The Measurement of Tax Elasticity in India: A Time Series Approach

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A Time Series Approach

"It was only for the good of his subjects that he collected taxes from them, just as the Sun draws moisture from the Earth to give it back a thousand fold" –

--Kalidas in Raghuvansh eulogizing KING DALIP.

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Abstract

Revenue generation is an important goal of tax reform. The built-in responsiveness of revenues to changes in income, tax elasticity, provides very critical information for tax policy formulation. This paper utilises a time series approach to empirically estimate tax elasticities for India for the period 1991-2010. Tax elasticities are computed for income, turnover, excise, import and total taxes for the post-reform period. The elasticity coefficients reveal a low responsiveness of taxes to income growth and the value being less than unity in most of the cases.

1. Introduction

It is essential to estimate built-in tax elasticity or tax elasticity which measures percentage increase in tax revenue due to the changes in the base caused by a one percent rise in GDP. However, estimation suffers from a specification bias due to the lack of an observable quantitative variable capable of reflecting all changes in an individual (or overall) tax system in public finance.

As the primary purpose of tax policy adjustment in developing countries is to increase the revenue, the study of tax elasticity and various parameters affecting tax collection becomes important. An elastic tax system is desirable especially to developing countries. It is also important for revenue forecasting purposes, for analyzing the automatic stabilizing property of tax system and examining the progressivity of tax system.

Tax elasticity is defined as

$$\mathbf{TE = \%\Delta Revenue \div \%\Delta Base}. \quad \text{-------------------------------} \ (1)$$

Revenue is calculated as it would have been if there were no changes in the tax laws, including the tax rates or bases. Thus the tax elasticity is a hypothetical construct. It tries to reconstruct what would have happened if there had been no changes in the tax rules - i.e. what tax revenue would have been if last year's laws continued to apply this year. The increases are measured in real terms i.e., after adjusting for inflation for an unbiased analysis and result.

There are varieties of taxes, such as import tax, export tax, excise tax, sales/value added/turnover tax, and corporate income tax and so on; throughout this study, the term "individual tax" will be used to refer to each of these taxes. Each tax has its own tax system--a set of laws and regulations governing the process of estimation, assessment and collection of its corresponding tax revenue--which will be called the "individual tax system". The term "discretionary tax measures (DTMs)" will be used to describe changes in these systems which include changes in statutory tax rates, tax bases, tax allowances and credits, and of tax administrative efficiency.

Above equation of tax elasticity (TE) gives rise to a new definition of elasticity as the ratio of the Marginal Tax Rate (MTR) to the Average Tax Rate (ATR).

$$TE = MTR/ATR \quad \text{--} \ (2)$$

Where

$$\begin{aligned} MTR \quad &= \Delta T / \Delta Y \quad \text{--} \ (3) \\ &= dt/dy \\ &= T'(Y) \end{aligned}$$

And

$$ATR \quad = T/Y \ \text{---} \ (4)$$

This paper discusses the tax elasticity in the context of Indian Tax System from the period of 1991 to 2010. It attempts to provide insight to revenue responsiveness of Indian tax structure. Though there are number of methodologies employed to determine the tax elasticity this paper resorts to the traditional time series regression model to empirically examine tax elasticity of tax structure. Other methodologies are not considered mainly because of the data requirement by them. The rest of the paper is organized as follows. Section 2 discusses about the historical review of Indian tax structure. Section 3 outlines various international and national studies in this area of research. Section 4 states the research design and the paper goes on to Analysis of data and findings according to the relevant models run.

2. Historical Background

There are two types of taxes viz., 1) Direct taxes (eg. Income tax, Wealth tax) and 2) Indirect taxes (eg. Custom duty, Excise duty etc.). Direct taxes are the taxes which are not shifted i.e., the incidence of of which falls on persons who pay them to the Government. Similarly Indirect taxes are the taxes in which the burden of paying Tax is shifted through a change in price.

Direct taxes come under progressive taxation. It creates better civic consciousness. It also serves the purpose of transference of income from rich to poor.

Indirect taxes are difficult to evade. It is generally included in the price. Indirect taxes on drinks, narcotics and tobacco serve a social purpose by discouraging their consumption.

Indian tax system is characterized by : a) High dependence on indirect taxes b) low average effective tax rates and tax productivity c) High marginal effective tax rates and large tax-induced Distortions on investment and financing decisions.

Income tax in India was introduced in 1860 , discontinued in 1873 and reintroduced in 1886. More than 130 countries worldwide have introduced VAT, India being one of the last few to introduce it. VAT was introduced in 1999 and was implemented in April,2005 in some states. Tax revenues form about 20% of the total national income of India (2005-2006). Amongst the third world countries India is one of the high taxes countries.

