ANALYTIQUE

Bombay Chamber of Commerce & Industry

The Bombay Chamber of Commerce and Industry is India's premier Chamber of Commerce and Industry situated in Mumbai, the industrial, financial and commercial capital of India. Established in 1836, it is one of the oldest Chambers in the country and has a long and illustrious history of continuous service to trade and industry.

The Chamber can boast not only of its longevity but also of its impeccable lineage. With more than 4000 prime companies as its members, the Chamber represents the cream of Indian Industry, Commerce and Services. While the name 'Bombay Chamber' conjures images of an organization representing exclusively a city-based membership, in reality it represents a wide spectrum of highly reputed and professionally run companies which are based in the city of Mumbai, but whose manufacturing facilities and commercial influence spread not only all over India but also internationally.

The Chamber uniquely represents large and medium sized Corporations, Banking and Financial Institutions, professional Consulting Companies and a large number of Multinationals. It comes as no surprise that today the Bombay Chamber's membership represents as much as a third of the country's GDP in the manufacturing and service sectors.

From the Editor's Desk

On 8 November, 2016 the action by the GoI of demonetising ₹ 500 and ₹ 1,000 notes has acted as large contractionary monetary shock. This radical decision to withdraw the legal tender status of ₹ 500 and ₹ 1,000 notes hit all persons who have piles of cash that they cannot justify. It has been widely held that demonetisation of old currency notes is a bold act that will wipeout "black money and corruption and the bold step taken by the government deserves our support."

While it is broadly expected that the decision will reduce black money that casts a long shadow of parallel economy on our real economy, one should not overlook that India is predominantly a "cash economy", with one of the highest cash to gross domestic product ratios in the world (12%) and a large informal sector which depends overwhelmingly on cash transaction. Thus, cash being a large part of India's money supply and a critical vehicle for transactions, the said action must have implications for the business cycle as a whole. For example, in the short-run consumption demand and GDP may be affected. But it is held that if the shadow economy is reduced, previously unaccounted income will become part of the formal economy. Also, the ease of doing business will improve, India's sovereign rating could be revised upwards and there could be a surge in capital inflows, particularly FDI. Let us hope and pray for the best.

It is in this backdrop three emerging issues have been addressed in three different articles in this issue. We welcome your continued feedback and are also grateful to our readers for the overwhelming response we received throughout 2016 in our publication activities.

Welcome to the Year Ahead.

Contents

Special Theme

Current Affairs

1

Editorial Board

Performance Benchmarking of Commercial Banks in India-A Bilateral Comparison of Performance

Dr. Ram Pratap Sinha*

2

Abstract

The operation of non-public sector banks in India gathered renewed momentum in the post-1992 phase as a fall out of the initiation of banking sector reform and commitments given by the Indian government to open up its banking sector to the foreign participants in a gradual fashion. Against this backdrop, the present paper benchmarks the performance of public sector banks operating in India relative to the private sector and foreign banks for the period 2006-07 to 2010-11 through a 'Bilateral Comparison Model'. The statistical inference drawn from the exercise indicates superiority of performance of foreign and private sector banks relative to the public sector banks over the period of study.

Key Words: Public Sector Banks; Private Banks; Foreign Banks;DEA; Bilateral Comparison.

JEL Classification: G21, C61, D24.

Introduction

Commercial banking commenced in pre-independence India during the 1840s and 1850s with the establishment British owned foreign banks. In 1842, the Oriental Banking Corporation was set up at Bombay with royal charter which was followed by several others. Banks from countries like France, Germany, US and Japan entered in the Indian market. Thus at the time of independence, foreign private sector banks occupied commanding heights of the Indian economy. However, during the first four decades of independent India, the relative importance of private sector banking in the Indian banking sector diminished considerably due to the adoption of a policy of promoting public sector banks. This policy continued upto 1980s.

Since 1991, financial sector reform was initiated in India and banking sector reform measures were an integral part of the whole process. In 1993, the Reserve Bank of India (India's Central Bank) formulated guidelines for giving permission for the setting up of new private sector banks which were further revised in 2001. The operation of foreign banks also got a fresh boost in the post 1992 phase consequent on the commitments given by the Indian government (during the negotiations relating to Financial Services Agreement) to open up its banking sector to the foreign participants in a gradual fashion.

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Against this backdrop, the present paper attempts to benchmark the performance of public sector banks operating in India relative to the private sector and foreign banks through a 'Bilateral Comparison Model'. The sample used in the study comprises of 63 commercial banks (27 public sector banks,20 private sector banks and 16 foreign banks). The period of study is from 2006-07 to 2010-11.

Organisation of the study:

The paper is organized into five sections and proceeds as follows. Section one gives a brief review of the recent regulatory changes relating to private and foreign banks. Section two outlines the methodological issues regarding performance benchmarking. Section three provides a review of the literature. Section four provides the framework of study and the results. Section five concludes.

Section 1: Entry Deregulation in Indian Banking Sector : The Recent Developments

Entry Deregulation of Private Sector Banks:

In the post-independent India, the government assumed commanding heights of the banking sector through a series of bank nationalizations. The princely state banks were acquired in the 1950s, 14 private banks were nationalized in 1969 and 6 more in 1980. Moreover,since 1969 (the year in which 14 commercial banks were nationalized in India), no private sector bank was allowed to be set up (till the announcement of a new entry policy in January 1993). As a fall out, public sector

concentration in the Indian banking sector increased considerably during the phase. In January 1993 (i.e. on the eve of the announcement of relaxed entry norms), the public sector banks owned 91 percent of the bank branches and handled 85 per cent of the total banking business.

In the 1993 entry guidelines for the private sector banks, the Reserve Bank of India permitted the establishment of private banks with a minimum capital of Rs 1000 Million and having a minimum (BASEL I) capital adequacy of 8 per cent from the very beginning. The guideline stipulated that such banks would have to be established as public limited companies with shares listed in stock exchanges. The guidelines also included several safeguards to prevent unwarranted banking practices.

In 2001, the Reserve Bank of India introduced a revised guideline for the entry of private sector banks. The new entry guidelines stated that the initial minimum paid-up capital for a new bank shall be Rs.2000 Million which will have to be raised to Rs.3000 Million within three years of commencement of business. Further, the guidelines mentioned that the promoters' contribution shall be a minimum of 40 per cent of the paid-up capital of the bank at any point of time. This (promoter's) contribution shall be locked in for a period of five years from the date of licensing of the bank. The guidelines also laid down the procedures for conversion of Non-Bank Finance Companies in to commercial banks.

Consequent on the announcement of the entry norms in 1993, 12 banks were

set up in the private sector-10 banks between January 1993 and January 2001(when the revised entry guidelines were announced) and two thereafter. However, many of them had to be merged with other commercial banks. The experience of the past two decades suggest that only those institutions which have adequate experience in broad financial sector, have adequate financial resources, and competent managerial support could withstand the rigorous demands of promoting and managing a bank. For further details see the RBI discussion paper on the entry of new private banks (2011).

