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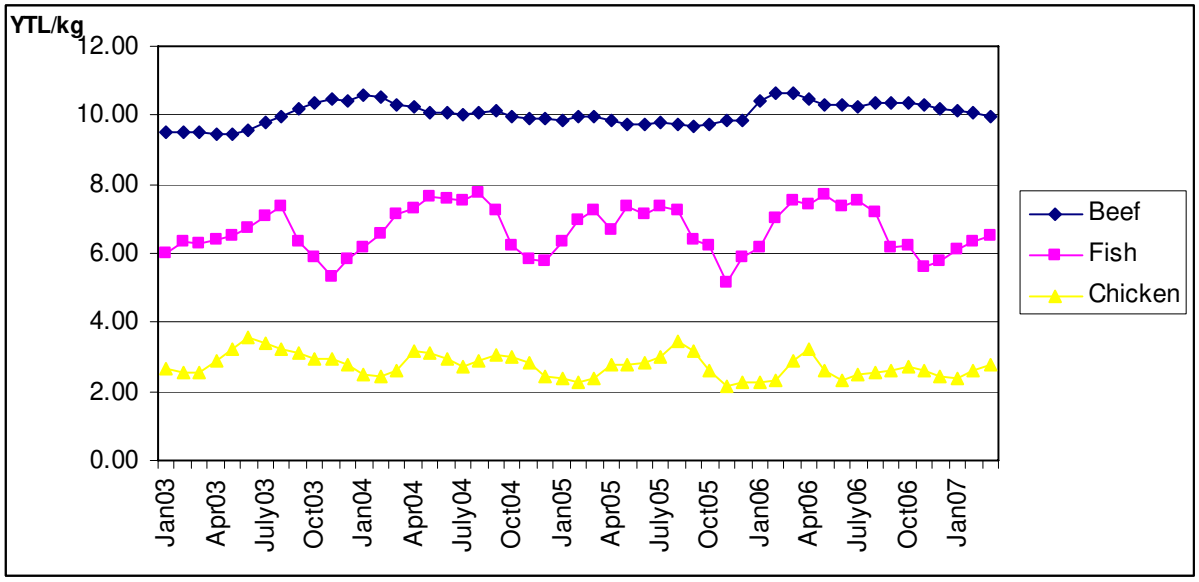
Abstract: The Atlantic bonito rush experienced in Turkey in the Fall of 2005 coincides with the avian influenza food scare that happened exactly at the same time-period in the country. In this research using time-series techniques, we investigate how the food scare and the excess fish caught jointly influence the demand for meat products in Turkey.

Research question

The Atlantic bonito rush experienced in Turkey in Fall 2005 coincides with the H5N1 avian influenza food scare that happened exactly at the same time period in the country. Hence, an interesting question that arises is how the food scare and the excess fish caught jointly influence the demand for meat products in Turkey. Using time-series techniques we would like to derive the impacts of these two factors on the beef, poultry meat, and fish prices for the mentioned period. Historical data on these three price series for the period between January 2003 and March 2007 are used in this analysis. The data we used on real prices are presented in the following figure.



Historical data on meat production in Turkey are presented in Table 2.

Table 2. Meat production in Turkey (tons)

	Sheep and goat	Cattle	Poultry	Fish
2000	132,534	354,636	662,748	441,690
2001	101,799	331,589	629,888	465,180
2002	91,282	327,629	726,607	493,446
2003	74,493	290,455	905,252	416,126
2004	80,015	364,999	914,458	456,752
2005	86,133	321,681	979,412	N/A

Source: Turkstat

Poultry sector in Turkey

The current size of the annual poultry sector in Turkey is estimated to be around 2.5 billion USD with around 150 million birds commercially traded. The employment figure in the sector is 150,000 people (GAIN, 2005; Harmanyeri, 2006). In 2005, total poultry production in Turkey was 1.1 million tones with a consumption quantity of 1 million tones, and consumption per person amounted to 14 kg/year. State Planning Organization projections show that in year 2010 demand in Turkey will reach 1.2 million tons with a per person consumption of 16 kg/year. Respective estimations are 1.5 million tons and 19 kg/year per person for the year 2015 (BESD-BIR, 2006).

