George Washington University
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An Assessment of the Determinants of Sales Tax Dynamic in the Minas Gerais State

(01/1995 to 03/2003)

An Empiric Econometric Approach

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Abstract

In face of Supplementary Law 101 to Brazilian Constitution, of May 4, 2000 that establishes public finance rules enforcing responsibility in fiscal management, driven that responsibility in fiscal management presupposes well-planned and transparent actions to prevent risks and correct deviations that may affect the equilibrium of public accounts this study intends to make a research of **Determinants of Sales Tax Revenue Dynamic** using Multivariate model (Vector Auto Regression (VAR), testing the cointegration, Error Correction Model) and developing a **preliminary model** that allow make forecasts. This methodology represents the time series dynamic and for the objectives of this paper the model will use a small number of variable under the Hypothesis that the contamination of exchange rate to the prices and the industrial production dynamics have a strong explanatory power for the Sales Tax Revenue. The number of variables can be increased in future applications.

Table Contents

I-Introduction

In terms of budget forecast the value of information is linked to the ability to understand what happened in the past and use it to help project what probably will occur in the future.

In terms of necessity of information the needs were demanded by the SUPPLEMENTARY LAW 101 to Brazilian Constitution, OF MAY 4, 2000 that establishes public finance rules enforcing responsibility in fiscal management, driven that responsibility in fiscal management presupposes well-planned and transparent actions to prevent risks and correct deviations that may affect the equilibrium of public accounts**, by compliance with revenue and** expenditure results targets, **observing limits and satisfying conditions regarding tax breaks**, generation of personnel and social security expenditures, among others, consolidated and security debt, credit operations, including those involving revenue anticipation, guarantees issued and outstanding liabilities.

In that way the **Process of Planning of The Multiyear Plan (PPA)** creates the obligation to draw every year the Budgetary Directives Law that must comply with the provisions to achieve balance between revenues and expenditures, rules on cost control and evaluation of results of programs financed with budgetary resources.

Also the **Budgetary Directives Law** must enclose a Fiscal Target Appendix, which will set annual targets, in current and constant values, for revenues and expenditures, nominal and primary results, and the public debt, for the current and for the two subsequent years.

The Appendix must also contain an evaluation of compliance with the previous year's targets, statement of annual targets, accompanied by the methodology and the historical records of calculation that support the intended results, comparing these targets with those for the three previous years, and evidencing their consistency with the national economic policy premises and objectives and statement of estimate and offsetting of tax breaks and growth margin of permanent mandatory expenditures.

The Budgetary Guidelines Law must enclose a Fiscal Risk Appendix, evaluating contingent liabilities and other risks that may affect public accounts, and detailing the measures to be taken, should such occur.

In the message submitting the Federal Government's draft proposal must contain, in a specific appendix, the objectives of the **monetary, credit, and foreign exchange policies**, as well as **the parameters and projections for major aggregates and variables, and inflation targets for the subsequent year**.

The **Annual Draft Budgetary Law**, which must be consistent with the **Multiyear Plan (PPA),** the **Budgetary Directives Law**, and the provisions of this **Supplementary Law 101.** The Budgetary execution and the compliance with fiscal targets based on the term of the Budgetary Directives Law and in due compliance with the provisions in the Executive Branch must define, up to 30 (thirty) days after the publication of the budgets, the financial programming and the **monthly disbursement schedule**.

The objective of this paper is to develop a preliminary forecasting model for the collection of **Public Revenues** especially in the Sales Tax of Minas Gerais State (ICMSMG).

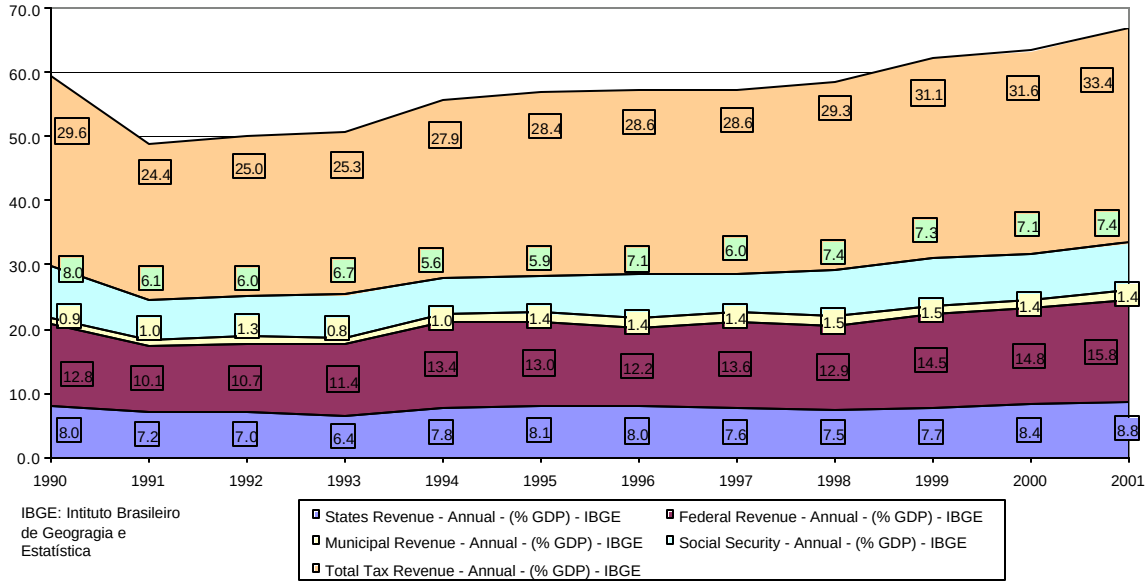
Fiscal management requires that the revenue forecasts must comply with technical and legal standards, taking into account the effects of changes in the legislation, in the price index variations, economic growth or any other relevant factor, and must be accompanied by a statement of its evolution in the last three years, a projection for the next two years, and the calculation methodology and premises adopted.

II- The Minas Gerais State

This Section intends to quickly draw the importance of the State of Minas Gerais in the framework of Brazilian Federation. Also will show in short the historic evolution of the tax system in percentage of the Gross Domestic Product (GDP) and the dynamic of macroeconomics variables in this specific period.

In this way looking back to the years of 1990 (year of the Collor Plan which had a strong impact of the tax revenue) the **Figure-1** shows the evolution of Tax Revenue as a % of Brazil GDP. There is increasing trend in of total amount of the tax revenue as a percentage of GDP in Brazil. Stressing the fact that Federal tax has passed from 10.1% in 1990 to 15.8% in 2001, the Social Security from 6.1% to 7.4%, the States Revenue from 7.2% to 8.8% and the Municipality from 1% to 1.4% of GDP, increasing 56.4%, 21.3%, 22.2% and 40% respectively.

Figure 1
Tax Revenue in % of Brazil GDP - Annual
Govermment Federal, States, Municipalities and Social Security
1990 - 2001



In this context, the State of Minas Gerais is the 3rd largest of the Brazil Federation either in tax revenue and GDP in fact, in these percentage is something about 10% and his economic structure in 2001 were Agriculture and Livestock Sector 7.8%, Industry Sector 42.8% and Services 49.4%. In terms of Brazil, Minas Gerais State represents something about 11% of national Agriculture and Livestock Sector, 10% of industry and 9% of services.

In the last two years, the economic performance Minas Gerais (MG) had been below the average rate of growth of 1.47% observed for Brazil, in fact this average rate was 0.85% per year and some reasons can explain this lower rate as follow:

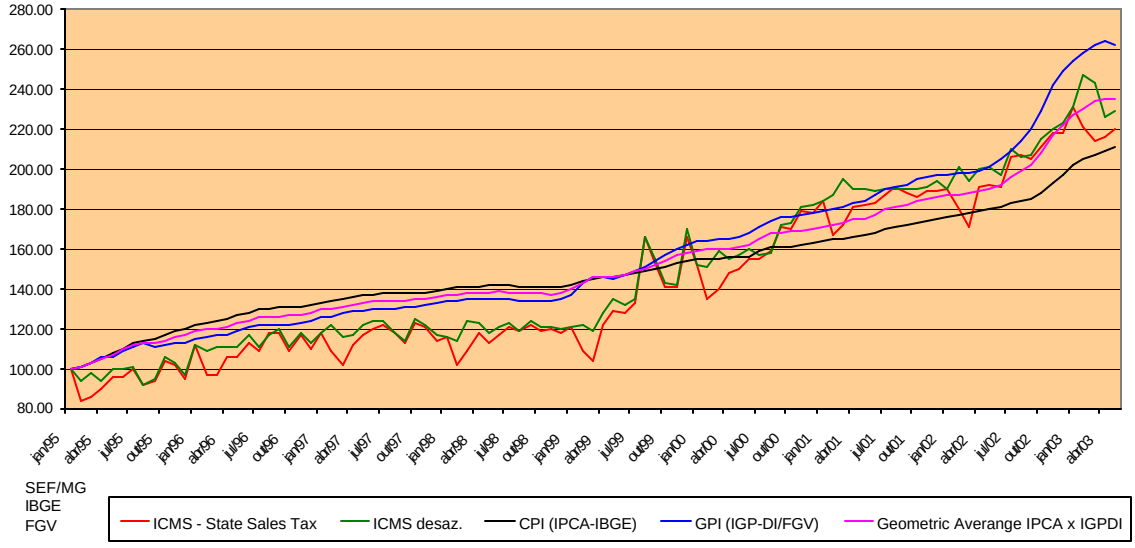
- The effects of crises on the rationing of electric energy were worse in MG because the intensive use of this factor of production in the important steel industry,

- A weak dynamic of export sector in the state, a function of exogenous shocks as a change in the international market oil,

- Changes in the Tax Sales derived from the Kandir Law (SUPPLEMENTARY LAW 87/1996 Brazilian Constitution that excludes mandatory payment of ICMS over exports of commodities, raw material and semi-manufactures since October of 1997. It was a very important loses in the Minas Gerais State revenue.

