

1 Results and Findings

The analysis was performed for different timeseries of two centers- Delhi and Mumbai.

Following analysis is for Mumbai. In case of Mumbai, there are total of 66 distinct days for which news articles exist. Here, articles not matched represents unique dates for which articles were present but system failed to report anomaly against that date.

	Anomalies Reported	Anomalies Matched	Articles Not Matched	Articles Not Matched which stated traders nexus as reason
Retail Vs Average Retail	125	64	49	12 (24.49%)
Retail Vs Arrival	323	153	33	9 (27.27%)
Retail Vs Wholesale	160	52	52	14 (26.92%)
Wholesale Vs Arrival	332	168	29	7 (24.13%)

Table 1: System Result for Mumbai

Following are the inferences from the above table:

- Analysis involving arrival timeseries tends to produce better matches. This could be because arrival is one of the determining factor for the price of commodity. Also, news often compare arrival data to explain the suspicious scenarios.
- Retail vs Average Retail does not produce good matches which shows that the prices at different centers tend to go in tandem which might be because of strong traders nexus.
- Retail vs Wholesale is not performing good results which gives a clear indication that usually retail prices align with the wholesale prices. So, retailers don't tend to get involved in the fixing of prices because they are forced to align the price of commodity with the wholesale prices.
- This also indirectly indicates that the most of the problem exists at the wholesale level where traders operate who are usually accused by the news reports for manipulating the price of commodity.

Following figures are the pictorial representation of the above results on timeline.

Note: In following figures, Yellow highlighted regions are system reported anomalies for which no corresponding news article was present, Violet highlighted region represents news article for which our system did not report any anomaly and Red highlighted region represents anomalies reported by system for which news articles were present.

