Product Differentiation and Equilibrium Transition:

Local premium quality foods and marketing contracts in the Wisconsin fresh potato market

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1 Introduction, stating general phenomena

Product differentiation is essential for economy, as diverse consumption drives prosperity. Industries face the challenge of attracting consumers, prompting firms to enhance the diversity and quality of their products. Success in these endeavors requires close coordination within the supply chain or a network, which consists of many distinct firms at each stage of production. As a result, these investment decisions alter the dynamics between firms. Networks that devise more effective strategies for meeting consumer preferences in product attributes tend to become leaders in their fields.

1.0.1 drivers of organizational transition

Industries that rely heavily on spot market transactions, such as agriculture, operate effectively under conditions of high standardization and low product differentiation. This allows for easy price comparison and competition on price, fostering an equilibrium where many small firms might thrive independently.

On the other hand, industries involving complex products like PCs or automobiles require detailed and prolonged collaboration between companies at different stages of the production process. This complexity often leads to a greater degree of vertical integration or strategic alliances, as firms seek to control more of the supply chain to ensure quality, coordinate R&D, manage inventories more efficiently, and respond more agilely to market changes.

As industries evolve, the shift from one organizational form to another, whether more or less integrated, reflects strategic adaptations to these underlying conditions. This repositioning can help companies gain competitive advantages, such as cost leadership or differentiation, and ultimately leads to a new industry equilibrium where organizational structures are better aligned with market demands and

technological realities.

1.1 literature review and motivation

1.1.1 Contribution to agricultural economics

The existing literature on transaction costs and new institutional economics (Williamson, 1998), (Ménard, 2004), (Ménard and Valceschini, 2005) has significantly advanced our understanding of how organizational forms are selected. In the context of agricultural economics, the impact of product differentiation on organizational forms is particularly evident. Notable studies in this area include those focusing on agricultural contracts adopted since the 1990s in the poultry, cattle, and fresh vegetables markets in the USA (MacDonald, 2015),(Prager et al., 2020).

The studies often highlight that substantial investments and vertical coordination, facilitated through production or marketing contracts, are necessary to enhance product quality. These arrangements are multifaceted, aiming to produce uniform, high-quality products (as seen in investments in hog genetics (Kliebenstein and Lawrence, 1995)) and to provide better risk protection (Martin, 1997). Contracts often include financial incentives for maintaining high quality, illustrating a clear link between product quality and organizational structure (Goodhue, 1997),(Alexander et al., 2007),(Hueth and Ligon, 1999).

Despite the extensive literature, research exploring potential drivers of equilibrium transition, such as product differentiation, remains sparse. This scarcity is primarily due to the difficulties in accessing data, as markets with pronounced product differentiation—like those for automobiles, microchips, and personal computers—often involve confidential business contracts, making comprehensive data collection challenging.

1.1.2 what I do in the paper

To fill this empirical gap I use case study of the Wisconsin fresh potato market. This market presents distinct advantages for study. Primary data was obtained through direct interviews with industry stakeholders, illuminating investment patterns throughout the agri-food value chain, from farmers to wholesalers (shippers/packers) to retailers. Such insights reveal the strategies employed by a local brand in launching new, premium products.

To provide a more scientific explanation how to identify contractual shifts in the agri-food chain, I utilize two distinct data sources: retail scanner data and data from the Agricultural Marketing Service (AMS) of the USDA. The retail scanner data captures interactions between retailers and consumers, showcasing how products are priced and sold in retail environments. On the other hand, the AMS data provides insight into the spot prices, which are the intermediate prices at which commodities like potatoes are sold from farmers to wholesalers.

By comparing these two data sets, I focus on the price dynamics at different retail formats. One type of retailer primarily sells its own private brands, while another offers a broader selection of both national and local brands. This comparison is crucial as it helps to pinpoint when contractual changes might have occurred.

From the analysis, it's observed that after 2013, prices of local brands at modern retailers, which offer a mix of brands, showed stability. In contrast, prices at traditional retailers, which focus on private brands, continued to fluctuate in alignment with the spot market prices. This stability in prices at modern retailers can be interpreted as an indication of contractual agreements between local wholesalers and the retailers. Such agreements, often long-term, likely include stipulations on both the quantity and price, leading to more stable and predictable pricing.

This shift towards more stable pricing and the establishment of marketing con-

tracts suggest an increase in vertical coordination within the supply chain. This coordination alongside storage and optical sorting investments which ensure price premium for high quality product helps in managing risks associated with price volatility and ensures a more consistent supply.

This analysis is supported by anecdotal evidence from industry stakeholders, which further corroborates the hypothesis that marketing contracts have become a significant aspect of the business strategy for local wholesalers, particularly in dealings with modern retail outlets.

In this paper I argue that case of Wisconsin fresh potato market shows the impact of contractual changes on investment protection. This process leads to the introduction of high-quality products in a previously uniform market. This situation provides a unique opportunity to analyze the effects of product differentiation through detailed demand analysis.

As consumers are generally indifferent to industry agreements between firms, these changes in contracts act as an effective exogenous variation for a final good demand. This means shifts in contracts are external changes in the supply-side. This wholesaler-retailer relationships affect consumer behavior only through one channel - providing more variety in a choice set.

The methodology used to measure the effects on sales and prices is like the difference-in-difference (DiD) approach. Although I cannot argue about causal interpretation, because of severe simultaneity issue, as a demand system involves interaction of many players producing many products with strategic price incentives. Anyway, this simple analysis's aim is just to show evidence about impacts of contractual change. My a ly DiD approach involves comparing the changes in outcomes over time between a group that is exposed to the intervention (in this case, local brand products after the implementation of new marketing contracts in September 2013) and a control group that is not exposed to the intervention. The findings indicate

a significant economic effect, with local sales increasing by an average of 5.8% and prices by 1.2%.

Further analysis with additional treatment categories for different varieties of the product (Red, Baby, Golden, and Russet) reveals that premium varieties, specifically Baby and Yellow, are the key drivers of sales and price increases for the local brand. Conversely, the share and prices of typical potatoes in local products decreased. This adds evidence that customers are switching to more fancy fresh products. Such consumers patterns could reflect local brand marketing strategies, when the sales of cheaper products lie Russet stimulates sales of Red and Golden premium varieties. I argue that the Wisconsin case could be informative to analyze industry transition from uncooperative and pooling to cooperative and separated equilibrium. The level of cooperation is reflected in contractual changes between wholesaler and retailer, pooling and separating reflects changes n relationship between farmer and wholesaler as with decreasing cost from implementing optical sorting investment the sorting out good farmers comes at less cost. In the futere I am going to implement more flexible demand estimation (mixed logit or BLP) to explore effects of product differentiation and contractual change on indutry profit dynamics.

The study also explores the effects of price stability induced by marketing contracts on consumer demand behavior. By incorporating a product characteristic that reflects price stability in a simple IV logit model (with plans to expand to a full mixed logit model using full set described in the paper instrumental variables), preliminary results indicate that the shift towards new long-term relationships and price stability has statistically and economically significant positive implications for consumer utility.

This analysis highlights the importance of contractual changes in influencing market dynamics and consumer preferences, demonstrating how legal and strategic business decisions can lead to significant shifts in market behavior.

1.2 Contribution

- I fill empirical gap on evaluation equilibrium transition in Industrial Organization field. I evaluate profit firms consequences from transition of uncooperative equilibrium with spot price transaction to cooperative one with product differentiation and large share of long-tern contract.
- As retailer-intermediary agreement data is rare, the evaluation of contractual change effects is rare.
- I explain where to look for the contractual transition and document such a transition from spot to contracts on the case of Wisconsin Fresh potato market.

2 Data description

2.1 Retailed scanned data

Our primary data source is unit weekly sales and prices of fresh potatoes from 2010 to 2019 from Nielsen's Retail Scanner Data. The data contain weekly pricing, volume, and store environment information generated by point-of-sale systems from more than 90 retail chains across all US markets. A market unit was a combination of a designed market area (DMA), a store chain, and a week. Nielsen defines 210 DMAs in the U.S. based on television station market reach. In the Nielsen data during the study period, the two largest grocery retail chains in Wisconsin accounted for 70% of total fresh potato sales. One is a traditional chain primarily selling store brand potatoes and the other is a modern chain that also provides quality premium potatoes, both local and national brands. In the Nielsen data, the market share of fresh potato volume for the modern chain increased from 36% in 2010 to 44 % in 2019. Among U.S. states, Wisconsin is third in potato production, with more

than 100 commercial-scale growers and more than 20 fresh shipper/packers in 2022 (https://wisconsinpotatoes.com/). Alsum Farms and Produce (https://alsum.com/), a Wisconsin potato grower with a packing shed, originally packed and shipped fresh russet potatoes primarily for national or customer brands. However, during the 2010 to 2019 study period, Alsum's (local brand) began expanding its packing capacity and partnering with growers in order to establish its own brand. This included signing long-term marketing contracts in 2013, which results in stabilization of in-store fresh potato prices. Also, Alsum's share of volume sales in Nielsen data for Wisconsin stores increased from 0.5% in 2010 to 22% in 2013 and remained stable after that. In the Nielsen data, two other major brands were apparent. The share of sales for generic store brand potatoes decreased from 37% to 25% over the study period and the share for a national brand (Green Giant Idaho Russet) fluctuated between 7% and 11%.