Section 2 : Bilateral Comparison- The Methodological Issues

Benchmarking of Productive Systems:

In the present context, our objective is to evaluate the performance of the observed commercial banks within a multi output multi input setting. In such a case, Shephard's (1953,1970) distance function provide a functional characterisation of the structure of production technology. The input set of the production technology is characterised by the input distance function which gives the maximum amount by which the producer's input vector can be radially contracted. The output set, on the other hand, is characterised by the output distance function which gives the minimum amount by which the producer's output vector can be deflated and yet remain feasible for a given input vector.

Farrell (1957) laid the foundation for new approaches to efficiency and productivity studies at the micro level, providing invaluable insights on two issues: defining efficiency and productivity, and the calculation of the benchmark technology and the efficiency measures. The core of the contribution of Farrell comprised of the following:

(i)   introduction of efficiency measures based on radial uniform contractions or expansions from inefficient observations to the frontier,

(ii)   specification of the production frontier as being the most pessimistic piecewise linear envelopment of the data,

(iii)   construction of the frontier through solution of the systems of linear equations,

obeying the two conditions on the unit isoquant:

(i)   that its slope is not positive;

(ii)   that no observed point lies between it and the origin.

The most immediate consequence of the Farrell measure of efficiency has been offer a decomposition of efficiency into technical efficiency, price (or allocative) efficiency and overall efficiency corresponding to a firm. The radial contraction/expansion connecting inefficient observed points with (unobserved) reference points on the production frontier as the basis for the measures is the hallmark, and due to fundamental duality between production– and cost functions identical measures can also be defined using the latter.

Farrell's definitions of efficiency had

close connections with the concepts of distance function since the reciprocal of the input distance function can be considered as the radial measure of input oriented technical efficiency whereas the radial measure of output oriented technical efficiency coincides with the output distance function .

Charnes, Cooper and Rhodes (1978) provided a generalization of Farrell's Single input single output technical efficiency measure to the multiple output- multiple input case and their contribution resulted in the genesis of Data Envelopment Analysis (DEA). The methodology originally developed by Charnes, Cooper and Rhodes (1978) later further extended by Banker, Charnes and Cooper (1984). DEA enables the construction of a production frontier in the context of a multiple input-output framework with minimal prior assumption on input-output relationship.

The DEA approach estimates a convex efficiency frontier of productive units out of piecewise linear stretches. In DEA frontier, efficient observations are those for which no other decision making unit or linear combination of units has as much or more of every output (given inputs) or as little or less of every input (given outputs). It leads to a deterministic envelopment of data set.Once DEA identifies the efficient frontier, the performance of inefficient DMUs is measured relative to the frontier.

The BCC Model for Data Envelopment Analysis:

The Banker-Charnes-Cooper (1984) model introduced performance benchmarking of productive entities based on local technology. In order to provide an extremely brief review of the model, let us consider a productive firm which produces a scalar output Y from a bundle of k inputs $x = (x_1, x_2, …, x_k)$. Let (x^i, y^i) be the observed input-out bundle of firm i (i=1, 2, …,n). The technology used by the firm is defined by the production possibility set.

$Ps = \{(x, y) : y \text{ can be produced from } x \}$

An input-output combination (x^0, y^0) is feasible if and only if $(x^0, y^0) \in Ps$

We assume the firm to be input minimiser given the level of output(s). The firm's optimization exercise can be written as:

$$\text{Min } \theta$$
$$\text{Subject to: } \theta x^0 \geq X\lambda,$$
$$y^0 \leq Y\lambda, e\lambda = 1, \lambda \geq 0$$

If we write the production function as: $Y = f(X) \rightarrow X = f^1(Y)$. Let X^* represent the minimum input corresponding to a given level of output (say Y_f). In the presence of technical inefficiency $X^0 \leq X^*$ where X^* represents optimal input. Technical efficiency of the firm is Optimal input usage / Actual input usage $= X^* / X^0 = 1 / \theta$.

A characteristic feature of the BCC envelopment model is that the technical efficiency varies between 0 and 1. This is because the data set which is used to evaluate the observed firm includes the firm's data also.

Comparison of Decision Making Units (DMUs) Belonging to Different Systems:

One of the basic assumptions of the

traditional DEA models is that the underlying production possibility set is convex. The immediate implication of this is that if two activities (x_1, y_1) and (x_2, y_2) belong to Ps then every point on the line segment joining the aforementioned two activities also belong to Ps. However, there are cases where this assumption is not valid. In particular, problems may arise when the decision making units belong to two different systems. For example, the activities (x_1, y_1) and (x_2, y_2) may be accomplished by using different kinds of instruments. Consequently, any activity which is basically an weighted average of the two may not be feasible.

Comparison of efficiency between two systems:

For the purpose of comparison of DMUs corresponding to the two different systems (say A and B), the inputs are divided in to X_a and X_b and the outputs in to Y_a and Y_b. The convexity assumption holds within the same system but not across systems. The DMUs corresponding to the two systems are now evaluated using a bilateral comparison framework. The distinguishing feature of the bilateral comparison framework is that when DMUs belonging to a particular system (say system A) are evaluated, the data set from which the benchmark is constructed does not include DMUs included in that system (here system A). Thus the technical efficiency score for any observed DMU 'a' (which is a member of system A) is computed from the following optimization program:

$$\text{Min } \theta$$
$$\sum_{j \in B} y_j \lambda_j \geq y_a \qquad \sum_{j \in B} x_j \lambda_j \leq \theta x_a$$
$$\lambda_j \geq 0 \qquad (\forall j \in B)$$

Then Technical Efficiency $\theta = \sum x_j \lambda_j / x_a$

Similar procedure may be adopted for any observed DMU included in system B. Note that since the data set for the DMU under evaluation is not included for the evaluation purpose, the technical efficiency score can be greater than 1.

Statistical Significance of Efficiency Scores:

When we compare the efficiency of two different categories, it is often useful to test the efficiency difference between two groups statistically. However, one can not make use of parametric tests for this purpose because the theoretical distribution of efficiency scores in DEA is not known. Under the circumstances, one needs to make use of non-parametric tests for which the distribution of efficiency scores are statistically independent.

In the present case, we can use the Rank-Sum Test for comparing the distribution of efficiency scores of the in-sample DMUs pertaining to the two systems: A and B. The test is based on the ranking of data. The methodology is now described in brief:

Let the data pertaining to two groups of observation be represented by A={a_1, a_2,.....,a_p} and B={b_1, b_2,......,b_q}. Now we form a new sequence C by merging A and B in which the data are arranged in descending order. C is now ranked from 1 to R(=p+q). If there is a tie, the mid rank is used for the tied observation. Next, the A's rank data are summed. Let the resultant figure be S.