Among the working 40% working population only 2.5% are liable to pay income tax in India. So we can say that Indian tax structure relies on a very narrow population base. Agricultural income is wholly exempt from the income tax despite the fact that a new class of rich farmers have emerged in country who can easily pay taxes. Service sector which accounts for more than 50% of GDP contributes just 7.8% towards tax revenue and 0.8% towards GDP. The cost of collection of tax has increased from Rs. 543 crores in 1990-91 to more than Rs. 3663 crores in 2006-2007

3. Literature Review

a. International Context

While researching about tax elasticity in his paper “An Econometric Method for Estimating the Tax Elasticity and the Impact on Revenues of Discretionary Tax Measures” , Jaber Ehdaie classifies all the individual taxes to major five categories (1) corporate income tax, (2) other direct taxes (individual income tax, social security, payroll tax, tax on property and other taxes on net income and profits), (3) import tax (tariff/customs duties and other charges), (4) tax on exports, and (5) tax on domestic consumption (general sales, turnover or value added taxes, selective excises on goods and services, taxes on use of goods or property and permission to perform activities, stamp tax and other domestic indirect taxes).

There is not a single economic channel through which changes in the individual tax systems affect individual tax bases. Because of this this paper uses private consumption, imports, exports, value added in non-agriculture sector and GDP respectively as proxy variables for potential tax bases of domestic consumption tax, import tax, export tax, corporate income tax and other direct taxes.

The major part of this analysis lies in demonstrating that the elasticity of reported income is not a primitive parameter and it identifies strength of its dependence on a particular administrative instrument of the tax base. It turns out that the elasticity of taxable income varies systematically with the tax base and that this effect is quantitatively important. (Wojciech Kopczuk 2003)

Wojciech Kopczuk (2003) argues that there are two major aspects of the tax system that are responsible for determining the broadness of the tax base. First, deductions and adjustments explicitly exclude parts of income from taxation. As they vary, the tax base of the taxpayer varies. Second, tax bases of itemizers and non-itemizers are different. Importantly, the effects of such changes vary also cross-sectionally. Changes in the standard deduction affect the itemization status (and therefore the tax base) only of those individuals whose gain from itemization are small enough. The elimination of charitable deduction for non-itemizers affects the tax base of people making charitable contributions but not of the others. Changes in the medical deduction affect the tax base of itemizers who have high enough medical expenses. These effects can interact suggesting that the tax base effects are not simple functions of income (and, therefore, aiding in the identification of the effect).

The elasticity of income determines only the cost of taxation, while any complete analysis of policy requires understanding benefits as well. There may be trade-offs involved in the choice of tax base to the extent that deductions from the tax base are socially beneficial on, for example, redistributive grounds. Also, a broader tax base may feature different administrative costs (Yitzhaki, 1979; Wilson, 1989).

The inverse relationship between tax rates and revenue is mentioned by Adam Smith in The Wealth of Nations (1776) –

> *High taxes, sometimes by diminishing the consumption of the taxed commodities, and sometimes by encouraging smuggling, frequently afford a smaller revenue to government than what might be drawn from more moderate taxes. (Book V, Chapter II)*

After the introduction of the Laffer curve in 1974, the quality of debate deteriorates significantly. Jude Wanniski (1978) chronicles every fiscal catastrophe from the fall of the Roman Empire to the Great Depression and attributes each of them to some tax hike occurring within a few years in either direction. At various points in his analysis Wanniski suggests (a) that the mere existence of a prohibitive range implies taxes should be reduced, (b) that the peak of the curve is at a 25 percent tax rate, and (c) that the peak of the curve "is the point at which the electorate desires to be taxed".-' The welfare maximizing government would operate somewhere on the normal range with the size of its budget determined by standard cost—benefit analysis.

For the opposition, Kiefer (1978) asserts that there is no tax rate for the overall economy which can be measured on the horizontal axis, and that "the Laffer Curve represents a gross simplification of a major portion of macro-economics into a single curved line." These arguments are not compelling, either, in view of the large number of economic models which oversimplify in order to comprehend and convey economic phenomena. Kiefer also begrudges the supply-side concentration, reminding us that income and substitution effects tend to be offsetting. "By concentrating primarily on incentive and supply-side effects, the Laffer Curve largely ignores the actual mechanism by which fiscal policy exerts its biggest and most immediate impact - demand side effects." One gets the feeling that these antagonists are talking past

Tax Stability: The revenue from different taxes varies from year to year. Taxes whose revenue is relatively stable, or whose revenue is negatively correlated with the revenue from other taxes, are likely to be particularly helpful in giving stability to the overall stream of revenue. Revenue stability is desirable, at least from the government's perspective, in that it makes it easier to put together plausible spending and borrowing plans for the year ahead. A simple measure of the stability of tax revenue is the coefficient of variation (CV), which is defined as the standard deviation of tax revenue (as a fraction of GDP usually) divided by its mean; i.e.

