A Macroeconomic Model for Analysing and Forecasting Levels of Business and Consumer Insolvency in Canada

by

Richard Archambault
(archambault.richard@ic.gc.ca)
Dominic Laverdière
(laverdiere.dominic@ic.gc.ca)

Economic Information and Analysis
Office of the Superintendent of Bankruptcy
Industry Canada

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***Note*:**
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Abstract

The main purpose of this document is to improve our understanding of the macroeconomic factors responsible for the increase in insolvency in Canada so as to be more able to predict how this will change in the future. On the basis of the existing literature, the authors developed one model for consumer insolvency and another for business insolvency.

Different statistical criteria were used to select each of the models. The results obtained with the models suggest that the debt-to-income ratio is the determinant having the greatest influence on the increase in consumer insolvency for the 1987–2003 period. In the case of business insolvency, it seems that the drop in interest rates was the main reason for the decrease in this type of insolvency between 1996 and 2003. The average forecasting error one year ahead for the consumer and business insolvency models is 3.6% in both cases.

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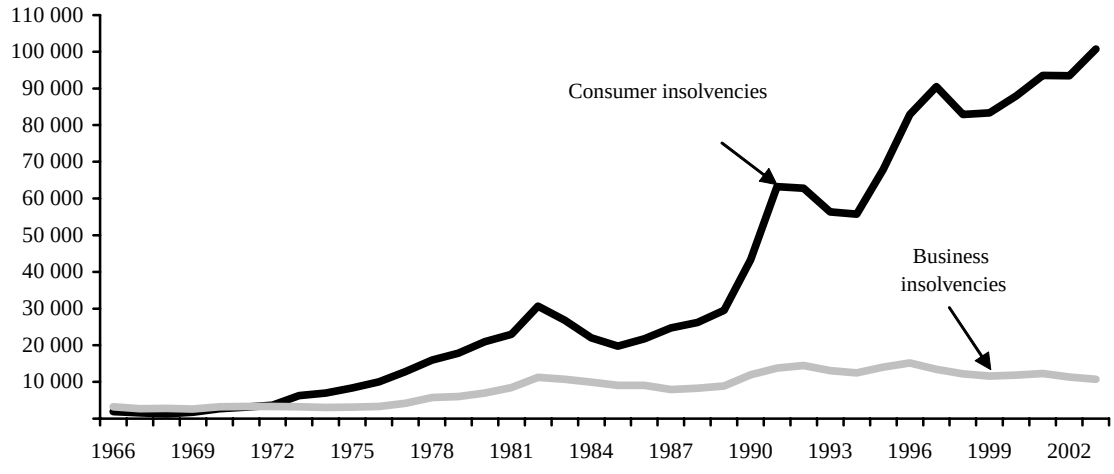
1. Introduction

In Canada, since the end of the 1960s, the number of cases of insolvency has increased by an average of 8.3% per year. These insolvencies are made up of two major types: consumer insolvencies and business insolvencies.[1] Since 1966, the number of consumer insolvencies has increased by 11.3% on average per year. In 1966, there were 1,903 cases of consumer insolvency or 0.15 cases per thousand Canadians aged 18 or over. In 2003, the number of consumer insolvencies rose to 100,745, corresponding to 4.1 cases per thousand Canadians aged 18 or over.

Taking a look at the summary administration bankruptcies[2] filed in 2003 allows us to draw a brief socio-economic portrait of these bankrupts. First of all, we notice that most of them are male (59%). The bankrupts are, on average, 42 years old and their average net monthly income is 1,479$. As for their marital status, 44% declared being

Figure 1: Number of insolvency cases filed with the OSB, Canada 1966-2003



[1] The classification of an insolvency file as consumer or business is determined by the proportion of debts related to consumption or operating a business. A file in which more than 50% of the debts are due to consumption will be considered as a case of consumer insolvency. Business insolvency includes, in addition to corporations, individuals who have more than 50% of their debts derived from the operation of a business.

[2] The data used for this profile are from the Office of the Superintendent of Bankruptcy's electronic filing system and concern summary administration bankruptcies only, i.e. non-corporate bankruptcies in which

married/common-law spouse whereas 28% are divorced, which is a much higher rate than in the general population.

The summary administration bankruptcy files have, on average, $57,199 of debt, which is considerably higher than the average net realizable value of the assets[3], which stands at $505. Assets consist mainly of furniture, automobiles and personal effects. The debts are primarily from credit cards, bank loans (excluding mortgages) and claims from federal, provincial or municipal governments.

During the 1966–2003 period, the annual average increase in business insolvencies was more moderate at 3.3%. Whereas there were 3,199 cases of business insolvency in 1966, this category peaked at 15,180 cases or 10.2 cases per thousand businesses in 1996. In 2003, there were only 10,670 cases of business insolvency or 4.8 cases per thousand businesses. At the time of filing for protection under the Bankruptcy and Insolvency Act, businesses had, on average, $688,405 in liabilities for $141,107 in assets.

The insolvency rate varies significantly between the different industrial sectors. Among the sectors with the highest insolvency rate per 1,000 businesses, we find Accommodation and Food services (10.6), Transportation and Warehousing (9.9), and the Manufacturing sector (9.8). At the other end of the spectrum we have the Real Estate and Rental and Leasing sector (1.2), Management of Companies and Enterprises (1.3), and the Finance and Insurance sector (1.3).

The insolvency process consists of two main types of procedure: bankruptcy and proposal. “Bankruptcy” corresponds to liquidation of the debtor’s assets and the cancellation of his liabilities. The proposal procedure involves an agreement between the creditors and the debtor whereby it is arranged that the debtor will reimburse part of his liabilities and keep his assets. Thus, business proposals allow the businesses concerned to

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the net realizable assets are not expected to exceed $10,000. Summary administration filings represent substantially all of consumer bankruptcies (99% in 2003).

[3] The net realizable value of assets is defined as the estimated dollar value of the assets less exempt property and any secured amount/liens.

continue operating. In 2003, proposals represented 16.4% of consumer insolvencies and 17.1% of business insolvencies.

In 1992 and 1997 respectively, certain provisions of the *Bankruptcy and Insolvency Act* (BIA)[4] were amended in key ways. The consumer-proposal procedure was introduced when the BIA was amended in 1992. Although the business-proposal procedure already existed at that time, certain amendments made this approach more viable and made it easier for creditors to accept. The main purpose of the reform of the BIA in 1997 was to encourage the use of consumer and business proposals as alternatives to bankruptcy. Furthermore, students' debts, which were previously dischargeable as soon as their studies were completed, became dischargeable only 10 years after completion of studies. Since this change was announced long before it took effect, many students seem to have filed for insolvency in a pre-emptive way. This phenomenon is the main reason for the increase in insolvency noted in 1996 and 1997, and the drop in 1998.[5]

The bankruptcy and proposal process in Canada is governed by the BIA and supervised by the Office of the Superintendent of Bankruptcy (OSB).[6] The rise in the number of files is a major concern of the OSB. Since the OSB has to supervise the administration of insolvency files, any increase or decrease in their number affects the OSB's requirements in human and financial resources.[7]

This article has two complimentary objectives. The first objective is to acquire a better understanding of the socio-economic factors that affect business and consumer

[4] There is another important law in Canada for the process of reorganizing businesses, the *Companies' Creditors Arrangement Act* (CCAA). This act can be used, at the debtor's discretion, for any business reorganization, providing that the total value of the liabilities is over $5 million. This act is not supervised by the OSB and no public register exists. For instance, Air Canada, Teleglobe and the Ottawa Senators hockey club have all used this mechanism in recent years to reorganize their operations.

[5] An OSB analysis by age group attributes 50% of the increase in 1996–1997 and 90% of the drop in 1998 to the 34-and-under group. This is the age group that is more likely to contain debtors with a student loan to repay.

[6] For more information about the OSB, please refer to its Web site at: http://strategis.ic.gc.ca/epic/internet/inbsf-osb.nsf/en/home.

[7] The OSB is a special operating agency of Industry Canada that is obliged to finance its own operations. Its main sources of revenue are the registration fees paid to open insolvency files and a levy imposed on the dividends paid to unsecured creditors.

insolvency. The second objective is to develop a forecasting model for business and consumer insolvency. We will attempt to develop two models, one for each type of insolvency.

The remainder of this document is organized as follows: In section 2, we present a review of the economic literature. The determinants that we will assess to develop the business and consumer insolvency models are described in section 3. Section 4 is devoted to the choice of models or business and consumer insolvency equations. Our choices are based on the results of the various statistical and specification tests and on the assessment of the forecasting performance of each model. The statistical inference results are presented in section 5 and our conclusions in section 6.

2. Literature review

The empirical literature on bankruptcy is relatively plentiful and is basically of two kinds. On the one hand, there are studies that focus on the microeconomic aspect of bankruptcy, which use cross-sectional data on the characteristics of individual businesses or consumers. On the other hand, there are studies that take a macroeconomic approach using chronological series data to identify the macroeconomic determinants of bankruptcy. Since one of the objectives of this article is to forecast the volume of business and consumer insolvencies, we will concentrate more on the macroeconomic approach, leaving the microeconomic approach for a later day.

2.1 Consumer insolvency

One of the first empirical studies of the macroeconomic determinants of consumer bankruptcy was made by Yeager (1974). Using data on American households for the period from 1950 to 1970, he developed a model for the rise in the number of bankruptcies per 100,000 individuals. Using only the consumer debt-to-income ratio[8] (lagged six months), he was able to explain 94% of the increase in bankruptcies during this period. To improve the model, the unemployment rate, lagged for several time periods was added, but the results were not convincing. Yeager's work was updated by Sullivan (1983) for the 1950–1982 period. In addition to confirming the relationship between the consumer debt-to-income ratio and the bankruptcy rate, Sullivan used the Consumer Sentiment Index as a measure of the willingness of households to repay their debts. Also, the addition of dichotomous variables for the years during which the American economy was in recession and to reflect the effect of changes to the American bankruptcy act enhanced the model's explanatory value. Shepard (1984) amply confirmed this hypothesis, stating, on the basis of the conclusions of his study on the annual number of bankruptcies in the United States that the rise in the debt-to-income

[8] The consumer debt-to-income ratio refers to consumer credit as a percentage of disposable personal income.

ratio of households is largely responsible for the sharp rise in the number of bankruptcies that occurred in the early 1960s.

The approach of Kowalewski (1982) is more complex from a theoretical standpoint. His approach revolves around an intertemporal model of the maximization of the consumer's utility whereby the preferences between current and future consumption are subject to the budgetary constraint of current and future income. The empirical calculation of the model, in which the dependent variable is the number of bankruptcies *per capita*, uses quarterly data for the 1961–1979 period. The independent variables of the model included permanent and temporary income measures, interest rates and a variable for non-discretionary expenses. Three variables involving households' portfolio of assets/liabilities were also included. All the variables, except the series on interest rates, proved to be statistically significant.

Fay, Hurst and White (2002), who portray bankruptcy as the result of a strategic decision, rather than the consequences of unforeseen events, state that the age of the head of the family, his/her level of education and the size of the household are also factors that affect the decision to declare bankruptcy. In a similar vein, Zywicki (2004) critiques what he considers as the "traditional model" where consumer indebtedness and unexpected income or expense shocks are the cause of consumer bankruptcies. His critique is based on the considerable increase of the consumer bankruptcy rate in the United States in the past 25 years. According to the author, there are no reliable indicators that can lead to the conclusion that this increase is the result of the deterioration of the financial condition of households or of an increase in the frequency or severity of financial shocks to which they are exposed. He concludes that the increase in the consumer bankruptcy rate comes from an increase in the propensity of households to file for bankruptcy when financial difficulties arise. This could be the result of changes in the relative economic costs and benefits of filing bankruptcy; changes in the social norms regarding bankruptcy; changes in the nature of consumer credit that have led to an increased willingness of consumers to discharge their obligations in bankruptcy.

Domowitz and Sartain (1997) argue that the most important factor in a given household's decision in the face of bankruptcy is the existence of health problems leading to a build-up of health care debts.[9] However, disproportionately high credit card debt is generally the strongest contributor to the likelihood of insolvency. As for the factors that determine whether an insolvent household opts for the proposal or the bankruptcy route, a rise in the marriage rate, the employment rate, income or the assets-to-liabilities ratio all point toward the proposal option. Using American credit card account data, Gross and Souleles (2001) belong to the small circle of authors who have found a link between the unemployment rate and a heightened risk of bankruptcy. In general, the authors concur in concluding that households that own their accommodation are less likely to declare bankruptcy.

O'Neil (1998) conducted one of the few studies that deal with the Canadian context. In another attempt to determine whether economic factors can explain bankruptcy statistics, he developed a model of the number of bankruptcies per 1,000 adults for the 1975–1996 period. The independent variables used were the real GDP growth rate and the ratio (lagged by two periods) of debt service[10] to disposable personal income. A dichotomous variable was added to take into account the structural change detected in 1992.[11] The results obtained indicate that all the variables are significant and have the expected sign.

In a study commissioned by the OSB, Schwartz and Anderson (1998) tried to draw up the profile of the typical insolvent Canadian debtor, using a sample of individuals who had sought the protection of the BIA during the months of March and April 1997. From the data gathered they determined that potential bankrupts do not constitute a homogenous group or one that is representative of the general Canadian

[9] This type of indebtedness is especially prevalent in the United States where health care is not one of the services provided by the government and health insurance is not something everyone can afford.
[10] Debt service refers to the interest paid on consumer and mortgage credit in relation to disposable income.
[11] The structural change in 1992 coincided with the amendments to the *Bankruptcy and Insolvency Act* that were designed to reduce the number of bankruptcies. However, the number of bankruptcies continued to increase. The author postulates that this change might be due to other factors, such as the increase in the cost of post-secondary education and the resultant upsurge in student indebtedness.

population. In fact, divorced people and individuals younger than 50 were over represented in their sample. In terms of household income, the median for the sample was $24,000, compared with $31,000 for the population at large. While the labour-market participation rate for the potential bankrupts was 85%, their unemployment rate was close to 25%, which was much higher than the national unemployment rate at the time. Moreover, at the time of the study, loss of employment turned out to be the main reason for recourse to bankruptcy. The authors also studied the changes in real GDP and the unemployment rate in relation to the evolving pattern of bankruptcies in Canada. Their basic hypothesis stipulates that [translation] "when the economy is strong, the economic situation of individuals improves and when the economy is poor, some individuals bear the consequences and the number of bankruptcies increases."