The **Figure-2** plots for Minas Gerais of the current values the ICMS, the ICMS desasonalized, the General Prices Index (IGP-DI of Fundação Getúlio Vargas) and the Consumer Price Index (IPCA of Instituto Brasileiro de Estatística – IBGE).

Figure 2
ICMS x ICMS Desazonalizaded x CPI (IPCA-IBGE) x GPI (IGP-DI x Averange Iindex (IGP e IPCA)
jan/95 a may/03
Índex Number for Corrente Values - jan/95 = 100
jan/95 a may/03

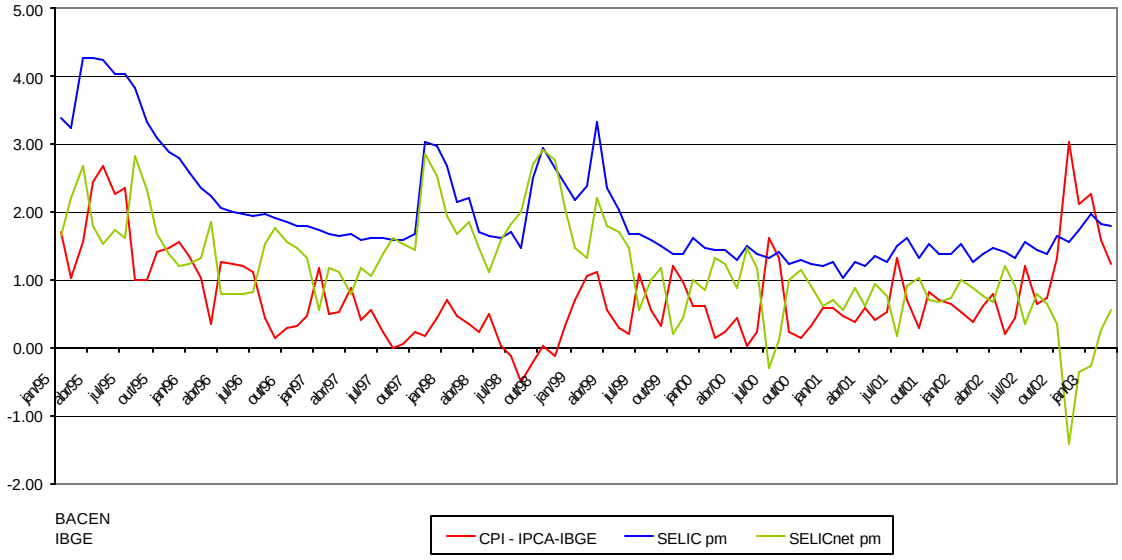


To comprehend the dynamic of these changes we should report what happened in the macroeconomic aspects during this period. In this sense go to aboard the structural imbalances of the public sector derived from the first administration of President Fernando Henrique Cardoso (FHC) that led to another unbalance now in the external accounts which was just starting to be solved in January of 1999, the point of acceleration of all series showed in the **Figure-2**. In this sense see Goldfajn, Ilan, and Werlang, Sergio, 2000, "The Passthrough From Depreciation to Inflation: a Panel Study", mimeo, Brazil.

III – A Short Glance in the Macroeconomics Environment

The **Real Plan** was implemented from December of 1993 and July of 1994. It was intended to be an economic stabilization plan and reduce the monthly rate of inflation from 40% to the level of 15% or 20% per year.

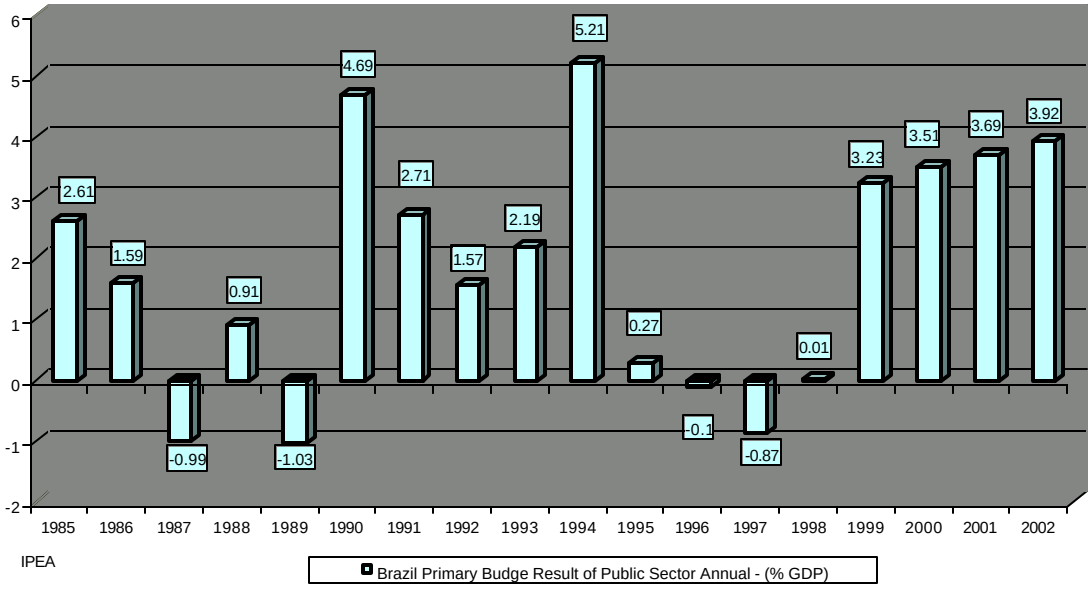
Figure 3
Basic Interest Rate of Brazil Central Bank (Selic and Selicnet) and CPI (IPCA-IBGE)
Monthly Rates
jan/1995 - mar/2003



Unfortunately, the achievement of these results for political reasons had been taken without regard for the basic rules of the stabilization policy. In fact, the key macroeconomic variables as restrictive monetary policy was the only instrument used in the proper sense but with unusual high basic interest rate (see SELIC, CPI (IPCA-IBGE) and SELIC net in Figure-3). Fiscal policy, at least in the period of 1994 until 1998 was considered untouchable until 1999, a year after the reelection of President FHC.

The Figure-4 shows that just after 1999 real actions were done to correct the primary fiscal unbalance consolidated for Federal Government, States, Municipalities, Social Security and public companies.

Figure 4
Primary Budge Result of Public Sector in Brazil
Annual - (% GDP)
1985 - 2002

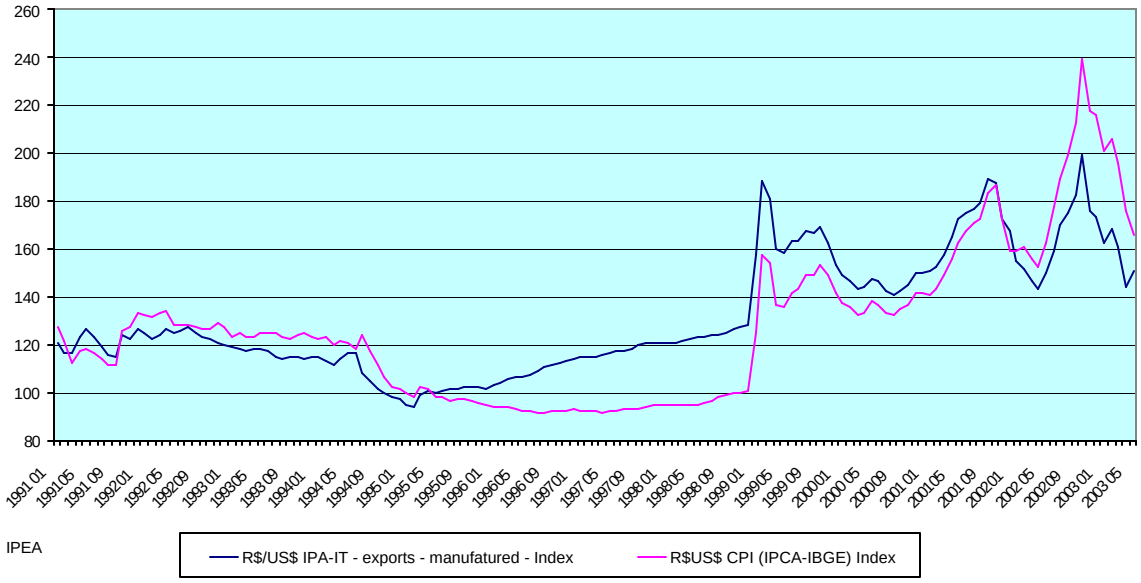


Unhappy when the budget adjustment was implemented the external account already was compromised as will show further.

As consequence of the expansionist fiscal policy the monetary policy had to pursue a strongly restrictive approach to fight the inflation, supported the stability of fiscal policy in the Real Plan.

