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### LINS CURVE IN ROMANIAN ECONOMY

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#### Abstract

The paper presents theoretical considerations and empirical evidence to test the validity of the Laffer in Narrower Sense (LINS) curve as a parabola with a maximum. Attention is focused on the so-called legal-effective tax gap (letg).

The econometric application is based on statistical data (1990-2013) for Romania as an emerging European economy. Three cointegrating regressions (fully modified least squares, canonical cointegrating regression and dynamic least squares) and three algorithms, which are based on instrumental variables (two-stage least squares, generalized method of moments, and limited information maximum likelihood), are involved.

Keywords: taxes, legal-effective tax gap.

JEL Classification: C32, E62, H26

#### I. Basic Assumptions

1. The Laffer curve (Laffer, 1981, 2004) relates to the correlation between tax rates and tax revenues. Synthetically, it has been described as follows: 'The basic idea...is that changes in tax rates have two effects on revenues: the arithmetic effect and the economic effect. The arithmetic effect is simply that if tax rates are lowered, tax revenues (per dollar of tax base) will be lowered by the amount of the decrease in the rate. The reverse is true for an increase in tax rates. The economic effect, however, recognizes the positive impact that lower tax rates have on work, output, and employment - and thereby the tax base - by providing incentives to increase these activities. Raising tax rates has the opposite economic effect by penalizing participation in the taxed activities. The arithmetic effect always works in the opposite direction from the economic effect. Therefore, when the economic and the arithmetic effects of tax-rate changes are combined, the consequences of the change in tax rates on total tax revenues are no longer quite so obvious (Laffer, 2004, p. 2)'. Following is a list of some of the important papers that have recently commented on Laffer's

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#### Economic Interferences



observation: Becsi (2000), Palda (2001), Novalesa and Ruiz (2002), Hairault et al. (2005, 2008), Trabandt and Uhlig (2010, 2012), and Busato and Chiarini (2012).

In its original form, the Laffer curve emphasizes the relationship between the level of taxation and the volume of public revenues actually obtained via taxation. Economic activities are influenced by the level of taxation via two main channels.

• Clearly, the Laffer curve captures the financial resources of the private sector, which reacts to aggregating demand and supply and subsequently to global output. As a result, the tax base and (ultimately) public revenues are also affected. Such an influence also exists in the BARS curve (Barro, 1990, 1991; Armey, 1995; Rahn, 1996; Scully, 1989, 1995, 1998) through the non-budgetary factor of economic growth. The ampleness of these factors obviously depends on the after-tax income of both firms and households. With respect to this aspect, the BARS and Laffer curves are superposed; relevant observations in this regard can be found in Chao and Grubel (1998) and Magazzino and Forte (2010).

• Simultaneously, the Laffer curve relates to taxation's impact on the relationship between taxpayers and tax authorities, an issue that public finance theory has examined pursuant to different concepts such as 'tax evasion', 'tax compliance', the 'tax gap' and so on. This phenomenon is also frequently discussed in connection with the so-called 'shadow (or its synonyms black, underground, non-observed, unaccounted, informal etc) economy'. Some differences and interferences do exist among these concepts, but they all primarily refer to the level of taxes collected compared to their volume as established by official norms. Therefore, technically we are concerned with the legal-effective tax gap (letg).

2. To avoid any possible confusion, we propose to define this second—more limited interpretation - as the 'Laffer in Narrower Sense' (LINS) curve. The problem was studied from several perspectives.

First, the problem was examined based on classical maximizing-utility behavior (Allingham and Sandmo, 1972; Friedland et al., 1978; Cowell, 1990; Andreoni et al., 1998; Slemrod and Yitzhaki, 2002; Giles et al., 2002; James and Alley, 2002; Devos, 2007; Bruhin et al., 2010; Alm, 2012; Piolatto and Rablen, 2013; Myles, 2014).

