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Sentiment analysis of demonetization of 500 & 1000 rupee banknotes by Indian government

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Abstract

All government policies have a down side and the burden of the down side is often felt only by the common man. This paper considers one such government policy, the demonetization of high denomination currency by the Indian government that took effect midnight on November 8, 2016. In this paper, we have minutely analyzed this government policy from the common person's perspective by using the concept of sentiment analysis and taking Twitter as a tool. In addition to performing a nation-wide analysis, we have also performed state-wide analysis using geolocation to further elucidate the reasons of displeasure among people of respective states.

Keywords: Government policy; Demonetization; Sentiment analysis; Twitter; Tweet

1. Introduction

While campaigning for the 2014 Indian General Elections, the Bharatiya Janata Party (BJP) laid huge emphasis on rampant corruption in the government machinery and promised the Indian public, that if the party would be voted into power, it will solve the problem of black money which is the root cause of many problems in India. Ever since the landslide victory of the BJP, they have faced great criticism from opposition parties, as well as the public, that they have done nothing regarding black money. As the clock struck 8:15 p.m. Indian Standard Time on November 8, 2016, the Prime Minister of India Narendra Modi made a live appearance on television to make a historic announcement; the higher denominations of currency would be demonetized to tackle the problem of black money. Other than curbing black money, it was a positive step towards the realization of the dream of a digital India and making India a cashless economy.

As per the announcement by Indian Prime Minister Narendra Modi, after midnight of November 8, 2016, the 500 and 1000 rupee banknotes would no longer be a legal tender and would be replaced by an alternate newer currency to be launched. Many people applauded this historic decision, while others criticized this policy, as it was a shock to them. The ministers and supporters of the BJP and their alliance partners were in favor of this policy, while ministers and supporters of all other major parties, including the Indian National Congress (INC), Aam Aadmi Party (AAP), Trinamool Congress (TMC), Samajwadi Party (SP), Bahujan Samaj Party (BSP) etc., were against the implementation of such policy. Similar reactions were reported by the news channels of both pro- as well as anti-establishment groups [1–3].

Social media (Twitter) plays an important role in expressing our feelings about an event [4]. The expression of anguish, as well as pleasure, can act as a measure of acceptance or rejection of certain ordinances. Therefore, this paper makes a fair judgment about this government policy by using the concept of sentiment analysis. For conducting the sentiment analysis of the public regarding this governmental policy, we have collected data from Twitter in 2 phases: November 8, 2016 to November 16, 2016 and November 17, 2016 to November 23, 2016. The purpose of splitting this data collection period was to conduct a fair analysis of what the people of India immediately felt after the policy, at the end of the first week

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of demonetization, and how did this trend change in the second week of demonetization. As in most government policies, the first week is generally the most difficult one, but slowly and steadily, things become smooth. Further, we have highlighted the importance of geolocation, i.e. place (state), of the person sending the tweet for making a prediction in this type of analysis.

2. Background of demonetization policy

Sudden demonetization is not a new phenomenon to India. In fact, this is the third demonetization since 1946 and 1978. However, the circulation of the higher denomination banknotes during that period was very limited and most of the higher denomination banknotes were held with banks only. According to Reserve Bank of India (RBI) records 2016, Indian rupee banknotes worth 16,664 billion are being circulated among the public. Of these 86% (14.180 billion) are in Rs 500 and Rs 1000 banknotes [5]. It is a general thought that the corrupt hold money in the form of such 500 & 1000 rupee bills. Therefore, the government stressed the fact that demonetization of Rs 500 and Rs 1000 notes will curb the black money holdings. However, relief was provided to people as they could exchange their old banknotes with the banks from November 10, 2016. Further, they could also deposit these old banknotes in their respective bank accounts. Additionally, the use of these old banknotes for necessary services such as purchasing petrol, diesel, air tickets and rail tickets was permitted by the government. Since the announcement was made, people have had a mixed reaction to this policy.

However, mayhem occurred on November 10, 2016 when huge crowds flooded every single bank in the country. The government started facing major criticism because the banks did not have enough of the new banknotes to meet the daily requirement of people. Still, the government insisted that these are just a few initial hiccups that are being faced and ultimately this would defeat the black money monster that had crippled the economy for last three to four decades.