2.2 Business insolvency

Few researchers seem to have spent time studying the macroeconomic determinants of business insolvency. Research to date seems to have focused more on forecasting bankruptcies using various financial ratios.

Takala and Viren (1996) studied business bankruptcies in Finland for the 1922–1994 period. The variables selected for the analysis were debt ratios (business debts-to-GDP), GDP percentage change, the real interest rate, the percentage change in share prices, the real exchange rate and the share of central government expenses in the GDP.[12] In addition, the number of bankruptcies, lagged by one year, was used to capture the persistence of bankruptcies. All these variables proved to be statistically significant and were able to explain up to 96% of the changes in number of bankruptcies.

To explain the changes in the rate of business bankruptcies in Canada, O'Neill (1998) repeated virtually the entire model used for consumers with the following independent variables: ratio of debt service to disposable personal income, GDP growth

[12] The share of central government expenditures in GDP is used as a determinant to properly include the period covering World War II when government expenditures accounted for 50% of GDP, whereas, in normal times, they only represent about 10%.

rate, and business profits as a percentage of GDP. The inclusion of the ratio of debt service to personal income is justified by the fact that many small businesses use personal credit and income to finance their operations. These three variables alone explain most of the increase in business bankruptcies during the 1978–1995 period.

3. The determinants selected to develop the model

Several variables[13] were considered in developing the business and consumer insolvency models. For each model, we selected a set of cyclical variables and a set of structural variables. While cyclical variables have transitory effects on increasing insolvency, structural variables have permanent effects.

3.1 The determinants selected for the consumer model

In this model, the cyclical variables tested are GDP, the unemployment rate and the employment rate. The effect of GDP and the employment rate on consumer insolvency should be contracyclical and the effect of the unemployment rate should be procyclical. We have an *a priori* preference for the employment rate variable for the following reasons. First, the employment rate is defined as the percentage of the Canadian population of working age that receives income from work. Creditors are more likely to grant credit to a debtor with employment income than to a debtor without work. Second, unlike the unemployment rate, fluctuations in the employment rate are independent of the movement of people entering and leaving the labour force.

With respect to structural variables, we strongly believe, like Yeager, Sullivan and Shepard, that an increase in the consumer debt-to-income ratio[14] is a major determinant of a higher number of insolvencies. There appears to be a lag between movements in the debt-to-income ratio and consumer insolvency (see figure 2). We will test two debt-to-

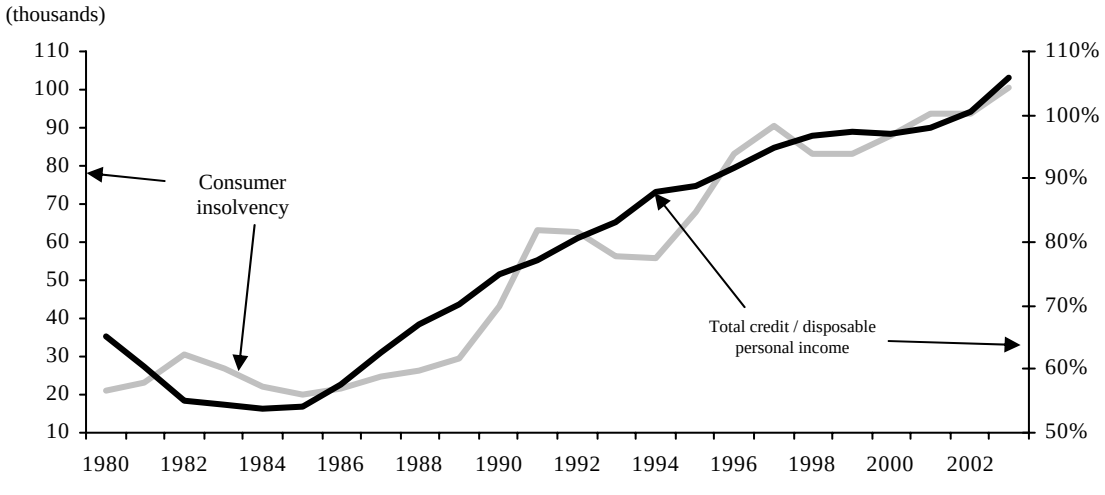
[13] The choice of variables was also subject to certain operational constraints. Since one of the objectives is a quarterly forecast of the number of business and consumer files, we were forced to restrict our choice to variables operating on a quarterly basis and which were available with little delay. For example, the number of divorces is a figure that is only available on an annual basis and is published with a two-year time-lag. This variable was nonetheless tested in an annual model, but the associated coefficient was the opposite of theoretical expectations. Divorce is a reason often mentioned by debtors to explain their recourse to the BIA.

[14] Several economists quoted in the daily newspapers often speak about the ratio of debt to assets as a better indicator of a consumer's financial health. Over the last 10 years, 89% of insolvent debtors who filed with the OSB had less than $10,000 in assets. That is why the debt/income ratio seems to be a better yardstick for the purposes of this exercise. Also, the data to construct a ratio of debts to assets have only been available since the early 1990s.

income ratios — one involving consumer credit debt and the other involving total credit debt. The first ratio reflects the weight of unsecured debt compared with the disposable income in circulation in the economy, while the second ratio takes into consideration secured and unsecured debt measured by the addition of mortgage debt. It seems that an increasing number of consumers are going to accumulate unsecured debt so as to be able to continue repaying their mortgages. The total credit ratio thus measures the entire weight of consumer debt with respect to disposable income. The ratio of total credit exceeded the 100% threshold in the second quarter of 2002. In other words, the average debtor in Canada now needs to devote slightly more than all his disposable income in a given year to repay all his personal debts.

The growth in the Canadian population will be another factor to consider. In fact, all things being equal, it might be expected that if the population grows, the number of insolvencies will increase as well. As suggested by O'Neil, we will test the debt-service ratio, and will also take into consideration mortgage interest rates. An increase in the mortgage interest rate will result in an increase in the interest burden of home-owning consumers. For all the structural variables, we expect that the associated coefficient sign will be positive.

Figure 2: Consumer insolvency and total debt / income ratio



3.2 The determinants selected for the business model

For the business model, we basically adopted O'Neil's approach with a few small additions. GDP[15] is used as the cyclical variable and we anticipate a contracyclical effect in the sense that when GDP increases, the number of business insolvencies should decline.

The structural variables tested in our models are business profits, business profits as a percentage of nominal GDP, debt-service ratio and short-term interest rates. We expect business insolvency to correlate negatively with business profits and positively with debt-service and short-term interest rates.

[15] This variable also reflects variations in the exchange rate. We tried to incorporate exchange rates directly into our model but were unsuccessful.

4. Results

4.1 Data source

The insolvency data used to develop and assess the models came from the IMPACT database, administered by OSB.[16] This database contains all the information relating to insolvency files since 1976, disaggregated by month. However, these data are only reliable from 1987 on. Before that date, the information needed to categorize the various file types (namely, the administrative codes) was incomplete. As a result, the data prior to 1987 will only be used as initial values in calculating the various equations.

Most chronological series used as independent variables in the models come from Statistics Canada's CANSIM database. The exception in the case of the series relates to

Table 1

Variable	*Mnemonic*	*No.*	*Source*
Consumer insolvency	ic		OSB
Employment rate	ep	v2062817	CANSIM
Unemployment rate	ur	v2062815	CANSIM
Debt-to-income ratio (a+b/c)	ratio		
Consumer debt-to-income ratio (b/c)	ratio_cons		
Mortgage credit (a)		v122726	CANSIM
Consumer credit (b)		v122689	CANSIM
Disposable personal income (c)		v498186	CANSIM
Population (15 +)	pop	v2062809	CANSIM
5-year mortgage rate	rmcm5	v122521	CANSIM
GDP (basic prices)	gdp	v2035516	CANSIM
GDP (market prices)	ygdpk	v1992067	CANSIM
Debt service	debtserv		BoC
Consumer debt service	debtserv_cons		BoC
Business insolvency	ie		OSB
90-day commercial paper interest rate	rcp90	v122491	CANSIM
Before-tax business profits	profits	v498214	CANSIM
Business profits as % of GDP	cpngdp		
Business profits		v498214	CANSIM
Nominal GDP (basic prices)		v1992223	CANSIM

OSB: Office of the Superintendent of Bankruptcy

CANSIM: Statistics Canada

BoC: Bank of Canada

[16] The OSB information consists of the number of new insolvency cases filed each month. We are thus dealing with flows that we will total to obtain quarterly series.

debt service, since these data were provided to us by the Bank of Canada directly. The debt-to-income ratio series and the business-profits-as-percentage-of-GDP series needed to be constructed because they were not directly available. The debt-to-income ratio was calculated by dividing total consumer and mortgage credit by disposable personal income. The business-profits-as-percentage-of-GDP figure simply represents before-tax business profits divided by nominal GDP expressed as a percentage.

4.2 Defining the models

The first step in our empirical analysis was based on reviewing the chronological series to control for unit roots. The results of the Augmented Dickey-Fuller tests and the Phillips-Perron test, as well as the order of integration of the series are presented in the appendix.

It is very apparent that, for the sampling period, all the series are integrated of order 1, except for the population series, which is integrated of order 2. However, this property has implications for the choice of model type that we propose estimating, given that there is a greater risk of false correlations when modelling by levels takes place in the presence of unit roots. That is why we opted for first-difference modelling,[17] in which all the series will be transformed so as to be integrated of order 0.

4.3 Estimating, forecasting and model assessment criteria

To calculate the models, we used the data for the entire period, i.e., from 1987:1 to 2003:4. The ordinary-least-squares (OLS) method was used to obtain the coefficient estimates. After this estimation, we undertook an initial round of selection to identify the best specifications. Our selection criteria were based on the usual tests, such as adjusted

[17]The various models envisaged were all developed in terms of growth rates. For the variables expressed as levels, growth rates were obtained by using the difference of the logarithm of the value of a series at time T and the logarithm of its value at T-1. For variables that are already expressed as rates (e.g., the debt-to-income ratio), we simply use the difference between the value of the variable at time T and its value at time T-1.

R^2, the LM serial correlation test, the Jarque-Bera normality test and the Ramsey to detect specification problems, plus certain stability tests that are described in the appendix.

To assess the forecasting performance of each equation, we separated our initial estimation period into two sub-periods. Through use of a recursive method[18] starting with the 1987:1–1998:4 period, we can make 20 iterations, producing the same number of forecasts on the basis of which we are then able to analyse the forecasting performance of each model.

The criteria we used to assess the forecasting capacity of the models focus not only focus on the models' accuracy, but also on their ability to predict variation direction. The accuracy of the forecasts is measured using the Theil Statistic, bias, variance and covariance proportions[19], as well as the mean absolute percentage error. With respect to the ability to forecast variation direction, this is measured using a confusion index. This index is obtained by computing the proportion of times the model gives correct directional predictions of the actual series.

4.4 Analysing the results

Tables 2a and 2b together show the equations that were tested, as well as their results on the different tests. It will also be seen that the series of residuals of each of these equations behaves like white noise. As mentioned in sections 3.1 and 3.2, various cyclical variables were tested to identify those that maximised the test criteria as a whole. Once the cyclical variable was chosen, various arrangements of the structural variables were then assessed.

[18] In this case, the recursive method consists in calculating the model on the observations T_0 to T_1 in order to calculate the forecast at time T_1+1. Then, the model is recalculated on the period T_0 to T_1+1 to obtain the forecast at timeT_1+2, and so on.

[19] The bias proportion corresponds, in part, to the systematic error in the forecast, in the sense that it represents the difference between the average of the predicted series and the average of the series containing the actual values. The variation proportion can be interpreted as reflecting the inefficiency of the forecast. This represents the difference between the variance of the predicted series and that of the actual data. Also, the covariance proportion is a measure of the non-systematic error in the forecast. The sum of these three components is 1 and the objective is to minimize the value of the bias and variance proportions.

In terms of consumer insolvency, the equations 1a, 2a, 3a and 4a employ different cyclical variables, namely, GDP (basic prices), GDP (market prices), the unemployment rate and the employment rate. As the results show, all these equations generally present very comparable statistics[20] and therefore constitute valid alternatives for modelling consumer insolvency behaviour.

An analysis of the statistics evaluating their predictive value indicates that none of the four equations dominates in all respects. In fact, they are all characterized by a covariance proportion close to 1, which indicates good forecasting performance by the various equations and that the forecasting errors are essentially non-systematic. However, as one of our concerns is to minimize the mean absolute percentage error (MAPE), this is minimal when the forecast is made using equations 1a and 3a in which the cyclical variable is either the employment rate or the unemployment rate. Furthermore, the statistical inference presented in section 5 shows that using the employment rate or the unemployment rate as cyclical variables does not leave permanent effects, which is not the case with GDP (measured on the basis of either basic prices or market prices). Lastly, as we mentioned in section 3.1, variations in the employment rate are independent of the movement of people entering and leaving the labour force, which is not the case with the unemployment rate. That is why we have adopted the employment rate as the cyclical variable.

Equations 5a, 6a and 7a continue to use the employment rate as the cyclical variable, but replace the total debt-to-income ratio by the consumer debt-to-income ratio, debt service or consumer debt service. Equation 5a, which employs the consumer debt-to-income ratio produces similar results to those in equation 1a. However, as noted in the discussion in section 3.1 on the build-up of unsecured debt, we prefer to use the total debt-to-income ratio as a determinant. In equations 6a and 7a, which use debt service and

[20] It is noteworthy that, for equations 5a and 1b, the Jarque-Bera test suggests the presence of a problem linked to the normality of the distribution of the residuals. This situation is due to the presence of a single outlier in the residuals of 5a and three outliers in the case of 1b.

consumer debt service, note that variable interest rate no longer appears, since this is now implicitly accounted for. The debt-service variable improves forecasting accuracy by diminishing the MAPE compared with equation 1a, but the Ramsey test results suggest the presence of specification problems. That is why we tend to favour using equation 1a over equations 6a and 7a.