The researchers referenced above also advocate the following non-expected utility paradigms, 'including (but not limited to): prospect theory, rank dependent expected utility theory, first order and second order risk aversion, regret theory, disappointment theory, non-additive probabilities, and ambiguity theory.' (Alm, 2012, p. 13).

Experimental economics has also made notable contributions to this field by involving applicable valences of modern psychology (Friedland et al., 1978; Kahneman and Tversky, 1979; Slemrod et al., 2001; Torgler, 2006; Gerxhani and Schram, 2006; Iyer et al., 2010; Kleven et al., 2010; Bruhin et al., 2010; Piolatto and Rablen, 2013; Myles, 2014). A comprehensive analysis of tax behavior from a psychoeconomic perspective was performed by Kirchler (2007).

Many studies use various econometric techniques to perform empirical quantitative analyses (Pissarides and Weber, 1989; Feinstein, 1991; Schneider and Enste, 2000; OECD, 2001, 2008; Brown and Mazur, 2003; Schneider, 2004, 2005, 2006; Buhn and Schneider, 2008; Bloomquist, 2011; Alm, 2012; Gemmell and Hasseldine, 2012, 2013; Henderson et al., 2012; Ottervik, 2013; Chernick and Merriman, 2013).

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3. The core of the LINS curve consists of the conflicting concepts of 'tax acceptability' and 'tax repulsiveness'.

3.1. The former can be understood as the availability of agent-payers (firms, households, institutions) to observe fiscal norms, whereas the second represents agent-payers' propensity to elude or infringe their legal fiscal obligations. In principle, tax acceptability can be linked to two types of situations.

3.1.1. The first type relates to the capacity of the government authorities to impose rules. The economic literature contains several assumptions related to the role of audit frequency and fine rates:

• An increased number of audits increases reported income (Andreoni et al., 1998; Slemrod et al., 2001; Dubin, 2007; Kleven et al., 2010; Iyer et al., 2010; Alm, 2012);

• Audits seem to have a 'spillover effect', or lead to an increase in compliance independent of the revenues generated directly from the audits and penalties themselves (Dubin, 2007); and

• 'large fines tend to be more effective deterrents than frequent audits (Friedland et al., 1978, p. 115)'.

We could term this taxpayer behavior as 'nolens acceptability'.

3.1.2. The opposite taxpayer attitude - that is, voluntary compliance with fiscal obligations - is also accepted as a representative phenomenon. Such an attitude involves numerous factors: Socio-demographic variables (such as gender, age, nationality, marital status, educational qualifications, occupation); Tax knowledge; Fairness, trust in authorities, reciprocity, social customs and interactions, tax morale, patriotism, and general ethics; Cultural differences; Religiosity and church attendance; and Institutional and administrative aspects, democracy, and perceptions of justice.

Following are some references that are relevant to this subject: Cowell and Gordon (1988), Myles and Naylor (1996), Andreoni et al. (1998), James and Alley (2002), Alm and Torgler (2006), Torgler and Schaltegger (2006), Kasipillai and Jabbar (2006), DeLuca at al. (2007), Devos (2007), Fortin et al. (2007), Hasseldine et al. (2009), Rizal Palil (2010), Rechberger et al. (2010), Traxler (2010), Alm (2012), and Vieider et al. (2015). The main epistemological premises of the psychological approach to economics are synthesized by Akerlof and Shiller (2009).

This second type of situation relates to voluntary taxpayer behavior, which can be termed 'volens acceptability'.

In this paper, 'tax acceptability' is used in the sense of both 'volens' and 'nolens', and the notion of 'shorter speaking' is used in the sense of 'willy-nilly acceptability'.

3.2. Conversely, some popular monographs and an impressive number of papers (Gutman, 1977; Friedland et al., 1978; Clotfelter, 1983; Giles et al., 2002; Gruber and Saez, 2002; Gërxhani and Schram, 2006; Schneider and Williams, 2013; Myles, 2014) indicate that a higher tax rate leads to lower compliance, with the inverse relationship assumed either directly or implicitly. The intensity of tax regulations (Giles et al., 2002), which affects the time consumed by the taxpayers (i.e., 'time is money'), has a similar consequence. The syntagm 'tax repulsiveness' is used in this paper to refer to this concept.

