Joint evolution of spatial integration and product segmentation on agricultural markets: the case of cereals in Mali

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Within the context of liberalisation experienced by the Malian economy since the beginning of the 1990s, spatial integration of cereal markets has been considered as a major tool as to avoid localised shortages due to production shortfalls. However, market dynamic reveals since then new patterns: the diversification of urban consumer demand towards "modern cereals", in particular rice and maize, drives the segmentation of the cereal market. As consumers are likely to substitute traditional cereals, like millet and sorghum, for other cereal types, new market segments emerge.
We account for this evolution with a theoretical model *à la Hotelling*: the good is considered according to two characteristics, the spatial localisation (local market) and the cereal type. We show that, as far as market integration implies the reduction of transaction, it affects the strategic decisions of sellers. In fact, incentives to invest in product differentiation (and exploit new market segments) rises relatively to the incentives to take advantage of spatial price differentials, as they decrease.
Last, we test this analytical proposition on price data collected by the agricultural market information system (SIM/PAM) from 1990 to 2004 on 6 local markets in central and northern Mali. We apply a vector error- correction model, and find evidence for the intensification of spatial co- integration relations during the period. Moreover, we relate this latter dynamics to the evolution towards the segmentation of cereal markets in Mali. Last, the leader markets of this progression are identified as being the central urban markets.

Keywords : product differentiation, co- integration, cereals, Mali

Introduction:

In order to match the requirements of structural adjustment programs, agricultural policies implied in developing countries tried to promote market integration. Since then, food policies mainly aimed at securing cheap cereal supply to urban consumers, and to achieve this aim, governments regulated the prices of major crops, both pan- seasonally and pan- territorially. However, the subsequent price incentives to producers were depressed and the productivity growth very slow. To prevent the countries from declining production levels, governments removed legal constraints to private cereals marketing and let supply and demand determine producers and consumers price. Nonetheless, they rapidly saw that basic market institutions were failing for the market reform to be effective. The Market Information System was introduced to reduce marketing costs trough greater market transparency, and thus improve market competition and facilitate the entry of new stakeholders into the production, wholesale and retails markets.

In this framework, the market is considered as an nationally integrated space, competitive and open towards other countries, where market information increased marketing flexibility by letting farmers know which location is the more profitable to market their products. The efficiency benchmark is then market ability to reduce transaction cots and intermediaries' margins, to insure producers' access to remote places and to supply consumers with products sold at affordable and stable prices. In developing countries where food security is one of the major policy concern, market integration was considered as a key tool in order to secure crop supply in whole country.

This view is at the heart of the analysis led by experts and policy makers. Regional policies that promote tariff unions (like the West African Monetary Zone, WAMZ) expand this framework at a regional level.

The case of cereals in Mali reflects this evolution. At the core of the Cereal Market Reform Program implemented in 1981 stand the choice of building an integrated national market, in order to prevent food crisis and famines. Studies focused on the spatial dynamics of local markets: however, parallel to this integration process, we can also observe the emergence of new marketing strategies that have been disregarded by economic analysis. The rise of maize consumption, especially in urban areas, set new incentives for producers and traders to differentiate their supply, not only spatially but also according to variety. As the returns to local monopolies (or oligopolies) are decreasing with market integration, agents turn to new strategies to restore their margin to its previous level.

In the following development, we propose to study this joint dynamics of spatial integration of the Malian cereal market and products differentiation that emerged there. We first develop which are the main questions at stake in the Malian case. We present then a theoretical model that stand for the joint evolution of spatial integration and product differentiation on the Malian

cereals market. We then test this dynamics using price data for the millet and maize markets.

1. Liberalisation and integration of the Malian cereal market

1.1. Grain production in Mali

Mali ranks among the poorest countries in the world (according to the Human Development Index developed by UNDP for 2003, it is ranking in the 174th position as 177 countries are classified). However, when considering it at the Sahel region's level, it appears to be viewed as a large agricultural country with a high potential: as early as in the 1930's, the French colonial government heavily invested in the development of the Niger valley, with the aim of making Mali a regional rice granary. The primary sector, namely agriculture and livestock, provides work for close to 70% of the active population (34% of GDP in 2004, OECD 2005). Apart of it, gold mining is a relatively recent sector of the Malian economy, but the production remains random in the last years.

The role of cereals is thus very important: approximately 70% of the total calories in the average diet come from cereals. Millet, maize and maize are the major rain-fed staples. They are produced by small producers with market access, except those of the dynamic cotton area[1]. Grain production is geographically as well as annually very variable due to fluctuating rainfall. Furthermore, the percentage of total production that is marketed is very low (between 15 and 20%) so that the market is very tight and prices highly volatile.

