

Minor Thesis

Department of Development Economics

Thesis Description

The effect of the Ivorian embargo on the futures market of Cocoa

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ABSTRACT

The Embargo on Ivorian Cocoa in 2011 had many effects that researchers explored. In this thesis, the focus is on the embargo effects on the relationship between futures markets with different delivery dates. Therefore, the study measures the evolution of the basis (future spread) in reaction to the export ban. The findings support the hypotheses that the uncertainties of supply during the ban have raised the cocoa price on the nearest delivery futures market over further futures delivery creating a backwardation in the market. However, different effects have been observed in the LIFFE (London future market) and ICE (New-york future market). If the findings showed that the export ban increase the value of the futures spread, the effect of the export ban was dominant on the London futures with a higher increase of price.

Key Words: Embargo, futures market, future spread, backwardation

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1. Introduction

Cocoa grows principally in specific regions of the world (Asia, South America and West Africa), however its importance is global as the main component in the chocolate industry. Among all the producing countries, Ivory Coast is the world's leading producer of cocoa with 38 % of the world production. In 2011, the international community responded to the political crisis in Ivory Coast by an import ban on their products. As a consequence of the supply disruption created by this import ban, high price in the international cocoa market were observed.

Commodity markets are well known to transmit disturbances internationally by linking exporting countries to commodity importers (Reinhart and Borenzstein, 1994). In the case of cocoa, the price is normally subject to high fluctuations (Haque, 2004). However, the embargo on Ivory Coast products led to an unusually high price on the futures market: a 9-month record for the London market and a 32-year record on the New-york market (ICCO, 2011).

Theoretically, these fluctuations can be explained by speculative influence and variability in supply and demand. Economists divide the variability in production and consumption into predictable and unpredictable variability, the latter referring to the term shock. Gilbert and Morgan (2010) considered that food price volatility arises from shocks that have different impacts in each separate commodity market. Among the many types of shock that exists, we can distinguish supply shock, which refer to event that moves the price level and real output in opposite directions (Blinder and Rudd, 2010). Thus for, the Ivoirian embargo can be considered as an unexpected event that creates a supply shock by decreasing the supply of cocoa in the World.

Burger and Ruf (2012) demonstrated that this embargo led to an increase of price in the spot market without creating a price transmission into the value chain of cocoa-chocolate. The high prices observed in the spot market were also observed in the futures market. This fact brings back to light questions about price dynamics in the

cocoa spot and futures market. A change in demand or supply will normally be reflected in both markets. The basis and futures spread account respectively for the noise that affects spot price and simultaneously affects futures price.

If politically the embargo was a success by bringing the elected president to power, it created a supply disruption in the cocoa market. Therefore, this thesis attempts to analyze the relationship between the embargo on Ivory Coast products and the increase of price in the cocoa market. In order to see how cocoa futures markets have been affected by this supply shock, we will examine the relationship between spot market (nearest future) and future market through the analysis of the basis. This study can be considered as a case study on a temporary trade shocks associate with a large price change on both markets.

2. Background and Problem definition

In this chapter, we are providing background information on the events that led to the embargo and the importance of Ivorian cocoa share on the market.

2.1. Cocoa Production and Ivory Coast role

Originating from South American Amazon forest, nowadays the Cocoa tree is mainly cultivated in West Africa. Cocoa only grows in tropical zones that are situated within 15 to 20 degrees of the equator. Worldwide, there are three major producers. In increasing order of importance, they are: Indonesia, Ghana and Ivory Coast.

Ivory Coast's cocoa beans represent approximately 40% of the world production, with 1.24 million tons in 2009-2010, making it the largest producer of cocoa beans (ICCO, 2010). Like others developing economies, the country depends on export earnings of primary products. Cocoa production is the main economic source of income of the country with on average 35% of the total value of Ivorian exports. The Ivorian Cocoa market-industry is so important that more than a quarter of the population is involved in the value chain (Global witness, 2007). There are, in

general, two harvests a year. The main campaign starts in September-October and can be extended to January or even March. After being harvested the beans are cleaned and dried, then they are exported from two ports: San Pedro in the west and Abidjan in the east. As a consequence of the high share of the country in the cocoa market, the port of San Pedro is the first exporting port of cocoa in the world. The cocoa beans are mainly exported to major treatment centers in Europe and America while 17% of the cocoa beans are processed in Ivory Coast.

2.2 Political instability of Ivory Coast

In the past, Ivory Coast could have been considered as a politically stable country. In 1999, a military putsch led to a prolonged period of political instability with some scenes of extreme violence. From 2000, many events increased the political instability: army rebellion in 2002, peace agreement in 2003 and postponed elections in 2005 and 2006. From March 2007 to the democratic election of 2010, the signing of a final political agreement brought some relief in this unstable political environment. (Global witness, 2012)

Despite the good performance of the first round of the presidential election in October 31th 2010, the second round was fraught with irregularities. At this stage, the people had to choose between Alassane Ouattara candidate of the RHPD (Rassemblement des Houphouëtistes pour la Démocratie et la Paix) and Laurent Gbagbo the outgoing President. Even though the result of election was in favor of Alassane Ouattara with 54.1% of the vote, the outgoing president Laurent Gbagbo did not accept to cede power. (International crisis group n176, 2011)

In support to the elected president of Ivory Coast, Alassane Ouattara, the international community imposed an embargo from the 24th January to eventually the 8th April on coffee and cocoa. The main goal of the embargo was to force the outgoing President, Laurent Gbagbo, to cede power after his defeat at the election.

2.3. Cocoa demand and consumption

Cocoa is an international commodity while Ivory Coast is the main producer; the United States and the Netherlands are the main processing countries. These cacao beans are mainly used in the chocolate industry through a long system of transformation.

In the case of the Ivorian cacao, the beans are cleaned and dried to a certain extent before being exported from the country to different destinations. Subsequently, in the different factories, the roasted cocoa beans are transformed into a paste of cocoa and then into cocoa liquor. From this new product, cocoa butter and cocoa mass are derived through a pressure process. Cacao powder is obtained through the transformation of cocoa mass. Chocolate is obtained by adding to cocoa liquor a bit of cocoa butter and others ingredients such as sugar, milk and emulsifiers.

2.4. Theoretical problem definition

The embargo of the UN on Ivory Coast had multiple effects. In this case, it was a success on the political plan as predicted. Moreover, the effects on the Ivorian economy were the main reason of this economic sanction used as a political policy. On a market side, the commodity world was also affected through this embargo. The cocoa price for example reached during the embargo is highest price in 32 years with a value of 3, 775 dollars. If high prices were noticed in the nearest futures market, they were also observed in further delivery futures market. Since the embargo was proven to be one of the reason of high price in the spot market, this research investigate the effects of this export ban within futures prices.

Regarding this problem the following main research question seems relevant:

What is the impact of the Ivory Coast Embargo on the futures spread of the Cocoa Market?

3. Literature Review

This study was developed around a paper of Burger and Ruf (2012) entitled “Who paid for the embargo on Ivorian cocoa in 2011?”. In their research, they studied the impact of the embargo on the international spot price and the domestic market. The paper was used as a starting point and framework for our model of cocoa basis analysis.