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3.3. With respect to the interaction between tax acceptability and tax repulsiveness, the assumption that 'acceptability' is prevalent under low taxation and repulsiveness is prevalent under excessively high level of taxation is generally admitted.

4. As we see, the core of the LINS curve is the so-called legal-effective tax gap (letg), defined as follows:

where TAXT - collected taxes and TAXTL - total legal taxes

Introducing the average legal taxation, atax (=TAXTL/GDP), an extremely simplified LINS curve can be represented by the formula:

 $letg = \lambda 1 * atax + \lambda 2 * atax^{2} + \lambda 3 * \tau$ (2)

where  $\lambda 3$  – the influence of other factors which, for simplicity, will be represented as a time-variable parameter.

If only the impact of taxation level is considered (therefore ignoring parameter  $\tau$ ), then it seems natural to accept that letg passes through the coordinates' origin, which explains the absence of the intercept in relationship (2). According to our main assumptions, an LINS curve admits  $\lambda 1>0$  and  $\lambda 2<0$ , whereas the sign of  $\lambda 3$  may differ depending on the adjusted sample. From the first derivative of letg, the optimal level of atax (denoted ot) can be approximated by ot= $0.5*\lambda 1/-\lambda 2$ .

#### **II. Econometric Application**

1. Empirically, the LINS curve will be illustrated using Romanian economic statistics (main primary indicators for 1990-2013 are detailed in Appendix A1).

1.1. The 2012 version of the Romanian macromodel (Dobrescu, 2013a, 2013b) classifies general consolidated budget (GCB) taxes into four categories: Direct taxes on profit (DTP); Direct taxes on wages as income (DTW); Employers' and employees' social security contributions (SSC); and Net indirect taxes (NIT), which represent a combination of the value-added tax (VAT), excise and other similar taxes, customs duties, and public budget subsidies on products (with a negative sign).

The symbols within brackets were used to indicate effective (actually collected) taxes. When we addressed their legal level, the respective acronyms were used with the suffix L. These values were calculated by applying the legal rates (in lower case with the prefix l) to the corresponding macro-indicator as follows:

DTPL = Idtp * GOSF	(3)
GOSF –firms' gross operating surplus	
DTWL = ldtw * WTOT	(4)
WTOT –total wages	
SSCL = Issc * WTOT	(5)
NITL = Ivat * GVA	(6)
GVA –total gross value added	

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(1)

Despite our best efforts, the global legal rate of the net indirect taxes could not be reliably determined. Consequently, lvat was used as the greatest component of NIT. Considering that on the one hand, the lvat does not relate to the entire GVA and on the other, NIT includes indirect taxes other than VAT, the formula of NITL was taken as a satisfactory approximation of the total legal net indirect taxes.

The legal tax rates (ldtp, ldtw, lssc, and lvat) were approximated by Stanica (2013).

1.2. The indicators defined above were aggregated into the total effective taxes (TAXT) and the total legal taxes (TAXLT):

TAXT = DTP + DTW + SSC + NIT	(7	)
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TAXLT = DTPL + DTWL + SSCL + NITL(8)

2. As an aggregate magnitude, letg is related to other macroeconomic indicators in the manner of 'indirect procedures' (Schneider, 2011, p. 5).

2.1. So-called average legal taxation (atax) will be used as the main measure of the taxation policy targeted by the government. Although complicated, the impact of different factors on letg ultimately gravitates around two contradictory leverages.

Almost all of the models follow the presumption that increasing taxation negatively influences tax compliance by firms and households. However, it seems reasonable to admit that authorities' anti-evasion capacity is higher in a situation of low legal taxes and vice-versa. Consequently, our specification will designate average legal taxation as a binomial (atax and atax<sup>2</sup>). Normally, for atax=0, letg is also zero, which means that letg passes through the origin of the coordinates.