1.2. Market reforms, market construction

The liberalization of cereal marketing occurred under the program PRMC (Programme de Restructuration du Marché Céréalier) that was heavily financed by international donors. Up until this date, the market was regulated by an official grain marketing agency: the government fixed the consumer and producer prices of the major crops on the whole territory. The consequences of the reform have been major chances in price determination in the marketing system. The key market institution that has proven to be effective in building the market was the Market Information System (SIM, Système d'information de Marché, now called OMA Observatoire des Marchés Agricoles or Agricultural Market Watch). It aimed at developing a national technical expertise needed to produce accurate, reliable information for clients and to improve the timeless transmission of this information (radio diffusion was widely used). Moreover, it developed credit programs oriented to producers' unions and traders.

Trade liberalisation was at the core of PRMC: and as a result of improved knowledge of market opportunities, it increased marketing flexibility for farmers who then know when and where it was the most profitable to market their products. The improved integration of the national market should, on the

[1] Rice is grown in the government-established irrigation projects, that of the Niger office and in lowland-inland swamps (bas fonds)

one hand, increase producers income by increasing producer prices, and offer them the opportunity to produce more. On the other hand, it should decrease the price paid by the consumers as it decreases transaction costs and intermediaries margins.

1.3. Cereals production growth and structure

During the 25 years, cereals production almost tripled (table 1). But the composition of cereal production also changed: as millet and sorghum represented more than 80% of total production at the beginning of the 80's, it accounts for the half of it in 2002- 04.

		1980-82	2002-04
Millet- Sorghum	%	80,4	54,3
Maize	%	4,5	13,6
Rice paddy	%	12,2	31,4
Total s	1000 t.	1,148,9	2,682,8

Sources : FAOSTAT

Table 1: Repartition of fed- rain cereals between 1980- 82 and 2002- 2004

Moreover, in 2002- 04, the third of total production is maize. Contrarily to the determinants of production growth for millet and sorghum that relies on cultivated areas, that of maize is due to an increase in yields. Cereals are produced mainly in the centre of the country, particularly around Koulikoro, Sikasso, Ségou and Mopti.

1.4. Market efficiency and segmentation

Researches on market spatial integration have been led since the 80's. They mostly use correlation coefficients (Dembélé, Traoré et Staatz, 1999) and found that the integration level reached in the central regions is high, and that remote areas tended to become more integrated to the national market in the 1990's. Most of the studies only investigated millet and sorghum as maize was far less consumed (Barry, 1989).
They conclude on an improved diffusion of price information at the national level that reinforce competition among traders.
We refer to this literature and propose to develop the study by first using accurate statistical and econometrical tools to study more precisely the co-movement of prices in Mali. We had maize to this study to take into account the diversification of species and varieties we can observe in this country. As urban consumers are turning to modern cereals that fit with their taste and cooking habits, a new opportunity emerges for traders and producers. When millet price increases, consumers will tend to buy other cereal types.

On a more analytical point of view, we borrow from industrial economics (Bain, 1959) that can be used to analyse the efficiency of food- producing agriculture in developing countries (Moustier, 1996). As soon as in the 1970's, competition and efficiency were linked as to explain the sluggish adjustment of local prices

in African countries (Jones, 1972 and 1974). With the improvement of statistical tools, the approach was soon renewed by cointegration models (Ravaillon, 1987), and long debated (Harris, 1979 ; Harris et Palaskas, 1993). We follow this tradition and develop the question in the new industrial economics perspective.

2. Understanding the joint evolution of integration and segmentation of cereal markets in Mali: a theoretical model

2.1. Hypothesis

In the following section, we develop an analytical framework that highlights the influence of market integration on sellers' behaviour. The latter choose to market products endowed with strategic characteristics as they tend to compete with distant local markets.

Using a model that takes into account product differentiation *à la Hotelling* (1929), we show that, when transport costs are high, geographic dimension dominates other product characteristics: sellers are thus not incited to differentiate the good they are marketing. Geographic dispersion protect them from competition, as each is established on a local market. However, as transport costs are increasing, geographic distance doesn't shield them from national competition and product differentiation works then as a way as to let competition soften. This condition can be interpreted as the firms' response to the profit erosion due to transport costs' decrease.