The statistic S, follows an approximately normal distribution

with mean p(p+q+1)/2 and variance pq(p=q+1)/12 for m,n $\geq$ 10.By normalizing S, we have:

$$Z = [S - p(p+q+1)/2]/\sqrt{pq(p=q+1)/12}$$

Z has an approximately standard normal distribution. Using Z, we can test the normal hypothesis that the two groups have same distribution against the alternative hypothesis at a significance level α. The null hypothesis is rejected if $Z \leq -Z_{\alpha/2}$ or $Z \geq Z_{\alpha/2}$. Here $Z_{\alpha/2}$ correspond to the upper $\alpha/2$ percentile of the standard normal distribution.

Section 3: Review of Literature

Saha and Ravisankar (2000) examined the non-parametric efficiency of the Indian public sector banks in two phases during the period 1992-95 in a two stage framework. The study considered four input variables- interest expenditure, establishment expenditure, non-establishment expenditure and six output variables: deposits, advances, investments, non-interest income, interest spread and total income. The results obtained by them show that the performance of the public sector banks (with the exception of a few) had improved over the years of study.

Sathye (2003) measured the productive efficiency of 94 commercial banks operating in India (including 27 public sector banks, 33 private sector banks and 34 foreign banks) for the year 1997-98. For this, he made use of two models: Model A and Model B. Model A considered interest and non-interest expenses as the two inputs and net interest income and non-interest income as the two outputs. Model B used deposits and employees as the two inputs and net loans and non-interest income as the two outputs. The study showed that as per Model A, the public sector banks exhibited a higher mean efficiency score as compared to the private sector and foreign commercial banks in India. As per Model B, they had lower mean efficiency score than the foreign banks but still higher than private sector commercial banks.

Shanmugam and Das (2004) measured technical efficiency of banks in four different ownership groups in India during the period, 1992–1999 with the application of stochastic frontier function methodology for panel data. The results obtained by them indicate that the efficiency relative to interest margin is time invariant while the efficiencies relating to other outputs-non-interest income, investments and credits are time varying. The state bank group and foreign banks were found more efficient than their counterparts. The reform period witnessed a relatively high efficiency for augmenting investments, which is consistent with economic growth objective of the reform measures. However, the study confirmed the presence of large gaps between the actual and potential performances of banks.

For the period 1992-2000, Rammohan & Ray (2004) benchmarked the performance of 58 public , private sector and foreign banks using a revenue maximisation efficiency approach. The study had taken loans, investments and other incomes as bank outputs and deposits and operating costs were taken as the inputs. Rammohan & Ray argued that during the period, Indian banks did

not have much freedom in trimming costs especially the cost of labour. Under the circumstances, revenue maximisation best describes efficiency objectives of the in-sample banks for the period. The study showed that the public sector banks exhibited better performance relative to the private sector banks However, no difference was found between public sector banks & foreign banks. Further, decomposition of revenue maximization efficiency scores in to technical and allocative components showed that the difference between the public and private sector banks remained mainly because of gaps in technical efficiency and not in respect of allocative efficiency.

Das, Nag and Ray (2005) examined output oriented technical efficiency, cost efficiency, revenue maximizing efficiency and profit efficiency of Indian(public, private and foreign) banks for 1997-2003 in the context of four inputs - borrowed funds, number of employees, fixed assets and equity. The study included only those banks which had at least three branches during the sample period. The results revealed that the Indian banks were still not much differentiated relative to input or output oriented technical efficiency or cost efficiency. However, they differed considerably in respect of revenue and profit efficiencies.

Ray(2007) evaluated the size efficiency of Indian banks for the period 1997-2003. A bank is considered size inefficient if breaking it up into a number of smaller units results in a larger output bundle than what could be produced from the same input by a single bank. Ray's study showed that many of the Indian banks

exhibit size inefficiency in various years. He also found that while a bank may be exhibiting diminishing returns to scale this did not necessarily imply that the bank was an ideal candidate for break up.

Das and Ghosh (2009) examined the impact of financial deregulation on cost and profit efficiency of Indian commercial banks for the post-reform period 1992–2004 using data envelopment analysis. The results indicate high levels of cost efficiency and lower levels of profit efficiency, reflecting the importance of inefficiencies on the revenue side of banking activity. The decomposition of profit efficiency shows that a large portion of outlay lost is due to allocative inefficiency. A multivariate regression of the proximate causes of profit efficiencies highlights the importance of bank size, ownership, product diversity and prudential indicators as important variables resulting in these efficiency differences.

Using a translog cost function, Zhao, Casu and Ferrari (2010) examined the impact of a deregulation-prudential re-regulation framework on the characteristics of competitive behavior, cost structure and cost efficiency relationship of Indian banking for the time-span 1992-2004.The results indicate in favour of changes in input-mix and output composition in response to the changes in the regulatory environment as also improvement in cost efficiency after 1996.

Tabak and Tecles (2010) used Bayesian stochastic frontier to draw inference on cost and profit efficiencies of the Indian banking sector for the period 2000 to 2006. They also tested for the inclusion

of off balance sheet data in model specification. The study revealed that the public sector commercial banks were most efficient followed by private and foreign banks. The performance of the banks, however, exhibited convergence over the sample period.

Ray and Das (2010) used DEA methodology to estimate cost and profit efficiency of Indian banks during the post-reform period. The results show considerable variation in average levels of profit efficiency across various ownership categories of banks. In general, state owned banks are found to be more efficient than their private counter parts. Further, efficiency tends to be low among the small banks (assets up to Rs. 50 billion), indicating that at the existing scale of operations, these banks are operating far below the efficient frontier. We also examine the distribution of efficiency using nonparametric kernel density estimates. The analysis reveals a rightward-shift of the efficiency distribution over the years. A major part of this shift comes from the state owned banks. Based on the conditional distribution, the study finds strong evidence of ownership explaining the efficiency differential of banks. Additionally, bank size and product-mix are also found to be important, although to a lesser extent.

Section 4: Framework of Present Study and Results:

Approach of the Present Paper:

The present paper benchmarks the performance of public and private commercial banks operating in India for a five year span starting 2006-07 and ending 2010-11 using a bilateral comparison approach. The cross-section of commercial banks used for the study includes 63 commercial banks for 2006-07 to 2009-10 and 62 for 2010-11 (since State Bank of Indore was merged with State Bank of India during that year). The data set excludes the relatively small and insignificant (in terms of Indian operations) foreign banks. The banks have been categorized in to 'Public' and 'Other' banks for the purpose of bilateral comparison. The 'Other' category includes both private and foreign banks.