2.2 Choice of counties in WI

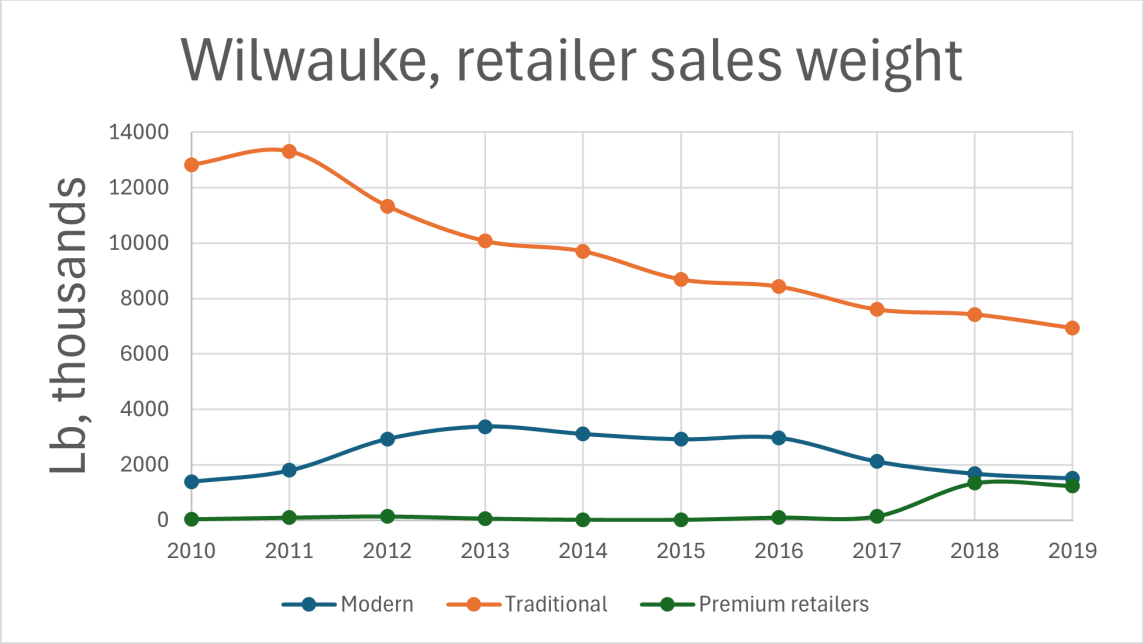
I choose the following counties in Wisconsin : Milwaukee, Green-bay Appleton, Madison, Wausau-Rhineland. The main reasons behind it are stability of market shares (see coefficient of variation on the figure **??**) and large enough volume sales. In my sample I have more then 90% of total sales in Wisconsin from retail scanned data.

	DULUTH-SUPERIOR MN-WI	GREEN BAY-APPLETON WI	LA CROSSE-EAU CLAIRE WI	MADISON WI	MILWAUKEE WI	MINNEAPOLIS-ST PAUL MN	WAUSAU-RHINELANDER WI
count	4	10	10	10	10	10	10
mean (sales)	21494	4149242	211039	2981883	12326059	108016	1711764
std	25661	349696	122153	299004	1986235	71151	175785
min	105	3543267	100984	2513442	9695110	42574	1509956
max	52687	4613109	435647	3410855	15190477	211693	1989773
coef of variation	1.194	0.084	0.579	0.100	0.161	0.659	0.103
share	0.001	0.193	0.010	0.139	0.573	0.005	0.080

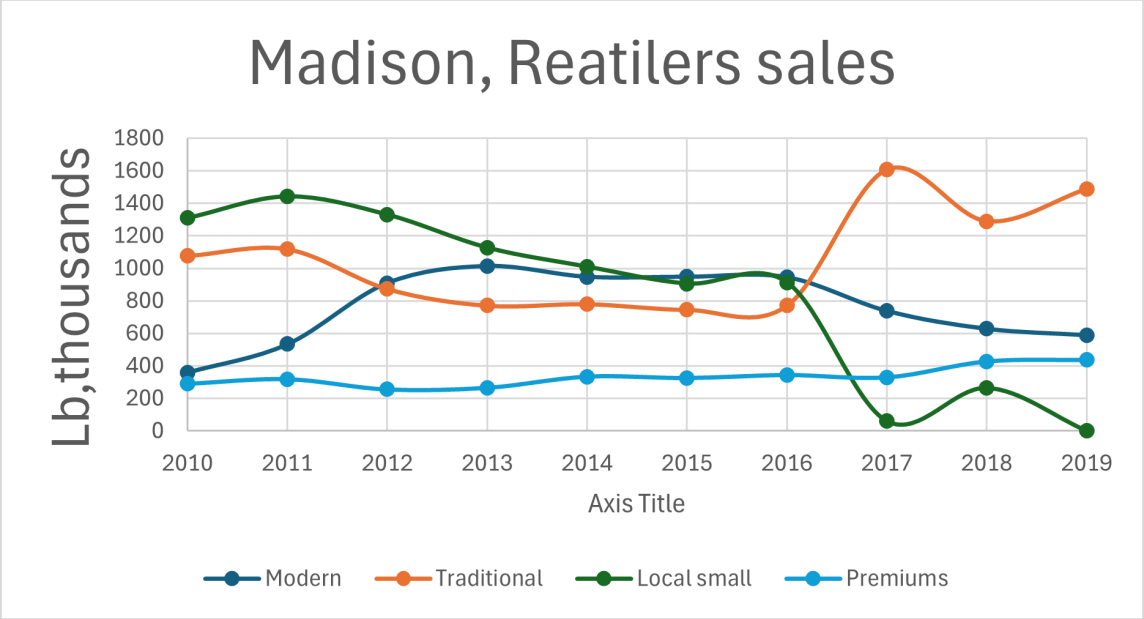
2.3 Retailer merges and stability in numbers of shops

In this section I consider retailers dynamics in Wisconsin. I show that after 2017 the retailers market structure experienced strong changes that could potentially affect price setting for the fresh produce.

The figure 1a shows that in Milwaukee in 2017 there was a rise of new retailers entries. These entrants mostly sell premium brands, like pricey creamer varieties from "Little Potato company". The figure 1b shows that traditional retailer took over another local retailer, different from the mentioned above modern one. As the traditional retailer experience decline in market shares from 2013-2017, such a takeover could be an indicator of new competition policies.



(a)



(b)

2.4 Agricultural marketing(AMS) services USDA data

AMS USDA data provides the daily aggregated information about market conditions. to get market level information their specially trained personnel daily makes hundreds of industry stakeholders' face-to-face interviews or phone calls. The gath-

ered data contains a wide ranch of product level characteristics and their choice set are decided upon negotiating with the industry and widely used in business.

I use the following data types from AMS. First, shipping point prices and shipments reports. They reflect dynamics on the first potato handlers markets, presumably between farmers and intermediaries

wholesaler. This data contains variety level characteristics that can be matched with the Nielsen's retailers scanned data. I have information on variety level (Russet, Red, Idaho, Golden, Creamer) and sorting-size level (100s,90s and so on), grade (USA 1 or 2) and potato origin.

Given such elaborate data gathering procedure and wide range of product level characterisation, this data reflects well local market transaction reflecting one of the stages of agri-food chain (farmer-wholesaler).

3 Industry overview

3.1 USA fresh potato market trends and challenges

The potato industry in the United States is highly developed and marked by remarkable productivity among farmers. Data from the United States Department of Agriculture (USDA) indicates a substantial increase in yield over the last century, with figures showing an almost seven-fold rise from 7.4 tons per hectare in 1930 to 50.9 tons in 2020. During the same period, the area harvested for potatoes decreased by approximately four times, from 1.2 million hectares in 1930 to 0.37 million hectares in 2020.

Despite the increase in production efficiency, consumption patterns for fresh potatoes have shifted. Per capita consumption of fresh potatoes declined from 21.4 kg in 2000 to 15.5 kg in 2019. In contrast, the proportion of potatoes processed in-

creased from 66% of total consumption in 2000 to 71% in 2019. These changes reflect significant technological advances in potato processing methods and a decreasing trend in the fresh potato market.

Overall, the primary challenge for U.S. fresh potato farmers is not production capacity but rather effective marketing strategies. As income levels rise, the traditional approach of producing inexpensive products at large scales for basic consumption needs is becoming less viable. In the current market environment, it is crucial for farmers to explore innovative strategies to boost sales and meet consumer demands.

3.2 Wisconsin fresh potato trends, Supply side

The most important shifts in farmers' institution in Wisconsin are next. In the last 25 years the industry experienced a waves of consolidation on farmer and wholesaler level. The number of farmers decreased from 200 to 100. The numbers of sheds(wholesaler) decreased from dozens to three big locals and one foreign.

