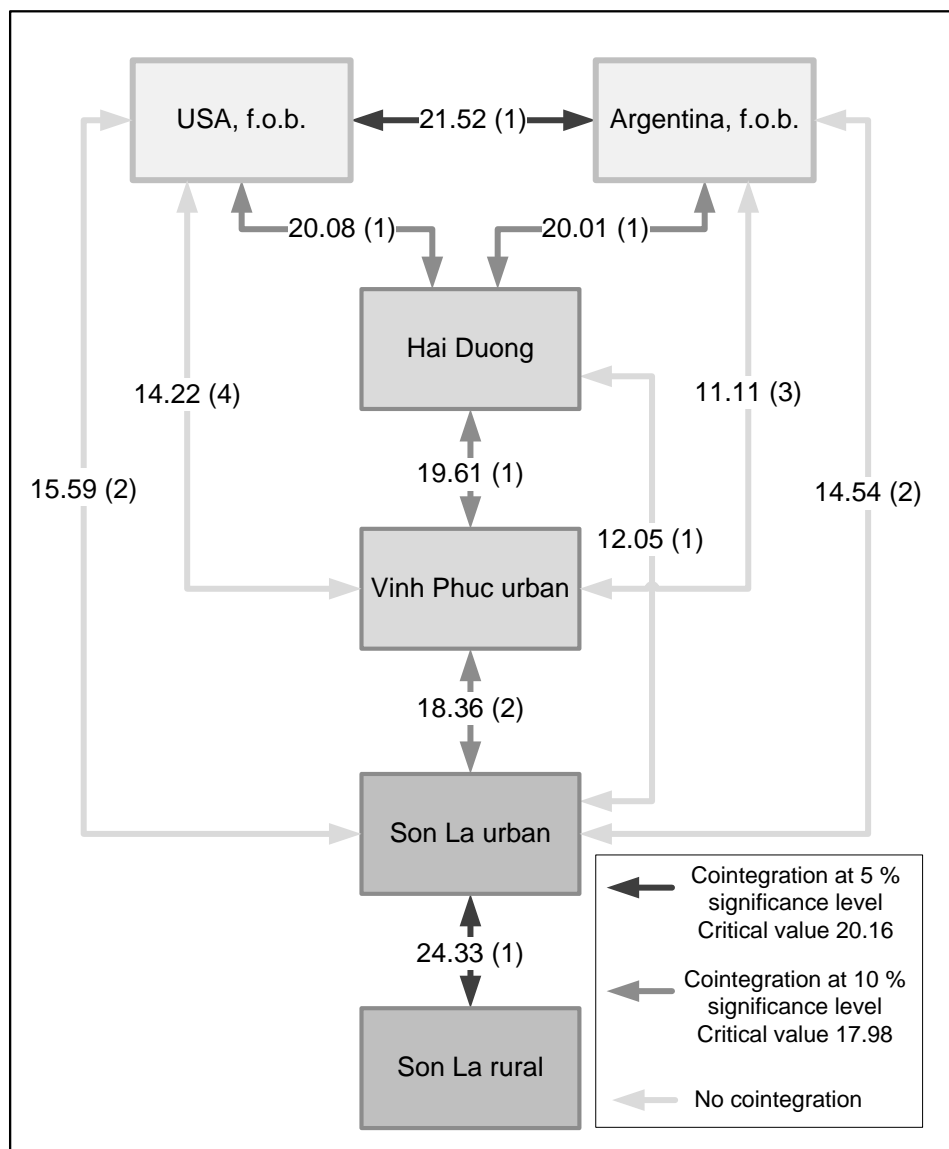
Figure 5: Results of the Johansen Trace Test for monthly maize prices; figures on arrows show the maximum likelihood value, numbers in brackets declare the number of lags according to Hannan-Quinn Criterion
Source: own calculations, based on data provided by FAO (2009a); GSO (2009b)

Vector Error Correction Model

The market pairs for which cointegration relationships are found are further analyzed by constructing a VECM. The results are compiled in Table 2. All models pass both tests applied for autocorrelation. For the domestic comparisons seasonal dummies are added as they are found to be significant in the ADF test.