The crawling peg regime (an intermediate exchange rate regime – see Marco Bonomo and Cristina Terra, march 1999) with bands mechanism was electively followed from March of 1995 to January of 1999. The Central Bank of Brazil (BACEN) was forced to established the minimum and maximum limits of the exchange rate, promising to intervene whenever the minimum and maximum limits were reached to avoid the inflation that a recurrent devaluation of domestic currency could lead to internal prices. The problem to keep the purchase power parity rate of the exchange rate which guarantee a surplus in trade balance was not just reached by devaluation by the internal inflation

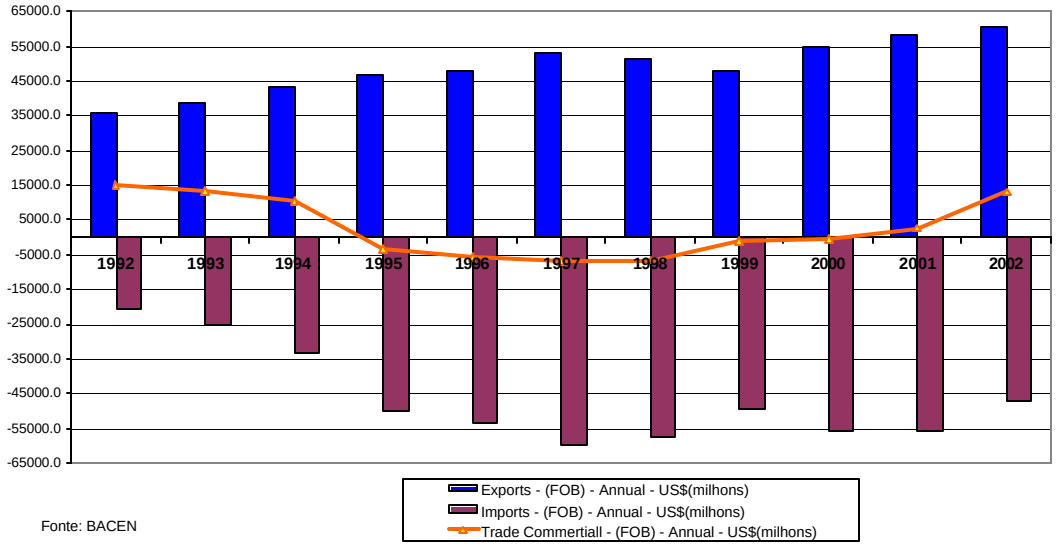
Figure 5
Real Exchange Rate R$ per US$
Wholesales Business Industrial and CPI (IPCA-IBGE) Index jan/95 = 100
jan/92 - jul/03



rate less the inflation rate of most significant commercials partners but the starting point also is important. Unfortunately, once more time it was not followed for the Federal Government which electively holds the external control of Brazilian Central Bank that started the crawling peg regime from an appreciated level of Real looking for his objectives of exchange rate anchor.

The **Figure-5** shows that since September of 1994 the national currency starting his appreciating facing the US Dollar, increasing the power purchase of the Brazilian Real what leads to a reversion in Brazilian imports and exports dynamic as can be viewed in the **Figure-6**. Of course this imbalance in the trade commercial account in the long run created a scarcity of dollars and pressured the BACEN to eventually devaluate the Brazilian currency. By the way it is happen in January of 1999 with the new floating exchange rates searching its real equilibrium rate to recovery the trend to produce a surplus in the trade balance. Moreover is interesting to note that when the exchange rate

Figure 6
Imports x Exports x Commertial Trade
Anual FOB US$(milhões)
1991 - 2002



Fonte: BACEN

is inflate by the IPA the vale is not so deep as than when the CPI (IPCA) is used. In this way see Radelet, Steven and Sachs Jeffrey to an Arrangement and Triggers to this kind of crisis.

The **Figure-6** helps to illustrate the mechanisms that leads to the devaluation of the Real to offset the deficits in the Trade Commerce and create greater volatility in exchange rate and had a strong impact in prices and demand for some sector in the economy of the State Minas Gerais as showed in the **Figure-2** ICMS x IGP-DI x IPCA-IBGE. . See Goldfajn and Werlang for Passthorough from Depreciation to Inflation.

The **Figure-7** shows the most important positive sectors change in the ICMS revenue. The Petroleum Sector had suffered strong influence from changers in the oil price in the international markets and in the Real exchange rate volatility. The Electrical Energy Sector and the Telecommunications Sector in the privatization process had contracts linking their annual price readjustments to the IGP-DI that have 60% of their components in the Industrial Price Index (IPA) which is strongly affected by the exchange rate linked to their needs to inputs imports.

Figure 7

Evolution of Some ICMS Sector in Minas Gerais

	Petrol Sector	Energy Sector	Comunication Sector	% of ICMS
% of ICMS jan/95	8.98%	7.32%	4.78%	21.07%
% of ICMS jun/03	24.58%	12.57%	12.00%	49.15%
rate of change	173.89%	71.72%	151.15%	

Finance Secretary State of Minas Gerais

IV - Modeling the Determinants of Sales Tax Revenue Dynamic

This section describes the research using a Multivariate model in this case Vector Auto Regression (VAR), testing the cointegration, Error Correction Model and developing a **preliminary model** to produce forecasts. This methodology represents the time series dynamic and for the objectives of this paper the model will use a small number of variable that can be increased in future applications.

The Key Variable in study is the **Sales Tax** (Add-Value Tax = **ICMSMG**), the **Real Industrial Production of State Index** (PIM/MG/IBGE = **PIMMG**) as a proxy variable to the Minas Gerais State GDP, the **Exchange Rate Real to American Dollar** – (Central Bank of Brazil = **RUS**) as a transfer mechanism to prices and of course to the Sales Tax since the two first variable are taken in constant values. Also the model incorporates and tests for a seasonality and structural breaks related to the **Change in Tax Law – KANDIR** and in the **Exchange Rate Crisis** and etc.

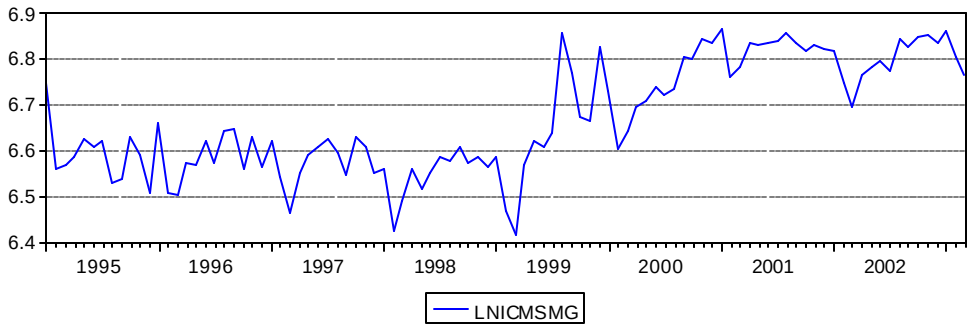
The Hypothesis to be tested is **if the exchange rate depreciation with high volatility can be used together the industrial production of Minas Gerais State as a simplified multivariate model to explain and project the dynamics of sales tax revenue of this state.**

IV.1 –The Sales Tax Revenue - ICMSMG

This series has 99 monthly observations and it is expressed in millions of Reais, actualized with the Consumer Price Index (CPI) (IPCA-IBGE), divided by 1,000,000.00. The series **LNICMSMG** has been transformed to Natural Logarithmic.

I- The key series of interest for this paper is the LNICMSMG in the period of jan/95 – mar/03. In the **Figure-8** we can observer some different trends in these period that can suggest breaks structural in the dynamic of this series. First from jan/95 until the oct/97 the series look stable, since then, until some point in the first trimester of 99 there is a downward trend as result in a change of Constitutional States Sales Tax Law. After that, starting strongly in aug/99 the entire series change its entire level upward, with some volatility that not can be attributed for just one fact.

Figure - 8
Sales Tax Revenue of Minas Gerais State in Levels- LNICMSMG
Jan/95 - Mar/03 Monthly Data

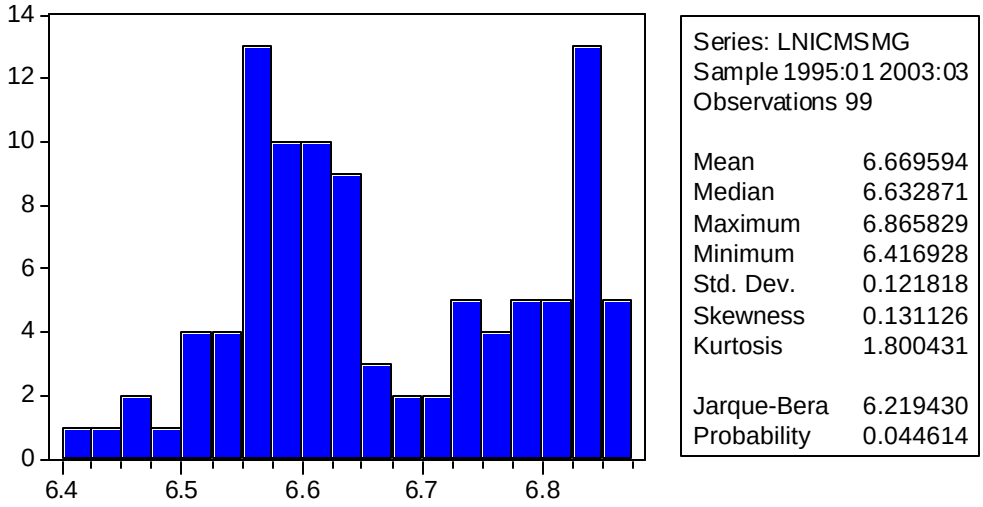


In truth it most likely can be attributed by a set of occurrences like strong movements in the exchange rate (jan/99 – mar/2003) transferring to LNICMSMG, changes in the international prices of petrol (volatility from 1999 – 2003), crises of supply electric energy (2001), electoral uncertainty (2002), contamination from Argentina crisis (2001) and fraud of accountings of big Americans companies (2002). Most of these events were transmitting to ICMSMG by movements of exchange rate, increases of interest rate, decreases in the GDP resulting in changes in the relative prices). For simplification just

the structural break of Kandir Law and Exchange Rate this last variable as the essential mechanism of transfer to ICMS are tested.