- Retail Price vs Average Retail Price

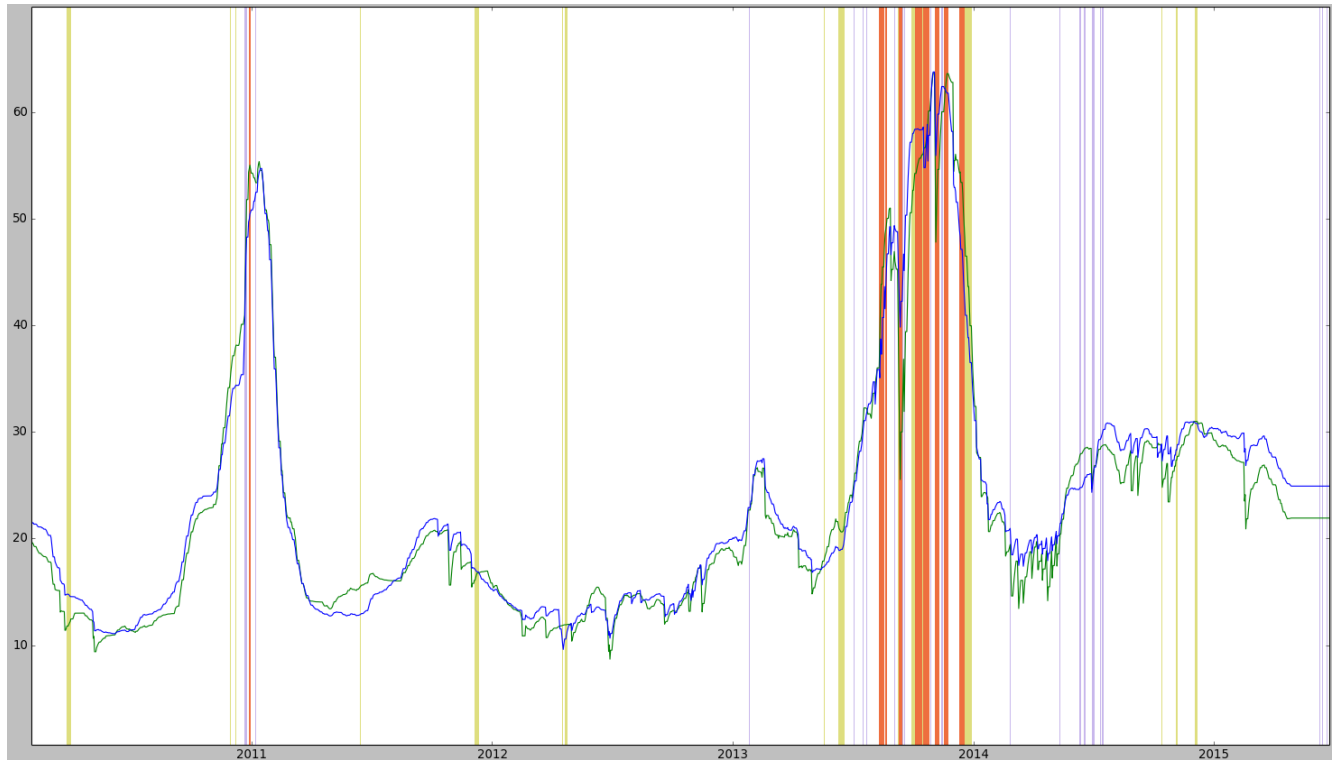


Figure 1: System Result (Green line - Centre Retail Price, Blue Line - Average Retail Price)

- Retail Price vs Arrival Data

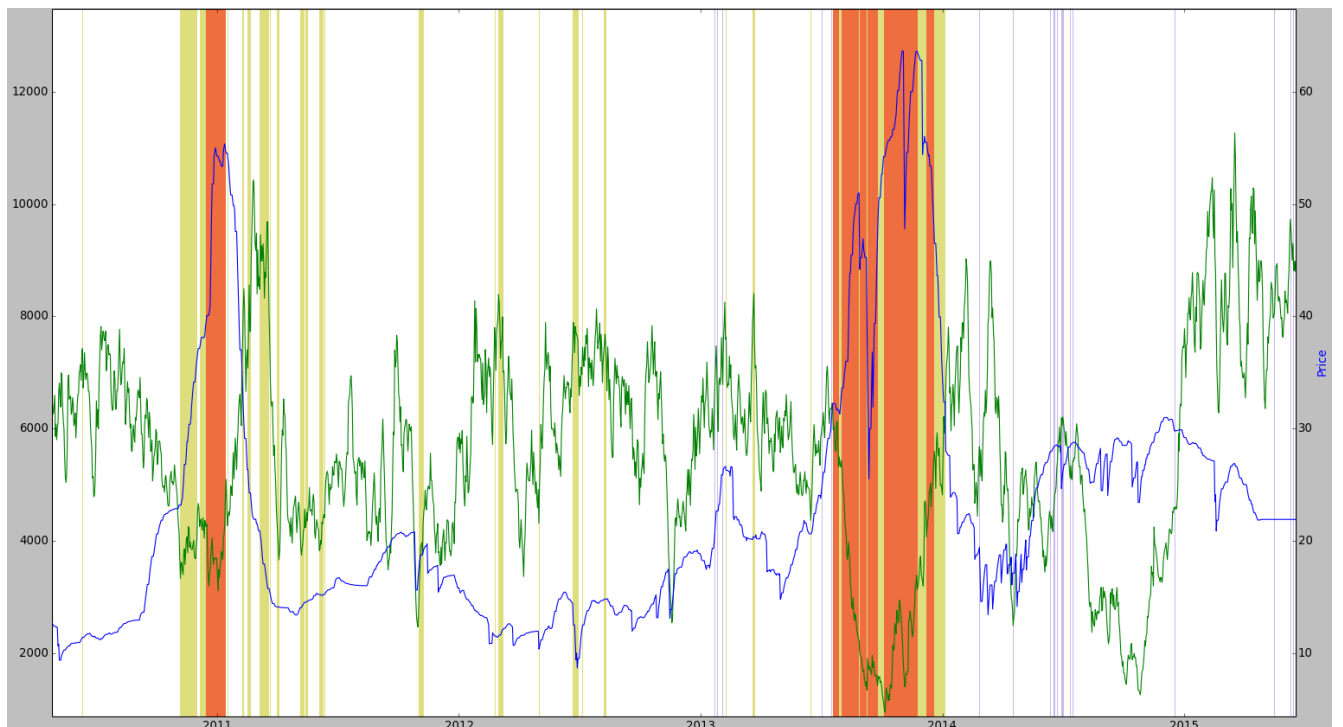


Figure 2: System Result (Green line - Arrival Data of Onion, Blue Line - Retail Price)