Depending on the contextual characteristics of the economy, a large variety of functional specifications are possible. A parabola is one of the most convenient methods of formalizing a model. Therefore, the influence of Laffer behavior on taxation are signified if the statistical sample properties generate a positive coefficient for atax and a negative coefficient for atax<sup>2</sup>.

2.2. Regarding time-variable ( $\tau$ ), although the linear form (t=1, 2,...,n) is highly correlated with the sample of letg used in this paper, its inclusion in the econometric determination could induce, for relatively great t, aberrant results (explosive dynamics). Simple asymptotical time-variables 1/t, t/(t+1), and (t+1)/t can overcome such a problem, but they completely ignore the fluctuating feature of statistical series, as adjusted by the Hodrick-Prescott (HP) filter (Figure no. 1).

The periodical functions were then examined. Some of those functions were expressed in the usual form  $\sin(2*\pi/d)$ , whereas others showed a diminishing trend of oscillations  $\sin(2*\pi*t/d)/t$ . In both cases, five values for d - namely, 4, 5, 6, 7, and 8 - were calculated, denoting the first series  $\sin(d)$  and the second  $\sin(d)$ .

The correlations (Galtung-Pearson and Spearman rank-order) and the results of a causality Granger test between the periodical functions and letg are presented in Appendix A2. To compare the results, an eight-year duration was considered acceptable, because this duration is compatible with the domestic socioeconomic environment (two successive four-year electoral cycles with almost regularly alternating political power).

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Figure no. 1: Actual and Hodrick-Prescott filtered LETG series

2.3. The following specification was ultimately retained for the estimation:

letg =  $\lambda 1 * atax + \lambda 2 * atax^2 + \lambda 3 * sint8$ 

(9)

The Augmented Dickey-Fuller and Phillips-Perron unit root tests showed unambiguously that atax,  $atax^2$ , and letg are I(1). The Johansen algorithm was applied to these series together with the time factor sint8; both the trace and the max-eigenvalue tests indicated two cointegrating equations at the 0.05 level.

3. Consequently, the specification of letg (as a dependent variable) with the regressors atax, atax<sup>2</sup>, and sint8 was estimated using the fully modified least squares (FMOLS), the canonical cointegrating regression (CCR), and the dynamic least squares (DOLS) methods. The corresponding equations are denoted as EqL1, EqL2, and EqL3.

3.1. The results obtained were synthesized and presented in Table no. 1.

Table no. 1: Output of estimated coefficients with cointegrating regressions for letg = f (atax, atax<sup>2</sup>. sint8)

Variable	Parameter symbol	EqL1- FMOLS	EqL2-CCR	EqL3 DOLS
atax	λ1	4.254728	4.135635	4.162906
atax <sup>2</sup>	λ2	-6.66771	-6.39857	-6.45939
sint8	λ3	0.323017	0.288066	0.355533
R-squared		0.78909	0.79452	0.785541
Adj.R-squared		0.766889	0.772891	0.708948

Independent of the applied technique, the estimators and coefficients of determination have similar values. The discrepancy registered in the case of DOLS between  $R^2$  and  $adj-R^2$  results from the lower number of degrees of freedom involved in this technique.

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3.2. The cointegrating relationship among the involved indicators was investigated using the Park Added Variables, the Engle-Granger, and the Phillips-Ouliaris tests. With the exception of the Park Added Variables test for EqL3, the tests confirmed that the series are cointegrated (Table no. 2).

