Market power in food supply chain: evidence from Italian pasta chain

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STRUCTURED ABSTRACT

PURPOSE: During the last years, Italian pasta chain has been strongly affected by some events such as CAP reforms in the durum wheat sector that have progressively reduced government intervention in the market and a case of anticompetitive practices against pasta makers was identified and sanctioned by the Italian Antitrust Authority. The purpose of this paper is to detect the presence of market power in the different phases of the Italian pasta supply chain

DESIGN/METHODOLOGY/APPROACH: The authors applied the "first-pass" test proposed by Lloyd et al. (2009) on a set of monthly price indexes series from 2000 to 2013 in order to estimate if market power exists along Italian pasta chain

FINDINGS: Estimated results suggest that market power exists in the Italian pasta supply chain. Precisely, the presence of market power is detected for semolina producers in 2000-2004, for pasta makers in 2005-2008 as already identified by Italian antitrust and, finally, for retailers in 2008-2013.

RESEARCH LIMITATIONS/IMPLICATIONS: The method is a "first pass" test that only allows researchers to identify the presence of market power, but it is unable to estimate the intensity of this power

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1. INTRODUCTION

The food supply chain plays a substantial role in the European economy, connecting sectors such as agricultural, food processing industry and distribution that together make more than 5% of European value-added and 7% of employment (EC, 2014). The food supply chain is a complex series of inter-related markets where competition at different stages of the supply chain matters for the overall functioning of the food sector. Welfare implications of competition at any stage of the food supply chain increase the public concern for greater transparency over food pricing issues. Competition issues become very relevant given the increased concentration of downstream stages and the distribution of value added in the last decades (EC, 2014). As a consequence, a better functioning food supply chain is crucial both for consumers and for ensuring a sustainable distribution of value added along the chain (Sorrentino et al., 2016). In the last years, an increasing number of studies, using different methodological approaches such as asymmetric price transmission (APT) and structural models, focused on oligopolistic and oligopsonistic power exerted within agri-food systems at food processing and retailing stages to the detriment of farmers and consumers (Zavelberg et al., 2015; Fałkowski, 2010; Bakucs et al., 2012; Cacchiarelli and Sorrentino, 2016).

Pasta represents a strategic product in the Italian agri-food industry, having Italy the peculiarity of being, at the same time, the main producer and consumer of pasta. The durum wheat production involves more than 250,000 farmers while industrial sector, which is almost 6% of the total Italian agri-food industry turnover, is composed of semolina and pasta production. The last segment of the Italian pasta supply chain concerns food retail market: based on some evidences and stakeholders' statements, in some cases pasta seems to play an important role in the retailers' pricing strategy as a loss leader product; in many circumstances large retailers use to sell pasta at a price below its production cost to stimulate other sales of more profitable goods. The selected food supply chain is characterized by high concentration of the downstream stages: i) semolina sector has experienced a consolidation characterized by relevant decrease of the share held from small-medium millers; ii) pasta market shows a leader (Barilla which held around 35-40% of market share), a national brand, De Cecco (10%), which competes at the highest market segment with Garofalo and Voiello, and

several national and regional brands with shares lower than 2%; iii) the last decades have been characterized by a strong development of modern retails in which the share of large outlets (hypermarkets, supermarkets and discount stores) has grown to the detriment to smaller stores (Sorrentino et al., 2016). Moreover, the penetration of private labels by retail chains is an increasingly significant feature of the food sector.

During the last years, pasta supply chain has experienced some relevant changes. The most relevant event concerns a case of anticompetitive practices, identified and sanctioned by the Italian Antitrust Authority, against pasta makers (Antitrust, 2009). According to Antitrust sentence, for the period October 2006-March 2008, Italian pasta makers (about 90% of Italian market) and two Industrial Unions of Italian pasta makers have put into practice a restrictive-competition accord aimed at harmonizing increases in the sale price for semolina dry pasta that applies to the retail sector. Moreover, while before 2007 durum wheat price showed a slight alternative trend, where short upward movements were followed by smooth downward periods, in the spring of 2007 until March 2008 there has been an extraordinary price increase. As a consequence, the processing and retailing stages experienced important production costs. Finally, CAP reforms have affected durum wheat sector, progressively reducing government intervention in the market. Specifically, the mid-term reform, applied to the durum wheat sector at the start of 2005, represented a deep change in the tools applied in the CAP, with a turn from coupled income support to a single decoupled aid where farmers' incomes are directly supported and are no longer linked to levels or types of production. This has led to a reduction of durum wheat production in areas where it is no longer economically profitable (ISMEA, 2011) and, consequently, partially affected Italian wheat prices.

