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Indian System of Fringe Benefits Tax: An Empirical Analysis of Its Collection and Economic Insights

Praveen Kishore

A recent controversial move by the Indian income tax authorities was the introduction of a fringe benefits tax (FBT) in 2005. Its introduction has been justified on the grounds that it taxes fringe benefits which are collectively enjoyed by employees and are in the form of facilities and amenities that are difficult to identify, segregate and apportion among beneficiaries and tax. Accordingly, the tax liability has been fixed on employers and not on employees. FBT collection data for the first 2 years have been analysed to gain deeper insight into reforming and fine-tuning the FBT regime. It has been found that Banking and Insurance, Infotech and Petrochemical are some of the important sectors of the economy making significant contribution to FBT collection. Further, out of the expense heads specified as base of FBT, it was found that 'employee welfare', 'conveyance', 'telephones' and 'maintenance of cars' are most important in terms of collection. Evidence from statistical tests shows that the proportion of FBT collection from different heads has remained constant over the 2 years of its operation, even at the level of 'economy sectors'. Other tests show that there are significant 'interaction' effects between 'FBT heads' and

Praveen Kishore, a member of the Indian Revenue Service (IRS), is presently posted as Joint Director, Directorate of Human Resource Development, Central Board of Direct Taxes, Ministry of Finance, New Delhi; e-mail: praveenkishore@rediffmail.com
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'economy sectors'. However, there is also statistical evidence that sample data are not homogeneous, which points towards arbitrary booking of expenses under different heads, possibly to avoid the FBT.

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JEL Classification: *H2, H20, H25, H26, H27, H3*

1. Introduction

1.1 Taxation of Salary and Its Components

Taxation is a certainty in today's world. It is the most important instrument available to governments for taking resources from the private sector. Salary income, referred to as income from employment, is generally the most important component of the income of individuals in many countries. In general, salary income includes wages, salaries, pensions, gratuity, leave salary, perquisites, allowances and fringe benefits. Taxation of salary income is one source where tax compliance is generally maximum, as the tax is deducted at source in most countries (this is also called 'withholding tax'). Still, various ways have been devised to reduce tax liability, such as payment of some portion of salary in the form of non-cash facilities, allowances, fringe benefits and reimbursements.

The taxation of employees' fringe benefits has always been a vexing issue for taxation authorities and governments. In most cases, fringe benefits are either not taxed or subjected to softer tax treatment, primarily because such benefits are difficult to identify and still more difficult to apportion among benefiting individual employees. Further, there are practical difficulties and administrative inefficiencies in bringing such benefits to tax. However, over a period of time, tax authorities in many countries have come up with different methods for identifying, valuing and taxing such fringe benefits. On the other hand, employers also have come up with novel ways of providing fringe benefits to their employees to avoid taxation, so that tax authorities claim that the proliferation of fringe benefit plans is slowly eroding the tax revenue of governments.

1.2 Fringe Benefits and Their Taxation

There is no universally accepted definition of 'fringe benefits'. It is generally accepted that fringe benefits provided by an employer cover all advantages, other than monetary salary and wages, in consequence to services rendered. Thus, they are part of an employee's overall remuneration packages, but are largely not in the form of cash payments. Some exceptions can also arise,

for example 'entertainment allowances' or other cash expense allowance granted or reimbursed to an employee which exceeds his actual expenses incurred. Sometimes, an employer may also have a statutory obligation to provide a benefit (e.g., employees' provident fund contribution by employers in India). In some countries, including India, a distinction is made between wages and salaries in kind (often called perquisites in those countries) and other fringe benefits. Examples of 'in kind' components of salary are rent-free accommodation or a free car provided by the employer. With the introduction of the fringe benefits tax (FBT), this distinction has been made more prominent in India.

The most important justification for taxation of fringe benefits is meeting the objectives of fairness and equity in the tax system. Although the concept of equity in taxation is generally accepted as a desirable objective, it often poses practical problems in implementation. The notion of 'horizontal equity' which suggests that 'equals should be treated equally', in turn implies that employees/taxpayers in receipt of equal economic remuneration should pay an equal amount of tax irrespective of the mix (cash, kind or facilities) of the remuneration package. For this reason, softer/favourable taxation of fringe benefits may be unfair for those who cannot take advantage of such benefits. Similarly, 'vertical equity' implies that 'unequals should be treated unequally'. Clubbing this concept with the idea of progressive taxation requires that taxpayers' tax liability and the average rate of tax should increase as their incomes increase. It is generally accepted that highly paid executives are more likely to receive a greater share of their remuneration in the form of fringe benefits. This being the case, a soft FBT regime also violates the principle of vertical equity and reduces the progressivity of the tax system.

Another justification for taxing fringe benefits is erosion of the tax base. When fringe benefits are subjected to soft and favourable tax treatment, it erodes the tax base and tax revenues are lost. It has been apprehended that the loss in tax revenue and erosion in the tax base may be significant when this process of soft tax treatment continues for a long time. The spread of fringe benefits can have broader economic implications, by affecting resource allocation and the market structure.

Despite these economic arguments favouring taxation of fringe benefits, tax authorities from all over the world have faced numerous practical and administrative difficulties in their efforts to bring fringe benefits to tax. The vexing issues of its identification, definition of its base, valuation rules, record-keeping requirements and administration have often thwarted numerous efforts towards an effective and efficient taxation of fringe benefits.

2. FBT in India

2.1 FBT: Meaning and Application

Indian income tax authorities have recently devised a creative, though highly controversial, way of taxing fringe benefits. In the Annual Budget of 2005, the Finance Minister introduced a new tax, titled the FBT. It is a tax that the 'employer' (and not the 'employee') pays on perquisites or benefits that employees derive as a result of employment. The taxation of fringe benefits has been justified by the government on grounds of equity and economic efficiency. However, this tax has been vehemently opposed by the corporate sector, trade associations and substantial sections of academia, on the grounds that in an era of fiscal and taxation reforms such a tax is a retrograde step.

The tax is payable by a certain class of employers on the value of fringe benefits provided or deemed to have been provided by them to their employees. The deeming provisions are a presumptive method of valuation of fringe benefits, wherein the tax is applied to certain heads or categories of expenditure as a measure or indicator of fringe benefits. The Indian Income Tax Act already contains provisions relating to taxation of various kinds of perquisites and allowances which employees receive in addition to their salary or wages. These perquisites are taxed as part of salary income. Therefore, with the introduction of a FBT, the relevant provision relating to taxation of various perquisites has been amended to make them coterminous with the new provisions of the FBT.

2.2 Tax Base, Valuation and Rate

A mixed category of expenses generally incurred by employers for providing benefits or facilities to employees, at the work place or otherwise, has been defined as a base for the FBT. A comprehensive and specific list of such expense categories has been enumerated in the Income Tax Act. Through the deeming provisions, a particular percentage (which varies from 5 to 100 per cent) of such categories of expenses has been declared as 'deemed to have been incurred for providing fringe benefits to the employees of the organisation and this becomes the value of the fringe benefits. The FBT is applicable on this value at a flat rate of 30 per cent with an applicable surcharge and cess. At present, there are 20 such heads of expense. Table 1 gives a snapshot of the base and valuation of the FBT system.

In some of the sectors, the valuation base has been kept low for specific expenses, based on the nature of business. For example, for employers engaged in 'computer software' business, the value of fringe benefits arising from 'conveyance'

Table 1 FBT Heads and Valuation Base Rate

Expense Heads Specified as FBT Base	*Valuation Rate (as a Percentage of Expense)*
Contribution to superannuation fund (above Rs 100,00 per employee per annum)	100
Free or concessional tickets	100
Value of ESOP@	100
Entertainment	20
Hospitality of any kind by an employer	20
Conferences, excluding fee for participation by employees	20
Sales promotion including publicity but excluding specified expenditure on advertisement	20
Employees' welfare	20
Conveyance*	20
Use of hotel, boarding and lodging facilities	20
Repair, running (including fuel) and maintenance of a car and the amount of depreciation thereon	20
Repair, running (including fuel) and maintenance of aircraft and the amount of depreciation thereon	20
Use of telephone (including mobile phone)	20
Maintenance of any accommodation in the nature of guest house	20
Festival celebration	50
Use of health club and similar facilities	50
Use of any other club facilities	50
Gifts	50
Scholarships	50
Tours and travel including foreign travel*	5

Source: Income Tax Act 2008 and Economic Surveys and annual Budget documents (2005–06, 2006–07 and 2007–08), Ministry of Finance, Government of India.

Notes: @Introduced from financial year 2007–08. ESOP, employee stock ownership plan.

*These two heads were together in the first year with a valuation base of 20% and have been separated into two distinct heads with a different valuation base from the second year, i.e., 2006–07.

expenses has been fixed at 5 per cent of 'conveyance' expenses, instead of the 20 per cent applicable to other sectors. Table 2 gives details of the sectors and their concessional FBT valuation base.

The FBT is administered with income tax and there is common tax return form. Other provisions of administration, assessment and tax payment, etc., have also been made coterminous with the income tax system in India.

Table 2 Concessional Economy Sectors for FBT Valuation

FBT Heads / *Business Activity/ Economy Sector*	*Hospitality of Any Kind*	*Conveyance*	*Use of Hotel, Boarding, and Lodging*	*Running, Depreciation, Repair of Car*
	FBT valuation base (% of expense incurred)			
Airline and air cargo	5	–	5	–
Construction	–	5	–	–
Computer software	–	5	5	–
Hotel	5	–	–	–
Pharmaceutical	–	5	5	–
Shipping	5	–	5	–
Transport (goods and passengers)	–	–	–	5
All others	20	20	20	20

Source: Income Tax Act 2008 and Economic Surveys and annual Budget documents (2005–06, 2006–07 and 2007–08), Ministry of Finance, Government of India.

3. Research Objective, Methodology and Design

The FBT was introduced from financial year 2005–06. Since then, despite strong demands from various corporate lobbies against this tax on the ground that it defies logic, is inefficient and increases compliance costs for taxpayers, the government has not accepted this demand. On the contrary, the 'value of ESOP' has been included as a fringe benefit in the last budget.

This paper is an empirical analysis of FBT collection data for first 2 years of its operations to gain insights and derive meaningful observations for reforming, fine-tuning and modifying the FBT regime. The objective, therefore, is not to delve into the qualitative issues and arguments about desirability or otherwise of the FBT, its effects on employers and employees, on the remuneration structure, and so on, as this would form a separate discussion paper in itself.

No empirical analysis of the FBT collection pattern has been conducted so far. There have been general articles and discussions on FBT in India, but the researcher could not find any empirical studies on this. In general, tax policy analysis and related empirical studies have largely been a neglected field of study by researchers/academicians. One important reason for this is the lack of reliable data. Data within the Income Tax Department are not easily available and its access to any outside researcher is even more difficult.

Since financial year 2006–07, paperless electronic filing (popularly called e-filing) of income tax returns (including the FBT return) has become compulsory for corporate taxpayers. It has been extended to 'firms' from financial year 2007–08. This facility has greatly facilitated the present exercise of collection as well as analysis of data. Data for the present study have been taken from FBT returns filed by corporate taxpayers electronically for 2005–06 and 2006–07. (The researcher was given special permission by Central Board of Direct Taxes, Ministry of Finance, to access the electronic data from the tax returns of around 1,000 top FBT payers for 2006–07 and 2007–08).[1] There are only 2 years for which FBT returns data were available at the time of study (October 2007–January 2008). Returns for the third year, 2007–08, is due during financial year 2008–09, for which the last date for filing is 31 October 2008.