		1		1				
	EqL1-		EqL2-		EqL3-			
	FMOLS		CĈR		DÔLS			
	Value	Droh	Value	Droh	Value	Droh		
	value	1100.	value	1100.	value	1100.		
Park Added Variables—Null hypothesis: Series are cointegrated								
Chi-square	2.505002	0.4744	2.231128	0.5258	13.40819	0.0038		
Engle-Granger—Null hypothesi	s: Series are 1	not cointeg	grated					
Engle-Granger tau-statistic	-4.27853	0.0025	-4.27853	0.0025	-4.27853	0.0025		
Engle-Granger z-statistic	-40.0921	0	-40.0921	0	-40.0921	0		
Phillips-Ouliaris—Null hypothesis: Series are not cointegrated								
Phillips-Ouliaris tau-statistic	-3.28474	0.0224	-3.28474	0.0224	-3.28474	0.0224		
Phillips-Ouliaris z-statistic	-14.6589	0.0249	-14.6589	0.0249	-14.6589	0.0249		

 Table no. 2: Cointegration tests for letg=f(atax, atax2, sint8)

3.3. The residuals of the above-presented equations (resL1, resL2, and resL3) were tested (Appendix A3.1) for normality, unit root, and serial correlation (BDS in normal and bootstrapped variants). Except for some BDS estimations for resL1, these tests validated the econometric specification examined here.

3.4. The estimators of EqL1, EqL2, and EqL3 therefore confirm the presence of an LINS curve in the analyzed series. The optimal levels of atax are as follows: 0.319055 for ot1, 0.323169 for ot2, and 0.322237 for ot3.

3.5. That said, the effects of collinearity could not be ignored. The variance inflation factors appear as in Table no. 3.

	EqL1- FMOLS		EqL2- CCR		EqL3- DOLS	
Variable	Coefficient Variance	Uncentered VIF	Coefficient Variance	Uncentered VIF	Coefficient Variance	Uncentered VIF
atax	0.046634	193.3219	0.045536	191.2524	0.054655	214.814
atax <sup>2</sup>	0.239934	199.6515	0.234858	195.4273	0.283056	214.9064
sint8	0.005068	1.998049	0.003653	1.440275	0.008573	1.069702

Table no. 3: Variance inflation factors of cointegrating regressions for letg = f (atax, atax<sup>2</sup>, sint8)

We note that the disturbing collinearity effects relate to the estimators of main determinants of letg - atax and atax<sup>2</sup>.

4. Consequently, the specification of letg was solved using two-stage least squares (TSLS), generalized method of moments (GMM), and limited information maximum likelihood (LIML) techniques. The corresponding equations are denoted EqL4, EqL5, and EqL6.

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4.1. The econometric results are given in Table no. 4.

Variable	Parameter symbol	EqL4-SLS	EqL5-GMM	EqL6-LIML
atax	λ1	4.3425	4.465522	4.386063
atax <sup>2</sup>	λ2	-6.8864	-7.19486	-6.98649
sint8	λ3	0.368309	0.406647	0.382287
R-squared		0.77745	0.739495	0.768777
Adj. R-squared		0.751267	0.708848	0.741575

 Table no. 4: Output of estimated coefficients with instrumental variables

 for letg = f (atax, atax<sup>2</sup>, sint8)

4.2. As in the previous cases, these econometric results were subjected to residual tests for normality, unit root, and serial correlation (Appendix A3.2). It was found that only serial correlation showed problems. Nevertheless, even in this case, there are significant bootstrap probabilities.

#### **III. Some Closing Notes**

1. The paper presents theoretical considerations and empirical evidence to attest to the validity of the Laffer In Narrower Sense (LINS) curve with parabolas at their maximum. The following simulation is relevant. The above determinations (EqL1-EqL6) were computed for changing atax from 0.1 to 0.55 under the constant sint8=-0.030744 (last term of used sample). Figure no. 2 plots the values of letg (denoted LINS with the suffix of the corresponding equation).



Figure no. 2: Simulated LINS curve for changing atax

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We cannot underestimate the disturbing effect of the information shortage. The author endeavored to compensate for this by simultaneously using several econometric techniques. We note that different procedures resulted in acceptably close estimations, thus confirming the robustness of the computed specifications and by implication, the consistency of their conceptual pillars.