For the business insolvency model (Table 2b), two cyclical variables were considered: GDP at basic prices and GDP at market prices. The structural variables that were employed are the short-term interest rate (rcp90), business profits (profits) and business profits as a percentage of GDP (cpngdp). A dichotomous seasonal variable was also included in certain models.

Our first observation is that the results are once again very comparable. However, it is apparent that the models which employ base-price GDP generally give the better results when forecasting performance is assessed. This is particularly reflected in lower values in terms of the Theil Statistic and the MAPE and higher values for covariance proportion. We therefore conclude that GDP (basic prices) is the cyclical variable that we should favour.

GDP (basic prices) appears in equations 1b, 2b, 5b and 7b where it, unlike the other variables, is estimated in terms of both the first difference and seasonal difference to take into account seasonal influence in the number of insolvency cases. However, our concern to minimize the mean absolute error leads us to choose specifications 1b, 2b or 7b, which, in the final analysis, are equivalent in their ability to forecast one quarter ahead. A comparison of these models based on a four-quarter forecast horizon one to two years in advance[21] allows us to add an additional model-selection criterion.

The one-year-in-advance and two-years-in-advance results show us that equation 1b does not perform well compared with 2b and 7b over such a forecasting horizon. In fact, its MAPEs of 7.6% and 16.32% one and two years in advance, respectively, are

[21] The Results Table is shown in the appendix.

perceptibly higher than those of other specifications. Equation 7b, despite its greater forecasting discrepancy than that of 2b, partly compensates through its higher Confusion Index. In addition, the effect of seasonal factors in the number of business bankruptcies argues in favour of the specification where we used seasonal-difference. We therefore consider that specification 7b is the best for predicting the number of business insolvencies.

Table 2a (n=20)

Éq.	Variables	R^2	Adjusted R^2	DW	Ser. corr. (prob)	S.E. regres	Ramsey (prob)	Jarque-Bera (prob)	Theil	Bias	Var	Covar	MAPE	Confusion
1a	ic, ep, ratio, pop, rmcm5	0.5651	0.5144	1.9167	0.7770	0.0534	0.1228	0.1128	1.0097E-06	0.026578	0.050840	0.922582	3.95%	70%
2a	ic, gdp, ratio, pop, rmcm5	0.6401	0.5769	1.9808	0.9586	0.0498	0.0327	0.9761	1.1464E-06	0.037967	0.054747	0.907286	4.44%	65%
3a	ic, ur, ratio, pop, rmcm5	0.6502	0.5889	1.8806	0.6016	0.0491	0.2140	0.4963	1.0521E-06	0.000358	0.084000	0.915643	3.82%	70%
4a	ic, ygdpk, ratio, pop, rmcm5	0.6431	0.5804	2.0453	0.7358	0.0496	0.0436	0.9328	1.0784E-06	0.011229	0.027390	0.961382	4.22%	60%
5a	ic, ep, ratio_cons, pop, rmcm5	0.5250	0.4695	1.8350	0.4886	0.0558	0.6872	0.0014	1.1747E-06	0.000132	0.019461	0.980407	4.36%	70%
6a	ic, ep, ratio, pop, debtserv	0.5577	0.5061	2.0265	0.8685	0.0539	0.0059	0.8955	9.3895E-07	0.159538	0.043573	0.796888	3.61%	65%
7a	ic, ep, ratio, pop, debtserv_cons	0.5538	0.4933	1.9759	0.9029	0.0545	0.0365	0.5814	9.9240E-07	0.060792	0.011817	0.927391	3.88%	75%

Table 2b (n=20)

Éq.	Variables	R^2	Adjusted R^2	DW	Ser. corr. (prob)	S.E. regres	Ramsey (prob)	Jarque-Bera (prob)	Theil	Bias	Var	Covar	MAPE	Confusion
1b	ie, gdp, rcp90, profits, seas	0.7771	0.7284	1.9279	0.7859	0.0565	0.0479	0.0004	1.0935E-05	0.072125	0.010653	0.917222	4.07%	80%
2b	ie, gdp, rcp90, profits	0.7603	0.7132	2.0856	0.5867	0.0581	0.1112	0.4513	8.9723E-06	0.002832	0.000002	0.997165	4.47%	85%
3b	ie, ygdpk, rcp90, profits	0.7262	0.6782	2.1086	0.4974	0.0615	0.0993	0.4149	9.7329E-06	0.000283	0.018266	0.981452	4.93%	85%
4b	ie, ygdpk, rcp90, profits, seas	0.7892	0.7385	2.2817	0.0916	0.0555	0.0253	0.0914	1.0705E-05	0.009140	0.134347	0.856514	5.00%	85%
5b	ie, gdp, rcp90, cpngdp	0.7526	0.7040	2.0648	0.6704	0.0590	0.0897	0.5400	1.0162E-05	0.001171	0.000077	0.998752	4.99%	80%
6b	ie, ygdpk, rcp90, cpngdp	0.6625	0.6167	2.1044	0.4800	0.0671	0.1159	0.7484	1.0630E-05	0.000008	0.059701	0.940291	5.22%	85%
7b	ie, gdp, rcp90, profits	0.7408	0.7006	2.2730	0.1946	0.0584	0.0663	0.4697	9.4529E-06	0.000684	0.008196	0.991120	4.44%	90%
8b	ie, gdp, rcp90, profits	0.7266	0.6842	2.0094	0.9043	0.0600	0.1833	0.0406	1.1664E-05	0.016328	0.007683	0.975989	5.40%	80%

5. Statistical inference

The estimation results suggest that the main determinant of consumer insolvency is the debt-to-income ratio. Thus, by using equation 1a estimations (all other things being equal), the increase in the debt-to-income ratio accounts for 88% of the increase in consumer insolvency between the first quarter of 1987 and the fourth quarter of 2003. On the basis of the estimations of the other equations, this contribution would vary between 85% and 128%. This implies that some determinants mitigated the increase in consumer insolvency. This is, in fact, the situation with the five-year mortgage interest rate, which (all other things being equal) reduced the number of consumer insolvencies by 19% according to the estimations in equation 1a. Since the five-year mortgage interest rate is currently at its lowest level in the last 40 years, it is likely that any future increase will also increase the number of consumer insolvencies in Canada.

The lagged endogenous variable in equation 1a, which represents the persistence effect, would account for 20% of the increase in consumer insolvency during the estimation period, all other things being equal. According to the various estimations, the contribution of this variable would range between 12% and 20%. This persistence effect might indicate that the social stigma associated with personal insolvency has diminished over the last 20 years. Insolvent debtors might thus be less socially embarrassed to submit an insolvency file today than they were in the 1980s.

The population variable has a negligible effect (less than 5%) in all the equations. Lastly, the employment rate, used as a cyclical variable, would account for only -1.4%. This result is in line with the temporary nature of cyclical effects. On the other hand, in the two equations in which GDP was used as a cyclical variable, it appears that effects were permanent, rather than temporary, with negative contributions of 34% and 22%.

In terms of business insolvency, it seems that the variable that played the greatest role in the drop in insolvency numbers since 1996 is the interest rate. In fact, the drop in interest rates, which results in lower financing costs for businesses, could account for as

much as 35% of the decline in the number of business insolvencies recorded since 1996. The business-profits variable could explain around 15% of this change and GDP a little less than 10%.

5.1 Simulating the impact of a one-percentage-point increase in the exogenous variables

For this simulation, we used the coefficients of equations 1a and 7b. We simulated an annual one-percentage-point "shock" effect spread over four consecutive quarters (0.25, 0.25, 0.25 and 0.25). The duration of this impact was based on the time-lag characteristics of each variable. The repercussions of this shock could last as long as around 10 quarters. The total result of the simulation is shown in Table 5.1. The levels of business and consumer insolvency recorded in 2003 were used as the starting values for the impact of this simulated shock on the various levels.

Thus, a positive impact of a one-percentage-point increase in the employment rate could produce a drop of 1,725 cases (-1.7%) of consumer insolvency over a two-year period. This reducing effect is at its strongest when the shock hits. According to the estimations of equation 1a, if the mortgage interest rate increased by one percentage point, the number of insolvency files would increase by 5,869 (+5.8%) over a period of just over two years. Lastly, an increase of one percentage point in the debt-to-income ratio would cause an increase of 2,701 more cases (+2.7%). In 2003, the debt-to-income ratio increased by five percentage points. Thus, according to our estimations, it is probable that during 2004 and 2005, all other things being equal, this increase will cause an increase in files of 13,505 (+13.4%).

In the business equation, the simulated increase in GDP growth resulted in an increase of 34 files (+0.3%). At first blush, an increase in business insolvency resulting from an increase in GDP would seem to run counter to theoretical expectations. However, this result arises from the fact that the sign of the coefficient of the first GDP-

related time-lag is negative and the second sign is positive. This situation can be explained in the following way. A growth in GDP indicates an improvement in the economy. This encourages new players to enter the market, who, in turn, increase the level of competitiveness. After a certain time, the less successful players run into difficulties. We believe that this rationale can also apply to profit growth. Lastly, a one-percentage-point increase in the 90-day commercial paper interest rate, which means an increase in business financing costs, would result in an increase of 1,132 (+10.6%) in the number of business insolvency files over a period of slightly more than two years.

Table 5.1: Simulation of the impact of a one-percentage-point increase in the independent variables on the number of insolvencies

Consumer equation (1a)	Total effect	+- 1 S.D.	Annual average increase of independent variables, 1999-2003
Employment rate	-1 725 -1.7%	5 005 5.0%	0.52 percentage points
Mortgage interest rate	5 869 5.8%	2 661 2.6%	-0.42 percentage points
Debt-to-income ratio	2 701 2.7%	742 0.7%	1.70 percentage points
Business equation (7b)	Total effect	+- 1 S.D.	Annual average increase of independent variables, 1999-2003
GDP growth rate	34 0.3%	245 2.3%	3.6%
90-day commercial paper interest rate	1 132 10.6%	326 3.1%	-0.11 percentage points
Profit growth rate	28 0.3%	23 0.2%	10.8%

6. Conclusion

We had two main objectives in mind in writing this document: first, to help us understand the socio-economic factors that affect the number of consumer and business insolvencies in Canada and, then, to make use of this knowledge to develop forecasting models for the two types of insolvency.

In the case of consumer insolvency, the best results are yielded from a model using the employment rate as the cyclical variable, and the total debt-to-income ratio, population size and the mortgage interest rate as the structural variables. On a quarterly basis, forecasts made one quarter in advance can produce a mean absolute percentage error (MAPE) of 3.95% with a confusion index of 70% and a covariance bias of 0.92. For an annualized forecast made one year ahead, the MAPE is 3.60% and the confusion index comes to 82%.

The determinant having the greatest effect on the increase in the number of consumer insolvencies during the 1987–2003 period is the total debt-to-income ratio. According to our calculations, this variable accounted for 88% of the increase in consumer insolvency during this period.

In terms of business insolvency, market-price GDP turned out to be the most influential cyclical determinant, while the 90-day commercial paper interest rate and the before-tax business profits were the most influential structural determinants. Such a model, estimated using first and seasonal differences, produces a MAPE of 4.44%, a confusion index of 90% and a covariance bias of 0.99 for a quarterly forecast made one quarter in advance. On an annualized basis, this model's forecast made one year in advance produces a MAPE of 3.60% and a confusion index of 94%.

Between 1996 and 2003, the number of business insolvency files decreased. Our calculations indicate that 35% of this drop was due to lower 90-day commercial paper interest rates, which effectively corresponded to a drop in business financing costs.

The insolvency file data that the OSB has gathered contains a considerable amount of information on debtor characteristics. This information would make it possible to complement this document with a study using a micro-economic approach. For example, several analyses could be made from constructs of insolvent debtors' income, expenses, assets, liabilities and demographic profiles.