This study aims at estimating the existence of market power along the different stages of the Italian durum wheat-pasta chain. We apply the "first-pass" test proposed by Lloyd et al. (2006; 2009) on a set of monthly prices and cost index series from 2000 to 2013 in order to verify the presence of market power in the select food supply chain according with the main changes of the policy and market conditions. Although the limitations of the model employed, this paper represents an attempt to estimate and assess how some relevant factors (policy changes and raw material prices fluctuations) affect the distribution of the market power along food value chain.

The paper is organized as follows. After a brief discussion of the literature review on market power in agri-food chain included in section 2, section 3 shows the methodology employed to test the presence of market power. Section 4 reports data used and the preliminary analysis of stationarity and cointegration, while Section 5 shows the results. Finally, Section 6 concludes.

2. LITERATURE REVIEW

In literature many works have employed various approaches to examine the presence of market power along food supply chain. Price transmission asymmetry (APT) study represents a useful way to verify how price signals are transmitted along market vertically related.. An APT, where the price increases of raw material are incorporated on retail prices faster and more completely than price decreases, is often considered as an evidence of anticompetitive behaviour. Many authors identify the exercise of market power by middlemen, made possible by imperfect competition at the processing and retailing stage (Peltzman, 2000), as being among the possible factors that may explain the presence of APT along a food chain. Other explanations include retailer behaviour such as menu cost, cost of acquisition and the use of psychological pricing points (Levy et al, 2011) and Political regulation including the CAP. However, the causal relationship between market power and ATP is not theoretically grounded (Cacchiarelli et al., 2016).

The other methodologies employed to detect market power are included in the New Empirical Industrial Organisation (NEIO) structural models. The NEIO approach focuses more on aspects of market conduct such as the behaviour and strategic reactions of firms in the industry. It addresses the weak theoretical foundation of the Structure-Conduct-Performance approach by deriving model from microeconomic theory (Perloff et al., 2007). In their simpler versions, NEIO models are usually aimed at testing for the presence of market power exertion or to estimate its extent at market level and not along the entire food chain; they differ according to: i) the side of the market analysed (product supply or factor demand, measuring, respectively, oligopolistic or oligopsonistic power); ii) the kind of product examined (homogeneous vs differentiated); iii) the estimation strategy adopted (parametric vs non-parametric model); iv) the repetition of interactions among economic agents (static vs dynamic models). In their more complex versions, NEIO models analyse the extent of oligopolistic and oligopsonistic power on more stages of the marketing chain (Sexton and Zhang 2001), estimating market power for each stage of the supply chain, but at the cost of increasing demand for data and econometric sophistication. Obviously, since NEIO models are rooted in economic theory, findings on the extent of market power exertion derived from their use are more conclusive and reliable than those of APT studies, although some criticisms regarding their accuracy are arising (Perloff and Shen, 2012).

Finally, an intermediate way to detect the presence of market power along food supply chain is represented by theoretical model introduced by McCorriston et al. (2001) and adapted by Lloyd et al. (2006; 2009) for empirical application to some food supply chains which merges some characteristics of APT methods and NEIO paradigm. It is a “first pass” test that only allows researchers to identify the presence of market power, but it is unable to estimate the level of this power. Its theoretical framework represents a modification of Gardner (1975) model releasing the

assumption of perfect competition. In order to verify the presence of market power the empirical equation requires time series of prices and costs easily available. As a consequence, this model has been employed to test the existence of market power in various food supply chains in many countries (Madau et al., 2016; Fałkowski 2010; Niemi and Xing 2016; Cavicchioli, 2010).