3.1. Export restriction

Worldwide, many types of export restriction are in used. They go from export bans to export quotas and export taxes with sometimes inclusion of export restricting measures of state trading enterprises. Export ban also called embargo or export prohibition is one of the extreme forms of export restrictions. It represents an absolute restriction on exports (Bonarriva et al. 2009). Bans generally have large impact in terms of welfare measures and trade flow. In global food markets, embargoes have many effects on prices. Prices response to the instatement of a ban varies from one day to the next one. While sometimes these prices change are not noticeable, they can have dramatic effects when the ordainment of a ban is by a major exporter. That’s why many authors call for a prohibition on export ban. (Sharma, 2011)

Diverse reasons push a country to instate an export ban on food commodities. First, it can be in response to domestic matters. This type of export ban is mainly a defensive measure to protect consumers or producers of the country. In this case, the ban is related to products that are exchanged or consumed in their raw form: wheat, maize, rice (Mitra and Josling, 2009). It can be for economic reason as the US ban on soybean to prevent an increase of the domestic soybean price when others are for health reasons like the one on beef from UK and Canada. Another reason is a protest against another country’s domestic politics or to force the target

government to change its political behavior (Yang, 2000). When embargoes are used to influence international diplomatic behavior, they targeted specific exporting countries.

Another aspect of export ban is their unpredictability. The uncertainty can be seen at many levels. First, nobody knows when it will occur. There is no possible way to determine in advance the date an embargo will be imposed. Furthermore, the duration is also unpredictable. From its imposition, no matter the length announced at the beginning, it can be extended. In summary, the unpredictability of the export restriction resides in the launching date and the length period. (Bergström et al. 1985)

Export ban's uncertainty seems to be also in their effectiveness and their impacts. In general the consequences depend on the type of countries involved: small exporter or large exporter. In addition to the effects of the case of a small exporter, there are terms-of-trade effects in the case of a large exporter. In this case, the effects of the embargo are more on the volume of products and the incremental change in the world price. For importing countries, the main consequences are the rise of import prices and welfare losses. Thus, export restriction is called "beggar-thy-neighbor policy" in reference to the multilateral concern it raises. (Sharma, 2011)

In conclusion, any export restriction constitutes a distortion in the market. When it is imposed to a producing country, its first effect is a reduction of supply to the rest of the world. As a consequence of this, international prices of the commodity will increase with a slump of consumer welfare and an aggregate economic welfare loss will be caused in the rest of the world. (Mitra and Josling, 2009)

3.3. Cocoa spot and future markets

Like coffee and other commodities, Cocoa is traded on spot and futures markets. When sold on the spot market, the cocoa is exchanged immediately for cash. On the

futures market, the transaction and the physical delivery of the cocoa is delayed to a specified place and time in the future. To ensure a smooth functioning of the future market, each transaction is based on a standardized contract. By definition, a futures contract represents an agreement between two parties to exchange a product in the future at a specific price and period. These futures contracts can be traded only at two places: the ICE (Inter Continental Exchange) futures in the United States and the LIFFE (London International Financial Futures Exchange) in the UK. The main differences between these two markets reside on the currency use for the exchange and the quality of the beans that tends to be a touch lower at ICE. Table 1 shows the different characteristics of a standardized contract of the ICE.

In the cocoa market, the determination of the futures price is based on the comparison of the expected spot price at this moment to the prevailing future price. Consequently, futures prices summarized the information on the expected supply, level of stocks and the demand expectation at the maturity of the contract.

However, latest studies on cocoa market have confirmed that LIFFE futures market is unbiased and serves as price discovery channels when deregulation of financial and physical instruments raise concern about the efficiency of cocoa futures market (Maurice, 2011). Nardella (2007) demonstrated that the price discovery mechanism of cocoa futures market is efficient. Geman and Sarfo (2012) shown that cocoa market is subject to seasonality that should be taken into account in the analysis of this study.

Table 1: LIFFE COCOA CONTRACT SPECIFICATIONS	
Unit of Trading	10 metric tons
Delivery months	March, May, July, September, December, such that ten delivery months are available for trading
Deliverable units	Standard Delivery Unit (SDU) – bagged cocoa with a nominal net weight of ten tonnes. Large Delivery Unit (LDU) – bagged cocoa with a nominal net weight of 100 tonnes. Bulk Delivery Unit (BDU) – loose cocoa with a nominal net weight of 1,000 tonnes
Minimum price movement (tick size and value)	£1 per tonne
Last trading day	Eleven business days immediately prior to the last business day of the delivery month at 12:00
Trading Hours	09:30 - 16:50 London time
Notice day/Tender day	The business day immediately following the last trading day
Origins tenderable	Côte d'Ivoire, Democratic Republic of Congo (formerly known as Zaire), Equatorial Guinea, Ghana, Grenada Fine Estates, Jamaica, Nigeria, Republic of Cameroon, Republic of Sierra Leone, Togo, Trinidad and Tobago Plantation, Western Samoa at contract price. All other origins tenderable at set discounts

3.4. Future markets

The difference between cash market and futures market lies not just in the deferred sale. In fact, future markets are mainly financial standardized contracts exchanged between market participants that play many roles.

Masters and White (2008) considered that while futures markets don't fulfill the outright sale of the products, they perform a role of price discovery and hedging efficiency. Price discovery can be defined as a function through which market participants define spot price in function of the movement of futures price when hedging refer more to concepts of risk avoidance and insurance. The justification of the existence of future market rest on two factors: the cost of storage and unpredictability of the evolution of the price due to permanent change in supply and demand. In consequence, the market participant benefits from extremely low default.

The Hedging advantage of the future market is linked to the use of futures contracts where the price, the currency, the quantity, the place and date of the delivery are specified. The futures contracts guarantee liquidity and lower the price risk (Pennings, 2001).

If futures market price can be use as forecast of the future spot price, Tomek (1996) recommend focusing on their function as determining a price level and price difference appropriate to the temporal definitions of the contract. Furthermore, he considers futures price as poor forecaster joining Holbrook Working (1949) that was already opposed to view futures prices as forecast. Therefore, instead of considering future price as forecast, the use of the relationship (basis or future spread) between the future price and the spot price is recommended.

3.5. Spot and future relationship

Nowadays, the relationship between spot and future price is theoretically defined by two theories: the “theory of storage” and the “theory of risk premium”. While the theory of storage explains the variation in term of storage interest, convenience yield from inventory and transportation cost, the theory of risk premium is more adapted to the analysis of price transfer by defining the futures price as a forecast of the maturity spot price and expected risk premium risk. In this study, the relationship between spot and futures price are studied under the function of price discovery. For Working (1948), future price should converge toward spot price and referred to the term basis convergence. Therefore, the theory of storage will be examined to get a better understanding of this relationship between spot and futures prices.