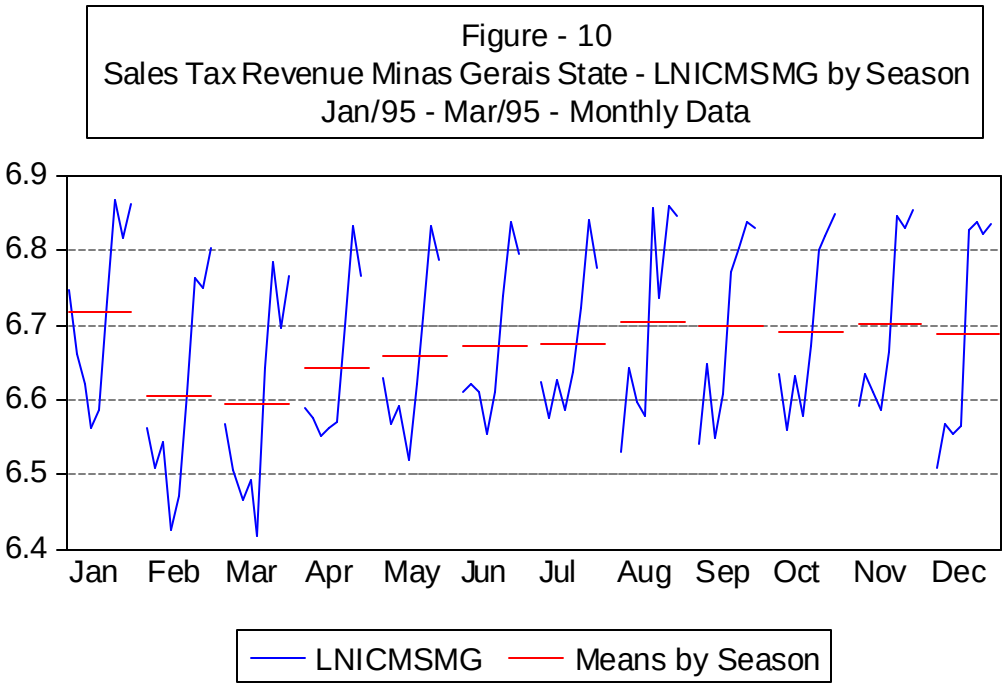
II-The Summary Statistics for LNICMSMG as showed in **Figure-9** the Skewness of 0.1311, what suggest an asymmetric to right side, a Kurtosis of 1.8004 showing a flatness of curve and the Jarque-Bera of 6.21 with 0.04% of probability also suggest a normal distribution for this series.

Figure - 9
Sales Tax Revenue Minas Gerais State - LNICMS - Basic Statistics
Jan/95 - Mar/03 - Monthly Data



The mean of 6.66 with minimum of 6.41, maximum of 6.86 and standard deviation of 0.12 do not suggest great volatility for this series instead the **Figure-8** shows a possible structural break.

The seasonality of the monthly LNICMSMG series is showed in the **Figure-10**. The Sales Tax Revenue is highest from August through January (the peak derived from Christmas Sales). There is an approx 10% drop of in Tax Revenue in February and



March.

When proceeds the Franses Seasonal Unit Root Test for Monthly Data the result for Y8(-1) (LNICMSMG – LNICMSMG(-12)) is 0.07 (see Table 1.5 in the Annex). So, the null hypothesis for a Unit Root for a Seasonal Lag for the LNICMSMG series cannot be rejected.

When look for the Autocorrelation Function in the correlogram of LNICMSMG with 13 lags (see Table 1 in the Annex) series do not converge to zero geometrically what mean that the series is not stationary.

When proceed to the correlogram of series at its first difference (see Table 1.1 in the Annex) the Autocorrelation for D1(LNICMSMG) follow a damped oscillatory path what suggest that the series can be stationary at this level.

Proceeding the tests for the null hypothesis of a unit root or I(1) process with the **Augmented of Dickey-Fuller** or **ADF Test** (Models 1, 2 and 3), assuming deterministic components in the series (Constant and Trends), and **Philip-Perron** for seasonal lags and structural breaks the results are showed in the **Table Resume-1** (for more information see the Tables in the Annex). The Schwarz criterion of –2.7203 suggest the Model 5 and the Akaike criterion of –3.3007 suggest the Model 6.

Table Resume 1

D1 LNICMSMG - First Diference for Sales Tax Revenue for Minas Gerais
ADF and Phillip-Perron Test for Seasonal Lag and Structural Break
Jan/1995 - Mar/2003

	ADF			Phillip-Perron		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Table	1.6	1.7	1.8	1.9	1.10	1.11
Constant	no	0.48	1.67	3.83	1.22	2.91
Trend	no	no	0.00	0.00	0.00	0.00
Alfa 1	0.00	-0.07	-0.26	-0.58	-0.19	-0.44
Struct Break	no	no	no	yes	no	yes
Seasonal Dummies	no	no	no	no	yes	yes
t-Statistic	0.52	-1.35	-2.87	-4.81	-2.27	-3.99
Test critical values: 1% Level	-2.59	-3.50	-4.06	-4.06	-4.06	-4.06
Test critical values: 5% Level	-1.94	-2.89	-3.46	-3.46	-3.46	-3.46
Test critical values: 10% Level	-1.61	-2.58	-3.15	-3.15	-3.15	-3.15
R-squared	0.17	0.19	0.24	0.39	0.61	0.67
Adjusted R-squared	0.16	0.16	0.21	0.32	0.52	0.58
S.E. of regression	0.06	0.06	0.06	0.05	0.04	0.04
Sum squared resid	0.32	0.32	0.30	0.24	0.15	0.13
Log likelihood	137.09	138.04	141.30	147.63	168.74	177.13
Durbin-Watson stat	2.06	2.04	2.01	2.08	2.03	2.03
Mean dependent var	0.00	0.00	0.00	0.00	0.00	0.00
S.D. dependent var	0.06	0.06	0.06	0.06	0.06	0.06
Akaike info criterion	-2.79	-2.79	-2.84	-2.91	-3.21	-3.30
Schwarz criterion	-2.71	-2.69	-2.71	-2.61	-2.72	-2.71
F-statistic		7.22	7.34	5.29	7.00	7.09
Prob(F-statistic)		0.00	0.00	0.00	0.00	0.00

Based in this criterion the opted model is the Table-1.11 as follow:

Table 1.11
D1 LNICMSMG -First Diference for Sales Tax Revenue for Minas Gerais
Phillip-Perron Test for Seazonal Lag and Structural Break
Jan/1995 - Mar/2003

Dependent Variable: D(LNICMSMG)
Method: Least Squares
Date: 11/18/03 Time: 17:52
Sample(adjusted): 1995:06 2003:03
Included observations: 94 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.9076	0.7237	4.0178	0.0001
LNICMSMG(-1)	-0.4397	0.1102	-3.9890	0.0002
@TREND(1995.01)	0.0010	0.0006	1.6452	0.1043
DL101996	-0.0283	0.0203	-1.3915	0.1684
DL011999	0.0660	0.0219	3.0141	0.0036
DP101996	0.0079	0.0259	0.3065	0.7601
DP011999	-0.0923	0.0304	-3.0340	0.0034
SFEB	-0.1126	0.0216	-5.2145	0.0000
SMAR	-0.0999	0.0235	-4.2468	0.0001
SAPR	-0.0318	0.0262	-1.2134	0.2289
SMAY	-0.0279	0.0263	-1.0615	0.2920
SJUN	0.0182	0.0249	0.7294	0.4681
SJUL	-0.0096	0.0245	-0.3930	0.6954
SAGO	0.0047	0.0241	0.1932	0.8473
SSEP	-0.0135	0.0224	-0.6024	0.5488
SOUT	-0.0162	0.0218	-0.7435	0.4596
SNOV	-0.0152	0.0216	-0.7010	0.4856
SDEC	-0.0346	0.0216	-1.6032	0.1133
D(LNICMSMG(-1))	-0.3353	0.1258	-2.6647	0.0095
D(LNICMSMG(-2))	-0.4040	0.1275	-3.1676	0.0023
D(LNICMSMG(-3))	-0.1228	0.1236	-0.9935	0.3238
D(LNICMSMG(-4))	0.0575	0.1047	0.5485	0.5850

R-squared	0.6740	Mean dependent var	0.0015
Adjusted R-squared	0.5789	S.D. dependent var	0.0647
S.E. of regression	0.0420	Akaike info criterion	-3.3007
Sum squared resid	0.1270	Schwarz criterion	-2.7055
Log likelihood	177.1345	F-statistic	7.0883
Durbin-Watson stat	2.0299	Prob(F-statistic)	0.0000

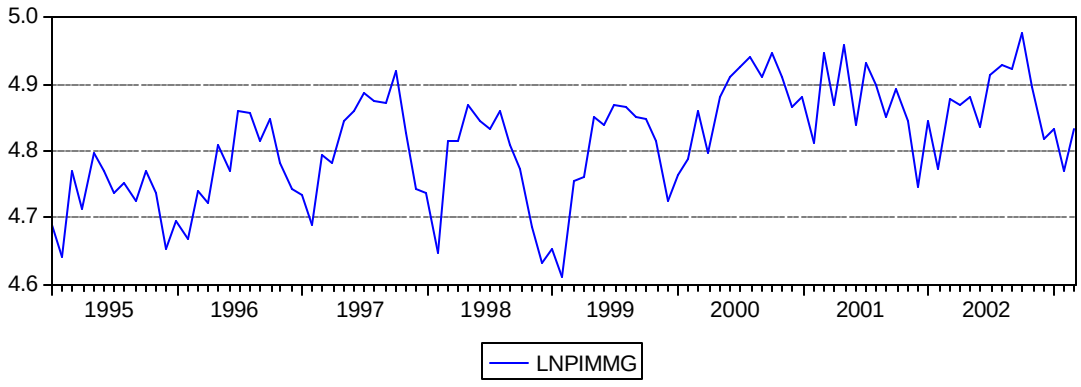
Based in the a_1 of LNICMSMG(-1) of –0.44 and in the t-statistic of –3.99 accepted at 5% of significance, the null hypothesis cannot be rejected, what meaning that series has a unit root for structural breaks and seasonality.

IV.2 – The Industrial Production - PIMMG

The next series is LNPIMMG. It is the index number of Physical Production of Industry in the State of Minas Gerais (base average year 1991 = 100) researched by IBGE is transformed into Natural Logarithms.