3. METHODOLOGY

3.1 The model

The theoretical approach proposed by McCorriston et al. (2001) and Lloyd et al. (2009) was used in this study in order to verify the existence of market power in the Italian pasta supply chain

The authors built a theoretical model through a modification of Gardner model (1975) by releasing the assumption on perfectly competitive markets. This theoretical framework, which takes into consideration food supply chain by focusing on farm and marketing levels, is based on estimating the role of some exogenous shocks in conditioning possible market power along a supply chain and taking into account both upstream and downstream prices.

Our goal is to analyze the type of competition which characterizes any segment of durum wheat-semolina-pasta chain. As a consequence, our strategy is to: i) briefly explain Lloyd et al. (2006, 2009) model which take into consideration farmers and an intermediate stage of the food chain considered as an aggregate of the food processing and retailing sectors and derive the econometric equation employed to test the presence of market power; ii) specify the different segments of the Italian pasta chain in which we investigate on stakeholders' behaviour; iii) introduce some hypotheses on who might exert market power along pasta supply chain and on the role played by CAP reform and the commodity price crisis in changing the source of market power in the selected chain.

In Lloyd et al. (2006, 2009) theoretical framework, retailers face the following demand function for the processed product:

$$x = D(Px, N) \quad (1)$$

where Px is the retail price of the good and N is a general demand shifter. The supply function of the agricultural raw material is given, in inverse form, from:

$$Pa = k(A, W) \quad (2)$$

where A is quantity of agricultural product supply by farmers to retailers and resold by retailers to consumers as x. W is the exogenous shifter in the farm supply equation.

Furthermore, the model takes into account a representative retail firm which has the following profit function:

$$\pi i = Px(x)xi - Pa(a)ai - Ci(xi) \quad (3)$$

where Ci is the other costs not directly related to agricultural product and incurred by intermediate agents along the supply chain (marketing cost). The source of power in the food chain is given to be at retail level in the form both of oligopsony power "θ" (versus suppliers) and of oligopoly power "μ" (versus consumers).

Remanding to Lloyd et al. (2006, 2009) for further details on the theoretical structure of the model, it delivers to a quasi-reduced form equation aimed at estimating possible presence of market power as follows:

$$Px - Pa = \beta_0 + \beta_1 M + \beta_2 N + \beta_3 W \quad (4)$$

Under perfect competition (neither oligopoly nor oligopsony), exogenous shifters N and W do not affect retail-farm spread, therefore, β_2 and β_3 are expected to be not statistically significant. However, if oligopoly power and/or oligopsony power is exercised, the parameters related to shifters are significant in the spread equation such that $\beta 2 > 0$ and $\beta 3 < 0$ as set in the theoretical model[1].

3.2 The model specifications in the pasta supply chain

The next steps are to specify the various segments of durum wheat-pasta chain, assuming who could exercise market power, and finally estimate the different specifications[2] of the equation (4) in order to test the presence of market power along the selected food chain. Table 1 shows, respectively, the different market power equations and some hypotheses on where we expected the market power to be and how the different events might have affected the distribution of market power along pasta chain. At the first segment of the selected value chain we find semolina producers who buy wheat from farmers and sell semolina to pasta makers. Therefore, through the first model specification our goal is to investigate on semolina producers' behaviour. Based on the findings of price transmission reported by Cacchiarelli et al. (2016), we assumed that semolina producers exercise buyer power against farmers. In the second segment of pasta supply chain, we focus on pasta producers' behaviour. They buy semolina from millers and sell pasta to retailers. In this case, our hypothesis was that they could have exerted oligopsonistic power against semolina producers and oligopoly power vs retailers as demonstrated by Italian Antitrust (2009) for period 2006-2008. Finally, in the last segment of the selected food supply chain we find retailers who buy

