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Abstract

Mongolia's first composite leading indicator (CLI) is designed here to give early signals of turning-points in economic activity in the near future. This information is of prime importance for economists, businesses and policy makers to enable timely analysis of the current and short term economic situation. Mongolia's CLI uses monthly GDP as a proxy measure for economic activity. It focuses on the business cycle, defined as the difference between the smoothed GDP data and its long-term trend. Mongolia's CLI aims to predict turning-points in this business cycle estimate. The CLI is composed from a set of selected economic indicators whose composite provides a robust signal of future turning points. Out of 51 monthly time series covering the real economy, financial markets, international trade and the government sector that pass these criteria the quantity of imported diesel, M2, FDI, total import, international gold price and new real estate loans were selected on the basis of their predictive precision of turning points. The composite leading indicator based on these 6 components not only successfully predicts the turning points but also is highly correlated with the cyclical movements of the GDP growth.

JEL classification: E32, E37.

Keywords: macroeconomic forecasting, Mongolia, composite leading indicator, structural changes.

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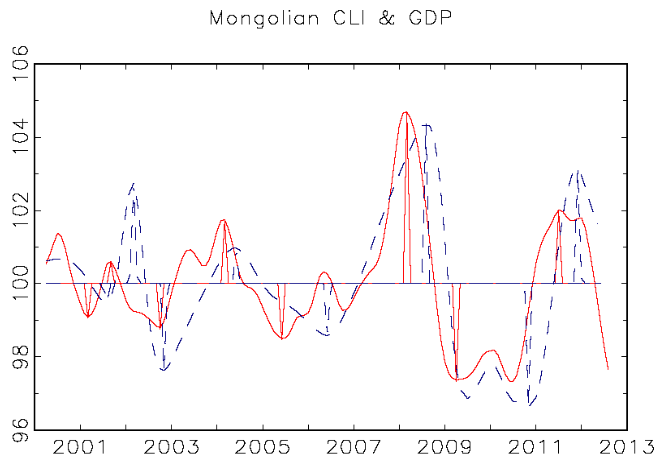
Executive summary

Mongolia's first composite leading indicator (CLI) is designed here to give early signals of turning-points in economic activity in the near future. This information is of prime importance for economists, businesses and policy makers to enable timely analysis of the current and short term economic situation. Mongolia's CLI uses monthly GDP as a proxy measure for economic activity. It focuses on the business cycle, defined as the difference between the smoothed GDP data and its long-term trend. Mongolia's CLI aims to predict turning-points in this business cycle estimate. The CLI is composed from a set of selected economic indicators whose composite provides a robust signal of future turning points. The criteria in choosing this set of indicators were economic relevance, breadth of coverage, frequency, absence of revision, timeliness, and length. Out of 51 monthly time series covering the real economy, financial markets, international trade and the government sector that pass these criteria the quantity of imported diesel, M2, FDI, total import, international gold price and new real estate loans were selected on the basis of their predictive precision of turning points. The composite leading indicator based on these 6 components not only successfully predicts the turning points but also is highly correlated with the cyclical movements of the GDP growth. However it has to be emphasized that Mongolia's CLI is optimised to identify turning points and not for judging the speed or strength of a recovery or downturn in the business cycle. A very high or low CLI for example cannot be interpreted as an indication of very high or low levels of economic activity or growth. It merely provides a strong signal of the phase the country is likely to be in its business cycle in the near future. At the same time a value above 100 in the de-trended GDP means a positive output gap.

Mongolia's CLI is therefore an event forecast, where the forecasted event is the turning-point in economic activity measured by the de-trended GDP. This forecast is calculated without modelling the interaction between variables and it is based solely on historical data, without invoking any expert judgments. The following graph presents the CLI and the estimated business cycle for Mongolia. The two series show strong co-movements, with all the turning points of the CLI consistently preceding those of the business cycle.



Mongolia's CLI (continuous red line) and economic activity (blue dashes); (long term trend=100)

Estimation of the business cycle based on data covering the period up to August 2012 indicates that Mongolia's economic activity reached its peak in December 2011 while the CLI's peak occurred five months before that. On average Mongolia's CLI predicts peaks and trough 5 and 9 months in advance respectively. Currently Mongolia's economic activity is proceeding towards its trough but the CLI shows no turning points yet, meaning that the economic situation will worsen at least for 9 months before improving. This however may change if the copper production of Ouy Tolgoi alters completely the past relationship among economic variables.