Coefficient of Variation = Standard Deviation ÷ Mean.

b. National Context

In estimating the built-in elasticity of a tax either the time series data on tax revenues need to be adjusted to eliminate the effects of discretionary tax measures, or a suitable estimation methodology has to be adopted. The most appropriate method would clearly depend upon the availability, nature and reliability of information on tax revenues, discretionary changes in the tax structure and tax bases. Over the years, at least four approaches have been used :

(1) Proportional adjustment;

(2) Constant rate structure;

(3) Divisia index; and

(4) Econometric methods.

In the Indian case, estimates of tax yields arising out of discretionary changes in tax rates and coverages are routinely available in the budget documents. Therefore, the application of the proportional adjustment method is perfectly feasible for estimating tax elasticities in India. There have been several such attempts, but the weight of general opinion is that these estimates are not particularly accurate, primarily because of the questionable reliability of the budget estimates of the effects of the discretionary changes. This judgment is based primarily on comparisons between the predicted and the actual tax collections for in-sample forecasts. (Pronab Sen)

The result of this dissatisfaction with the methodology has been that the use of elasticity estimates in forecasting tax collections has all but ceased in India, and recourse is increasingly being taken to the use of buoyancy estimates for most analytical purposes. Pronab Sen argues that this is unfortunate, since the use of buoyancies in making forecasts or projections implicitly assumes that there is a well-defined trend in the discretionary changes that have been made in the past, and that this trend will continue in the future as well.

4. Research and Design:

Objectives:

To determine Tax Elasticity for India from period 1990-91 to 2009-2010

Variable Selection:

For the purpose the variables used for the study purpose are:

LTDT: Natural Log Total Direct Tax

LTIDT: Natural Log Total Indirect Tax

LGT: Natural Log Gross Tax

LGDPF: Natural Log GDP at current prices factor cost

LGDPM: Natural Log GDP at current prices market price

The data pertaining to Direct, Indirect and Gross tax is only taken as there is no discretionary tax changes data available for the various constituents of the Indirect tax such as Customs, Excise and Service tax for India. This has put limitation of a more meaningful study.

The tax revenue and corresponding tax base will be taken as shown below:

Tax Revenue	Proxy Base
Direct Tax	GDP current at factor cost
Indirect Tax	GDP current at factor cost
Gross Tax	GDP current at market price

Sample Selection:

The data pertaining to taxes and the GDP has been taken from the RBI database:

http://dbie.rbi.org.in/InfoViewApp/listing/main.do?appKind=InfoView&service=%2FInfoViewApp%2Fcommon%2FappService.do

The data pertaining to the discretionary changes in tax and the resultant revenue loss/gain has been taken from the Budget speeches from 1991-92 to 2009-2010:

http://indiabudget.nic.in/

Time Period:

The time period selected for the study is between1991-92 and 2009-2010. The reason for the same is that there has been structural break in 1990-91 in Indian scenario due to various LPG policies adopted by India and opening up of its economy. From the tax base perspective there has been phenomenon changes starting this period and thus only this part is relevant for the study. Using data prior to 1990-91 with later data will result in spurious results and thus incorrect model.

5. Methodology:

We will first convert our tax revenue series to the adjusted form, adjusting for the discretionary changes in the tax over the years. Our base year will be 1991-92 and thereon we will adjust our tax revenue as shown below:

$$AT_{n-1} = T_{n-1} \left(T_n / T_n - D_n \right)$$

Where,

AT_{n-1} = the Adjusted Tax

T_{n-1}=actual Tax revenue

D_n = Revenue effect of discretionary changes

For the reference year we will have:

$$AT_n = T_n$$

Now the time series based regression model will be used to perform the study. Tax buoyancies have been calculated to measure the effect of the discretionary changes in the various taxes. The estimation of the tax elasticity will be done through the regression analysis based on the partitioning approach where the tax elasticity will be divided into tax to base and base to income elasticity. The equations can be represented as shown below:

Tax to Base:

$$\ell n\ T = a + b\ \ell n\ X$$

Where:

T = Adjusted Tax revenue

X = Tax Base

Base to Income Elasticity:

$$\ell n\ B = a + c\ \ell n\ Y$$

Where:

B = Tax Base

Y = GDP at current market price

Now the coefficients calculated in above regression equations (b and c) can be used to give an overall estimate of the elasticity by using equation:

Overall elasticity = b*c

Limitations:

1) The data is for overall categories of direct tax and indirect tax only and should have been for the subgroups for better matching with the tax bases. At present it has lead to the generalization and thus the results will be very general in nature.
2) The data pertaining to 1991 and hence forth has been taken and so the number of observations are very less but the more data collection is restricted by the availability of coherent data in Indian perspective.