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Appendices

Results for unit root tests

Variable	Level		1st difference		Integration Order
	Phillips-Perron	***DFA***	***Phillips-Perron***	***DFA***	
Consumer insolvency (log)	1.677799	2.107464	-9.084501	-3.251275	I(1)
Employment rate	1.405864	0.718905	-3.893998	-3.893998	I(1)
Unemployment rate	-1.148726	-0.856487	-5.605575	-5.605575	I(1)
Debt-to-income ratio	5.638984	2.522985	-4.823865	-1.851315	I(1)
Population (15+) (log)	51.48344	2.669708	-0.330251	0.028278	I(2)
5-year mortgage rate	-1.455959	-1.746072	-8.377777	-5.592601	I(1)
GDP (basic prices) (log)	5.799242	2.253445	-3.149761	-2.348065	I(1)
GDP (market prices) (log)	5.927801	2.666463	-3.369394	-2.167896	I(1)
Debt service	-0.713489	-0.562598	-6.497759	-4.355319	I(1)
Consumer debt service	-0.386159	-0.427523	-6.978332	-6.978332	I(1)
Business insolvency (log)	-0.181308	0.248882	-11.00278	-2.479788	I(1)
90-day commercial paper interest rate	-1.184219	-1.219538	-7.502641	-3.889202	I(1)
Before-tax business profits (log)	1.630191	1.163169	-5.849492	-3.092757	I(1)
Business profits as % of GDP	0.111862	-0.120788	-6.044483	-6.044483	I(1)

Critical values

1% : -2.59
5% : -1.94
10% : -1.61

Consumer insolvency

		1 year ahead (n=17)						2 years ahead (n=13)					
Eq.	**Variables**	**Theil**	**Bias**	**Var**	**Covar**	**MAPE**	**Confusion**	**Theil**	**Bias**	**Var**	**Covar**	**MAPE**	**Confusion**
1a	ic, ep, ratio, pop, rmcm5	2.4981E-07	0.0469	0.0469	0.9062	3.60%	82%	4.1164E-07	0.0050	0.1886	0.8064	6.57%	62%
2a	ic, gdp, ratio, pop, rmcm5	2.8181E-07	0.0337	0.2268	0.7395	4.39%	71%	4.0702E-07	0.0055	0.5837	0.4108	5.43%	62%
3a	ic, ur, ratio, pop, rmcm5	2.7916E-07	0.0909	0.2241	0.6850	4.63%	76%	5.1773E-07	0.5501	0.2623	0.1876	9.17%	85%
4a	ic, ygdpk, ratio, pop, rmcm5	2.4764E-07	0.0024	0.1474	0.8501	3.70%	76%	3.7675E-07	0.1188	0.3469	0.5343	5.76%	85%
5a	ic, ep, ratio_cons, pop, rmcm5	4.0144E-07	0.0541	0.0791	0.8668	5.89%	82%	9.1029E-07	0.3377	0.2993	0.3630	15.77%	62%
6a	ic, ep, ratio, pop, debtserv	2.9602E-07	0.4962	0.0741	0.4298	4.36%	65%	5.4122E-07	0.7383	0.1125	0.1492	8.14%	15%
7a	ic, ep, ratio, pop, debtserv_cons	3.0717E-07	0.2374	0.0123	0.7503	4.18%	65%	4.1881E-07	0.3177	0.1131	0.5692	6.53%	38%

Business insolvency

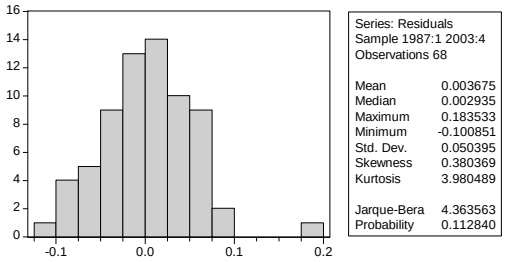
		1 year ahead (n=17)						2 years ahead (n=13)					
Eq.	**Variables**	**Theil**	**Bias**	**Var**	**Covar**	**MAPE**	**Confusion**	**Theil**	**Bias**	**Var**	**Covar**	**MAPE**	**Confusion**
1b	ie, gdp, rcp90, profits, seas	3.5898E-06	0.2052	0.3003	0.4945	7.60%	76%	7.0037E-06	0.4499	0.1937	0.3564	16.32%	23%
2b	ie, gdp, rcp90, profits	1.6617E-06	0.0719	0.0987	0.8294	3.09%	88%	2.8630E-06	0.2566	0.0657	0.6778	5.65%	31%
3b	ie, ygdpk, rcp90, profits	1.7234E-06	0.0022	0.0824	0.9154	3.27%	88%	2.2715E-06	0.0018	0.2610	0.7372	4.50%	54%
4b	ie, ygdpk, rcp90, profits, seas	2.3673E-06	0.0330	0.0862	0.8808	4.36%	88%	3.0457E-06	0.0672	0.0570	0.8759	6.57%	23%
5b	ie, gdp, rcp90, cpngdp	2.0649E-06	0.0488	0.2574	0.6938	3.97%	88%	3.7194E-06	0.2616	0.2185	0.5199	6.61%	38%
6b	ie, ygdpk, rcp90, cpngdp	2.0200E-06	0.0002	0.1474	0.8524	3.89%	76%	2.1687E-06	0.0304	0.3003	0.6693	4.12%	62%
7b	ie, gdp, rcp90, profits	1.8940E-06	0.0707	0.2334	0.6959	3.60%	94%	3.8119E-06	0.3048	0.2507	0.4445	6.85%	46%

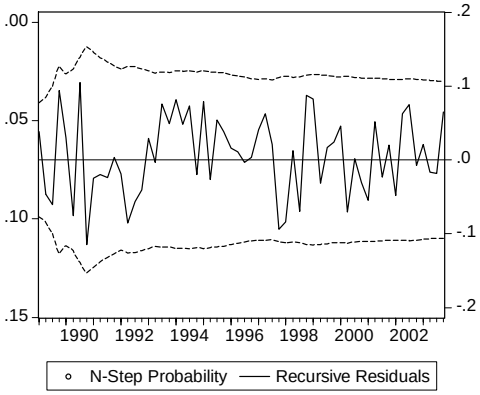
Eq. 1a

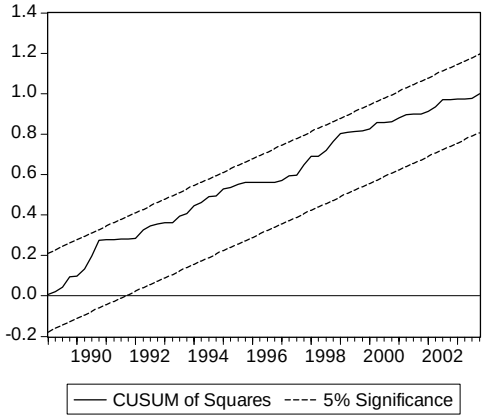
Dependent Variable: DLOG(IC)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

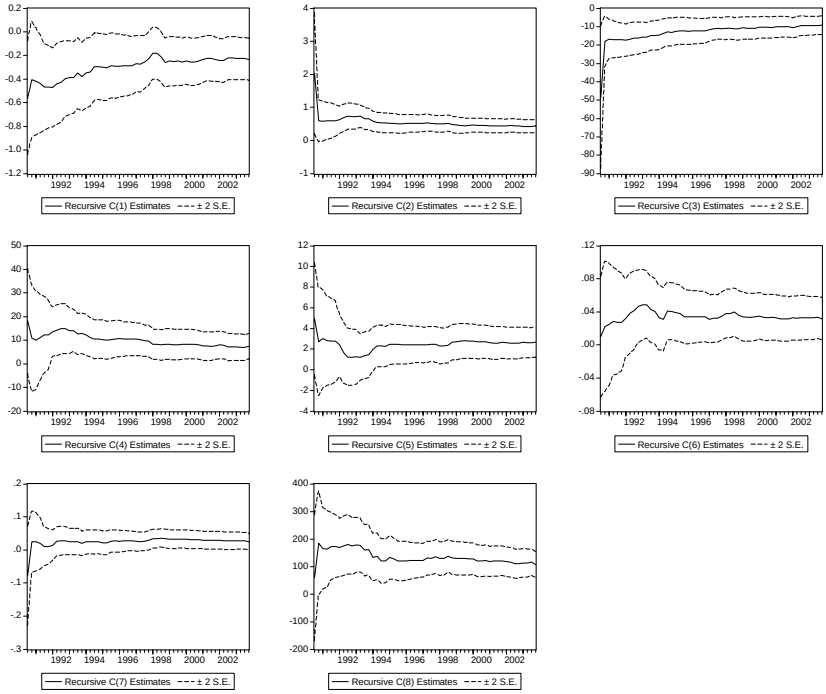
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IC(-1))	-0.234445	0.088689	-2.643451	0.0105
DLOG(IC(-4))	0.432388	0.098776	4.377477	0
D(EP)	-9.193239	2.536278	-3.624696	0.0006
D(EP(-4))	7.454891	2.68716	2.774263	0.0074
D(RATIO(-2))	2.663413	0.724869	3.674336	0.0005
D(RMCM5(-1))	0.031691	0.012783	2.479099	0.016
D(RMCM5(-5))	0.025299	0.012657	1.998709	0.0502
D(DLOG(POP(-3)))	106.4275	23.41311	4.545636	0

R-squared	0.565146	Mean dependent var	0.021298
Adjusted R-squared	0.514413	S.D. dependent var	0.076627
S.E. of regression	0.053397	Akaike info criterion	-2.911999
Sum squared resid	0.171073	Schwarz criterion	-2.65088
Log likelihood	107.008	Durbin-Watson stat	1.916691







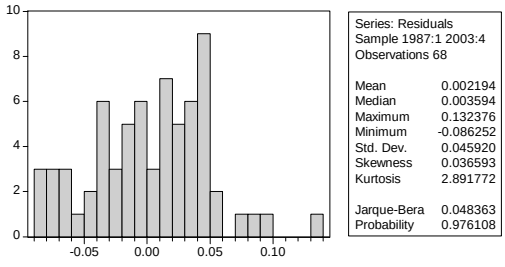


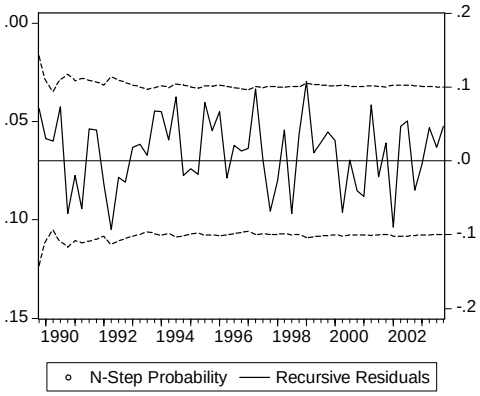
Eq. 2a

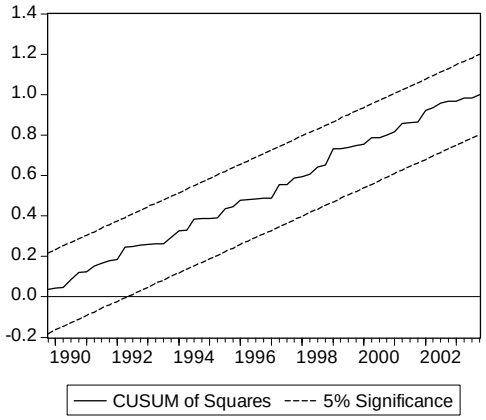
Dependent Variable: DLOG(IC)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

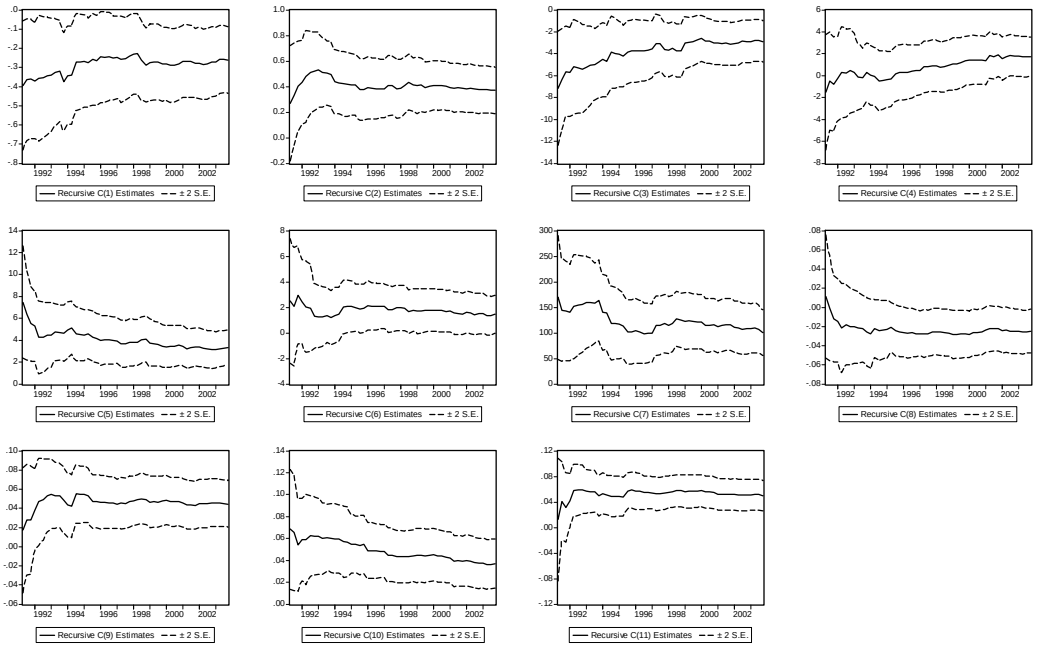
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IC(-1))	-0.261553	0.087636	-2.98455	0.0042
DLOG(IC(-4))	0.369639	0.089959	4.108958	0.0001
DLOG(GDP(-1))	-2.876989	0.944367	-3.046474	0.0035
DLOG(GDP(-10))	1.717927	0.906933	1.894215	0.0633
D(RATIO(-2))	3.328864	0.806726	4.126386	0.0001
D(RATIO(-10))	1.468826	0.746261	1.968246	0.0539
D(DLOG(POP(-3)))	100.7285	22.28819	4.519364	0
D(RMCM5)	-0.024684	0.011358	-2.173313	0.0339
D(RMCM5(-1))	0.044439	0.012119	3.666768	0.0005
D(RMCM5(-3))	0.036967	0.01116	3.312493	0.0016
D(RMCM5(-5))	0.049934	0.011878	4.203988	0.0001

R-squared	0.640055	Mean dependent var	0.021298
Adjusted R-squared	0.576907	S.D. dependent var	0.076627
S.E. of regression	0.049843	Akaike info criterion	-3.012824
Sum squared resid	0.141604	Schwarz criterion	-2.653786
Log likelihood	113.436	Durbin-Watson stat	1.980751







