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Mark-up Volatility in Food Value Chains: Evidence from France and Italy

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Abstract

This paper estimates firm-level mark-ups and their volatility along the agri-food value chain using the methodology of De Loecker and Warzynski (2012). We estimate mark-ups of farmers, processors, wholesalers and retailers, how they change over time, and their volatility. We use detailed micro-level data from companies from Italy and France for the period 2006-2014. We find that farmers have a significantly higher volatility of mark-ups than other agents in the agri-food value chain, such as food processors, wholesalers and retailers. The volatility is negatively related with firms size in all sectors, and especially in agriculture.

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1. Introduction

Measuring mark-ups in value chains can provide important insights on several issues. First, they can provide insights on possible anti-competitive behavior of firms in (parts of) the value chain. Second, they can provide insights on how firms and certain segments of the value chain deal with external changes. These insights are important to enhance both the functioning of the value chains through private sector strategies and through government regulation. These issues have been hotly debated in the agri-food value chains, both inside countries and globally. In terms of global value chains, there is much debate on the distribution of surplus, given the tight standards being increasingly implemented and the concentration in parts of the modern value chains (Reardon et al., 2003, 2009; Swinnen, 2007; Swinnen et al., 2015). Also for domestic value chains, increasing concentration in value chains at the agribusiness, processing and especially retail level have caused much concern about the impact on farmers in both developing countries and rich countries. For example in the EU, market concentration and technological advances are claimed to have shifted the balance of power in the food system to retailers and other concentrated sectors (European Commission, 2009; Bukeviciute et al., 2009; Kaditi, 2013a; Swinnen and Vandeplass, 2010).

The debate has been reinforced by the perceived effects of the shocks and volatility of global food prices after 2006. Major price fluctuations on global markets have transmitted into domestic price fluctuations, but with major differences along the value chain. Figure 1 illustrates, for both the EU level and for France and Italy (the countries we will focus on in our empirical analysis), how prices for farmers, food processors and consumers have all fluctuated strongly since 2006. While the average price increase over the decade covered by Figure 1 is relatively close for the three segments of the value chain, the volatility of prices is quite different. The volatility of farm prices is much stronger than that of processor prices, and the consumer prices are the least volatile.

Uncertainty associated with such volatility of prices is argued to cause inefficiencies, by making it difficult for consumers and producers to formulate optimal decisions and lowering their confidence in the market and in investment returns (Barrett et al., 2013; Dawe and Timmer, 2012).¹ The policy debate has focused on whether there is a need for governments to intervene to reduce price volatility and thus risk and uncertainty affecting the functioning of food and agricultural markets (Bureau and Swinnen, 2017; Pieters and Swinnen, 2016). Related to this, there have been many complaints from farmers that price transmission has been asymmetric, i.e. that processor and retailers pass on lower prices when prices decline but fail to pass on higher prices when prices increase (McCorrison, 2015, 2016; Swinnen and Vandeplass, 2015)

These complaints and the pressures on policy-makers have recently led to the creation of an EU “Agricultural Markets Task Force” and calls on European policy-makers to introduce regulations to constrain so-called Unfair Trading Practices (UTPs) of firms in the value chains (Falkowski et al., 2017). In many EU countries, governments have already introduced regulations to limit UTPs (see Swinnen and Vandeveld (2017) for an overview).²

A number of theoretical and empirical studies have analyzed various aspects of these issues. One line of research had measured (asymmetries in) price transmission along the agri-

¹ However, other studies, which have theoretically analyzed the effects of price volatility on consumer and producer welfare, have reached more nuanced conclusions (for a review on this topic see Bureau and Swinnen (2017)).

² When discussing higher volatility in the agri-food markets, reference is typically made to the inherent risks in the agriculture sector. Studies generally distinguish between two main groups of risks: price risk, driven by imbalance between demand and supply chain resulting in strong price volatility; and production risk, referring to the possibility of output/yield falling below than an expected level due to uncertain events (e.g. JRC, 2008; Tangermann, 2011; European Commission, 2017). These risks are not independent, but are often correlated to each other. For example, production risk and price risk tend to be negatively correlated, resulting in lower fluctuations compared to those of either price or yield (Tangermann, 2011). The recent discussions on “unfair trading practices” (UTPs) have also linked these to the transfer of risks, i.e. consolidation, rising concentration and the associated shift in bargaining have allowed these firms to shift “excessive risks” to agricultural producers and consumers. However, evidence of these “excessive and unpredictable transfers of risk” to farmers is mostly anecdotal and hard to identify (Falkowski, 2017). Sexton (2017) also questions these arguments from a theoretical perspective: transferring costs to trading partners who are less efficient at bearing that cost will result in a reduction of gains of the transaction. Hence inflicting excessive risk to the other participant will reduce the likelihood of continuing doing business.

food chain.³ Other studies have tried to explain the observed differences in price fluctuations.⁴ Yet other studies have shown that complex vertical relationships in modern value chains will affect efficiency and equity outcomes.⁵

Only a few studies have analyzed how firms and farms cope with price fluctuations and volatility. Martin (1996), OECD (2000) and Hall et al. (2003) analyze the strategy of agricultural producers facing price volatility. A few qualitative studies analyzed firms at other stages of the value chain and suggest that the impact of price volatility on the margins and mark-ups of the farms and firms at other levels of the supply chain may differ because other sectors seem to adopt strategies that allow them to secure more stable margins ((Heyder et al., 2010; Von Davier et al., 2010; Assefa et al., 2017)).⁶

However, there is no hard evidence on this. Despite all the discussions so far there have been few attempts to actually measure how mark-ups change with price volatility – and how this may differ between firms. One partial exception is the work by Kaditi who measures mark-

³ Studies by McCorriston et al. (1998, 2001), Azzam (1999), Zachariasse and Bunte (2003), Bukeviciute et al. (2009) and Vavra and Goodwin (2005) find mixed results on asymmetric price transmission (see e.g. the collection of recent studies in McCorriston (2015) and the concluding chapter for a summary).

⁴ One argument is based on supply-demand structures. Typically in value chains, the supply elasticity of raw material production is lower than that of processed product, causing larger price fluctuations for the same demand shocks. This is relevant for farms (agricultural producers) in agri-food value chains. Farms might not be able to respond easily to short-term fluctuations as they have a more limited set of adjustment strategies than other agents in the value chain. In fact, both supply and demand of agricultural products tend to have limited price responsiveness. As noted by Tangermann (2011): “*On the supply side, the time required to complete the production process, for crops typically a year, means that output cannot be much adjusted in the short run when the price changes. On the demand side, the essential nature of food as a necessity results in a low price elasticity.*” (p.2). Moreover, depending on the characteristics of the product, some agricultural markets tend to exhibit cyclical price fluctuations (e.g. the phenomenon known as ‘hog cycle’).

⁵ Mérel and Sexton (2017), Sexton (2013) and Swinnen and Vandeplass (2010) show how imbalances of bargaining power do not necessarily lead to farmers’ marginalization. With vertical coordination, there may exist an optimal level of concentration in procurement markets resulting in higher efficiency and better returns to farms’ investments (Swinnen et al., 2015). Empirical studies also indicate that vertical coordination may be part of longer-run company strategies with supplying farms, providing them incentive to invest and thus increase productivity and upgrade the supply chain (Dries et al., 2009; Dries et al., 2004; Swinnen 2007).

⁶ Assefa et al. (2017) conducted interviews with farmers, wholesalers, processors and retailers in six EU agri-food supply chains to study price volatility perceptions and management strategies of these players and conclude that “*farmers’ strategies were mostly survival strategies through output and cost reduction in response to adverse price movements. Wholesalers and processors focus on adaptive strategies that allow them to secure stable margins regardless of price movements. Retailers’ main focus is to secure a continuous supply of quality produce for their customers rather than to reduce price volatility.*” (p.24).

ups in the agri-food chain (Kaditi, 2013a, 2013b)⁷ using a production function approach developed by Hall (1986) and extended by Roeger (1995). Their method exploits variation in the primal and dual Solow residual to derive a consistent estimate of the mark-ups and to deal with potential endogeneity problems when estimating the production function. However, Kaditi analyzes competition in the food chain and her methodology allows to estimate for average mark-up for each sector in the sample.

In our study, we use the econometric methodology proposed by De Loecker and Warzynski (2012) which allows to generate firm-level and time-specific mark-up estimations, while addressing the simultaneity problem in estimating production function coefficients. This method thus allows us to investigate the volatility of the mark-ups at firm level.

We use firm-level data from the Amadeus database, which is compiled by a commercial data provider, Bureau van Dijk (BvD)⁸, and contains company account data. Our analysis uses data from more than 86,000 firms in the agri-food supply chain of France and Italy between 2006 and 2014. The period 2006-2014 is an excellent period for this study since it was characterized by major price volatility in global agricultural and food markets. We use data from France and Italy because they are the two EU countries for which the quality of data along the supply chain is best and which are important producers of agricultural products and food in the EU.⁹

⁷ Kaditi (2013a and 2013b) focuses on analyzing the degree of competition in the food supply chain and thus estimates mark-up pricing as indicator of efficiency and surplus distribution in the food chain, not on volatility. The analyses of mark-ups in the food chain are applications of more general studies and recent advances in the empirical industrial organisation and trade literature (e.g. Hall, 1986; Tybout, 2003; Roeger, 1995; Konings et al., 2001; Konings and Vandenbussche, 2005; Konings et al., 2005; Abraham et al., 2009; De Loecker and Warzynski, 2012; Altomonte and Barattieri, 2015).

⁸ <https://amadeus.bvdinfo.com>

⁹ Their food sectors are the second and the third largest in the EU. In 2013 their food sectors, taken together, represented almost 30% of the EU food industry turnover (Eurostat). France and Italy also accounted for almost a third of the value of agricultural production in the EU. France is the leading agricultural producer with 16% of the value of total EU agricultural production, while Italy is the third largest (12%) (Eurostat).