pasta from pasta makers and sell it to consumers. Since the increased concentration of the Italian food retail market and the increasing role played by private label in food markets, we assumed that retailers could have exerted buyer power against pasta makers and market power versus consumers.
Table 1 also shows some hypotheses on how the different events might have affected the distribution of market power along pasta chain. Concerning CAP reform, we hypothesized that the reduction of Italian durum wheat could have weakened millers' position who faced some issues to find alternative trade opportunities, improving Italian farmers' bargaining power. As a consequence, we expected that after CAP reform we should not have foundd market at semolina level. On the other hand, raw material prices increases experienced in 2007-2008 have raised the processors and retailers' costs, putting under pressure downstream sectors for a product (pasta) which Italian consumers buy frequently and where the role of brand is still very important, although product label brands have increased their market share. In the same period, a case of anticompetitive practices against pasta makers was identified and sanctioned by the Italian Antitrust Authority (antitrust, 2009). This would suggest that the results should have showed market power exertion at pasta processing level from 2005 to 2008. Finally, the antitrust intervention (weakening pasta makers), the consolidation of retail sector and the recent penetration of private labels in pasta market could have allowed to retailers to exert market power in the recent period.
In order to estimate the parameters of the different specifications of equation (4), a preliminary step is to estimate the order of integration and the stationarity properties of the univariated time series involved in the model. Following Lloyd et al. (2006, 2009), it is appropriate to apply empirical analysis in a vector autoregressive (VAR) framework. However, estimation of the parameters of the VAR models requires that the variables are covariance stationary. If the times series are not covariance stationary, but their first differences are, a vector error-correction model (VECM) can be used (Enders, 2004). As a consequence, before we run VAR or VECM models, we investigate on stationarity and cointegration of the employed time series. All the time series in each dataset were tested for stationarity in level and in first differences looking for their order of integration. Furthermore, since there may exist up to m-1 cointegrating relations among m variables in x_t, the precise number is evaluated by Johansen's Trace test statistic (Johansen, 1988). In this test the null hypothesis is that there are at least r cointegrating relationships. Where a single cointegrating relationship among variables included in econometric equations is detected, our goal is to verify the significance of the supply and demand shocks in VECM estimations in order to investigate the presence of market power in the different segments of the Italian pasta chain.

Tab 1. Market power equations and some hypotheses on the distribution of market power along VC and on how events affected power

Table 1. Market power equations and hypotheses on the distribution of market power and on how events affected power

VC segment	Market power equation	Linkages	Hypothesis on the distribution of power along pasta VC	Events effects on power	
				CAP Reform	Price instability
Semolina Producers' behaviour	$Ps\text{-}Pf=\beta_0+\beta_1 M+\beta_2 N+\beta_3 W$	Semolina producers buy wheat from farmers and sell semolina to pasta makers	Buyer power against farmers	Improved farmers' position	Put under pressure semolina producers
Pasta makers' behaviour	$Pm\text{-}Ps=\beta_0+\beta_1 M+\beta_2 N+\beta_3 W$	Pasta makers buy semolina from semolina producers and sell pasta to retailers	Buyer power against semolina producers and market power against retailers	Weakened semolina producers' position	Put under pressure pasta makers
Retailers' behaviour	$Pr\text{-}Pm=\beta_0+\beta_1 M+\beta_2 N+\beta_3 W$	Retailers buy pasta from pasta makers and resell it to consumers	Buyer power against pasta makers and market power against consumers	-	Put under pressure retailers

[1]Pf refers to durum wheat price, Ps refers to semolina price, Pm refers to pasta producer price and Pr refers to pasta retail price

4. DATASET AND PRELIMINARY ANALYSIS

4.1 Dataset

We apply our test method to assess whether we can detect market power along Italian pasta chain using monthly data from January 2000 to Aug 2013. Table 2 reports the list of data involved in the model. The wheat and semolina prices and the pasta retail prices (obtained from household panel data of ISMEA-Nielsen) were released by Istituto di Servizi per il Mercato Agricolo Alimentare (ISMEA). Pasta producer prices were obtained through National Institute for Statistics (ISTAT) pasta producer index and pasta prices reported in Antitrust sentence (2009). All prices are expressed in Euro per Kg and related to the aggregated product categories. Furthermore, variables employed as proxy for demand shifter and for farm supply shifter were provided by Istat. Specifically, we used agricultural inputs prices index and labour and energy costs indexes as supply shifter while demand shifter was proxied through retail price indexes for all good, food, food and alcoholic beverages. The analysis covers the period 2000-2013. Based on what we expected about how the different events (CAP Reform, price instability and pasta makers' collusion) have affected the distribution of power along pasta chain and on an econometric test [2], we have identified the following three sub-periods: Jan 2000-Dec 2004 characterized by prices stability and before CAP reform; Jan 2005-Aug 2008 in which different events have affected the selected food chain such as prices instability, CAP reform and pasta makers' collusion; Sep 2008-Aug 2013 characterized by Antitrust intervention and price stability.