Selection of Output and Input: The Conceptual Issues

There are at least three approaches used for defining the outputs of the banking industry. The production approach [due to Benston (1965) and Bell and Murphy (1968)] considers indicators like the number of accounts, number of transactions etc. Most of the researchers following this approach have taken deposits and loans etc as outputs of the banking industry produced by inputs like labour and physical capital. The intermediation approach [advanced by Benston, Hanweck and Humphrey (1982)] focused on net interest margin (difference between interest earned and interest expended). The risk management approach [Huges and Mester (1993, 1994)] considers risk management and intermediation processing activities as the prime outputs of commercial banks. On the expense side, deposit servicing cost, labour cost and fixed capital related over heads constitute the major expenses on inputs by banks. Some have also taken branches maintained by commercial banks as one of the inputs.

The present study takes an eclectic view of the banking industry and considers two outputs: Business (=Deposits plus Advances) and Other Income and one input: operating expenses of the commercial banks. The input and output variables exhibit significant positive correlation. Kindly refer to appendix tables A 4 to A 8 for the details.

Data Source:

Data relating to the inputs and outputs used in the study have been collected from the Indian Banks' Association website.

Descriptive Statistics of Technical Efficiency:

Tables 1 and 2 represent the descriptive statistics of technical efficiency scores corresponding to the public sector and other banks operating in India. Table 3 provides the combined result for the two groups taken together. The bank wise technical efficiency scores for the three category of banks: public, private and foreign are presented in the three

Appendix Tables-A1 to A3.

Table 1: Descriptive Statistics of Technical Efficiency of the in-sample Public Sector Banks

Particulars	2006-07	2007-08	2008-09	2009-10	2010-11
Number of in-sample banks	27	27	27	27	26
Mean Technical Efficiency	1.0380	1.3535	1.1718	1.3507	1.46112
Standard Deviation	0.2166	0.6465	0.3984	0.3650	0.436961
Maximum Technical Efficiency	1.4240	4.2579	2.1475	2.5093	2.730475
Minimum Technical Efficiency	0.6052	0.7247	0.5495	0.9798	0.961908

Source: Calculated.

Table 2 : Descriptive Statistics of Technical Efficiency of the in-sample Other Banks

Particulars	2006-07	2007-08	2008-09	2009-10	2010-11
Number of in-sample banks	36	36	36	36	36
Mean Technical Efficiency	8.9370	8.6681	9.8977	7.996231	11.54531
Standard Deviation	16.1799	16.9012	16.8436	15.14527	22.15364
Maximum Technical Efficiency	70.6897	71.8333	73.9382	72.59204	92.29691
Minimum Technical Efficiency	0.3211	0.2704	0.3846	0.564536	0.684738

Source: Calculated.

Table 3 : Descriptive Statistics of Technical Efficiency of all in-sample Banks

Particulars	2006-07	2007-08	2008-09	2009-10	2010-11
Number of in-sample banks	63	63	63	63	62
Mean Technical Efficiency	5.551739	5.5333	6.158032	5.148125	7.316456
Standard Deviation	12.8411	13.2858	13.4474	11.91413	17.60149
Maximum Technical Efficiency	70.68965	71.8333	73.93822	72.59204	92.29691
Minimum Technical Efficiency	0.321071	0.2704	0.384645	0.564536	0.684738

Source: Calculated

Testing of Hypothesis: Wilcoxon-Mann-Whitney Test

In the preceding sub-section the descriptive statistics corresponding to the technical efficiency scores have been presented. The present sub-section now compares the two groups of banks on the basis of the procedure outlined earlier. Our null hypothesis is that the two groups of banks have the same distribution of efficiency scores. This is tested against the alternative hypothesis that the two groups of banks have non-identical distribution of efficiency scores.

The Rank-Sum Statistics corresponding to the two groups, the test statistics and the corresponding value under standard normal distribution are presented in table 4. The table also includes the statistical inference drawn on the basis of the results available from the application of Wilcoxon-Mann-Whitney test.

Table 4: Statistical Inference

Particulars	2006-07	2007-08	2008-09	2009-10	2010-11
Rank Sum Statistics for Public Sector banks	1094	990	1137	991	1004
Rank Sum Statistics for Other banks	922	1026	879	1025	949
Test Statistics	3.1944	1.75	3.7917	1.7639	2.6391
Standard Normal Distribution	0.000701	0.040059	0.00008	0.0389	0.0042
Inference drawn	Null hypothesis is rejected at a confidence level of 0.1401%	Null hypothesis is rejected at a confidence level of 8.0118%	Null hypothesis is rejected at a confidence level of 0.015%	Null hypothesis is rejected at a confidence level of 7.7751%	Null hypothesis is rejected at a confidence level of 0.8313%
Performance of Other banks relative to the Public Sector banks	Other banks outperform Public Sector banks	Other banks outperform Public Sector banks	Other banks outperform Public Sector banks	Other banks outperform Public Sector banks	Other banks outperform Public Sector banks

Source: Calculated.

Table 4 suggests that during the entire span of observation (2006-07 to 2010-11) the other banks outperformed the banks included in the category 'Public Sector Banks'.

Section 5: The Concluding Observations

In the present study, non-parametric performance benchmarking techniques have been applied to compare the performance of the Indian public sector banks with that of the private sector and foreign banks operating in the Indian market. For comparison of performance, the performance of banks belonging to one group is evaluated in the light of the data set of the other group. Thus the efficiency score is in a sense 'cross efficiency'. The results indicate substantially higher mean efficiency scores for the 'other banks' relative to

the 'public sector banks'. For drawing statistical inference, the null hypothesis that the two groups of banks have the same distribution of efficiency scores was tested against the alternative hypothesis that they do not have. The results indicate the rejection of the null hypothesis for all the years under observation.

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Table A1 : Bank wise technical efficiency scores- Public sector banks

Bank	2006-07	2007-08	2008-09	2009-10	2010-11
State Bank of India	1	1	1	1	1
State Bank of Bikaner & Jaipur	0.7795	0.768773	0.690892	1.033078	0.979554
State Bank of Hyderabad	0.9934	1.180266	1.18258	1.676036	1.602512
State Bank of Indore	0.8970	0.876599	0.607049	1.014941	-
State bank of Mysore	0.7730	0.754955	0.621294	0.979793	0.961908
State Bank of Patiala	1.1799	1.31209	1.338449	1.559653	1.307304
State Bank of Travancore	0.9037	0.906973	0.745038	1.101171	1.297076
Allahabad Bank	1.2661	1.468269	1.222523	1.543578	1.662077
Andhra Bank	0.8568	1.142672	0.961361	1.31883	1.543711
Bank of Baroda	1.2121	1.392912	1.501401	1	1
Bank of India	1.1599	1.631328	1.713678	1	1
Bank of Maharastra	0.8072	0.977076	0.81784	1.198638	0.986142
Canara Bank	1.4110	1.531326	1.675554	1	1
Central Bank	1.1038	1.61796	1.551403	1.785176	1.39528
Corporation Bank	1.0525	1.379751	1.365422	1.699971	2.096849
Dena Bank	0.8402	4.257915	0.718287	1.192183	1.422052
Indian Bank	0.7711	0.9575	0.983294	1.185318	1.549921
IDBI Bank	1	1	2.147469	2.509273	2.730475
Indian Overseas Bank	1.1153	1.420654	1.140569	1.092937	1.759262
Oriental Bank of Commerce	1.4240	1.754466	1.513229	1.734283	2.154802
Punjab &Sind Bank	0.6052	0.724695	0.549543	1.293636	1.413742
Punjab National Bank	1.0661	1.342377	1.428027	1	1
Syndicate Bank	1.2902	1.590347	1.501354	1.467493	1.659343
UCO Bank	1.2428	1.484943	1.447888	1.857561	2.056552
Union Bank	1.4052	1.712634	1.439137	1.724325	1.640164
United Bank of India	0.8244	0.97831	0.863661	1.302283	1.522609
Vijaya Bank	1.0459	1.380365	0.912045	1.197428	1.247783

Source: Calculated.