We estimate mark-up volatility and how it differs vertically (along the supply chain) and horizontally (among firms at the same value chain stage). We find (a) that mark-up volatility was much higher at the farm-level than at other levels of the agri-food chain, (b) that there is a negative relationship between firm size and mark-up volatility and (c) that this negative relationship is especially strong at the farm level, where mark-up volatility is largest.

The paper is structured as follows. Section 2 explains the empirical methodology applied in the estimation of the firm-level mark-ups and measurement of mark-up volatility. Section 3 describes the dataset. Section 4 presents the results and how mark-up volatility differ for different agents in the chain. Section 5 analyses the relationship between mark-up volatility and firm size. Section 6 concludes.

2. Methodology

2.1. Estimating Firm-level Mark-ups

The estimation of mark-ups has a long history in the field of industrial organization. In his seminal work, Hall (1986) proposes a simple way to estimate mark-ups by comparing the growth rates of the output to the ones of inputs and exploiting the fact that, under imperfect competition, cost and revenue shares of inputs differ. To deal with potential endogeneity problems when estimating the production function, Roeger (1995) extended Hall's methodologies and proposed a method which exploits variation in the primal and dual Solow residual to derive a consistent estimate of the mark-ups.

A major shortcoming of these methodologies based on a production function approach is that they only generate estimates for the average sector-specific mark-up in the sample. To address this, DLW (2012) propose a flexible approach for mark-up estimation, which provides

an empirical framework to obtain firm-level mark-ups. They rely on the assumption of standard cost minimization for variable inputs free of adjustment costs and relate the output elasticity of an input to the share of that input's expenditure in total sales and the firm's mark-up. Exploiting the insights of Olley and Pakes (1996), Levinsohn and Petrin (2003) and Akerberg, Caves and Frazer (ACF) (2006), DLW employ a two-step procedure to address simultaneity problems and control for unobserved productivity shocks using a control variable in the estimation of the production function and of the output elasticities. The key advantage is that this procedure allows to estimate firm and time-specific mark-ups without making assumptions on any particular consumer demand structure and any of specific price setting model, while simultaneously dealing with the econometric issues of production function coefficients.

2.2. Defining Mark-up

Consider a production function of the following form:

$$Q_{it} = \Omega_{it}F(L_{it}, M_{it}, K_{it}), \quad (1)$$

where Q represents quantity of gross output produced while Ω , L , M , and K are productivity, labor, material and capital respectively. One restriction imposed is that the production function is continuous and twice differentiable with respect to its arguments. Assuming that producers are cost minimizers, the following first order condition of the cost minimization problem with respect to the variable input X^V is obtained:

$$P_{it}^{X^V} - \lambda_{it} \frac{\partial Q_{it}(X_{it}^V, K_{it})}{\partial X_{it}^V} = 0, \quad (2)$$

where $P_{it}^{X^V}$ denotes a firm's input price for variable input X^V and λ_{it} is the lagrange multiplier associated to the technological constraint. Using the definition of mark-up for firm i in time t

as $\mu_{it} \equiv \frac{P_{it}}{\lambda_{it}}$ and multiplying both sides by $\frac{X_{it}}{Q_{it}}$ condition (2) can be rearranged and expressed μ_{it} in terms of elasticities as follows:

$$\mu_{it} \equiv \theta_{it}^X (\alpha_{it}^X)^{-1} \quad (3)$$

where θ_{it}^X is the output elasticity with respect the variable input X_{it} and α_{it}^X is equal to the share of expenditures on input X_{it} in total turnover ($P_{it}Q_{it}$). To estimate the price-cost margins, we follow Brandt et al (2012 and 2017) and choose to use material as a perfectly variable intermediate input, whereas labor is treated like capital, as quasi-fixed input, subject to adjustment costs.¹⁰

In our analysis we adopt a Cobb-Douglas (CD) gross output production function of labor, capital and material, as follows:

$$y = \beta_k k + \beta_l l + \beta_m m + \omega \quad (4)$$

In order to compute firm level mark-ups, we need to estimate the output elasticity of material θ_{it}^M . In case of a CD production function, the mark-up will be given by:

$$\theta_{it}^M = \hat{\beta}_m \quad (5)$$

¹⁰ This choice is due to the fact that labor is unlikely to be as easily adjustable as material, where market frictions, restrictions on hiring or firing, and work rules can be prevented firms from freely adjusting their labor force to minimize their costs (Brandt et al., 2012).

2.3. Estimating Output Elasticity

Assuming the productivity being a Hicks-neutral scalar term and having common technology parameters across the set of producers (DLW, 2012), the following log transformation of the gross-output production function can be computed:

$$q_{it} = f(m_{it}, l_{it}, k_{it}) + \omega_{it} + \epsilon_{it}, \quad (6)$$

where q_{it} is the log of gross output, m_{it}, l_{it}, k_{it} are the log of material, labor and capital respectively. The last two terms are unobservable (to the researcher). However, the two differ in that ω_{it} , the productivity shock, is known by the firm and thus affects the firm's input choices, whereas ϵ_{it} peaks measurement error and idiosyncratic unexpected productivity shock as it is not observable to both the firm and researcher, it captures the unknown elements that affect the output but not the choice of inputs.

As the choice of inputs is correlated with the productivity shock (ω_{it}), the estimation of the production function will in general yield inconsistent estimates of the elasticities of material, labor and capital and thus affecting the estimates of mark-ups. In order to address the endogeneity related to the estimates of inputs' coefficients of the production function, we closely follow the two-step procedure developed in ACF. In the first step, we obtain the estimates of $\widehat{\phi}_{it}$ and $\widehat{\epsilon}_{it}$ by running the following regression:

$$q_{it} = \phi_{it} + \epsilon_{it}, \quad (7)$$

where $\phi_{it} = f(m_{it}, l_{it}, k_{it}) + h(l_{it}, m_{it}, k_{it}, e_{it})$ and $h(\cdot)$ represents the inverse of the material demand function that serves as proxy of the productivity term.¹¹ In the second step,

¹¹ The unknown function $h(\cdot)$ can be approximated parametrically by polynomial expansion of order J in the parameters. In the empirical exercise we will use a third order polynomial.

the elasticities on production parameters are estimated through GMM, using as instruments the inputs orthogonal to the unexpected productivity shock. After the first stage, we can employ the estimated value $\widehat{\phi}_{it}$ to compute the estimate for productivity ω_{it} for each value of β_s as following:

$$\begin{aligned} (\widehat{\omega}_{it}) = & \phi_{it} - \beta_k k_{it} - \beta_l l_{it} - \beta_m m_{it} - \beta_{kk} k_{it}^2 - \beta_{ll} l_{it}^2 - \beta_{mm} m_{it}^2 - \beta_{lk} l_{it} k_{it} - \\ & \beta_{lm} l_{it} m_{it} - \beta_{km} k_{it} m_{it} - \beta_{lkm} l_{it} k_{it} m_{it} \end{aligned} \quad (8)$$

This second stage relies on the law of motion for productivity. The law of motion of productivity is described by the following $g(\cdot)$ function:

$$\omega_{it} = g(\omega_{it-1}) + \xi_{it}, \quad (9)$$

where $\xi_{it}(\beta)$ is the innovation to productivity. To recover ξ_{it} , one can use a non-parametrical regression of ω_{it} on the third order polynomial of its lag ω_{it-1} as constructed in (9). Given the assumptions above, ξ_{it} is independent of the predetermined working capital stock k_{it} and l_{it} , as well as the lagged variable inputs m_{it-1} . In the case of our three-input CD production function with labor and capital quasi-fixed and intermediate inputs fully flexible, the following moment conditions to estimate parameters in the production function are used:

$$E[\xi_{it}(\beta)Z_{it}] = 0 \quad (10)$$

$$Z' = (m_{it-1}, l_{it}, k_{it}) \quad (11)$$

The production function coefficients are then used together with data on inputs to compute the output elasticities as expressed in (5).

2.4. Measuring Mark-up Volatility

To measure mark-up volatility across the different actors of the chain, we adopt an approach and measurement that are commonly used in the price volatility literature. We follow Gilbert and Morgan (2010) and Pieters and Swinnen (2016) and compute firm's mark-up volatility as the standard deviation of the logarithm changes of firm-level mark-ups as follows:

$$v_i = sd(r_i) = \left[\sum \frac{1}{T-1} (r_{it} - \bar{r}_i)^2 \right]^{0.5} \quad (12)$$

where $\bar{r}_i = \sum \frac{1}{T} r_{it}$, $r_{it} = \ln \left(\frac{\mu_{it}}{\mu_{it-1}} \right)$ and μ_{it} is the mark-up of firm i in time t .

As explained in Gilbert and Morgan (2010) and Pieters and Swinnen (2014), measuring volatility as the standard deviation of the difference in logarithm of mark-ups addresses the issue of de-trending the series.¹²

As a robustness test, we also compute two alternative measures of mark-up volatility, following Asker et al. (2014). The first alternative measure is the term σ_s in the AR(1) specification $\ln \mu_{it} = \alpha_s + \rho \ln \mu_{it-1} + \sigma_s v_{it}$, i.e. the standard deviation of the regression residuals. The second alternative measure is σ_s from an AR(1) specification where α_s is replaced by firm-level fixed effects, referred to as 'AR(1) FE'. To make these alternative measures comparable, we also compute our previous measure of volatility in equation (12) at sector level, v_a .

¹² For a further discussion on this issue see Gilbert and Morgan (2010); Pieters and Swinnen (2014); Minot (2014) and Dawe et al., (2015).