Table 2. List of data involved in the model (2000-2013)

Variable	Source
Durum wheat price (euros/kg)	ISMEA
Semolina price (euros/kg)	ISMEA
Pasta producer price (euros/kg)	ISTAT- Italian Antitrust
Pasta retail price (euros/kg)	ISMEA
Agricultural inputs prices index (supply shifter)	ISTAT
Labour cost index (supply shifter)	ISTAT
Energy cost index (supply shifter)	ISTAT
Retail price indexes all good, food and alcoholic beverages (demand shifter)	ISTAT

4.2 Preliminary analysis

As a first step we analyse the time series proprieties of the data such as stationarity and cointegration. Results from the application of the Augmented Dickey-Fuller (ADF, 1979) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS, 1992) are reported in table 3. While in the former the null hypothesis is that of a unit root, in the latter the null hypothesis is stationarity. In the ADF model, the tests were conducted including both the number of lags that were suggested by AIC score and trend if evident in the data. Likewise, KPSS tests were assessed through the same lag structures with intercept and trend. Table 3 shows that semolina producers' price margin, pasta makers' price margin, retailers' price margin, labour index, energy index and variables used as demand and supply shifters were non-stationary in all periods but integrated of order 1. The next step is to test whether the series employed in the model were cointegrated through Johansen's Trace test statistics (Johansen, 1988). In this test the null hypothesis is that there are at least r cointegrating relationships. Where a single cointegrating relationship is detected formal testing of the significance of the supply and demands shocks is undertaken to investigate whether market power is present. We report in Tables 4 the results of Johansen's Trace test for the combinations of variables employed to VECM estimates.

Table 3. Stationarity tests

	2000-2004		2005-Aug 2008		Sep 2008-Aug 2013	
	ADF	KPPS	ADF	KPPS	ADF	KPPS
Semolina producers price margin	-1.123	0.472**	-0.994	0.179**	-1.865	1.277*
Pasta makers price margin	-1.073	0.481**	-0.055	0.122***	-1.603	0.631**
Retailers price margin	-0.5411	0.183***	-0.145	0.162***	-1.893	1.321*
Labour cost	-0.597	1.248*	-1.264	0.948*	-2.266	1.718*
Energy cost	-1.234	0.149**	0.183	0.907*	-0.446	0.147**
Farm supply shifter	-2.836	1.929*	-1.094	0.256*	-0.611	0.429*
Demand shifter	-1.541	3.027*	-1.448	0.501*	0.529	0.789*

[1] *Statistically different from zero at level of significance 5%; **statistically different at level of significance 10%.
[2] In ADF test, the null hypothesis is unit root while in KPSS is stationarity.