3. Data collection

We have used Twitter as a tool to collect data. To interoperate this data in a trusted manner, a system has been developed using visual studio 2012 [6]. Tweetinvi API [7] was integrated into in the developed system to perform the tweet fetching operation. The developed system returned us tweet IDs, tweets, dates, senders, and their locations. Tweets were collected based on specific hashtag (#demonetization). A total of 18,926 tweets were collected in the first phase, from November 8 to 16, 2016. Additionally 11,294 tweets were collected in the second phase, November 17–23, 2016. The daily tweet collection is shown in Table 1.

One important point to be noted is that the beginning of the first phase marked the day the announcement was made. However, banks were closed on November 9, 2016, the second day of the phase, and resumed operation from November 10, 2016. This is an important reason why we had higher tweet collections on November 8 and 9, 2016, as people were initially supporting this historic decision taken by the Indian government.

Table 1
Daily tweet collection.

First phase		Second phase	
Date	Number of tweets	Date	Number of tweets
8/11/2016	2240	17/11/2016	1663
9/11/2016	2638	18/11/2016	1508
10/11/2016	2375	19/11/2016	1339
11/11/2016	1914	20/11/2016	1602
12/11/2016	2121	21/11/2016	1797
13/11/2016	1811	22/11/2016	1991
14/11/2016	2007	23/11/2016	1394
15/11/2016	2232		
16/11/2016	1588		

4. Sentiment analysis

Once data was collected, we applied the process of sentiment analysis to the data. Sentiment analysis is the process of identifying sentiments from the given text. This helps us to understand the feelings of a person who has written a text about that entity. Sentiment analysis is also referred to as opinion mining [8]. In our experiment, we have used sentiment analysis API from meaningcloud [9], which can be added as an add-in to MS-Excel. API can yield results as follows: P+ (highly positive), P (positive), N+ (highly negative), N (negative) and Neu (neutral). The results of the analysis are shown in Table 2, which is comprised of three parts: the first phase, the first phase without non-banking days and the second phase. The first phase without non-banking days was considered separately to ensure an unbiased analysis.

The results of Table 2 clearly elucidate that as the announcement was made on November 8, 2016, people supported demonetization by tweeting a high number of positive tweets. In total 4,878 tweets were tweeted on November 8 and 9, 2016, the day of the announcement and the following day, which was a non-banking day. Out of these, 1,869 (38.31%) tweets were either highly positive or positive tweets, while 1,270 (26.03%) tweets were either highly negative or negative tweets. But as the banks started operating on the 10th, and people started facing problems such as long bank queues, and non-availability of new banknotes, the overall sentiment/opinion of the people started sliding towards the negative side.

As discussed, when the situation on the non-availability of new banknotes started becoming grave the people became negatively biased. This is evident from the fact that out of the total 14,048 tweets collected during the first phase without non-banking days, November 8 and 9, 2016, a total of 4,551 (32.42%) tweets were either highly positive or positive tweets, while 4,675 (33.32%) tweets were either highly negative or negative tweets. This shows a clear dip towards the negative side, compared to the initial two days post the announcement.

As for the second phase, out of 11,294 tweets collected, 3,722 (33.01%) tweets were either highly positive or highly positive tweets, while 3,689 (32.70%) tweets were either highly

Table 2
Results of sentiment analysis.

Date	P+	P	Neutral	N+	N	Total
First Phase						
8/11/2016	238	666	808	149	379	2240
9/11/2016	213	752	931	175	567	2638
10/11/2016	147	615	882	178	553	2375
11/11/2016	92	534	672	115	501	1914
12/11/2016	121	575	704	174	547	2121
13/11/2016	115	427	545	122	602	1811
14/11/2016	123	569	674	159	482	2007
15/11/2016	118	609	789	122	594	2232
16/11/2016	85	421	556	113	413	1588
Total	***1252***	***5168***	***6561***	***1307***	***4638***	***18926***
Mean	***140***	***575***	***729***	***146***	***516***	***2103***
%	***6.65***	***27.34***	***34.66***	***6.94***	***24.53***	***100***
Combined %	***33.99***		***34.66***	***31.47***		***100***
First Phase ***(Without Non-Banking Days 8th and 9th November 2016)***						
10/11/2016	147	615	882	178	553	2375
11/11/2016	92	534	672	115	501	1914
12/11/2016	121	575	704	174	547	2121
13/11/2016	115	427	545	122	602	1811
14/11/2016	123	569	674	159	482	2007
15/11/2016	118	609	789	122	594	2232
16/11/2016	85	421	556	113	413	1588
Total	***801***	***3750***	***4822***	***983***	***3692***	***14048***
Mean	***115***	***536***	***689***	***141***	***528***	***2007***
%	***5.72***	***26.70***	***34.32***	***7.02***	***26.30***	***100***
Combined %	***32.42***		***34.32***	***33.32***		***100***
Second Phase						
17/11/2016	92	416	586	135	434	1663
18/11/2016	83	392	528	108	397	1508
19/11/2016	82	351	491	110	305	1339
20/11/2016	106	442	488	126	440	1602
21/11/2016	101	445	659	116	476	1797
22/11/2016	147	573	666	128	477	1991
23/11/2016	86	406	465	87	350	1394
Total	***697***	***3025***	***3883***	***810***	***2879***	***11294***
Mean	***100***	***433***	***555***	***116***	***412***	***1614***
%	***6.19***	***26.82***	***34.38***	***7.18***	***25.52***	***100***
Combined %	***33.01***		***34.38***	***32.70***		***100***