We analyse a differentiated market: the seller choose two product characteristics, that is marketing location and product type. Therefore, the seller enjoy a localised market power on the neighbouring consumers: even if the total number of sellers is high, one particular seller directly compete with only a few number of them. The market is considered as segmented in different sub- markets where sellers are more or less captive – that is that they have to bear additional costs if they want to get a product that is not sold by the most neighbouring seller. The analysis led by Hotelling (1929) presented two distinct strategies: if the sellers choose to locate in the middle of the market, they have a greater market potential but they tend to suffer under a very harsh competition. If they choose to locate at different place, their market power is restricted to a smaller market, but they soften competition. D'Aspremont and al. (1979) show that competition in price is the strongest force leading location choice and tends to promote spatial dispersion. We extend these frameworks for the case where the product is endowed with two characteristics.

We solve the model by inverse induction: we first derive market size according to chosen pricing strategy, then we induce from this first result the choice of product characteristics (location and variety).

We consider a market with 2 sellers denoted by 1 and 2. Products are defined by two characteristics: the marketing location (x) and the variety (horizontal

differentiation, y). Consumers exhibit preferences along these characteristics, they are uniformly distributed according to these preferences. We are thus considering products differentiated on a plane.

We consider a consumer whose preferred location is (a,b). The selling charges the consumer with transaction costs so that:

$$U(a,b;x_i,y_i,p_i)=S-p_i-t_a(x_i-a)^2-t_b(y_i-b)^2 \quad \text{for} \quad i=1,2$$

We thereby choose a traditional form for the utility function (Combes et al, 2005) and enlarge it so that it takes into account two instead of one characteristic. The more a considered product is different from that the consumer prefers, the lower the utility level. S represents the consumer surplus from which we subtract the price and the mismatch between the purchased good and the one that should have brought the higher satisfaction. The weights affected to the two characteristics can be different ($t_a \neq t_b$) according to the way the consumer's disutility increases when the product doesn't correspond to the perfect location.

The marginal consumers that are indifferent between purchasing goods by seller 1 or 2 correspond to the points where $U(a,b;x_1,y_1,p_1)=U(a,b;x_2,y_2,p_2)$ that is

$$b=\frac{p_2-p_1-t_a(x_1^2-x_2^2)-t_b(y_1^2-y_2^2)}{2t_b(y_1-y_2)}-a\frac{t_a(x_2-x_1)}{t_b(y_2-y_1)}$$

This line separates the set of characteristics (the plane) into two different sub-markets that represent consumers' demand addressed two the sellers. We find the traditional trade- off we mentioned before between a central location subject to a tough competition, and a peripheral one which is protected.

2.2. The demand functions

This demand depends on the relative weight of each characteristic in the consumers' utility function. We choose: $t_a(x_2-x_1)<t_b(y_2-y_1)$ for which the weighted difference between two locations of characteristic 2 is higher that for characteristic 1. This correspond to the fact that transportation cost are less important (or valorised) that horizontal differentiation. As these costs are paid by the consumers, it is identical to say that transportation cost are decreasing.

According to the relative position of prices and characteristics' valorisation, we obtain three specifications for the demand function:

- if $0<p_2-p_1+t_a(x_1^2-x_2^2)+t_b(y_1^2-y_2^2)<t_a(x_2-x_1)$ then

$$D_1 = \frac{\left[p_2 - p_1 + t_a(x_1^2 - x_2^2) - t_b(y_1^2 - y_2^2)\right]^2}{8t_a t_b (x_2 - x_1)(y_2 - y_1)}$$

- if $t_a(x_2 - x_1) < p_2 - p_1 + t_a(x_1^2 - x_2^2) + t_b(y_1^2 - y_2^2) < t_b(y_2 - y_1)$ then

$$D_2 = \frac{\left|p_2 - p_1 + t_a(x_1^2 - x_2^2) - t_b(y_1^2 - y_2^2) - t_a(x_2 - x_1)\right|}{2t_b(y_2 - y_1)}$$

- if $2t_b(y_2 - y_1) < p_2 - p_1 + t_a(x_1^2 - x_2^2) + t_b(y_1^2 - y_2^2) < 2\left|t_a(x_2 - x_1) + t_b(y_2 - y_1)\right|$ then

$$D_3 = \frac{\left[p_2 - p_1 + t_a(x_1^2 - x_2^2) - t_b(y_1^2 - y_2^2) - 2t_a(x_1 - x_2) - 2t_b(y_1 - y_2)\right]^2}{2t_a t_b (x_2 - x_1)(y_2 - y_1)}$$