I - The LNPIMMG in the period of jan/95 – mar/03, in the Figura-11 draft some different trends in the dynamic of this series in these periods. First from jan/95 until the oct/97 the series seems slow upward and a negative effect derived from the Constitutional change in the States Sales Tax Law is not expected, in fact these effect it is supposed to be positive but not efficient because the exchange rate appreciation before January of 1999, also the high level of interest rate to kept the exchange rate untouchable driven the economy to low levels of growths in the years of 1998 and 1999 when there was a downward trend.

Figure 11
Natural Log Industrial Production of Minas Gerais State LNPIMMG Series
Jan/95 - Mar/03



That trend just had been reverted in 2000 after the assimilation of the exchange rate devaluation when the Brazilian economy growths about 4%. This new trend was broken

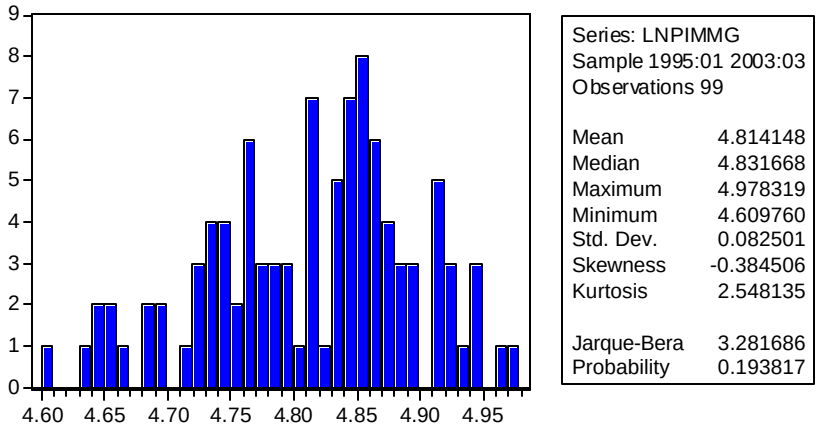
by energy crisis of 2001 and a new expansion period started in the beginner of 2002 when it was halted again by the restrictive monetary policy at the end of 2001fight another exchange rate crisis.

In the first quarter of 2002 the exchange rate had appreciated and the basic interest rate was reduced and so the industrial production rate increases. Once more time events that affect the exchange rate (see the session IV.3) at the final quarter of 2002 and beginner of 2003 and the electoral uncertainty forces the Central Bank to the implement the pull of interest rate to fight the increase in the inflation rate.

Also from the **Figure-11**, we can see movements of peaks and plains that can suggest seasonal behave for this series.

II - The Summary Statistics in **Figure-12** shows the Skewness of -0.3845, what suggest

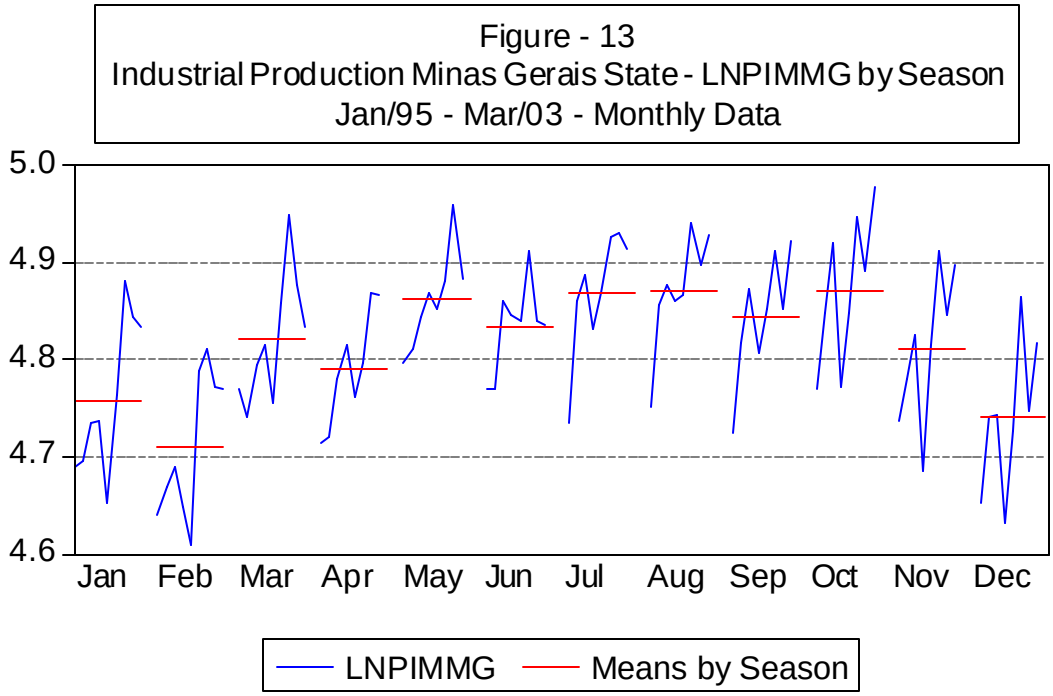
Figure - 12
Industrial Production Minas Gerais State - LNPIMMG - Basic Statistics
Jan/95 - Mar/03



an asymmetric to left side, a Kurtosis of 2.5481 showing a light flatness of this curve.

The Jarque-Bera of 3.2816 with just 0.1938 of probability suggests a normal distribution for this curve instead its shape look like it. The mean of 4.8141 and the standard deviation of 0.0825 do not insinuate great volatility in this series.

The **Figure-13** helps to explicit this seasonality for the Industrial Production (LNPIMMG), which have a different pattern from the Sales Tax Revenue. In fact, if one lag is used in the monthly series of PIMMG from January to October a similarity can be observed with the months of LNICMSMG from February to November.



In fact, when proceeds the Franses Seasonal Unit Root for Monthly Data the result for Y8(-1) = (LNPIMMG – LNPIMMG(-12)) is 0.03 (Table 2.5) what suggest that we can not reject the null hypothesis for a Unit Root a Seasonal Lag for the LNPIMMG series.

When look for Autocorrelation Function the correlogram of LNPIMMG with 13 lags (see Table 2 in the Annex) the series convert zero until the lag 6 but after lag 8 its start to increase what probably say that this series is not stationary at this level.

When take the correlogram Industrial Production at its first difference d1(LNPIMMG) (see Taable-2.1) the Autocorrelogram follow dampened oscillatory path around zero what is usual when $?_1$ is negative (see Enders 2003) but in the lag 12 there is a increase what also suggest seasonality in this series in the first difference.

Proceeding the tests for the null hypothesis of a unit root or I(1) process with the

Table Resume 2
D1 LNPIMMG - First Diference for Industrial Production for Minas Gerais
ADF and Phillip-Perron Test for Seasonal Lag and Structural Break
Jan/1995 - Mar/2003

	ADF			Phillip-Perron		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Table	2.6	2.7	2.8	2.9	2.10	2.11
Constant	no	1.29	2.00	2.70	1.21	1.29
Trend	no	no	0.00	0.00	0.00	0.00
Alfa 1	0.00	-0.27	-0.42	-0.57	-0.25	-0.27
Struct Break	no	no	no	yes	no	yes
Seasonal Dummies	no	no	no	no	yes	yes
t-Statistic	0.07	-3.72	-4.75	-4.13	-2.73	-2.26
Test critical values: 1% Le	-2.59	-3.50	-4.06	-4.06	-4.06	-4.06
Test critical values: 5% Le	-1.94	-2.89	-3.46	-3.46	-3.46	-3.46
Test critical values: 10% Le	-1.61	-2.58	-3.15	-3.15	-3.15	-3.15
R-squared	0.21	0.31	0.36	0.43	0.78	0.79
Adjusted R-squared	0.19	0.29	0.34	0.36	0.73	0.73
S.E. of regression	0.05	0.05	0.05	0.05	0.03	0.03
Sum squared resid	0.28	0.24	0.22	0.20	0.07	0.07
Log likelihood	144.23	150.97	154.89	156.81	202.40	203.80
Durbin-Watson stat	2.01	2.09	2.23	1.99	1.97	1.98
Mean dependent var	0.00	0.00	0.00	0.00	0.00	0.00
S.D. dependent var	0.06	0.06	0.06	0.06	0.06	0.06
Akaike info criterion	-2.94	-3.06	-3.12	-3.10	-3.92	-3.87
Schwarz criterion	-2.86	-2.96	-2.99	-2.80	-3.44	-3.27
F-statistic		13.76	13.01	6.15	16.06	12.80
Prob(F-statistic)		0.00	0.00	0.00	0.00	0.00

Augmented of Dickey-Fuller or **ADF Test** (Models 1, 2 and 3), assuming deterministic

components in the series (Constant and Trends), and **Philip-Perron** test for seasonal lags and for structural breaks the results are showed in the **Table Resume-2** (for more information see the Tables in the Annex). The Model 5 and the Model 6 with Schwarz criterion of –3.9234 and –3.886 and Akaike criterion of –3.4364 and –3.2729 respectively, suggest that both models are nearly equivalents. So, the Model 6 had been choused to have seasonal dummies variables.

The complete Model 6 is showed in the **Table-2.11**. Based in the ?$_1$ of LNPIMMG(-1) of –0.27 instead the t-statistic of –2.26 that do not accepted at 1%, 5% and 10% of significance, the null hypothesis cannot be rejected, because clearly the series has a seasonality unit root for structural breaks and seasonality.?