negative or negative tweets. Hence, we conclude that as we approached the starting date of the second phase, November 17, 2016, already 10 days into demonetization, new banknotes that were not available earlier started flowing into banks. Moreover, people had already deposited or exchanged their old banknotes. Therefore, the sentiment again became positively biased.

5. Results and findings

In the previous section, we discussed that when demonetization was announced, people fully supported this decision, but when they started facing hardships regarding non-availability of banknotes, the sentiment of the people flipped to the negative side. As the situation on availability of banknotes improved and people stated getting new banknotes, the sentiment once again turned towards the positive side. This was an integral analysis of the country, considering India as a single entity. However, India is a highly diverse country. We can find a 94% literacy rate in a state like Kerala which is 32.20% higher than Bihar. Similarly, the population of Uttar Pradesh (UP) is 19,98,12,341 which accounts for 16.5% of the total Indian population., Sikkim has a population of 6,10,577, almost 327 times smaller than Uttar Pradesh [10]. With such high diversification, India should ideally not to be analyzed as a single entity; the importance of geolocation comes into play. In this section, therefore, we will analyze the information state wise to have better results. An exception made in this analysis is that only 29 states and the national capital New Delhi are considered, while other union territories are not.

5.1. Analysis based on geolocation (State from where the tweet was tweeted)

Based on collected data and computed results evaluated in the previous section, we summarize those in more meaningful ways here. As discussed earlier, the tool developed also returned the location from where the tweet originated. This enables us to present the data in the form of heat maps. This would help us in representing which Indian states were happy with this policy and which states were against the demonetization policy. This is done because cumulative data show one scenario, but when we discuss the results based on geo-location the results present us with a totally different scenario. We have plotted two Indian heat maps to represent data collected over the two phases. To represent the happiness of the states, we have used a scoring method as shown in Eq. (1).

$$\begin{aligned}(1 \times (\text{Highly Positive Tweets}) + 0.5 \times (\text{Positive Tweets})) \\ - (1 \times (\text{Highly Negative Tweets}) \\ + 0.5 \times (\text{Negative Tweets})) = \text{Net Score}.\end{aligned} \tag{1}$$

Based on the net score obtained from Eq. (1), we have classified the states into very happy, happy, very sad, sad, neutral, and no data. The states with no data indicate that no tweet originated from those states. Neutral states are those with a net score of zero, i.e. where the numbers of positive and negative tweets are equal. Very happy states are those in which the net score is highly positive, while the states with a net score more than zero are labeled as happy states. Similarly, very sad states are those with a highly negative net score, while the states with a net score less than zero are labeled as sad states. The net scores of the 29 states and New Delhi are shown in Table 3.

Fig. 1 shows the results of the first phase in the form of a heat map. A total of 8 states were classified as states with no data, which includes most north-eastern states with an exception of Chhattisgarh. Tamil Nadu was the lone neutral state. Four states were classified as sad states, while 5 states were classified as very sad states. A total of 7 states were classified as happy states, while 4 states were classified as very happy states. Most states are happier at the end of the first week of demonetization.

Fig. 2 shows the results of the second phase in the form of a heat map. A total of 7 states were classified as states with no data. Jammu & Kashmir, New Delhi and Assam were the neutral states. Totally, 3 states were classified as sad states while 6 states were classified as very sad states. A total of 4 states

Table 3
Net score of Indian states.