In all cases the Wald test showed no evidence against $\beta^B = -1$. For this reason perfect price transmission can be concluded in all cases at the 5 % significance level, which means in the long run a price signal will transmit to 100 % from one market to the other along the whole marketing chain.

The short run parameters are not significantly different from zero for international markets, which can be interpreted as price leadership (weak exogeneity). On the other hand prices in Hai Duong province adapt to changes on the world market. This is feasible as the USA and Argentina are the biggest maize exporters in the world, whereas Viet Nam is only a small importer of maize (the import share of Viet Nam compared to the whole world market is below 1 %). In the short run Hai Duong markets adjust to price shocks by 9-10 % per month in both of

the international prices investigated. In other words this means that half of a price shock in international markets is adjusted within about 7 months. Even if the long shipping time between America and Viet Nam of about 2 months is taken into account, this still is a rather long reaction time. The analysis of the multiplicative margin shows that in equilibrium prices in Hai Duong are about 42 to 46 % higher than the world market level.

The domestic comparison yields that prices in Hai Duong as well as Son La urban markets react to price changes in Vinh Phuc. Price shocks are found to transmit to 50 % from Vinh Phuc to Hai Duong within 4.4 months and to Son La urban markets within 2.5 months. Also Son La urban markets react on price changes in Son La rural markets. 31 % of a price shock between these two markets is transmitted within one period (half life: 1.9 months).

Multiplicative margins show in equilibrium rather high trade margins within Son La province and between upland and lowland markets (9-10 %) and lower margins within the Red River Delta, with prices being about 4 % higher in Hai Duong than in Vinh Phuc urban markets, reflecting the predominant trade direction of the domestic value added chain.

Table 2: Vector error correction models for selected maize markets, based on monthly data

Market pair	Currency	Optimal lag	α^A	β^A	Half life	α^B	β^B	Half life	β_0	Autocorrelation (p-value) Portmanteau Test	adjusted Portmanteau Test
Hai Duong - USA f.o.b.	USD	0	-0.098*	1	6.7	0.031	-1	-	-0.424	0.362	0.198
Hai Duong - Argentina f.o.b.	USD	0	-0.090*	1	7.3	0.076	-1	-	-0.458	0.295	0.152
Vinh Phuc urban - Hai Duong[1]	VND	0	-0.079	1	-	0.145*	-1	4.4	0.043	0.903	0.789
Son La urban - Vinh Phuc urban[1]	VND	1	-0.242*	1	2.5	0.066	-1	-	0.099	0.376	0.196
Son La rural - Son La urban[1]	VND	0	-0.017	1	-	0.307*	-1	1.9	0.090	0.724	0.548

* Indicates significance at the 5 % level; i.e. |t-value| > t-critical (1.984)

[1] inclusive seasonal dummies (centered)

Source: own calculations, based on data provided by FAO (2009a); GSO (2009b)

5 Conclusions

In Son La, maize is clearly the most important agricultural commodity for rural households as more than 90 % of the farm households are involved in its production and receive 76 % of their farm income from it as described by KEIL et al. (2008). Most of the maize is transported to feed factories near Hanoi in the Red River Delta, were also most of the maize which is imported arrives to be further processed.

There is only a small number of big feed factories which purchase most of the maize and link the domestic market to the world market as they or their suppliers are the main maize importers. The procurement managers of the feed factories decide whether imported or domestic maize (predominantly from the mountainous North) shall be used. For the decision mainly price, delivery time and quality criteria are decisive. According to procurement mangers interviewed nowadays about half of the maize demand is met by imports. Due to their large share of maize consumption, the feed factories have a relatively high market power and can influence the price in Son La province considerably. This is consistent with the econometric analysis which finds that both, the time series of Son La urban markets and Hai Duong are influenced by the price in Vinh Phuc province.