Table 2.11
D1 LNPIMMG -First Diference for Industrial Production for Minas Gerais
Phillip-Perron Test for Seasonal Lag and Structural Break
Jan/1995 - Mar/2003

Dependent Variable: D(LNPIMMG)
Method: Least Squares
Date: 11/18/03 Time: 17:53
Sample(adjusted): 1995:06 2003:03
Included observations: 94 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.2877	0.5679	2.2676	0.0264
LNPIMMG(-1)	-0.2716	0.1202	-2.2600	0.0268
@TREND(1995.01)	0.0000	0.0004	-0.0237	0.9811
DL101996	0.0099	0.0133	0.7413	0.4609
DL011999	0.0212	0.0157	1.3482	0.1818
DP101996	0.0021	0.0186	0.1142	0.9094
DP011999	-0.0193	0.0235	-0.8223	0.4136
SFEB	-0.0447	0.0218	-2.0506	0.0439
SMAR	0.0851	0.0225	3.7807	0.0003
SAPR	-0.0119	0.0284	-0.4205	0.6754
SMAY	0.0636	0.0287	2.2162	0.0298
SJUN	-0.0210	0.0270	-0.7762	0.4402
SJUL	0.0427	0.0280	1.5222	0.1323
SAGO	0.0146	0.0225	0.6515	0.5168
SSEP	-0.0060	0.0246	-0.2455	0.8068
SOUT	0.0284	0.0193	1.4674	0.1466
SNOV	-0.0388	0.0216	-1.7939	0.0770
SDEC	-0.0748	0.0196	-3.8199	0.0003
D(LNPIMMG(-1))	-0.0900	0.1423	-0.6324	0.5291
D(LNPIMMG(-2))	0.0575	0.1343	0.4281	0.6699
D(LNPIMMG(-3))	0.1299	0.1275	1.0193	0.3115
D(LNPIMMG(-4))	-0.0243	0.1198	-0.2032	0.8395

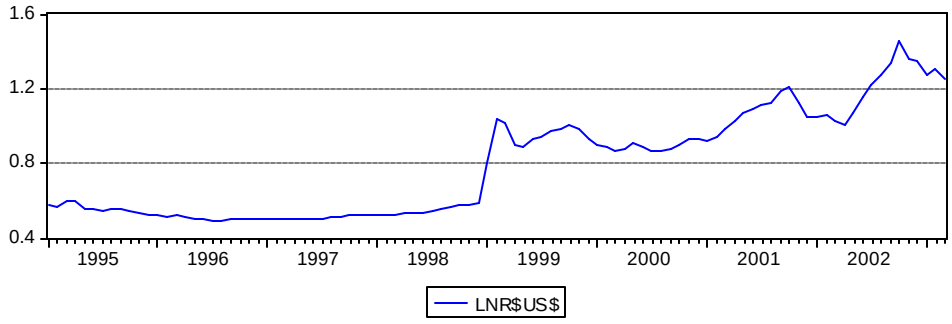
R-squared	0.7887	Mean dependent var	0.0004
Adjusted R-squared	0.7271	S.D. dependent var	0.0605
S.E. of regression	0.0316	Akaike info criterion	-3.8682
Sum squared resid	0.0720	Schwarz criterion	-3.2729
Log likelihood	203.8045	F-statistic	12.79796
Durbin-Watson stat	1.9834	Prob(F-statistic)	0.000

IV.3 - Exchange Rate - RUS

The LNRUS series has 99 observations is expressed in R$ (Reais), actualized with the Consumer Price Index (CPI) (IPCA-IBGE), transformed to Natural Logarithmic.

I-This series cover the period of jan/95 – mar/03. In the Figure-14 can be observed some different trends in this period that suggest structural breaks in its dynamic. The first big movement happened in jan/99 (when the series suffered a violent change upward as result of strong pressure of the appreciation of the Real for a long period driven to deficits in the trade balance that was not be able to be financed for international investments flows, in fact they were converted in heavily inflows (for this kind of mechanisms see Calvo, Guilhermo, Leonardo Leiderman, and Carmen Reinhart, 1993 and 1996).

Figure - 14
Exchange Rate Real Brasileiro / US Dollar - LNrUS
Jan/95 - Mar/03 Monthly Data



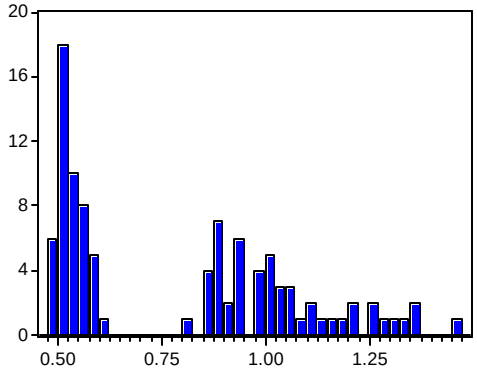
Since then the series looking “stable” until jan/01 with a new trend upward brooked down in oct/01 until apr/02 when comes to a maximum point in oct/02 and so there is a down trend. That behave not can be attributed for just one fact but a set of events like strong movement in the basic interest rate of BACEN willing to attract externals capital flow and avoid the rejection to domestic currency. Of course externals shocks increasing the

international uncertainties make the things worse as a changes in the international prices of petrol (volatility from 1999 – 2003), WTC (2001), contamination from Argentina crisis (2001) and fraud of accountings of big Americans companies (2002).

Moreover the electoral uncertainty in 2002 was an important player in this game together the another events and were supposed to transmit his effects to sales tax revenue (ICMSMG) by movements of exchange rate, increases of interest rate and decreasing the GDP resulting in changes in the relative prices.

I- The Summary Statistics showed in Figure-15, the Skewness of 0.4453, what suggest an asymmetric to right side, a Kurtosis of 1.8882 showing a flatness of this curve. The Jarque-Bera with 8.3709 at 0.01521 of probability of distribution suggested a normality distribution for this curve. The mean is 0.7937 and the standard deviation is 0.2806 shows height volatility level compared with the previous series as described above.

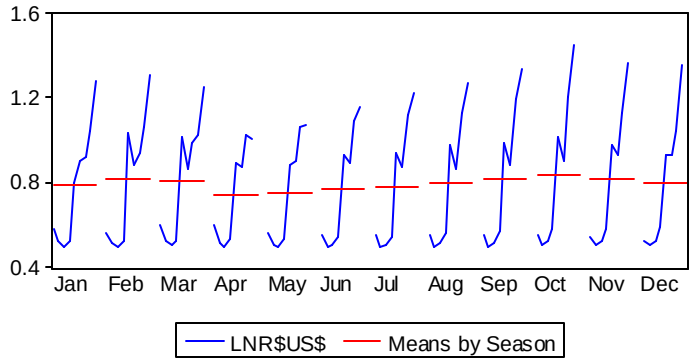
Figure - 15
Exchange Rate Brazilian Real / US Dollar - LNRUS - Basic Statistics
Jan/95 - Mar/03



Series: LNRUS	
Sample 1995:01 2003:03	
Observations 99	
Mean	0.793765
Median	0.861183
Maximum	1.452883
Minimum	0.492425
Std. Dev.	0.280619
Skewness	0.445332
Kurtosis	1.888227
Jarque-Bera	8.370958
Probability	0.015215

In this specific case the seasonality is not relevant as showed in the Figure-14 and in the Figure-16.

Figure - 16
Exchange Rate Real Brasileiro / US Dollar - LNrUS by Season
Jan/95 - Mar/03 - Monthly Data



When proceeds the Franses Seasonal Unit Root Test for Monthly Data the result for Y8(-1) (LNRSUS – LNRUS(-12)) is -027324 (see Table 3.5 in the Annex). So, the alternative hypothesis for a Unit Root for a Seasonal Lag for the LNRUS series cannot be rejected.

When look for the Autocorrelation Function in the correlogram of LNRUS with 13 lags (see Table 3 in the Annex) the series do not converge to zero geometrically what mean that the series is not stationary.

When proceed to the correlogram of series at its first difference (see Table 3.1 in the Annex) the Autocorrelation for D1(LNRUS) follow a damped oscillatory path to zero what suggest that the series can be stationary at this level.

Proceeding the tests for the null hypothesis of a unit root or I(1) process with the **Augmented of Dickey-Fuller** or **ADF Test** (Models 1, 2 and 3), assuming deterministic components in the series (Constant and Trends), and **Philip-Perron** test for seasonal lags and also for structural breaks the results are showed in the **Table Resume-3** (for more information see the Tables in the Annex). Model 4 had Schwarz criterion of –3.3770 and an Akaike criterion of –3.6746 suggesting that in this case best model should include a

Table Resume 3

D1 LNRUS - First Diference for Exchange Rate Real/American Dollar
ADF and Phillip-Perron Test for Seasonal Lag and Structural Break
Jan/1995 - Mar/2003

	ADF			Phillip-Perron		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Table	3.6	3.7	3.8	3.9	3.10	3.11
Constant	no	0.01	0.04	0.12	0.05	0.09
Trend	no	no	0.00	0.00	0.00	0.00
Alfa 1	**0.01**	**-0.01**	**-0.11**	**-0.28**	**-0.12**	**-0.24**
Struct Break	no	no	no	yes	no	yes
Seasonal Dummies	no	no	no	no	yes	yes
t-Statistic	**0.99**	**-0.35**	**-2.92**	**-4.68**	**-2.84**	**-3.97**
Test critical values: 1% Lev	**-2.59**	**-3.50**	**-4.06**	**-4.06**	**-4.06**	**-4.06**
Test critical values: 5% Lev	**-1.94**	**-2.89**	**-3.46**	**-3.46**	**-3.46**	**-3.46**
Test critical values: 10% Le	**-1.61**	**-2.58**	**-3.15**	**-3.15**	**-3.15**	**-3.15**
R-squared	0.20	0.20	0.27	0.46	0.41	0.55
Adjusted R-squared	0.18	0.17	0.24	0.39	0.28	0.41
S.E. of regression	0.04	0.04	0.04	0.04	0.04	0.04
Sum squared resid	0.17	0.16	0.15	0.11	0.12	0.09
Log likelihood	169.33	169.60	174.24	183.71	179.78	192.15
Durbin-Watson stat	1.93	1.93	1.94	1.75	1.92	1.74
Mean dependent var	0.01	0.01	0.01	0.01	0.01	0.01
S.D. dependent var	0.05	0.05	0.05	0.05	0.05	0.05
Akaike info criterion	**-3.47**	**-3.45**	**-3.53**	**-3.67**	**-3.44**	**-3.62**
Schwarz criterion	**-3.39**	**-3.34**	**-3.39**	**-3.38**	**-2.96**	**-3.03**
F-statistic		7.65	8.56	6.96	3.09	4.12
Prob(F-statistic)		0.00	0.00	0.00	0.00	0.00

constant, a trend, and a structural break.

