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How does a shorter supply chain affect pricing of fresh food? Evidence from a natural experiment ☆

Cevriye Aysoy [a], Duygu Halim Kirli [a], Semih Tumen [a,b,*]

[a] Research and Monetary Policy Department, Central Bank of the Republic of Turkey, Istiklal Cad. No: 10, 06100 Ulus, Ankara, Turkey
[b] IZA, P.O. Box 7240, 53072 Bonn, Germany

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ABSTRACT

The market for fresh food is often characterized by a large number of intermediaries delivering the product from the farmer to the retailer. The existence of these intermediaries, especially the informal ones, is often claimed to introduce market frictions that push fresh food prices up. We test the hypothesis that scaling down these frictions reduces the level of prices. Our data come from a policy reform in Turkey concerning the supply chain regulations in the market for fresh fruits and vegetables. Starting from January 1st, 2012, a new law is enacted (i) to remove informal intermediaries, (ii) to reduce the farmers' cost of access to formal intermediaries such as wholesale market places, and (iii) to provide the farmers with the option to directly sell their products to retailers—bypassing the wholesale intermediaries. This policy reform resembles a natural experiment that exogenously reduces the supply chain barriers in the market for fresh fruits and vegetables. Using quasi-experimental methods, we show that the policy reform has strikingly reduced the prices in the wholesale market. We also provide some rough evidence that there is no price effect in the retail market, which suggests that part of the wholesale markups may have been transferred to the retailers. Taken at face value, these results provide some hints that consumers have not received any direct benefits from the reform—ignoring the general equilibrium effects.

Introduction

The fresh food sector has an extensive supply chain encompassing agricultural production, transportation, classification/processing, and related commercial services.[1] As a result, many agents are involved in the process of delivering the product from the farmer to the final seller. Achieving a well-monitored supply chain is an important policy priority and has recently attracted a lot of attention from policymakers and researchers. Tracing the supply chain is also economically important, because each of the link in the chain corresponds to an additional activity affecting the formation of fresh food prices. However, existence of informal intermediaries—which is a major obstacle for traceability of the supply chain—and excessive bureaucratic formalities—which prevent direct contact between farmers and retailers—are often regarded as important "supply chain barriers" in the market for fresh food.[2] Reducing these barriers has been an important food policy issue. In fact, over the past 30 years,

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* Corresponding author at: Research and Monetary Policy Department, Central Bank of the Republic of Turkey, Istiklal Cad. No: 10, 06100 Ulus, Ankara, Turkey.
E-mail addresses: cevriye.aysoy@tcmb.gov.tr (C. Aysoy), duygu.halim@tcmb.gov.tr (D.H. Kirli), semih.tumen@tcmb.gov.tr (S. Tumen).

[1] The term "fresh food sector" is generally used to describe the sectoral activity of producing a group of farm-produced items including fruits, vegetables, meats, grains, oats, etc. In this paper, we focus on a specific category of fresh food: fresh fruits and vegetables.

[2] The costs that the farmers face in accessing the markets are typically high in Turkey. These costs include not only the direct costs of harvesting, storage, and transportation, but the other bureaucratic formalities including imposts, certain pesticide tests, and quality certification of the produce. The informal intermediaries in the market for fresh fruits and vegetables in Turkey typically exploit the existence of these costs and other formalities. Farmers are mostly visible to the authorities, while the informal agents can hide. They are not registered with the authorities and, thus, are able to avoid those costs conditional on not getting caught. Being able to avoid these costs and other taxes, the informal agents buy the produce from the farmers "on the tree" and serve as an intermediary between the farm and the final seller. The informal intermediaries either sell these produce directly to the consumers in the designated "local bazaars" or to the retailers. Typically, more than one informal intermediaries are involved in the process, which translates into multiple markups added on the final price.

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policies that favor more traceable supply chains have been widely implemented (Aubry and Kebir, 2013; IFC, 2013). These policies encourage retailers to source directly from farmers rather than from channels that involve several layers of anonymous transactions. The main concerns driving this policy shift include issues related to health, safety, quality, and productivity. Most importantly, reducing supply chain barriers is expected to reduce the prices and, thus, to offer consumers cheaper and healthier access to fresh fruits and vegetables.

In this paper, we formally test the hypothesis that reducing supply chain barriers leads to a decline in the price levels of fresh fruits and vegetables. To answer this question, we exploit a policy reform in Turkey concerning the supply chain regulations in the market for fresh fruits and vegetables. Starting from January 1st, 2012, a new law is enacted (i) to remove informal intermediaries, (ii) to reduce the farmers' cost of access to formal intermediaries such as wholesale market places, and (iii) to provide the farmers with the option to directly sell their products to retailers—bypassing the wholesale intermediaries. The pre-reform period can be marked as an imperfectly-monitored market, in which informal intermediaries also try to capture profits along the supply chain. In the post-reform era, informal intermediaries have been eliminated to a large extent and the journey of each product from the farm toward the final seller has been monitored through computerized systems. At the end, the policy reform is expected to reduce the price levels of fresh fruits and vegetables in Turkey.

This policy reform resembles a natural experiment that exogenously reduces the supply chain barriers in the market for fresh fruits and vegetables. To evaluate the impact of the policy reform, we employ a quasi-experimental method: the regression discontinuity design. We perform the empirical analysis along the wholesale/retail divide using two different data sets. In other words, we investigate the impact of the reform on both wholesale and retail prices. For wholesale prices, we use daily price data collected from the Antalya Wholesale Market—a major market hall that supplies a significant fraction of the fresh fruits and vegetables consumed in Turkey, especially in the Winter season. For retail prices, we use nationally representative consumer price data collected and published on a monthly basis by the Turkish Statistical Institute.