Since data relating to tax returns are personal and proprietary in nature, with the Income Tax Department being only a custodian, the names of individual companies and taxpayers have not been disclosed in the report. Instead, the industry segment which a particular taxpayer represents has been taken as a basic unit of analysis. Tax returns data for the top 1,000 FBT payers were filtered and collected for some selected fields for financial years 2005–06 and 2006–07. Naturally, the ranks of the top payers did not remain the same over the 2 years. Thus, the individual taxpayers in the list of top 1,000 for both years are not the same, though the large majority are common. The data obtained were then cleaned. Finally, data for 965 and 987 taxpayers remained for 2006–07 and 2005–06, respectively. As we will see in the following section, data for the top 350 FBT payers have been analysed in detail.

4. Overall Collection of FBT and the 'ABC' Pattern

Interestingly, despite the controversy generated by the imposition of the FBT, its collection as part of overall direct tax collection is not very significant. Table 3 gives direct tax collection figures for the past 3 years of the FBT's operations. FBT collection as a percentage of total direct tax collection has been around 2.8, 2.3 and 2.2 per cent in the first 3 years, thus showing a slow decline in its contribution to total collection. However, it has shown a growth rate of 11.5 and

[1] It may be noted that income tax or FBT returns are due the following fiscal year. Thus, for fiscal 2005–06 (called the previous year in income tax terminology), the tax returns became due and are filed in fiscal 2006–07 (called the 'assessment year' in income tax terminology).

Table 3 Collection of Direct Taxes (Rs in Million)

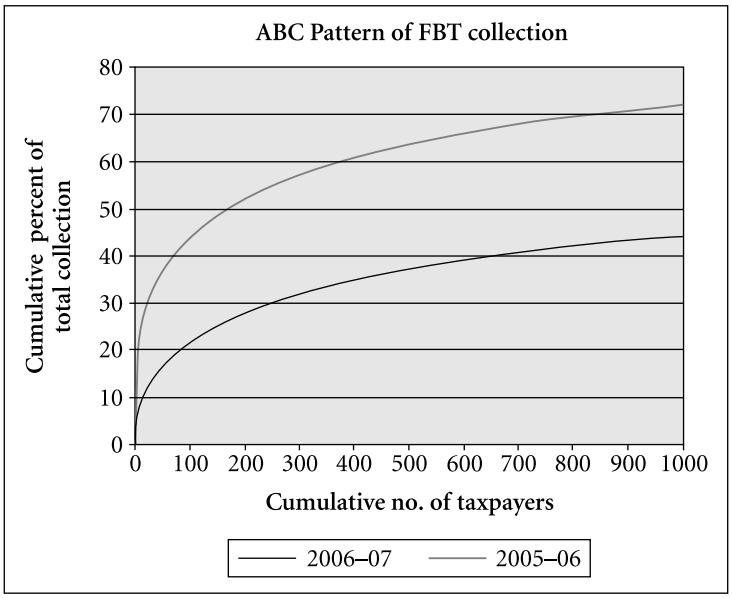
	Financial Year		
Components of Direct Tax	*2005–06*	*2006–07*	*2007–08 (Provisional)*
Corporate tax	1,012,770	1,432,600	1,882,620
Income tax	559,850	760,350	1,039,240
FBT	47,723	53,230	67,430
Securities transaction tax	25,590	46,480	85,770
Banking cash transaction tax	3,210	5,020	5,730
Other taxes (including wealth tax)	3,010	3,230	6,500
Total direct taxes	**1,652,150**	**2,300,910**	**3,087,290**

Source: Economic Surveys and Budget documents (2005–06, 2006–07 and 2007–08), Ministry of Finance, Government of India.

26.7 per cent in 2006–07 and 2007–08, respectively. The growth of 11.5 per cent in 2006–07 is significant because the provisions of the FBT were relaxed slightly that year. Despite this, in percentage terms, it does not appear to be an important contributor to total direct tax collection. However, for a resource-starved country, an additional Rs 60–70 billion is not a small sum. Further, the effect of introducing a FBT can also be gauged through the growth in individual income tax collection (due to the widely acknowledged effect of the FBT on salary structures), which has been quite impressive after the introduction of the FBT. However, empirical examination of such an effect is not easy and it has not been the focus of present research.

Next, the analysis of collection figures showed that FBT collection displays an ABC pattern. This means that a small number of FBT players contribute the maximum amount of tax. By corollary, a large number of small FBT payers are contributing only a small amount. There are more than 400,000 FBT payers. An analysis of the top 1,000 FBT payers very clearly manifests the ABC pattern. Further, the ABC pattern is very prominent in the first year of operation (see Figure 1). For financial year 2006–07, the top 1,000 taxpayers contributed around 45 per cent of FBT against 72 per cent in the previous year. This proportion was 34 and 59 per cent for the top 350 FBT payers in these 2 years. These taxpayers are from all sectors and represent all types of business activities. Therefore, the top 350 taxpayers being a representative sample, data from only these FBT payers have been analysed in detail.

Figure 1 ABC Pattern in FBT Collection during 2006–07 and 2005–06



Source: Compiled from data provided by CBDT, Ministry of Finance.

5. Sector-wise Distribution of FBT Collection

5.1 Classification of Economic Sectors

The total collection of FBT during 2006–07 and 2005–06 was Rs 53,230 million and Rs 47,723 million, respectively. Of this, the research sample of the top 350 FBT payers, which has been analysed in detail, contributed around 34 and 59 per cent of total FBT collection, respectively, in 2006–07 and 2005–06.

5.2 Sector-wise Collection Pattern

Data from FBT return have been analysed by grouping individual taxpayers into the 22 categories of economic activities, used for all government classification. Table 4 represents the contribution from these sectors in total FBT collection for 2006–07 for the top 350 taxpayers in absolute amounts as well as in percentage. Banking is the largest sector contributing around 15.5 per cent of total FBT collection, followed by petrochemicals, Infotech software, Infotech ITES

Table 4 Sector-wise Distribution of FBT Collection, 2006–07

	Value of Fringe Benefits		*Number of FBT Payers*	
Economy Sectors	*Rs in Million*	*Percentage of Total*	*No.*	*Percentage of Total*
Banking	8,343.73	15.47	38	10.86
Petrochemical	4,717.63	8.74	10	2.86
Infotech software	4,613.60	8.55	34	9.71
Infotech ITES	3,535.57	6.55	27	7.71
Insurance	3,299.89	6.12	12	3.43
Electrical/electronics manufacturing	2,899.26	5.37	19	5.43
Services financial consultancy	2,831.63	5.25	27	7.71
Telecom service	2,740.66	5.08	8	2.29
Engineering manufacturing	2,402.03	4.45	13	3.71
Pharma drugs biotech	2,218.16	4.11	23	6.57
Power energy	2,107.54	3.91	14	4.00
Diversified	2,065.11	3.83	16	4.57
Automobile ancillary	1,799.43	3.34	17	4.86
Minerals metals	1,774.99	3.29	11	3.14
Steel	1,455.68	2.70	7	2.00
FMCG consumer goods	1,324.15	2.45	9	2.57
Transport hotel communication storage	1,255.05	2.33	10	2.86
Agro-food beverage	1,225.27	2.27	15	4.29
Construction	1,089.46	2.02	11	3.14
Trading retail	792.91	1.47	9	2.57
Media entertainment	766.10	1.42	9	2.57
Chemical fertiliser	689.82	1.28	11	3.14
Total fringe benefits	**53,947.66**	**100.00**	**350**	**100.00**
FBT	**18,071.06**			

Source: Compiled from data provided by CBDT, Ministry of Finance.

(IT enabled services), insurance, electrical and electronics manufacturing, services financial consultancy and telecom services. The same analysis has been repeated for financial year 2005–06 and the results are shown in Table 5.

The largest contributing sector has remained the same over the 2 years while insurance has gone down in ranking from second to fifth. In the first year, the FBT was introduced, collections from banking and insurance were unusually high, accounting for up to 45 per cent of the total collection of the sample; this has gone down to 21 per cent in 2006–07. This was mainly due to the large collection under the head 'Contribution to superannuation fund' from these

Table 5 Sector-wise Distribution of FBT Collection, 2005–06

	Value of Fringe Benefits		*Number of FBT Payers*	
Economy Sectors	*Rs in Million*	*Percentage of Total*	*No.*	*Percentage of Total*
Banking	23,890.84	28.43	41	11.70
Insurance	14,170.67	16.86	14	4.00
Petrochemical	5,342.10	6.36	10	2.90
Power energy	4,873.80	5.80	25	7.10
Infotech software	3,643.78	4.34	23	6.60
Automobile ancillary	2,988.25	3.56	23	6.60
Telecom service	2,904.44	3.46	9	2.60
Electrical/electronics manufacturing	2,787.71	3.32	19	5.40
Infotech ITES	2,615.64	3.11	22	6.30
Pharma drugs biotech	2,550.98	3.04	26	7.40
Diversified	2,267.26	2.70	14	4.00
Services financial consultancy	2,252.59	2.68	20	5.70
Transport hotels communication storage	1,990.40	2.37	12	3.40
Engineering manufacturing	1,913.15	2.28	15	4.30
FMCG consumer goods	1,823.15	2.17	12	3.40
Steel	1,735.36	2.07	6	1.70
Minerals metals	1,719.01	2.05	11	3.10
Agro-food beverage	1,301.68	1.55	12	3.40
Chemical-fertilizer	1,112.01	1.32	13	3.70
Construction	819.71	0.98	9	2.60
Trading retail	732.31	0.87	8	2.30
Media entertainment	597.18	0.71	6	1.70
Total fringe benefits	**84,032.01**	**100.00**	**350**	**100.00**
FBT	**28,213.45**			

Source: Compiled from data provided by CBDT, Ministry of Finance.

sectors. The reasons are explained in the next section. For clarity and analysis, the Infotech sector has been divided into two: Infotech software and Infotech ITES. If we add the collection from these two sectors, Infotech as a whole would be as large as banking in 2006–07.

A sector-wise frequency distribution is also attempted to examine the number of taxpayers in the top 350 list from each sector (Tables 4 and 5). The sector-wise frequency distribution for 2005–06 is not very different from that for 2006–07 and shows consistency.

5.3 What can we Infer?

Can we infer something about the extent of fringe benefits an employee can expect on employment in a particular sector? Though it may be a gross generalisation, it appears that financial services, mainly banks and insurance companies, are quite generous in terms of providing benefits to employees. This is also true of petrochemical and infotech companies. On the other hand, sectors like media entertainment, trading retail, construction, chemical fertiliser and agro-food beverages appear to be parsimonious in terms of providing fringe benefits to their employees. These five sectors have been at the bottom in both years, contributing only around 9 per cent of the total FBT collection. The presence of media entertainment and trading retail, which represent the new economy sectors and are perceived to be very good paymasters, at the bottom of the contributor list is surprising. It maybe mentioned that for a meaningful comparison, the figures need to be normalised in some manner, by considering the number of employees, total wage bill, wages per employees, by gross value added for each sector or by other similar factors.