Initially developed by Kaldor (1939) and Working (1948, 1949), the theory of storage explains the intertemporal relationships between spot and future prices. This theory introduced the concept of *basis (B)* – the difference between the current spot price at time t , S_t , and the futures price at time t with delivery at time T , F_t^T . The basis is defined as:

$$\text{Basis (B)} = \text{Spot price (} S_t \text{)} - \text{Futures price of the contract used (} F_t^T \text{)}$$

The future spread or future basis is the difference between two futures prices. The spread or basis can be presented as a function of expected inventory behavior. In this case, the basis is defined by the following equation:

$$\text{Basis} = C - (rt + W)$$

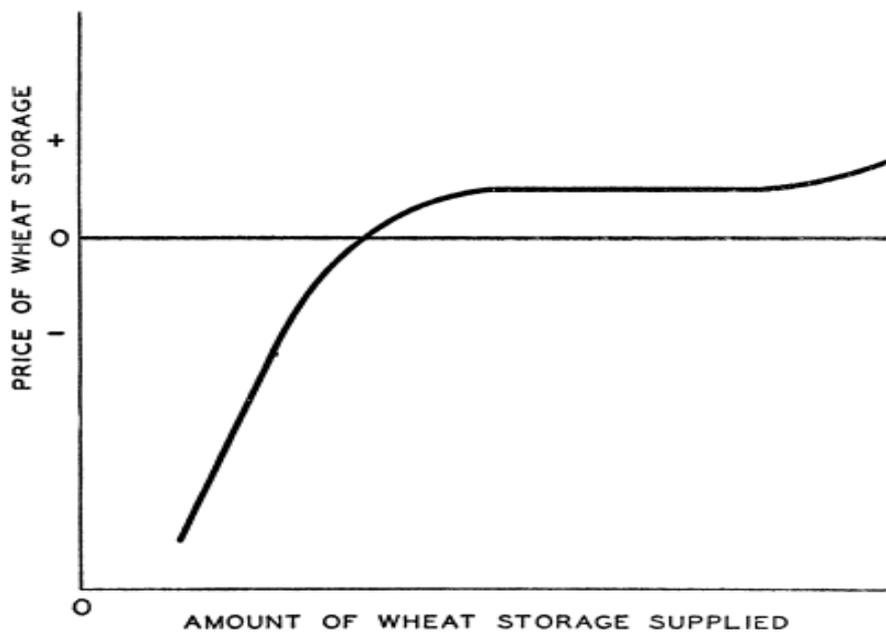
Where C is the convenience yield, rt is the opportunity cost of holding stocks and W is the physical storage cost.

Being related to market conditions, the basis is affected by a number of factors: storage cost, transportation cost, profit margin and supply/demand condition. In commodity market, the role of inventory is linked to its capacity to smooth price fluctuations in reaction to a supply and demand shift with the ability to use inventory in response to changes in demand being limited by the costs of holding that inventory. It should be noted that the convenience yield represents the marginal benefit of holding inventory. Under the theory of storage, demand and supply shocks affect futures and spot prices through the variation in inventory. By linking the basis to the cost and benefits of carrying inventory, the theory of storage describes two specific cases depending on the level of the inventory. A high level of inventory associated with a low convenience yield leads to a negative value of the basis. In contrast, a positive value of the basis represents low level of inventory and high convenience yield. For Hull (2002), "The convenience yield reflects the market's expectations concerning the future availability of the commodity. The greater the possibility that shortages will occur during the life of the futures contract, the higher the convenience yield "

A positive basis refers to a situation of "backwardation" where the futures price is below the expected future spot price. In contrast, a negative basis refers to a situation of "contango" in which the futures price is above the spot price.

The relation between the amount of supply and the price of storage is represented in Figure 2. Here, the price of storage represents the return to storage. As described by Working (1949), for a normal storage market of physical commodities like wheat, the return to storage increases with the amount of supply. However, a low amount of supply can result in a negative return for storage.

Figure 2: Complete storage supply curve



Source: Working (1949)

In practice, the analysis of the basis should not only consider its value but another important factor: its change. We refer to strengthening basis when the value of the basis becomes more positive or less negative. In this case, the spot-futures relationship is affected by a future price decrease relative to spot price. In opposition, when the value of the basis becomes more negative or less positive we refer to the term weakening. In this case, we have a spot price decrease relative to future price.

The main components accountable for the change in the basis are mostly the short-term supply and demand. When the supply falls and the demand rise, the basis strengthens as a consequence of spot price rising in proportion to futures price. In opposition, a weak demand and the presence of a large supply would lead to futures price rising in proportion to spot price.

4. Methodology

4.1. DATA

In order to study the evolution of the spot future basis of the cocoa market, it was important to have access to the market data. The primary data set used to compile the monthly data consist of daily future price with several delivery dates. The full data set cover the period from 2nd January 2009 to 28 September 2012. The figure 3 entitled “Roll-Over” describes the correspondence between the delivery month and its contract position (nearby, 2nd to expire, 3rd to expire) in relation to the stamp date.

The period surveyed was from February 2009 to September 2012, giving a reasonable number of data points. . This period was chosen in order to be able to test the seasonality.

The future contract covering up to the fourth future delivery dates were used in the study to calculate the different spread.

Figure 3: Roll-over chart

		TERMINAL MARKET CONTRACT								
Date		Current year					Next year			
Month	(Inclusive)	MAR	MAY	JUL	SEP	DEC	MAR	MAY	JUL	
January		X	X	X						
February	1 - 14	X	X	X						
February	15 - 28		X	X	X					
March			X	X	X					
April	1 - 14		X	X	X					
April	15 - 30			X	X	X				
May				X	X	X				
June	1 - 14			X	X	X				
June	15 - 30				X	X	X			
July					X	X	X			
August	1 - 14				X	X	X			
August	15 - 31					X	X	X		
September						X	X	X		
October						X	X	X		
November	1 - 14					X	X	X		
November	15 - 30						X	X	X	
December							X	X	X	

4.2. Methods

4.2.1. Calculation of the future spread

The Cocoa future spread is calculated as the difference between the nearest futures price and the third futures price (approximately 6-months futures). As a consequence, a negative value of this future spread should lead to negative value of the future spread for 3-months futures. The embargo was planned to last only one month but finally lasted 3 months. Therefore, the 6 months future price should not account for effect of the embargo since the market was supposed to be back to normal.

4.2.2. Regression model

In this study, we want to explain the effect of the export ban on the future spread. Therefore, we used a set of explanatory variables in the regression of the future spread. The different explanatory variables are:

- Dummies variable for the months of the year
- Dummy variable for the embargo (0= absence of embargo; 1= embargo)
- Past three values of the futures spread
- Trend

The hypothesis:

1. The Cocoa future spread will be positively related with the embargo.

This result in the following econometric model used to test the effects of determinant factor of the future spread: $B_t^T = f_1(Emb_t, B_{t-1}^T, \beta_1Jan + \beta_2Feb + \beta_3Mar + \beta_4Apr + \beta_5May + \beta_6Jun + \beta_7Jul + \beta_8Aug + \beta_9Sep + \beta_{10}Oct + \beta_{11}Nov + \beta_{12}Trend_t + \mu_t$

A positive sign is expected for the coefficient of the dummy embargo because of the anticipated decline in supply should have increase the future spread and put the market in backwardation.

Seasonal factors are included as each month is expected to have an effect on the level of supply based on cyclical nature of the production.

The error term, added to the regression, account for the effects of independent variables that are not included in the regression. Indeed, the independent variables mentioned in the model cannot fully describe the variation in the dependent variable.

4.2.4. Counterfactual *model*

To determine the estimated futures spread that would have prevailed in absence of the embargo, we calculated from the results of the regression the predicted value of the spread by replacing the dummy variable “embargo” by its opposite value. By using the regression, the predicted values are calculated in function of the different variables and their predicted values in absence of embargo.