3. Data

The data we use are firm-level balance-sheet data from France and Italy for the period 2006-2014 from the Bureau van Dijk's (BvD) Amadeus database. We use data from firms in five sectors (by 2-digit code in the European NACE Rev. 2) that operate along the agri-food value chain in France and Italy: (1) the agricultural sector, (2) the food processing sector, (3) the drink sector, (4) the food wholesale sector and (5) the food retail sector.¹³ In a second step, we further disaggregate the agricultural sector.

The BvD Amadeus database includes financial and balance-sheet information from business registers collected by the local Chambers of Commerce to fulfil legal and administrative requirements and are relayed to BvD via different information providers (see Table in Appendix A for a list of the information providers to BvD for France and Italy). Data include turnover, total assets, material costs and total wage bill for each firm.

All the variables used in the mark-up estimations are deflated using national 2-digit industry deflators, when available. Turnover and material costs were deflated using the gross product output and intermediate input deflators from OECD STAN. For labour costs use was made of a labour cost deflator taken from the European Central Bank, while firms' total assets were deflated using the gross fixed capital formation deflator from Eurostat.

We eliminated all observations that report zero or negative values of production variables. Following De Loecker et al. (2016) we also dropped the bottom and top 3rd

¹³ In terms of NACE Rev. 2 classification these sectors belong to the following code categories: the agricultural sector refers to Agriculture and Fishing (NACE A 01 and NACE A 03), the food processing sector refers to Manufacture of Food Products (NACE C 10), the drink sector refers to Manufacture of Beverages (NACE C 11), the wholesale sector refers to Food and Drink Wholesale (NACE G 46.2 and NACE G 46.3) and the retail sector refers to Food and Drink Retailer (NACE G 47.1 and NACE G 47.2).

percentiles of mark-ups distribution.¹⁴ After estimating firm-level mark-ups and the volatility indicators, this results in an unbalanced dataset of a total of 32,466 firms for Italy and 54,096 for France. Table 1 provides an overview of the number of companies and how they are distributed across sectors in the two EU countries. Table 2 reports selected summary statistics of the variables used in our empirical estimation of mark-ups. Wholesalers account for the largest share in the Italian sample, while the majority of the firms in the French sample operate in the food retail sector. In both countries the drink sector¹⁵ has the largest value of turnover.

A constraint for our estimation of mark-ups is that physical output is not included in the dataset. Therefore, we use deflated turnover as a proxy of physical quantity when estimating output elasticities. This approach is potentially subject to omitted output and input prices biases, which affect the estimates of the input coefficients and therefore estimates of the output elasticities, as discussed in De Loecker and Goldberg (2014). However, only the mark-up level is potentially affected by this bias, while the model is still robust on how mark-ups change over time (DLW 2012), when a Cobb-Douglas production function is assumed, as in our study. This implies that the changes over time of the mark-ups are estimated unbiased, but that a comparison of mark-ups between firms and sectors is problematic because of this potential bias.

¹⁴ The food sector refers to the manufacture of food products (NACE C 10). This division includes the processing of the products of agriculture, forestry and fishing into food for humans or animals, and includes the production of various intermediate products that are not directly food products. This division is organised by activities dealing with different kinds of products: meat, fish, fruit and vegetables, fats and oils, milk products, grain mill products, animal feeds and other food products. This division does not include the preparation of meals for immediate consumption, such as in restaurants. The French *manufacture of bakery and farinaceous products* (NACE 4-digit code 10.71) account for almost 50% of the overall French food processing sector (NACE C 10). Most of these firms are composed by no employees and could represent potential outliers. For this reason, following other papers dealing with the same issue (e.g. Gaigne et al., 2015), we have applied a further cleaning within this sector, i.e. we have removed those companies reporting less than 5 employees. Note that our results are robust to the inclusion of these potential outliers.

¹⁵ The drink sector refers to the manufacture of beverages (NACE C 11). This division includes manufacture of beverages, such as non-alcoholic beverages and mineral water, manufacture of alcoholic beverages mainly through fermentation, beer and wine, and the manufacture of distilled alcoholic beverages.

For this reason, we focus on the variations in the mark-ups and the volatility and present the series of average annual mark-ups of each chain sector as an index with the food sector's average mark-up over the period 2006-2014 as a base.

Finally, it should be recognized that although the BvD Amadeus dataset is commonly used in the empirical literature to estimate firm-level mark-ups¹⁶, the firm coverage is biased to economically large firms, which are generally subject to more extensive accounting rules than small and medium firms (Ashtari Tafti et al., 2016). Table 3 compares the average turnover of firms in our dataset set with that of a nation firms in the Eurostat dataset, which captures most firms in the countries. As expected, the average turnover from the BvD Amadeus dataset is significantly higher than the average national computed from Eurostat. This sample bias towards economically large firms affects all sectors across the agri-food value chain, but the difference is particularly large in the case of the agricultural sector in both countries. Still, there are almost 14,000 farms in our sample. We will discuss later how this bias may affect our results.

4. Results

Table 4 and Figures 3 and 4 summarize the results. The volatility indicators in Table 4 clearly show that mark-up volatility in agriculture is much higher than in the other segments of the value chain. The mark-up volatility in the agricultural sector is surprisingly similar in France and Italy: 0.27 and 0.28, respectively. This is much higher than volatility downstream from the

¹⁶ A number of mark-up studies have used the BvD Amadeus dataset in their empirical application. Some focus their mark-up analysis directly on the agri-food chain such as Kaditi (2013a and 2013b); others used BvD Amadeus database in the analysis of mark-ups in the context of empirical trade and industrial organization literature such as Konings and Vandebussche (2005), Konings et al. (2001), Konings et al. (2005), Hong (2017); others used the BvD national database such as BvD Aida on Italian firms (Altomonte and Barattieri, 2015) and Bel-first BvD on Belgian firms (e.g. Abraham et al., 2009).

farms. The majority of the other segments have a mark-up volatility of 0.08 or less – which is almost four times lower than that at the farm level.

Volatility at the food wholesale level is 0.07 in France and 0.08 in Italy and at the food retail level 0.05 and 0.04 respectively – five to seven times lower than at the farm level. Mark-up volatility at the food processing (0.11 in Italy) and the drink sector (0.15 in France and 0.12 in Italy) are at intermediate levels. All these differences are statistically significant at the 1% level as reported in Table 4.¹⁷

The differences in mark-up volatility are illustrated in Figure 3 and Figure 4. While the farm-level volatility numbers are similar in France and Italy, the movement of the mark-ups is quite different between the countries. In France, the agricultural mark-up index fluctuates strongly (with higher peaks and deeper troughs than those for the other chain segments) while in Italy the agricultural mark-up index changes strongly over the 2006-2014 period but fluctuates less.

In Italy, the mark-up indicators show that mark-ups have increased significantly since 2009 (year of the Great Recession) across the entire agri-food chain. This is not the case in France where there is not a clear pattern in the evolution of mark-ups over the 2006-2014 period.

In both countries, the “drink industry” has the highest mark-up volatility of the value chain after agriculture: 0.15 in France and 0.12 in Italy. This industry is dominated by wine producers: in our data sample they account for more than 60% of total French and Italian “drink companies”. One potential reason for the high volatility might be that wine producers are generally highly export oriented and thus strongly exposed to international demand shocks such

¹⁷As a robustness check, we have also computed the volatility by including only those firms which report mark-up estimates for at least 4 years. The results show a similar pattern in terms of volatility and are significant at 1% level. Results are available from the authors upon request.

as those experienced during the economic crisis of 2009.¹⁸ Moreover, the wine sector shares some similar characteristics with agricultural commodity sectors, which make it exposed to similar sources of risks, such as climate and weather related events.

As explained in section 2.4, we check the robustness of our results to alternative measures of volatility based on AR(1) specifications, like in Asker et al. (2014). Table 5 confirms that for all indicators mark-up volatility in the agricultural sector is much higher than that at other levels of the chain. The volatility measures v_a and AR(1) are very similar in magnitudes. The AR(1) FE measures are lower for all sectors of chain (part of the variation is taken by firm specific effect) but the difference in volatility between agriculture and other sectors is very similar. These findings thus indicate that our results are robust to alternative specifications of the mark-up volatility.

To see whether the high volatility in the agricultural sector is present in the entire agricultural sector or specific to certain parts of agriculture, we split the sample of farms into the following sub-sectors: (1) the cereal sector, (2) the livestock sector, (3) the fruits, nuts and vegetables sector (4) other crops (perennial and non-perennial), (5) mixed farming; and (6) other agricultural activities.¹⁹

¹⁸ Especially in France mark-ups in the “drink sector” declined sharply between 2006 and 2014. While the sharp decline in 2009 is almost certainly due to the decline in both domestic consumption and in wine exports during the Great Recession. French wine exports declined by 23% in value between 2008 and 2009 (*Agriste Conjuncture*, 2010). In addition to this decrease in exports, domestic consumption of wine, cider and champagne declined in 2008 and 2009 (France AgriMer, 2011). However it is less clear what caused the significant further reduction in mark-ups after 2010. Our results are consistent with the findings of Aleksanyan and Huiban (2016) who study the evolution of bankruptcies over the period 2001-2012. They find a dramatic increase in the bankruptcies for this sector since 2010.