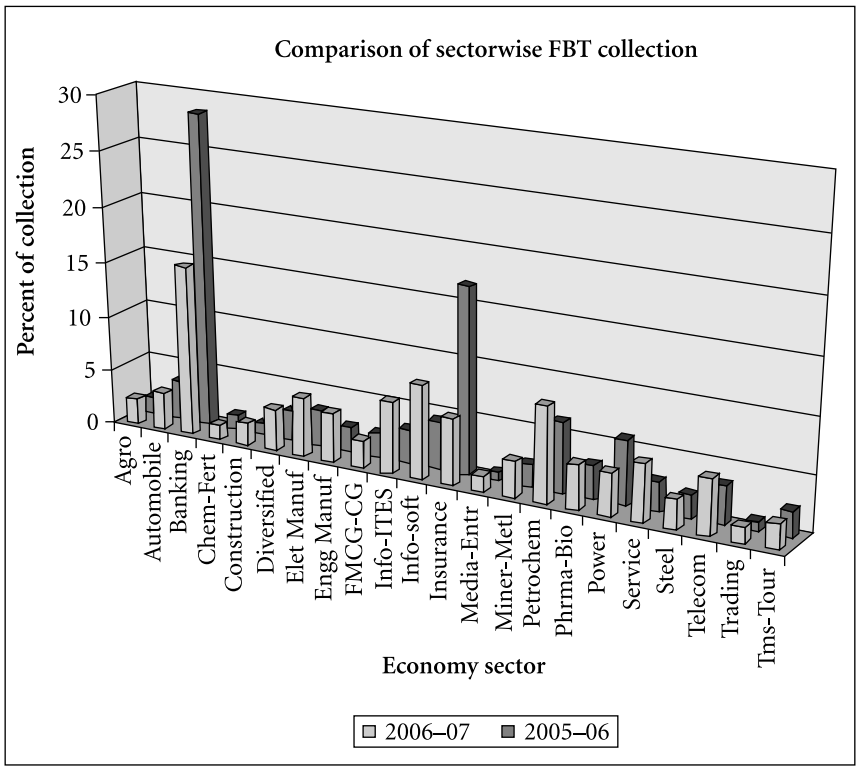
For 2006–07, the top six sectors contribute more than 50 per cent of total collections and the top 10 sectors contribute around 70 per cent. Among the top six sectors, only two are manufacturing, while four represent service sectors. 'Petrochemicals' being the second largest contributor is represented by only 10 taxpayers, most of which, obviously, are public sector companies. This points towards the fact that this sector is perhaps the best in terms of providing benefits to its employees. Banking and insurance, too, with few exceptions, are dominated by public sector companies. Further, telecom service sector, being the eighth largest contributor is represented by only eight taxpayers in the sample being analysed.

Though FBT has been in operation only for 3 years, an analysis of collection from different sectors of the economy over 2 years has been attempted on the data set. The proportion of contribution by banking, insurance and power has fallen in 2006–07; in banking and insurance, it has reduced significantly (Figure 2). If we factor out the change due to banking and insurance, contributions from the other sectors show a consistent pattern.

6. Analysis of Head-wise FBT Collection

The next stage of analysis concerns looking at collection from different 'heads' of FBT. There are 19 heads of expenses which have been included in defining

Figure 2 Comparison of Sector-wise Collection of FBT



Source: Compiled from data provided by CBDT, Ministry of Finance.

the base of the FBT. Most of these expenses are of mixed category, wherein a percentage can be and are generally incurred for providing benefits to employees. Some of these expenses are even primarily incurred for providing benefits to employees, like employee welfare, gifts to employees, scholarships, contributions to superannuation fund, free lunch, free tickets, other free benefits, etc.

What has been attempted by the provisions of the FBT is to include almost all possible heads of expense in the FBT base which can be used to provide employees with benefits. This defies the logic of identification and enumeration of a correct base, but was claimed to have been done to plug the loophole, whereby the FBT could have been avoided by booking expenses under non-FBT heads. However, due to the differential base for different categories of expense, the opportunity to avoid the FBT still remains. In some cases, employers can book expenses under heads where the valuation base is low (20 per cent).

6.1 Head-wise collection pattern

Eighteen heads of expenses were included in the FBT base in the first year of its operation, 2005–06. In 2006–07, the head 'conveyance, tour and travel' was split into two, 'conveyance' and 'tour and travel,' and the valuation base for the latter was reduced to 5 per cent of total expenses, while it remained 20 per cent for 'conveyance'. Therefore, the total number of heads became 19 in 2006–07.

From an analysis of head-wise collection for 2006–07 (top 1,000 and top 350 taxpayers) (Table 6), 'employee welfare' is the largest contributing head

Table 6 Head-wise Distribution of FBT Collection, 2006–07

	Top 350 FBT Payers		*Top 1,000 FBT Payers*	
FBT Heads	*Value of Fringe Benefits (Rs in Million)*	*Percentage of Total*	*Value of Fringe Benefits (Rs in Million)*	*Percentage of Total*
Employee welfare	11,955.01	22.16	14,649.21	20.92
Conveyance	8,018.07	14.86	10,172.60	14.52
Telephone	5,014.91	9.30	6,938.88	9.91
Repair, running, depreciation on car	5,021.94	9.31	6,921.80	9.88
Sales promotion (and publicity)	4,805.57	8.91	6,294.84	8.99
Use of hotel, boarding	4,581.93	8.49	6,228.93	8.89
Tour and travel	3,116.51	5.78	4,405.72	6.29
Gifts	2,991.81	5.55	3,716.08	5.31
Contribution to superannuation fund	2,232.53	4.14	2,721.88	3.89
Conference	2,073.67	3.84	2,643.63	3.77
Repair, running, depreciation on aircrafts	887.77	1.65	998.14	1.43
Entertainment	742.42	1.38	987.91	1.41
Hospitality	757.27	1.40	970.83	1.39
Maintenance of guesthouses	669.91	1.24	920.83	1.31
Scholarships	403.54	0.75	463.87	0.66
Festival celebration	223.97	0.42	407.33	0.58
Other clubs	237.13	0.44	334.30	0.48
Free/concessional tickets	138.86	0.26	180.72	0.26
Health club	74.85	0.14	110.35	0.16
Total fringe benefits	**53,947.66**	**100.00**	**70,067.85**	**100.05**
FBT	**18,071.06**		**23,488.21**	

Source: Compiled from data provided by CBDT, Ministry of Finance.

followed by 'conveyance', 'telephone', 'repair, running and depreciation on car', 'sales promotion' and 'use of hotel, boarding and lodging facilities.'

A similar analysis for 2005–06 (Table 7) reveals that 'contribution to superannuation fund' was the largest contributor with a share of around 40 per cent, followed by 'conveyance, tour and travel', 'employee welfare', 'telephone' and 'sales promotion'. This high collection from 'contribution to superannuation fund' was due to the fact that the entire contribution made by employers was taken to be the base for valuation. On representation from various sectors, the relevant provisions were modified, and from 2006–07 only contributions above

Table 7 Distribution of FBT Collection, 2005–06

	Top 350 FBT Payers		*Top 1,000 FBT Payers*	
FBT Heads	*Value of Fringe Benefits (Rs in Million)*	*Percentage of Total*	*Value of Fringe Benefits (Rs in Million)*	*Percentage of Total*
Contribution to superannuation fund	38,200.62	45.46	40,541.91	39.60
Conveyance, tour, travel	15,267.50	18.17	21,101.40	20.61
Employee welfare	8,995.89	10.71	11,265.80	11.01
Telephone	4,358.11	5.19	6,098.13	5.96
Repair, running, depreciation on car	3,968.71	4.72	5,651.07	5.52
Sales promotion (and publicity)	4,118.82	4.90	5,582.35	5.45
Use of hotel, boarding, etc.	2,648.56	3.15	3,532.06	3.45
Gifts	1,863.33	2.22	2,464.38	2.41
Conference	1,399.49	1.67	1,851.35	1.81
Entertainment	627.19	0.75	839.76	0.82
Maintenance of guesthouses	505.98	0.60	715.38	0.70
Hospitality	528.30	0.63	708.10	0.69
Repair, running, depreciation on aircraft	609.75	0.73	710.24	0.69
Scholarships	326.74	0.39	386.84	0.38
Other clubs	226.58	0.27	315.45	0.31
Festival celebration	155.61	0.19	282.88	0.28
Free/concessional tickets	173.53	0.21	237.63	0.23
Health club	66.92	0.08	93.27	0.09
Total fringe benefits	**84,041.62**	**100.01**	**102,377.99**	**100.01**
FBT	**28,213.45**		**34,370.18**	

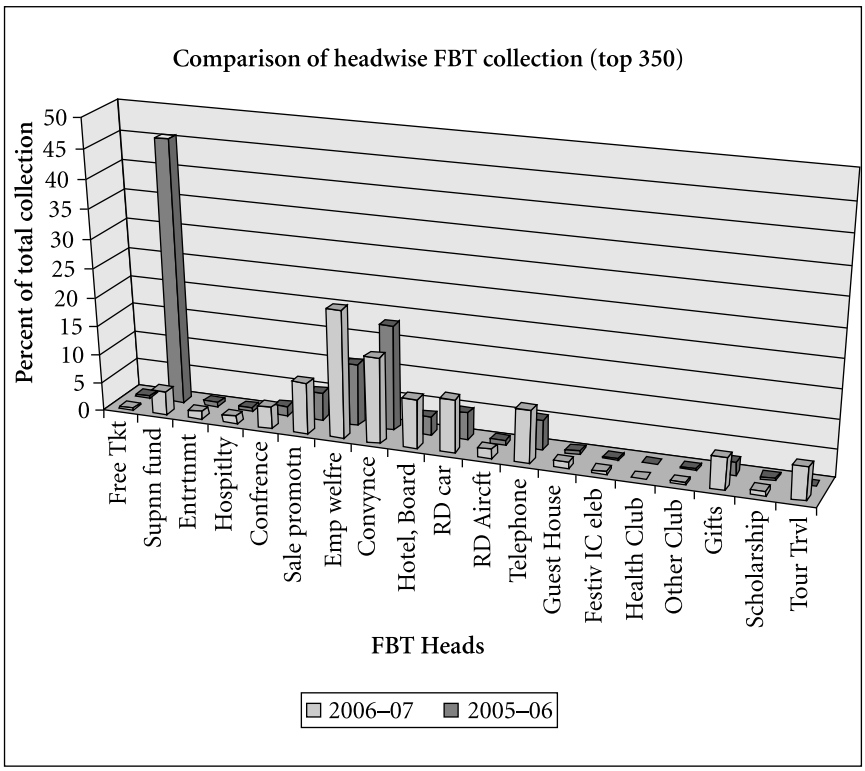
Source: Compiled from data provided by CBDT, Ministry of Finance.

Rs 100,000 per employee per year are taken as the base for valuation. With this change, the share of collection from this head has fallen drastically to around 4 per cent of the total FBT collection in 2006–07.

It is also noticed that the proportion of collections from different heads does not change much with an increase in sample size from 350 to 1,000. In 2006–07, for the top two 'heads', it has slightly decreased, whereas for the next five 'heads', it has slightly increased. There is no clear pattern with an increase in sample size. This is in conformity with the assumption that the data set of 350 FBT payers is a representative sample.

A comparison of 2-year data on head-wise FBT collection (Figure 3) shows that collections from 'contributions to superannuation fund' and 'conveyance, tours and travel' have come down in 2006–07.

Figure 3 Comparison of FBT Collection (Top 350)



Source: Compiled from data provided by CBDT, Ministry of Finance.