3.3 Wisconsin main players

ALSUM grows locally, presumably, premium Russet and Red varieties. Alsum first in Wisconsin implement investments in 2010, such as in storage and optical sorting. Also, around 2007-2008 the local brand attracted former potato chip farmers to work with the ALSUM shipper/packer, after the farmers were disappointed in work with McKain, the transnational giant, specializing in processed potato Second, RPE grows high-quality white varieties, mostly sells happen in big sites and local sales are minimal. RPE only build optical sorting systems only in 2019. Third, "Bushman" is specialized in low-cost high-volume and mostly work in selling Russet potato of typical quality Last, Little Potato Company is a Canadian brand that in 2017 after

reaching agreement with local farmers to cooperate build shipping processing facilities. They specialized in creamer varieties.

3.4 Wisconsin Fresh potato: Demand side-Consumer preference changes

The Wisconsin fresh market offers an insightful case study for examining the effects of product differentiation due to several reasons:

1. Significant Industry Presence**: Wisconsin is the third-largest potato producer in the United States, generating substantial revenue, which amounted to $415 million in 2022. This scale provides a robust data set for analysis.

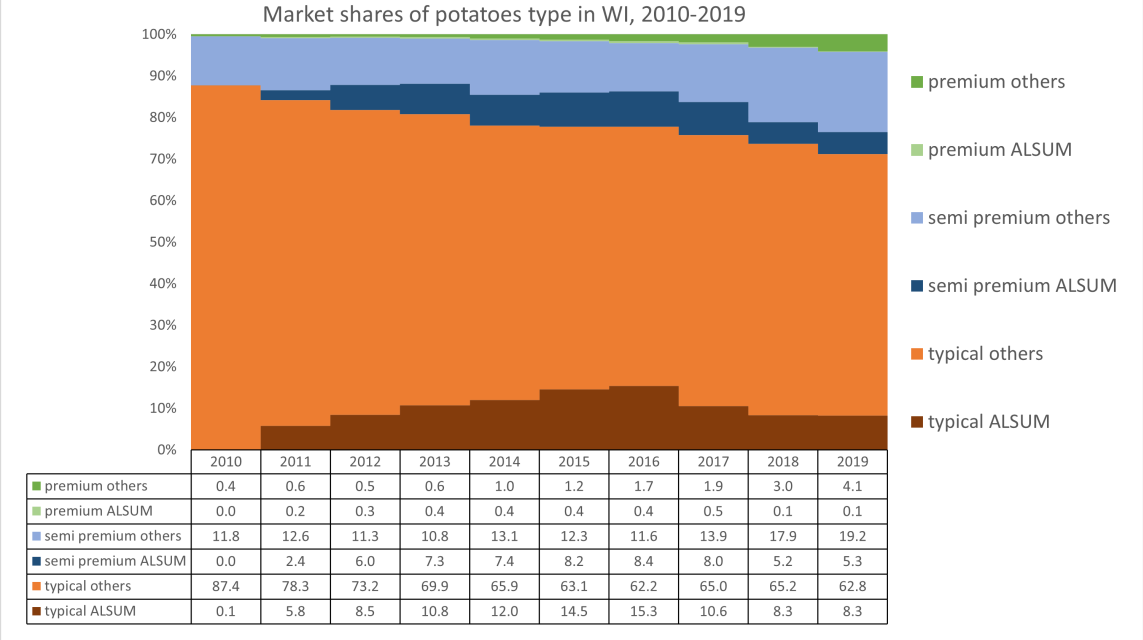
2. Evidence of Product Differentiation: Using retail scanned data, one can track the expansion of local brands and how they differentiate their products. For example, a notable local brand, "Alsum", enhanced its product quality by investing in storage and advanced optical sorting systems around 2010. By 2014, this brand had expanded its market share to 20% within the local market (see figure 2a). Such data help illustrate how investments in quality can influence brand growth and consumer preference at a local level.

3. Impact of New Entrants**: The entry of "The Little Potato Company" into the Wisconsin market in 2017 serves as another critical point of analysis. This company built a packing and processing facility in collaboration with local farmers, leading to a significant increase in the sales of its premium creamer potatoes—from 2.1 million pounds in 2015 to 16.1 million pounds in 2019 in USA (see figure 2b. Despite overall volume sales dropping in Wisconsin from 2011 to 2019 (see figure 3a, dollar sales increased post-2017 (see figure 4a), indicating a shift in consumer preference towards more premium potato varieties.

These elements suggest that the Wisconsin market is a valuable model for studying how local dynamics and the entry of new players can lead to shifts in consumer behavior and product differentiation. This case also underscores the broader trend

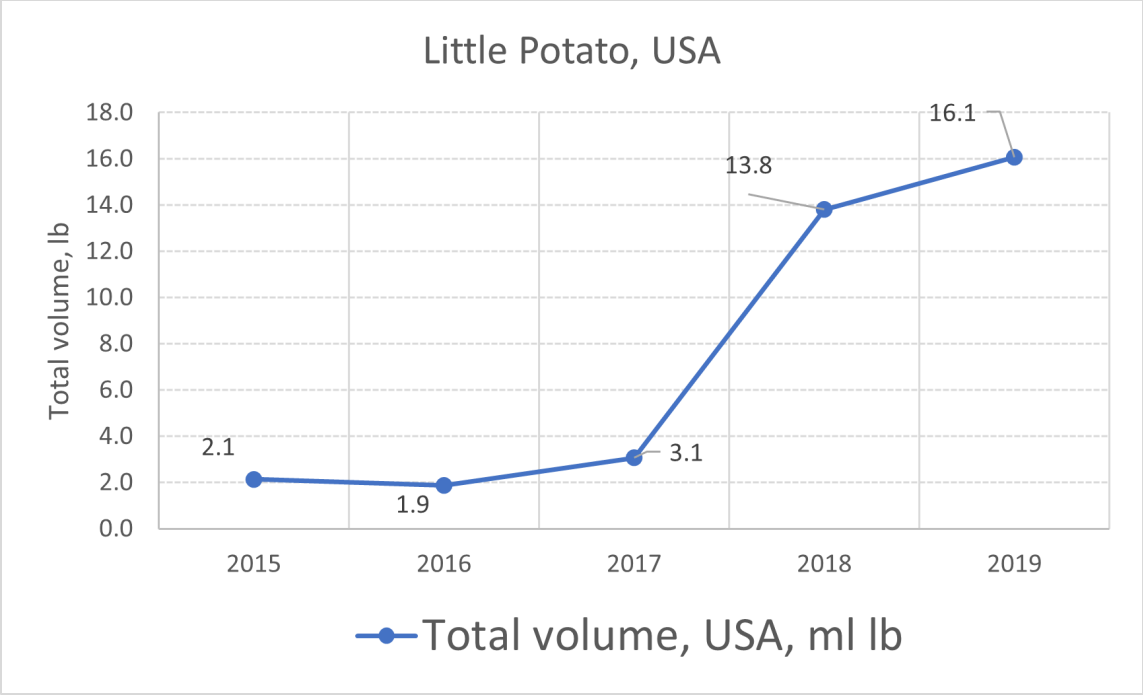
of premiumization in agricultural products, reflecting similar consumer behavior in adjacent markets like Chicago. Here, the shift from popular local varieties to premium brands like Dole or Idaho suggests a widespread change in consumer preferences towards higher quality, differentiated products (see figures 5a and 6a).

NB: Using terminal market data I notice that amount of sorted potato shipped from Wisconsin to Chicago was almost zero (only 1 week) for 2013-2016. I should notice that number of weeks when unsorted potato shipped was much bigger. After 2017 the occurrence of shipment of sorted potato from Wisconsin increased tremendously.