- Retail Price vs Wholesale Price

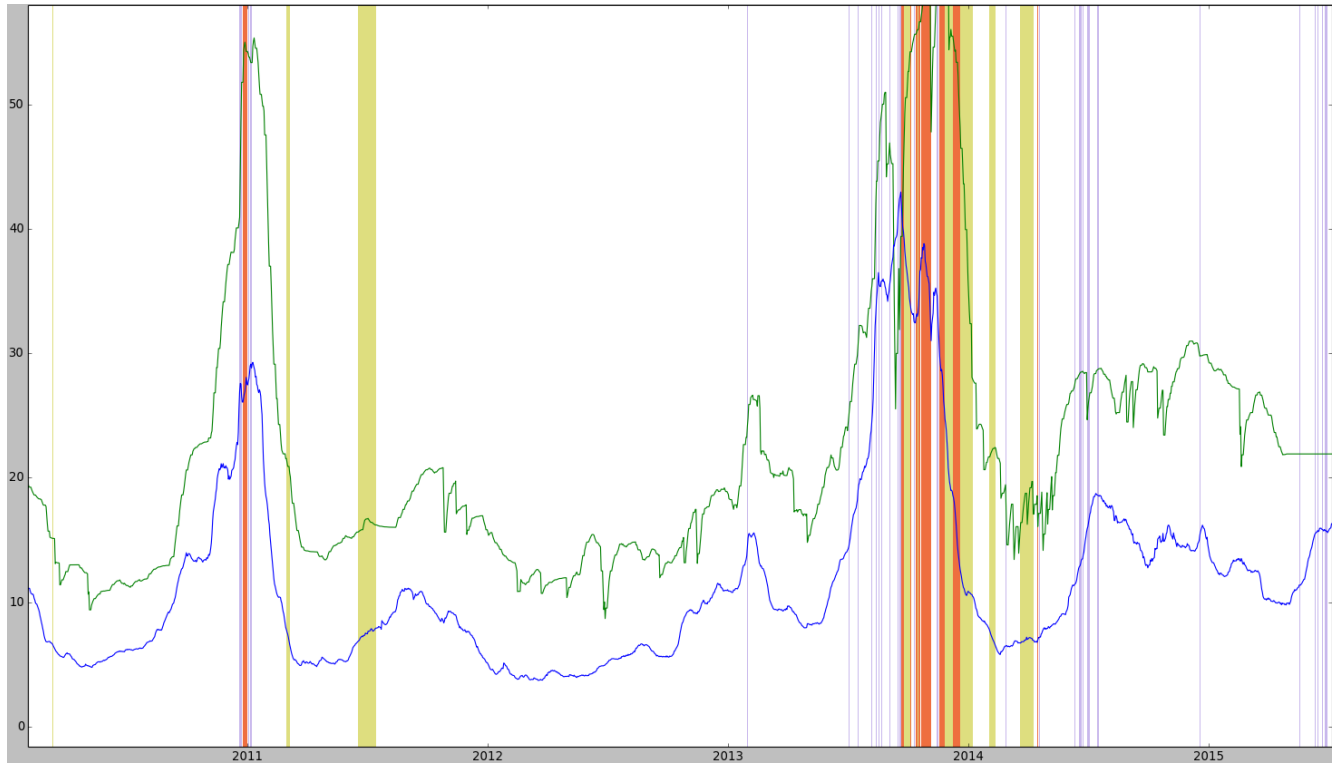


Figure 3: System Result (Green line - Retail Price, Blue Line - Wholesale Price)