6.2 'Running, Depreciation and Maintenance of Aircraft'

In the sample data, the head 'running, repair, depreciation of aircraft' is conspicuous because its contribution is 'nil' for as many as seven sectors. These sectors are banking, electrical and electronics manufacturing, FMCG consumer goods, Infotech software, insurance, services financial consultancy and telecoms. However, overall it ranks 11th, contributing 1.65 per cent of total FBT collection. Further, in five sectors, it is among the top 10 heads contributing on average 5–10 per cent of the total FBT. These sectors are automobiles (5.8 per cent), construction (4.2 per cent), petrochemicals (5.9 per cent), steel (10.6 per cent) and transport hotels tourism (8 per cent). Due to its special nature and particular collection pattern, this head can be made applicable to only those five sectors where its contribution is above 5 per cent. Alternatively, it can be made applicable to 10 more sectors where it is contributing something and can be removed from the FBT base of the seven sectors where its contribution is nil. However, such a suggestion needs to be considered in the light of the possibility of the evasion of the FBT under this head.

6.3 Identifying Important and Unimportant Heads

The FBT heads are the building blocks of the FBT systems. There has been wide-ranging debate on the nature of different FBT heads and justification for including them in the FBT base. It has been vehemently argued by the government that all heads have been included in the FBT base only after due consideration. The debate is closely related with the issues of classification and standardisation of expenses heads, and the complete liberty available to business organisations for accounting treatment of booking of expenses. Against this backdrop, the significance of each head is examined, from the point of view of its contribution to total FBT collection and distribution in different sectors. The FBT return data for 2006–07 only (having 19 'heads' of expenses) has been used in this analysis because the collection data for this year are more stable and balanced, representing changes made in some of the provisions after a year of operation.

An analysis of the largest and smallest contributing 'heads' gives some interesting insights. (This analysis has been done only for the collection figures for 2006–07). About 10 FBT heads are major contributors, accounting for more than 90 per cent of the total FBT collection. Similarly, the cumulative contribution by the bottom 5 heads is only around 2 per cent of the total FBT collection, with the least contributing head 'Health club' contributing as little as 0.14 per cent of total FBT collection (Table 6).

To see if the pattern of top and bottom heads applies to separate sectors, the data were segregated for each of the 22 sectors. For most sectors, these top 10 heads are indeed contributing more than 90 per cent of total FBT collection, except for automobiles, petrochemical, steel and transport tourism. However, in these four cases, when the top 11th FBT 'head' (running, repair and depreciation on aircraft) was included, the total contribution became more than 90 per cent.

Thus, even on segregating data on the basis of sectors, the top 10 heads are the same for all sectors, and contribute almost 90 per cent of the total FBT collection. However, within these top 10 heads, the proportion of contribution by different heads differs for each sector and thus the order of ranking of the top 10 heads is not the same for all the sectors. For example, 'employee welfare' is not always the top ranking 'head' for each sector. Similarly, the contribution of the bottom 5 heads did not exceed 2 per cent for most of the sectors. Further, for as many as 10 sectors, this share was as low as 1 per cent or less (Table 8).

6.4 Removal of Unimportant 'Heads' and Booking of Expenses

On the basis of the above analysis, it is easy to conclude that the bottom 5 heads of the FBT, namely 'scholarships', 'other clubs', 'festival celebrations', 'free or concessional tickets' and 'health club', which contribute a miniscule amount of FBT, can be removed from the FBT base without significantly affecting the collection. However, such a conclusion would be simplistic. The issue is closely linked with the issue of classification of expenses and discretion available to business organisations to book expenses under any head.

As of now, there is no standard procedure or classification system for booking of expenses and accounting treatment by business organisations. The finance or accounts department alone determines a head and books an expense under it. No guidelines or accounting standards have been issued by the Institute of Chartered Accountants of India (ICAI) for this purpose. What is generally found in the books of annual accounts of large organisations is a broad four- or five-fold classification of all expenses under the manufacturing, selling, employees, administrative and miscellaneous expenses heads. These broad 'heads' are then subdivided into various specific 'heads' for the booking of expense, but there is no uniformity even here. This gives complete discretion to an organisation in accounting treatment and in classifying and booking an expense. Further, due to the complex nature of modern business enterprises and the diversity in the nature and type of expenses incurred in the course of business, it is very difficult to have a practicable classification and standardised system of accounting treatment for booking expenses. The accounting treatment is standard to the

Table 8 Contribution by Top 10 and Bottom 5 FBT Heads for Different Sectors, 2006–07

Sector	*Contribution by Top 10 Heads as Percentage of Total*	*Contribution by Bottom 5 Heads as Percentage of Total*
Agro-food beverage	93.14	1.87
Automobile ancillary	84.16	4.21
Banking	92.19	1.11
Chemical-fertilizer	95.48	1.37
Construction	89.99	1.34
Diversified	89.82	2.59
Electrical/electronics manufacturing	93.65	0.98
Engineering manufacturing	95.31	1.06
FMCG consumer goods	97.39	1.58
Infotech ITES	91.64	1.15
Infotech software	93.92	0.74
Insurance	95.89	0.50
Media entertainment	95.50	1.40
Minerals metals	93.14	0.83
Petrochemical	87.47	0.91
Pharma drugs biotech	96.27	0.96
Power energy	94.37	0.51
Services financial consultancy	94.61	1.73
Steel	80.89	0.95
Telecom service	96.89	0.95
Trading retail	94.39	1.64
Transport hotel tourism storage	83.16	3.00
Total	**92.33**	**2.01**

Source: Compiled from data provided by CBDT, Ministry of Finance.

extent that all revenue expenses (which have been incurred for carrying out regular business of the enterprise) are debited to the profit-and-loss account thereby determining the level of profits earned by the organisation.

Of the bottom 5 heads, four are those where the base/valuation rate is 50 per cent of the total expense. Further, expenses under these four heads can also be booked under other heads, notably 'employee welfare'. 'Employee welfare' is general enough to legally include expenses incurred for providing 'scholarships', 'festival celebrations,' etc. However, this would have the impact of reducing the FBT liability due to the differential valuation bases for these 'heads' of expense. *Prima facie*, it maybe the reason why the heads with 50 per cent base are least contributing and why 'employee welfare' is the largest contributing head.

However, it would be too naive to arrive at such a conclusion only on the basis of the above analysis.

What is needed is further analysis of the data before making any observation regarding removing some of the least contributing heads from the FBT system. This issue and the findings of statistical tests are discussed in the following sections.

6.5 Sector-wise Important Heads

As we have seen above, there are 10 top 'heads' which are major contributors to FBT collection, which remain the same for almost all sectors. But, though the heads are the same, their rankings vary considerably for the different sectors (Table 9). It is clear that there is considerable variation among the top four ranking 'heads'. A similar pattern has been observed for the top 10 heads, though the results of such an analysis are not included here due to the paucity of space.

It is noted that generally 'employee welfare', 'conveyance' and 'sales promotion' are the top heads for most sectors. However, 'running and maintenance of car' is the largest contributing head for construction and 'contribution to superannuation fund' is the largest contributing head for 'insurance.' 'Gifts' being the eighth ranking head overall is among the top four heads for as many as five sectors.

7. Statistical Tests and Inferences

There are certain question and issues which have arisen during the preliminary analysis of the data collection in the last section. Some of these are: Are the overall collection patterns of FBT in the 2 years of its operation similar? Are these patterns similar even for different sectors of the economy? Can we arrive at any conclusion with certainty based on statistical tests? Is the collection of FBT dependent on the sector or heads or both? What do the top 10 and bottom 5 heads signify? Can the bottom 5 heads be removed from the FBT system, without affecting the collection? Can we infer something about booking of expenses and uniformity of sample data? To address most of these issues, statistical tests have been conducted to get some rigorous and dependable inferences.

The tests were conducted at three levels of FBT collection data. First, at the level of 'overall FBT collection', to check equality of the collection pattern, under each head for the first 2 years. Second, tests were conducted separately for each sector to test the equality of proportion of collection under each head for the

Table 9 Top Contributing FBT Heads for Each Sector

	Top Four Contributing 'Heads'			
Sectors	*First*	*Second*	*Third*	*Fourth*
Banking	Conveyance	Employee welfare	Telephone	Contribution to superannuation fund
Petrochemical	Employee welfare	Conveyance	Running and depreciation of car	Gifts
Infotech software	Employee welfare	Conveyance	Hotel, boarding	Telephone
Infotech ITES	Employee welfare	Hotel, boarding	Conveyance	Tour travel
Insurance	Contribution to superannuation fund	Employee welfare	Gifts	Conveyance
Electrical/electronics manufacturing	Conveyance	Hotel, boarding	Sales promotion	Employee welfare
Services financial consultancy	Employee welfare	Hotel, boarding	Telephone	Conveyance
Telecom service	Employee welfare	Running and depreciation of car	Sales promotion	Conveyance
Engineering manufacturing	Employee welfare	Gifts	Conveyance	Hotel, boarding
Pharma drugs biotech	Sales promotion	Conferences	Gifts	Tour travel
Power energy	Employee welfare	Running and depreciation of car	Conveyance	Telephone
Diversified	Sales promotion	Conveyance	Employee welfare	Hotel, boarding
Automobile ancillary	Sales promotion	Employee welfare	Running and depreciation of car	Hotel, boarding

(*Table 9 continued*)

(*Table 9 continued*)

	Top Four Contributing 'Heads'			
Sectors	*First*	*Second*	*Third*	*Fourth*
Minerals metals	Employee welfare	Running and depreciation of car	Conveyance	Gifts
Steel	Conveyance	Employee welfare	Running and depreciation of aircraft	Running and depreciation of car
FMCG consumer goods	Sales promotion	Conference	Employee welfare	Hotel, boarding
Transport hotel communication storage	Employee welfare	Running and depreciation of car	Conference	Conveyance
Agro-food beverage	Sales promotion	Employee welfare	Conveyance	Running and depreciation of car
Construction	Running and depreciation of car	Sales promotion	Employee welfare	Hotel, boarding
Trading retail	Employee welfare	Conveyance	Running and depreciation of car	Hotel, boarding
Media entertainment	Sales promotion	Conveyance	Employee welfare	Telephone
Chemical fertilizer	Sales promotion	Employee welfare	Running and depreciation of car	Conveyance
Overall	**Employee welfare**	**Conveyance**	**Running and depreciation of car**	**Telephone**

Source: Compiled from data provided by CBDT, Ministry of Finance.

first 2 years. To measure the interaction between the sectors and FBT heads, a two-factor analysis of variance (ANOVA) was also conducted. Lastly, tests were conducted to check the homogeneity of the proportion of the collection of sample data for each combination of head and sector. For all the tests, collection of FBT from each head was converted into a proportion of the total FBT collection. Some other modifications were also made in the data which are explained in the respective paragraphs.

8. Overall FBT Collection: Test of Equality of Proportion over the Years

The first statistical test is a comparison of total FBT collection under each head for the first 2 years to check whether the proportion contribution by each head has statistically remained the same. We have used a hypothesis test generally known as 'large sample test for the difference between two population proportions'.

The FBT collection data for 2 years are not strictly comparable. This is due to the change in provisions relating to the head 'contribution to superannuation fund' and the division of 'conveyance, tour and travel' into two heads namely 'conveyance' and 'tour and travel' with a reduced base of 5 per cent. Therefore, before conducting the tests, the data have been modified in the following way:

- Collections from 'contribution to superannuation fund' have been taken out of the data before calculating the proportion; and proportions have been calculated on the reduced total.
- The figures for 2006–07 for 'tour and travel' were multiplied by 4 and then added to the collection figures 'conveyance'. In this way, the collection figures and proportions for 2006–07 under 'conveyance' and 'tour and travel' become comparable to the collection figures and proportions of 'conveyance, tour and travel' in 2005–06.