¹⁹ In terms of NACE rev.2 classification these sub-sectors belong to the following categories: (1) Cereal sector including “cereals (except rice), leguminous crops and oil seeds” (NACE A 01.11) and “rice” (NACE 01.12); (2) Livestock sector including “animal production” (NACE A 01.14); (3) Fruits, nuts and vegetables sector including “vegetables and melons, roots and tubers” (NACE A 01.13), “grapes” (NACE A 01.21), “tropical and subtropical fruits” (NACE A 01.22), “citrus fruits” (NACE A 01.23), “pome fruits and stone fruits” (NACE A 01.24), “other tree and bush fruits and nuts” (NACE A 01.25), and “oleaginous fruits” (NACE A 01.26); (4) Other crops (perennial and non-perennial) sector including “sugar cane” (NACE A 01.13), “fibre crops” (NACE A 01.16), “other non-perennial crops” (NACE A 01.19), “beverage crops” (NACE A 01.27), “spices, aromatic, drug and pharmaceutical crops” (NACE A 01.28), and “other perennial crops” (NACE 01.29); (5) Mixed farming

Swinnen et al. (2014) have documented that at the EU level, the extent of price volatility has differed among subsections of agriculture. In addition, there are structural differences among the commodities in terms of the impact of global price volatility. The global price spikes were especially strong for grain. Grain prices are output prices for grain producers, but input prices (costs) for livestock producers, so the impact on mark-ups may differ significantly. Figure 2 illustrates how in both Italy and France, the evolution of the terms of trade (measured by the grain/fertilizer price ratio) for grain producers was very different than the terms of trade in the livestock sector (measured as the animal output/feed price ratio). The latter fluctuated less and moved in opposing directions than the former. We analyzed whether these differences are also reflected in a different mark-up volatility.

Table 6 shows that the volatility indicators for almost all agricultural sub-sectors varies between 0.21 and 0.32, both in Italy and France (with the exception of 0.17 for “other crops” in France). This means that virtually all agricultural sub-sectors have higher volatility than any downstream sector, and most have much higher volatility: 6 sub-sectors (50%) have 0.26 or higher. The highest volatility was in the cereal sector in Italy (0.32). Hence, this means that the high mark-up volatility of the agricultural sector is not caused by very high volatility in specific sub-sector(s) of agriculture and low volatility in others, but that high mark-up volatility is pervasive throughout all agricultural sub-sectors.

including “*mixed farming*” (NACE A 01.5); (6) Other agricultural activities including “*plant propagation*” (NACE A 01.3), “*support activities to agriculture and post-harvest crop activities*” (NACE A 01.6), and “*hunting, trapping and related service activities*” (NACE A 01.7). We left out the “*fishing*” (NACE A 03.1) and “*aquaculture*” (NACE A 03.2) sectors.

5. Mark-up Volatility and Firm Size

It is useful to recall that in both countries the samples are biased towards larger firms, especially for the farming sector. The extent to which firm size affects mark-up volatility is difficult to determine *a priori*. In the case of the farming sector, for example, on the one hand mark-up volatility may be higher for small farms if they are less efficiently managed than large farms. However, on the other hand volatility may be higher for large firms if they are more specialized and they have less mitigation strategies, such as off-farm sources of income.

Figure 5 illustrates how mark-up volatility changes with firm size by comparing average mark-up volatility for different percentile categories of the turnover distribution: (1) below or equal the 10th percentile; (2) between the 10th and 25th percentile; (3) between the 25th and 50th percentile; (4) between the 50th and 75th percentile; (5) between the 75th and 90th percentile; and (6) the 90th percentile and above.

Figure 5 shows a clear negative relationship between firm size and mark-up volatility for all stages of the value chain. However, the relationship is particularly strong in the case of the agricultural sector where volatility is the highest. It falls from 0.41 for the smallest farms in our sample to 0.10 for the largest farms. This level of volatility is similar to that of the smaller wholesale, food processing and retail companies.

Table 7 presents the results of a regression analysis where we have regressed firm-level volatility on firm-size and its squared term for the five stages of the value chain (with country fixed effect included). The results are fully consistent with the graphs in Figure 5. There is a significant negative relationship between firms size for all stages of the value chain and mark-up volatility and the relationship is strongest for agriculture. The estimated coefficient of firm size in the linear model is -0.06, which is twice as large as in the drink (-0.03) and the wholesale

sector (-0.023), four times as large as in the food processing sector (-0.015) and more than six times as large as in the retail sector (-0.009).

We also ran a similar regression for the sub-sectors within agriculture and we find that the negative relationship is significant in all sub-sectors (see Appendix Table B.3).

In summary, these results indicate that there is a negative correlation between firm size and mark-up volatility, and that this relationship is particular strong at high volatility levels. These results also suggest that, if anything, our volatility indicators might be downward biased, because our dataset is biased towards larger firms.

6. Conclusions

In this paper we provide empirical evidence on the evolution and the volatility of mark-ups along the agri-food value chain during the 2006-2014 period of high food price volatility. We use a new econometric methodology proposed by De Loecker and Warzynski (2012) to estimate firm-level mark-ups using data from 32,466 firms for Italy and 54,096 for France at various stages of the agri-food chains of Italy and France (i.e. farms, processors, wholesalers and retailers).

Our results show that both in France and Italy mark-up volatility in agriculture is much higher than in the other segments of the value chain. On average, the mark-up volatility in the agricultural sector is more than three times higher than that at companies at other stages of the value chain. The difference is largest with the retail sector, which has a mark-up volatility which is six times lower than for farms.

In Italy, mark-ups have increased significantly since 2009 (year of the Great Recession) across the entire agri-food chain. This is not the case in France, where there is not a clear pattern in the evolution of mark-ups over the 2006-2014 period.

To see whether the high volatility in the agricultural sector is present in the entire agricultural sector or specific to certain parts of agriculture, we analyzed mark-ups for several sub-sectors. We find that virtually all agricultural sub-sectors have higher volatility than any downstream sector, and most have much higher volatility. Hence, this means that the high mark-up volatility of the agricultural sector is not caused by very high volatility in specific sector(s) and low volatility in others, but that high mark-up volatility is pervasive through all agricultural sub-sectors.

Finally, our analysis shows a strong negative correlation between firm size and the relationship is strongest for the agricultural sector where volatility is highest. Given that the sample of firms in our dataset are biased towards larger farms, these findings suggest that, if anything, our volatility indicators might be biased downwards.

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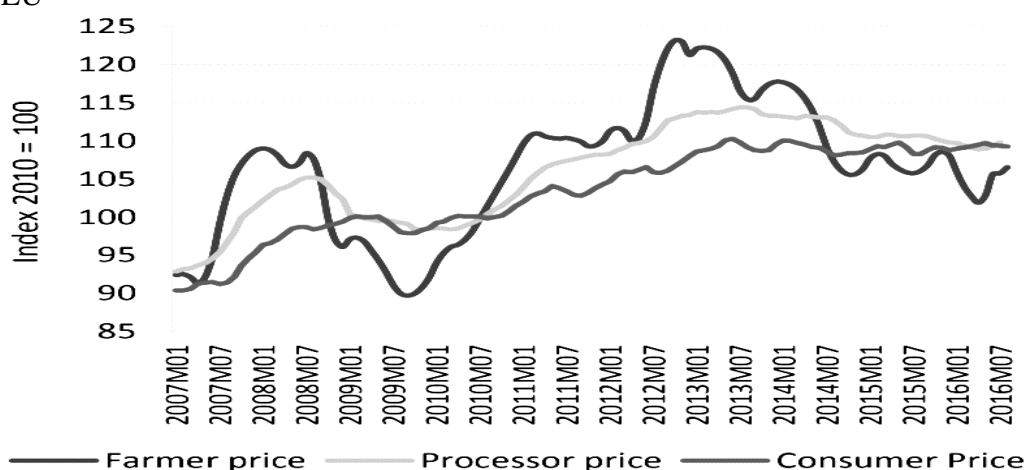
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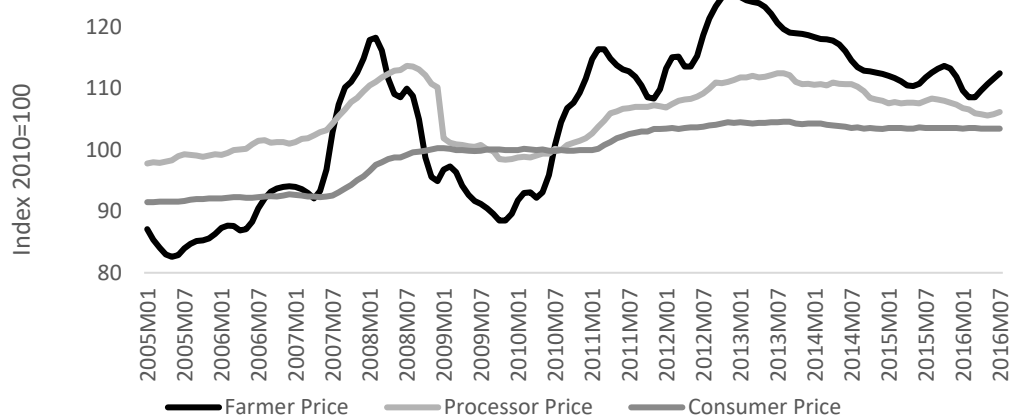
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Figure 1: Evolution of prices along the agri-food value chain, 2005-2016²⁰