2. Many problems remain to be investigated.

2.1. For instance, it is very important to deepen the structure of the  $\tau$  factor (in formula 2), which involves supplementary specific variables, using adequate statistical measures.

2.2. It would also be of great interest to define the legal-effective tax gaps (letg in formula 1) distinctly for the main components of atax for direct taxes on profit (DTP), direct taxes on wages as income (DTW), employers' and employees' social security contributions (SSC), and net indirect taxes (NIT), respectively. Such a disaggregation would offer a more comprehensive image of the phenomenon analyzed in this paper and consequently, would enable the identification of more efficient recommendations for macroeconomic policies.

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#### Appendix A1: Statistical Series

	atax	GDP	letg	Т	TAXLT	TAXT
Year	Average legaltaxation;	Gross domestic product, current prices, bill.RON	Legal- effective tax gap	Time	Total legal taxes, bill.RON	Total collected taxes (DTP+DTW+SSC+NIT), bill.RON
1990	NA	0.08579	NA	NA	NA	0.02565
1991	0.506381	0.22039	0.569707	1	0.111601	0.06358
1992	0.54672	0.60292	0.461428	2	0.329629	0.1521
1993	0.492541	2.00357	0.551102	3	0.98684	0.54385
1994	0.456317	4.97732	0.572398	4	2.271235	1.30005
1995	0.43781	7.6489	0.523387	5	3.348765	1.7527
1996	0.429013	11.3842	0.504569	6	4.883969	2.4643
1997	0.416121	25.5298	0.5652	7	10.6235	6.0044
1998	0.477059	37.0551	0.550197	8	17.67749	9.7261
1999	0.502109	55.1914	0.52091	9	27.71207	14.4355
2000	0.464875	80.9846	0.563458	10	37.6477	21.2129
2001	0.46473	117.9458	0.543425	11	54.81295	29.7867
2002	0.452971	152.017	0.552178	12	68.85927	38.0226
2003	0.435344	197.4276	0.572818	13	85.949	49.2331
2004	0.435764	247.368	0.573447	14	107.7942	61.8143
2005	0.381185	288.9546	0.663141	15	110.1451	73.0417
2006	0.381551	344.6505	0.672792	16	131.5016	88.4732
2007	0.382277	416.0068	0.675155	17	159.03	107.3699
2008	0.383408	514.7	0.664217	18	197.3402	131.0767
2009	0.393687	501.1394	0.626471	19	197.2922	123.5978
2010	0.411424	522.5611	0.555749	20	214.994	119.4826
2011	0.429143	556.7	0.601665	21	238.9037	143.74
2012	0.428945	587.5	0.599758	22	252.0053	151.1421
2013	0.426524	626.2	0.60998	23	267.0893	162.9192

Appendix A2: Correlation and Granger test between time-variable periodical functions and letg

Time-variable	Galtung-Pearson (ordinary) correlation	Spearman rank-order correlation	The probability that time- variable does not Granger-cause letg (one lag)
sin4	-0.10661	-0.00988	0.6232
sin5	-0.04049	-0.04644	0.8669
sin6	-0.27536	-0.20751	0.9537
sin7	0.138512	0.157115	0.581
sin8	-0.02632	-0.14526	0.2011
sint4	-0.05231	-0.05138	0.0112
sint5	-0.04049	-0.04644	0.8669
sint6	-0.22458	-0.12253	0.159
sint7	-0.16407	0.025692	0.2367
sint8	-0.22158	-0.11265	0.1148

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**Appendix A3** Statistical tests A3.1:Tests of residuals of cointegrating regressions for letg=f(atax, atax<sup>2</sup>, sint8)