The system of Mongolia CLI includes pre-programmed Gauss codes and Excel data files. It is designed to require a minimal intervention from the user. Intervention is restricted by updating the Excel data files of Mongolia's and international financial and economic variables every month. All the rest should be done by the program.

Contents

1. Introduction

Information on where the economy is heading in the near future is of paramount importance for economists, businesses and policy makers to enable timely analysis of the current and short term economic situation. One of the key interests of the early analysts of business cycle was to identify series that moved in and out of recession before the rest of the economy. Identification of such series was attempted based on simple extrapolation, sophisticated macro econometric models, the so-called "technical analysis" and surveys of consumers and entrepreneurs (e.g. Purchasing Managers' Index).

System of leading indicators has been one of the most widely used methods of anticipation of future economic activity in the sense Mitchell and Burns (1938) originally defined. They developed its earlier versions of this technique at the National Bureau of Economic Research during the 1930s and 1940s. The idea behind this approach is simple and clear: there should be an "early warning" system to forecast when the economy will shift from expansion to recession (or on the contrary, from recession to expansion). In other words, we have to choose the indicators, which get to their *turning points* earlier than the economy in general. Then, whenever the leading indicator gets to its *peak* or to its *trough,* we are able to predict a forthcoming peak or trough in the business activity in general. However it must be emphasized that this concept is totally different from forming linear forecasts by minimizing the mean squared error of a forecast for the level of the variable. The most prominent examples of the CLI include the United States' composite leading index that originally based on 12 most promising leading indicators and has been systematically released since 1968 and the OECD's system of composite leading indicators that was developed in the 1970's and 1980's for its member countries. In the 1990's, leading indicators for Turkey, Korea, Hungary, and Poland and other emerging economies were developed under the supervision of the OECD. In addition to commonly used "official" indices, some "designers' indicators" were also introduced, with subtle variations in handling the initial statistical data.

Unfortunately such information is currently unavailable for Mongolia. The composite index presented in the following sections is a variant of the one elaborated by the OECD's Statistics Division. The modifications incorporate statistical techniques that facilitate the estimation process in the presence of possible structural changes that are happening in the country. This document can also serve as a user manual for a GAUSS computer language based system on composite leading indicator (CLI) to forecast economic activity in Mongolia. The cycle here is the result of deviations of the economy from its long term trend. A contractionary phase of the cycle means a decline in the rate of growth of the economy, and not necessarily an absolute decline in economic activity.

For this analysis it is necessary to select a reference economic activity measure such as Index of Industrial Production or GDP growth. I chose to use the latter on the basis of its availability and also because the industrial production might be losing its importance in the current economic structure. Then a group of candidate variables are selected from a large pool of data to predict the turning points in the reference series. The selection of the components of the leading indicator is based on the turning point forecast efficiency and on their economic significance. Once selected and cleared from seasonality and outliers allowing for possible endogenous structural breaks, using a methodology to be detailed in what follows, the relevant variables are adjusted, de-trended and aggregated into a single CLI that forecasts the de-trended reference series turning points. For de-trending the series, the Hodrick-Prescott (HP) Filter method is applied. This method is a smoothing technique that decomposes seasonally adjusted series into cyclical and trend components. I also use the same filter to remove high frequency noise components from the series.

Out of 51 monthly time series covering the real economy, financial markets, international trade and the government sector that pass initial economic criteria 6 of them were selected on the basis of their predictive precision of turning points. The resulting leading indicator not only successfully predicts the turning points but also is highly correlated with the cyclical movements of the GDP growth. The methodology can be outlined as follows:

1. Choose the reference series to be forecast (GDP growth in this case).
2. Adjust the reference series for seasonal, outlier and trend effects, after taking into account of possible structural changes. Quarterly series is linearly interpolated to produce monthly data.[2]

[2] In fact every quarterly data such as those from the Quarterly Loan Report of the Mongol Bank are treated the same way.

3. Selection of the components of the CLI. This is based on economic relevance, breadth of coverage, frequency, absence of revision and timeliness. Estimation of seasonally adjusted, outlier corrected versions of the selected series after taking into account of possible structural breaks. Quarterly series are linearly interpolated to produce monthly data.
4. Detrending the seasonally-adjusted-reference and component series of the CLI with a double Hodrick-Prescott Filter. The first filter removes the long term trend while the second one gets rid of the noise with frequencies higher than 12 months.
5. Identifying turning points in the reference and component series using Bry and Boschan (1971).
6. Selecting those component series that predict the turning points in the reference series and aggregate them into a single CLI.
7. Comparison of the business cycle of the reference series and the CLI.