- Wholesale Price vs Arrival Data

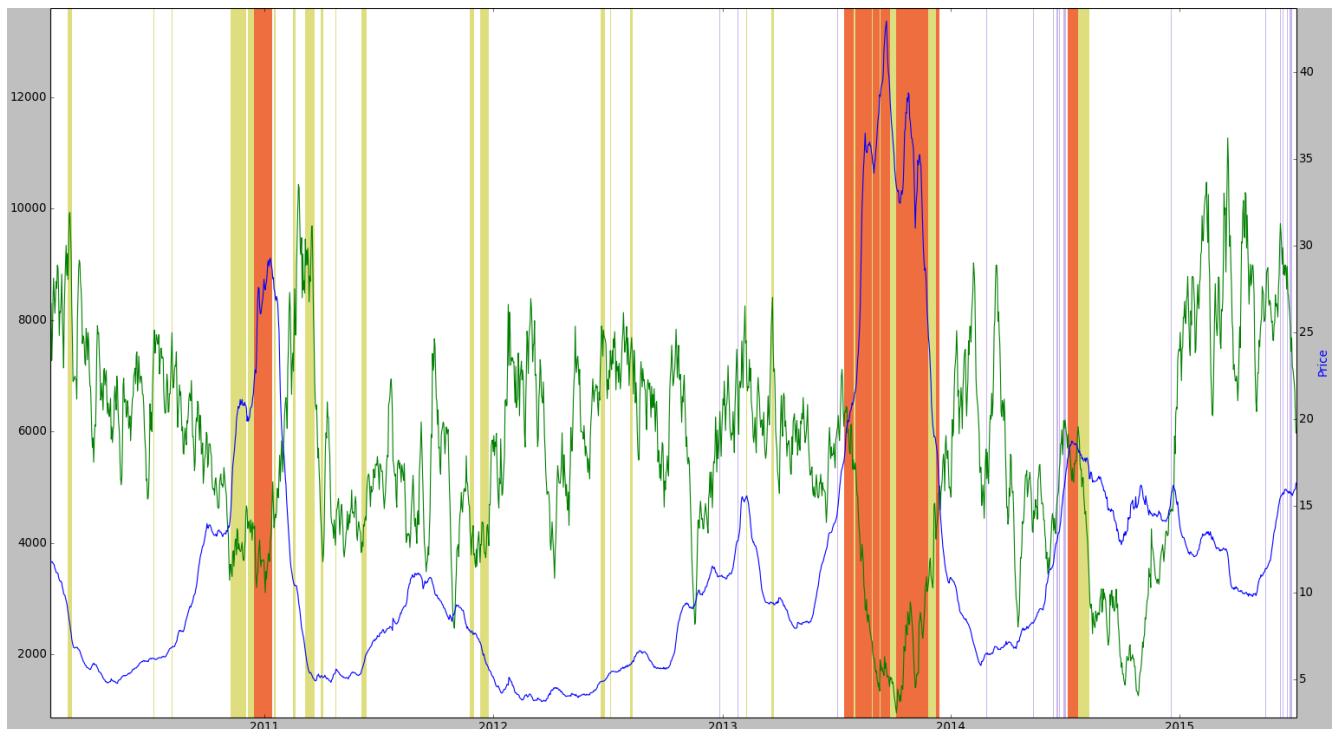


Figure 4: System Result (Green line - Arrival Data of Onion, Blue Line - Wholesale Price)

Following table has few examples showing system reported anomalies and an article supporting it.