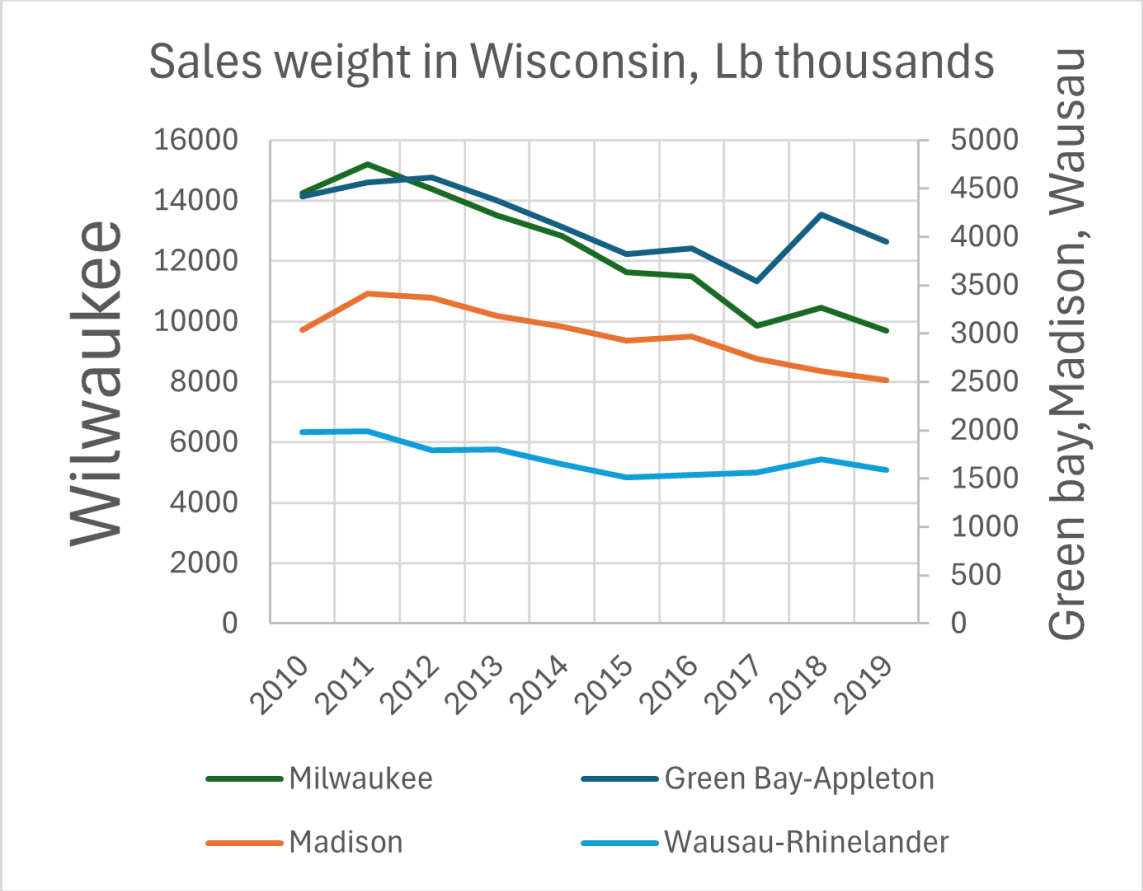


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
premium others	0.4	0.6	0.5	0.6	1.0	1.2	1.7	1.9	3.0	4.1
premium ALSUM	0.0	0.2	0.3	0.4	0.4	0.4	0.4	0.5	0.1	0.1
semi premium others	11.8	12.6	11.3	10.8	13.1	12.3	11.6	13.9	17.9	19.2
semi premium ALSUM	0.0	2.4	6.0	7.3	7.4	8.2	8.4	8.0	5.2	5.3
typical others	87.4	78.3	73.2	69.9	65.9	63.1	62.2	65.0	65.2	62.8
typical ALSUM	0.1	5.8	8.5	10.8	12.0	14.5	15.3	10.6	8.3	8.3

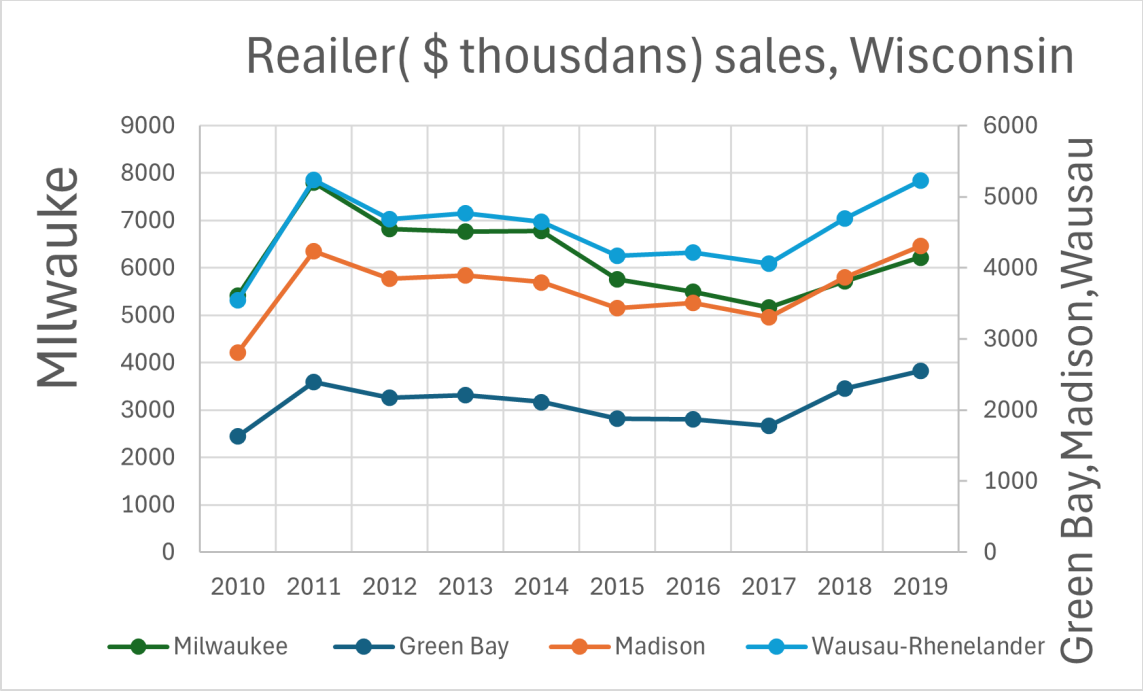
(a)



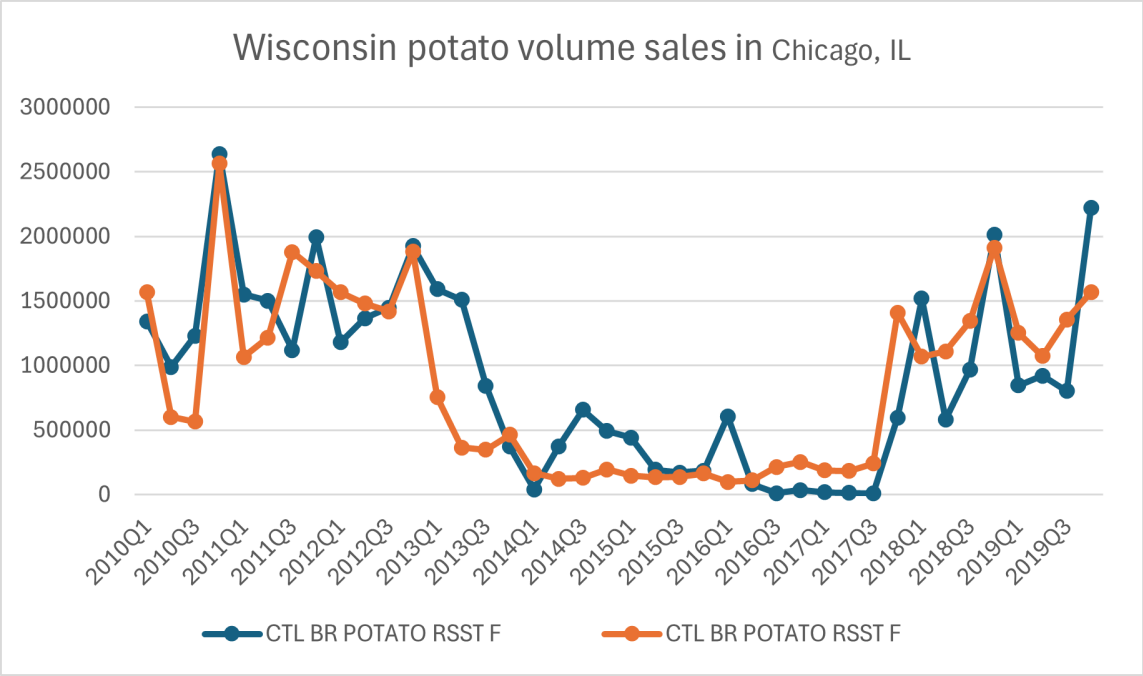
(b)


Sales weight in Wisconsin, Lb thousands
Wilwaukee
Green bay,Madison, Wausau
16000
14000
12000
10000
8000
6000
4000
2000
0
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Milwaukee
Green Bay-Appleton
Madison
Wausau-Rhinelander

(a)


Reailer($ thousdans) sales, Wisconsin
MIlwauke
Green Bay,Madison,Wausau
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
6000
5000
4000
3000
2000
1000
0
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Milwaukee
Green Bay
Madison
Wausau-Rhenelander

(a)