State Name	Net Score (1st Phase)	Net Score (2nd Phase)	State Name	Net Score (1st Phase)	Net Score (2nd Phase)
Andhra Pradesh	+1	+1.5	Maharashtra	+20.5	+11.5
Arunachal Pradesh	No Data	No Data	Manipur	No Data	No Data
Assam	−2.5	0	Meghalaya	No Data	No Data
Bihar	−1.5	−0.5	Mizoram	No Data	No Data
Chhattisgarh	No Data	−0.5	Nagaland	No Data	No Data
New Delhi	+0.5	0	Odisha	+3.5	+2.5
Goa	−1	−2	Punjab	+1	+1.5
Gujarat	−1	+6	Rajasthan	+0.5	+1
Haryana	−5	−4.5	Sikkim	No Data	No Data
Himachal Pradesh	+0.5	+0.5	Tamil Nadu	0	−1
Jammu & Kashmir	+0.5	0	Telangana	−4.5	−6.5
Jharkhand	+0.5	+1.5	Tripura	No Data	No Data
Karnataka	−2	−2.5	Uttar Pradesh	−0.5	−2
Kerala	+4.5	+2.5	Uttarakhand	−0.5	−0.5
Madhya Pradesh	+1.5	+0.5	West Bengal	+1.5	+2