This document is accompanied by a pre-programmed Gauss code and a set of Excel files that need to be updated every month. Although this document considers a methodology of predicting turning points in the overall economic activity this could also be used for other reference series as well.

2. Pre-selection

A. Reference series

The reference variable is the benchmark that indicates fluctuations in the economic activity, and is the variable whose turning points are to be forecast. Usually chosen is the Industrial Production Index, IIP, which has the advantage of being reported on a monthly basis, available for most countries, and measures the real sector of the economy. The GDP growth data is chosen as a reference series for Mongolia since the industrial production index is not available. I use seasonally adjusted quarterly data reported in monthly Statistical Bulletins and they cover the period of the 1st quarter of 2000 to the second quarter of 2012. Following the OECD's leading indicator methodology I linearly interpolate them into monthly frequency by assuming the growth rate in each month is the same in a given quarter.

B. Component series

As previously mentioned, the essential feature taken into account for selecting a component of the CLI is that it leads the reference series with a similar cyclical profile. Other salient features are: the consistency of the lead of the indicator over the reference cycle at turning points, the absence of extra or missing cycles, smoothness, freedom from excessive revisions by the authorities, timeliness in delivery from the authorities, and availability of a long run of data of satisfactory reliability with no breaks. Monthly series are preferred. A general requirement applied here for a candidate component series is to satisfy at least one of the following:

- to display the expectations of economic agents;

- to respond to changes in business activity earlier than the overall economy;

- to have gained recognition as a leading indicator in other countries.

Moreover, from a practical point of view, series must also meet the following:

- to have cyclical fluctuations (that is, there must be a succession of growth and decline periods);

- to be sufficiently reliable and comparable during the whole period in question;

- to be renewed on a timely basis, preferably each month.

The candidate component series for the composite indicator are 51 monthly variables that cover ten spheres of the Mongolian economy: production input, energy use, mining production, international trade, monetary environment, finance, government finances, new loans to economic sectors, international commodities markets and Chinese economic situation measured by its CLI provided by the OECD. The following table provides the breakdown.

	Category	Name of the candidate component series	Data coverage	Source
1	Input	Quantity of imported tires (thousands)	2000.01-2012.08	Customs
2		Price of imported tires (USD)	2000.01-2012.08	Customs
3		Quantity of imported trucks (thousands)	2000.01-2012.08	Customs
4		Price of imported trucks (thousand USD)	2000.01-2012.08	Customs
5	Energy use	Quantity of imported diesel, thousand ton	1997.10-2012.08	NSO
6		Price of imported diesel, USD/ton	1997.10-2012.08	NSO
7		Quantity of imported petrol, thousand ton	1997.10-2012.08	NSO
8		Price of imported petrol, USD/ton	1997.10-2012.08	NSO
9	Mining	Coal production, thousand ton	2000.01-2012.08	NSO
10		Copper concentrate production (35%), thousand ton	2000.01-2012.08	NSO
11		Molybdenum concentrate production, ton	2000.01-2012.08	NSO
12	Trade	Copper concentrate export price, USD/ton	1998.01-2012.08	NSO
13		Molybdenum concentrate export price, USD/ton	1998.01-2012.08	NSO
14		Total trade, mln USD.	1997.10-2012.08	Mongol Bank
15		Import, mln. USD	1997.10-2012.08	Mongol Bank
16		Export, mln. USD	1997.10-2012.08	Mongol Bank
17		Export to China, mln. USD	1997.10-2012.08	Mongol Bank
18		FDI, mln. USD	1997.10-2012.08	Mongol Bank
19		Net trade, mln. USD	1997.10-2012.08	Mongol Bank
20		Export to import ratio, %	1997.10-2012.08	Mongol Bank
21	Monetary	Consumer Price Index	1997.10-2012.08	Mongol Bank