These two adjustments made the data comparable and gave 17 heads on which the test of equality of proportion was performed. The sample size is large enough (350 each in both years) so that the distribution of proportions of FBT from each head as percentage of the total FBT can be approximated by a normal distribution. Therefore, the difference between these two sample proportions (for the 2 years under consideration) is also approximately normally

distributed and this gave rise to a test of equality of sample proportion, based on the standard normal distribution. The mathematical model of the test is given in Appendix A.

This test was conducted for each head of FBT separately, totalling to 17 tests. In all cases, where the value of the *Z*-statistics is between (–) 1.645 to (+) 1.645, the null hypothesis has been accepted, otherwise rejected (Table 10). It can be seen that the null hypothesis has not been rejected even for one head of FBT. This means that in totality, the proportion of contribution by each head of FBT in total FBT collection is not significantly different for both years. Further, the value of the *Z*-statistics is always between (–) 1.00 and (+) 1.00 and in many cases is even less than 0.50. This means that the null hypothesis would be accepted even at a stronger level of confidence. Therefore, it can be said that the proportion of collection by different heads in the 2 years has remained the same and that the statistical evidence to support this hypothesis is very strong. This points to an overall stability in the FBT regime and FBT collections from the first year of its operation.

Table 10 Test for Equality of Proportion for FBT

FBT Heads	*Test Statistics (Z)*	*Null Hypothesis* $H_0: p_1 = p_2$
Employee welfare	(–) 0.3638	Accepted
Conveyance, tour and travel	(+) 0.1785	Accepted
Repair, running, depreciation on car	(–) 0.1066	Accepted
Telephone	(–) 0.2568	Accepted
Sales promotion (and publicity)	(–) 0.5311	Accepted
Use of hotel, boarding	(+) 0.0155	Accepted
Gifts	(+) 0.0672	Accepted
Conference	(+) 0.9169	Accepted
Repair, running, depreciation on aircraft	(+) 0.2063	Accepted
Hospitality	(+) 0.1396	Accepted
Entertainment	(–) 0.6027	Accepted
Maintenance of guesthouse	(+) 0.0085	Accepted
Scholarships	(–) 0.0609	Accepted
Other clubs	(–) 0.0846	Accepted
Festival celebration	(+) 0.2115	Accepted
Free concessional tickets	(–) 0.5336	Accepted
Health club	(–) 0.0832	Accepted

Source: Derived from data provided in Tables 4–9.

9. Test of Equality of Proportion over the Years for Each Economy Sector: Chi-square Tests

The next step is to test the equality of proportion of the FBT for each head over these 2 years, for each of the 22 sectors of the economy. This will allow us to ascertain whether the collection pattern of FBT under each head over the 2 years has statistically remained the same or not for each sector.

Therefore, the relevant statistical null hypothesis is that the proportion of FBT collection from different heads over the 2 years has remained same, even for each sector separately.

Conducting the same test as in the previous section is not appropriate in the present situation, as the sample size for each sector is small, often less then 30, which violates the presumption of a large sample size and thus the assumption of the normality of distribution. Further, the sample sizes are not equal for different sectors as well as across years for each sector. Therefore, the non-parametric test, the chi-square test for equality of proportion, was conducted. Many of the stringent assumptions of parametric tests are not necessary in the chi-square test and it is more appropriate in the present situation. The mathematical model of the test is described in Appendix B. Here again, before conducting the tests, the collection data have been modified in the same way as in the previous test, to make the figures and proportion of collection for the 2 years comparable.

Separate tests have been performed for each sector (Table 11). It is found that in 19 sectors, the null hypothesis has been accepted, whereas it has been rejected for three sectors. Therefore, it is concluded that the proportion of collection from different heads of FBT has more or less remained the same over the 2 years even when the data are examined for each sector separately.

The null hypothesis has been rejected for insurance, engineering manufacturing and the power energy sectors, which means that for these sectors FBT collection data for different heads of expenses show large variations in the 2 years, thereby leading to more variability. The heads of gifts, employee welfare and sales promotion display major fluctuations in percentage terms over the 2 years, thereby contributing to the rejection of the null hypothesis for these three sectors. Further, the lowest value for the χ^2 statistics has been found for sectors like steel, banking, minerals and metals, services financial consultancy, which imply that the FBT collection pattern under different heads shows strong homogeneity during the 2 years for these sectors.

Table 11 Results of Chi-square Test for Equality of Proportions of FBT Collection

Economy Sector	χ^2 *Statistics*	*Null Hypothesis* $H_0: p_1 = p_2$
Banking	2.2030	Accepted
Petrochemical	4.1032	Accepted
Infotech software	5.9995	Accepted
Infotech ITES	19.7771	Accepted
Insurance	29.0183	Rejected
Electrical/electronics manufacturing	3.9897	Accepted
Services financial consultancy	3.3607	Accepted
Telecom service	9.2342	Accepted
Engineering manufacturing	43.1121	Rejected
Pharma drugs biotech	15.0360	Accepted
Power energy	41.4008	Rejected
Diversified	4.6591	Accepted
Automobile ancillary	7.7707	Accepted
Minerals metals	3.3925	Accepted
Steel	1.6843	Accepted
FMCG consumer goods	4.9539	Accepted
Transport hotel storage	17.9197	Accepted
Agro-food beverage	6.8788	Accepted
Construction	16.3344	Accepted
Trading retail	5.4992	Accepted
Media entertainment	10.2717	Accepted
Chemical fertiliser	5.8329	Accepted
Critical value of χ^2	**26.2962**	

Source: Derived from data provided in Tables 4–9.

10. Two-factor 'ANOVA' for 'Interaction' Effect

It is obvious that variability in FBT collection is due to two factors: heads of FBT and sectors. It would be natural, therefore, to make an attempt to know as to whether the proportion of FBT collection (as percentage of total FBT) shows any form of statistical homogeneity for the different heads and sectors. It would also be interesting to see if these two factors affect each other and if so, in what manner and to what extent. The most important analytical tool for such an exercise is the ANOVA.

What has been attempted in the present situation is a two-factor ANOVA. In this model, the effect of each factor alone is called the factor's main effect and the combined effect of both factors, beyond what is expected from the

consideration of each effect separately, is called the interaction effect between the two factors. The interaction, therefore, is the extra effect that happens as a result of a particular combination of a treatment from one factor with the treatment of another factor. Such an effect exists when, for at least one combination of treatment (say banking sector and employee welfare head), the effect of the combination is not additive. It becomes imperative to test the existence of such an interaction effect first before proceeding further in the two-factor ANOVA.

10.1 Two-factor ANOVA and Its Findings

The specific ANOVA used for the present study is the two-factor ANOVA with unequal observations per cell, because for different sectors, the number of observations is not the same.

We have three hypotheses for testing three issues or questions:

- Are there any factor 'sector' main effects?
- Are there any factor 'FBT heads' main effects?
- Are there any 'interaction effects' of the 'sector' and 'FBT heads' factors?

The details of the ANOVA model and formulae used are given in Appendix C.

There are two strong assumptions here. The first assumes that the populations under study are normally distributed, with some mean (which may or may not be equal), but with equal variances or standard deviation. The second assumes the independence and normal distribution of the error term $\varepsilon_{ijk.}$ The data are also assumed to be a random sample from populations modelled by the above equations which are estimates of the model parameters. These estimates as well as the different measures of variations are used in testing hypotheses (Aczel and Sounderpandian 2006: 402). However, in the present case, clearly the data are not a random sample.

The ANOVA computation was done as detailed in Appendix C. First, the 'interaction effect' was computed and the *F*-ratio was found to be 10.002 for the given sample (Table 12).

The *F*-ratio in this analysis for the interaction effect is 10.002. The critical value of the *F*-ratio from the standard distribution table for numerator degree of freedom of 378 (it was taken to be the value corresponding to 120 in the table of *F*-distribution) and denominator degree of freedom of 6232 (it was taken to be the value corresponding to " from the table of *F*-distribution, since 6232 is

Table 12 ANOVA for Interaction Effect

Source of Variation	*Sum of Squares*	*Degrees of Freedom*	*Mean Square*	*F-ratio*
Factor 'Economy sector'	$SS(Es)$	–	–	–
Factor 'FBT head'	$SS(Fh)$	–	–	–
Interaction effect	$SS(Es - Fh) = 248{,}031.13$	$21 \times 18 = 378$	656.167	10.002
Error	$SSE = 408{,}832.62$	6232	65.6021	–
Total	SST	–	–	–

Source: Derived from data provided in Tables 4–9.

too large and *F*-ratios are generally not given for any degree of freedom greater than 120). The corresponding *F*-ratio was noted to be 1.22 at the 0.05 level of significance. This critical value is far lower than the test statistics obtained above (10.002) and therefore the null hypothesis of the interaction effect was rejected with a wide margin. Thus, we conclude that there is a significant amount of interaction between the two factors: sector and FBT heads. In other words, there is statistically significant evidence to conclude that the observation in a cell corresponding to head and sector depends on both these factors.

10.2 What Next When 'Interaction' Is Found?

When a two-factor ANOVA with unequal observations per cell give evidence of an interaction effect, then calculation of the individual factor effects becomes redundant. That is, calculating the *F*-ratio for the two-factor effects separately is not required of the difference among levels of one factor, averaged over all the levels of the second factor.

In such a situation, the course of action to be adopted is to perform a one-way ANOVA for the main effects of the factor 'sector' (at each level of 'FBT head') and similarly for the main effect of 'FBT head' (at each level of 'sector') (Goon et al. 2003). In effect, it is preferable to check sector-wise variations separately for each FBT head and to check whether variations among FBT head are there for each sector.

However, there are certain issues which need to be looked into here. First, the high interaction effect found in the present case shows a high level of interaction between the two factors 'sector' and 'FBT head'. Further, as we already know the ANOVA analysis makes some very strong assumptions. One of them is that the error terms are independently and identically normally distributed with a mean of zero (0) and standard deviation (σ). This is particularly a strong assumption. We do not have any idea about the distribution of error terms. In fact, we do not have much idea even about the distribution of the sample observation and

have only assumed it to be normally distributed. In such a situation, it appeals logic to conduct some other kind of statistical test.

One of the best alternative tests in such a situation is the chi-square test for homogeneity of sample data. In fact, the *F*-ratio is nothing but a ratio of two chi-square statistics. Further, being a non-parametric test, the chi-square test does not make any assumptions on the normalcy of distributions of sample or error terms. Though not as strong a test as the ANOVA, it is a better test to apply in the current situation. Further, the chi-square test is easy to comprehend and its calculations are also easier.

11. Test of Homogeneity of Sample Data: Chi-square Test for Sectors and FBT Heads

The chi-square test is the natural outcome of the two-factor ANOVA conducted in the previous section. In fact, the chi-square test has been conduced here as a test for measuring homogeneity of sample data. The sample data are represented by data points present in each cell—being combinations of FBT heads and sectors.

11.1 The Chi-square Test for Each Combination of 'Sectors' and 'Heads'

The first two levels of tests have shown broad homogeneity of collection data. The last levels of tests have been conducted to check the homogeneity of collection proportions for individual samples, present in a particular combination of 'sector' and 'head'. The chi-square test for homogeneity of sample data has been conducted for each of the 19 FBT heads for all the 22 sectors. This tests, whether individual FBT payers in a particular combination of 'sector' or 'FBT head' have statistically similar patterns of contribution. For example, in the automobile ancillary sector, where the sample consists of data from 17 individual FBT payers, it is checked whether the 'per cent contribution' [2] from a FBT head, say 'employee welfare' from each of these 17 taxpayers, is statistically homogeneous or not. In essence, the test shows whether FBT collection proportion shown by individual samples in a particular combination of 'sector' and 'head' are statistically equal to the average proportion of that particular combination. Since the same type

[2] 'Per cent contribution' here means contribution by an FBT head as a percentage of total FBT collection for the particular data set/taxpayer. It has also been called 'proportion of FBT collection' in subsequent paragraphs.

of business generally has similar kinds of expense patterns, in the ideal situation the sample data are expected to show some statistical homogeneity. The model of the chi-square test used here is described in Appendix D.