During the Fall of 2005, within two weeks of the outbreak, the consumption of poultry in Turkey (roughly 1.2 kilogram per capita per month before the crisis) dropped by 50 percent. Retail poultry prices fell almost by 20 percent. The market capitalization of the traded Turkish poultry firms dropped by over 30 percent within the first week following the crisis (EU, 2006; Sarnıç, 2006; Turkstat, 2006). This is partly due to the fact that Balıkesir and the nearby provinces account for over 40 percent of Turkey's broiler enterprises and poultry production. Demand for eggs, where the production is also concentrated in the provinces stated above, fell from 12 eggs per capita per month by also 20 percent and retail prices of eggs dropped by 22 percent (EU, 2006; Turkstat, 2006). Prior to the outbreak, the

turnover of the poultry and egg sector was estimated to be around three billion dollars annually, but as a result of the outbreak, the poultry and egg sector incurred losses of roughly US$ 0.9 million per day within the October-December 2005 period (BESD-BIR, 2006; EU, 2006). In November 2005, real retail and wholesale poultry prices reached their lowest levels since the beginning of 2003. Only starting in March 2006, the sector started to observe signs of recovery.

Avina Influenza in 2005

The first reported case of the H5N1 virus in Turkey was on October 5, 2005. The outbreak occurred in a backyard flock kept in a sparsely populated area in Manyas district, Balıkesir province. This first outbreak was quickly contained with no signs of transmission to humans. However, later in January 2006, a second widespread outbreak occurred starting in northeastern Turkey. As of mid-March 2006, the presence of the H5N1 virus was confirmed in 58 of Turkey's 81 provinces. As for the first human case, it occurred in four children from a family in Doğu Beyazıt on January 5, 2006. In total, 21 human cases of avian influenza with four deaths were reported by the WHO. Later on, experts confirmed that all the patients had a history of close contact with sick birds and therefore, there was no indication of human-to-human transmission (WHO, 2006). On August 2006, it was announced that Turkey was cleared from the highly pathogenic avian influenza based on the OIE Animal Terrestrial Code classifications.

Fishery sector in Turkey

Turkey has a long coastline of the size of 8,300 km. However, the annual production and consumption of fish is not in parallel with this length and they are remarkably small compared with the world averages. Considering the per capita fish consumption, world average is

around 15 kg, with levels of 25 kg in Italy, 31 kg in France, 44 kg in Spain, 70 kg in Japan, whereas it was only 9.8 kg in 1995 in Turkey, and this number even dropped to 7.5 kg in recent years (Saygı et al., 2006). Annual production was 456,752 tons in 2004 (Turkstat). Historically, around 76% of fish caught comes from Black Sea, 11% Marmara, 9% Aegean, 5% Mediterranean seas (Timur and Doğan, 1999). Annual aquaculture production was 79,943 tons in 2003 but cultured fish production has been steadily increasing in recent years. Contribution of fisheries to the GDP is only at 0.3 percent and to Turkey's total agricultural production only at 2.7 percent (FAO, 2006).

The major fish species caught commercially in Turkey counting for 90% of total marine catches are anchovy, grey mullet, hake, whiting, pilchard, horse mackerel, Atlantic bonito, chub mackerel, sprat and blue fish (ABGS, 2006). Data on quantity on sea fish caught is presented in the next Table. Among the fish caught 25% is used to produce flour or oil, and the remaining 75% are consumed as fresh or processed meat (Şenol and Saygı, 2001). The legally allowed commercial fishing season in Turkey is between September and April.

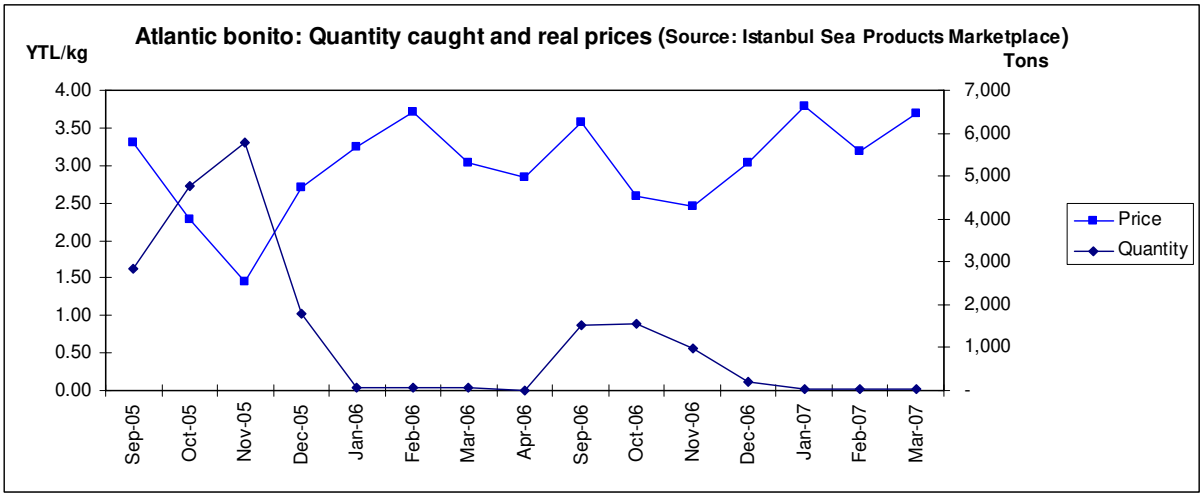
Table X. Quantity of sea fish caught (Tons)