Tests	resL1		resL2	0 ( )	resL3	
37 1.	JB Stat.	Prob.	JB Stat.	Prob.	JB Stat.	Prob.
Normality	1.285799	0.525766	1.586431	0.452388	1.701066	0.427187
Unit root for I(0)						
Arra Distance Faller	t-Stat.	Prob.	t-Stat.	Prob.	t-Stat.	Prob.
Aug. Dickey-Fuller	-4.33729	0.0002	-4.2242	0.0002	-3.28516	0.0025
Phillips-Perron	Adj. t- Stat.	Prob.	Adj. t- Stat.	Prob.	Adj. t- Stat.	Prob.
1	-3.26575	0.0024	-3.16827	0.0031	-3.1388	0.0035
BDS	Normal Prob.	Boot. Prob.	Normal Prob.	Boot. Prob.	Normal Prob.	Boot. Prob.
Fraction of pairs						
Dimension						
2	0.0049	0.06	0.2122	0.52	0.8898	0.74
3	0.004	0.08	0.2848	0.42	0.5036	0.94
4	0.0321	0.1	0.4843	0.48	0.0004	0.08
5	0.6705	1	0.3644	0.86	0.0003	0.02
6	0.6888	0.82	0.7723	0.78	0.007	0.08
St. deviations						
Dimension						
2	0.0297	0.1956	0.0012	0.1806	0.5055	0.8936
3	0.0746	0.2736	0.0563	0.348	0.4391	0.5662
4	0.0114	0.1808	0.149	0.7922	0.2439	0.8758
5	0	0.0748	0.0077	0.4098	0.0071	0.3044
6	0	0.0392	0.0625	0.5842	0.2363	0.7654
Fraction of range						
Dimension						
2	0.051	0.4754	0.0405	0.4844	0.0191	0.5078
3	0.0043	0.417	0.0024	0.4148	0.0106	0.5646
4	0.004	0.4784	0.0013	0.4242	0	0.059
5	0	0.0342	0	0.0404	0	0.1654
6	0	0.0984	0	0.1228	0	0.2754

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# A3.2:Tests of residuals of equations with instrumental variables for $letg=f(atax, atax^2, sint8)$

Tests	resL4		resL5		resL6	
Normality	JB Stat.	Prob.	JB Stat.	Prob.	JB Stat.	Prob.
	0.398116	0.819502	0.167275	0.919764	0.315338	0.854133
Unit root for I(0)						
Aug. Dickey-Fuller	t-Stat.	Prob.	t-Stat.	Prob.	t-Stat.	Prob.
	-4.51469	0.0001	-3.73421	0.0009	-4.41572	0.0002
Phillips-Perron	Adj. t- Stat.	Prob.	Adj. t- Stat.	Prob.	Adj. t- Stat.	Prob.
	-3.15664	0.0391	-3.02779	0.0045	-3.25251	0.0027
BDS	Normal Prob.	Boot. Prob.	Normal Prob.	Boot. Prob.	Normal Prob.	Boot. Prob.
Fraction of pairs						
Dimension						
2	0.0373	0.24	0.076	0.3	0.0165	0.28
3	0.8656	0.7	0.7181	0.92	0.782	0.58
4	0.7848	0.56	0.67	0.96	0.8734	0.5
5	0.4838	0.38	0.9273	0.74	0.3706	0.28
6	0.4874	0.34	0.7377	0.48	0.2947	0.18
St. deviations						
Dimension						
2	0.0281	0.142	0.0349	0.1632	0.0129	0.1256
3	0.0768	0.2162	0.0342	0.1542	0.0145	0.1504
4	0.0001	0.067	0.0048	0.11	0	0.065
5	0	0.0212	0	0.0242	0	0.0222
6	0	0.0162	0	0.0144	0	0.018
Fraction of range						
Dimension						
2	0.2001	0.6512	0	0.403	0.3021	0.6528
3	0	0.116	0	0.5026	0	0.1316
4	0	0.4262	0	0.4298	0	0.2738
5	0.0624	0.8076	0.014	0.8134	0.0006	0.5892
6	0.4559	0.9616	0.3256	0.9692	0.0329	0.8318

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