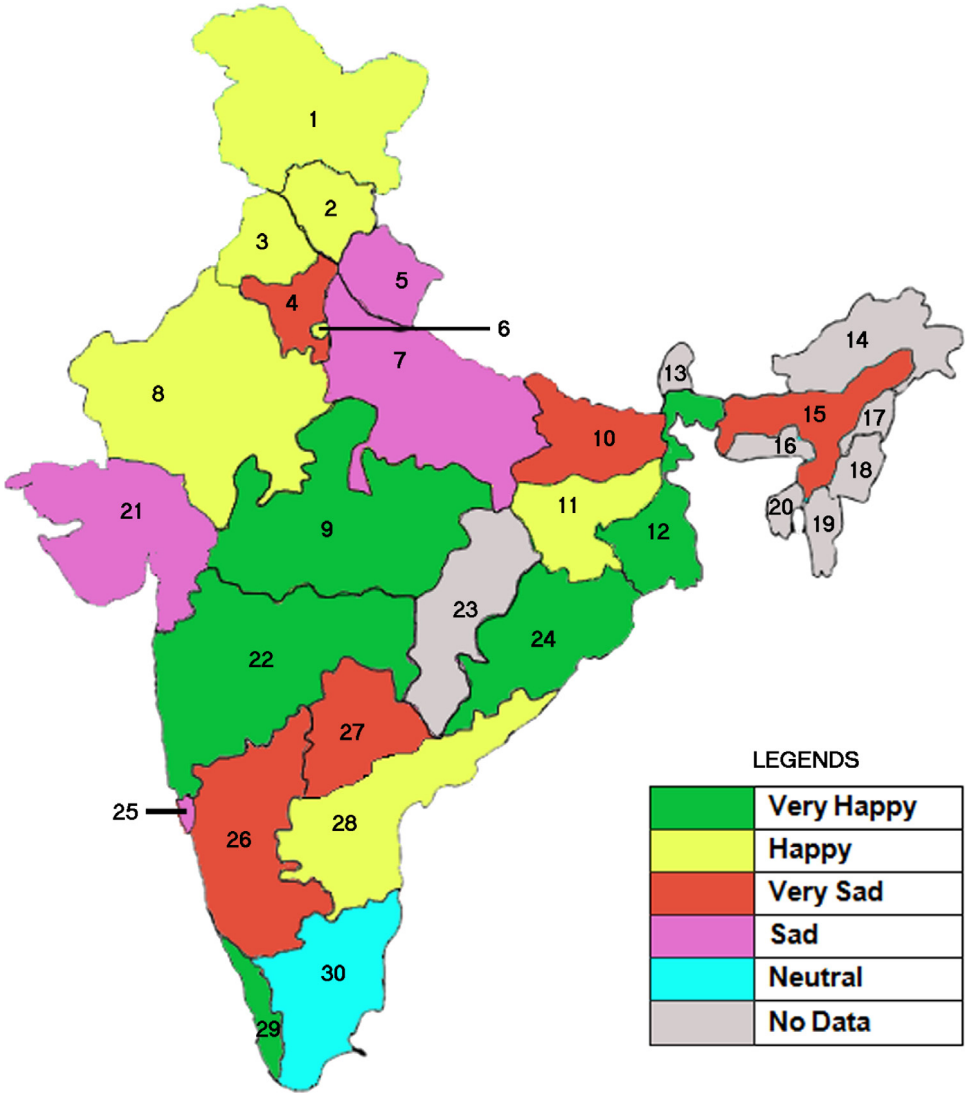

Fig. 1. *State wise Results of analysis (First Phase). Note:* [1. Jammu & Kashmir, 2. Himachal Pradesh, 3. Punjab, 4. Haryana, 5. Uttarakhand, 6. New Delhi, 7. Uttar Pradesh, 8. Rajasthan, 9. Madhya Pradesh, 10. Bihar, 11. Jharkhand, 12. West Bengal, 13. Sikkim, 14. Arunachal Pradesh, 15. Assam, 16. Meghalaya, 17. Nagaland, 18. Manipur, 19. Mizoram, 20. Tripura, 21. Gujarat, 22. Maharashtra, 23. Chhattisgarh, 24. Odisha, 25. Goa, 26. Karnataka, 27. Telangana, 28. Andhra Pradesh, 29. Kerala, 30. Tamil Nadu].