Theoretical nearest prices are also calculated from the predicted values of the basis and the actual values of the third delivery futures prices.

5. Empirical Results

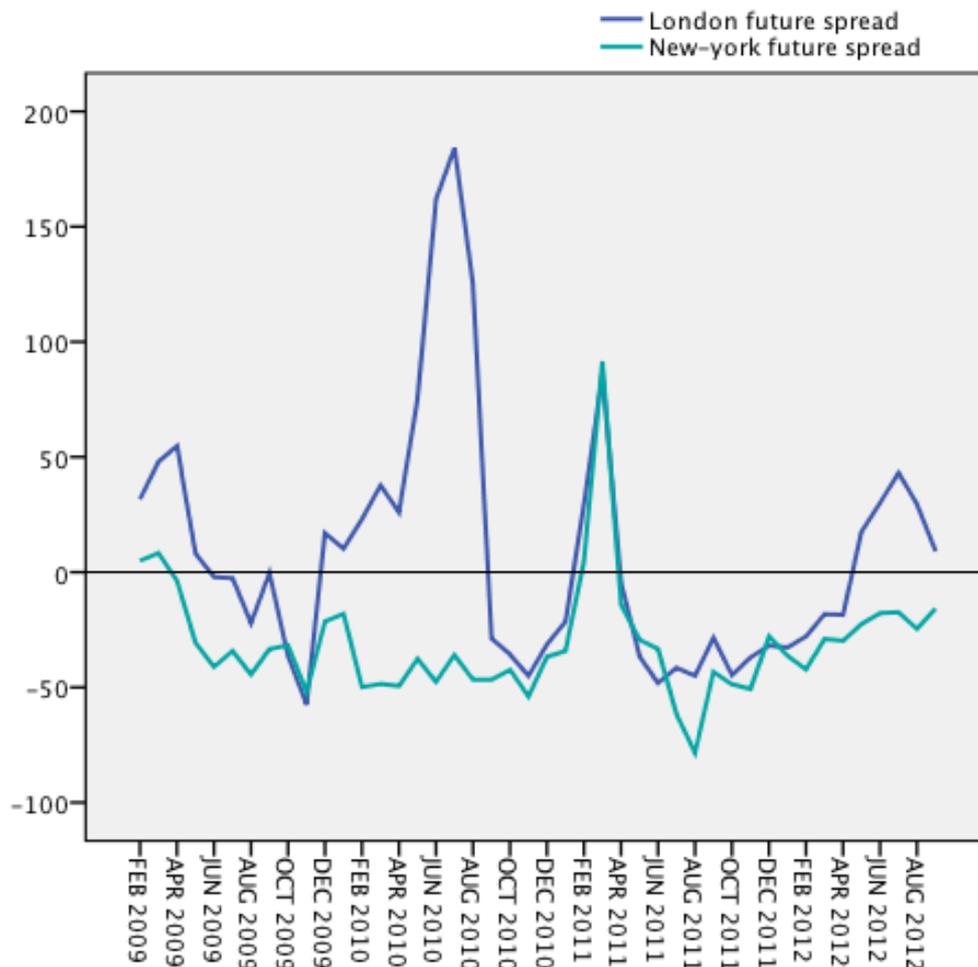
To test the effects of the Ivorian embargo on Cocoa, this research focus on the nearest futures and 6 months futures price relationship. First, the effects were test by using monthly data and then daily data.

Monthly regression

If the embargo was established the 24th of January, the period considered for the embargo in the monthly regression was February to April. The figure 4 presents the evolution of the future spread for both markets. During the period of the embargo, the spread is positive. Therefore, the market can be considered in backwardation with the nearest future price above the 6-months future price. From this figure, we can conclude that the traders were expecting price to decrease over the long term. In relation to the supply-demand function, the backwardation of the market

represents a low supply relative to the demand.

Figure 4: Monthly future spread from February 2009 to September 2012



A possible explanation for the divergence of result between the two markets might be the 2009 price hike triggered by a London-based hedge fund –Armajaro. Indeed, the price record observed in the London future market was only a 9 month-record when the New-york market observed a 32-years price record. Therefore only the spread of New York is considered for the monthly regression. The empirical result of the regression is summarized in Table 2.

Autocorrelation Test

The regression coefficients in the equation were significant. For the model with 44 sample sizes and 17 explanatory variables, when level of significance was 1%, by DW statistical table look-up, it can be known that $dL=0.771$, $dU=2.057$. As $dL < DW < dU$,

the test is inconclusive.

Table 2: Monthly regression

	New-york regression	
	Coefficients	Std. Error
Intercept	-26,206*	13,266
Embargo	54,855***	13,933
Trend	-0,106	0,251
January	-0,794	16,888
February	-6,078	16,237
March	20,178	16,216
April	-9,517	16,198
May	-1,497	15,797
June	-6,317	15,795
July	-8,586	15,797
August	-19,681	15,803
September	-5,85	15,813
October	-12,511	16,893
November	-23,706	16,888
R ²	0.552	
Durbin-watson	1,411	
N	44	

Significance at : *= 10% **= 5% ***= 1%

The New-york future market gives positive relationship between the future spread and the dummy variable embargo, significant at 1%. The reminder of variable correlations is not significant even on 10% at the exception of the intercept. These results imply a positive effect on the embargo on the relationship between nearest future price and 6-months future price.

Daily regression

Using the daily data, each market future spread was regressed using past three days value, monthly dummies, trend variable, embargo dummy and exchange rate. The period considered for the embargo was the 24th January to the 8th April for the New-york futures market when the period was the 17th January to the 8th April for the London futures market.

Autocorrelation test

The regression coefficients in the equation were significantly. For the model of New York with 967 sample sizes and 16 explanatory variables, when level of significance was 1%, by DW statistical table look-up, it can be known that $dL = 1.817$, $dU = 1.881$. As $dU < DW = 1.98 < 4 - dU$, there is no serial correlation in the model of New-york futures spread.

For the model with 543 sample sizes and 16 explanatory variables, when level of significance was 1%, by DW statistical table look-up, it can be known that $dL = 1.73$, $dU = 1.85$. As $dU < DW = 2.007 < 4 - dU$, there is no serial correlation in the model of London futures spread.

Table 3: Daily regression

	Spread regression			
	New york		London	
	Coeff.	Std. Error	Coeff.	Std. Error
Intercept	-0,257	1,661	-3,573*	1,874
Embargo	6,099***	2,065	3,099**	1,497
Trend	3,54E-05	0,001	0,004*	0,002
January	-3,178	1,974	0,421	1,228
February	-1,491	1,903	0,556	1,367
March	-1,866	2,001	-0,2	1,386
April	-4,021**	1,908	-1,871	1,363
May	-5***	1,881	0,019	1,258
June	-3,019	1,878	1,209	1,241
July	-4,926***	1,869	-1,061	1,267
August	-5,736***	1,881	0,274	1,263
September	-3,137*	1,858	-0,653	1,173
October	-3,883**	1,892	-0,705	1,136
November	-8,611***	2,028	-0,753	1,231
B (t-1)	0,571***	0,032	1,046***	0,043
B (t-2)	0,208***	0,036	-0,008	0,063
B (t-3)	0,104***	0,032	-0,076*	0,043
R2	0,837		0,974	
Durbin-watson	1,98		2,007	
N	967		543	
			Period start: 1er Sept. 2010	

Significance at : * = 10% ** = 5% *** = 1%

The London futures market gives positive relationship between the futures spread and its past values (t-1/t-3) significant at 1%. The embargo is significant at 5%. The reminder of variable correlations is not significant even on 10%. From these findings, we can conclude that the embargo had a positive influence on the futures spread evolution in the London future market.