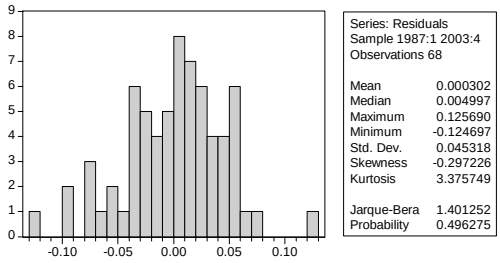


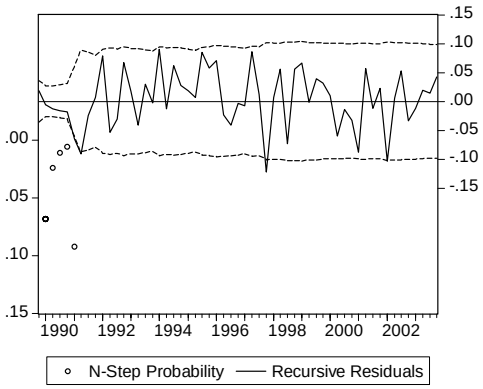
Eq. 3a

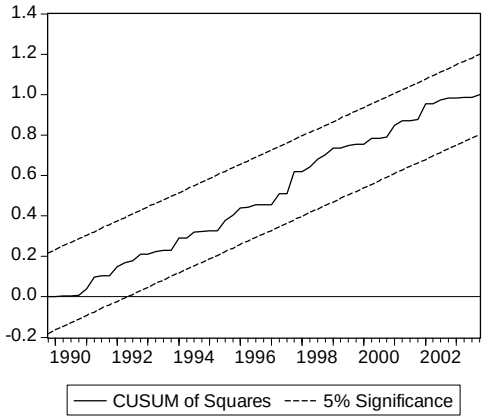
Dependent Variable: DLOG(IC)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

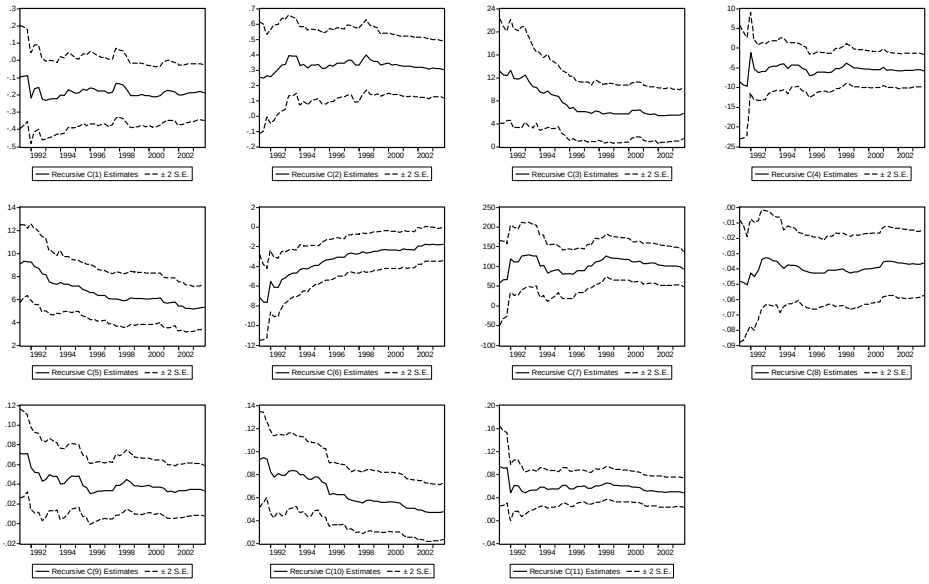
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IC(-1))	-0.186375	0.080596	-2.312457	0.0244
DLOG(IC(-4))	0.302121	0.091513	3.301394	0.0017
D(M_UR(-2))	5.800762	2.202272	2.63399	0.0108
D(M_UR(-6))	-5.823638	2.085752	-2.792105	0.0071
D(RATIO(-2))	5.330678	0.940743	5.666453	0
D(RATIO(-5))	-1.751656	0.838126	-2.089968	0.0411
D(DLOG(POP(-3)))	93.62752	22.29675	4.199156	0.0001
D(RMCM5)	-0.036231	0.010725	-3.37825	0.0013
D(RMCM5(-1))	0.033423	0.012883	2.594389	0.012
D(RMCM5(-3))	0.047508	0.01215	3.910073	0.0002
D(RMCM5(-5))	0.048004	0.012572	3.818313	0.0003

R-squared	0.650226	Mean dependent var	0.021298
Adjusted R-squared	0.588862	S.D. dependent var	0.076627
S.E. of regression	0.049133	Akaike info criterion	-3.041487
Sum squared resid	0.137603	Schwarz criterion	-2.682449
Log likelihood	114.4106	Durbin-Watson stat	1.880635







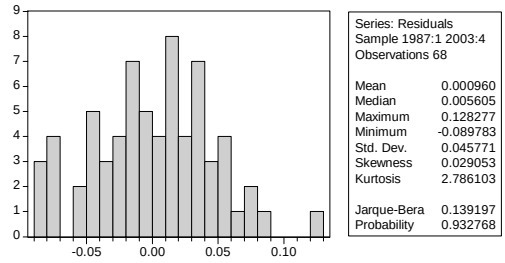


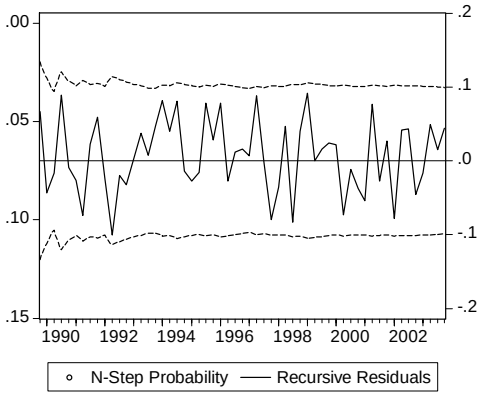
Eq. 4a

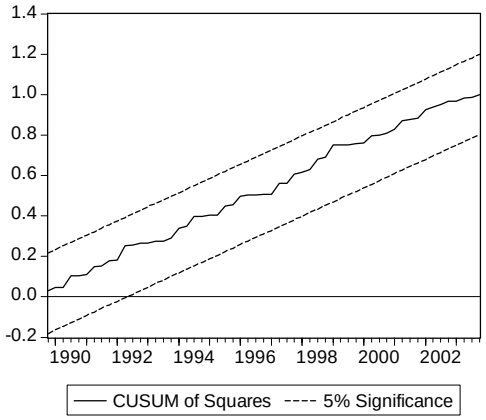
Dependent Variable: DLOG(IC)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

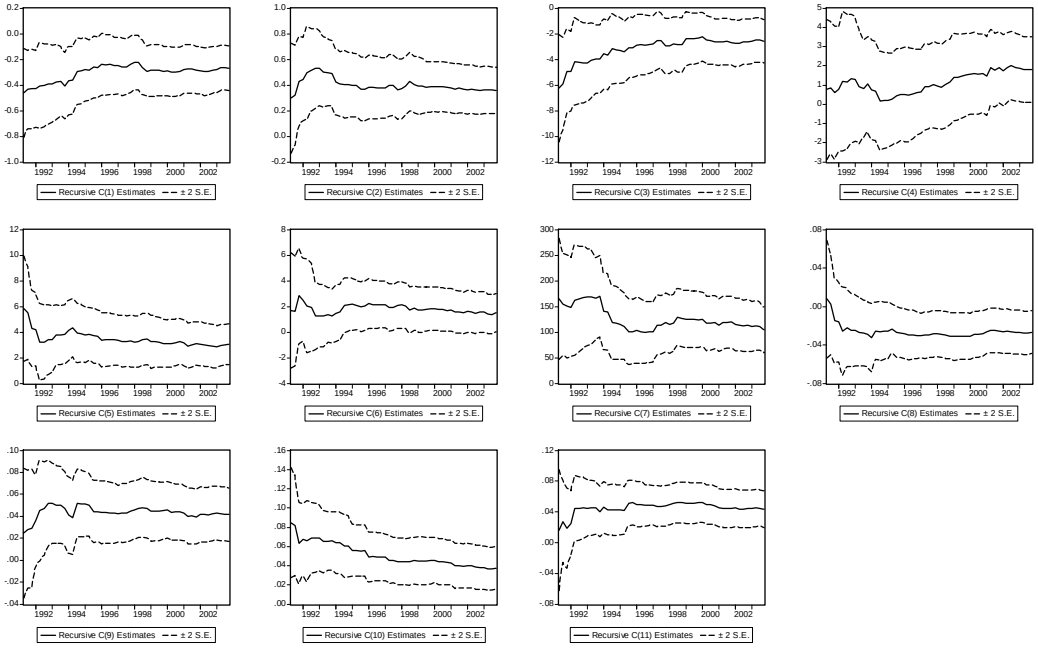
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IC(-1))	-0.269203	0.087299	-3.083679	0.0031
DLOG(IC(-4))	0.355359	0.090099	3.944089	0.0002
DLOG(YGDPK(-1))	-2.592426	0.848053	-3.056915	0.0034
DLOG(YGDPK(-10))	1.802591	0.851639	2.116613	0.0387
D(RATIO(-2))	3.05036	0.787935	3.871335	0.0003
D(RATIO(-10))	1.512282	0.746806	2.025001	0.0476
D(DLOG(POP(-3)))	104.597	22.23047	4.705118	0
D(RMCM5)	-0.026702	0.011106	-2.404343	0.0195
D(RMCM5(-1))	0.041403	0.011989	3.45351	0.0011
D(RMCM5(-3))	0.037339	0.011108	3.361518	0.0014
D(RMCM5(-5))	0.043318	0.01182	3.664747	0.0005

R-squared	0.643053	Mean dependent var	0.021298
Adjusted R-squared	0.580431	S.D. dependent var	0.076627
S.E. of regression	0.049635	Akaike info criterion	-3.021187
Sum squared resid	0.140424	Schwarz criterion	-2.662149
Log likelihood	113.7204	Durbin-Watson stat	2.045278







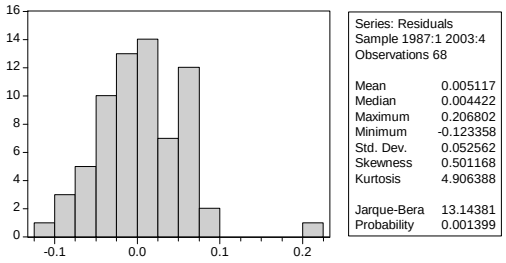


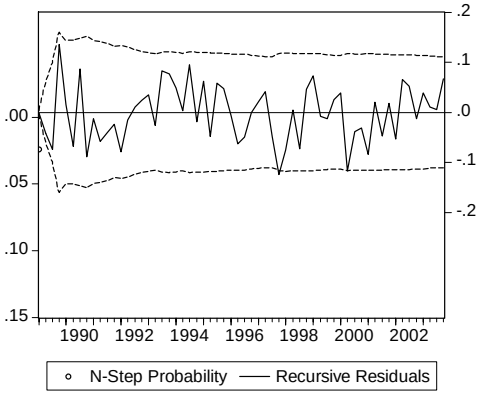
Eq. 5a

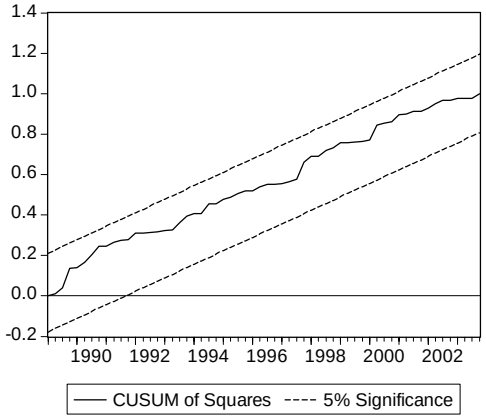
Dependent Variable: DLOG(IC)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

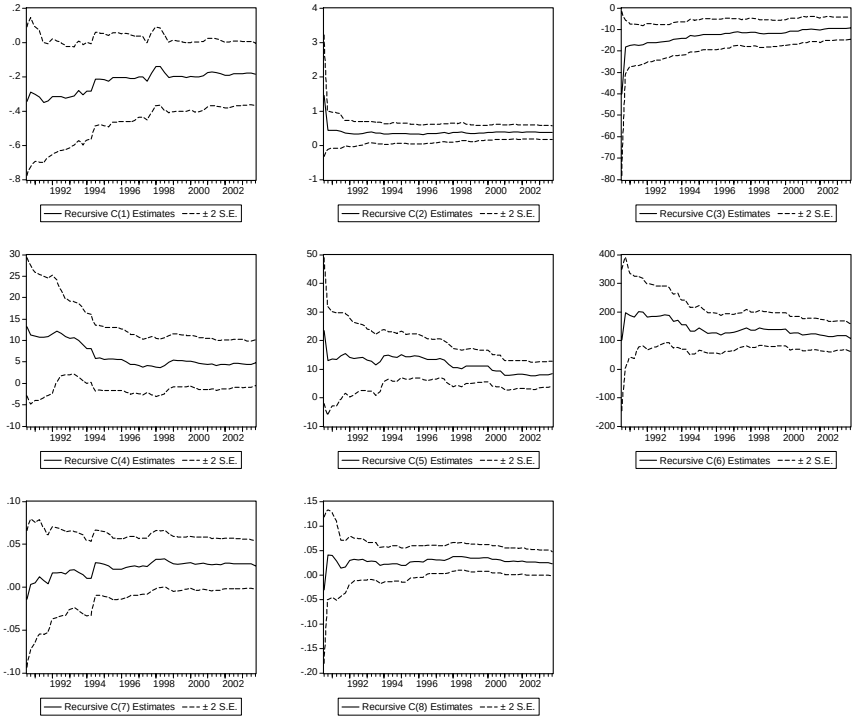
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IC(-1))	-0.185952	0.091374	-2.035076	0.0463
DLOG(IC(-4))	0.365946	0.099556	3.675792	0.0005
D(EP)	-9.374982	2.653763	-3.532712	0.0008
D(EP(-7))	4.840587	2.673638	1.810487	0.0752
D(RATIO_CONS(-2))	8.461695	2.189536	3.864607	0.0003
D(DLOG(POP(-3)))	108.2407	23.95682	4.518157	0
D(RMCM5(-1))	0.024896	0.014064	1.770178	0.0818
D(RMCM5(-5))	0.022616	0.012548	1.802454	0.0765

R-squared	0.524955	Mean dependent var	0.021298
Adjusted R-squared	0.469533	S.D. dependent var	0.076627
S.E. of regression	0.05581	Akaike info criterion	-2.8236
Sum squared resid	0.186885	Schwarz criterion	-2.562481
Log likelihood	104.0024	Durbin-Watson stat	1.835032