Table 4. Trace test statistic for Cointegration in the three models

Model	Max rank	2000-2004		2005-Aug 2008		Sep 2008-Aug 2013	
		trace statistic	5% critical value	trace statistic	5% critical value	trace statistic	5% critical value
semolina producers price margin	0	46.76	34.55	67.11	54.64	60.19	54.64
	1	18.17*	18.54	32.19*	34.55	29.8*	34.55
	2	3.74	3.74	9.93	18.17	11.41	18.17
	3	-	-	3.3	3.74	2.54	3.74
	LM test	12.54	0.18	6.48	0.43	7.84	0.32
	Jarque Bera	11.48	0.21	7.48	0.29	4.48	0.47
	ADF	-4.32	0	-3.89	0	-5.32	0
pasta makers price margin	0	87.53	54.64	62.54	58.48	68.38	58.64
	1	31.51*	34.55	31.58*	36.85	29.72*	37.85
	2	7.35	18.17	11.99	17.78	11.83	19.79
	3	0.42	3.74	2.04	2.94	0.05	4.11
	LM test	9.26	0.32	7.22	0.38	6.53	0.27
	Jarque Bera	3.26	0.61	5.48	0.47	5.82	0.33
	ADF	-5.25	0	-4.69	0	-7.23	0
retailers price margin	0	65.36	47.14	68.08	39.89	49.38	39.89
	1	28.16*	29.58	19.42*	24.31	18.24*	24.31
	2	9.51	16.39	8.21	12.53	3.71	12.53
	3	0.92	4.24	1.19	3.84	0.57	3.84
	LM test	6.67	0.44	7.22	0.38	6.53	0.27
	Jarque Bera	5.61	0.43	5.48	0.47	5.82	0.33
	ADF	-5.25	0	-4.69	0	-7.23	0

Note: * denotes the first rank which does not reject the hypothesis null

5. RESULTS AND DISCUSSION

5.1 Results

Tables 5 reports the results of VECM estimates to test the presence of market power, respectively, of semolina producers, pasta makers and retailers in the three selected periods (2000-2004, 2005-2008 and 2009-2013). Before we start to analyse and discuss the results, it is useful to recall the necessary conditions that have to be satisfied according to underlying economic theory in order to test the presence of market power along wheat-semolina-pasta chain. Firstly, according to economic theory the parameters related to other costs as labour and energy should be positive and significantly different from zero. Secondly, to infer perfect competition between various segments

of the selected food chain, parameters related to supply and demand shifters have to be simultaneously not significantly different from zero ($\beta_2=\beta_3=0$). Lastly, in order to detect market power along the food chain, exogenous demand shifter has to be positive and significantly different from zero while, simultaneously, exogenous supply shifter has to be negative and significantly different from zero.

Table 5 shows semolina producers, pasta makers and retailers' behaviour in the three selected periods, reporting, respectively, the parameters of the cointegrating vectors normalised on the semolina producers, pasta makers and retailers' prices margins. All the ECT coefficients results are statistically significant and the signs of the parameters are negative, suggesting that the systems might tend toward equilibrium in the long run. Concerning the first model specification, in the first period (2000-2004), the unique combination of the variables which presented a one cointegrating vector was that in which semolina producers' price margin was explained by demand and supply shifters. Since our goal is to detect market power through the check of these variables we consider such combination of variables able to verify semolina producers' behaviour. Both demand shifter and supply shifter are significantly different from zero and assume the sign according to theoretical model indicating the presence of buyer power of semolina producers against wheat producers.

Table 5. ECM cointegrating vectors parameters normalised respect to different price margins

	Variable	2000-2004		2005-Aug 2008		Sep 2008-Aug 2013	
		Coef	p-value	Coef	p-value	Coef	p-value
semolina producers price margin	Labour	-	-	-	-	0.09781	0.001
	Energy	-	-	0.00019	0.471	-	-
	demand shifter	0.1065	0.014	0.00221	0.134	0.005038	0.041
	supply shifter	-0.0043	0.001	0.00071	0.281	-0.00034	0.501
	Trend	-0.0019	-	0.00146	-	-0.00059	-
	Constant	-0.5126	-	0.3041	-	0.67819	-
	ECT	-0.0312	0.452	-0.52842	0.001	-0.0657	0.431
pasta makers price margin	labour	0.03945	0.001	-	-	0.1923	0.002
	energy	-	-	0.03464	0.091	-	-
	demand shifter	0.00356	0.717	0.6227	0.003	0.03241	0.566
	supply shifter	-0.00288	0.325	-0.1842	0.002	-0.0025	0.821
	trend	0.1068	0.01	0.0986	0.002	0.01813	0.001
	constant	0.3743	0.002	0.4608	0.001	0.2021	0.003
	ECT	-0.01112	0.852	-0.2345	0.002	-0.0252	0.799
retailers price margin	Energy	0.001949	0.007	0.00305	0.061	0.0102	0.001
	demand shifter	0.026239	0.001	0.04913	0.002	0.01003	0.022
	supply shifter	-0.0042	0.178	-0.0032	0.156	0.00644	0.068
	trend	0.0044	0.002	0.0017	0.004	0.005	0.004
	constant	0.9124	0.005	0.4652	0.006	0.693	0.008
	ECT	-0.2606	0.041	-0.0851	0.002	-0.08598	0.013