6. Analysis and Findings:

Stationarity Test: Using ADF Method

H0: The variable has a unit root

Variable	ADF(c,t,p)	t-Statistics	Prob.
LTDT	**ADF(0,0,0)**	7.871282	1.0000
LTIDT	**ADF(0,0,0)**	4.296678	0.9999
LGT	**ADF(0,0,0)**	6.584881	1.0000
LGDPF	**ADF(0,0,0)**	2.530098	0.9947
LGDPM	**ADF(0,0,0)**	2.324860	0.9922
ΔLTDT	**ADF(1,0,0)**	-3.783960	0.0123*
ΔLTIDT	**ADF(1,0,0)**	-1.681008	0.0869**
ΔLGT	**ADF(1,0,0)**	-2.947668	0.0606**
ΔLGDPF	**ADF(1,0,0)**	-2.809527	0.0790**
ΔLGDPM	**ADF(1,0,0)**	-2.797117	0.0795**

*Significant at 5% level

**Significant at 10% level

All series found to be stationery at first level of difference only.

Structural Break Tests:

We need not perform the Perron structural breakpoint test due to various reasons:

1) From the visual inspection the various taxes doesn't show any significant deviation
2) It is well known that the major structural break happens in 1990-91 for India and our data is after this time period only
3) The data set is too small to have any meaningful analysis of the structural break as significant observations are required prior as well as after the break pint for the analysis

Tax to Base Elasticity:

Direct Tax:

Direct Tax (t)	coefficient	Std. error	t-statistics	Prob
Constant	-12.35518	2.002790	-6.168981	0.0000*
GDP factor	1.625584	0.135115	12.03112	0.0000*
Direct tax (t-1)	0.639921	0.157910	4.052437	0.0012*
Adjusted R-Square	0.989600			
S.E. of Regression	0.091626			
Sum squared resid	0.117534			
F-statistics	762.2104*			

*Significant at 5% level

Indirect Tax:

Indirect Tax (t)	coefficient	Std. error	t-statistics	Prob
Constant	-1.197869	0.739448	-1.619951	0.1275
GDP factor	0.891738	0.050490	17.66178	0.0000*
Indirect tax (t-1)	0.453193	0.179174	2.529344	0.0241*
Adjusted R-Square	0.986652			
S.E. of Regression	0.059447			
Sum squared resid	0.049476			
F-statistics	592.3545*			

*Significant at 5% level **Significant at 10% level

Gross Tax:

Gross Tax (t)	Coefficient	Std. error	t-statistics	Prob
Constant	-5.355947	1.267525	-4.225516	0.0007*
GDP market	1.203048	0.084496	14.23786	0.0000*
Gross tax (t-1)	0.639060	0.132908	4.808301	0.0002*
Adjusted R-Square	0.991898			
S.E. of Regression	0.063000			
Sum squared resid	0.059535			
F-statistics	1041.608*			

*Significant at 5% level **Significant at 10% level

Base to Income elasticity:

Now in order to estimate base to income elasticity, we have a problem of existence of simultaneity bias in the equations. The GDP at factor cost and GDP at market price were all thought to be endogenous and so a 2-Stage Least square (2SLS) approach has to be adopted. Now for LGDPF we have:

$$LGDPF = \alpha + \beta\ LGDPM + €$$

But the LGDPM constitutes an endogenous variable in all the base to income and so need to be purged of the constituting stochastic content in the first stage of the 2SLS procedure.

FIRST STAGE:

$$LGDPM_t = \alpha + \beta\ LGDPM_{t-1} + \gamma\ LG + €$$

Where:

$LGDPM_t$: Log GDP at market price

$LGDPM_{t-1}$: Delayed Log GDP at market price

LG: Log of Government spending

Here Government spending (LG) and lagged value of LGDPM are two exogenous variables that have been used to estimate the fitted values in the first stage of the 2SLS. Now we will proceed to second stage where we will be using the fitted value (Y) in the equations to find the base to elasticity.

SECOND STAGE:

$$LGDPF_t = \alpha + \beta\, Y_t + €$$

Where:

$LGDPF_t$: Log GDP at factor cost

Y_t : Fitted value of Log GDP at market price

The results are as shown below:

Dependent Variable: GDP_FACTOR				
Method: Two-Stage Least Squares				
Date: 12/11/10 Time: 12:58				
Sample (adjusted): 1993 2009				
Included observations: 17 after adjustments				
Instrument specification: C GDP_MARKET GOVT_SPENDING GDP_MARKET(-1)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.16878	0.030211	-5.586858	0.0001