2.3. The equilibrium price

This represents the reaction function of a seller according with respect to consumers' preferences and the price charged by the competitor. The seller chooses strategically the price he proposes: if it is low, the market size will be high (he has a high attractive power), but the profitability per unit is low. Conversely, if the price is high, the number of consumers disposed to pay for the good will be lower. Caplin and Nalebuff (1991) identified the conditions of existence and uniqueness of price equilibrium. The utility function chosen in our case is a particular case of that chosen by Caplin et Nalebuff and the uniform distribution of consumers over the preferences corresponds to their framework. We infer from their result that a pure strategy unique equilibrium exists for each location. Moreover, Irmen et Thisse (1998) demonstrate for a *n*-dimension space that this strategy belongs to the intermediary interval described above.

When maximizing profit $\Pi_1(p_1, p_2) = p_1(p_2) D_2(p_1, p_2)$

We obtain, for each p_2

$$p_1 = \frac{\left|p_2 + t_a(x_1^2 - x_2^2) - t_b(y_1^2 - y_2^2) - t_a(x_2 - x_1)\right|}{4t_b(y_2 - y_1)}$$

We derive the same equality for p_2, so that the price equilibrium is

$$p_1 = p_2 = \frac{t_a(x_1^2 - x_2^2) - t_b(y_1^2 - y_2^2) - t_a(x_2 - x_1)}{4t_b(y_2 - y_1) - 1}$$

2.4. Location choice

As he knows the equilibrium price for each location he could choose, the seller maximizes hos profit over the possible positions.

We find (x_1,y_1) and (x_2,y_2), the profit maximizing choice. For (x_1,y_1),

$$\Pi_1(x_1,y_1,x_2,y_2)=p_1(x_1,y_1,x_2,y_2)D_2(x_1,y_1,x_2,y_2)$$

thus

$$\text{Max}\,\Pi_1=\frac{\left[t_a(x_1^2-x_2^2)-t_b(y_1^2-y_2^2)-t_a(x_2-x_1)\right]^2}{(4t_b(y_2-y_1)-1)2t_b(y_2-y_1)} \text{ because } p_1=p_2$$

We find

$x_1= x_2=0,5$

and $(y_1= 1 ; y_2=0)$ and conversely $(y_1= 0 ; y_2=1)$

We conclude that the differentiation is minimal $(x_1= x_2=0,5)$ for the less profitable characteristic, and that it is maximal, $(y_1= 1 ; y_2=0)$ and $(y_1= 0 ; y_2=1)$, for more profitable one. When transportation costs are decreasing, sellers will strategically decide to differentiate their products according to their varieties. When transportation costs are inexistent, the framework presenting the differentiation according to one characteristic applies: d'Aspremont and *al*. (1979) show that the optimal strategy is to protect oneself from competition by differentiating the product supply as much as possible.

3. Empirical strategy: millet and maize market dynamics

3.1. Data

Data consist in price series collected by SIM/OMA (Système d'Information de Marché/Observatoire des Marchés Agricoles or Market Information System/ Agricultural Markets Observatory)[2] in Mali from April 1989 to August 2004. We consider two cereals: millet and maize over 7 local markets: Segou, Sikasso, Mopti, Kayes; Bamako, Tombouctou and Gao, ordered by decreasing population size. Summary statistics are given in Appendix 1.

Figure 1: Political map of Mali

We observe a general increase of prices during the period (see variation in mean prices between 1990 and 2003 in Appendix 1), but the way standard errors between the same years are varying is far more heterogeneous. As

[2] The Agricultural Markets Observatory was designed to collect and disperse information about agricultural markets actual state, as well as forecasts.

maize s considered as a modern cereal and mainly consumed by the urban population, we aim at investigating whether the integration of millet market that has been showed by previous studies can be related to the development of a market for maize. Therefore, we analyse the temporality of integration intensification of these markets during the period. We show the integration of millet market is contemporaneous to the increase in substitution between the two cereals at the local market level and that the development of a spatially integrated maize market is slower.