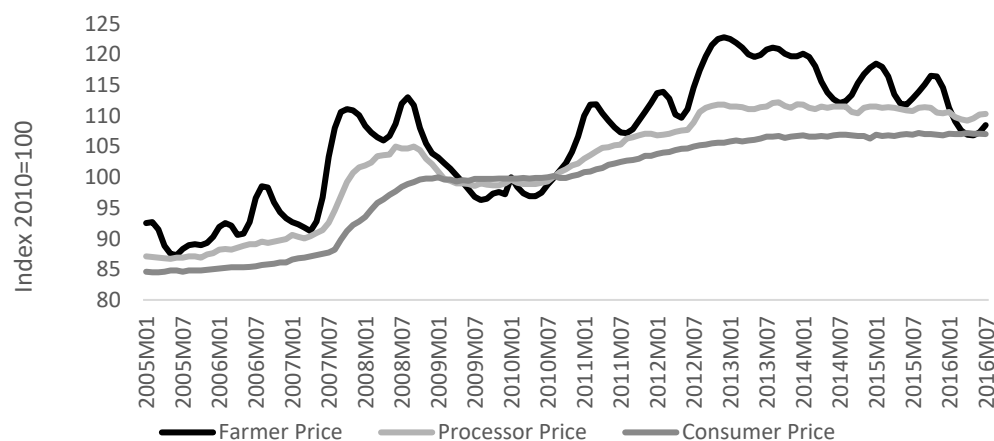
A. EU



B. France



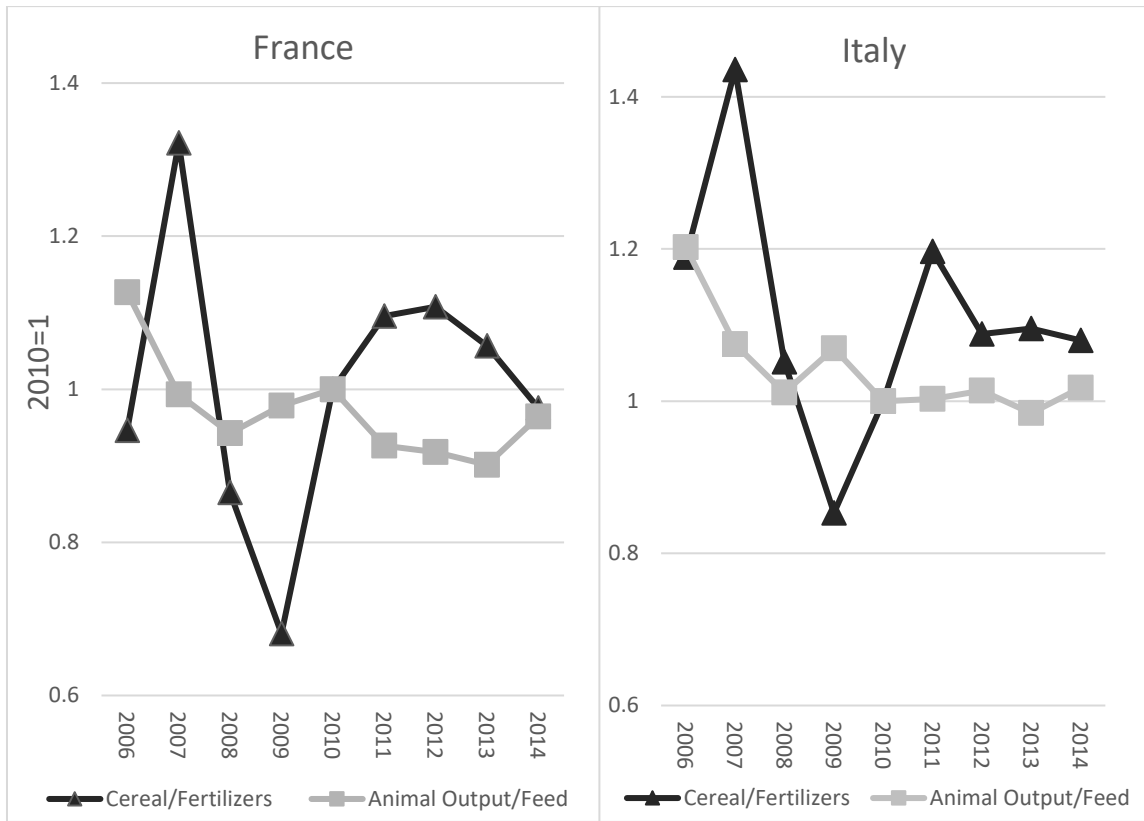
C. Italy



Source: European Commission (2016) Eurostat- Food Price Monitoring tool (2017)

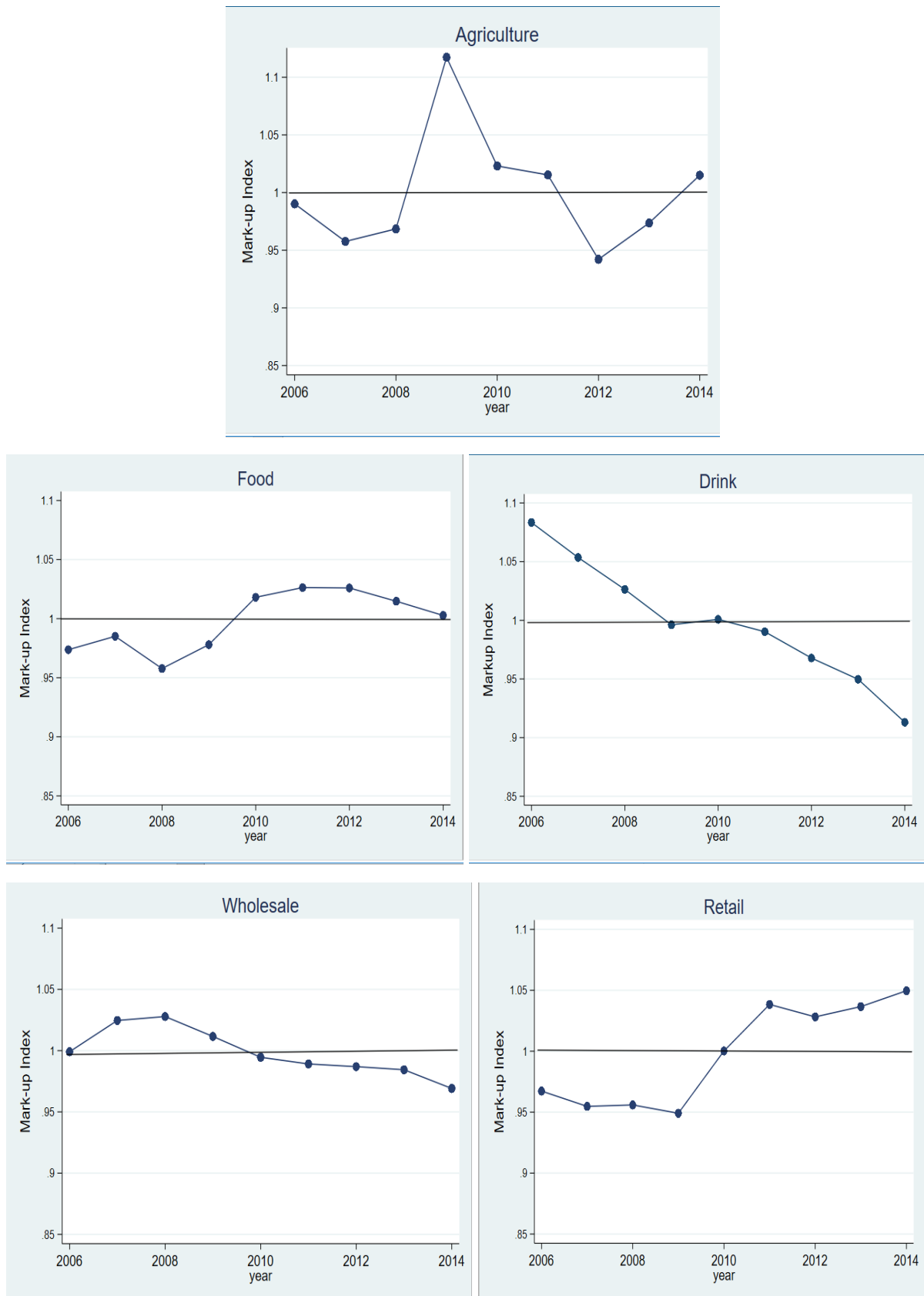
²⁰ Note: For the EU level the evolution of monthly prices are taken from DG AGRI Bulletin, which stressed that Eurostat monthly indices for EU farmer prices are not available since 2013. Until December 2015, they are estimated based on MS data weighted by their share in the agricultural output. Beyond, indices are estimated based on cereal, sugar, milk and meat monthly prices weighted by annual production (European Commission, 2016).

Figure 2: Evolution of the ratio of cereal over fertilizer prices and the ratio of animal output over animal feed prices, in France and Italy (2006-2014)



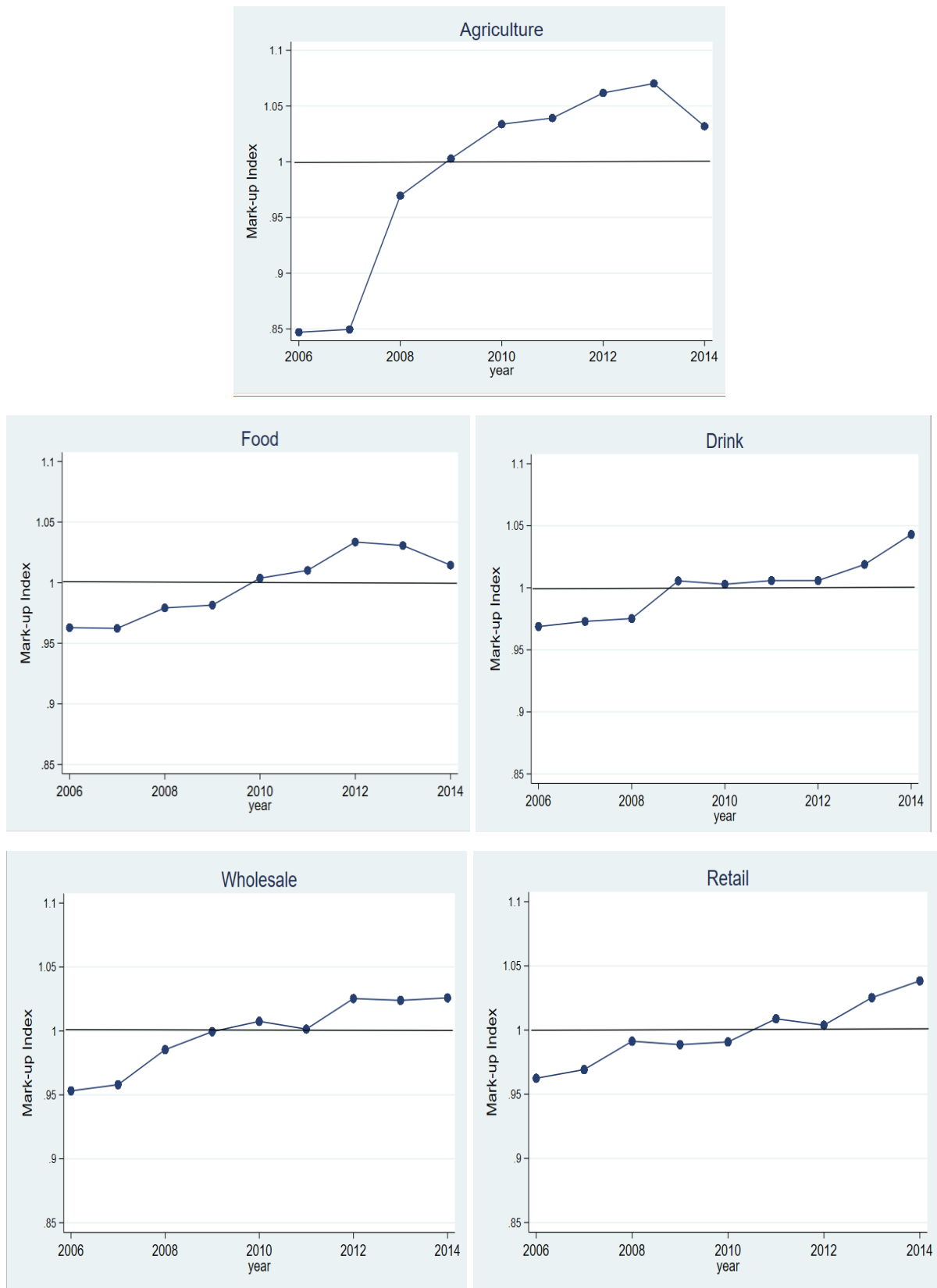
Source: Author's elaboration from Eurostat (2017)