	4			
GDP_MARKET	1.005590	0.002076	484.2787	0.0000
R-squared	0.999936	Mean dependent var		14.45042
Adjusted R-squared	0.999932	S.D. dependent var		0.591270
S.E. of regression	0.004884	Sum squared resid		0.000358
F-statistic	234525.8	Durbin-Watson stat		1.492414
Prob(F-statistic)	0.000000	Second-Stage SSR		0.000358
J-statistic	5.992993	Instrument rank		4
Prob(J-statistic)	0.049962			

Dependent Variable: GDP_MARKET				
Method: Two-Stage Least Squares				
Date: 12/11/10 Time: 13:03				
Sample (adjusted): 1993 2009				
Included observations: 17 after adjustments				
Instrument specification: C GDP_MARKET GOVT_SPENDING GDP_MARKET(-1)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	-2.39E-12	6.19E-13	-3.864063	0.0015
GDP_MARKET	1.000000	4.26E-14	2.35E+13	0.0000
R-squared	1.000000	Mean dependent var		14.53794
Adjusted R-squared	1.000000	S.D. dependent var		0.587965
S.E. of regression	1.00E-13	Sum squared resid		1.50E-25
F-statistic	5.52E+26	Durbin-Watson stat		0.045565
Prob(F-statistic)	0.000000	Second-Stage SSR		1.36E-12
J-statistic	0.000120	Instrument rank		4
Prob(J-statistic)	0.999940			

Hence the elasticity can be summarized as below:

Tax Elasticity

Tax	Coefficient	SE
Direct Tax	1.625584	0.135115
Indirect Tax	0.891738	0.050490
Gross Tax	1.203048	0.084496

Tax Buoyancy

Tax	Coefficient	SE

Direct Tax	1.005590	0.002076
Indirect Tax	1.005590	0.002076
Gross Tax	1.000000	4.26E-14

Overall elasticity

Tax	Elasticity
Direct Tax	1.634671
Indirect Tax	0.896722
Gross Tax	1.203048

As can be seen from the results:

Tax Elasticity of Direct tax is high at 1.62 compared to other taxes and thus showing that changes in taxes has been higher than the changes in tax base and thus showing that more and more people from the tax base are paying more taxes. This is a healthy sign and can lead to lowering of effective tax rate with time. This can also be result of increasing effective tax rate for individuals and the corporate and thus showing the increasing tax burden. In former case the trend is favorable and in the later it is not. For indirect tax the elasticity is less than 1 and thus the chnge in tax revenue collection is not keeping up with the changes in the tax base. This shows that government has been lenient or conservative with the tax collection in indirect tax area. For overall gross tax collection the elasticity is again high at 1.2 and shows that govt has been able to get more tax revenue collection with relatively less changing tax base. It might be advantageous in short term in terms of revenues but in long run it can burden tax payers leading to more and more black money and non-disclosures.

In terms of tax buoyancy, both direct tax and indirect tax shows nearly 1 as elasticity as expected. There is no deviation from the expected results.

The overall elasticity remains same as tax elasticity as there is not much different from 1 for tax buoyancy.

7. Summary and Recommendations:

The overall outlook looks good for India as the elasticity calculated are high and more than 1 and thus shows that the tax revenue collections responds better to the changes in tax base and income. The collection always is more than change in the tax base and so either through higher effective tax rates or better compliance, the tax collections exceeds changes in the tax base.

APPENDIX

Data available:

Years	Total Direct Tax	Service Tax	Excise Tax	Customs	Indirect tax	Gross Tax	GDP at factor cost currect prices	Private consumption at market price	Private Consumption	Government Consumption	Imports of goods and service	GDP at current market price
1991-92	15207	NA	28110	22257	52059	67266	594168	451815	435723	74814	47850.8	654729
1992-93	18132	NA	30831	23776	56434	74566	681517	506915	490823	84720	63374.5	752591
1993-94	20298	NA	31697	22193	55392	75690	792150	581447	562932	98279	73101.0	865805
1994-95	26966	407	37347	26789	65328	92294	925239	669124	651951	109346	89970.7	1015764
1995-96	33563	862	40187	35757	77661	111224	1083289	769542	751734	129572	122678.1	1191813
1996-97	38891	1059	45008	42851	89871	128762	1260710	905672	886559	146933	138919.7	1378617
1997-98	48260	1586	47962	40193	90960	139220	1401934	981262	965339	173780	154176.3	1527158
1998-99	46600	1957	53246	48668	97197	143797	1616082	1130216	1121595	215232	178331.9	1751199
1999-2000	57959	2128	61902	48420	113794	171753	1786526	1257541	1253643	252744	215236.5	1952036
2000-01	68305	2613	68526	47542	120298	188603	1925017	1345583	1339274	265088	230872.8	2102314
2001-02	69198	3302	72555	40268	117862	187060	2097726	1470302	1467195	281786	245199.7	2278952
2002-03	83088	4122	82310	44852	133178	216266	2261415	1552618	1551365	290978	297205.9	2454561
2003-04	105089	7891	90774	48629	149259	254348	2538170	1703546	1699486	310297	359107.7	2754620
2004-05	132771	14200	99125	57611	172187	304958	2877701	1848110	1840406	338052	501064.5	3149407
2005-06	165216	23055	111226	65067	199433	364649	3282385	2064296	2055387	375562	660408.9	3586743
2006-07	230181	37597	117612	86327	241331	471512	3779384	2319826	2307822	421546	840506.3	4129173
2007-08	312213	51301	123425	104119	279134	591347	4320892	2605859	2596084	479099	1012311.7	4723400
2008-09	333818	60941	109343	99850	269680	603498	4933183	NA	2913386	616447	1374435.6	5321753
2009-10	379559	58484	104659	84244	247357	626916	NA	NA	NA	NA	1356468.7	5856569