Type of fish	**2000**	**2001**	**2002**	**2003**	**2004**	**2005***	**2006***
Anchovy	280,000	320,000	373,000	295,000	340,000		
Blue fish	4,250	13,060	25,000	22,000	19,901		
Horse mackerel	15,000	15,545	19,500	16,400	18,068		
Pilchard	16,500	10,000	8,684	12,000	12,883		
Grey mullet	27,000	22,000	12,000	11,000	12,424		
Whiting	18,000	10,000	8,808	8,000	8,205		
Atlantic bonito	12,000	13,460	6,286	6,000	5,701	15,170	4,251
Sprat	7,000	1,000	2,050	6,025	5,411		
Hake-European hake	18,190	20,810	10,500	7,500	4,380		
Chup mackerel	9,000	4,500	1,500	1,480	1,402		
Other	34,750	34,805	26,118	30,721	28,377		
Toplam - Total	**441,690**	**465,180**	**493,446**	**416,126**	**456,752**		

Source: Turkstat; *: traded in Istanbul Wholesale Fish Market, the 2005 figure includes only the September-December period.
http://www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=693

Atlantic bonito "rush" of Fall 2005

Atlantic bonito is one of the highly traded fish species in Turkey. Whereas historic data shows that until 2001 annual Atlantic bonito caught was above 12,000 tons, this number suddenly decreased to the levels of 6,000 tons in 2002 and stayed around that until 2005. Not only for atlantic bonito but for fish caught in Turkey in general, the highly cited reasons for this decrease is excess fishing and sea and ecological pollution. However, the picture changed in September 2005 with the atlantic bonito "rush." Whereas in the previous three years at most 6,286 tons were caught for a whole year, in September 2005 2,828 tons, in October 4,762 tons, in November 5,785 tons, and in December 1,785 tons were caught adding-up to 15,170 tons. This is directly reflected in prices; whereas the (CPI adjusted) price of Atlantic bonito was 3.30 YTL/kg in September, it decreased to 2.27 YTL/kg in October, and further to 1.44 YTL/kg in November. Historical Atlantic bonito prices at Istanbul Sea Products Marketplace is presented in the next Figure. Istanbul is the largest city in Turkey and a major portion of fish caıught in Turkey is traded at the Istanbul Sea Products Marketplace (Tekinay, et al., 2003).



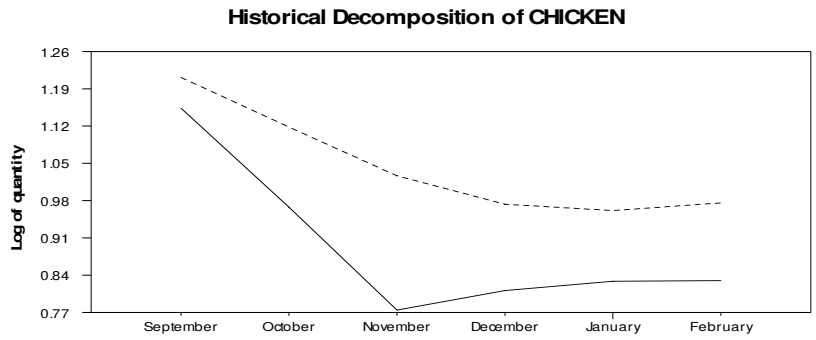
Empirical model and Results

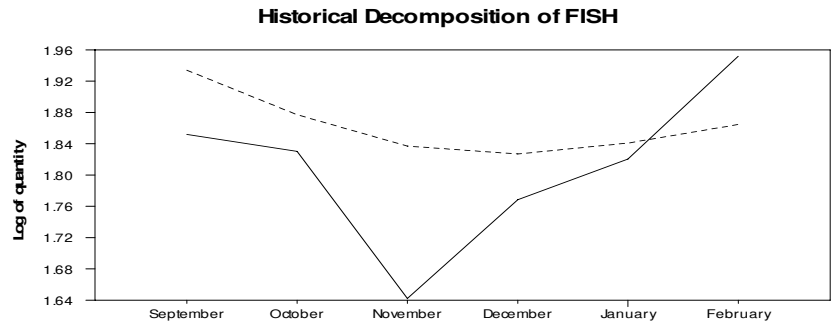
Measuring the impact of the food safety scare and the Atlantic bonito shock can be handled by historical decomposition graphs. Historical decompositions decompose the series to determine the impact of the two events on quantity consumption in a neighborhood (time interval) of the events. Historical decomposition graphs are based upon partitioning of the moving average series into two parts:

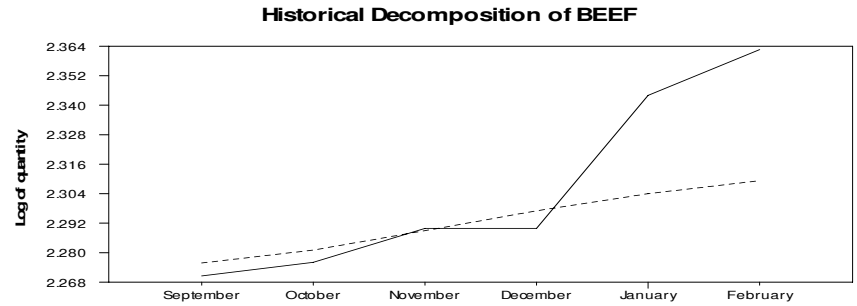
$$P_{t+j} = \sum_{s=0}^{j-1} \psi_s U_{t+j-s} + \left[X_{t+j}\beta + \sum_{s=j}^{\infty} \psi_s U_{t+j-s} \right],$$

where P_{t+j} is the multivariate stochastic process, U is its multivariate noise process, and X is the deterministic part of P_{t+j}. The first sum represents that part of P_{t+j} due to innovations (shocks) that drive the joint behavior of the series for period $t+1$ to $t+j$, the horizon of interest, and the second is the forecast of the series based on information available at time *t*, the date of an event—that is, how series would have evolved if there had been no shocks (RATS, 2004).

The figure below shows the historical decomposition graphs of the three consumption series for a six month horizon from RATS software. The solid line is the actual quantity consumed which includes the impact of the events and the dashed line is the forecast of that variable excluding the effect of any shock. The dynamic impacts of the shocks can spread over many time periods or dissipate quickly. It is also likely that other effects would normally occur after a few weeks or months might cloud their impacts. For this study we have used a six month time-period for forecasting and testing the impact of the fish surge and the H5N1 virus shock.







Actual quantities consumed including the events: _____
Forecasted consumption quantities before the events: ----------

The H5N1 avian influenza and Atlantic bonito impacts on Turkish beef, chicken and fish consumption (log-form).

The Atlantic bonito rush occurred in the Fall of 2005, and the H5N1 virus was discovered in October 2005. In September 2005, the actual consumption quantities (solid lines) and their forecasted estimates (dashed lines) followed each other closely with minor differences that are commonly expected between any actual series and its forecast. However, the series began to depart in October 2005. Historical decomposition of the retail quantities consumed, which includes the impact of the shock, showed that the wide departure of actual

chicken and fish consumption occurred in October, while reaching their maximum by the end of this month. It is estimated that the chicken consumption dropped by 28% and fish consumption dropped by 20% in October 2005 compared with their forecasted quantities. Yet in November 2005, the estimated magnitude of the actual beef consumption is exactly the same as its forecasted amount. We know that there was a huge increase in the quantity of fish caught during the same period, leading to a decrease in the fish prices; but consumers apparently did not think fish to be a good substitute for chicken at the beginning, and the amount of fish consumed actually fell by 20%. However, the consumption of fish began to increase sharply by the beginning of November 2005.

The beef consumption began to increase in December with a one month lag compared to the increase in fish consumption and quickly surpassed its forecasted amounts. Meanwhile, the fish consumption surpassed its forecasted quantities in January. The difference between the actual (solid line) and the forecast chicken consumption (dashed line) indicates that chicken consumption did not reach its forecasted estimates for the whole duration of the time period under investigation, suggesting the lingering consumers' concerns for food safety.

Interestingly, between October and November of 2005, beef consumption was increasing as was expected the by the forecasted quantities. There was a suppressed demand for poultry during the crisis with demand for poultry meat decreasing, while companies destroyed chicks they owned and cancelled the contracts they had signed with growers, suppressing their supply as well. Also, during the crisis, due to excess financial pressure several small sized producers went bankrupt and exited the market (Yalçın, 2006b).

Overall, the historical decomposition results showed, as expected, that the H5N1 virus discovery impacted chicken consumption negatively, but the initial decrease in the fish consumption is surprising. The H5N1 virus discovery was covered by the media and electronic news outlets rather quickly, and the estimated one month lag of the increase in fish

consumption might reflect the role of contracts and the fact that in this research we are dealing with monthly data series, rather than reflecting problems with the flow of information through the chain.

Conclusions

The results indicated that the consumption of poultry dropped as expected due to the H5N1 avian flu scare and consumers substituted beef more than fish for poultry. Surprisingly, with the increase in fish supply and decrease in prices, the increase in consumption of fish is less than the estimated forecast levels, suggesting fish is not considered a good substitute for poultry. It seems that beef consumption by Turkish consumers is considered to be a better substitute for poultry.

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