22	environment	M2, mln. MNT	1997.10-2012.08	Mongol Bank
23		M1, mln. MNT	1997.10-2012.08	Mongol Bank
24		Loan to deposit ratio, %	1997.10-2012.08	Mongol Bank
25		Weighted average loan rate in MNT, %	1997.10-2012.08	Mongol Bank
26		Weighted average loan rate in foreign currency, %	1997.10-2012.08	Mongol Bank
27		Central Bank Bill rate, %	1997.10-2012.08	Mongol Bank
28	Finance	Top20	1997.10-2012.08	Mongol Bank
29		USD exchange rate (MNT/USD)	1997.10-2012.08	Mongol Bank
30		Yuan exchange rate (MNT/Yuan)	1997.10-2012.08	Mongol Bank
31	Budget	Current income	1997.10-2012.08	Mongol Bank
32		Current expenditure	1997.10-2012.08	Mongol Bank
33		Capital expenditure	1997.10-2012.08	Mongol Bank
34	Loans	Total new loans, thousand MNT	2000Q1-2012Q2	Mongol Bank
35		New loans to administrative service	2000Q1-2012Q2	Mongol Bank
36		New agricultural loans	2000Q1-2012Q2	Mongol Bank
37		New construction loans	2000Q1-2012Q2	Mongol Bank
38		New consumer loans	2002Q1-2012Q2	Mongol Bank
39		New loans to electricity, steam generation	2002Q1-2012Q2	Mongol Bank
40		New loans to financial and insurance activities	2000Q1-2012Q2	Mongol Bank
41		New loans to health organizations	2000Q2-2012Q2	Mongol Bank
42		New industrial loans	2000Q1-2012Q2	Mongol Bank
43		New mining loans	2000Q1-2012Q2	Mongol Bank
44		New real estate loans	2000Q3-2012Q2	Mongol Bank
45		New loans to transport sector	2000Q1-2012Q2	Mongol Bank
46		New wholesale and retail trade loans	2002Q1-2012Q2	Mongol Bank
47	International	International oil price	1997.10-2012.08	IndexMundi
48		International copper price	1997.10-2012.08	IndexMundi
49		International coal price	1997.10-2012.08	IndexMundi
50		International gold price	1997.10-2012.08	IndexMundi
51	China	Composite Leading Indicator of China	1997.10-2012.08	OECD

Table 1. Prospective component series for the Mongolia’s CLI.

Although some of the preceding series may not be included in the final index, all exhibit a close cyclical relation with GDP and were tested for inclusion in the CLI (see Figures in Appendix 3). There is an ongoing official attempt to include publically non-reported statistics such as the new car registration number, building permits, mining equipment imports. I think they need to be added to the above list once the necessary data from the relevant government authorities are obtained. It has also to be said that it's important to enrich the above list as much as possible since the system sifts through all the available data and checks their relevance for predicting the turning points in the reference series. Appendix 5 includes some component indicators that are being used in other countries that could guide to expand the list in the future.

3. Decomposition and business cycle extraction in the presence of structural breaks

A. Rationale

The absence of leading economic indicators in former communist countries, except in a few eastern European countries and Russia is often associated with the possible structural breaks happening in those economies and consequently a lack of sufficient data to make a distinction between a long-term trend and cyclical or short-term fluctuations. Mongolia is no exception. Its economy is experiencing important structural changes, first related with the break-up of the centrally planned economy and the emergence of a market based system and more lately with the rise of the mining sector in the economy. So it's crucial to take into account possible structural breaks in any analysis involving Mongolia macroeconomic variables.

On the other hand it is vital for the composite leading indicator methodology to decompose any time series and remove its seasonal fluctuations and aberrant observations before estimating its long term trend and high frequency fluctuations. Conventional technique to remove seasonality and identifying outliers is often based on a filtering operation, and the smoothing implied in such adjustment may reduce the magnitude of changes in the mean and persistence properties (Ghysels and Perron, 1996); I return to this issue below. Furthermore, the seasonal pattern itself may also exhibit structural change, which is not handled adequately by seasonal adjustment filters and thus should be modelled explicitly for a country like Mongolia.

Such a methodology for countries possibly experiencing structural changes were developed recently in Bataa, Osborn, Sensier and Dijk (2012). Their methodology first tests for any structural breaks in the time series components and that information is later used in identifying seasonality, outliers and the rest. The following section explains their methodology.

B. Decomposition methodology

In this section I first detail the iterative decomposition used to identify and distinguish between breaks in mean, seasonality, persistence and (conditional) volatility of the series, while also accounting for the possible presence of outliers. This is followed by an outline of Qu and Perron's (2007) multiple break testing procedure, which is my main econometric tool.