Years	Changes in Direct Tax	Changes Service Tax	Changes Excise Tax	Changes Customs Tax	Changes in Indirect Tax	Changes in Gross Tax	Adjusted Direct Tax	Adjusted Indirect Tax	Adjusted Gross Tax
1991-92	2136	NA	1440	-744	696	3528	15916	52250	68513
1992-93	795	NA	2210	-2023	187	1169	17844	51161	64211
1993-94	-300	NA	-2249	-3273	-5522	-11344	18580	53574	70347
1994-95	-2430	NA	106	-2282	-2176	-6782	26277	64122	89286
1995-96	-900	NA	-311	-1179	-1490	-3880	34323	79208	115163
1996-97	912	NA	760	950	1710	4332	41198	87554	126649
1997-98	2651	NA	0	-2625	-2625	-2599	47342	99199	155773
1998-99	-950	220	5009	3304	8533	16116	49012	102742	151657
1999-2000	3100	NA	NA	NA	6234	9334	62988	115509	180104
2000-01	5080	NA	3252	-1428	1824	8728	63623	122867	188227
2001-02	-5500	NA	4677	-2128	2549	-402	74745	121890	200981
2002-03	6000	NA	6700	-2200	4500	15000	80848	136183	216553

2003-04	-2955	NA	NA	NA	3294	339	106638	149259	256000
2004-05	2000	NA	NA	NA	0	2000	137685	172187	309994
2005-06	6000	NA	NA	NA	0	6000	168109	201100	369325
2006-07	4000	NA	NA	NA	2000	6000	232414	241331	473940
2007-08	3000	NA	NA	NA	0	3000	312213	273205	585640
2008-09	0	NA	NA	NA	-5900	-5900	333818	271878	605429
2009-10	0	NA	NA	NA	2000	2000	379559	247357	626916

Stationarity Tests Results:

Null Hypothesis: DIRECT_TAX has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=0)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		7.871282	1.0000
Test critical values:	1% level	-2.699769	
	5% level	-1.961409	
	10% level	-1.606610	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 18

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DIRECT_TAX)
Method: Least Squares
Date: 12/10/10 Time: 23:28
Sample (adjusted): 1993 2010
Included observations: 18 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIRECT_TAX(-1)	0.016037	0.002037	7.871282	0.0000

R-squared	-0.006753	Mean dependent var	0.178736
Adjusted R-squared	-0.006753	S.D. dependent var	0.095927
S.E. of regression	0.096251	Akaike info criterion	-1.789766
Sum squared resid	0.157492	Schwarz criterion	-1.740301
Log likelihood	17.10790	Hannan-Quinn criter.	-1.782946
Durbin-Watson stat	1.975558		

Null Hypothesis: D(DIRECT_TAX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=0)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.783960	0.0123

Test critical values:	1% level	-3.886751
	5% level	-3.052169
	10% level	-2.666593

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 17

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DIRECT_TAX,2)
Method: Least Squares
Date: 12/10/10 Time: 23:30
Sample (adjusted): 1994 2010
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DIRECT_TAX(-1))	-0.985366	0.260406	-3.783960	0.0018
C	0.176243	0.053404	3.300172	0.0049

R-squared	0.488375	Mean dependent var	-0.002795
Adjusted R-squared	0.454267	S.D. dependent var	0.138221
S.E. of regression	0.102109	Akaike info criterion	-1.615419
Sum squared resid	0.156394	Schwarz criterion	-1.517394
Log likelihood	15.73106	Hannan-Quinn criter.	-1.605675
F-statistic	14.31835	Durbin-Watson stat	1.956256
Prob(F-statistic)	0.001801		

Null Hypothesis: INDIRECT_TAX has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=0)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		4.296678	0.9999
Test critical values:	1% level	-2.699769	
	5% level	-1.961409	
	10% level	-1.606610	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 18