The New-york futures market gives positive relationship between the futures spread and the dummy variables embargo, July, August, November and also the past values of the futures spread, significant at 1%. The variable October and April are significant at 5% when the variable September is significant at 10%. The other coefficients are not significant even at 10%. These results imply a positive effect of the embargo on the relationship between nearest futures price and 6-months futures price.

The results of the regression confirm the hypothesis 1 that the embargo affects positively the futures spread.

Counterfactual analysis

From the results of the regression, counterfactual prices were calculated by considering the absence of the embargo. These prices are calculated up to September 2011. The disruption of supply created by the embargo should vanish with the start of a new production cocoa year.

Monthly analysis

Figure 5 and 6 present respectively the evolution of monthly futures spread and nearest futures price of New York. The values of the futures spread observed during the embargo are higher than the basis that will have prevailed without the embargo. As a consequence the embargo have driven the nearest futures prices upward.

Figure 5: Monthly future spread and predicted future spread for 2011 (New-york futures market)

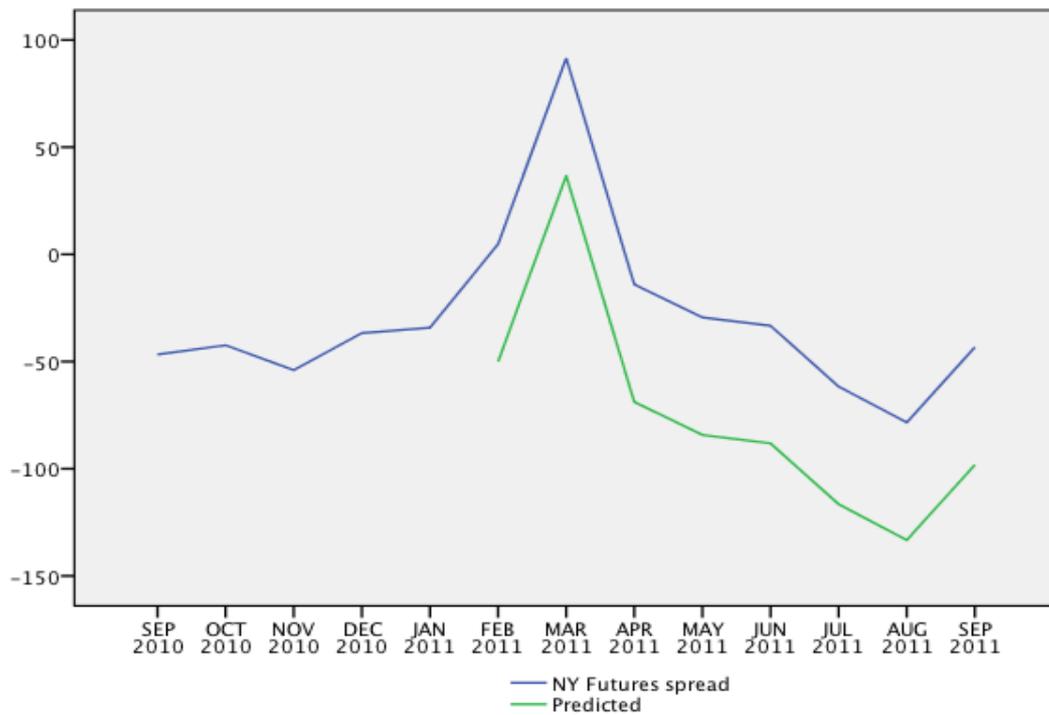


Figure 6: Monthly nearest futures price and predicted futures price for 2011 (New-york futures market)

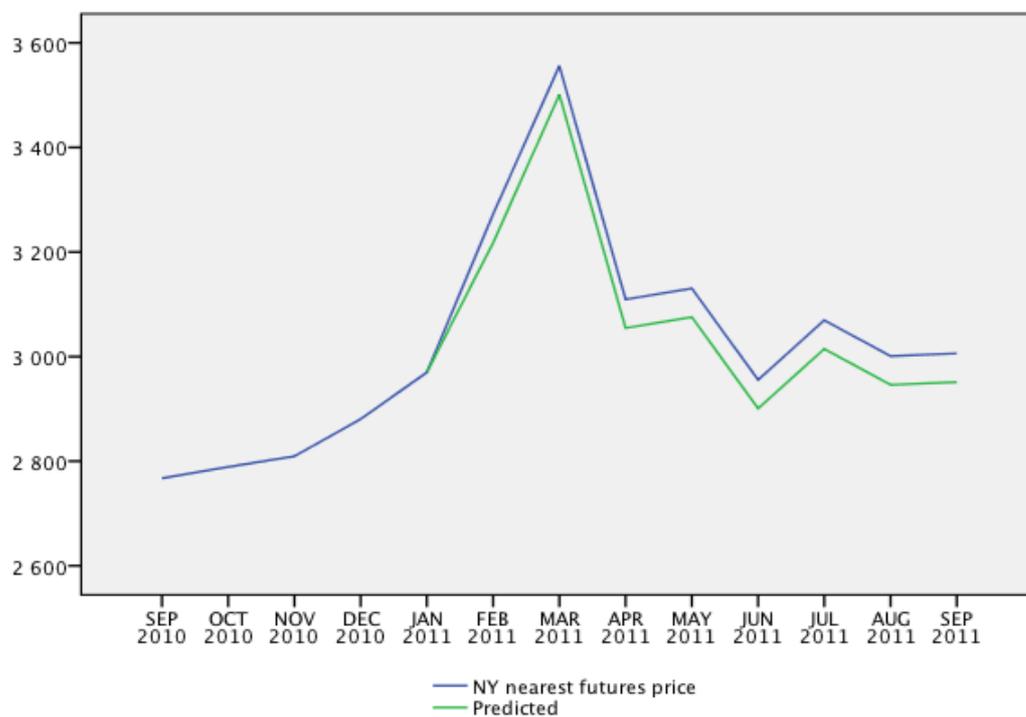
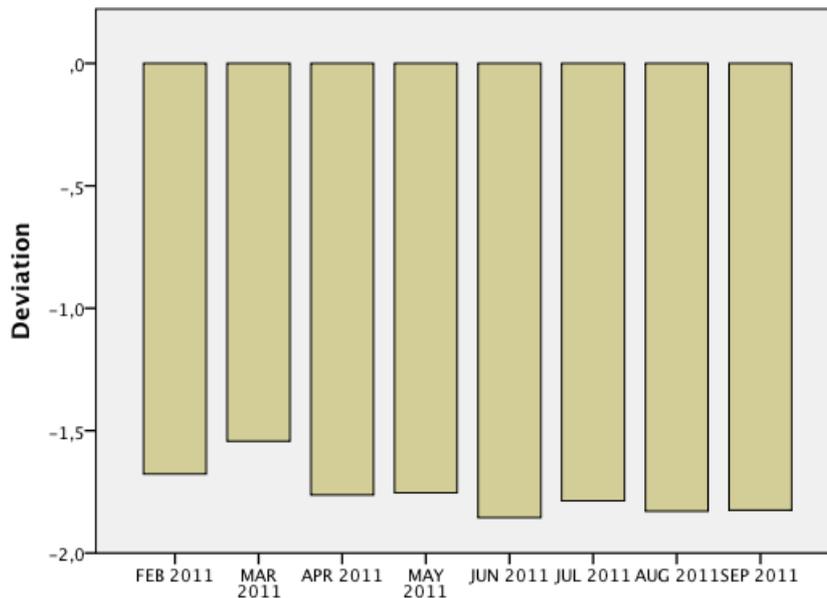


Figure 7: Percentage deviation in 2011 between actual and dynamic simulation (New-york futures market);



From the results of the monthly regression, the difference on the nearest futures prices showed that the embargo have constantly risen the price by at least 1.5 %. The futures prices didn't come back to normal up to September.