11.2 Classification of Expenses

The chi-square test is relevant in analysing another significant issue, 'classification' and the booking of expenses. It has been pointed out in the previous section that in India there is no standard procedure or classification system for booking expenses and their accounting treatment by business organisations. No guidelines or accounting standards have been issued by the Institute of ICAI for this purpose. This gives complete discretion to an organisation for classifying and booking an expense.

It has been noted during the preliminary data analysis that of the bottom 5 heads, four have base/valuation rates which are 50 per cent of total expense. Further, these four heads are such that expense made for these purposes can also be booked under other heads of expense, notably under 'employee welfare'. The head 'employee welfare' is general enough to legally include expenses such as 'scholarships', 'festival celebrations', etc. However, this would reduce the FBT liability due to the differential valuation bases for these 'heads' of expense. *Prima facie*, it may be the reason why heads with 50 per cent base are least contributing and also why the head 'employee welfare' is the largest contributing head. However, it would be simplistic to arrive at such a conclusion on the basis of the above notion.

The present tests could give us the required insight. It is safe to assume that there is some homogeneity in the nature of expenses incurred by entities engaged in the same economic or business activity. That is, for the Infotech ITES sector as a whole, it can be assumed that expenditure incurred on some 'head' say 'telephone' as a proportion of total expenses or some other similar parameter would be similar for most individual taxpaying entities. Based on this logic, the collection of FBT from a head as a proportion of total FBT collection for each individual taxpayer in the sample should show statistical homogeneity/equality for each combination of 'head' and 'sector'. If this is not the case, then there is some indication to show that the sample data are heterogeneous and that perhaps booking of expenses is arbitrary.

11.3 Test Results and Summary

A total of 418 chi-square tests were to be conducted, one each for each possible combination of 'sector' and 'head' (22 sectors × 19 heads). However, there were

no data in 18 instances relating to the expense head 'free tickets' and 'repair, running, depreciation of aircraft' for different sectors, so no tests could be conducted. Thus, a total of 400 chi-square tests were conducted.

The test results for two sectors, 'banking' (18 tests) and 'petrochemical' (19 tests), being the two largest contributing sectors, for all the heads are given in Tables 13 and 14. In the case of banking, the null hypothesis has been rejected in all the 18 tests, i.e., for all the heads, implying that the sample data are not homogeneous, even for a single combination. For the petrochemicals, the null hypothesis was rejected in 13 tests and accepted in 6 tests, showing some homogeneity in the sample data for accepted heads.

It is difficult to find meaningful patterns, results, inferences and insights from the results of all the 400 tests at first sight. Therefore, we look deeper into the results by summarising them (Table 15). Each cell of the matrix represents the result of the chi-square test for the sample data represented by that cell.

Table 13 Banking Sector: Summary Results of Chi-square Tests for Homogeneity of Sample Data

FBT Head	χ^2 *Statistics*	*Null Hypothesis:* $p_0 = p_1 = \ldots = p_n$
Employee welfare	231.53	Rejected
Conveyance	241.82	Rejected
Telephone	139.04	Rejected
Repair, running, depreciation on car	221.23	Rejected
Sales promotion (and publicity)	204.17	Rejected
Use of hotel, boarding, etc.	467.94	Rejected
Touring and travel	73.21	Rejected
Gifts	337.39	Rejected
Contribution to superannuation funds	1388.68	Rejected
Conference	133.67	Rejected
Repair, running, depreciation on aircraft	–	–
Entertainment	231.53	Rejected
Hospitality	241.82	Rejected
Maintenance of guesthouse	139.04	Rejected
Scholarships	221.23	Rejected
Festival celebrations	204.17	Rejected
Other clubs	467.94	Rejected
Free/concessional tickets	73.21	Rejected
Health club	337.39	Rejected
Degrees of Freedom = $(n - 1) = 37$		

Source: Derived from data provided in Tables 4–9.

Table 14 Petrochemical Sector: Summary Results of Chi-square Tests for Homogeneity of Sample Data

FBT Head	χ^2 *Statistics*	*Null Hypothesis:* $p_0 = p_1 = \ldots = p_n$
Employee welfare	85.96	Rejected
Conveyance	34.24	Rejected
Telephone	7.15	Accepted
Repair, running, depreciation on car	104.00	Rejected
Sales promotion (and publicity)	891.79	Rejected
Use of hotel, boarding, etc,	285.98	Rejected
Tour and travel	175.21	Rejected
Gifts	56.76	Rejected
Contribution to superannuation funds	2045.67	Rejected
Conference	54.83	Rejected
Repair, running, depreciation on aircraft	98.02	Rejected
Entertainment	2.05	Accepted
Hospitality	22.51	Rejected
Maintenance of guesthouse	32.68	Rejected
Scholarships	15.94	Accepted
Festival celebration	7.25	Accepted
Other club	4.75	Accepted
Free/concessional tickets	47.80	Rejected
Health club	9.11	Accepted
Degrees of freedom = $(n - 1) = 9$		

Source: Derived from data provided in Tables 4–9.

'R' represents the cases when the null hypotheses have been rejected (and therefore we can conclude that the sample data are heterogeneous), whereas 'A' represents the cases where the null hypotheses have been accepted (and we can conclude that the sample data show homogeneity). 'X' marks the cells, where no test has been conducted due to the lack of data. Of 400 tests, in 99 instances (around 25 per cent of the total number of tests), the null hypothesis has been accepted. Therefore, overall, it can be concluded that there is not much statistical evidence to accept the null hypothesis and accordingly it is difficult to conclude that the sample data are homogeneous.

It is not the individual test results which are significant but the summary of these and the pattern of these results which throws valuable insights. From Table 15, we notice that the upper left corner has very few acceptances of the null hypothesis, whereas the occurrences of acceptances of the null hypothesis increases in the right side of the result matrix, which represents the least contributing heads, thereby implying that the sample data are more

Table 15 Summary Results of Chi-square Test for Equality of Sample Proportion

Factors		*Heads of FBT*																		
		EW	*Cnv*	*Tel*	*Car*	*Slp*	*Hot*	*Tor*	*Gft*	*Sup*	*Con*	*Air*	*Ent*	*Hos*	*GH*	*Sch*	*Fes*	*OC*	*Tkt*	*HC*
Sectors of economy	Bnk	R	R	R	R	R	R	R	R	R	R	x	R	R	R	R	R	R	R	R
	Petr	R	R	A	R	R	R	R	R	R	R	R	A	R	R	A	A	A	R	A
	Inf-S	R	R	R	R	R	R	R	R	R	R	x	R	R	R	R	R	R	R	A
	Inf-I	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	x	R
	Insur	R	R	R	R	R	R	R	R	R	R	x	A	R	A	R	A	R	x	R
	EleM	R	R	R	R	R	R	R	R	R	R	x	R	R	R	R	R	A	x	R
	SeFC	R	R	R	R	R	R	R	R	R	R	x	R	R	R	R	A	A	R	R
	Tele	R	R	R	R	R	R	A	R	R	R	x	A	R	R	A	A	A	x	A
	EngM	R	R	R	R	R	R	R	R	R	R	R	R	R	R	A	R	R	x	A
	PhDr	R	R	R	R	R	R	R	R	R	R	R	A	R	A	A	A	R	x	A
	PowE	R	R	R	R	A	R	R	R	R	R	R	A	R	A	A	A	R	x	R
	Divr	R	R	R	R	R	R	R	R	R	R	R	R	R	A	A	A	A	R	R
	Auto	R	R	R	R	R	R	R	R	R	R	R	R	R	R	A	A	R	R	A
	MinM	R	R	A	R	A	R	A	R	R	A	R	A	R	A	R	A	A	A	A
	Stl	R	R	A	R	A	R	A	R	R	A	R	A	A	A	A	A	A	x	A
	FMCg	R	R	R	R	R	R	R	R	R	R	x	A	R	A	A	A	A	x	A
	TrHC	R	R	R	R	R	R	R	R	R	R	R	R	R	R	A	A	A	R	A
	AgFd	R	R	A	R	R	R	R	R	R	R	R	R	A	R	A	R	R	x	R
	Const	R	R	A	R	R	R	A	R	A	R	R	R	R	R	A	R	A	x	A
	TrRtl	R	R	R	R	R	R	R	R	R	R	R	A	R	R	A	A	R	A	A
	MeEn	A	R	A	R	R	A	R	R	R	R	R	A	R	A	A	A	A	R	R
	ChFrt	R	R	A	R	R	R	R	R	R	A	R	A	R	R	A	A	A	A	A

Source: Derived from data provided in Tables 4–9.

Notes: R = Null hypothesis rejected.

A = Null hypothesis accepted.

x = No test conducted due to absence of data.

Table 16 Chi-square Test: Occurrence of Acceptance of Null Hypothesis for FBT Heads

FBT Head	*Valuation Base (% of Expense)*	*No. of χ^2 Tests Conducted*	*Number of Instances of Accepting Null Hypothesis*	*Percentage of Acceptance of Null Hypothesis*
Employee welfare	20	22	1	4.5
Conveyance	20	22	0	0
Telephone	20	22	7	31.8
Repair, running, depreciation on car	20	22	0	0
Sales promotion (and publicity)	20	22	3	13.6
Use of hotel, boarding, etc.	20	22	1	4.5
Tour and travel	5	22	4	18.2
Gifts	50	22	0	0
Contribution to superannuation funds	100@	22	1	4.5
Conference	20	22	3	13.6
Total		**220**	**20**	**9.1**
Repair, running, depreciation on aircraft	20	15*	0	0
Entertainment	20	22	11	50.0
Hospitality	20	22	2	9.1
Maintenance of guesthouses	20	22	8	36.3
Scholarships	50	22	15	68.2
Festival celebrations	50	22	15	68.2
Other clubs	50	22	12	54.5
Free/concessional tickets	100	11**	3	27.3
Health clubs	50	22	13	59.1
Total		**180**	**79**	**43.1**
Grand total		**400**	**99**	**24.7**

Source: Derived from data provided in Tables 4–9.

Notes: @Contributions up to Rs 1 lakh per employee per year are exempt.

*There are only 15 sectors for which this head has shown any collection, and in none of the instances has the null hypothesis been accepted.

**There are only 11 sectors for which this head has shown any collection and of these 11 tests, in only three instances has the null hypothesis been accepted.

homogeneous for this portion of the matrix. We also note that the head-wise pattern is more discernible than the sector-wise pattern. Accordingly, Table 16 further summarises the occurrences of the acceptance of the null hypothesis in absolute and in percentage terms for each FBT head. The heads have been

listed in decreasing order of their contribution to total collection. The table has been horizontally divided into two parts, thus listing the top 10 and bottom 9 heads separately.

11.4 Inferences and Insights into Tax Avoidance

Two distinct patterns are clearly discernable. For the top 10 heads, the occurrences of the acceptance of the null hypothesis are mostly between 0 and 15 per cent, except for the head 'telephone'. For this group of top 10 heads, overall, the null hypothesis has been accepted in 20 out of 220 (22 sectors × top 10 heads) instances of tests which give an acceptance percentage of 9. For heads 'conveyance', 'gifts' and 'maintenance of car', the null hypothesis has not been accepted even once. This shows that for these heads of expenses, the data for individual taxpayers are very heterogeneous.