All series exhibit a unit root (the null of a unit root is rejected at 1% level, and for most of them at 5% level), that is that they don't follow a random walk, and are at least first- order integrated. We report in figure 2 the results of the augmented Dickey Fuller test , which is similar to Dickey Fuller standard test but allows for heteroscedasticity and thus gives more robust results. Lag selection correspond to Akaike information criterion (in brackets)

Figure 2: Unit root test

	Millet	Maize
Bamako	(1) - 1,323	(1) - 2,662
Gao	(1) - 1,935	(1) - 3,023
Kayes	(3) - 2,879	(1) - 2,297
Mopti	(1) - 2,569	(2) - 2,904
Ségou	(1) - 2,967	(1) - 3,087
Sikasso	(8) - 1,863	(8) - 2,064
Tombouctou	(1) - 1,323	(1) - 2,426
1% critical value: - 3,478 5% critical value: - 2,945		

3.2. Model

As unit roots are present for all series, we can proceed to the study of cointegration. Based on the traditional Johansen and Juselius (1990) approach, the technique is the following:
Consider the Vector Error Correction Model (VECM)

$$\Delta X_t = \Pi_1 \Delta X_{t-1} + \Pi_2 \Delta X_{t-2} + ... + \Pi_p \Delta X_{t-p} + \varepsilon_t$$

where ε_t residual, X_t vector of prices (X_t to X_{t-p+1} are integrated at least from order 1, X_{t-p+1} is order 0 integrated, that is it has no unit root) and Π_p matrix of coefficients whose rank is r.
The Johansen & Juselius method of estimation of Π generates two statistics of interest: The first is the λ_{trace} statistic, which is a test of the general question of whether there exist one or more cointegrating vectors ($r \geq 1$). An alternative test statistic is the λ_{max} statistic, which allows testing of the precise number of cointegrating vectors (r=1, for instance). As the rank of matrix cannot be higher than the number of prices taken into account, the highest number of cointegrating vectors is 1 when investigating the cointegration between two series.

We analyse the spatial cointegration of millet and maize markets from April 1989 to August 2004 and compare this evolution to the cointegration dynamics of millet and maize at the local level. As only two price series are studied in the latter case, we choose to present the λ_{trace} statistic for each municipality. In a recursive analysis these test statistics can be plotted over time to examine the time varying nature of market integration. The following graphs present the evolution of the spatial cointegration of both millet and maize markets (Figure 3), and the dynamic of local cointegration of both market, that is the evolution of the substitutability between the two products, at the local level (Figure 4).

We chose to study real prices as the inflation rate was high for some periods: in fact, this inflationary nation- wide phenomenon can bias the result because it artificially introduce a common trend in the local dynamics. Therefore, nominal prices should bias upward the cointegration result. We corrected the SIM/OMA (Système d'Information de Marché/Observatoire des Marchés Agricoles or Market Information System/ Agricultural Markets Observatory) prices by deflating the series using the Banque de France data for the Franc Area (Zone Franc and FC area).

3.3 Results

[Figure 3 and 4 about here]

We observe on these two graphs that the integration of all considered markets increased along the period: however this is a non monotonous evolution. In particular, the millet and maize markets are affected by two shocks that decrease the integration level – these shocks are marked by a line. From 1996 to 1997, the integration level of both markets sharply declined, as it did in 2001- 02, but in a less sensible way.

The first observation refers to the overall amelioration of market functioning (see section 1 for a description of public policies oriented towards market transparency) as well as to the decrease of transaction costs. In particular, the quality of the transport network improved as a result of work undertaken under the 1995- 2004 sectoral transport project (OECD, 2006). It expanded the roads system to Kayes (to be finished in December 2006). To the North East, the road Gao- Ansongo to Niger has been enhanced, a project that helps to reduce the country's isolation and its dependence on the port of Abidjan – a very risky road to procure imports since the civil unrest experienced by Côte d'Ivoire. The Ivorian crisis forced Mali to put a priority on combating its land-lacked position.
Furthermore, contrarily to the evolution observed in Burkina Faso where fuel price increased transportation costs, Mali didn't experienced a sensible increase in its transportation cost or production factor price (Traore and al, 2003).
These two phenomena favour market integration at the national level.

However, we can see that this evolution is not monotonous. The first inflexion point correspond to the devaluation of the CFA Franc (common currency in the

West African Monetary Zone) in 1994. This change in parity rate immediately increased the competitiveness of Malian cereals, that are namely tradable goods, and stimulated internal trade also (Dembélé and Staatz, 2000). The mechanism at stake, that has been reveal by the recent study developed by Araujo et alii (2005) may work in the following way: as the prices of imports are decreasing with the devaluation, the prices of inputs are decreasing. In particular, Araujo et alii put the stress on the price of labour which they consider to be the most important part of trade costs. In their view, it becomes cheaper to trade products across regions: this analytical result was successfully tested for the livestock market in Burkina Faso.