B1. Iterative procedure for structural break and outlier detection

Consider decomposing a stationary time series Y_t into components capturing level (L_t), seasonality (S_t), outliers (O_t) and dynamics (y_t), where level and seasonality are deterministic and only the last component is stochastic and represented by means of an autoregressive (AR) process (although this could include stationary stochastic seasonality, if appropriate). This differs from the usual unobserved components approach, as employed by Harvey (1989) and others, which is designed to capture nonstationarity in both the levels and seasonal components. However, the presence of such stochastic components would imply that a time series has both a zero frequency unit root and the full set of seasonal unit roots, a conclusion which has not found support in previous analyses; see, for example, Canova and Hansen (1995) for the US or Osborn and Sensier (2009) for the UK.

As indicated in the Rationale, the possibility of changes to the Mongolia's macroe economic process is important for the conduct and understanding of monetary and fiscal policies. The model I consider allows for structural change in each of the level, seasonal and dynamic components, where breaks in the latter may occur in the AR coefficients or in the conditional volatility. A crucial feature of the model is that the numbers of structural breaks in these components do not have to be the same and nor do their temporal locations. The general model specification is given by

$$Y_t = L_t + S_t + O_t + y_t \tag{1}$$

$$L_t = \mu_{k_1} \qquad t = T^1_{k_1-1}+1,\ldots,T^1_{k_1}, \quad k_1 = 1,\ldots,m_1+1 \tag{2}$$

$$S_t = \sum_{l=1}^{s} \delta_{k_2 l} D_{lt} \qquad t = T^2_{k_2-1}+1,\ldots,T^2_{k_2}; \quad k_2 = 1,\ldots,m_2+1 \tag{3}$$

$$y_t = \sum_{i=1}^{p} \phi_{k_3,i}\, y_{t-i} + u_t \qquad t = T^3_{k_3-1}+1,\ldots,T^3_{k_3}; \quad k_3 = 1,\ldots,m_3+1 \tag{4}$$

$$\text{var}(u_t) = \sigma^2_{k_4} \qquad t = T^4_{k_4-1}+1,\ldots,T^4_{k_4} \; ; \quad k_4 = 1,\ldots,m_4+1 \tag{5}$$

where m_j denotes the number of breaks of type j that occur at observations $T^j_{k_j}$ (k_j = 1, ..., m_j), with $T^j_0 = 0$ and $T^j_{m_j} = T$ (where T denotes the total sample size), and for s seasons per year (s = 12 for monthly data), D_{lt} (l = 1, …, s) are seasonal dummies equal to unity if the observation at time t falls in season l and zero otherwise. Note that the coefficient $\delta_{k_2 l}$ represents the deviation of the unconditional mean of Y_t in the l-th season (month) from the overall mean level μ_j and, for identification purposes, we impose the restriction $\sum_{l=1}^{s} \delta_{k_2 l} = 0$ for all seasonality regimes k_2 = 1, …, m_2+1. Hence, except for outlier effects, the decomposition implies

$$E[Y_t | l] = \mu_{k_1} + \delta_{k_2 l} \tag{6}$$

when t falls into regime k_1 for the mean and regime k_2 for seasonality, with l being the season corresponding to the specific observation.

Although our principal interest is the possibility of breaks in the components (2) to (5), outliers are corrected to prevent these distorting inference concerning other components. Outliers, O_t in (1), are observations that are abnormally distant from the overall level, defined using the procedure of Stock and Watson (2003) and, when detected, are replaced with the median of the six neighbouring non-outlier observation[3]. However, the particular outlier methodology is not our central concern, and other procedures could be employed, such as that of Tsay (1988).

Returning to our focus of interest, namely (2) to (5), it is difficult, if not impossible, to test satisfactorily for multiple structural breaks in all these components in a simultaneous procedure if breaks may occur at different dates. Complications arise because the structural break testing methodologies developed so far assume a pre-specified minimum distance between consecutive break dates, thus limiting the possible number of breaks. For example, using 15% trimming in the methodology of Bai and Perron (1998, 2003a) or Qu and Perron (2007) would allow at most 5 breaks in the parameters in any of (2) to (5) over the 35-year sample period we analyse. However, potential changes in seasonal patterns due to (say) changes in data collection methods or to tax effects, considered alongside mean and/or persistence shifts arising from changes in monetary policy and volatility changes due to good luck renders plausible the existence of more than a total of five parameter changes over our sample. Nevertheless, estimating and testing for breaks sequentially also poses problems, since testing for structural breaks in one component can be affected by the presence of breaks in other components. For example, Marques (2005) shows empirically that conclusions concerning changes in inflation persistence crucially depend on the specification of mean inflation, with much more evidence for a decline in inflation persistence obtained if mean inflation is assumed constant than if the level is allowed to exhibit structural breaks. In addition, a further complication is that the presence of outliers can affect persistence estimates; see Franses and Haldrup (1994).