Based in this criterion the opted Model 4 is showed in the Table-3.9 as follow:

Table 3.9
D1 LNRUS -First Difer Exchange Rate Real/Dollar
Phillip-Perron Test for Structural Break
Jan/1995 - Mar/2003

Dependent Variable: D(LNRUS)
Method: Least Squares
Date: 11/18/03 Time: 17:48
Sample(adjusted): 1995:06 2003:03
Included observations: 94 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.11737	0.02845	4.12504	0.00010
LNRUS(-1)	-0.27840	0.05947	-4.68128	0.00000
@TREND(1995.01)	0.00232	0.00059	3.95437	0.00020
DL101996	-0.05221	0.01887	-2.76654	0.00700
DL011999	0.05204	0.02112	2.46373	0.01580
DP101996	0.02195	0.02097	1.04690	0.29820
DP011999	0.04955	0.02758	1.79676	0.07600
D(LNRUS(-1))	0.45402	0.10656	4.26050	0.00010
D(LNRUS(-2))	-0.11727	0.11863	-0.98855	0.32580
D(LNRUS(-3))	-0.06359	0.11080	-0.57391	0.56760
D(LNRUS(-4))	0.29105	0.10086	2.88573	0.00500

R-squared	0.4560	Mean dependent var	0.00736
Adjusted R-squared	0.3905	S.D. dependent var	0.04673
S.E. of regression	0.0365	Akaike info criterion	-3.67460
Sum squared resid	0.1104	Schwarz criterion	-3.37698
Log likelihood	183.7062	F-statistic	6.95858
Durbin-Watson stat	1.753383	Prob(F-statistic)	0.00000

In this case the t-statistic shows that the dummy variable of pulse DP101996 (change in the sales tax law) is not significant.

V – The Vector Auto Regression Estimates – VAR

Once the endogenous variables had been tested, some estimates of the VAR models were made with arbitrary Lags. After that these lags were tested for Lag Order Selection by Akaike and Schwarz Criteria (see Table 5 in Annex) the model kept the Lags 1, 2, 3 and 12. The VAR Lag Exclusion Wald Tests also suggest to kept this Lags orders (see Table

6 in Annex) and after these proceeds the choice were summarized in the Table Resume-4 (For more details of results see Table-4.1 in the Annex).

Table Resume 4
VAR estimations

Sales Tax Revenue of Minas Gerais (LNICMSMG), Industrial Production of MG (LNPIMMG) and
Jan/95 - Mar/03
Monthly Data

	Model 1.0	Model 1.1	Model 1.2	Model 1.3
Lag	1	1	1	1
Lag	2	2	2	2
Lag	3	3	3	3
Lag	12	12	12	12
Constant	yes	yes	yes	yes
Dummies Events	yes	yes	no	no
Dummies Seasonal	yes	no	yes	no
Determinant Residual Covariance	0.0000	0.0000	0.0000	0.0000
Log Likelihood (d.f. adjusted)	395.9636	363.1341	385.2136	345.7393
Akaike Information Criteria	**-7.1716**	**-7.1755**	**-7.2003**	**-7.0515**
Schwarz Criteria	**-4.7907**	**-5.7300**	**-5.1596**	**-5.9461**
Restritions of Model dof (degree of freedom)	0.0000	33.0000	12.0000	45.0000
LM = - 2 * (LRrestric - Lrunrestric)		**65.6590**	**21.5000**	**100.4486**

Using the Akaike, Schwarz criteria and the Likelihood (LR) adjusted for degree of freedom between the Unrestricted Model 1.0 (the Lagrange Multiplier) and the other three restricted models, the preference went to the Model 1.3.

Moreover, the VAR Pairwese Granger Causality/Block Exogeneity Wald Tests shows (see Table Resume-7) that the most parsimonious model without dummies of events and dummies of seasonality have the best feedback to determine the variable LNICMSMG from LNPIMMG and LNRUS. In the same way the feedback to variable the LNPIMMG from LNICMSMG and LNRUS works well in this Model 1.3 and **there is no feedback to LNRUS from the other variables as expected.**

Tabela Resumo 7
VAR Pairwise Granger Causality/Block Exogeneity Wald Tests
Sample: 1995:01 2003:03
Included observations: 87

	Model 1.0			Model 1.1			Model 1.2			Model 1.3		
Dependent variable: LNICMSMG												
Exclude	Chi-sq	df	Prob.	Chi-sq	df	Prob.	Chi-sq	df	Prob.	Chi-sq	df	Prob.
LNPIMMG	12.0166	4	0.0172	31.9137	4	0.0000	4.8905	4	0.2987	21.1713	4	0.0003
RUS	2.0295	4	0.7303	2.4915	4	0.6462	6.8138	4	0.1461	8.5112	4	0.0745
All	13.9192	8	0.0839	38.6448	8	0.0000	12.9614	8	0.1132	27.0952	8	0.0007
Dependent variable: LNPIMMG												
Exclude	Chi-sq	df	Prob.	Chi-sq	df	Prob.	Chi-sq	df	Prob.	Chi-sq	df	Prob.
LNICMSMG	0.8761	4	0.9280	8.5059	4	0.0747	0.9758	4	0.9134	8.5473	4	0.0735
RUS	2.8743	4	0.5791	9.5463	4	0.0488	4.4654	4	0.3467	9.1639	4	0.0571
All	5.0950	8	0.7474	18.8828	8	0.0155	9.0892	8	0.3348	18.4347	8	0.0182
Dependent variable: RUS												
Exclude	Chi-sq	df	Prob.	Chi-sq	df	Prob.	Chi-sq	df	Prob.	Chi-sq	df	Prob.
LNICMSMG	1.1395	4	0.8880	6.1309	4	0.1896	2.1074	4	0.7160	7.4715	4	0.1130
LNPIMMG	3.0770	4	0.5450	0.2511	4	0.9928	3.5087	4	0.4766	2.2053	4	0.6981
All	3.8010	8	0.8746	7.8314	8	0.4501	4.4200	8	0.8174	8.0025	8	0.4332

VI - Cointegration Test and Error Correction Model

Since the Model 1.3 was elected as the VAR model the Cointegration Tests were proceed to this unrestricted model (see Table-8) and the Vector Error Correction (VEC) were estimated (see Table-9).

The next step was to impose restrictions in the VEC model in order to test the homogeneity between the Sales Tax and the Industrial Production in the short run (see

Table-10). The result for this test shows the statistic Chi-square to rank 1 of 22.52 with nearly 100% of possibility so the restricted model 1.3 was rejected.

This time the restriction were imposed in VEC model 1.3 to test the weak exogeneity of exchange rate (RUS) on Sales Tax Revenue (LNICMSMG) and the null hypothesis cannot be rejected (see Table 11 in the Annex). It is meaning that model not shows direct statistic influence of exchange rate in behaves of Sales Tax.

Taking these results some equations of Error Correction Model (ECM) had been estimated to Sales Tax and to Industrial Production and one final configuration were achieved (see Table 12 and Table 13 in the annex).

VII – Forecast and Conclusion

These two equations were joined in a model to make some forecasts and the Equations for Industrial Production (PIMMG) and Sales Tax Revenue (ICMSMG) in the final model were:

Equation Eq_ECM_IP for Industrial Production

dlog(pimmg) dlog(icmsmg(-1)) dlog(icmsmg(-2)) dlog(icmsmg(-3)) dlog(pimmg(-1)) dlog(pimmg(-2)) dlog(pimmg(-3)) dlog(rus(-1)) dlog(rus(-2)) dlog(rus(-3)) dp042001 dp092001 dp022002 dp032002 dl052002 dp052002 dp062002 sfeb smar sapr smay sjun sjul sago ssep sout snov sdec dlog(icmsmg(-12)) dlog(pimmg(-

12)) d(rus(-12)) (log(icmsmg(-1)) - 1.340161622*log(pimmg(-1)) - 0.09371979067*rus(-1))

The Dummies Variables for events in Industrial Production equation were (Table-13 in Annex):

dp042001 - dummy of pulse - supply energetic crisis,

dp092001 - dummy of pulse - WTC crisis of confidence affecting the exchange rate,

dp022002 - dummy of pulse - The Carnival holiday do not happen in this month,

dp032002 - dummy of pulse - The Carnival holiday happen in this month,

dl052002 - dummy of level - Accounting fraud in big US company's scandals,

dp052002 - dummy of pulse - Accounting fraud in big US company's scandals,

dp062002 - dummy of pulse – Uncertainties about Brazilian Presidential Elections

and dummies for seasonality

Equation Eq_ECM_Tax1 for Sales Tax Revenue

dlog(icmsmg) c dlog(icmsmg(-1)) dlog(icmsmg(-2)) dlog(pimmg(-1)) dlog(pimmg(-2)) d(rus(-1)) dl011999 dl101996 dl042001 dp042001 dp092001 dp022002 dp032002 dp052002 dp062002 sfeb smar sapr smay sjun sjul sago ssep sout snov sdec dlog(icmsmg(-12)) dlog(pimmg(-12)) dlog(rus(-12)) (log(icmsmg(-1)) - 1.340161622*log(pimmg(-1)) - 0.09371979067*rus(-1))

Dummies Variables for events in Sales Tax Revenue equation were (Table-12 in Annex):

dl101996 - dummy of level - change in the constitution to state sales tax law,

dl011999 - dummy of level - exchange rate crisis, the first big devaluation,

dl042001 - dummy of level - supply energetic crisis,

dp042001 - dummy of pulse - supply energetic crisis,

dp092001 - dummy of pulse - WTC crisis of confidence affecting the exchange rate,

dp022002 - dummy of pulse - The Carnival holiday do not happen in this month,

dp032002 - dummy of pulse - The Carnival holiday happen in this month,

dp052002 – dummy of pulse - Accounting fraud in big US company's scandals,

dp062002 - dummy of pulse – Uncertainties about Brazilian Presidential Elections,

and dummies for seasonality

These two equations were joined in a model to make some forecasts of Sales Tax (LNICMSMG) in Figure-17 and Industrial Production (LNPIMMG) in Figure-18, both variables to Minas Gerais State.