Wisconsin potato volume sales in Chicago, IL
3000000
2500000
2000000
1500000
1000000
500000
0
2010Q1
2010Q3
2011Q1
2011Q3
2012Q1
2012Q3
2013Q1
2013Q3
2014Q1
2014Q3
2015Q1
2015Q3
2016Q1
2016Q3
2017Q1
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2018Q1
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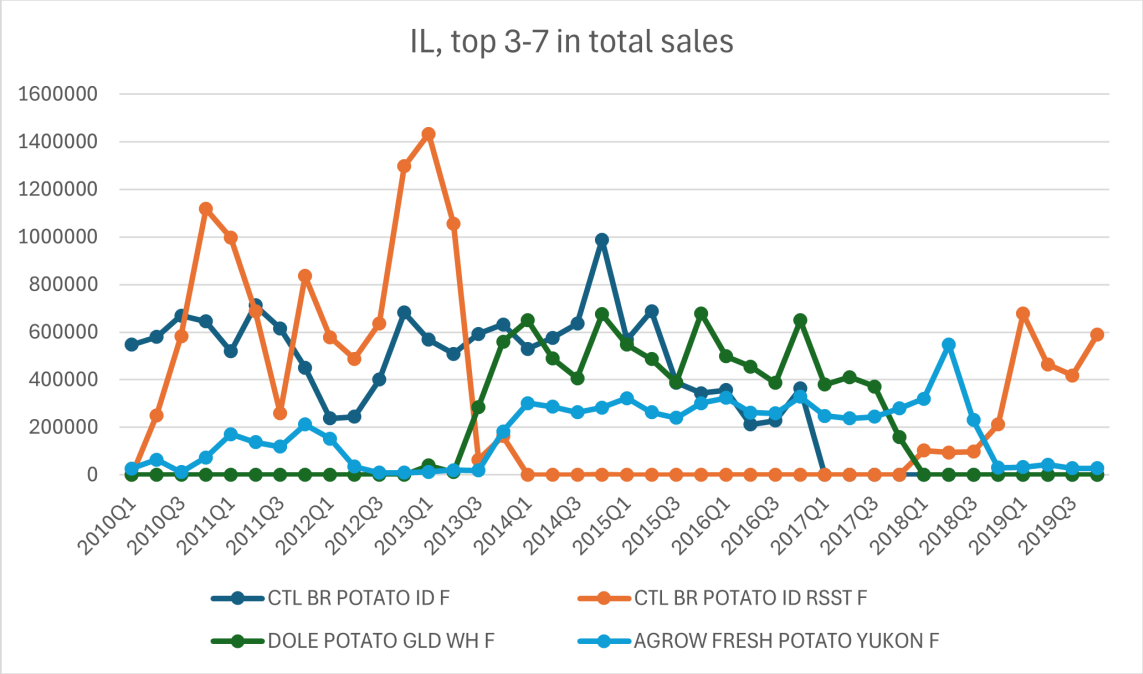
2019Q1
2019Q3
CTL BR POTATO RSST F
CTL BR POTATO RSST F

(a)



(a)

4 evidence about equilibrium transition

4.1 important features of the fresh potato market

The most important features that define organizational form in the agri-food chain are seasonality(harvest one time and year, and with time quality deteriorates) and fact that fresh produce is perishable. These features translates in key challenges to maintain quality over the year - storage practices. The potatoes are living organisms and to ensure quality after long time of harvest, the farmers and wholesaler should provide adequate condition for long-term storage.

4.2 vertical coordination in agri-food chain for fresh potato

I argue that product differentiation, particularly industry desire to produce higher quality, induce organizational change between players that boosts vertical coordi-

nation. The figure 7 present a simplified model explaining the way how vertical coordination enhance quality of product.

The production of fresh potato is multi-stage process and each stage has a direct consequence on the next one. First, Farmers should buy certified seeds,use appropriate field practices and maintain good conditions in short-term storage(1-2 weeks), otherwise, harvested potatoes are prone to various diseases that makes long-storage impossible. The main job of wholesaler is to provide long-term storage (up to 1 year). This requires capital investments in storage and sorting systems to sort out prone-to-contamination potatoes. So, if wholesalers trust farmers and good farmers obtain price premium for quality, a retailer can maintain a stable quantity of high-quality potatoes all over the year that translates in higher aggregate profits for the whole chain (internalization of vertical structure)

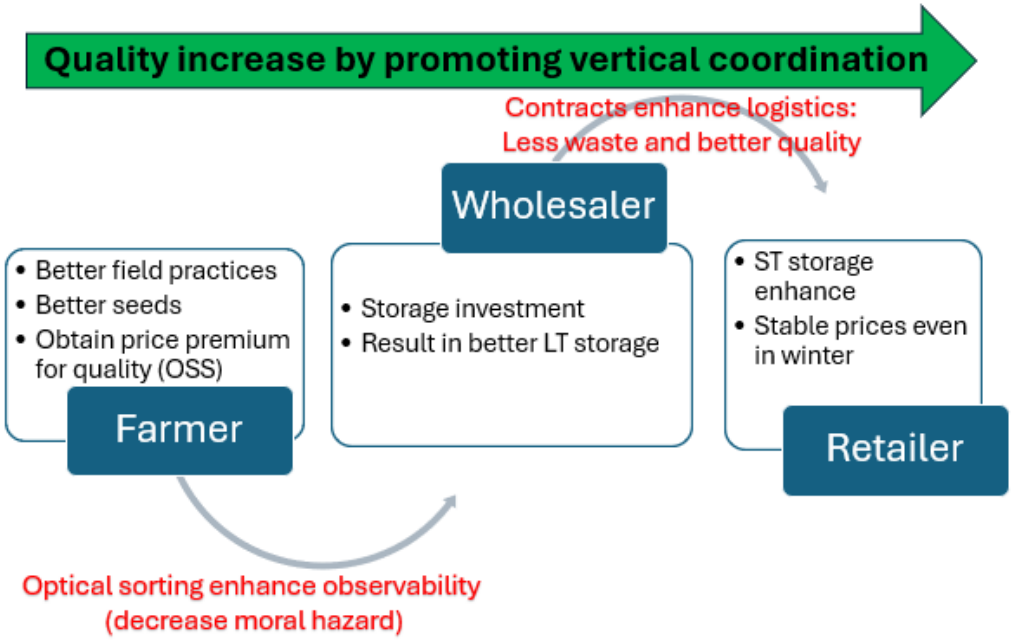
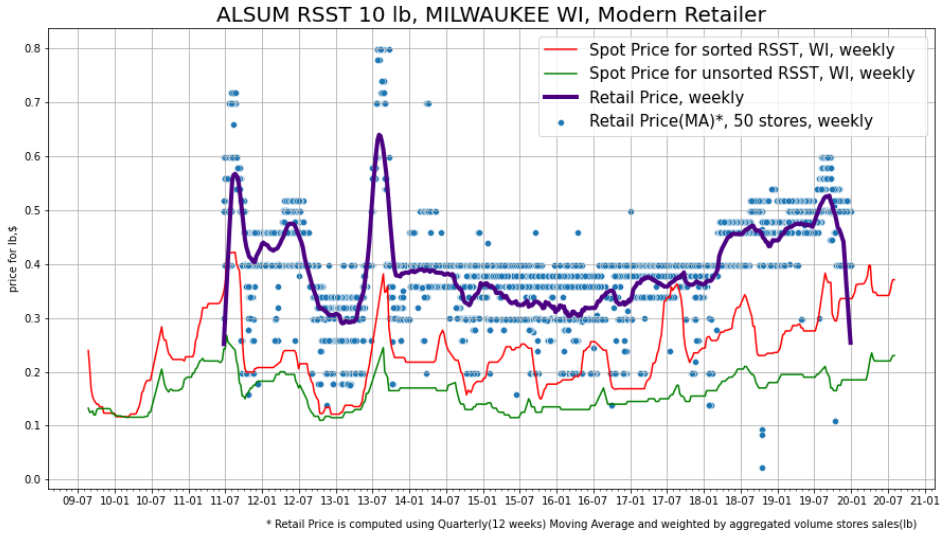


Figure 7: Caption

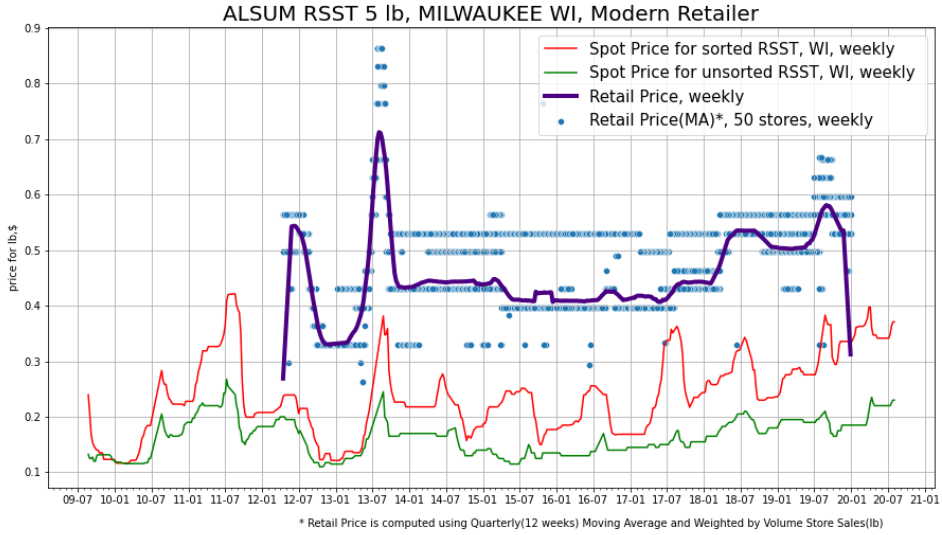
4.3 Change in contract and price transmission region

The figure 8 presents evidence that in Wisconsin fresh potato market such changes happened. A violet line plots a 3-mounts moving average price weighted by store volume sales. The blue dots are scatter plot of prices in particular shops. The red and green lines represent average equilibrium spot prices for the first handlers (from AMR USDA) for sorted and unsorted respectively.