[3] The procedure was downloaded from Mark Watson's website http://www.princeton.edu/~mwatson/publi.html. The results presented define an outlier as being more than five times the interquartile range from the median; except in the initial loop, this is measured after the removal of mean, seasonal and dynamic effects. Neighbouring observations are also considered in this context. Outlier correction is sequential (one at a time), until no more are detected. Outlier correction is applied in the inflation series, unless two sequential approximately off-setting outliers are detected. In this latter case, a single correction is made to the underlying CPI series, rather than two corrections for inflation.

For this reason, I employ an iterative approach to examine breaks in each of the components of the economic series alongside outlier detection and removal. First, an initial identification of outliers is made. Outliers are considered first in this procedure for the same reason that they are conventionally removed prior to other empirical analysis, namely so that these do not distort inference on the components of primary interest. This procedure, however, later re-considers outliers within each iteration (see below). Second, assuming a constant mean, I test for breaks in the seasonal component[4], which then yields (using the appropriate sub-samples) our first estimate of the seasonal component allowing for structural instability. Third, the deterministic seasonal component is removed and level shifts are examined in the outlier-corrected series. The break dates are recorded, leading to the first estimate of mean of the series, adjusted for any breaks uncovered. In the fourth step of the loop, having removed outliers, seasonal and level components from the original series, we test for breaks in the autoregressive (AR) coefficients of the dynamic component. The choice to consider breaks in deterministic components prior to those for dynamics is based on the analyses of Cecchetti and Debelle (2006), Levin and Piger (2004), Marques (2005).

In this initialisation, heteroskedasticity and autocorrelation (HAC) robust inference is employed when testing seasonal and level changes, since (6) may be subject to dynamic effects and possible volatility changes. Similarly, heteroskedasticity consistent (HC) inference is employed in the initial analysis of changes in dynamics[5], to take account of possible volatility breaks. Although the within loop component order outliers, deterministic components, dynamics follows recent empirical practice, I build on this by iterating the loop until convergence is achieved, in the sense that the dates of outliers and all structural breaks do not change. In each iteration, the latest estimates of the components of (1) are removed, except for that under study. Since dynamics are taken into account, HC (not HAC) inference is employed for mean and seasonal break tests subsequent to the initialization.

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[4] When initial mean breaks are considered prior to initial seasonal breaks, qualitatively very similar results are obtained in relation to the numbers and dates of breaks. In practice, however, we prefer the analysis considering seasonality first because it yields better convergence overall for our data series and we conjecture this is because of the larger role of seasonality to changing mean effects for inflation in (6).

[5] Since we lose p observations in order to estimate the AR(p) model, and consequently our dynamic component will be p observations short of others, we set missing dynamic components to their unconditional mean of zero.

Once convergence is achieved in the iterative procedure just described for the components of (1), we could in principle subtract these four components from the original series and proceed to test for (conditional) volatility breaks in the residuals $\hat{u}_t$. However, Pitarakis (2004, page 44) notes that "It is a notoriously difficult problem to design good test procedures about the equality of regression slopes while not necessarily maintaining the equality of variance assumption". Indeed, Hansen (2000) shows that structural changes in the marginal distribution of regressors render the Andrews (1993) type structural break tests asymptotically invalid.

To account for this possibility I incorporate an additional 'inner loop' that iterates between testing for breaks in the AR coefficients of the dynamic component y_t and its conditional volatility. To be precise, after removing outliers, mean and seasonal components, the sub-loop tests for breaks in dynamics (assuming serially uncorrelated disturbances); in the first sub-loop iteration this employs HC inference, but subsequently a constant variance assumption is used. If any break is detected, the AR model is estimated allowing for these breaks, with variance breaks then investigated using the resulting residuals. If volatility breaks are detected, the residual standard deviations are estimated over the implied volatility segments, which are then used to apply generalized least squares (GLS) estimation. Specifically, the test for breaks in dynamics is applied to the GLS-transformed data, with the volatility break test repeated, and so on until convergence is achieved in the dynamics/volatility break dates. Once this 'inner loop' has converged, we return to the main loop and proceed as above.