Figure - 17
Sales Tax Revenue Minas Gerais State (ICMSMG)
Jan/95 - Mar/03
R$ 1,000,000.00
values constants CPI (IPCA-IBGE) - may/03 = 100

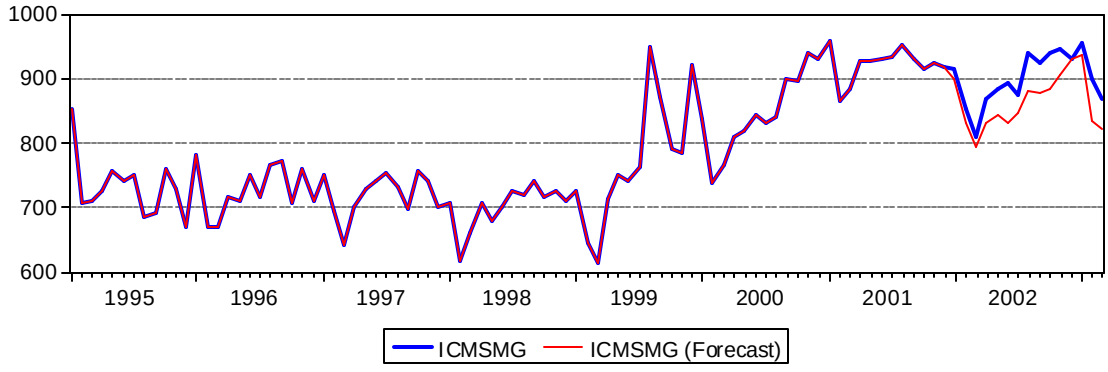
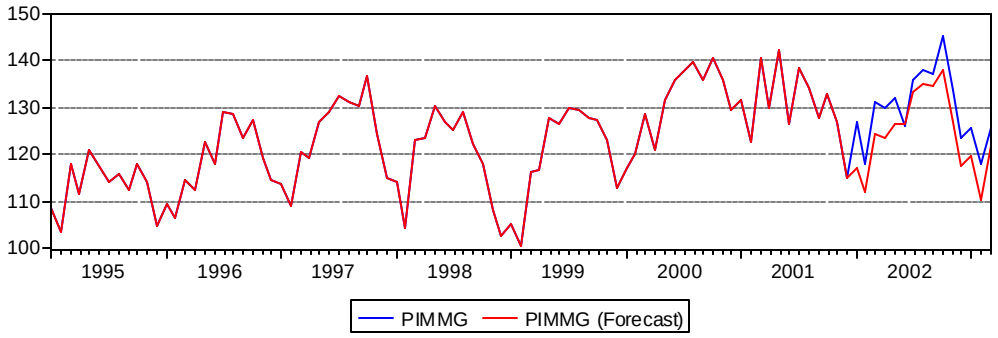


Figure - 18
Industrial Production Minas Gerais State (PIMMG)
Jan/95 - Mar/03
Index Number (IPCA-IBGE) - Jan/91 = 100



The Table 14 shows the values of Sales Tax actual (ICMSMG) and the values of Sales Tax fitted (ICMSMG forecast) by the model.

Table 14

Sales Tax Minas Gerais State (ICMSMG) Actual and Forecast - Error Correction Model - ECM

Period	ICMSMG actual	ICMSMG forecast	Error
jan/02	913.89	900.66	-1.45%
fev/02	853.76	830.28	-2.75%
mar/02	809.69	795.84	-1.71%
abr/02	867.45	832.11	-4.07%
mai/02	885.55	843.17	-4.79%
jun/02	894.67	832.80	-6.92%
jul/02	876.58	847.58	-3.31%
ago/02	939.22	882.44	-6.05%
set/02	923.93	876.75	-5.11%
out/02	941.98	883.83	-6.17%
nov/02	947.65	906.91	-4.30%
dez/02	929.61	931.05	0.15%
jan/03	955.76	936.59	-2.01%
fev/03	901.49	835.14	-7.36%
mar/03	867.73	822.83	-5.17%
Total	13,508.96	12,957.99	-4.07%

Remembering despite that is a preliminary model and some other variables can be incorporated in further application, the average error of forecasts simulation is –4.07% and it probably would be reduced. So with some limits this model is a representation of what happen in the dynamic of Sales Tax in Minas Gerais State.

The Table 15 shows the values of Industrial Production actual (PIMMG) and the values of Industrial Production (PIMMG forecast) by the model.

Table 15

Industrial Production of Minsd Gerais State (PIMMG)
Actual and Forecast - Error Correction Model - ECM

Period	PIMMG actual	PIMMG forecast	Error
jan/02	126.92	117.17	-7.68%
fev/02	118.22	111.85	-5.39%
mar/02	131.33	124.29	-5.36%
abr/02	129.95	123.79	-4.74%
mai/02	131.97	126.45	-4.18%
jun/02	125.92	126.63	0.56%
jul/02	136.11	133.60	-1.85%
ago/02	138.25	134.89	-2.43%
set/02	137.33	134.49	-2.07%
out/02	145.23	138.03	-4.96%
nov/02	133.87	127.03	-5.11%
dez/02	123.64	117.63	-4.86%
jan/03	125.60	119.71	-4.69%
fev/03	117.91	110.57	-6.22%
mar/03	125.75	121.76	-3.18%
Mean	129.87	124.52	-4.14%

In the same way, remembering despite that is a preliminary model and some other variables can be incorporated in further application, the average error of forecasts simulation is –4.17% and it would be reduced. So with some limits this model is a representation of what happen in the dynamic of Industrial Production in Minas Gerais State.

The last conclusion is that the exchange rate is a variable that helps to determine the dynamic of sales tax and Industrial Production in Minas Gerais State in this model (see the Granger Test of Causality) but it is has a weak exogeneity (see Table-11) in this determination and had no feedback from Sales Tax Revenue and Industrial Production. The weak exogeneity can be attributed to the fact that any omitted variable as a basic interest rate of Central Bank of Brazil, GDP, prices index - in face of divergence of then as CPI (IPCA-IBGE) and General Price Index (IGP-DI/FGV) showed in Figure-2 - that in truth behave as transfer mechanism to prices, industry production, sales of commerce and so to sales tax as kind of The Passthrough process from depreciation to Inflation as suggest to Goldfajn and Werlang.

References

Whitt Jr., Joseph A. – "The Mexican Peso Crisis" in King, Philip "International Economics and International Economy Policy – A Reader – Third Edition, Section VIII. Financial Crises: From Mexico to Asia, pages 335-355.

Radelet, Steven and Sachs Jeffrey – "The Onset of the East Asian Financial Crisis" - in King, Philip "International Economics and International Economy Policy – A Reader – Third Edition, Section VIII. Financial Crises: From Mexico to Asia, pages 366-405.

IMF Staff – "The Asian Crisis Causes and Cures" - in King, Philip "International Economics and International Economy Policy – A Reader – Third Edition, Section VIII. Financial Crises: From Mexico to Asia, pages 406-411.

Baig, T. and Goldfajn, I. – "Financial Markets Contagion in the Asian Crisis", IMF Staff Paper, 46, 167-195

Baig, T. and Goldfajn, I. – "The contagion from Russia to Brazil," Working Paper No 420, Department of Economics at PUC, Rio de Janeiro, Brasil.

Bonomo, Marco and Terra, Cristina – "The Political Economy of Exchange Rate Policy in Brazil: 1964 – 1997. Graduate School of Economics – Getulio Vargas Foundation, Rio de Janeiro, RJ, March 1999.

Calvo, Guilhermo, Leonardo Leiderman, and Carmen Reinhart, 1993 “Capital Inflow to Latin America: The Role of External Factor”, Staff Paper, International Monetary Fund, Vol. 40 (march), pp. 108-51.

Calvo, Guilhermo, Leonardo Leiderman, and Carmen Reinhart, 1996 “Inflows of Capital to Developing Coutries in the 1990s”, Journal of Economics Perspectives, Vol. 10, No 2, pp, 123-39.

Charemza, W. and Deadman, Derek. – New Directions in Econometric Practice. Second Edition – Edgar Elgar - 2003 – Northampton, MA.

Enders, Walter – Applied Econometric Time Series – Second Edition – Wiley & Sons, Inc. 2004, New York, NY.

Ericsson, Neil R. and Irons, John S. – Testing Exogeneity – 2001, Oxford University Press, Oxford, UK.

Franses Philip – Time Series Models for Business and Forecasting – 1998, Cambridge University Press.

Goldfajn, Ilan, and Werlang, Sergio, 2000, “The Passthrough From Depreciation to Inflation: a Panel Study”, mimeo, Brazil.

Gujarati, Damodar N.2000 "Econometria Basica" – Makron Books, Terceira Edicao. Sao Paulo, S.P., Brasil.

Judge, George G., Griffiths, Willian E. and Hill, R. Carter – 2000 "Econometria" , Editora Saraiva, 2o Edicao. Sao Paulo, S.P., Brasil.