Moreover, Son La urban prices are found to react to price changes in Son La rural markets. Son La rural markets can be viewed as the producer level, whereas Vinh Phuc represents the consumption level. Son La urban market is an intermediary market between production and

consumption. It might be considered as the trader level, as traders are usually situated closer to the urban centers of Son La province. For this reason prices in Son La urban markets adapt to both the supply from the rural producers and the demand from the Red River Delta.

A similar pattern is observed also for Hai Duong province, where prices react on both: price changes in the world market (supply side) and in Vinh Phuc province (demand side).

In general the trade of maize in Viet Nam today is much liberalized and almost exclusively run by private enterprises and traders which are very competitive and also well informed about prices. Maize prices are negotiated freely between buyer and seller on most levels. However, due to the strong competition negotiation potential is limited and prices are rather based on quality and transportation cost issues.

Also the econometric analyses of the price data suggests that along the domestic and international supply chain of maize all relevant markets are cointegrated. However, in equilibrium the price in Son La province rural markets is about 20 % lower than in the Red River Delta. This is a consequence of high transportation costs due to underdeveloped road-infrastructure and an efficiency loss due to many middlemen involved in the trade. Both effects diminish the revenue for maize producers in the northern uplands of Viet Nam.

On the other hand, in the long run in all cases complete price transmission was found, which means that changes in market prices in the world market fully transmit to the farmers in the mountainous regions. In terms of price increases were experienced on all levels of the marketing chain in recent years, this certainly is desirable for rural households in the mountainous North of Vietnam. However, they mostly strongly depend on a single sector which carries high risks: According to traders situations occurred in recent years in which maize prices dropped sharply because demand for animal feed collapsed when Viet Nam was struck by avian influenza. At this time farmers were not able to sell their maize for a price which covered their production costs. Also it has been found, that input prices also increased considerably over the last years (compare e.g. DAWE, 2008, UFER, 2010). Another problem is the lacking ability of farmers to store maize after the harvest. This is mainly due to the need for money to pay back credits after harvest and high quality losses when storing over longer periods (compare UFER, 2010). Due to this when world market prices for maize peaked in June 2008 only very few farmers could profit from it. At the peak of the harvest in November that year world market prices had already dropped by about 40 %.

A shortcoming of this analysis is that in the Johansen Trace Test transportation costs are not accounted for separately. All transfer costs are only represented in the price difference between the markets. If transport costs are not stationary, the margin between the market prices changes and thus the null hypothesis of no cointegration relationship might hold even though the markets are actually cointegrated (compare FACKLER and GOODWIN, 2001). Especially in the period from July 2007 to January 2008 the grain freight index of the International Grains Council (IGC) rose by more than 70 % from 7000 to more than 12000 due to high fuel costs. After remaining at a raised level for some months, within the last quarter of 2008 it fell drastically to the lowest level of the last 20 years, as a result of the global economic crisis. Shipments from the USA to Korea for example were 127 USD/t in May 2008, dropped to 29 USD/t in November that year and had only increased to 46 USD/t by May 2009 (FAO, 2009b). These fluctuations were also experienced by procurement managers of the feed factories in Viet Nam, who stated shipping costs of about 100 USD/t for imports from the USA in 2008, whereas HOANG XUAN THANH and NEEFJES in 2005 reported freight rates of 20 USD/t from the USA to Viet Nam. This shortcoming might explain why no stronger evidence for cointegration with the world market is found (e.g. at higher significance level; more markets).

In conclusion it can be said, that after two decades of reformation process in Viet Nam domestic maize production and marketing today is to a large extent liberalized and highly competitive. Over the last 20 years many private collectors, traders and wholesalers established their businesses and thus today trade is almost completely in private hands. Accordingly price

transmission between the relevant domestic and international markets is found and farmers in the mountainous uplands of Viet Nam are found to be reached by the recently high world market prices. However, they not necessarily can profit from it, as maize production is seasonal and storage is limited. Also they are affected by increasing input costs which often exceed the additional revenue due to increasing maize prices.

6 References

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