We can see a sharp slowdown of co-movement of prices of millet and maize in 2000. The weather was particularly bad during the 2000/01 growing season and this reduced cereal production by about 20 per cent (OECD, 2003). Except for rice (up 2 per cent), output of all other grains fell sharply (as much as 65 per cent in the case of maize). This poor food-crop performance was accompanied by the collapse of cotton production, hit by steadily falling world prices since 1995 and major structural problems. The slowdown in activity linked with the cotton crisis sharply reduced household revenues in 2001, cutting back private consumption 1.6 per cent by volume. It has been shown (Egg & Tallec, 2004) that Malian consumers are substituting products for a preferred one up to a price threshold. Thus, they are willing to pay more for quality or for goods that give them a higher satisfaction level when prices are in general not to high: the budget constraint limited the possibility to pay.
However, this decrease in the substitution of millet and maize doesn't imply a slowdown in the spatial integration of local markets. In fact, in case of production shortage, traders adapt all the more to market opportunities and they make even a much more accurate trade-off among the places they can market their products into (Traore, Jeudy & Blein, 2003). Furthermore, this trade-off seems not to have been influenced by government messages concerning its intervention.

Last, we remark that 2002 is a breaking point in the evolution of integration in the national market: we notice an acceleration of it in 2002, followed by a deceleration during the next few years. The year 2002 was a turning point for Mali when it hosted the Africa Nations Cup football tournament and held presidential and parliamentary elections that led to the first-ever peaceful handover of power by one group to another. The Africa Cup event greatly boosted economic development; the government took the occasion seriously and seized the opportunity to develop the country's infrastructure. Many roads were built or repaired in Bamako and several provincial towns, such as Kayes and Sikasso, got airstrips. The private sector also invested heavily in the event, mainly in hotels. Related sectors, such as electricity and telephones, also benefited.
Furthermore, growth was sustained by the mining sector. Mali has opened up new deposits — at Morila in October 2000 and Yatela in May 2001. These new mines almost doubled national production in 2001.
The increase in real prices in 2002/03 (Traore, Jeudy, Blein, 2003) is not due to a decrease in production, but to improved marketing strategies of traders.

Price levels are since then high and the differential price between millet and maize is tightening.

Conclusion

The joint dynamic of the integration of maize and millet markets in Mali is a complex one. Maize is a modern cereal towards which urban population is turning to and that becomes continuously more consumed in remote areas. We show that even if the substitution between these two cereals is highly volatile, depending mostly on the price levels, the spatial integration of both markets is increasing during the period 1993- 2004.