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INDIRECT_TAX)
Method: Least Squares
Date: 12/10/10 Time: 23:33
Sample (adjusted): 1993 2010
Included observations: 18 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INDIRECT_TAX(-1)	0.007351	0.001711	4.296678	0.0005

R-squared	-0.021186	Mean dependent var	0.086581
Adjusted R-squared	-0.021186	S.D. dependent var	0.083804
S.E. of regression	0.084687	Akaike info criterion	-2.045760
Sum squared resid	0.121922	Schwarz criterion	-1.996295
Log likelihood	19.41184	Hannan-Quinn criter.	-2.038940
Durbin-Watson stat	1.240370		

Null Hypothesis: D(INDIRECT_TAX) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=0)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.681008	0.0869
Test critical values:	1% level	-2.708094	
	5% level	-1.962813	
	10% level	-1.606129	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 17

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INDIRECT_TAX,2)
Method: Least Squares
Date: 12/10/10 Time: 23:36
Sample (adjusted): 1994 2010
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INDIRECT_TAX(-1))	-0.302124	0.179728	-1.681008	0.1122

R-squared	0.140700	Mean dependent var	-0.009829
Adjusted R-squared	0.140700	S.D. dependent var	0.096331
S.E. of regression	0.089298	Akaike info criterion	-1.936661
Sum squared resid	0.127585	Schwarz criterion	-1.887649
Log likelihood	17.46162	Hannan-Quinn criter.	-1.931789
Durbin-Watson stat	1.812122		

Null Hypothesis: GROSS_TAX has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=0)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		6.584881	1.0000
Test critical values:	1% level	-2.699769	
	5% level	-1.961409	
	10% level	-1.606610	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 18

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GROSS_TAX)
Method: Least Squares
Date: 12/10/10 Time: 23:36
Sample (adjusted): 1993 2010
Included observations: 18 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_TAX(-1)	0.010211	0.001551	6.584881	0.0000

R-squared	0.000415	Mean dependent var	0.124009
Adjusted R-squared	0.000415	S.D. dependent var	0.079922
S.E. of regression	0.079905	Akaike info criterion	-2.161994
Sum squared resid	0.108543	Schwarz criterion	-2.112529
Log likelihood	20.45795	Hannan-Quinn criter.	-2.155174
Durbin-Watson stat	1.513294		

Null Hypothesis: D(GROSS_TAX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=0)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.947668	0.0606
Test critical values:	1% level	-3.886751	
	5% level	-3.052169	
	10% level	-2.666593	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 17

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GROSS_TAX,2)
Method: Least Squares
Date: 12/10/10 Time: 23:37
Sample (adjusted): 1994 2010
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GROSS_TAX(-1))	-0.768411	0.260684	-2.947668	0.0100
C	0.095353	0.039176	2.433935	0.0279

R-squared	0.366788	Mean dependent var	-0.003821
Adjusted R-squared	0.324574	S.D. dependent var	0.100690
S.E. of regression	0.082752	Akaike info criterion	-2.035816
Sum squared resid	0.102717	Schwarz criterion	-1.937791
Log likelihood	19.30444	Hannan-Quinn criter.	-2.026073

F-statistic	8.688748	Durbin-Watson stat	1.748350
Prob(F-statistic)	0.009981		

Null Hypothesis: GDP_FACTOR has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.530098	0.9947
Test critical values:	1% level	-2.717511	
	5% level	-1.964418	
	10% level	-1.605603	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 16

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP_FACTOR)
Method: Least Squares
Date: 12/11/10 Time: 00:02
Sample (adjusted): 1994 2009
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP_FACTOR(-1)	0.003548	0.001402	2.530098	0.0240
D(GDP_FACTOR(-1))	0.567181	0.152700	3.714351	0.0023

R-squared	0.432668	Mean dependent var	0.123714
Adjusted R-squared	0.392145	S.D. dependent var	0.027873
S.E. of regression	0.021731	Akaike info criterion	-4.703680
Sum squared resid	0.006611	Schwarz criterion	-4.607107
Log likelihood	39.62944	Hannan-Quinn criter.	-4.698735
Durbin-Watson stat	2.147327		

Null Hypothesis: D(GDP_FACTOR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.809527	0.0790
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 16

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP_FACTOR,2)
Method: Least Squares
Date: 12/11/10 Time: 00:03
Sample (adjusted): 1994 2009
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP_FACTOR(-1))	-0.462975	0.164788	-2.809527	0.0139
C	0.054938	0.021794	2.520842	0.0245