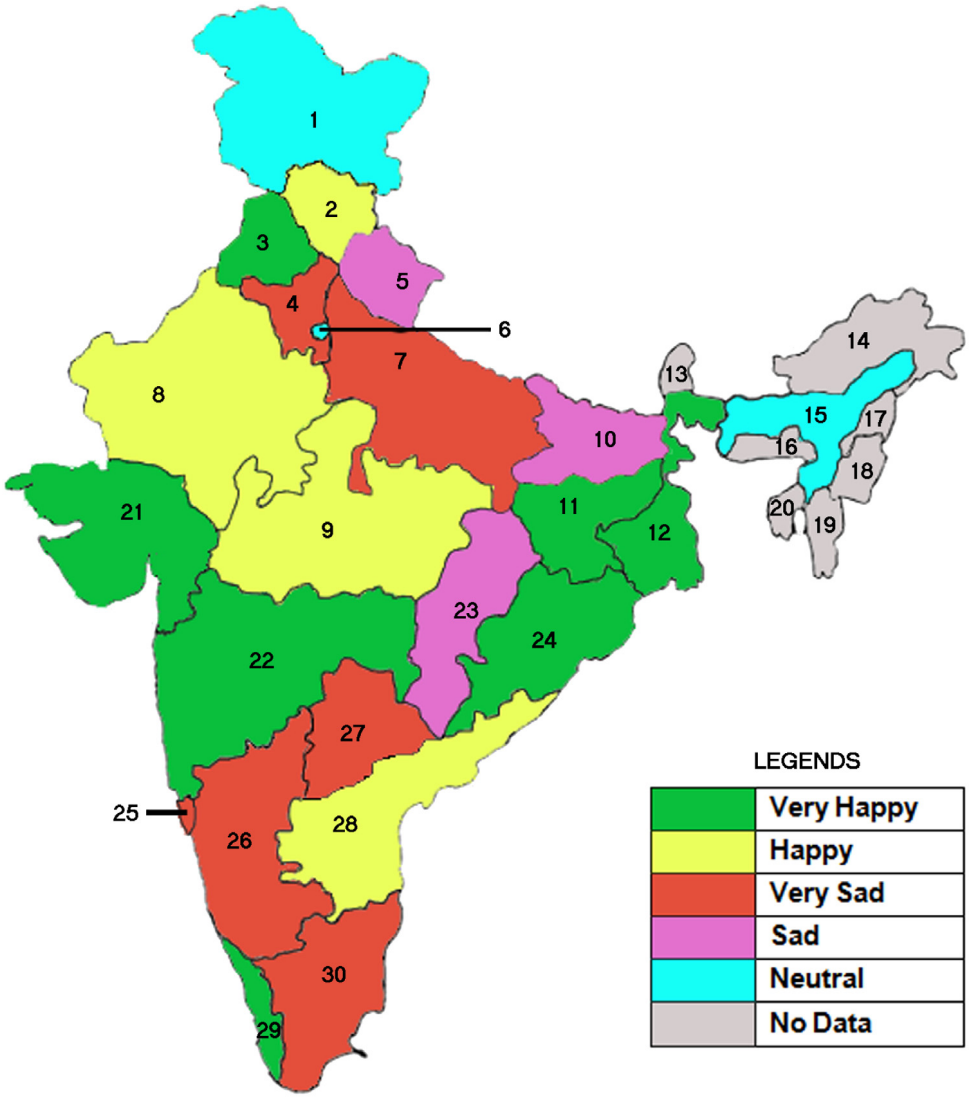

Fig. 2. *State wise Results of analysis (Second Phase). Note:* [1. Jammu & Kashmir, 2. Himachal Pradesh, 3. Punjab, 4. Haryana, 5. Uttarakhand, 6. New Delhi, 7. Uttar Pradesh, 8. Rajasthan, 9. Madhya Pradesh, 10. Bihar, 11. Jharkhand, 12. West Bengal, 13. Sikkim, 14. Arunachal Pradesh, 15. Assam, 16. Meghalaya, 17. Nagaland, 18. Manipur, 19. Mizoram, 20. Tripura, 21. Gujarat, 22. Maharashtra, 23. Chhattisgarh, 24. Odisha, 25. Goa, 26. Karnataka, 27. Telangana, 28. Andhra Pradesh, 29. Kerala, 30. Tamil Nadu].

were classified as happy states, while 7 states were classified as very happy states. The scenario improved from the first phase, and the mood of more states swung towards positive. For the second week, the mood of most states was on happier side.

Both phases clearly show that most states are happy with this demonetization policy.

5.2. Reasons for Indian states being against the demonetization policy

In the above sections, we have identified a total of 9 states that were not happy with the demonetization policy. This section will focus on possible reasons that turned their sentiment towards the negative side.

(i) *High rural population:* All the 9 states have a high rural population of more than 50% barring Goa [10]. This implies a majority settled in rural areas with limited access to banks.

(ii) *Population having computers/laptops with internet and mobiles:* E-Banking and M-Banking are the two common alternatives to traditional banking for performing various banking operations. These require the use of devices such as mobile phones, computers, or laptops with internet connections. All 9 states had a very low percentage of population having access to such facilities [11].

(iii) *Main occupation of state:* The main occupation of all 9 states involved liquid cash. Goa, which is a tourist hub, suffered because people did not have the new legal banknotes. Similarly, the rest of the states had agriculture

Table 4
Reasons of negative sentiment among Indian states.

State	% of Rural population	% of Population having computer/laptop with internet	% of Population having mobile phones	Main occupation
Bihar	88.44	0.9	51.6	Agriculture
Chhattisgarh	76.74	1.2	27.2	Agriculture
Goa	37.8	12.7	53.8	Tourism Industry
Haryana	65.2	5.3	66.9	Agriculture+ Manufacturing Industries
Karnataka	61.46	4.8	56.5	Agriculture
Tamil Nadu	51.54	4.2	62.1	Agriculture
Telangana	61.33	2.6	54.9	Agriculture
Uttar Pradesh	77.62	1.9	61.2	Agriculture
Uttarakhand	69.65	3.2	64.8	Agriculture + Tea Production

as their main occupation. Since November was the harvest month, these states suffered due to the hardship of obtaining new banknotes, which resulted in a negative sentiment for the demonetization policy. The results of above stated reasons are shown in Table 4.

6. Conclusions

Whenever a new government policy is implemented, it always has some negative repercussions, particularly for the common people. The aim of this paper was to analyze the effect of the demonetization policy implemented by the Indian government by using the concept of sentiment analysis. The result of our analysis shows that a large share of Indian people was happy with this policy. During the initial days the sentiment was more towards the negative side as the common man had to suffer many hardships. Ultimately, as the new banknotes were made available, the overall sentiment of the people became positive.

State-wide analysis led us to conclude that out of 30 (29 states and the national capital New Delhi) states considered for analysis only 9 states had negative sentiment; they were not happy with the demonetization policy. These states comprise a share of 30%. Various social economic factors, such as a higher percentage of rural population, an agriculture based economy that involved hardship in obtaining new banknotes, and a lack of known alternatives that could be used for performing various banking operations were factors that explained this displeasure.

Finally, to sum up our analysis, if we exclude minor hurdles that were faced by 9 states, the rest of the states or, in broader terms, the whole of India supported the demonetization policy implemented by the Indian government.

Conflict of interest

The authors declare that there is no conflict of interest in this paper.

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