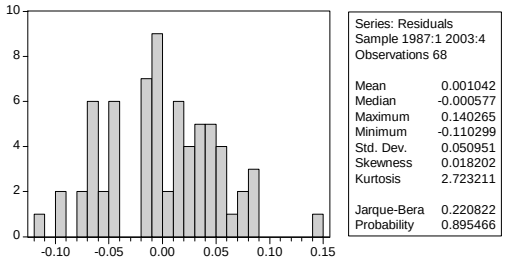


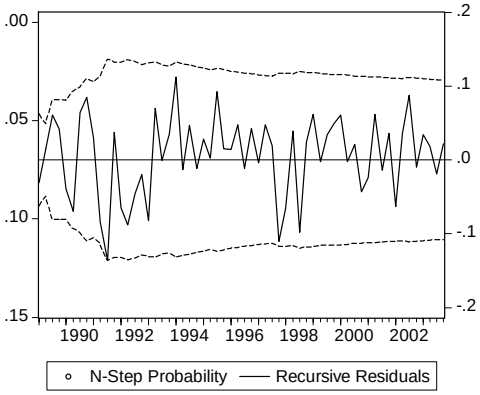
Eq. 6a

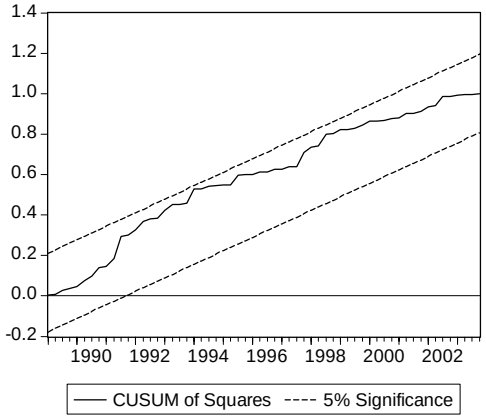
Dependent Variable: DLOG(IC)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

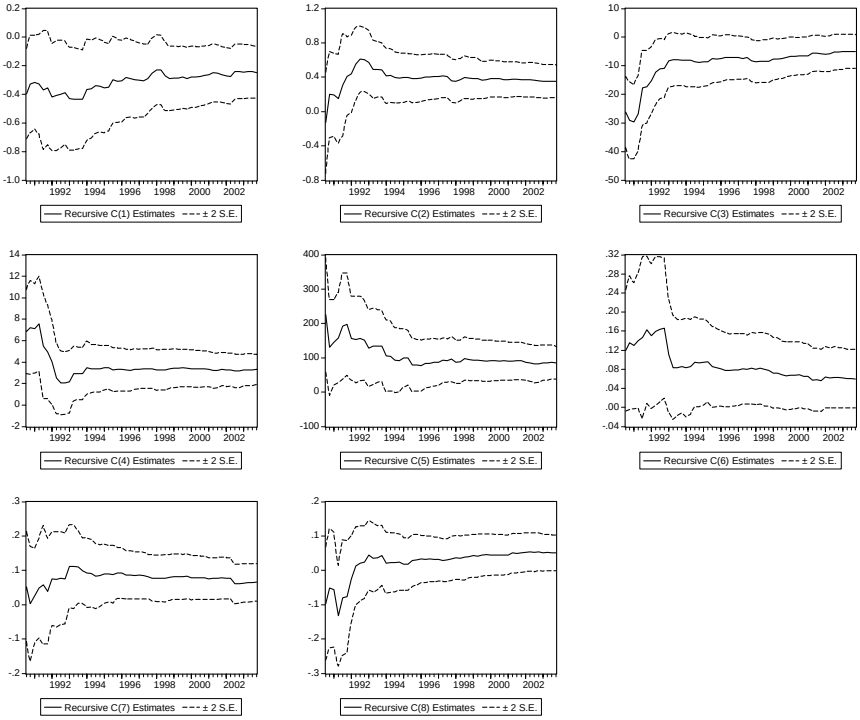
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IC(-1))	-0.247731	0.091074	-2.720116	0.0085
DLOG(IC(-4))	0.350348	0.09506	3.685548	0.0005
D(EP(-2))	-5.089526	2.942468	-1.729679	0.0888
D(RATIO(-2))	3.324819	0.711793	4.671049	0
D(DLOG(POP(-3)))	84.93302	23.55611	3.605562	0.0006
D(DEBTSERV(-1))	0.05972	0.030415	1.963491	0.0542
D(DEBTSERV(-3))	0.065123	0.027215	2.392879	0.0199
D(DEBTSERV(-4))	0.051463	0.025909	1.986339	0.0516

R-squared	0.557696	Mean dependent var	0.021298
Adjusted R-squared	0.506094	S.D. dependent var	0.076627
S.E. of regression	0.053852	Akaike info criterion	-2.895013
Sum squared resid	0.174004	Schwarz criterion	-2.633894
Log likelihood	106.4304	Durbin-Watson stat	2.026523







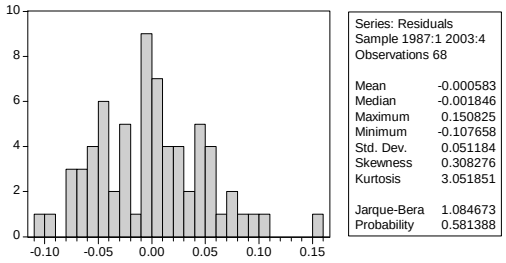


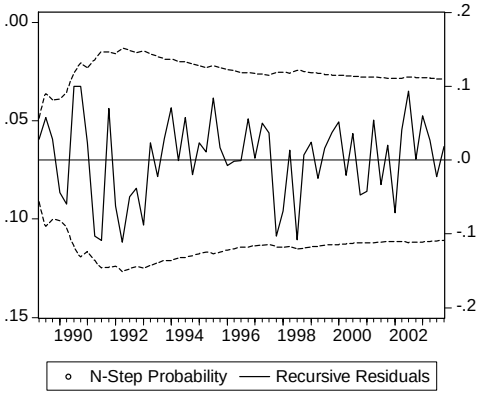
Eq. 7a

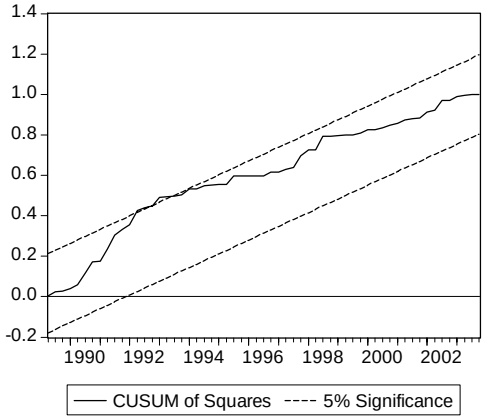
Dependent Variable: DLOG(IC)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

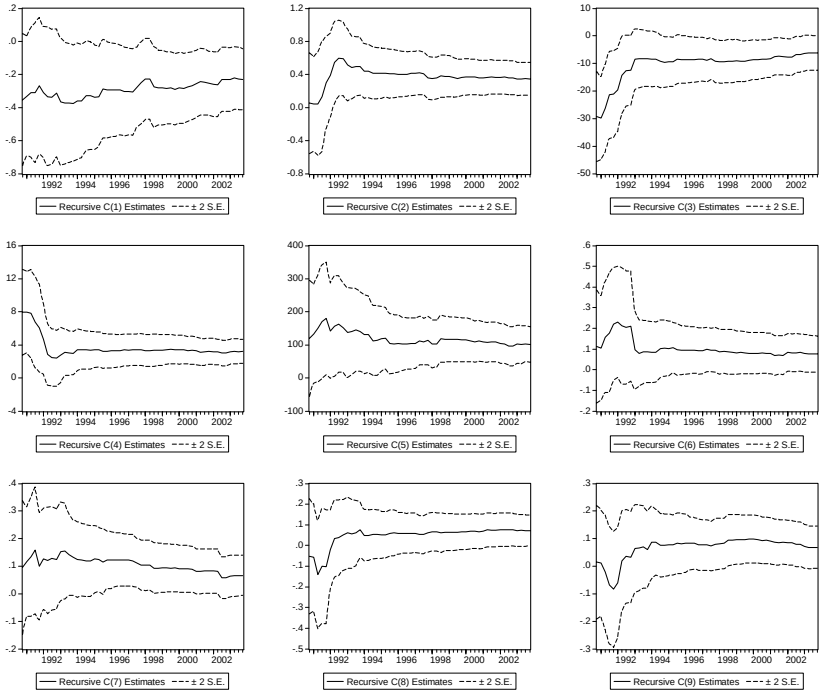
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IC(-1))	-0.230035	0.092022	-2.499783	0.0152
DLOG(IC(-4))	0.347086	0.098879	3.510216	0.0009
D(EP(-2))	-6.274345	3.121352	-2.010137	0.049
D(RATIO(-2))	3.228368	0.728869	4.429284	0
D(DLOG(POP(-3)))	101.2601	26.52411	3.817664	0.0003
D(DEBTSERV_CONS(-1))	0.075265	0.044041	1.708997	0.0927
D(DEBTSERV_CONS(-3))	0.066826	0.036494	1.831159	0.0721
D(DEBTSERV_CONS(-4))	0.072087	0.037291	1.933102	0.058
D(DEBTSERV_CONS(-5))	0.069059	0.038333	1.801571	0.0767

R-squared	0.553767	Mean dependent var	0.021298
Adjusted R-squared	0.493261	S.D. dependent var	0.076627
S.E. of regression	0.054547	Akaike info criterion	-2.856757
Sum squared resid	0.17555	Schwarz criterion	-2.562998
Log likelihood	106.1297	Durbin-Watson stat	1.975933







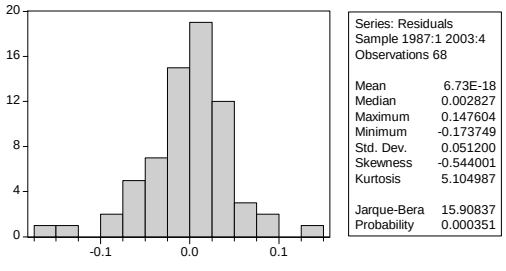


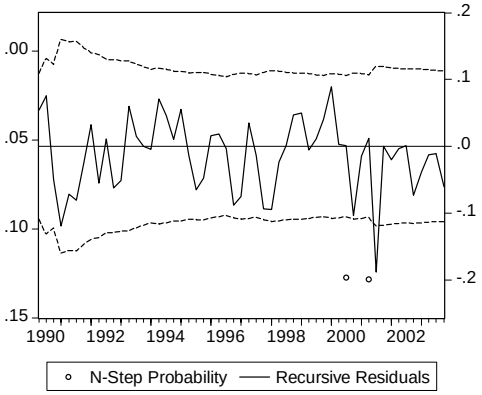
Eq. 1b

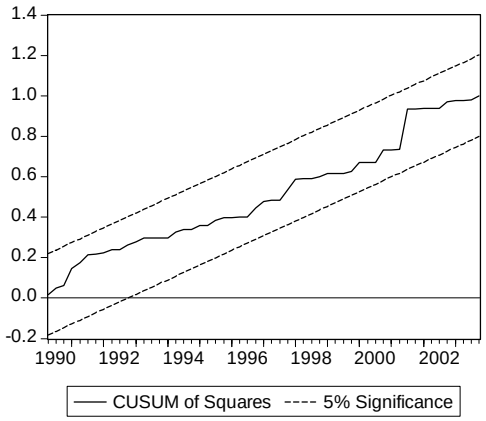
Dependent Variable: DLOG(IE)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

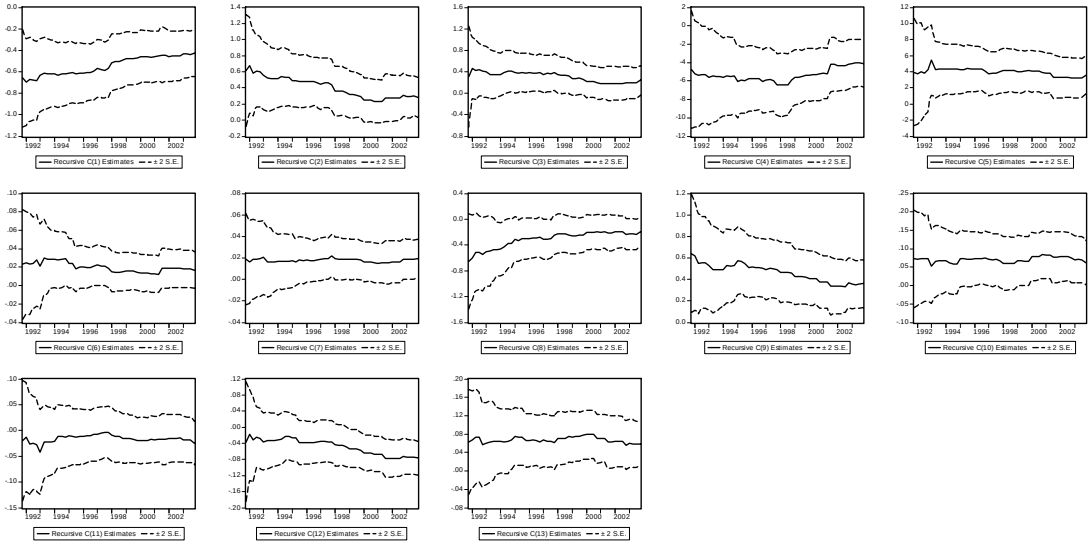
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IE(-1))	-0.428034	0.108473	-3.945979	0.0002
DLOG(IE(-8))	0.281465	0.123202	2.284573	0.0262
DLOG(IE(-9))	0.240283	0.138091	1.740029	0.0874
DLOG(GDP)	-4.114326	1.274234	-3.228863	0.0021
DLOG(GDP(-9))	3.595418	1.16811	3.077978	0.0032
D(RCP90(-2))	0.016623	0.009919	1.675911	0.0994
D(RCP90(-4))	0.019247	0.00907	2.121993	0.0384
DLOG(PROFITS(-2))	-0.194925	0.111461	-1.748817	0.0859
DLOG(PROFITS(-4))	0.359399	0.110271	3.259221	0.0019
@SEAS(1)	0.061897	0.030314	2.041877	0.046
@SEAS(2)	-0.024432	0.021289	-1.147646	0.2561
@SEAS(3)	-0.076699	0.021239	-3.611197	0.0007
@SEAS(4)	0.058714	0.024881	2.359772	0.0219