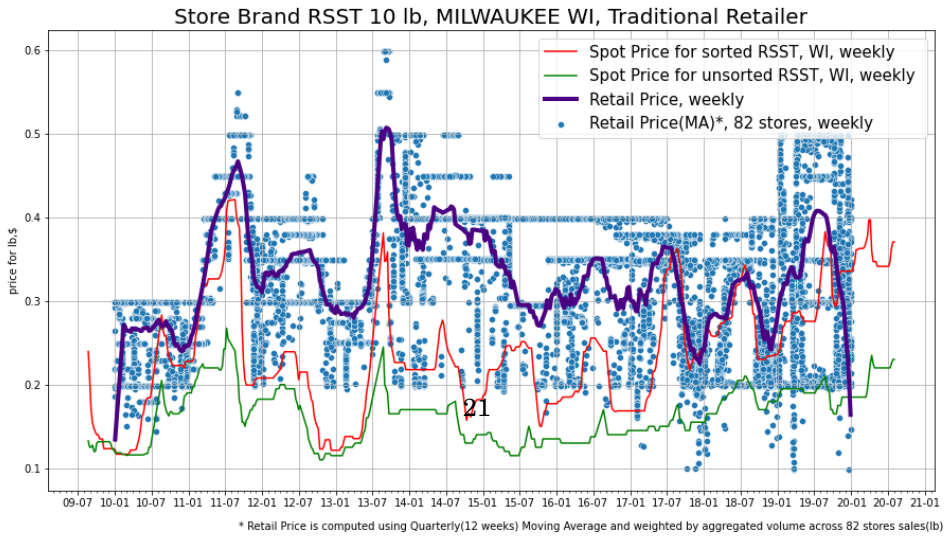
First, on the figure 8a, the local brand most popular item in 10lb package. after 2013 the pass-though regime for the local product changes, I mean, that spot prices fluctuation generally do not have effects on retailer price. It is more evident on the figure 8b, for 5lb premium Russet, as across-store price variation is less prominent due to this product is for less-price sensitive customers (presumably, with higher income levels). With contrast, for the store brand Wisconsin potato 8c the price transmission regime did not change, as the spot price follows the retailer price fluctuation. We interpret it as marketing contracts from the local brand and the modern retailer.


ALSUM RSST 10 lb, MILWAUKEE WI, Modern Retailer
Spot Price for sorted RSST, WI, weekly
Spot Price for unsorted RSST, WI, weekly
Retail Price, weekly
Retail Price(MA)*, 50 stores, weekly
price for lb,$
* Retail Price is computed using Quarterly(12 weeks) Moving Average and weighted by aggregated volume stores sales(lb)

(a)

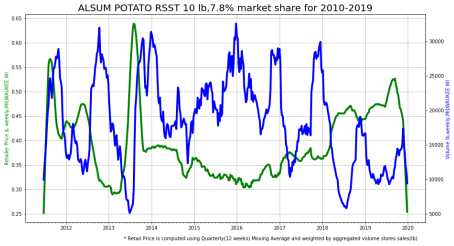

ALSUM RSST 5 lb, MILWAUKEE WI, Modern Retailer
Spot Price for sorted RSST, WI, weekly
Spot Price for unsorted RSST, WI, weekly
Retail Price, weekly
Retail Price(MA)*, 50 stores, weekly
price for lb,$
* Retail Price is computed using Quarterly(12 weeks) Moving Average and Weighted by Volume Store Sales(lb)

(b)

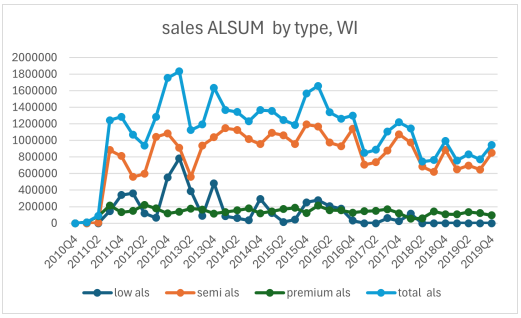

Store Brand RSST 10 lb, MILWAUKEE WI, Traditional Retailer
Spot Price for sorted RSST, WI, weekly
Spot Price for unsorted RSST, WI, weekly
Retail Price, weekly
Retail Price(MA)*, 82 stores, weekly
price for lb,$
* Retail Price is computed using Quarterly(12 weeks) Moving Average and weighted by aggregated volume across 82 stores sales(lb)

4.4 evidence about increased vertical coordination, internalizing vertical chain

Because of local brand investments, the local brand reached two goals. The price became stable and all-year sales increase(see figure 9a. The increase of volume of more pricies varieties by the local brand can be observed on the figure 9b-there was a significant increase in semi-premium varieties after 2013.



(a)



(b)

??. The amount of sells for the top product increased after 2013 and the price is downward trend, so it can be evidence transformation from uncooperative to cooperative equilibrium.

4.5 Additional evidence of vertical coordination for premium local brand products

For top product - the RED Baby the price and volume are pro-cyclical.

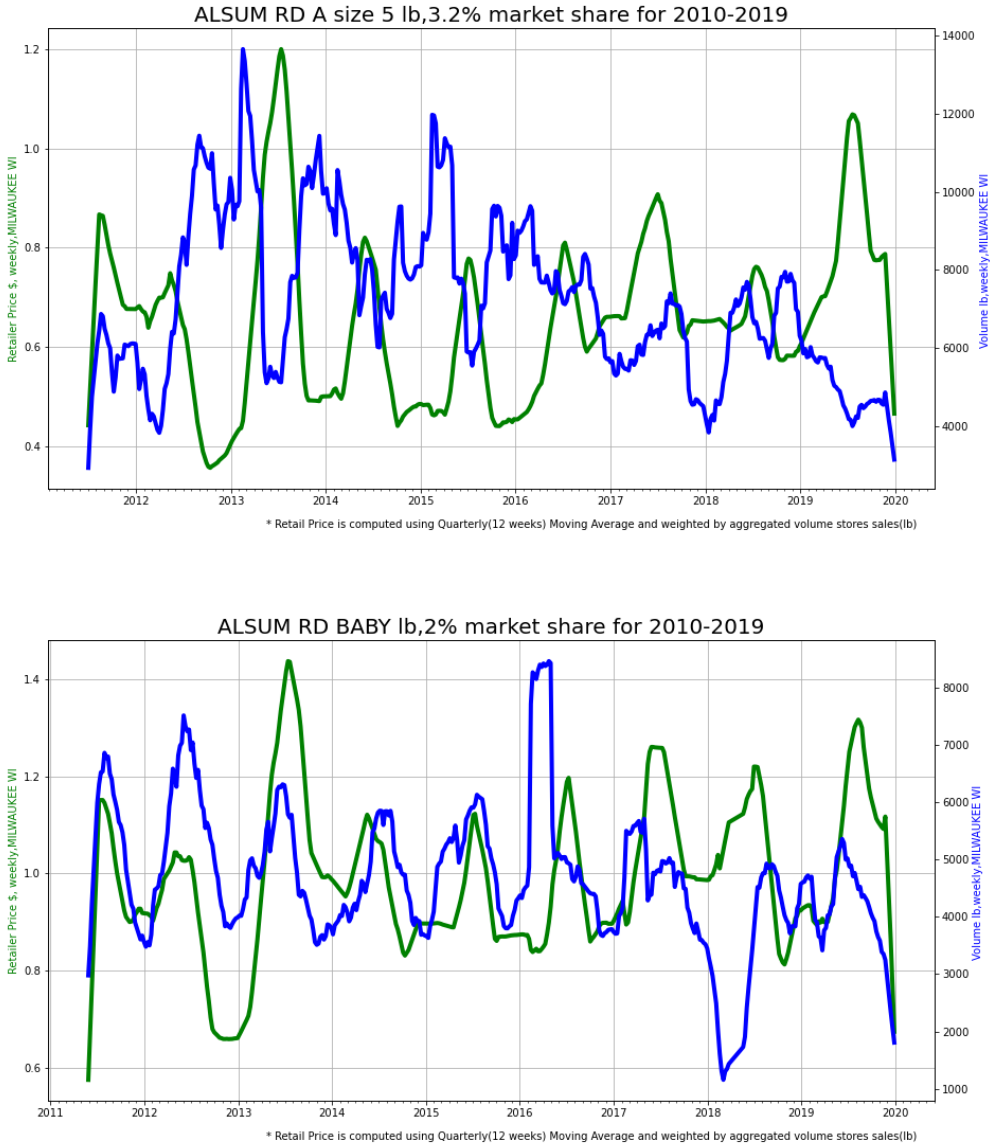


Figure 10: Caption

4.6 Shipping point prices as Instruments

The spot price between farmers and wholesalers defines a supply side in the eyes of consumers, so such prices can be used as instruments.