On the other hand, it is easy to notice that in the bottom 9 heads, the occurrences of the acceptance of the null hypothesis have suddenly increased and are in the range of 30–70 per cent for all heads except for 'hospitality' and 'repairs, running, and depreciation on aircraft'. Overall, for the bottom 9 heads, 180 chi-square tests have been conducted, of which in 79 instances (43 per cent), the null hypothesis of equality/homogeneity of sample data has been accepted.

If we analyse the distribution of the acceptance of the null hypothesis for different sectors, the sample data have been found to be more homogeneous in some sectors, such as minerals metals, steel, chemical fertiliser and media entertainment, where the null hypothesis has been accepted in 8–11 instances of the test out of 19 tests, i.e., in about 50 per cent of the cases. On the other hand, for two sectors, namely banking and Infotech ITES, the null hypothesis has not been accepted even once, showing a high degree of heterogeneity of sample data for these sectors.

However, it is the distribution of test results according to the heads of FBT which throws some interesting insights. We have seen that for the top 10 heads, the sample data are not homogeneous, whereas for bottom 9 heads, the sample data are more homogeneous. Table 16 also shows the valuation base for each head of expense. It is easy to note that in heads with 50 per cent valuation base, most of which form the bottom 5 heads, the occurrences of the acceptance of the null hypothesis are significantly higher. Similarly, the top 10 heads, most of which have a 20 per cent valuation base, are most heterogeneous. The type of heterogeneity shown in the test by the top 10 heads is difficult to explain only on the basis of internal diversity and differences in individual organizations/taxpayers. What can we infer from this analysis?

It is natural for taxpayers to attempt to reduce their FBT liability, if legally possible. Due to the discretion given to booking expenses under different heads, it is logical to expect that taxpayers would be motivated to book more expenses under heads where the valuation base for the FBT is lower. From the results of the chi-square test, this appears to be the case. Taxpayers are perhaps taking advantage of the lack of a standardised method for the classification and booking of expenses, which is why data for heads with a lower base are most heterogeneous, representing arbitrary booking practices and are the largest contributing heads. This is not illegal and, to some extent, natural a particular expense always has the possibility of being included in more than one category of expenses. Using the same logic, generally heads with higher valuation bases are least contributing and the individual sample data are also more homogeneous because these are not experiencing arbitrary booking in. It should also be noted that a heterogeneous, arbitrary pattern emerges when not all taxpayers are cross-booking their expenses and that the cross-booking or shifting of expenses to other heads is random within the existing possibilities.

Further, perhaps for this reason, the head 'employee welfare' which is a wider category and can accommodate a large number of other expenses like gifts, other benefits, scholarships, etc., is the largest contributing head for FBT. Due to its very nature of being 'highly accommodative', it also shows a high level of heterogeneity, indicating perhaps a general trend of booking-in various kinds of expenses under this head. Other heads in the top 10, like 'conveyance', 'sales promotion' and 'tour and travel' are general enough for FBT taxpayers to book different kinds of expenses under them and therefore show high variability in booking practices.

The heads which least contribute 'gifts', 'scholarships', 'health club' etc., are specific in nature and it would be difficult to book other expenses under these heads, though it is easy and perfectly legal to book such expenses under 'employee welfare' or some other similar head. Further, there is no benefit of reduced tax liability by booking other expense under these heads with a 50 per cent valuation base. Similarly, the head 'telephone' is quite specific and it would be blatant to book other expenses under it, which is the reason for its high homogeneity; this however has a low valuation base of 20 per cent, which makes it attractive for cross-booking in.

On the basis of the above analysis, one is tempted to conclude that perhaps booking of expenses is being done in a manner to reduce FBT liability by business organisations, which is reflected in the higher heterogeneity of the sample data for wider FBT heads with 20 per cent valuation base. However, it may be

added that there is further scope for data mining and investigation to get deeper insights into this issue.

12. Concluding Observations

Only 3 years have passed since the introduction of the FBT in India. The above analysis of the collection pattern has given some interesting and important insights. First, there is high variability in the collections from different sectors of the economy and from different heads of FBT. Although only around half the heads of expenses forming the base of the FBT are significant and contribute as much as 90 per cent of the collection, it should not lead us to conclude that the least contributing heads should be removed from the FBT base. Significantly, the important FBT heads are almost the same for all the sectors of economy. Further analysis shows that these highly contributing 'heads' are those with a lower valuation base.

The FBT has been a controversial tax since its introduction. It has been criticised on many grounds—on the method of its valuation, deeming provisions which have increased compliance costs for taxpayers, on its apparent lack of logic in taxing expense, etc. On its part, the government has argued that there is no additional burden in terms of cost of compliance, and the deeming provisions have been introduced to make it simple and to make its collection and administration efficient.

It has been suggested that this tax should be replaced by a 'tax equivalent' surcharge on corporate income tax. This would translate into a flat rate surcharge of around 4 per cent on corporate tax. However, as we have seen in the previous paragraphs, there is wide variability in collection from different sectors, as well as from different heads of expenses. In such a situation, any flat surcharge would not be able to take these intrinsic differences into account. In any case, it should be noted that there is huge scope for further deliberation, research and empirical analysis of FBT collection data, through the involvement of all stakeholders, to gain valuable insights into the issue. This would contribute to informed discussion, reform of the FBT regime and overall improvements in tax policy formulation and the taxation structure of the Indian economy.

References

Aamir Aczel and Jayavel Sounderpandian (2006), *Complete Business Statistics, Sixth Edition*, New Delhi, India: Tata McGraw Hill.

Goon, A.M., M.K. Gupta and B. Dasgupta (2003), *Outline of Statistical Theory*, Vol II. Kolkata: World Press Limited.

Appendix A: The Model for the Test for Equality of Two Population Proportion

Here, we take p_1 = proportion of FBT collected from a head to total FBT, for the year 2006–07 and p_2 = proportion of FBT collected from a head to total FBT, for the year 2005–06.

Then, we have

Null hypothesis, H_0: $p_1 = p_2$

And alternate hypothesis, H_1: $P_1 \neq P_2$

We define $p = \dfrac{(n_1 p_1 + n_2 p_2)}{(n_1 + n_2)}$, where p is combined population proportion, n_1 = no. of observations in 2006–07 = 350, n_2 = no. of observations in 2005–06 = 350 and the sample standard deviation 'S' is given by

$$S = \sqrt{p(1-p)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}.$$

We calculate the Z-statistics as follows:

$$Z = \frac{(p_1 - p_2)}{S}.$$

The Z-statistics so calculated is then compared to the critical value of the Z-statistics. The critical value for a given level of confidence (it has been taken at 5 per cent in this case) is found by looking at the normal distribution table. It is a two-tailed test of hypothesis and the corresponding critical value which leaves 5 per cent area of the standard normal distribution in each of its tails (thus keeping 90 per cent area within the acceptable limits of critical value) is 1.645. Thus, if we have a value of the test statistic between the critical value of (–) 1.645 and (+) 1.645, we cannot reject the null hypothesis and if it is more than the critical value, the null hypothesis is rejected.

Appendix B: The Model for the Chi-square Test for Equality of Proportion

Twenty-two separate chi-square (χ^2) tests have been conducted, one for each sector. For each test in this model, there are two populations, being the proportion of FBT for 2 years and there are 17 categories of proportions within each population, one each for each head of FBT. The null hypothesis in this case is that the proportion of each head of FBT is equal across both the populations. The alternative hypothesis is that not all proportions are equal across all populations.

Mathematically,

H_0: $p_{1i} = p_{2i}$ for all i
H_1: At least one i not same

Where p_{1i} is the proportion of FBT collection for the ith head for 2006–07 and p_{2i} is the proportion of FBT collection for the ith head for 2005–06; there are in total 17 heads, i.e., i varies from 1 to 17.

Chi-square (χ^2) test statistics is calculated as follows:

$$\chi^2 = \sum_{i=1}^{n} \frac{(p_{1i} - p_{2i})^2}{p_{1i}} \quad \text{with } (n-1) \text{ degrees of freedom,}$$

where n is the total number of FBT categories, i.e., 17 and the degrees of freedom, thus, is 16.

The χ^2 statistic so calculated is compared from the critical value of the chi-square distribution for the given degrees of freedom and confidence level. In the present analysis, a confidence level of 95 per cent is taken and the critical value at this confidence level with 16 degrees of freedom is found to be 26.2962. Thus, if the test statistics, i.e., the χ^2 value calculated is less than the critical value, the null hypothesis is accepted; otherwise, it is rejected. When null hypothesis is accepted for a particular sector, it is concluded that the proportion of FBT collection for each head is statistically the same for both years being compared. Otherwise, it is not the same.

Appendix C: Mathematical Model for Two-factor ANOVA with Unequal Observations Per Cell

For conducting the ANOVA, the data on FBT collection for top 350 FBT payers for 2006–07 have been taken. The collection figures under each FBT head for each taxpayer has been converted into percentage of total contribution of FBT by the taxpayer. The data so obtained have been arranged into what is called two-way ANOVA layout. Table C1 depicts a portion of this layout. The first factor is 'sector'. There are 22 sectors and therefore we have 22 levels of this factor. We denote this factors as 'i' and the number of levels for this factor as $p = 22$. Similarly, there are 19 different FBT heads and therefore we have 19 levels for second factor. We denote this factor as 'j' and the number of levels for this factor as $q = 19$.

Thus, there are $(p \times q) = (22 \times 19) = 418$ 'combinations of levels' which are also called 'cells'. Each cell is considered a treatment. We have different sample sizes/observations for each of the cells/levels represented by 'sector' (i). That is, for the first level ($i = 1$) being 'agro-food beverage' in the factor 'sector', we have 15 observations. This number of observations remains the same for all levels of factor 'FBT heads' (for all $j = 1, \ldots, 19$). Similarly, for the second level ($i = 2$) being 'automobile ancillary' in the factor 'sector', we have 17 observations per cell which remain same for all the levels of factor 'FBT head'

Table C1 Portion of Two-Factor ANOVA Data Layout

		Factor 'FBT Heads' j = 1, …, 19 (q = 19)							
		j = 1 Free Ticket	*j = 2 Superannuation Fund*	*j = 3 Entertainment*	*j = 4 Hospitality*	*j = 5 Conference*	*j = 6 Sales promotion*	*j = 7 Employee Welfare*	*j = 8 Conveyance*
Factor 'Economy sector' *i* = 1, …, 22 (*p* = 22)	*i* = 1 agro-food beverage (for *i* = 1 level, we have 15 observations per cell for all the *j* levels)	0.00	4.97	0.00	0.84	2.48	64.49	1.84	3.39
		0.00	1.50	0.23	0.29	1.30	75.13	2.88	1.75
		0.00	0.00	0.00	0.00	6.43	37.98	12.26	16.64
		0.00	17.02	0.06	0.25	3.64	22.37	15.43	10.52
		0.00	8.32	8.83	0.00	6.79	0.23	10.52	12.79
		0.00	2.96	0.72	0.53	2.28	40.68	10.66	3.38
		0.00	20.29	0.00	0.00	0.00	58.55	4.39	3.49
		0.00	1.13	1.74	2.00	2.33	1.99	45.06	10.50
		0.00	2.54	0.02	0.00	5.10	62.74	1.88	16.94
		0.00	13.41	0.46	0.00	11.60	9.35	13.98	9.13
		0.00	0.97	1.04	0.54	4.74	24.93	7.35	11.65
		0.00	3.68	1.60	0.07	0.75	7.13	37.17	1.03
		0.00	0.00	0.03	0.08	0.63	87.78	2.26	4.44
		0.00	4.27	0.98	0.00	1.44	4.01	9.70	10.05
		0.00	12.66	0.26	0.00	8.84	3.80	7.66	13.56