System Reported Tenure	News Articles Link	Analysis Type	Location
27-Dec-2010 to 29-Dec-2010	http://timesofindia.indiatimes.com/city/pune/Onion-prices-still-leave-consumers-teary-eyed/articleshow/7147525.cms	Retail vs Average	Mumbai
17-Oct-2013 to 27-Oct-2013	http://www.thehindu.com/business/Industry/monopoly-of-wholesale-trade-causing-onion-price-hike/article5264512.ece	Retail vs Average	Mumbai
15-Dec-2010 to 13-Jan-2011	http://articles.economictimes.indiatimes.com/2010-12-21/news/27586208_1_minimum-export-price-onion-prices-mep	Retail vs Arrival	Mumbai
17-Oct-2013 to 25-Nov-2013	http://www.dnaindia.com/mumbai/report-dna-exclusive-traders-not-farmers-making-the-most-of-soaring-onion-price-1909850	Retail vs Arrival	Mumbai
29-Jun-2014 to 06-July-2014	http://timesofindia.indiatimes.com/india/Retail-onion-prices-soar-to-double-of-wholesale-rates/articleshow/37490678.cms	Retail vs Arrival	Delhi
18-Nov-2013 to 24-Nov-2013	http://www.firstpost.com/politics/onion-tomato-price-hoardings-to-malign-party-cong-writes-to-ec-1238589.html	Retail vs Wholesale	Mumbai
21-Oct-2013 to 04-Nov-2013	http://www.dnaindia.com/mumbai/report-dna-exclusive-traders-not-farmers-making-the-most-of-soaring-onion-price-1909850	Retail vs Wholesale	Mumbai
27-Oct-2013 to 03-Nov-2013	http://www.thehindu.com/news/national/karnataka/are-farmers-benefiting-from-soaring-onion-prices/article5269250.ece	Retail vs Wholesale	Delhi
17-Oct-2013 to 24-Nov-2013	http://www.moneycontrol.com/news/economy/onion-prices-remain-high-at-rs-100kg-crisis-to-continue_976318.html	Wholesale vs Arrival	Mumbai
15-Dec-2010 to 12-Jan-2011	http://articles.economictimes.indiatimes.com/2010-12-21/news/27586208_1_minimum-export-price-onion-prices-mep	Wholesale vs Arrival	Mumbai
29-Jun-2014 to 05-July-2014	http://timesofindia.indiatimes.com/india/Retail-onion-prices-soar-to-double-of-wholesale-rates/articleshow/37490678.cms	Wholesale vs Arrival	Delhi

Table 2: Few Examples

Explanation of all the cases listed in table are as following:

- 27-Dec-2010 to 29-Dec-2010 : Retail price of onion took a sharp rise then faced a downfall which was not seen being followed by Delhi. Instead retail prices at Delhi continued to grow. (See Figure 5)

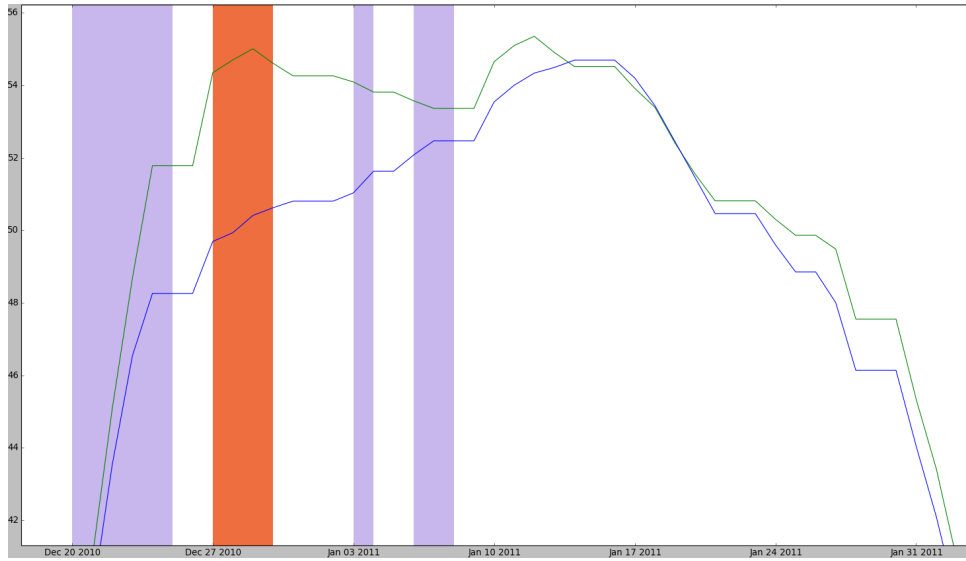


Figure 5: Slope Based Anomaly Detection (Green line - Centre Retail Price, Blue Line - Average Retail Price)

Few of the analysis which were local to center could not be matched with national news articles, but on digging more in regional news article, we could justify the anomaly. One of such case is the anomaly reported on 7th and 8th January 2013, in Delhi, for which news was reported in Jagran local news paper on 28th December 2012 which says due to fog there was disruption in the supply of onions. Despite of the speculation on low arrival of onion we observed considerable hike in arrival (which could be hoarded onion stocks brought into market) to earn better profits to take advantage of increased price of onion. Also, we have observed 2 news articles suspecting traders' nexus as the reason for the increased onion prices.