Figure 3: Evolution of mark-ups of the agri-food value chain, France 2006-2014



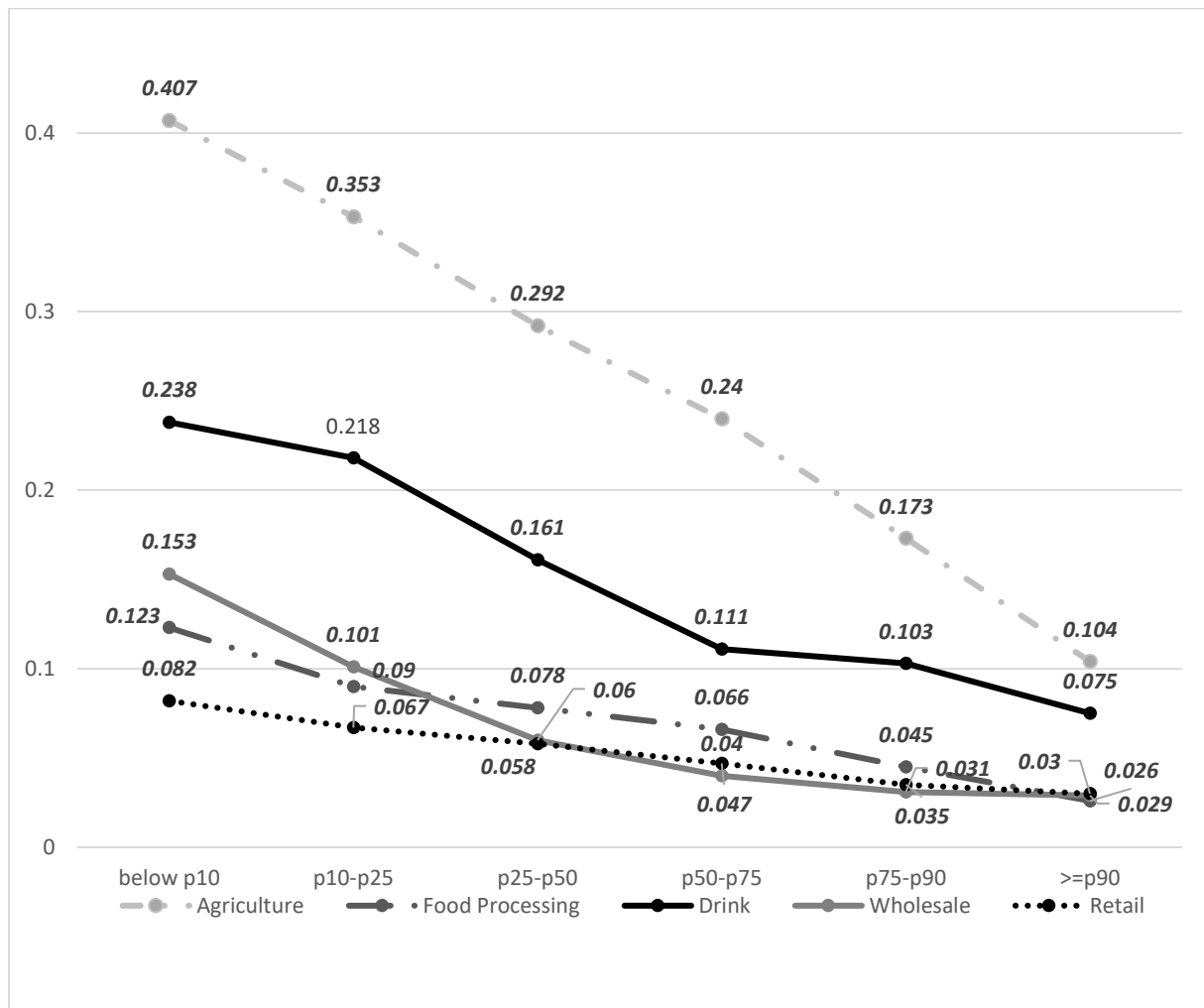
Source: Authors' estimations from BvD Amadeus database

Figure 4: Evolution of mark-ups of the agri-food value chain, Italy 2006-2014



Source: Authors' estimations from BvD Amadeus database

Figure 5: Relationship between mark-up volatility and firm size



Note: For illustration purposes, we report the results as reference category French firms belonging to the lower end of the firm size distribution “below or equal the 10th percentile”. To obtain the shift size for the Italian firms see row 10 in Table B.2. of the regression results. Results in ***bold and italics*** are statistical significant at the 0.1, or 0.05, or 0.01 levels.

Source: Authors’ estimations from BvD Amadeus database

Table 1: Sample distribution of firms of the agri-food value chain in France and Italy (% firms).

Sector	France		Italy	
	Nr. of Firms	Share	Nr. of Firms	Share
Agriculture	6,505	12.0%	7,241	22.3%
Food Processing	12,970	24.0%	7,248	22.3%
Drink	1,229	2.3%	1,036	3.2%
Food Wholesale	10,718	19.8%	10,148	31.3%
Food Retailers	22,674	41.9%	6,793	20.9%

Source: Authors' elaboration from BvD Amadeus database

Table 2: Descriptive statistics for France and Italy

Variable	France		Italy	
	Nr. of observations.	Mean	Nr. of observations	Mean
<i>Agriculture</i>				
Turnover	41,890	1,280	46,610	2,673
Total Assets	41,890	1,860	46,610	4,714
Material	41,890	433	46,610	1,790
Cost of Labor	41,890	287	46,610	337
<i>Food Processing</i>				
Turnover	81,774	5,626	51,107	12,859
Total Assets	81,774	3,380	51,107	11,216
Material	81,774	2,963	51,107	7,841
Cost of Labor	81,774	863	51,107	1,258
<i>Drink</i>				
Turnover	8,588	19,043	7,570	13,665
Total Assets	8,588	21,845	7,570	16,956
Material	8,588	9,658	7,570	6,826
Cost of Labor	8,588	1,892	7,570	1,272
<i>Food Wholesale</i>				
Turnover	73,649	14,384	68,518	8,352
Total Assets	73,649	5,974	68,518	4,869
Material	73,649	11,237	68,518	6,591
Cost of Labor	73,649	799	68,518	415
<i>Food Retail</i>				
Turnover	142,338	6,099	42,609	12,842
Total Assets	142,338	2,031	42,609	7,365
Material	142,338	4,621	42,609	9,477
Cost of Labor	142,338	624	42,609	1,347

Note: Values are expressed in thousands of €.

Source: BvD Amadeus

Table 3: Sample representativeness – comparison of average firm turnover between Eurostat and BvD Amadeus, in France and Italy 2013

Sector	France		Italy	
	Average firm turnover		Average firm turnover	
	Total Coverage Eurostat*	Sample Coverage Amadeus	Total Coverage Eurostat*	Sample Coverage Amadeus
Agriculture	154,929	1,071,946	56,746	2,206,537
Food Processing	2,691,518	4,480,550	2,035,119	11,276,620
Drink	8,997,632	23,949,050	5,777,823	13,017,460
Food Wholesale	8,910,217	14,505,090	1,423,772	7,545,566
Food Retail	3,190,952	6,057,175	917,368	10,337,100

Note: Values are expressed in €.

* Average firm turnover from Eurostat data is computed as total sector turnover divided by total number of firms operating in that sector.

Source: Eurostat - Economic Account for Agriculture; Eurostat - Structural business statistics; and BvD Amadeus

Table 4: Mark-up volatility along the agri-food value chain

Sector	France		Italy	
	Volatility	p-value	Volatility	p-value
Agriculture	0.27		0.28	
Food Processing	0.08	0.00	0.11	0.00
Drink	0.15	0.00	0.12	0.00
Food Wholesale	0.07	0.00	0.08	0.00
Food Retail	0.05	0.00	0.04	0.00

Note: The reported p-values are the result of the t-test comparing agricultural sector against the other sectors.