Moreover, the figure 11 the retailer's price jumps coincide with the time when Wisconsin trade of red variety stops. So, the retailer price jumps reflect changes in

trasportation cost.

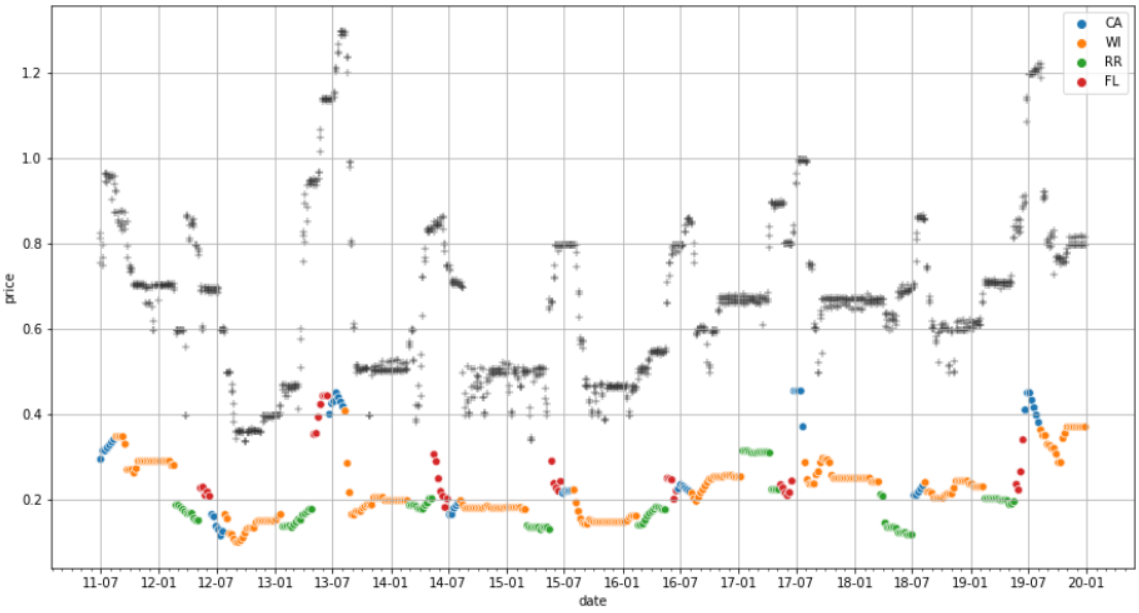


Figure 11: Caption

5 Econometric specifications

5.1 Key difficulties in demand analysis. Need for instruments

5.1.1 Aggregate data and demographics

To analyze the demand system I would like to incorporate individual characteristics of consumers. It is important for many reasons. The most key one is the fact that people are price sensitivity decreases with the income rise. So, homogeneous consumers model do a pretty bad job in evaluation of true elasticises of products that invalidates any meaningful economic analysis. The way of circumvent it to exploit individual panels to flexible (non-linear) incorporate demographics and the majority of well-done research shows importance of it. In the absence of micro data and only available aggregate data, it is a difficult to incorporate observable individual demographics. So, I need to find a way how to use aggregate distribution to meaningfully take observed or unobserved characteristics demographics. As I do not observe directly individual income level, such observable could influence which products (demographic unobservalbe correlate with market unobservalbes) are bough and prices the consumers are ready to pay. So, endogeneity rises.

5.1.2 Products Unobservables

In econometrics specification researchers often do not observe the important characteristic of good. In my market of fresh potato such characteristics is freshness, perception of eco-friendliness and brand-loyalty. For instance, it looks reasonable to price higher products that more fresh and beautiful then others. As consumers values appearance and consider it as a signal of quality, the price is correlated with freshness, the indicator I as a researcher cannot observe. This creates an endogeneity that I have to account for.

I show the importance of instrument and problems how to account for different types of unobservables in the section Results.

5.2 Consumer task. BLP

To analyze demand I employ discrete choice model. A consumer i in market t has choice set of products F_J. Among them she obtains utility from consumption product j from F_t in the following way.

$$u_{ijt} = \sum_{k=1}^{K} X_{jk}\beta_{ik} + \alpha_i p_j + \sum_{k=1}^{K} \sigma_{kj} X_{j,k} v_{ik} - \sigma_{pi} v_{ip} p_j + \xi_j + \epsilon_{ij} \tag{1}$$

In the equation 1 a consumer i has a random taste parameters for product characteristic X_{jk}. β_{ik} is a taste parameter reflecting mean of k'th characteristic and σ_{kj} relates to dispersion.α_i and σ_{pi} price sensitivity and its variation. ξ_j is a unobserved quality of product. I assume that taste parameters depends on demographics. To recover taste parameters from the aggregated demographics of consumer I need instruments that identify moments from GMM (I explain the procedure below).

5.3 Firm problem.

5.3.1 Uncooperative case. Nash-Bertrand

To illustrate firm behavior in the spot market interaction I assume that firms play Nash-Bertran game. Given the settings, the price-cost margins could be recovered from inversion of system of first order conditions (see 2 for firms profit maximization task and ownership matrix of products (Nevo, 2000). Given the demand estimation, it is possible to recover product elasticities and plug in to estimate marginal costs.

$$\Pi = \sum_{j \in F} (p_j - mc_j) s_j(p) - C \tag{2}$$

5.3.2 Cooperative equilibrium

I am going to incorporate the long-term incentive for storage and optical sorting system investments by putting in the model switching tools. In other words, I amend the 2 by adding discounted profits after contractual change. The logic is the following.

A firm can make investment and obtain different type of market with products differentiation. It amends firms products profits and this change I can capture from the demand estimation. As consumers do not care what kind of wholesaler-retailer relationship, the demand analysis could predict adequate products elasticities. From this I can infer different flow of predicted price cost margins (with cooperative incentive and without). Comparing which has better fit of price equation, I can estimate effects of contractual change on profits redistribution (I am still in process to adequately formalize this idea)

5.4 Identification

There are several ways to obtain demand specification.

First, the supply cost sifters, like in Berry (1994). In this sense, I use the transportation cost proxy for some varieties during times when I cannot observe spot trading in AMS data. Additional instruments I describe in the Identification section.

Second, the wide geographical coverage with strong variation of demographics across markets. Although my DMAs demographics have a large variation, the small number of them (only 4). But I still use some insights of it.

Third, the micro-moments could be very useful (Berry et al., 2004). According to (Berry and Haile, 2014), it is possible to obtain non-parametric identification in quite non-strict assumption if a researcher has wide range of micro (consumer) data with

consumer level demographics. I am going to employ this insight using consumer panel and obtain representative sample of consumers coming to particular retailers.

5.5 Products characteristics

Here, I discuss additional horizontal differentiated characteristics of products. With comparison to price, where I assume that vertical differentiation (premium quality products are considered by everyone as better then typical quality), a characteristics like Red or Russet varieties could be affected by the consumers taste that I can partially capture with characteristics dummies.

- package size dummies. In the smaller package the brands tend to put higher quality potatoes.
- brand dummy variables for Alsum (local), Green Giant Idaho (national) and Little Potato Company (foreign). Alsum chooses only most beautiful potato to brand using optical sorting system to screen out defected ones. Idaho is considered to be more testier Russet because of unique soil conditions. LPC speciality is testier and easier-prepared creamer variety. For instance
- Note: As the most of typical potato consist of store brand Russet potato, and such potato tend to be less eye-appealing, I choose it as the baseline.

5.6 From uncooperative to cooperative

6 Identification

6.1 Instruments

The key aspect of demand estimation is the appropriate instruments. To follow the logic of employed instruments I need to understand the key drivers of observed vari-

ation in price and market shares in my data. moreover, I need to face the following challenge: similar products have the similar price changes to separate own and cross elasticises I need product level instruments.

I consider the fresh potato industry, so the most important features of the market is seasonality (harvest is only 1 time a year and allocated along the year) and freshness (products are perishable).

So, the price volatility comes from several souses. First, the interaction between different stages of agri-chain. The picture 12 provides a simplifies model of price transition from first-handler market to retailer that sells to consumers. To put it simply, the changes in demand-supply conditions between farmers and wholesalers affect the retailer price.

Second variation comes form difference in storage facility. Farmers and retailers only have short term storage, and wholesalers long term. Given that retailers have inventories, product is perishables, and transportation cost is large, retailers ship goods at bulk. So, from time to time retailers have to sale product to lower prices. I use these fact to create task of retailers in managing their stocks. I could use the logic of storable good estimation but only relation to retailers with their own inventory task (Hendel and Nevo, 2006) (Erdem et al., 2003) (Pesendorfer, 2002).

Next, difference in storage ability of wholesaler in the varieties. As Wisconsin farmers can store Russet over the year there is no such shipments. Whereas, Red variety has to bough outside Wisconsin. Such changes in acquiring cost via transportation cost increasing is supply shocks that can be used as an instrument for demand. As in the traditional retailer the sales of Red premium varieties significantly decreases during winter seasons whereas the local brand sales in modern one is large, such instrument could be very useful.