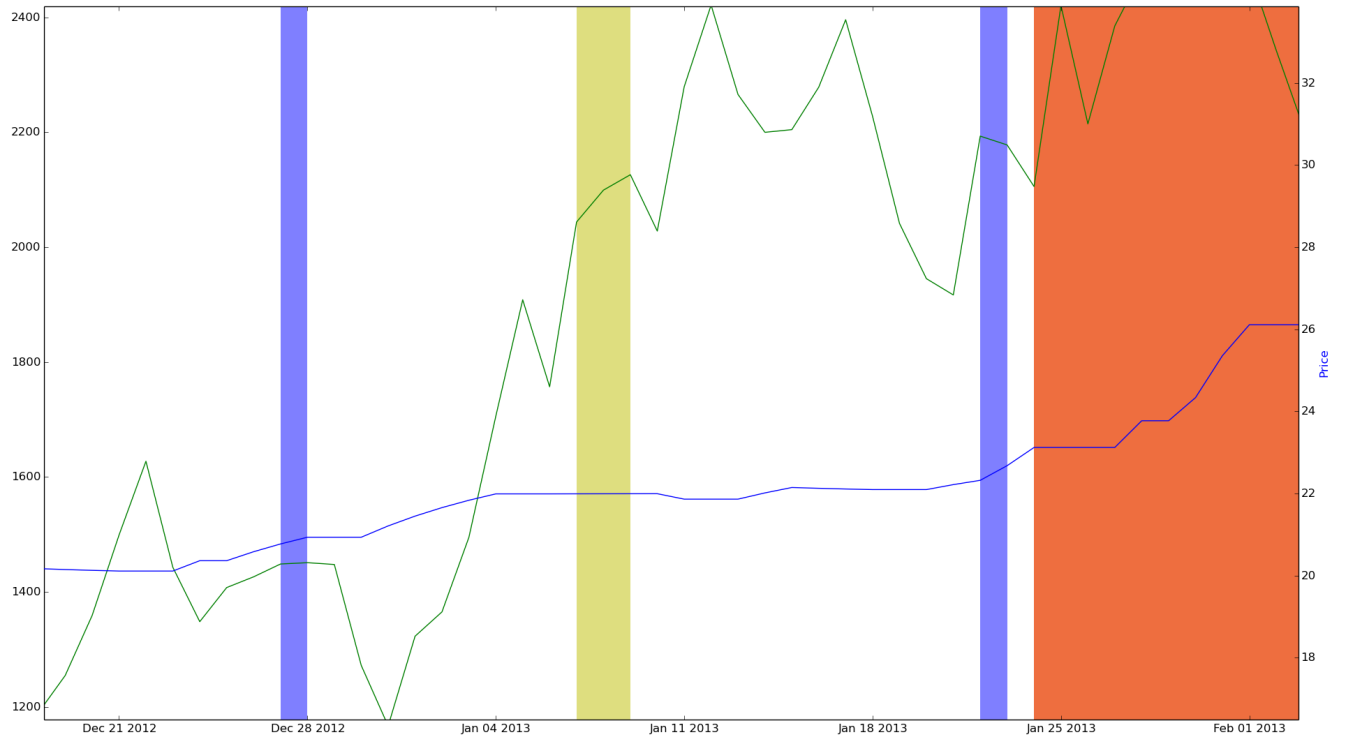


Figure 6: System Result (Green line - Arrival Data of Onion, Blue Line - Retail Price)

News Article stated the following,

नई दिल्ली [सुरेंद्र प्रसाद सिंह] प्याज एक बार फिर आंसू निकालने को तैयार है। ठंड बढ़ने से जहां प्याज की मांग बढ़ी है, वहीं आपूर्ति कम होने से प्याज की कीमतें साल के उच्चतम स्तर पर पहुंच गई हैं। उत्पादक और उपभोक्ता मंडियों के मूल्य में भारी अंतर तो है ही, थोक और खुदरा कीमतों की खाई भी बढ़ गई है। कोहरे की वजह से महाराष्ट्र की प्याज की सप्लाई लाइन टूट गई है।

Figure 7: Jagran News paper article