Figure 3

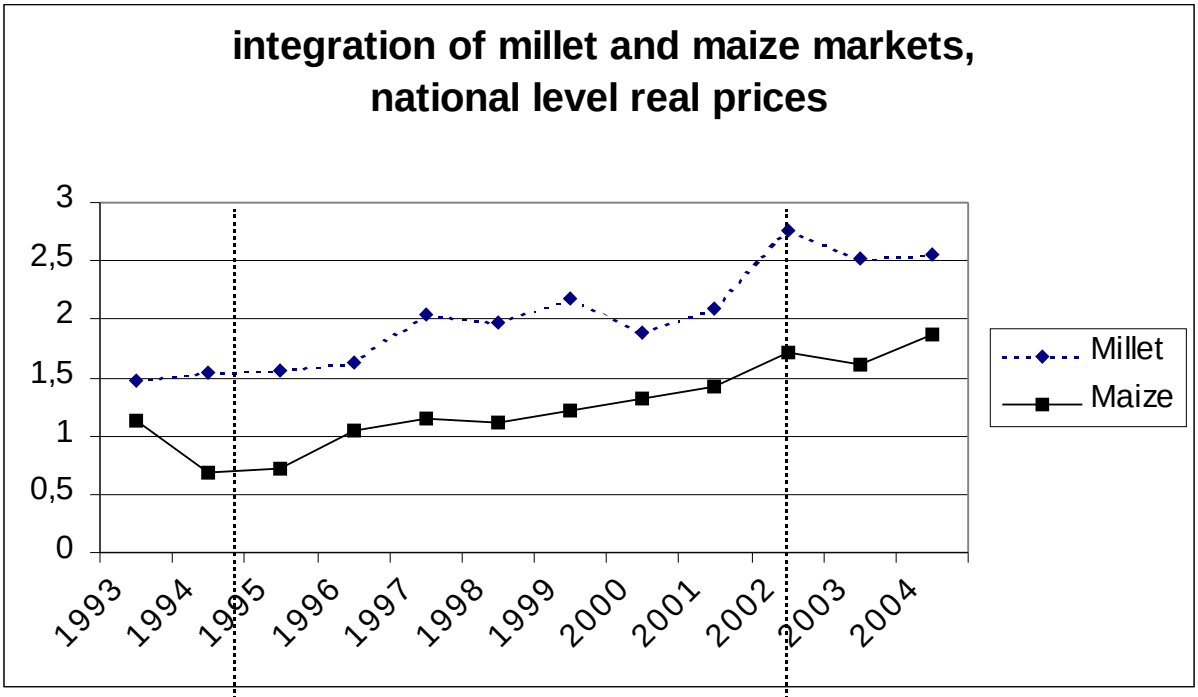
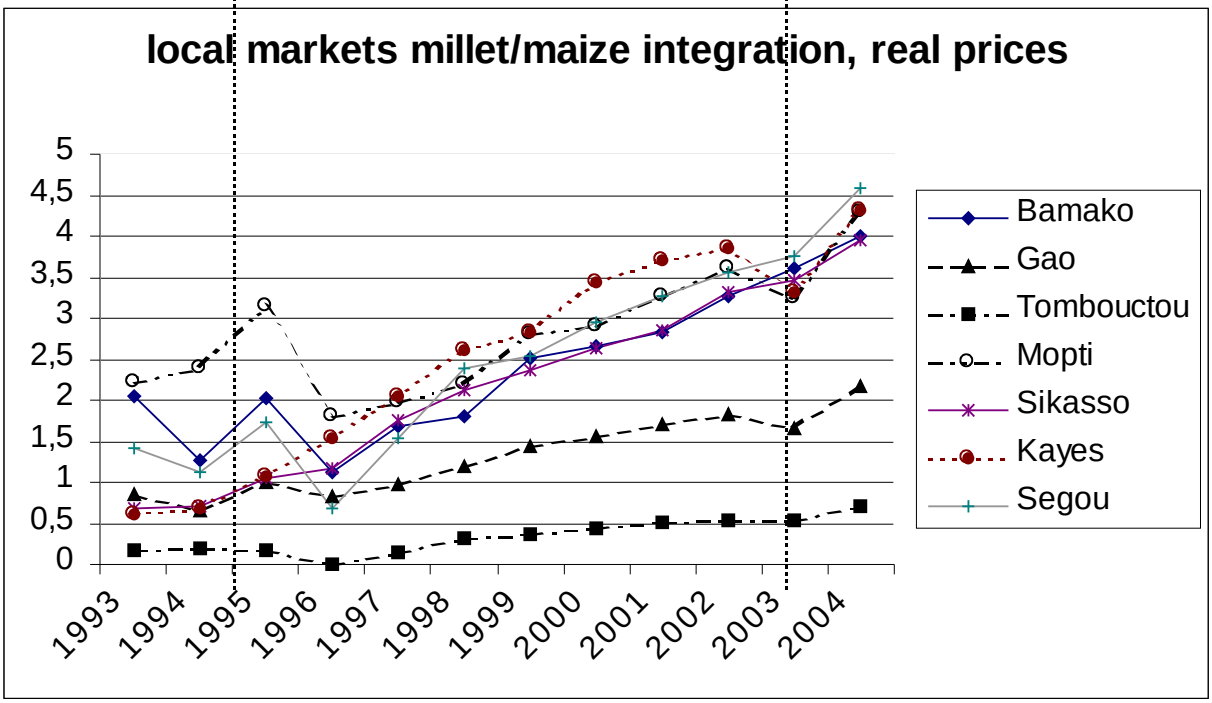