R-squared	0.777057	Mean dependent var	0.001999
Adjusted R-squared	0.728415	S.D. dependent var	0.108436
S.E. of regression	0.05651	Akaike info criterion	-2.738615
Sum squared resid	0.175637	Schwarz criterion	-2.314297
Log likelihood	106.1129	Durbin-Watson stat	1.927904







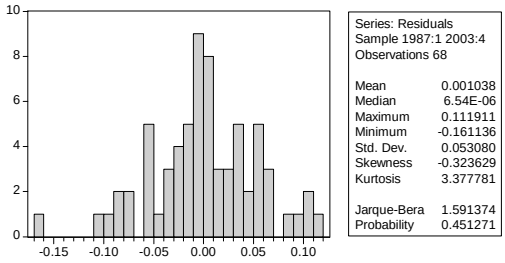


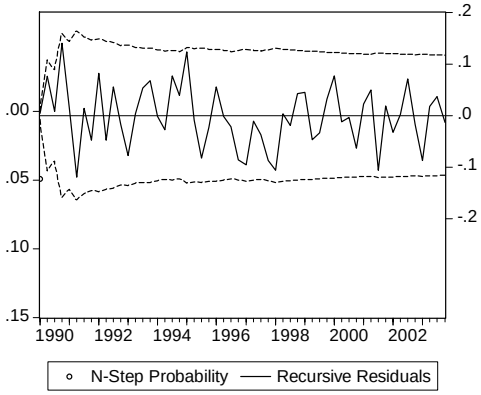
Eq. 2b

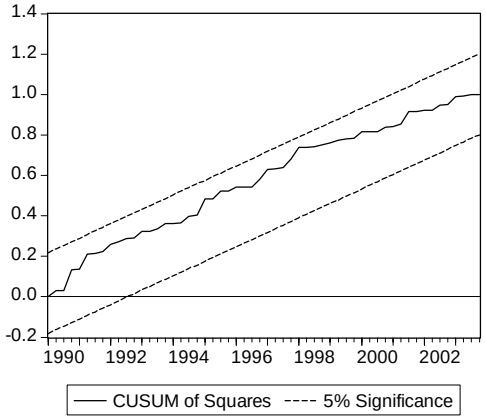
Dependent Variable: DLOG(IE)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

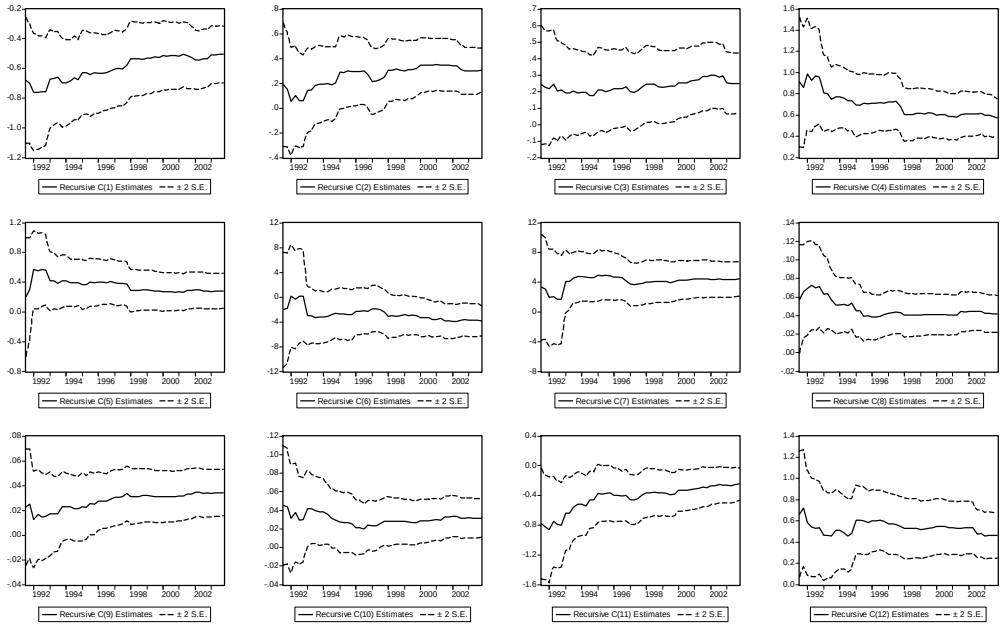
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IE(-1))	-0.506578	0.094996	-5.332598	0
DLOG(IE(-4))	0.304331	0.090277	3.371083	0.0014
DLOG(IE(-5))	0.249042	0.090743	2.744477	0.0081
DLOG(IE(-8))	0.575821	0.090184	6.384992	0
DLOG(IE(-9))	0.281897	0.117196	2.405346	0.0195
DLOG(GDP(-7))	-3.842101	1.227738	-3.129413	0.0028
DLOG(GDP(-9))	4.430942	1.131847	3.91479	0.0002
D(RCP90(-2))	0.041948	0.009909	4.233265	0.0001
D(RCP90(-4))	0.034311	0.009343	3.672202	0.0005
D(RCP90(-6))	0.031568	0.010403	3.034418	0.0037
DLOG(PROFITS(-2))	-0.248642	0.110079	-2.258758	0.0278
DLOG(PROFITS(-4))	0.464632	0.10708	4.339097	0.0001

R-squared	0.760296	Mean dependent var	0.001999
Adjusted R-squared	0.713211	S.D. dependent var	0.108436
S.E. of regression	0.05807	Akaike info criterion	-2.695536
Sum squared resid	0.188842	Schwarz criterion	-2.303858
Log likelihood	103.6482	Durbin-Watson stat	2.085574







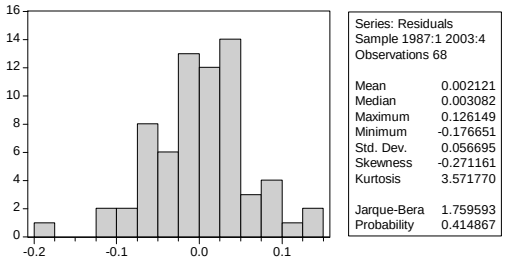


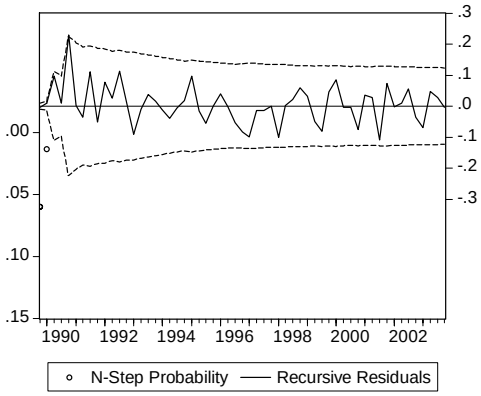
Eq. 3b

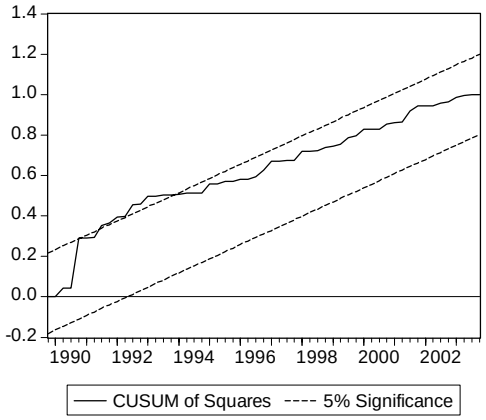
Dependent Variable: DLOG(IE)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

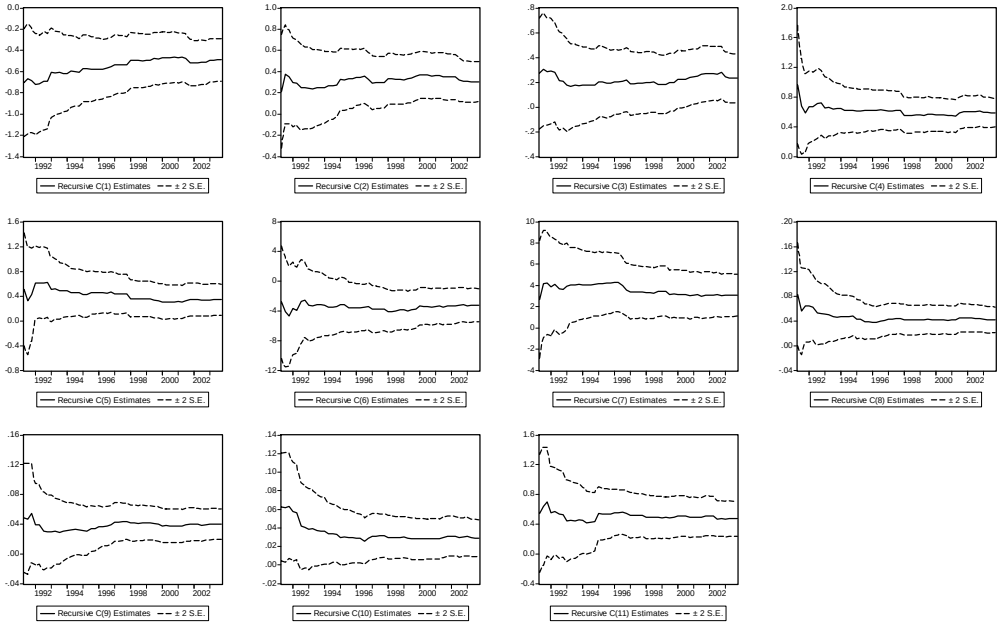
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IE(-1))	-0.490426	0.100359	-4.886701	0
DLOG(IE(-4))	0.303709	0.093902	3.234325	0.002
DLOG(IE(-5))	0.231637	0.098063	2.362122	0.0216
DLOG(IE(-8))	0.584897	0.095091	6.150893	0
DLOG(IE(-9))	0.342266	0.126091	2.71444	0.0088
DLOG(YGDPK(-5))	-3.221524	1.117462	-2.882893	0.0055
DLOG(YGDPK(-9))	3.074692	0.986572	3.116541	0.0029
D(RCP90(-2))	0.041464	0.010463	3.96302	0.0002
D(RCP90(-4))	0.040008	0.010223	3.913419	0.0002
D(RCP90(-6))	0.028934	0.009942	2.910301	0.0051
DLOG(PROFITS(-4))	0.47273	0.117351	4.028362	0.0002

R-squared	0.726246	Mean dependent var	0.001999
Adjusted R-squared	0.678219	S.D. dependent var	0.108436
S.E. of regression	0.061511	Akaike info criterion	-2.592124
Sum squared resid	0.215666	Schwarz criterion	-2.233086
Log likelihood	99.13222	Durbin-Watson stat	2.108618







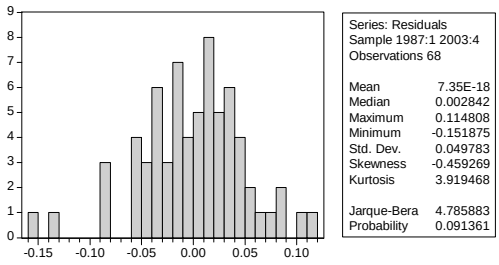


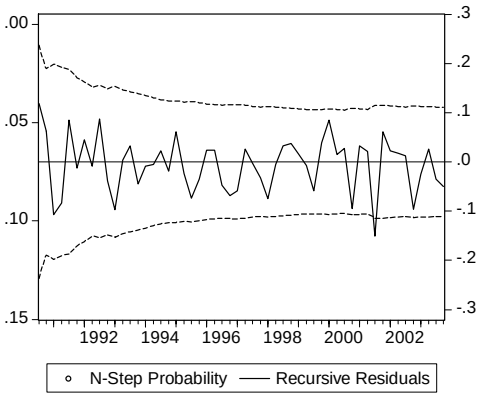
Eq. 4b

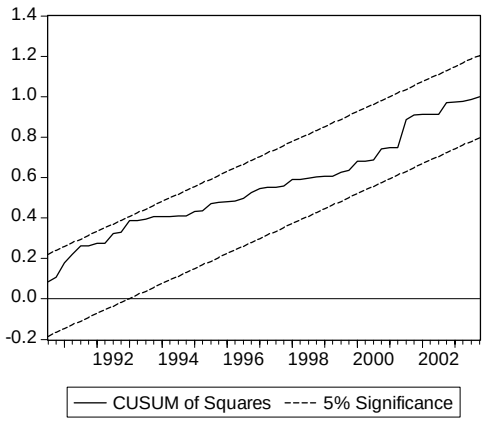
Dependent Variable: DLOG(IE)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