Source: Authors' estimations from BvD Amadeus database

Table 5: Alternative measures of mark-up volatility

Sector	France			Italy		
	v_a	AR(1)	AR(1) FE	v_a	AR(1)	AR(1) FE
Agriculture	0.31	0.30	0.21	0.34	0.33	0.23
Food Processing	0.09	0.09	0.06	0.14	0.14	0.11
Drink	0.21	0.21	0.16	0.13	0.13	0.10
Food Wholesale	0.09	0.09	0.07	0.13	0.13	0.10
Food Retail	0.06	0.05	0.04	0.06	0.05	0.04

Source: Authors' estimations from BvD Amadeus database

Table 6: Mark-up volatility in agricultural sub-sectors

Sector	France		Italy	
	Volatility	p-value	Volatility	p-value
Cereal Sector	0.23		0.32	
Livestock Sector	0.25	0.27	0.21	0.00
Fruits Nuts and Vegetables Sector	0.26	0.01	0.28	0.01
Other Crops	0.17	0.00	0.27	0.03
Mixed Farming	0.24	0.64	0.29	0.31
Other Agricultural Activities	0.28	0.00	0.21	0.00

Note: See Section 4 for the categorization of the agricultural sub-sectors. The reported p-values are the result of the t-test comparing cereal sector against the other sub-sectors.

Source: Authors' estimations from BvD Amadeus database

Table 7: Mark-up volatility and firm size

<i>Dep. variable:</i>	Agriculture		Food Processing		Drink		Food Wholesale		Retail	
<i>Mark-up</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>volatility</i>	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Size (log)	-0.06039*** (0.001)	-0.09728*** (0.009)	-0.01571*** (0.001)	-0.05258*** (0.003)	-0.02895*** (0.002)	-0.07597*** (0.011)	-0.02256*** (0.001)	-0.10775*** (0.004)	-0.00940*** (0.000)	-0.03279*** (0.001)
Size^2		0.00286*** (0.001)		0.00240*** (0.000)		0.00293*** (0.001)		0.00531*** (0.000)		0.00157*** (0.000)
Country	0.01749*** (0.004)	0.01502*** (0.004)	0.05128*** (0.002)	0.05250*** (0.002)	-0.02687*** (0.006)	-0.02525*** (0.006)	0.01692*** (0.001)	0.02198*** (0.001)	-0.00428*** (0.001)	-0.00265*** (0.001)
Constant	0.63125*** (0.009)	0.74539*** (0.032)	0.17838*** (0.003)	0.31172*** (0.014)	0.37108*** (0.015)	0.54975*** (0.047)	0.23961*** (0.005)	0.56647*** (0.018)	0.11713*** (0.001)	0.19956*** (0.004)
Observations	13,746	13,746	20,218	20,218	2,265	2,265	20,866	20,866	29,467	29,467
R-squared	0.110	0.111	0.096	0.106	0.118	0.126	0.108	0.140	0.132	0.148

Note: The dummy variable “Country” takes value 0 for France and 1 for Italy. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

APPENDIX A: Filing requirements and data providers

Country	Which companies have to file accounts?	Data Provider
FR	<p>All of the following:</p> <ul style="list-style-type: none"> • les sociétés responsabilité limitée (SARL et EURL) ; • les sociétés de personnes (sociétés en nom collectif et sociétés en commandite simple), sous certaines conditions: les sociétés en nom collectif (SNC) dont au moins l'un des associés est une personne physique ne sont pas dans l'obligation de déposer leurs comptes annuels (pour plus de précisions, se référer l'article L. 232-21 du Code de Commerce) ; • les sociétés par actions (sociétés anonymes, sociétés par actions simple es et sociétés en commandite par actions) ; • les sociétés commerciales dont le siège est situé à l'étranger qui ont ouvert un ou plusieurs établissements en France • les sociétés d'exercice libéral (SELARL, SELAFA, SELCA, SELAS) ; • les sociétés coopératives et unions sous certaines conditions (pour plus de précisions, se référer l'article R. 524-22-1 du Code Rural). 	Ellisphere
IT	<p>Includes:</p> <ul style="list-style-type: none"> • S.p.A. (Società per Azioni), • S.r.l. (Società a responsabilità limitata), • Sapa (Società in accomandita per azioni), • Società Cooperative, • Società Consortili, • G.e.i.e, Società di persone (only consolidated accounts), • Consorzi con qualifica di Confidi. • Società a responsabilità a socio unico e società per azioni a socio unico. 	Jordan Limited

Source: Kalemli-Ozcan et al. (2015)

APPENDIX B: Additional tables and figures

Table B.1: Correlations among alternative measures of mark-up volatility

Correlation	France	Italy
v_i and v_a	0.9872	0.9891
v_i and AR(1)	0.9813	0.9884
v_i and AR(1) FE	0.9813	0.9884
v_a and AR(1)	0.9991	1.0000
v_a and AR(1) FE	0.9975	0.9992
AR(1) and AR(1) FE	0.9994	0.9994

Source: Authors' estimations from BvD Amadeus database

Table B.2: Regression results of firm's mark-up volatility on firm size by percentile categories of turnover distribution

<i>Dependent variable: Mark-up volatility</i>	(1) Entire Agri-Food Chain	(2) Agriculture	(3) Food Processing	(4) Drink	(5) Food Wholesale	(6) Food Retail
Food Processing	-0.160*** (0.002)					
Drink	-0.099*** (0.004)					
Food Wholesale	-0.158*** (0.002)					
Retail	-0.195*** (0.002)					
p10-p25	-0.050*** (0.003)	-0.054*** (0.011)	-0.033*** (0.003)	-0.020 (0.015)	-0.052*** (0.004)	-0.015*** (0.001)
p25-p50	-0.074*** (0.002)	-0.115*** (0.010)	-0.045*** (0.003)	-0.077*** (0.013)	-0.093*** (0.004)	-0.024*** (0.001)
p50-p75	-0.101*** (0.002)	-0.167*** (0.010)	-0.057*** (0.003)	-0.127*** (0.012)	-0.113*** (0.004)	-0.035*** (0.001)
p75-p90	-0.123*** (0.002)	-0.234*** (0.010)	-0.078*** (0.004)	-0.135*** (0.013)	-0.122*** (0.004)	-0.047*** (0.001)
>=p90	-0.127*** (0.002)	-0.303*** (0.010)	-0.097*** (0.004)	-0.163*** (0.012)	-0.124*** (0.004)	-0.052*** (0.001)
Country	0.022*** (0.001)	0.016*** (0.004)	0.050*** (0.002)	-0.027*** (0.006)	0.022*** (0.001)	-0.003*** (0.001)
Constant	0.322*** (0.003)	0.407*** (0.009)	0.123*** (0.003)	0.238*** (0.012)	0.153*** (0.004)	0.082*** (0.001)
Test that...	p-value	p-value	p-value	p-value	p-value	p-value
$\beta_{p10-25} \# \beta_{p25-p50}$	0.000	0.000	0.000	0.000	0.000	0.000
$\beta_{p25-p50} \# \beta_{p50-p75}$	0.000	0.000	0.000	0.000	0.000	0.000
$\beta_{p50-p75} \# \beta_{p75-p90}$	0.000	0.000	0.000	0.301	0.000	0.000
$\beta_{p75-p90} \# \beta_{>=p90}$	0.0007	0.000	0.000	0.000	0.456	0.000
Observations	86,562	13,746	20,218	2,265	20,866	29,467
R-squared	0.308	0.108	0.099	0.127	0.132	0.140

Note: The dummy variable "Country" takes value 0 for France and 1 for Italy. Robust standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1 denote statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

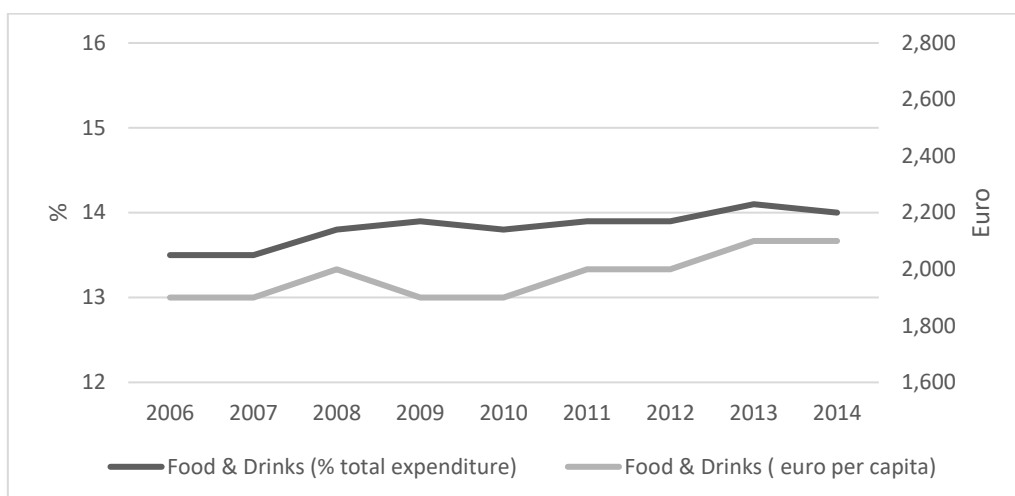
Table B.3: Regression results of firm's mark-up volatility on firm size in agricultural sub-sectors