R-squared	0.360539	Mean dependent var	-0.004354
Adjusted R-squared	0.314863	S.D. dependent var	0.026284
S.E. of regression	0.021756	Akaike info criterion	-4.701386
Sum squared resid	0.006627	Schwarz criterion	-4.604812
Log likelihood	39.61109	Hannan-Quinn criter.	-4.696441
F-statistic	7.893444	Durbin-Watson stat	2.063007
Prob(F-statistic)	0.013917		

Null Hypothesis: GDP_MARKET has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.324860	0.9922
Test critical values:	1% level	-2.708094	
	5% level	-1.962813	
	10% level	-1.606129	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 17

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP_MARKET)
Method: Least Squares
Date: 12/11/10 Time: 00:06
Sample (adjusted): 1994 2010
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP_MARKET(-1)	0.003384	0.001456	2.324860	0.0345
D(GDP_MARKET(-1))	0.562801	0.162024	3.473566	0.0034

R-squared	0.360723	Mean dependent var	0.120694
Adjusted R-squared	0.318105	S.D. dependent var	0.027654
S.E. of regression	0.022836	Akaike info criterion	-4.610812
Sum squared resid	0.007822	Schwarz criterion	-4.512787
Log likelihood	41.19190	Hannan-Quinn criter.	-4.601068
Durbin-Watson stat	1.813243		

Null Hypothesis: D(GDP_MARKET) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.797117	0.0795
Test critical values:	1% level	-3.886751	
	5% level	-3.052169	
	10% level	-2.666593	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 17

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP_MARKET,2)
Method: Least Squares
Date: 12/11/10 Time: 00:06
Sample (adjusted): 1994 2010
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP_MARKET(-1))	-0.481019	0.171970	-2.797117	0.0135
C	0.054895	0.022477	2.442246	0.0275

R-squared	0.342793	Mean dependent var	-0.006091
Adjusted R-squared	0.298979	S.D. dependent var	0.026908
S.E. of regression	0.022529	Akaike info criterion	-4.637867
Sum squared resid	0.007614	Schwarz criterion	-4.539842
Log likelihood	41.42187	Hannan-Quinn criter.	-4.628123
F-statistic	7.823866	Durbin-Watson stat	1.767187
Prob(F-statistic)	0.013538		

Regression results:

Dependent Variable: DIRECT_TAX
Method: Least Squares
Date: 12/11/10 Time: 02:38
Sample (adjusted): 1993 2009
Included observations: 17 after adjustments
Convergence achieved after 6 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.35518	2.002790	-6.168981	0.0000
GDP_FACTOR	1.625584	0.135115	12.03112	0.0000
AR(1)	0.639921	0.157910	4.052437	0.0012

R-squared	0.990900	Mean dependent var	11.18303
Adjusted R-squared	0.989600	S.D. dependent var	0.898453
S.E. of regression	0.091626	Akaike info criterion	-1.783423

Sum squared resid	0.117534	Schwarz criterion	-1.636385
Log likelihood	18.15909	Hannan-Quinn criter.	-1.768807
F-statistic	762.2104	Durbin-Watson stat	2.283138
Prob(F-statistic)	0.000000		

Inverted AR Roots	.64

Dependent Variable: INDIRECT_TAX
Method: Least Squares
Date: 12/11/10 Time: 12:13
Sample (adjusted): 1993 2009
Included observations: 17 after adjustments
Convergence achieved after 6 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.197869	0.739448	-1.619951	0.1275
GDP_FACTOR	0.891738	0.050490	17.66178	0.0000
AR(1)	0.453193	0.179174	2.529344	0.0241

R-squared	0.988321	Mean dependent var	11.70277
Adjusted R-squared	0.986652	S.D. dependent var	0.514553
S.E. of regression	0.059447	Akaike info criterion	-2.648664
Sum squared resid	0.049476	Schwarz criterion	-2.501626
Log likelihood	25.51364	Hannan-Quinn criter.	-2.634048
F-statistic	592.3545	Durbin-Watson stat	1.807187
Prob(F-statistic)	0.000000		

Inverted AR Roots	.45

Dependent Variable: GROSS_TAX
Method: Least Squares
Date: 12/11/10 Time: 02:53
Sample (adjusted): 1993 2010
Included observations: 18 after adjustments
Convergence achieved after 6 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.355947	1.267525	-4.225516	0.0007
GDP_MARKET	1.203048	0.084496	14.23786	0.0000
AR(1)	0.639060	0.132908	4.808301	0.0002

R-squared	0.992851	Mean dependent var	12.25057
Adjusted R-squared	0.991898	S.D. dependent var	0.699908
S.E. of regression	0.063000	Akaike info criterion	-2.540353
Sum squared resid	0.059535	Schwarz criterion	-2.391958
Log likelihood	25.86318	Hannan-Quinn criter.	-2.519892
F-statistic	1041.608	Durbin-Watson stat	1.763938
Prob(F-statistic)	0.000000		

Inverted AR Roots	.64

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