Note: missing values refer variables no included in the equation

In the second period (2005-2008) energy cost is included in cointegrating vector but its parameter is not statistically significant; also exogenous shifters are not significantly different from zero showing a competitive market. In the last period (2008-2013), the cointegrating vector includes the labour cost which has sign and statistical significance as required by economic theory. Conversely, exogenous demand and supply shifters are not significantly different from zero confirming a competitive market.

The results of VECM estimation which allow us to verify pasta makers' behaviour show that in the first period (2000-2004) price spread, labour cost, demand shifter and supply shifter are included in cointegrating vector. The parameter related to labour cost is positive and statistical significant while both exogenous shifters have the sign according to the theoretical model but their coefficients are not statistically significant. In the second period (2005-2008) energy cost substitutes labour cost in cointegrating vector showing a positive and statistically significant coefficient at ten percent. The parameters related to supply and demand shifters have the sign as required by theoretical model and are significantly different from zero at 1%. This result confirms the exertion of market power of pasta makers against semolina producers and/or retailers as identified and sanctioned by the Italian Antitrust (2009). In the last period (2008-2013) in the cointegrating vector the variables included are pasta makers' margin, labour cost and the two exogenous shifters. While labour cost has a positive and highly significant parameter, the coefficients of demand and supply shifters are not significantly different from zero indicating that Antitrust intervention has produced some substantial effects in the Italian pasta market by restoring a state of appreciable competitiveness among companies.

Finally, table 5 reports the VECM results showing retailers' behaviour. For all periods, in cointegrating vectors the variables included are retailers' price margin, energy cost and supply and demand shifters. In the first period (2000-2004) energy cost positively affects price spread, as well as parameter related to demand shifter is positive and statistically different from zero while coefficient of supply shifter is negative but no statistically significance at a conventional level. This result is not conclusive indicating that retail market was no competitive but there was no evidence of the presence of market power in food retail market. The estimation for the second period (2005-2008) shows the same results. Conversely, in the last period (2008-2013) estimates indicate that retailers have exerted oligopsonistic power against pasta makers and/or oligopolistic power versus consumers. Specifically, parameter related to demand shifter is positive and highly significant and coefficient of supply shifter is negative and significant at 5% of the level of significant as required by theoretical model in order to detect the presence of market power.

5.2 Discussion

Table 6 shows that empirical analysis detected the presence of market power of semolina producers in 2000-2004, of pasta makers in 2005-2008 and of retailers in 2008-2013 evidencing an anticompetitive behaviour of the main operators involving in the different stages of the Italian pasta supply chain. These results evidence very interesting findings on how the different events could have affected the distribution of market power along pasta supply chain. Firstly, as we have previously hypothesized the CAP Reform seems to have played a crucial role in the relationship between durum wheat producers and semolina producers. In fact, as long as the CAP partially decoupled payments guaranteed a high production level of durum wheat, semolina producers was able to exert buyer power against farmers. The introduction of the integrally decoupled aid has led to a reduction of durum wheat production in areas where it was no longer economically profitable. This seems to have improved farmers' countervailing power and restored an acceptable degree of competition in the first segment of the supply chain. Secondly, concerning pasta makers' behaviour the results confirm that processors have exerted market power in 2005-2008, as identified by Italian antitrust. A possible interpretation is that both CAP reform and prices increase in 2007, weakening and putting under pressure at the same time semolina producers and retailers, have allowed pasta makers to determine an explicit collusion. Specifically, on the one hand, the decoupled aid has reduced Italian durum wheat production weakening semolina producers which have faced some issues to procure raw material. On the other hand, commodities prices boom occurred in the 2007, involving inflationary pressure and a lower purchasing power of consumers, might have caused some difficulties to retailers. These interpretations are partially confirmed by some interviews included in Antitrust sentence (Antitrust, 2009). Finally, the results showed the presence of market power of the Italian food retailer in 2008-2013. To understand the retailers' strategies it is useful highlight some factors. First, previous studies (Kantor et al., 1997) and stakeholders statements (Unionalimentari, 2010) have showed that pasta is considered as a loss leader product, sold at price below its market cost to stimulate other sales of more profitable goods. Second, in the last years there has been a power shift from manufacturers to retailers through factors such as firm size increases, store brand introductions and service level differentiation (Draganska et al., 2010; Villas Boas, 2007).