Figure 4



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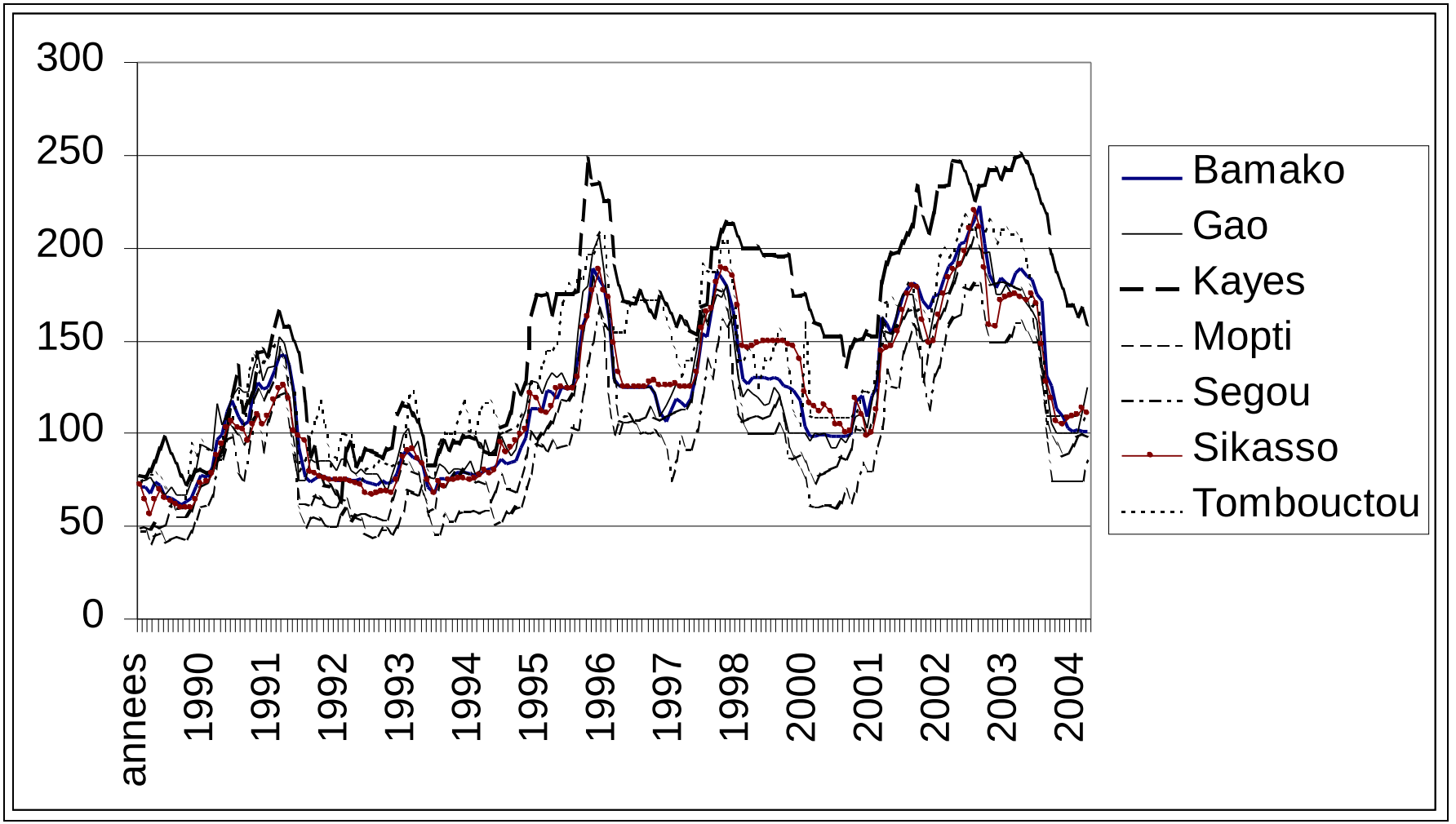
Appendix 1: Summary statistics

		Mean	Δ2003/1990	Std Dev 2003/1990	Δ	Min	Max
Millet	Bamako	119,7	97,8%	40,3	- 19,4%	62,0	222,5
	Gao	120,6	68,3%	36,9	- 1,8%	66,6	206,5
	Kayes	155,1	157,4%	53,7	- 52,5%	63,0	250,0
	Mopti	107,2	100,0%	40,8	46,1%	48,0	209,8
	Ségou	92,6	105,8%	38,2	- 4,1%	40,7	180,6
	Sikasso	119,1	96,4%	39,4	- 18,6%	56,0	220,2
	Tombouctou	134,3	93,2%	41,4	132,5%	60,0	217,5
Maize	Bamako	111,5	76,1%	33,5	41,4%	61,2	195,4
	Gao	119,8	64,3%	34,8	22,0%	44,4	190,5
	Kayes	135,5	110,7%	47,3	72,3%	55,4	245,8
	Mopti	100,7	99,7%	37,5	105,2%	40,0	185,0
	Ségou	92,9	99,3%	36,1	115,5%	42,8	183,2
	Sikasso	84,9	78,2%	28,1	123,0%	45,9	164,4
	Tombouctou	114,8	395,6%	51,3	- 30,0%	20,0	212,0

Δ2003/1990 is the variation in mean prices and standard errors between 1990 and 2003 (in percentage)

Appendix 2a : Millet price evolution in considered local markets



Appendix 2b : Maize price evolution in considered local markets