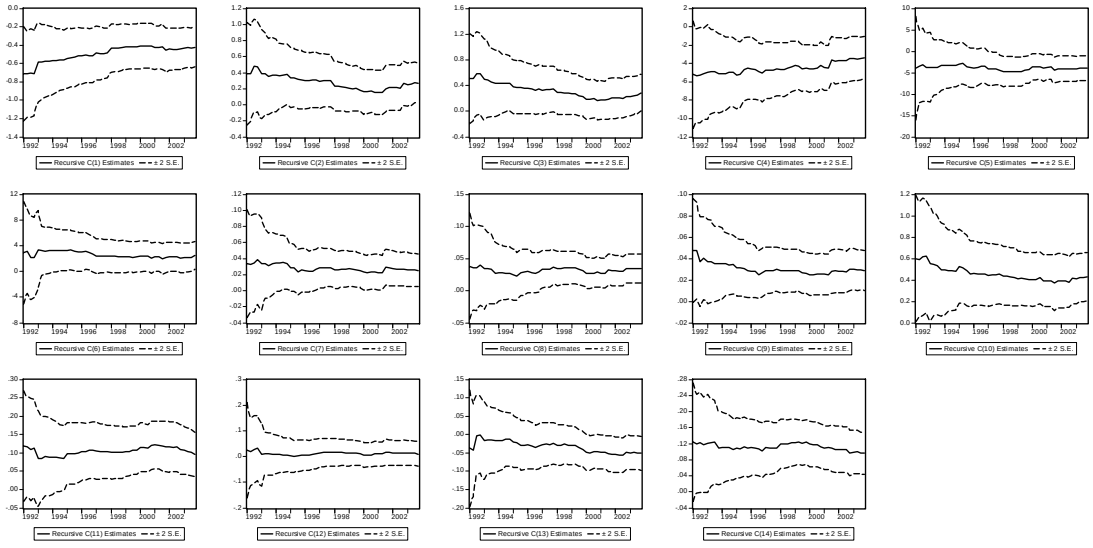
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IE(-1))	-0.424449	0.107565	-3.945968	0.0002
DLOG(IE(-8))	0.265892	0.125694	2.11539	0.039
DLOG(IE(-9))	0.283407	0.142631	1.986988	0.052
DLOG(YGDPK)	-3.401328	1.163863	-2.922445	0.0051
DLOG(YGDPK(-5))	-3.935584	1.430855	-2.750512	0.0081
DLOG(YGDPK(-9))	2.444587	1.078345	2.26698	0.0274
D(RCP90(-2))	0.025354	0.010299	2.461883	0.017
D(RCP90(-4))	0.034393	0.011147	3.085375	0.0032
D(RCP90(-6))	0.028847	0.009359	3.0823	0.0032
DLOG(PROFITS(-4))	0.428955	0.112263	3.820993	0.0003
@SEAS(1)	0.09524	0.03076	3.09622	0.0031
@SEAS(2)	0.008157	0.022858	0.356844	0.7226
@SEAS(3)	-0.051178	0.022882	-2.236583	0.0295
@SEAS(4)	0.096157	0.02635	3.649138	0.0006

R-squared	0.789228	Mean dependent var	0.001999
Adjusted R-squared	0.738486	S.D. dependent var	0.108436
S.E. of regression	0.055452	Akaike info criterion	-2.765339
Sum squared resid	0.166049	Schwarz criterion	-2.308382
Log likelihood	108.0215	Durbin-Watson stat	2.28172







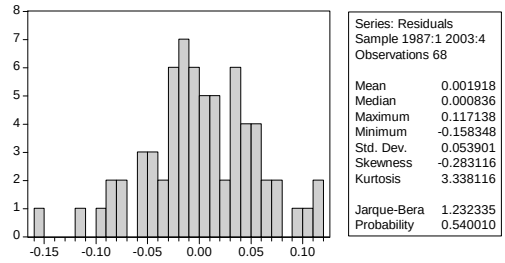


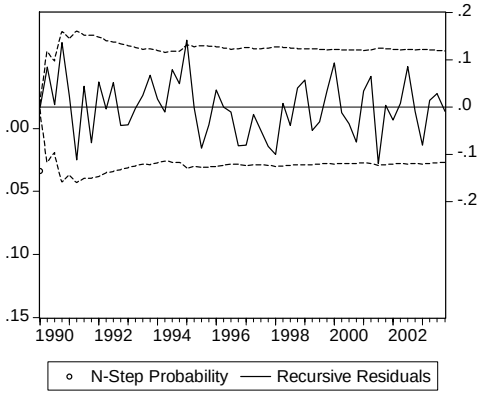
Eq. 5b

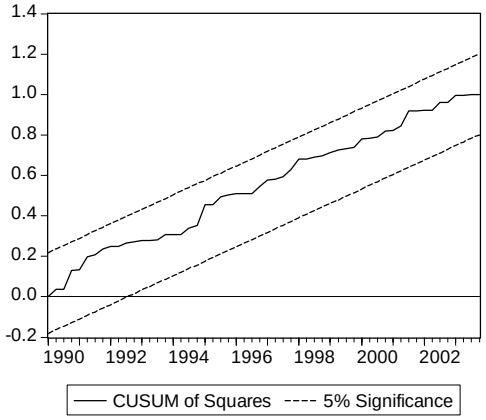
Dependent Variable: DLOG(IE)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

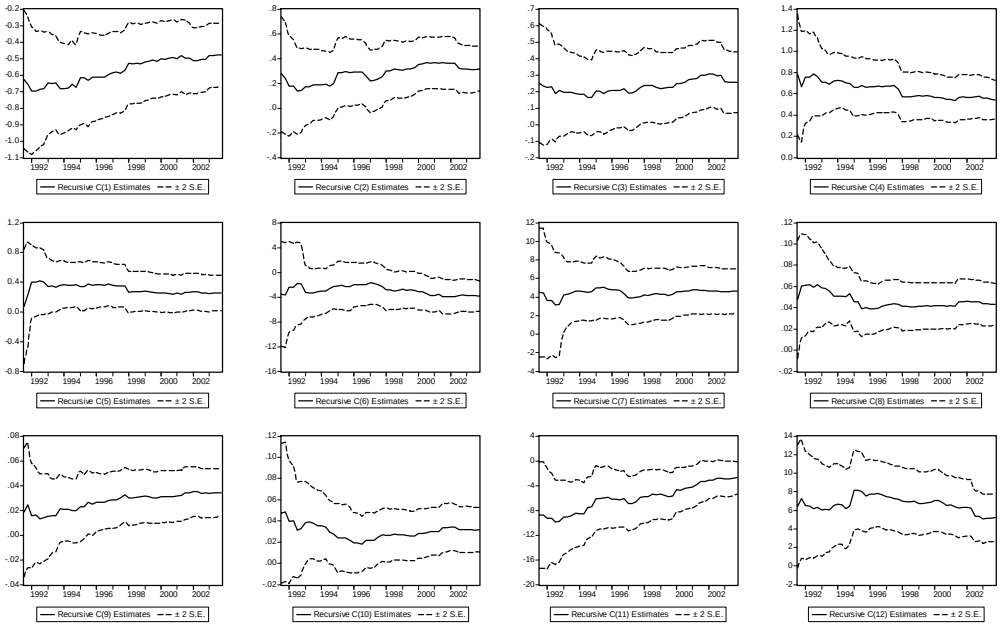
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IE(-1))	-0.480242	0.095845	-5.010627	0
DLOG(IE(-4))	0.316176	0.090852	3.480099	0.001
DLOG(IE(-5))	0.255898	0.09204	2.780303	0.0074
DLOG(IE(-8))	0.542682	0.091688	5.918768	0
DLOG(IE(-9))	0.256171	0.118824	2.155888	0.0354
DLOG(GDP(-7))	-3.833692	1.223935	-3.132268	0.0028
DLOG(GDP(-9))	4.672345	1.161724	4.021906	0.0002
D(RCP90(-2))	0.043127	0.010018	4.305072	0.0001
D(RCP90(-4))	0.03417	0.009535	3.583664	0.0007
D(RCP90(-6))	0.03157	0.010409	3.032814	0.0037
D(CPNGDP(-2))	-2.768915	1.311107	-2.111891	0.0392
D(CPNGDP(-4))	5.179724	1.27423	4.064985	0.0002

R-squared	0.752595	Mean dependent var	0.001999
Adjusted R-squared	0.703998	S.D. dependent var	0.108436
S.E. of regression	0.058996	Akaike info criterion	-2.663916
Sum squared resid	0.194908	Schwarz criterion	-2.272238
Log likelihood	102.5731	Durbin-Watson stat	2.064815







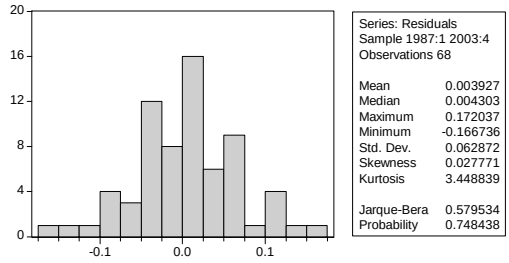


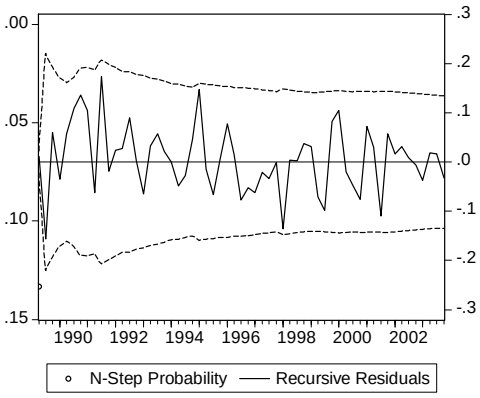
Eq. 6b

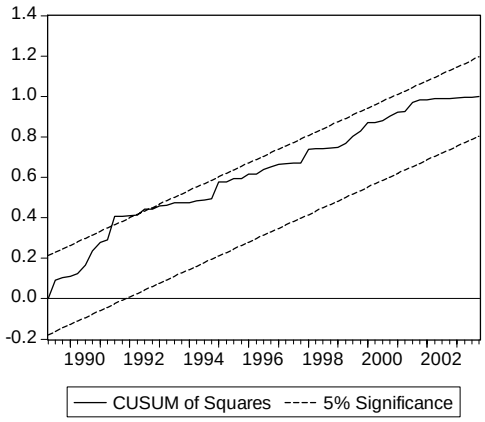
Dependent Variable: DLOG(IE)
Method: Least Squares
Date: 03/08/04 Time: 10:49
Sample: 1987:1 2003:4
Included observations: 68

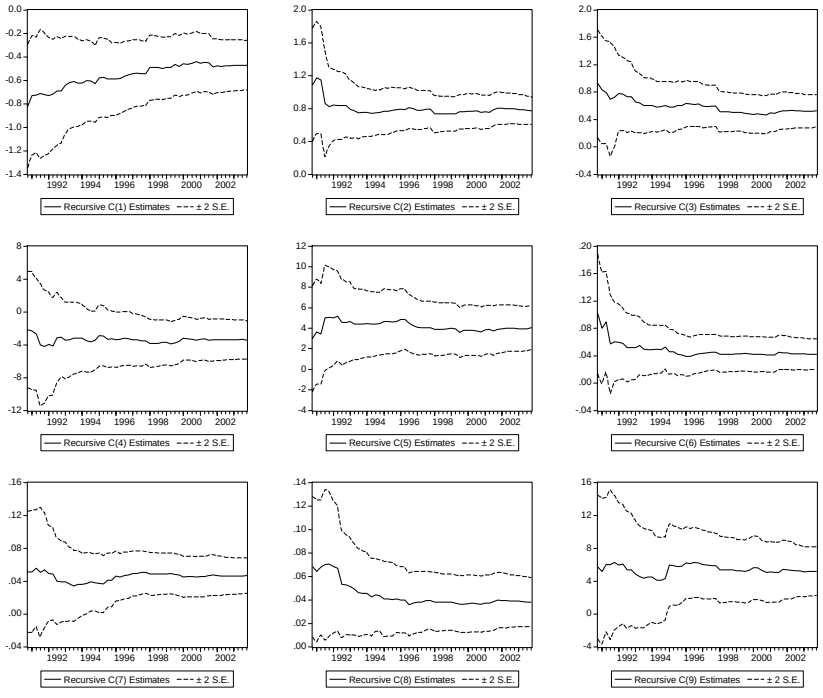
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IE(-1))	-0.472282	0.105914	-4.459113	0
DLOG(IE(-8))	0.76963	0.082066	9.378195	0
DLOG(IE(-9))	0.528965	0.118066	4.480233	0
DLOG(YGDPK(-5))	-3.450687	1.158246	-2.979236	0.0042
DLOG(YGDPK(-9))	4.027236	1.06643	3.776371	0.0004
D(RCP90(-2))	0.042096	0.01126	3.73865	0.0004
D(RCP90(-4))	0.046532	0.010862	4.283922	0.0001
D(RCP90(-6))	0.038024	0.010466	3.6331	0.0006
D(CPNGDP(-4))	5.203402	1.473038	3.532428	0.0008

R-squared	0.662493	Mean dependent var	0.001999
Adjusted R-squared	0.616729	S.D. dependent var	0.108436
S.E. of regression	0.067132	Akaike info criterion	-2.441591
Sum squared resid	0.265892	Schwarz criterion	-2.147833
Log likelihood	92.01409	Durbin-Watson stat	2.104418









Eq. 7b

Dependent Variable: DLOG(IE,1,4)
Method: Least Squares
Date: 03/15/04 Time: 15:17
Sample: 1987:1 2003:4
Included observations: 68

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(IE(-1),1,4)	-0.405798	0.07187	-5.646276	0
DLOG(IE(-4),1,4)	-0.634972	0.081662	-7.775653	0
DLOG(IE(-9),1,4)	0.228061	0.09147	2.493283	0.0155
DLOG(GDP(-7))	-3.146043	1.247623	-2.521631	0.0145
DLOG(GDP(-9))	3.474229	1.119608	3.103077	0.003
D(RCP90(-2))	0.043999	0.009878	4.454292	0
D(RCP90(-4))	0.030473	0.008811	3.458508	0.001
D(RCP90(-6))	0.028417	0.009853	2.884213	0.0055
DLOG(PROFITS(-2))	-0.24536	0.109073	-2.249513	0.0283
DLOG(PROFITS(-4))	0.514175	0.107397	4.787619	0

R-squared	0.74078	Mean dependent var	0.000406
Adjusted R-squared	0.700556	S.D. dependent var	0.106696
S.E. of regression	0.058385	Akaike info criterion	-2.708451
Sum squared resid	0.197713	Schwarz criterion	-2.382053
Log likelihood	102.0873	Durbin-Watson stat	2.27295