Table 6. The main results of the market power models

Model/Period	Jan 2000-Dec 2004	Jan 2005-Aug 2008	Sep 2008-Aug 2013
Semolina Producers' behaviour	market power	-	-
Pasta makers' behaviour	-	market power	
Retailers' behaviour	-	-	market power

6. CONCLUSIONS

This paper aims at making an empirical contribution to competition analysis of the food supply chain, applying a theoretical framework and an empirical model that yield conclusive results on the presence of market power using easily available data. This approach may be used as a "first pass" test to check for the presence of imperfect competition along the supply chain, before applying more complex and data-intensive methods to measure the extent of market power in each vertically related market.

We chose wheat-semolina-pasta supply chain because, in the last years, it has been affected by some relevant events such as CAP reform, price instability and an anticompetitive case where Italian pasta makers (about 90% of Italian market) and two Industrial Unions of Italian pasta makers have put into practice a restrictive-competition accord aimed at harmonizing increases in the sale price. Moreover, it is worthwhile to note that pasta represents a good which consumers buy frequently, reducing the effort to compare the various brands and where the role of brand is very important. However, in the last years the presence of private labels and economic crisis may have induced part of consumers to take into consideration more the prices than the products quality.

In order to verify the presence of market power of semolina producers, pasta makers and retailers from 2000 to 2013, the model proposed by Lloyd et al. (2006, 2009) was readapted to the characteristic of the selected food supply chain and econometric equations were estimated by employing a VECM model.

The results showed the presence of buyer power of semolina producers against wheat producers in pre-CAP period (2000-2004), while evidence of market power by pasta processors occurred in the post CAP reform period (2005-2008) as already detected and sanctioned by Italian antitrust. Furthermore, there was indication of market power at food retail market retailers during the last period (2008-2013).

These results evidenced very interesting findings on how CAP reform and other events might affect the structure and the distribution of power along food supply chain (Happe, 2004). The CAP seems to have played a crucial role in the relationship between durum wheat producers and semolina

producers. In fact, the introduction of the integrally decoupled aid has led to a reduction of durum wheat production improving farmers countervailing power. Concerning pasta makers' behaviour the results confirm that processors have exerted market power in 2005-2008, as identified by Italian antitrust. A possible interpretation is that both CAP reform and prices increase in 2007, weakening and putting under pressure at the same time semolina producers and retailers, have allowed pasta makers to determine an explicit collusion. The presence of market power of the Italian food retailer in 2008-2013 can be explained taking into consideration some retailers' strategies such as pasta considered as a loss leader product and the penetration of private labels by retail chains which is an increasingly significant feature of the food sector.

These results imply that more information on the structure (e.g.: the level of vertical integration) and the dynamics (e.g.: the type and the transparency of contracts) of the Italian pasta chain is needed to evaluate the real functioning and how the prices are transmitted along of the different markets.

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[1] Following theoretical model, retail-farm price spread in a perfectly competitive market exclusively depends on marketing costs because of exogenous shifters relating to demand and supply functions play no role in determining the spread. This does not mean that they do not affect any price along food supply chain but they have an equal effect on farm and retail prices no determining their spread. Conversely, when retailers exert market power, in oligopolistic and/or oligopsonistic form, each exogenous shifter affects farm and retail price differentially and, therefore, the price margin changes. Specifically, in presence of market power the exogenous demand shifter increases retail-farm price while exogenous supply shifter decreases.

[2] The different model specifications of the equation (4), used to test the presence of market power in the different segments of the Italian pasta chain, are not presented here to economize space.