Daily analysis

From the counterfactual, we can conclude that the backwardation observed in this market couldn't have been avoided in both markets. These results are presented in the figure 8 and 9. However, such high difference between the futures prices was triggered by the embargo. For mid-February to mid-March 2011, the theoretical market is in backwardation. It is a sign that the market was expecting the price over the long term to decrease. The daily observation of the futures spread show that the market was already backwardated a week before the announcement of the embargo due to the political instability and the possibility of an embargo.

To this extent, the first hypothesis can be accepted. The embargo had a positive impact on the Cocoa future spread by driving the nearest future price above the 6-months future price.

Figure 8: Daily future spread and predicted future spread for 2011 (London futures market)

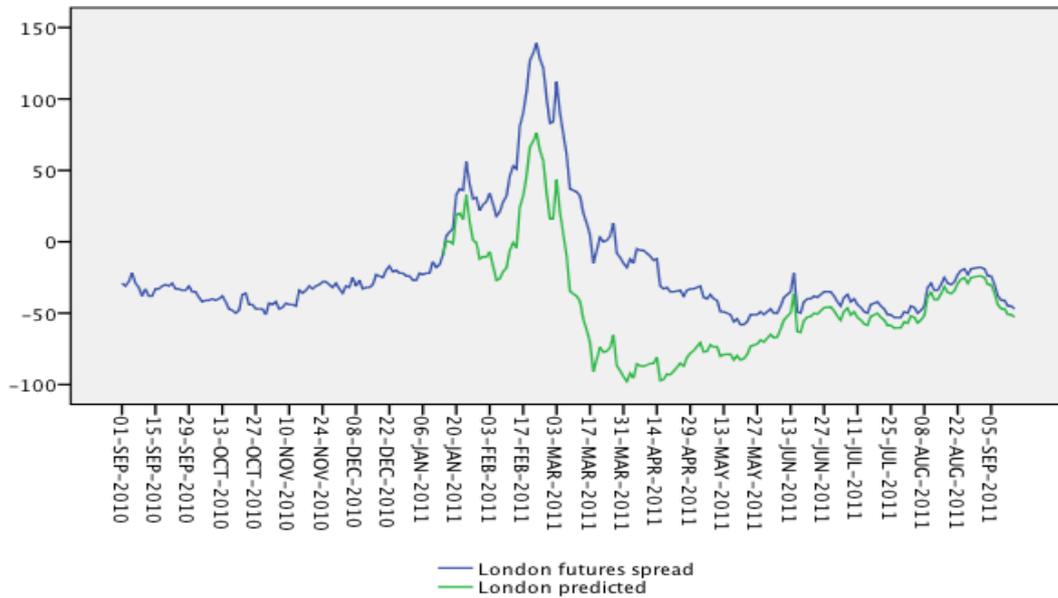
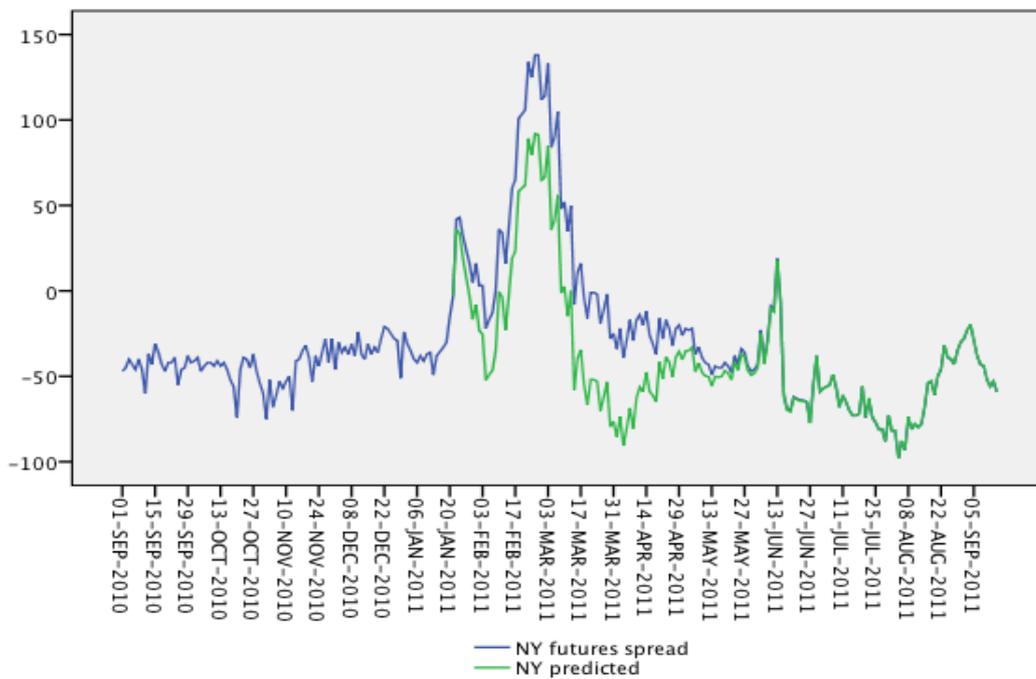


Figure 9: Daily future spread and predicted future spread for 2011 (New-york futures market)



The analysis of the nearest futures prices that have prevailed without the presence of the embargo revealed that the embargo has driven the prices upward. These results are presented in figure 10 to 13.