Table A2: Bank wise technical efficiency scores- Private banks

Bank	2006-07	2007-08	2008-09	2009-10	2010-11
City Union Bank Ltd.	4.5507	3.9541	3.719491	3.063858	4.2395
ING Vysya Bank Ltd.	0.8136	0.7178	1.098189	0.833684	1.054196
Tamilnad Mercantile Bank Ltd.	2.7809	2.5577	3.386501	2.195489	3.078319
The Catholic Syrian Bank Ltd.	2.9839	2.8524	4.619913	2.687529	3.174025
The Dhanalakshmi Bank Ltd.	4.6719	4.465581	5.796858	2.634808	2.663327
The Federal Bank Ltd.	1.0245	0.965822	1.121861	0.906941	1.15792
The Jammu & Kashmir Bank Ltd.	1.1982	1.15221	1.840136	0.934678	1.208845
The Karnataka Bank Ltd.	1.7260	1.410388	1.429613	1.325554	1.67124
The Karur Vysya Bank Ltd.	2.1300	1.993354	1.734613	1.457462	2.130571
The Lakshmi Vilas Bank Ltd.	4.0108	3.701391	4.299824	2.724957	4.021208
Nainital Bank Ltd.	12.1046	13.36447	44.3053	11.3461	16.40631
The Ratnakar Bank Ltd.	12.7544	14.4870	29.37645	13.12909	9.71058
The South Indian Bank Ltd.	1.8734	1.7379	2.800453	1.38769	1.983464
Axis Bank Ltd.	0.5969	0.4282	1.010428	1.140343	1.277295
Development Credit Bank Ltd.	2.3967	1.8029	3.831711	2.530536	4.263543
HDFC Bank Ltd.	0.3729	0.2910	1.034688	0.721378	0.790735
ICICI Bank Ltd.	0.8987	0.6806	1.186616	1.601695	1.382774
Indusind Bank Ltd.	1.1920	1.0716	1.174892	0.854687	1.120316
Kotak Mahindra Bank Ltd.	0.6728	0.4313	0.384645	0.571076	0.684738
YES Bank	2.1189	1.2706	1.195243	1.287312	1.552783

Source: Calculated.

Table A3: Bank wise technical efficiency scores- Foreign banks

Bank	2006-07	2007-08	2008-09	2009-10	2010-11
Abu Dhabi Commercial Bank Limited	21.7046	16.14837	34.98766	39.08802	62.92396
Antwerp Diamond Bank N.V.	70.6897	71.83333	54.13325	46.19494	76.7083
Bank of America NA	2.93312	2.59356	2.803483	2.411686	2.847409
Bank of Bahrain and Kuwait B.S.C.	38.2106	35.91667	27.35895	29.89084	53.09209
Barclays Bank PLC	3.1994	0.643928	0.707209	0.651467	1.20781
BNP Paribas	3.1702	2.448864	2.378125	2.13506	3.318616
Citibank N.A..	0.3211	0.29133	1.46284	0.564536	0.779932
DBS Bank Ltd.	5.5316	4.897727	2.791142	3.024668	3.365732
Deutsche Bank AG	0.5718	0.444758	0.813035	0.843038	1.200674
JPMorgan Chase Bank	5.8098	3.397516	5.263113	3.11745	4.837088
MIZUHO Corporate Bank Ltd.	23.9207	16.57692	12.70424	11.04662	16.98632
Standard Chartered Bank	0.3998	0.277782	1.261208	1.080354	1.093764
State Bank of Mauritius Ltd.	63.9626	71.83333	73.93822	72.59204	92.29691
The Bank of Nova Scotia	10.2783	10.775	7.854505	11.04662	17.15145
The Bank of Tokyo-Mitsubishi UFJ Ltd.	9.8251	14.36667	11.2757	9.963614	13.33088
HSBC Ltd	0.3333	0.270431	1.236937	0.878498	0.918546

Source: Calculated.

Brexit And The Aviation Industry: A Strategic Perspective

Dr. Sumana Chaudhari*

The Referendum in the Changing Times

Bob Dylan, the 2016 Nobel Prize Recipient in Literature shall ever be immortalized in his song " … The chance won't come again; And don't speak too soon; For the wheel's still in spin; And there's no tellin' who; That it's namin'; For the loser now; Will be later to win; For the times they are a-changin'. Indeed, with the Referendum held on 23 June resulted in a majority vote in favouring the decision of United Kingdom leaving the European Union, thus signaling a new era in European geopolitics and global trade, for the times are surely changing. Amidst the fear, and fervor of the decision, there are certainties of newer uncertainty and ambiguity in the political and business landscape of European Union. It is not only the EU or UK who have started taking stock of the impending proceedings, but also the global businesses have been shaken to the stirring and epoch making decision of the United Kingdom. While the British Prime Minister Theresa May has embarked upon her journey for the exit and the negotiations, there are already few early reflections and predictions that have come forth to describe the business dimensions that warranted our immediate attention. One such important sector is the air transport industry, which is truly global in character and has considerable stake in UK and the European Union.

It is pertinent therefore to examine the impact of Brexit on air transport companies and their ability to trade and operate in United Kingdom, Europe and elsewhere in the world. Historically, UK has been a key proponent of "alternative" to public holding of airports, with then Prime Minister Margaret Thatcher pushing for reforms in the sector with the divestment of the Heathrow Airport with the formation of British Airports Authority and the privatization of London, Gatwick and Stansted Airport. Perhaps, UK's access to European Open Skies tremendously augured the growth of UK's Low Cost Carriers (LCCs) in the last twenty years. Within the European Union, UK's LCC enjoyed the first mover right to operate freely, albeit fairly, with respect to aeronautical receipts, frequency of operations and slot allocations. Naturally, UK would like to continue with its pre – eminence in LCC operations in EU market. But there is a fine print to this. This privilege can only enjoyed with UK joining the European Common Aviation Area (ECAA), with the underlying belief that UK agrees to comply with the ground rules of the EU's ECAA aviation rules and regulations, and most importantly, EU Member countries' willingness to accept the decision of UK's affiliation to their cohort. Industry analysts opine that it may not be a cake walk for UK as most EU Member states, particularly those with limited

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abilities in their scale and scope of operations, would wish not to have UK's presence in their market, in the context of an already saturated air space with non – EU ECAA countries' LCCs. Also, in the near term, there lies the possibility of slowing down the travel demand of UK outbound air passengers, owing to a weaker Pound and sluggishness in the UK economy. These are some of the issues that requires careful analysis of the impact of Brexit on the aviation sector in EU, as well as the spillover effect in the Indian skies.