$i = 2$ automobile ancillary (for $i = 2$ level, we have 17 observations per cell for all the j levels)	0.00	1.31	1.17	2.02	4.45	15.37	18.55	3.70
	0.00	0.19	1.77	5.61	7.28	36.78	9.27	3.08
	0.00	7.83	1.01	0.00	3.03	2.28	13.76	5.69
	0.00	2.80	0.75	0.00	0.00	46.18	12.49	2.77
	0.00	1.97	2.51	0.39	1.16	14.32	10.59	5.28
	0.00	5.13	2.74	0.00	8.40	6.26	16.22	16.53
	0.00	1.60	6.36	2.19	17.79	2.51	10.60	10.79
	0.00	0.38	0.00	0.48	2.80	15.95	29.53	8.00
	0.00	13.29	2.90	0.00	0.26	0.00	8.83	0.00
	0.00	87.77	0.08	0.24	0.03	0.05	3.50	0.96
	48.68	1.83	0.48	0.95	1.83	8.21	4.28	2.01
	0.00	1.64	1.18	0.00	0.02	0.86	38.80	26.68
	0.02	1.46	0.31	0.12	2.41	8.78	17.26	8.67
	0.00	4.60	3.77	0.29	0.00	0.00	10.35	0.77
	0.00	0.73	0.80	0.53	6.55	22.78	12.94	5.72
	0.00	4.02	0.00	0.51	5.94	1.97	7.58	4.98
	0.00	0.30	4.34	0.04	0.47	0.49	13.05	2.15
	0.00	0.03	4.80	0.20	0.45	7.01	10.86	50.59
$i = 3$ banking	0.00	1.75	0.36	0.33	6.88	5.95	32.54	8.95

(for all $j = 1, \ldots, 19$) and so on. Thus, depending upon the 'sector', the sample size is different which makes the number of observation different in different cells. This has made the task of calculating the required statistics a bit tedious.

The two-factor ANOVA model, than, can be written as

$$X_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijk},$$

where μ is the overall mean, α_i is the effect of level i ($i = 1, \ldots p$) of factor 'sector'; β_j is the effect of level j ($j = 1, 2, \ldots, q$) of factor 'FBT head'; $(\alpha\beta)_{ij}$ is the interaction effect of levels i of factor 'sector' and level j of factor 'FBT head'; and ε_{ijk} is the error associated with the kth data point from level i of factor 'sector' and level j of factor 'FBT head'. The assumption here is that error term β_{ijk} is normally distributed with mean 0 and variance σ for all i, j and k.

Accordingly, three separate hypotheses have been formulated for the three corresponding questions. These are as follows:

(1) H_0: $\alpha_i = 0$ for all $i = 1, 2, \ldots, p$
H_1: Not all α_i's are 0.

(2) H_0: $\beta_j = 0$ for all $j = 1, 2, \ldots, q$
H_1: Not all β_j's are 0.

(3) H_0: $(\alpha\beta)_{ij} = 0$ for all $i = 1,2, \ldots, p$ and $j = 1, 2, \ldots, q$
H_1: Not all $(\alpha\beta)_{ij}$ are 0.

The first hypothesis test is designed to determine whether there is any factor 'sector' main effects. That is, the null hypothesis is true if and only if there are no differences in means due to the different treatments of factor 'sector'. Similarly, the second hypothesis will detect evidence of any factor 'FBT head' being main effects. The third hypothesis test is for the existence of 'interaction' between levels of the two factors 'sector' and 'FBT head'. In conducting the two-factor ANOVA, the third hypothesis is tested first. That is, the hypothesis relating to 'interaction effect' is to be first checked. The further course of action is depended on the result of this test of 'interaction effect'.

Formulae for Calculation of Test Statistics

Various statistics required for conducting ANOVA are to be calculated. These are sum of squares for error (*SSE*); sum of squares for interaction between two factors namely 'sector' and 'FBT head' [called *SS*(*Es* – *Fh*)]; sum of squares for factor 'sector' [called *SS*(*Es*)] and sum of squares for factor 'FBT head' [called *SS*(*Fh*)]. The important thing to note here is that the total sum of squares is partitioned into a part due to factor 'sector', a part due to factor 'FBT head', a part due to interaction of the two factors and a part due to 'error'.

Notations and formulae used for calculating different sum of squares for the present study are given below. A detailed analysis/treatment of this topic can be found in any advance book on statistical theory. In the present case, reference has been made to (Goon et al. 2003).

Let

X_{ijk} = kth data point from level i of factor 'sector' and level j of factor 'FBT head',

X_{000} = Grand mean.

Then,

$$SSE = \sum_i \sum_j \sum_k (x_{ijk} - x_{ij0})^2 \text{ with } (N - pq) \text{ degrees of freedom,}$$

$SS\ (Es - Fh) = (S_t^2 - SSE)$ with $[(p-1)(q-1)]$ degrees of freedom,

$$\text{where } S_1^2 = \sum_i \sum_j \sum_k x_{ijk}^2 - \sum_i \left(C_j - \sum_j q_{ij} R_i \right) \beta_j - \sum_i \left(\frac{R_i^2}{n_{i0}} \right)$$

and $C_j = \sum_i \sum_k x_{ijk}$ being total of jth level summed over all k elements in all i levels,

$R_i = \sum_j \sum_k x_{ijk}$ being total of ith level summed over all k elements in all j levels,

$n_{i0} = \sum_j n_{ij}$ being number of observations in each cell for the ith level summed for all j levels,

$$q_{ij} = \frac{n_{ij}}{n_{i0}},$$

$\beta_j = \frac{1}{n_{0j}} \sum_i \sum_k x_{ijk} - x_{000}$ where x_{000} is the grand mean and is the number of observations in each cell for the jth level summed over all ith level. It is 350 in our case.

We may note that in the present analysis, $p = 22$ being the number of levels for factor 'Economy sector' and $q = 19$ being the levels for factor 'FBT head'. Further, N is the grand total number of all the observations. It may also be noted that for a given i (factor Es), all j (factor Fh) cells have the same number of observation. This is because we have same number of taxpayers for a particular class of 'sector' data of which has been taken for all FBT heads. This gives us value of $q_{ij} = \frac{n_{ij}}{n_{i0}} = \frac{1}{19}$ for all cases being combinations of i and j.

Further,

with $(p-1)$ degrees of freedom,

$$\text{where } S_2^2 = \sum_i \sum_i \sum_k \left(x_{ijk} - \frac{C_j}{n_{0j}} \right)^2 \text{ with } (N - q) \text{ degrees of freedom}$$

and

$SS(Fh) = (S_3^2 - S_1^2)$ with $(q - 1)$ degrees of freedom,

where with $S_3^2 = \sum_i \sum_j \sum_k \left(x_{ijk} - \frac{R_i}{n_{i0}} \right)^2$ $(N - p)$ degrees of freedom,

$$SST = \sum_i \sum_j \sum_k (x_{ijk} - x_{000})^2.$$

After calculating the above sum of squares, we divide them by their respective degrees of freedom to obtain mean squares (MS). Mean squares have been calculated for factor 'FBT heads' [$MS(Fh)$], 'sectors' [$MS(Es)$], 'interaction effect' [$MS(Es - Fh)$] and 'error' [MSE].

ANOVA Table and Test Results

The degree of freedom for each situation is determined and an ANOVA table is constructed. Since there are p levels of the factor sector, the degree of freedom for this factor is $(p - 1)$. Similarly, there are $(q - 1)$ degrees of freedom for factor 'FBT head' and there are $(p - 1)(q - 1)$ degrees of freedom for interactions effect of 'sector' and 'FBT head'. The degrees of freedom for 'error' are $(N - pq)$. The total degrees of freedom are $(N - 1)$. The F-ratio for each of the hypothesis test is the ratio of the appropriate mean square to the mean square error. That is for test of factor 'sector' main effects, we use $F = MS(Es)/MSE$. Generally, an ANOVA table is constructed by showing all these summary calculations. A stylised ANOVA table is given in Table C2.

Table C2 ANOVA Table for Two-factor Analysis

Source of Variation	*Sum of Squares*	*Degrees of Freedom*	*Mean Square*	*F-ratio*
Factor 'sector'	$SS(Es)$	$(p - 1)$	$MS(Es) = \frac{SS(Ea)}{(p-1)}$	$F = \frac{MS(Es)}{MSE}$
Factor 'FBT head'	$SS(Fh)$	$(q - 1)$	$MS(Es) = \frac{SS(Fh)}{(q-1)}$	$F = \frac{MS(Fh)}{MSE}$
Interaction effect	$SS(Es - Fh)$	$[(p - 1)(q - 1)]$	$MS(EsFh) = \frac{SS(EsFh)}{(p-1)(q-1)}$	$F = \frac{MS(EsFh)}{MSE}$
Error	SSE	$(N - pq)$	$MSE = \frac{SSE}{(N - pq)}$	
Total	SST	$(N - 1)$		

The degrees of freedom associated with each *F*-ratio are the degrees of freedom of the respective numerator and denominator (the denominator being the same for all the three tests). For the testing of factor 'sector' main effects, the test statistics is the first *F*-ratio in the ANOVA table. When the null hypothesis is true, the ratio $F = MS(Es)/MSE$ follows an *F*-distribution with $(p-1)$ degrees of freedom for the numerator and $(N-pq)$ degrees of freedom for the denominator. This distribution is denoted by $F_{[(p-1),(N-pq)]}$.

Appendix D: Model for 'Chi-square Test of Homogeneity of Sample Data'

The chi-square test has been used in this section as 'test of homogeneity of sample data'. The test has been conducted for 2006–07 only because the data for this year are more stable and balanced. The null hypothesis in this case is that the proportions of FBT collection from all individual taxpayers in the sample of a given combination of 'sector' and 'head' are statistically similar (to that of the average value). Alternatively, at least one sample proportions is not equal. Separate chi-square tests have to be conducted on sample data set/cells present in each possible combination of 'head' and 'sector'.

Mathematically,

H_0: $p_1 = p_2 = p_3 = \ldots = p_n$
H_1: At least one p_n not the same

Where p_n is the proportion of FBT collection from *n*th FBT payer in the sample for a particular combination of 'sector' and 'Head' and *n* is total number of FBT payers in the sample representing a particular combination of 'sector' and 'head'.

We define p_0 as the sample average of proportion of FBT collection for a particular combination of 'sector' and 'head'; p_0 can also be called expected proportion or average proportion.

Chi-square (χ^2) statistics is then calculated as follows:

$$\chi^2 = \sum_{i=1}^{n} \frac{(p_1 - p_0)^2}{p_0} \text{ with } (n-1) \text{ degrees of freedom.}$$

The χ^2 statistics so calculated is compared form the critical value of chi-square distribution for the required degree of freedom and confidence level (taken to be 95 per cent in this case). For each of the economy sector, sample sizes are different which gave different *n* and different values for degree of freedom as $(n-1)$. The sample size of different sectors of the economy varies between 38 (banking) and 7 (steel). Accordingly, the critical values of χ^2 are different for different sectors of economy as they depend on size of sample also. Finally, if the test statistics, i.e., χ^2 value calculated is less than the critical value, null hypothesis is accepted, otherwise it is rejected.