<i>Dep. variable: Mark-up volatility</i>	Cereal Sector		Livestock Sector		Fruits, Nuts and Vegetables Sector		Other Crops		Mixed Farming		Other Agricultural Activities	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Size (log)	-0.04329*** (0.006)	-0.02772 (0.034)	-0.06367*** (0.004)	-0.16659*** (0.023)	-0.06061*** (0.003)	-0.10781*** (0.019)	-0.04970*** (0.007)	-0.11657*** (0.045)	-0.08419*** (0.012)	-0.15022 (0.101)	-0.05238*** (0.002)	-0.07769*** (0.014)
Size^2		-0.00125 (0.003)		0.00774*** (0.002)		0.00365*** (0.001)		0.00507 (0.003)		0.00531 (0.007)		0.00194** (0.001)
Country	0.08396*** (0.017)	0.08431*** (0.017)	0.00874 (0.012)	0.00788 (0.012)	-0.00325 (0.008)	-0.00783 (0.008)	0.08505*** (0.019)	0.08116*** (0.020)	0.06328* (0.033)	0.06188* (0.033)	-0.02449*** (0.007)	-0.02631*** (0.008)
Constant	0.48652*** (0.036)	0.44007*** (0.110)	0.62577*** (0.027)	0.94841*** (0.082)	0.65505*** (0.019)	0.80248*** (0.065)	0.49298*** (0.049)	0.70581*** (0.158)	0.73959*** (0.081)	0.93649*** (0.333)	0.58537*** (0.015)	0.66438*** (0.048)
Observations	880	880	1,751	1,751	3,827	3,827	511	511	337	337	4,380	4,380
R-squared	0.074	0.074	0.140	0.151	0.111	0.113	0.132	0.135	0.136	0.138	0.120	0.121

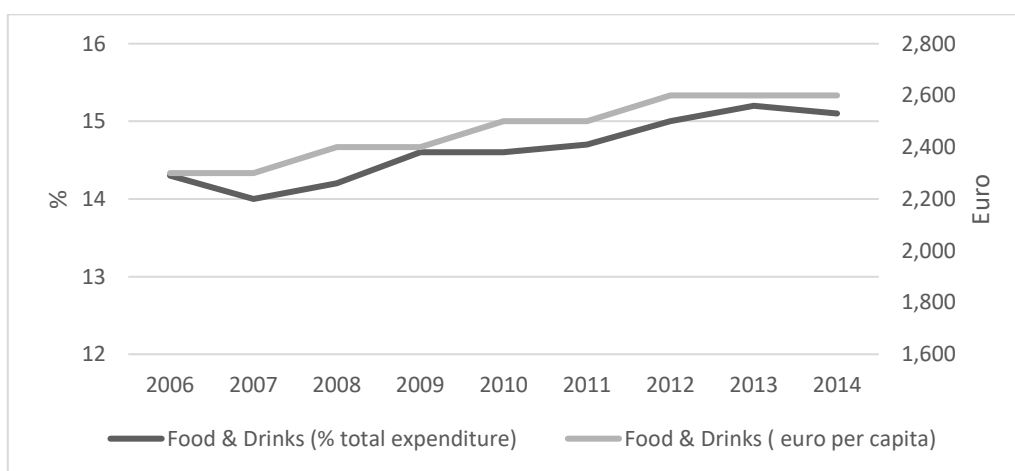
Note: The dummy variable “Country” takes value 0 for France and 1 for Italy. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Figure B.1: Evolution of consumption expenditure of food products, 2006-2014

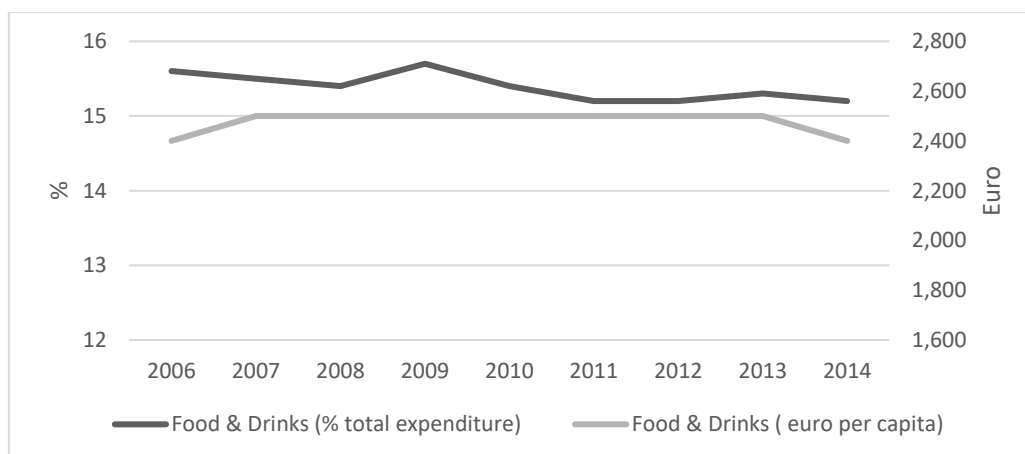
A. EU



B. France



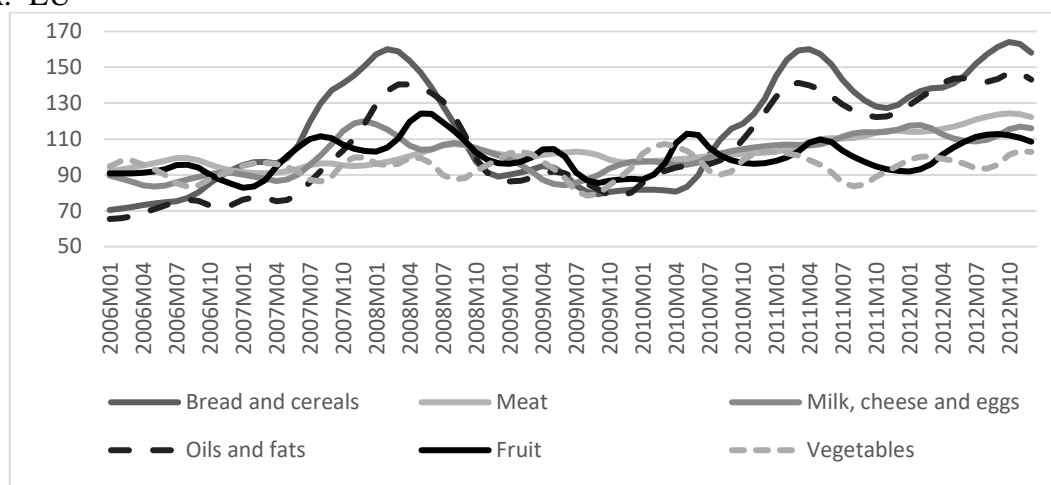
C. Italy



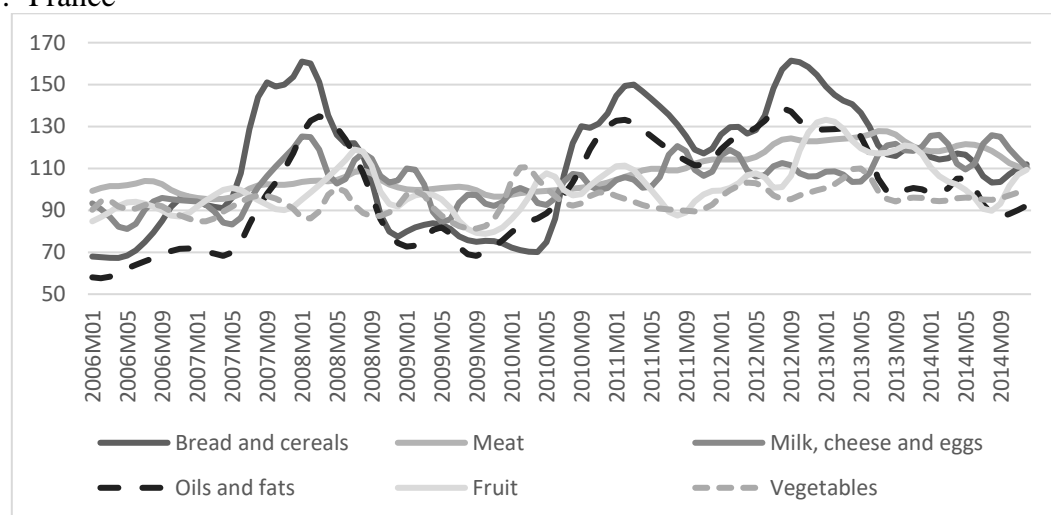
Source: Author's elaboration Eurostat (2017)

Figure B.2: Evolution of agricultural commodity prices, by commodity, 2006-2014

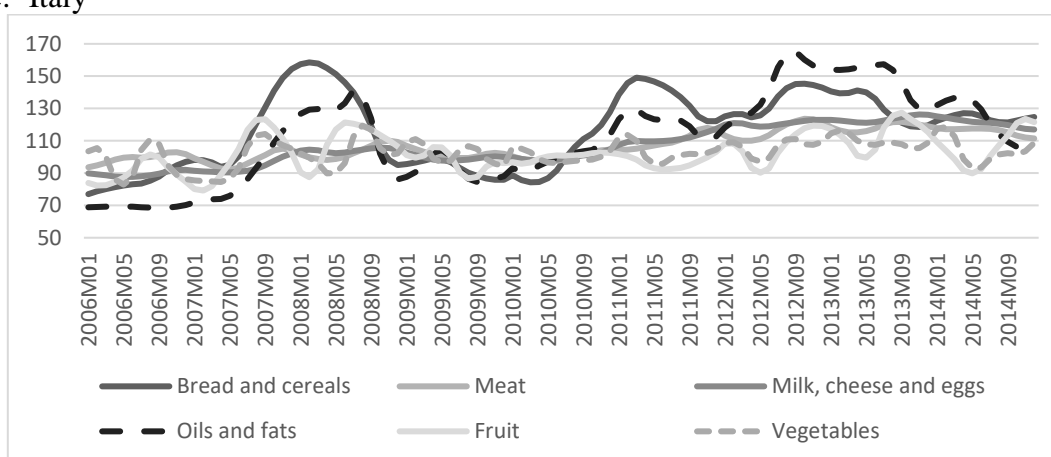
A. EU



B. France



C. Italy



Source: Eurostat – Food Price Monitoring Tool (2017)