Impact on UK Aviation and Related Stakeholders

UK's decision to leave EU has left many industries speculating about the possible impact that brings forth the divider. The separation will cause turmoil and pain in the geopolitics of nations and almost all sectors of the economy. Notwithstanding the fact, along with downslide in the manufacturing and industrial sectors, where UK was a lead player in EU, the separation will also have profound repercussions on the air connectivity between EU and UK. UK will be no more a beneficiary of the multiplicity of aeronautical revenue that it earned through its state fleet carriers like British Airways and powerful LCC like Ryan Air. It's a premature wakeup call from a slumber in the changing times. Already Airbus has expressed their gross "disappointment" and is currently evaluating the economic impact of the separation, as the fate of their 6000 strong employee base in North Waleslies in the decision. Quickly coming to terms with the decision, Airbus stated that they are going to work with UK Government to minimize any possible impact on their operations in North Wales.

Incidentally, Airbus and Rolls Royce, the two leading manufacturers in Britain, equivocally reiterated that UK government now really needs to push hard for securing favorable trade terms from EU for trade negotiations and uninterrupted trade investment in UK. The entire aerospace industry employs roughly 59000 employees in the Bristol and Bath region of UK and is worth over Euro 7 Billion. The pertinent question that is "blow'n in the wind" is the possible fate of the air transport industry in UK post Brexit.

The answer may not be as simple as the question which is fairly straight forward. There is perhaps no technologically and socially optimal solution to this issue. A better way to arrive at a strategic insight is perhaps value stream mapping of the entire chain. The economies of scale and scope and the time to market for aircraft will be critical enabler for success for an industry which is characterized by a global chain interspersed across multiple geographies and locations. To remain focused in their quest for growth pan EU, air transport players have developed a platform called iAero – a collaboration between the region's leading aerospace players to deliver a regional platform for innovation and growth. iAero is unique to UK and is pivotal to long term success of air transport players based out of UK in developing their capabilities and supply chain management.

Brexit may not automatically guarantee such an unhindered freedom of this multilateral trade accord. CAPA Centre for Aviation admits: "The UK's future exclusion from the ECAA may currently seem far-fetched, but there is precedent for powerful voices in European aviation to attempt to use

the bilateral air services framework to raise protectionist barriers to competition."There lies the fallacy. The ECAA Agreement contains no explicit clauses clarifying what would happen to a member state that ceased to be part of the EU.Nearly 40% of the global airlines does not have a cash – flow forecasting solution in place to predict the economic impact on their profitability post Brexit.

Some of them are already looking forward to a pale uncertainty to the future. The worst affected would be UK's LCCs like Easy Jet with subsidiaries and operations across EU. Many of their routes does not touch UK at all. Under this scenario it is likely that its UK base may be spun off from its EU base, with perhaps a new European ownership, which could be perilous in the long – term. The effects are also net negative for UKs full service carriers like British Airways and Virgin Atlantic, which relies heavily in business travel in its European and UK outbound International network. These routes are also likely to witness a dip in the wake of post – recessionary business environment in the Brexit era. For the British Airways, the other risk emerges from its parent company, the International Airlines Group (IAG), which includes Spain's Iberia, Low Cost Carrier Vueling and Ireland's Air Lingus. The transnational holding structure was permissible only in the context of UK's membership in the EU. IAG had generated significant revenues for British Airways in EU, which would no longer exist, in the changed geo – political landscape of UK.

For some, it may be a strategy to make the hay when the sun shines. The super powerful Gulf operators, namely, Etihad, Emirates and Qatar Airlines is looking forward to reap rich dividends in an already weakened bonding of EU and UK in the air space. The big three is now going to get greater access to UK skies, where Qatar Airways is an investor in the IAG. This could mean a more aggressive bilateral agreement of UK with Gulf Carriers, where the latter stands to gain.

Brexit and the Indian Aviation Economy

In a globally interdependent economy, no one can remain insulated from the other in the wake of an economic perturbation. Indian economy took a hit in the short – term, with the Sensex plunging below the 26000 level on 24 June 2016 and the rupee depreciating against USD crossing the 68 mark. However, the Indian economy quickly rebounded back to normalcy, reflecting the strong macroeconomic fundamentals, which earlier exhibited similar resilience in the aftermath of global financial meltdown in 2008.

In general, the lowering of the crude oil prices had a positive impact on India outbound International travel. Flights became cheaper, particularly leisure travel demand to UK got a shot in the arm with the British economy on a downswing and the pound losing against Indian Rupee by 8% in a single trading season in the money market. Lowering of the airline fares will see UK's travel destinations and holidays getting cheaper, as well as full service carriers like British Airways and Virgin Atlantic wooing Indian passengers with more attractive offers to counter balance its reducing share and operating margins in UK.

There has been a mixed bag of response from the airlines market in the aftermath of the referendum. Whereas LCCs like Easy Jet proclaimed "no noticeable change in passenger

booking behavior", most airlines are treading the cautionary path. Delta for instance, has decided to reduce six points of US-UK capacity from its winter schedule, with the steep drop in sterling pound and the uncertainty that veils the business ecosystem in UK post referendum. If this utopia of "missed flights to UK" by North American carriers is to be leveraged, airlines and airport expansion becomes critical. This can be a period of opportunity of Indian airlines in two counts. One, Indian carriers, particularly, LCCs like Indigo, Spicejet and Go Air can take advantage of 20/5 rule and start exploring untapped EU destinations, with lower fares as compared to EU Carriers, by entering into strong multilateral agreement with EU. On the other hand, full service carriers like Air India or Jet Airways can seize this opportunity and consider making Heathrow their secondary hub and Delhi or Mumbai as their primary hub. This would greatly enhance the logistic and passenger operations in and out of UK further to EU or North American destinations. As our Hon'ble Prime Minister Mr. NarendraModi aptly observed in November 2015: "As far as India is concerned, if there is an entry point for us to the EU, that is the UK"

"The Line It Is Drawn"

Following Brexit, UK will cease to be a member of ECAA. The Referendum will therefore put tremendous strain on UK as far as its competitive advantage in LCC operations in European market. Brexit has opened up new opportunities for India toward a free aviation market access in order to promote a competitive and successful business travel and tourism sector. Also, liberalizing of market access on international routes between the EU and Indian cities will promote both aeronautical and non – aeronautical

receipts, particularly for the Public Private Partnership Airports like Delhi and Mumbai. This move could further support the aim of Airports Economic Regulatory Authority of India (AERA), toward achieving regulatory convergence with EU countries on issues such as safety, security and fair competition. Once we receive clarity on the direction of Brexit in EU, India can effectively address existing airport capacity and financing, aviation taxes, regulatory driven costs with regard to enhancing passenger and cargo movement in EU and UK Market. The EU supremacy of the skies is already in the wane with the weakening of the market forces. As Bob Dylan would like to put it: "… The order is rapidly fadin'; And the first one now; Will later be last; For the times they are a-changin'."In summary, with Indian exports to the U.K. and the rest of the EU accounting for 0.4 % and 1.7% of GDP, financial impact of Brexit will be minimum, but potential and positives are strongly signaling to a new direction of increased trade and travel, the clarity is yet to be seen, but "The answer is blowin' in the wind."