Figure 10: Daily nearest futures price and predicted futures price for 2011 (London futures market)

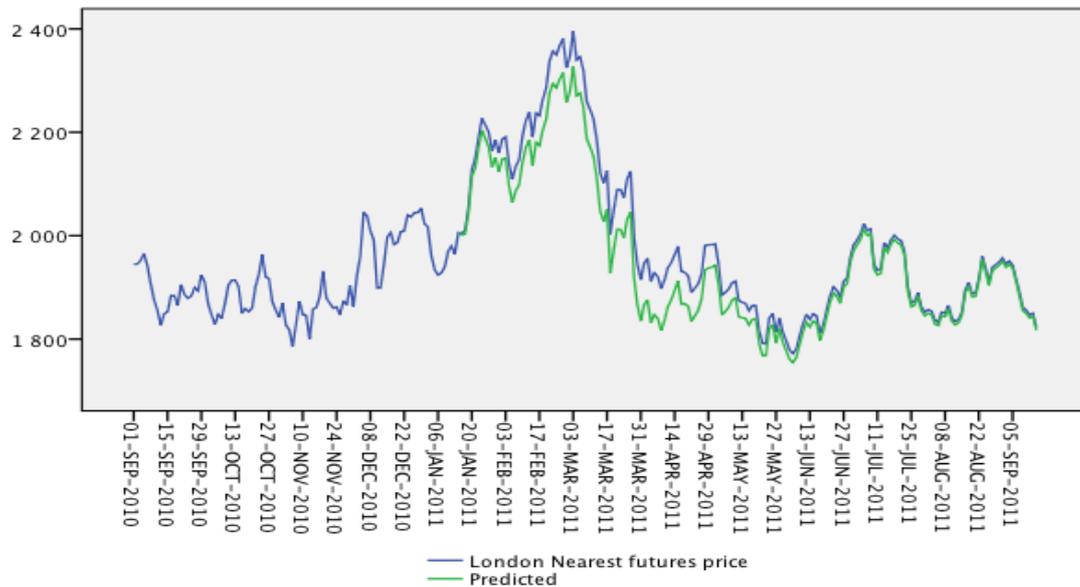


Figure 11: Daily nearest futures price and predicted futures price for 2011 (New-york futures market)

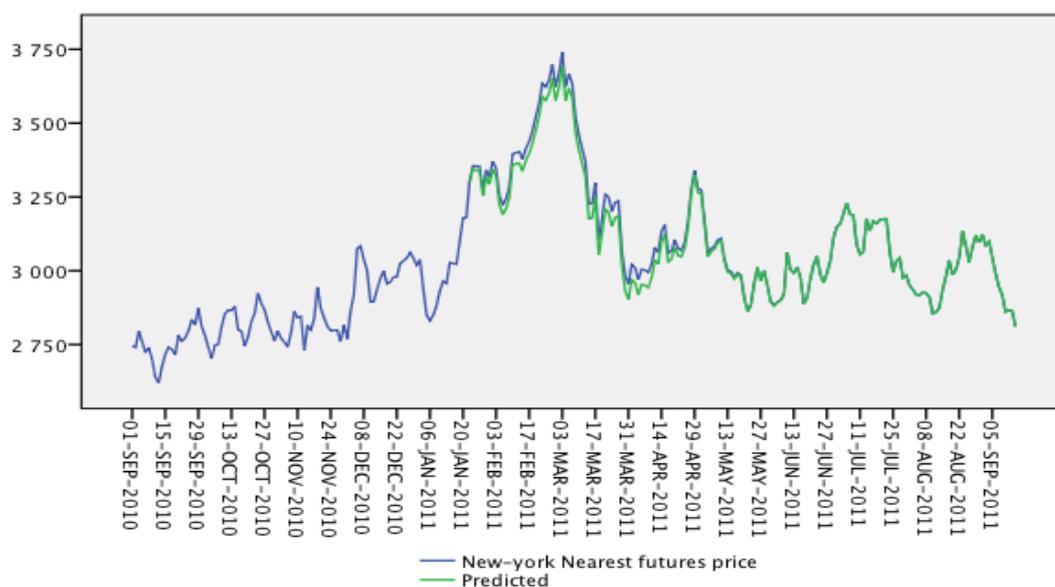


Figure 12: Percentage deviation in 2011 between actual and dynamic simulation (London futures market);

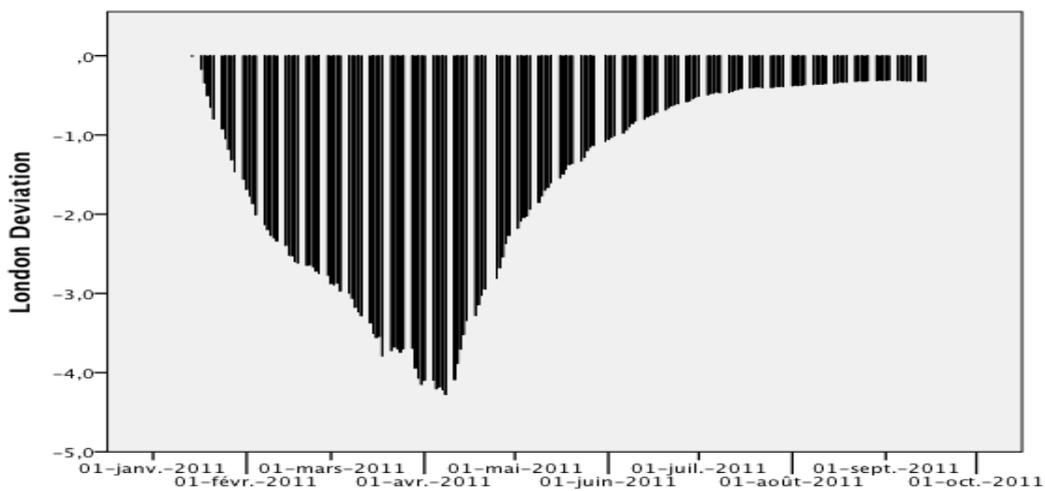
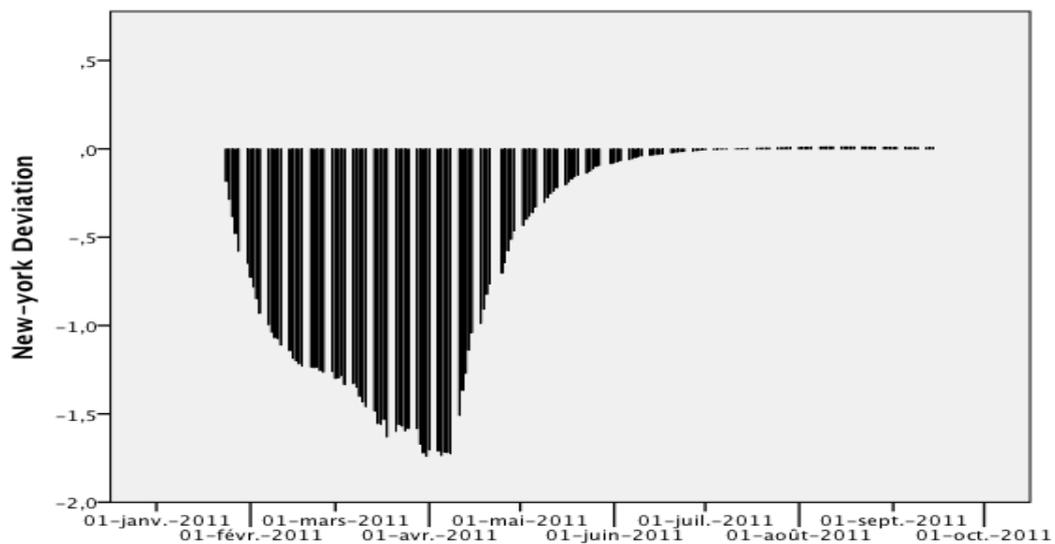


Figure 13: Percentage deviation in 2011 between actual and dynamic simulation (New-york futures market);



The result for New-york futures showed that the backwardation observed has been emphasized by the embargo. In absence of the ban, the nearest future prices would have stayed lower than the actual prices notices. From January to April, the prices have increase progressively up to 1.5% higher. In comparison to New-york, the

London market showed a bigger deviation of the nearest futures prices that went up by 4.4% in April.