We find that the reform has helped to reduce the wholesale prices in the range of 21–31 percentage points, which is quite significant.[3] This result is not sensitive to alternative empirical specifications. Although the case for retail prices is not as clear as the case for wholesale prices due to data limitations, it is still possible to obtain some hints that can be used in interpreting the general effectiveness of the reform. For retail prices, we provide rough evidence that the reform has not made a statistically significant impact, which implies that consumers have not received any direct benefits. Taken at face value, these results say that wholesalers reduced their prices after the reform, but the retailers did not, although they face lower costs in the post-reform period.

The plan of the paper is as follows. Section "Related literature" compares the current paper to the relevant work in the related literature. Section "The supply chain reform" describes the policy reform along with the institutional setup in the market for fresh fruits and vegetables in Turkey. Section "Data" provides detailed data description and summary statistics. Section "Empirical strategy: regression discontinuity design" presents our empirical strategy. Section "Results and discussion" discusses the empirical results. Section "Concluding remarks" concludes.

[3] Note that the estimates are reported in terms of "log points" in the Tables presented at the end of the paper, while they are converted into "percentage points" in the text using the conversion rules for regression coefficients summarized in Halvorsen and Palmquist (1980). Specifically, the log points are converted into the percentage-point terms using the formula $(\exp(x) - 1) \times 100$.

Related literature

Our paper presents a detailed econometric evaluation of a unique policy reform aiming to reduce the supply chain barriers in the market for fresh fruits and vegetables in Turkey. It is possible to interpret the findings of this paper in the light of the extensive literature on incomplete pass-through from wholesale to retail prices (see, e.g., Goldberg and Verboven, 2001; Nakamura and Steinsson, 2008; Nakamura and Zerom, 2010). The correlation between the wholesaler-level versus retailer-level price shocks is a key issue in understanding the formation of prices. The consensus in the literature is that there is incomplete pass-through from the wholesale to retail prices in a wide range of products. Our results support this view by providing suggestive evidence that reductions in the wholesale prices are not fully reflected on the retail prices in the market for fresh fruits and vegetables in Turkey. In other words, there is likely an incomplete pass-through from wholesale to retail prices in case of a decline in wholesale prices.

The incomplete pass-through literature is closely related to the asymmetric price transmission (APT) literature. To understand APT, suppose that there are two levels of prices for a specific product: a supply-point price (p_1) and a final price (p_2). The asymmetric price transmission (APT) is called as "positive" if an increase in p_1 is reflected fully on p_2, but a decline in p_1 makes only a negligible effect on p_2. On the other hand, the APT is "negative" if an increase in p_1 generates a negligible impact on p_2, while a reduction in p_1 is reflected remarkably on p_2. In his seminal paper, Ward (1982) documents—building on the asymmetry procedures developed by Wolffram (1971), Gollnick (1972), Houck (1977), Young (1980)—that there are substantial asymmetries between the pricing behaviors of retailers, wholesalers, and farmers. Further research has shown that this finding is more like a rule rather than exception. Peltzman (2000), in his breakthrough work, using an extensive sample of items mostly consisting of food and agricultural products, shows that vertical price transmission is indeed asymmetric. A detailed review of the asymmetry literature is provided by Meyer and von Cramon-Taubadel (2004). Although there is a wide consensus on the existence of such an asymmetry, the direction of the asymmetry is a rather controversial issue (Bailey and Brorsen, 1989). While Ward (1982) presents evidence favoring negative APT, a stream of the subsequent literature (see, e.g., Kinnucan and Forker, 1987) argues that food prices exhibit positive APT, which means that there is no consensus in the literature about the sign of APT.[4] Our results provide rough evidence that a decline in

[4] There is also no consensus on the potential mechanisms underlying the asymmetry in pricing. For example, Borenstein et al. (1997) and McCorriston et al. (2001) point out that differences in market power between wholesalers and retailers can explain the degree and direction of APT. Another explanation is price stickiness. Whether the degree of price stickiness differs across wholesale and retail markets of a certain product may also determine the degree and sign of APT. See, e.g., Ball and Mankiw (1994) and Buckle and Carlson (2000) for explanations related to menu costs of price adjustments. Existence of inventory adjustment costs offers another explanation (see, e.g., Blinder, 1982). Finally, the lack of consumer information about wholesale versus retail pricing behavior may affect the nature of APT (Miller and Hayenga, 2001). For some of the other important studies in the pricing asymmetry literature, see, e.g., Pick et al. (1990), Zhang et al. (1995) and Ward and Stevens (2000). The literature regarding APT on fresh food products provides some sector-specific insights that are worth mentioning. Ward (1982) and Kim and Ward (2013) show that the market for fruits and vegetables exhibits negative APT, perhaps due to the perishability of fresh fruits and vegetables, which suggests that retailers may not be willing to raise prices because of the risk of being left with a spoiled product. These papers rely on time-series econometric techniques concerning lag structures and, therefore, rely on non-experimental data reflecting long-run price developments. On the theoretical front, Weldegebriel (2004), assuming oligopoly power in the retail market and oligopsony power in the farm input market, shows that it is not possible to predict *a priori* the degree of pricing asymmetry. Other papers that study several aspects of price transmission in food markets include Cudjoe et al. (2010), Hassouneh et al. (2012), Baquedano and Liefert (2014), Burke and Myers (2014).