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Delhi's Odd-Even Formula As Public Policy To Address Market Failure: How Robust Has It Been?

Dr. Manas Paul, Dr. Parijat Upadhyay, Dr. Boishampayan Chatterjee*

Summary

The Delhi Government have implementation of odd-even rule a couple of times to address the issue of rampant pollution. This article critically analyses the odd-even rule and evaluates issues those needs to get addressed over possibly different phases of implementations to make it more effective and acceptable to the residents of Delhi. In its absence the resistance to change could magnify rendering the programme ineffective with risks of it fizzling out as another failed initiative.

Introduction

The Government of Delhi has implemented the 2nd phase of the odd-even rule in the last fortnight of April 2016 and there were news of even it contemplating of enforcing it a fortnight every month. The odd even rule restricts plying of non-transport four wheeled vehicles having registration number ending in with odd numbers on even dates and those ending with even numbers on odd days. The restrictions are to be applied between 08:00 am to 8:00pm on every day of the week except Sunday with some exemptions of course .

The genesis of the odd-even rule lies in the government effort to control Delhi's pollution. Private cars, on which the odd-even rule is imposed is one of the contributor to overall vehicular pollution.

Then should we see the odd-even rule as a classic case of government intervention to market failures due to negative externalities?

Market Failure and Efficacy of Government Intervention

The vehicular Traffic those burning fossil fuel adds to environmental pollution. This contributes to negative externality in terms of health hazards for the people living in and around Delhi. Moreover, too many vehicles impose externalities of frequent road congestions and traffic jams as well. Though the private vehicle users derive the convenience of travelling alone, they do not have to bear either the cost of health problem created on account of pollution they create on others or the economic costs of road congestion that they impose. If the market demand for polluting private

vehicles is not made to account for the costs they impose on the society, the market outcome would lead to over usage of cars leading to socially inefficient outcome. This is leading to market failure.

Herein come the role of government and in this case it gets manifested in the odd-even formula. Now the question that remains, is whether odd-even rule in its current form is"a good policy response in itself that can sustain over time" or "there are areas to re-work and re-think to make it more effective and acceptable to the people of Delhi. The odd-even rule acts as a quantitative restriction (quota) on car usage in Delhi. Apparently the rule is expected to ensure that around half of Delhi's 8.8 million vehicles remain off the roads on each day.
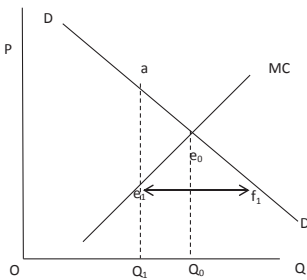
Now, the use of quota under the garb of odd-even rule can lead to a couple of concerns:

1. Odd-even rule is unable to address the issue of dead weight loss as can be done by a tax rule.

2. The use of quota is a restriction on the transaction that people would like to make but are not allowed to. Hence there is always an incentive to evade such laws or even break them. One sort of evasion could

be in the form of multiple car holdings by people who can afford to in securing a different type of registration number for the next car they buy.

a. Here, the government can of course introduce a rule, whereby a new car buyer is given no option for choosing his registration number. However, in the absence of strict implementation this runs to risks of fanning illegal rent seeking activities.

b. Suddenly, the second hand car market, where choice of a registration number is easy might witness a surge in demand.In such a situation, the end objective of the odd-even rule could get compromised to the extent the inventory (of polluting cars) in the second hand car market is able to meet such demand.

c. Moreover, amidst the surge in demand the issue of some private vehicles trying to provide cabbie service without having a requisite licence could be a reality. This runs the risk of illegal cabs on the streets and completely unregulated drivers on roads adding on to the share of road accidents and road safety violations in the city.

3. Increased demand for taxi and auto service leading to jump in fares not only in Delhi but also spilling over to other areas in NCR. Strict enforcement (like ban on taxi

aggregators)against such behaviour though required, might lead to an effective reduction in available supply putting the commuters to further inconveniences.

4. Above all, there is no sanctity that the government has been able to identify that half the traffic should correspond to the socially desirable level of supply. In that case it only adds to the sub-optimality concerns of the quota rule under the guise of odd-even formula.

Then what's the Intent Between Repeated Implementation of Odd-Even rule?

The answer to this may lie in the literature concerning the choice between tax and quantity restriction:
(i) under uncertainty (lack of free, complete and common information)

(ii) in the presence of rent seeking and lobbying activities and

(iii) in the presence of enforcement problem and hence enforcement costs.

Extant literature influenced by Weitzman (1974) and a large number of subsequent researches argued that in a situation of uncertainty concerning costs and benefits of economic agents and regulators, either of these restrictions could be superior to the other, leading to ambiguity in the superiority of tax based rule alone.

Finkelsthain and Kislev (1997) have shown that the preferred control instrument cannot be unambiguously determined in the presence of lobbying as well. In other words, quota might be a better choice over tax.

Finally, Glaeser & Shleifer (2001), offered a justification for implementation of quantity restriction over a corrective tax mechanism building on their insight for enforcement costs. They argued that quantity regulation greatly simplifies enforcement since it requires visual inspection only, leading to the reduction in enforcement costs.Salem Saljanain (2010) showed that general enforcement is much easier in case of quantity regulation and may therefore lower enforcement costs. When enforcement of a tax rule is sufficiently costly, quantity restriction may become desirable even if it eliminates some efficient conduct.

This shows that there exists a body of literature that suggests the choice of quantity restriction over tax based rule under certain conditions those are more likely to be prevalent in reality. Though we have no ways to confirm, this could be one of the reasons behind the government's preference for adhering to a quota under the garb of odd-even formula rather than depend on a tax based rule.

If this is be so then what could be the reason behind its repetitive implementation or even the thoughts if any of implementing it fifteen days in a month till the city was ready to have it permanently?

Could it be a behavioural change programme for making public transport system usage more acceptable to the people of Delhi?

If This Is a Behavioural Change Programme How Robust Is It?

Now if the odd-even is truly a

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ANALYTIQUE • Vol. XII, No. 3, July - September 2016

behavioural change programme, it's success or otherwise would depend on how well designed the programme is to deliver the change.