April was the end of the embargo resulting on a return of the arrivals of Ivorian cocoa beans in Europe and Netherlands. Therefore, during this period of embargo, the 6-months futures price will have stayed higher than the nearest futures due to the carrying inventory opportunity cost. The presence of embargo has reduced this cost and has encouraged the traders to release their stock on the nearest futures market. Therefore the nearest future price increased and reached the record observed.

Conclusion

The focus of this thesis was the 2011 export ban on Cocoa and its effects on the futures market. By performing different tests on the two different futures markets for cocoa (New-york and London), we studied the evolution of the futures spread between the nearest futures and the 6-months futures on the period of January 2009 to September 2012. The results showed that the backwardation on the cocoa market would have prevailed even in the absence of embargo. Both market demonstrated that the high difference between the nearest price and the 6 months future can be attributed to the embargo and therefore the price records measured in the nearest future market is due to the embargo.

Reference list

Araujo Bonjean C. and Brun, J-F. (2010). Price Transmission in the Cocoa-Chocolate Chain. CERDI, Etudes et Documents, E 2010.03

BBC (2011): <http://www.bbc.co.uk/news/business-12263680>

Bergström C., G. C. Lory and M. Persson (1985). Embargo Threats and the Management of Emergency Reserves. *Journal of Political Economy* , Vol. 93, No. 1 (Feb., 1985), pp. 26-42

Blinder, A. S. and Rudd, J. B. (2010). The supply-shock explanation of the great stagflation revisited. NBER Working Paper no. 14563.

Bonarriva J., M. Koscielski, and E. Wilson (2009). Export controls: an overview of their use, economic effects, and treatment in the global trading system. Office of Industries U.S. International Trade Commission,

Boswijk P., G. Griffioen C. Hommes. (2001). Success and Failure of Technical Trading Strategies in the Cocoa Futures Market. Department of Quantitative Economics CeNDEF, University of Amsterdam. October 10, 2001

Brennan, M.J. (1958). The supply of storage. *American Economic Review*, 48:50 – 72.

Burger K. and F. Ruf (2012). Who paid for the embargo on Ivorian cocoa in 2011?. Draft paper

Chang, C. Y. (2011). The basis under negative shock and the price discovery in futures market. *Applied Financial Economics*, 21(10), 755-761.

Depetris Chauvin N., Porto G., Olarreaga M. (2010). Supply Chains in Export Agriculture, Competition, and Poverty in Sub-Saharan Africa, draft for discussion.

<http://63.135.100.184/archivos/book-depetris-olarreaga-porto.pdf>

Fairtrade (2012): accessed on December 2012

http://www.fairtrade.org.uk/includes/documents/cm_docs/2011/C/Cocoa%20Price%20Chart%2094-11.pdf

Frank. J and P. Garcia (2005). “Time-Varying Risk Premium or Informational Inefficiency? Further Evidence in Agricultural Futures Markets” Department of Agriculture and Consumer Economics, University of Illinois at Urbana Champaign

Geman H. and S. Sarfo (2012). Seasonality in cocoa spot and forward markets: Empirical evidence. Commodity Finance Centre, Birkbeck University of London and ESCP Europe, United Kingdom

Gilbert C. L., Morgan C. W. (2010). Food price volatility. *Phil. Trans. R. Soc. B* 365, 3023–3034

Global witness (2007). How cocoa fuelled the conflict in Côte d’Ivoire. A report by global witness, June 2007 www.globalwitness.org

Haque, I. (2004). Commodities under Neoliberalism: The Case of Cocoa, G-24 Discussion Paper Series No. 25. Geneva, Switzerland: UNCTAD.

Hull, J. (2002). *Fundamentals of Futures and Options Markets*. Prentice Hall.

IMF (2003), “Fund Assistance for Countries Facing Exogenous Shocks”, SM/03/288.

International crisis group (2011). Report n°176 and 185. Online, Available at www.crisisgroup.org

ICCO (2010). Annual Report 2009/2010, International cocoa organization

ICCO (2011). Annual Report 2010/2011, International cocoa organization

Kaldor, N. (1939). Speculation and Economic Stability. *Review of Economic Studies*, 7, 1-27.

Le monde (2011). http://www.lemonde.fr/afrique/article/2011/02/24/conflit-en-cote-d-ivoire-le-cacao-grimpe-a-un-plus-haut-en-trente-deux-ans_1484450_3212.html

Masters, M.W. and White, A.K. (2008). "The Accidental Hunt Brothers: How Institutional Investors are Driving up Food and Energy Prices." Online, Available at <http://accidentalthuntbrothers.com/>

Mananyi, A. John J. Struthers,(1997). "Cocoa market efficiency: a cointegration approach", *Journal of Economic Studies*, Vol. 24 Iss: 3, pp.141 – 151

Maurice E. (2011). Unraveling the underlying causes of price volatility in world coffee and cocoa commodity markets. Thesis for Master in International Economics and Business Studies

Mitra S. and T. Josling (2009). Agricultural Export Restrictions: Welfare Implications and Trade Disciplines. IPC Position Paper Agricultural and Rural Development Policy Series

Nardella M. (2007). Price efficiency and speculative trading in cocoa futures markets. AES Annual Conference University of Reading, 2nd - 4th April 2007

Pennings J. (2001). Research in Agriculture Futures Markets: Past, Present and Future. Inaugural lecture given at the Wageningen Agricultural University in the Netherlands at June 8, 2001.

Piot-Lepetit, R. M'Barek (2011). *Methods to Analyse Agricultural Commodity Price Volatility*, DOI 10.1007/978-1-4419-7634-5_1, C Springer Science+Business Media, LLC 2011

Reinhart, C. and E. Borensztein (1994). *The Macroeconomic Determinants of Commodity Prices*. IMF Staff Papers, No. 41, pp. 236–61 (Washington: International Monetary Fund)

Richard C. Crook (1990). *Politics, the Cocoa Crisis, and Administration in Cote d'Ivoire*; *The Journal of Modern African Studies*, Vol. 28, No. 4 (Dec., 1990), pp. 649-669

Sharma Ramesh (2011). *Food Export Restrictions: Review of the 2007-2010 Experience and Considerations for Disciplining Restrictive Measures*. FAO COMMODITY AND TRADE POLICY RESEARCH WORKING PAPER No.32

Tomek W. (1996). *Commodity futures prices as forecasts*. Working paper. Department of Agricultural, Resource, and Managerial Economics. Cornell University, Ithaca, New York 14853-7801 USA

Varangis P., S. Varma, A. dePlaa and V. Nehru (2004). *Exogenous shocks in low income countries: economic policy issues and the role of the international community*. The World Bank. November 20, 2004. Background paper prepared for the Report: *Managing the Debt Risk of Exogenous Shocks in Low-Income Countries*

Yang Y. (2000). *Food embargoes against china: their likelihood and potential consequences*. Asia Pacific Economic Papers

Working, H. (1948). *Theory of the inverse carrying charge in futures markets*. *Journal of Farm Economics*, 30, 1-28.

Working, H. (1949). The theory of the price of storage. *American Economic Review*, 39:1254-1262.

Yadav, P. K., & Pope, P. F. (2006). Stock index futures arbitrage: International evidence. *Journal of Futures Markets*, 10(6), 573-603.