Another product level instrument induced by contractual change in wholesaler-retailer relationship. Because of long-term contracts the price and volume became

more stable for local brands, whereas for typical ones sold in traditional retailers such variables are volatile.

6.2 Idea of use equilibrium in the spot price between farmer and wholesaler to identify the demand for different varieties

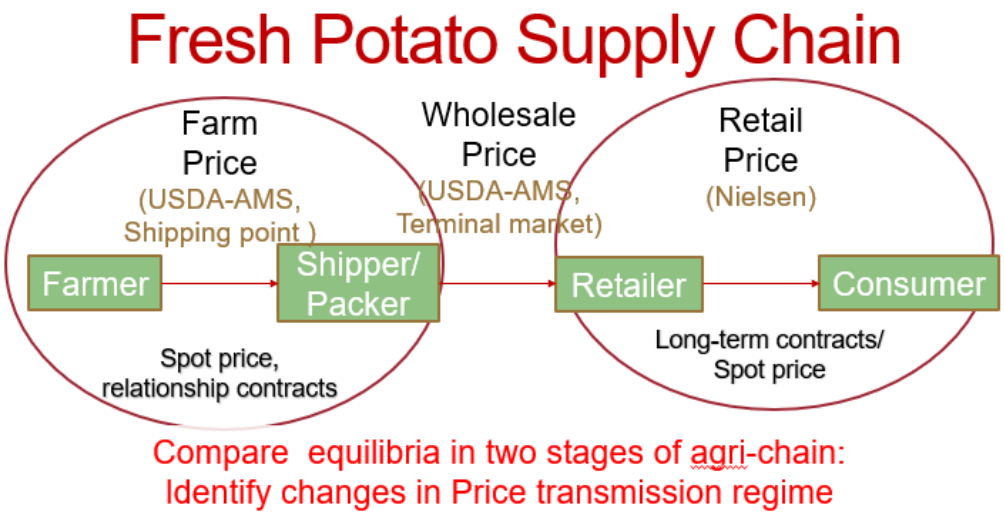


Figure 12: Price regime change

6.3 Importance of instruments

6.3.1 DiD, reduced form evidence for effects of contractual change

I use only the logic of Difference-in-Difference (DiD) estimation to show effects of contractual change as the demand system include strategic interaction of multiple firms that results in simultaneity problem. These DiD regressions only serve to show reduce-form evidence. Moreover, although I do not have contracts information, anecdotal evidence that I obtained from stakeholders indicates that local

Depended variable	log(sales,lb) (1) DiD	log(sales,lb) (2) 3 DiD	log(price,$) (3) DiD	log(price,$) (4) 3 DiD
Price	-1.3	-1.3		
	(.025)	(.03)		
Alsum	.12	-.26	-.09	-.04
	.02	.17	.004	.017
contracts	-.16	-.84	.28	.35
	.20	.22	.03	.02
Contracts*Alsum	.058	.048	.016	.004
	.023	.206	.004	.020
Contr*Alsum*RSST		.16		.15
		.21		.017
Contr*Alsum*Baby		.49		.09
		.20		.021
Contr*Alsum*GLD		-.16		.09
		.21		.022
Time FE	521	521	521	365
Retailer FE	5	5	5	2
DMA FE	4	4	4	4
Product char	5	5	5	5
R^2	0.49	0.51	0.84	0.93
Number obs	92,965	92,965	92,965	92,965

Table 1: Preliminary Results DiD

brand signed the marketing long term contracts with Wisconsin retailers. This fact is presented presented on the figure 8. The sub-figures 8a and 8b show that after September 2013 there was a change in price transmission regime. The fluctuations on the spot market of first handlers (farmer-wholesaler) stopped affecting retailer's price of the local brand. With comparison, the sub-figure 8c indicates that such a transition did not happened for the most common private brand. Given such evidence, I try to check whether the price transmission regime can be captured by difference-in-difference analysis.

As I observe the price stability after 2013 only for local but not private brands, I create group treatment indicator to all products of the local brand and the begging of treatment after September 2013. So, in the model 4-6 the variable Alsum is a dummy for local brand's products, contracts is a dummy for periods after September 2013 and Contracts*Alsum is their interaction. Given the following regression $y_i t = \beta_0 + \beta_1 Alsum + \beta_2 Contracts + \beta_3 Alsum * Contracts + \epsilon_i t$, I can point out the following averages.

- Control group before treatment period equals $y_{00} = \beta_0$ (first index for group treatment, the second for time)
- Control group after treatment $y_{01} = \beta_0 + \beta_2$
- Treated pre treatment $y_{10} = \beta_0 + \beta_1$
- Treated after treatment $y_{11} = \beta_0 + \beta_1 + \beta_2 + \beta_3$

So, the average effects of contractual change for the control group equals $Eff_{control} = y_{01} - y_{00} = \beta_2$ and for treated (local brand products) $Eff_{treat} = y_{11} - y_{10} = \beta_2 + \beta_3$. So, the causal effect equals $Eff_{treat} - Eff_{control} = \beta_3$.

I perform these logit to amount of sales and products prices. According to model (1), the coefficient Contracs*Alsum has economic and statistical importance when I

assume all local brand were treated equally. The results indicates the contractual change resulted in increasing average quality for all products, and especially, for local brand. Such story is plausible, with the advancement of the industry players has to adapt to new standards if they want to stay in the industry Levins and Cochrane (1996).

The model (3) shows importance of contractual change on the local and private brands' prices. It indicates that price increase happen for local brands with comparison to private.

In regressions (2) and (4) I include additional level of treatment - by variety. The inclusion of additional treatment categories for different varieties of the product (Red, Baby, Golden, and Russet) reveals that premium varieties, specifically Baby and Yellow, are the key drivers of sales and price increases for the local brand. Conversely, the share and prices of typical potatoes in local products decreased. It points out the strategic incentive for local brand in marketing its products. I think it also shows the transition to cooperative equilibrium.

7 Preliminary results. Logit demand. DMA-week market

In this sections I present part of my regressions to show importance accounting for endogeneity, particularly correlation between price and unobserved demand shock. I interpret it as the higher product price often means higher quality (vertical characteristics). According to the table 2 model (5) and (6), without addressing price endogeneity, the logit would predict unrealistic price insensitivity (price coefficient increased in absolute value from 0.71 to 27). I should mention that I cannot use products characteristics in product fixed effects models as these variables are dum-

mies and consequently time variant. So, all effects would be absorbed by product dummies and I can only use time varying advertisement (ads). I should notice that despite the fact that I only used one instrument - the number of products of the same variety in the retailer chain, the results are economically consistent and intuitive.

Moreover, the preliminary results indicates that set of product characteristics would not be enough to predict substitution patterns. According to model (7) where I use only 10 products characteristics (variety and package size dummies) the price coefficient equals 8.8 that is quite different from 27 and fit significantly decreased (MSE drops from 4.47 to 2.05). It highlights importance of incorporating product unobserved characteristics, partially taken account with product fixed effects). Although the product fixed effects predict negative effect of ads that is reversed in model (7).

In the Nested logit, model (8), I wanted to capture effects of retailers development. As in the aggregate data I observe that total market share of potato sales for tradition retailer rose from 34% in 2011 to 43% in 2016 I create a nest of retailer choice incorporating intrinsic value of the chains. So, I amend my specification in the following way.

$$\log s_{jt} - \log s_{0t} = \alpha p_{jt} + x_{jt}\beta^{ex} + \rho \log s_{j|h(j)t} + \xi_{jt},$$

where $s_{j|h(j)t} = s_{jt}/s_{h(j)t}$ and $s_{h(j)t}$ is the share of group h in market t The Nested logit estimation shows that ρ, reflection importance of nest division, is close to 1. This can be interpreted that choice of retailer is not random. Unfortunately, as $s_{h(j)t}$ is endogenous variable (the more popular retailer the bigger market shares of its products) other coefficients are unreliable. To circumvent such a problem I need to add more instruments.

In summary, I show the contractual change significantly renders consumers be-

Depended variable	$ln(s_{jt}) - ln(s_{0t})$, Across retatiler chain			
	(5)	(6)	(7)	(8)
	OLS	**IV**	**IV**	**Nested logit,IV**
Price	-.78	-27.67	-8.8	1.65
	(.033)	(5.2)	(.27)	(.089)
Alsum	-.67	-.79	-.85	.19
	.27	.91	.04	.012
Contracts*Alsum	-.073	2.6	.73	-.06
	.021	.53	.04	.011
Ads	.77	-.66	.64	.18
	.021	.289	.036	.010
Product FE	40	40		
Time FE	521	521	521	521
Retailer FE			5	5
DMA FE	4	4	4	4
Product char			10	10
Root MSE (fit criteria)	1.32	4.47	2.05	0.57
Number obs	92,965	92,965	92,965	92,965
First stage		3294	463	347

Table 2: Preliminary Results from Logit Demand

haviour and market structure. I believe using such shocks has a potential in more flexible demand estimation (BLP). In the future it allows me to perform welfare analysis and estimate effects of profits redisctibution acroos all supply chain.

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