The UK department for Transportation (DfT), suggests that for enabling a change in travel behaviour, the new behaviour should seem:

1. More advantageous - e.g. perceptions of costs and benefits change
2. More 'me' – behaviour fits in with perceptions of self or aspirations
3. More prevalent – increased awareness of who else is doing it
4. More doable – increased confidence in ability to change
5. Make their old behaviour seem less of any of the above.

The odd even rule in its current form appears to relate more clearly to the last point mentioned above.It makes using any non-conforming vehicle less advantageous, less doable, could fits less with aspects of aspirations and depending upon implementation is likely to be less prevalent.

At the same time, the costs of finding out a co-traveller for carpooling, inadequate taxi service and or high fare, lack of safe, efficient and timely public transport system with limited or no last mile connectivity could stand in the way of perceiving the rule to be more advantageous or doable,making the rest of the issues even less relevant.

A fact sheet on designing travel behaviour change project developed jointly by Departments of Transport, Environment & Conservation and Health, Government of Western Australia talks of a simple and effective formula in initiating a behavioural change in transportation.
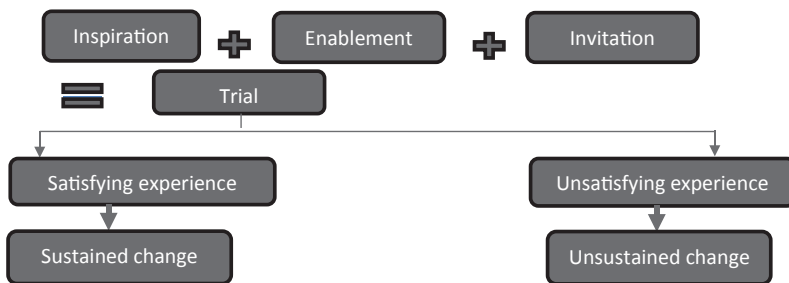
The basic building block of this approach is to lead the behavioural change programme towards the trial phase at the back of inspiration, enablement and invitation. If the resulting experiences are satisfying then it is easy to get the change accepted, if not, the success of the programme is not ensured.

[4]As claimed in some of the advertisements of odd-even formula.

[5]Singapore has multilayers of taxations, making owning of cars prohibitively costly, see Tax Structure for Cars at https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/owning-a-vehicle/costs-of-owning-a-vehicle/tax-structure-for-cars.html

[6]New Delhi ranked was 142nd in personal safety amongst 230 cities in the Mercer Quality of Living Survey 2016 - not an idealistic statistic favouring public transport. Also not so far back In October 2014, a Thompson Reuters Foundation report identified Delhi with Bogota as being among the most dangerous cities with the world's worst transport system for women. There is unlikely to have been any dramatic improvement in the perception since then.

When we talk about inspiration, it is something that people personally desire; it is connecting behaviour to peoples' personal motivations. Interestingly that is different from presenting people with the list of benefits that the program has. Presenting a list of benefits has a high chance of making people feel pressured to change, risking denial and resistance. Whereas, surprising, positive and emotional anecdotes about ordinary people experiencing changes in life that have surprised themselves and other are more likely to be effective in expanding listeners sense of what is possible for themselves. So far there appears to be serious limitations to this inspirational aspect of the odd-even rule in its current form. Then there are inconveniences of inappropriate infrastructure, concerns over frictions about last minute connectivity that neither ensure faster nor hassle free end to end journey. At the same time there is limited scope for it to emerge as a preferred vehicle to remain socially connected as well in this era of facebook, whatsapp and twitter.

Moreover, the current form of odd-even rule lacks in enablers. Easiness to adopt, incentives to adopt and disincentives for non-followers are some of the important enablers for a rule to succeed.In this present form of odd-even rule, though the disincentives of challans for dissentersare common they are far less prohibitive than say for

example the disincentives in Singapore, at the same time there is a glaring absence of incentives for followers as well. The commuters are forced to face the ordeal of scouting for a car pooling buddy, in the absence of any effective ride sharing service mechanism in place. They are forced to face the inadequacies of public transport system in the city, spikes in taxi and auto fares and refusal of services amidst concerns of personal safety. Daring all these without any other incentives looks severely unrealistic and impractical proposition for the person facing these challenges head on.A recent body of literature like Charles &Gneezy (2009) and Royer, Stehr and Sydnor (2015) highlights the importance of incentives in initiating behavioural change though in the context of health behaviour.

Some of the incentives adhered to globally have been reimbursement of full cost of business or office trips taken by public transport, allowances to people commuting by promoted modes of transport, preferred lanes and parking for carpools, reduced parking costs for carpools and park and ride facilities. Even employers have been encouraged to promote and incentivise carpooling and using promoted modes of transport through prize draws, coupons for local restaurants and entertainment, emergency rides home (for carpoolers) to attend exigencies and even accounting a part of the travel time in promoted system of transport within the daily working hour

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[7]For instance, car parks on the outer edges of the city with buses, rapid transit, light rail, E-vehicles, or carpools to reach the city centre.

[8]Seol Car-Free Days have reduced CO2 emissions by 10% annually "http://www.c40.org/case_studies/seoul-car-free-days-have-reduced-co2-emissions-by-10-annually"

schedules.A case in point where private and public incentives worked together with public incentives in reducing emission has been the Seoul's "Car-free Day Programme" where people were encouraged to choose a no driving day in a week.

To increase its relevance the odd-even rule needs to embrace some sort of an incentive structure mechanism, instead of leaving it only to the finer sense of individual responsibility alone.

Another important issue related to changing transport behaviour is autonomy. Since fear of control is one of the main reasons people resist change. Here taking people on board and involving them in making significant decisions about travel initiatives could increase its acceptability even though that might have its own set of challenges. Making a rule assuming that we know what people want and what their barriers to change could be can end up being a big mistake of making it look like an imposition. This can lead to a backlash of reaction and deterrence, thus killing the very notion of behavioural change. Though there are news reports of Delhi government seeking public opinion on when to start the third round of odd even but still nothing on how to make it more acceptable to people.

Dealing with these issues becomes important in enhancing people's belief that they can adopt the new behaviour and benefit from them, with some support and incentives to transition through interim discomforts, embarrassment, costs and other

inconveniences. This enhances the power of invitation to adopt the changes. Along with these, if each of the subsequent pilot testing shows the intent and the ability to address the existing concerns, the odd-even rule can go a long way in succeeding as a behavioural change program. Until then it would continue to remain a program with reduced effectiveness and risks of fizzling out as another failed initiative.

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24

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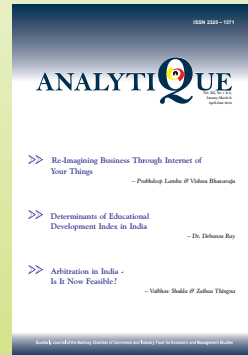
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