The procedure employed in the inner loop is based on the findings of Pitarakis (2004), who uncovers very large size distortions for coefficient break tests in the presence of unmodelled volatility change, but who also provides evidence on improvements offered by a feasible GLS transformation in that context.

In the implementation of this procedure, the maximum number of iterations is set to 20 for each of the main and inner loops. In a small number of cases, the procedure does not converge to a unique set of break dates, but rather converges to a cycle between two sets of dates. In such cases, we select between these based on the minimization of the Hannan-Quinn (HQ) information criterion, computed in this context as

$$HQ = \sum_{k_4=1}^{m_4+1} \ln\left(\sum_{t=T_{k_4-1}+1}^{T_{k_4}} \hat{u}_t^2 \Big/ (T_{k_4} - T_{k_4-1}) \right) + \frac{2\ln(\ln(T))}{T} \left[m_1 + 1 + 12(m_2+1) + p(m_3+1) + m_4 + 1 \right] \tag{7}$$

where the superscript has been omitted from T to ease notation.

B.2. Testing for multiple structural breaks

The iterative procedure outlined above is implemented using the Qu and Perron (2007) test for multiple structural breaks[6]. At each step, following the recommendation of Bai and Perron (2006), I first test the null hypothesis of no breaks against an unknown number of breaks. If the null of no breaks is rejected I use a sequential testing procedure to estimate the number and locations of breaks.

All tests relating to the components of (1) are examined in a regression framework, with the form of the regression varying according to the component being tested for structural breaks. Specifically:

(i) To test for breaks in the seasonal component S_t, we regress $Y_t - \hat{L}_t - \hat{O}_t - \hat{y}_t$ on a set of centred seasonal dummies $\Delta_{jt} = D_{jt} - D_{kt}$, $j = 1, \ldots, s$ but excluding $j=k$ (where D_{jt} is a conventional zero/one seasonal dummy variable for season j) that is $Y_t - \hat{L}_t - \hat{O}_t - \hat{y}_t = \sum_{\substack{j=1 \\ j\neq k}}^{s} \delta_{ij} \Delta_{jt} + u_t$, with the omitted season k coefficient retrieved using $\delta_{ik} = -\sum_{\substack{j=1 \\ j\neq k}}^{s} \delta_{ij}$. The estimated AR coefficients for the dynamic component y_t, are used to form $\hat{y}_t$.

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[6] Although the Qu and Perron (2007) procedure is developed for multivariate systems, it is adopted here because of its attractive features, including the possibility of using volatility break information when testing for coefficient breaks, as well as an explicit handling of volatility breaks that allows us to avoid using a volatility proxy in the context of the Bai and Perron (1998, 2003a) methodology.

(ii) For the level (mean) component L_t, we employ the regression $Y_t - \hat{S}_t - \hat{O}_t - \hat{y}_t = \mu_i + u_t$.

(iii) To test for breaks in the dynamic component $y_t \equiv Y_t - \hat{L}_t - \hat{S}_t - \hat{O}_t$, we use an AR($p$) model $\phi_i(L)y_t = u_t$, with AR polynomial $\phi_i(L) = 1 - \phi_{i1}L - \phi_{i2}L^2 - \ldots - \phi_{ip}L^p$ in the lag operator L.

In all cases, the most recent estimates are employed when constructing the dependent variable for the regression.

In the three cases listed above, to test the null hypothesis $H_0 : \mu_i = \mu_0 \ \ (i = 1, ..., m_1 + 1)$, $H_0 : \boldsymbol{\delta}_i = \boldsymbol{\delta}_0 \ \ (i = 1, ..., m_2 + 1)$ where $\boldsymbol{\delta}_i = (\delta_{i1}, ..., \delta_{is})'$, or $H_0 : \boldsymbol{\phi}_i = \boldsymbol{\phi}_0 \ \ (i = 1, ..., m_3 + 1)$ where $\boldsymbol{\phi}_i$ = $(\phi_{i1}, \phi_{i2}, ..., \phi_{ip})'$, against $m \leq M$ breaks (for a specified maximum M) we employ the statistic

$$WD\max = \max_{1 \leq m \leq M} a_m \left[\sup F_T(m, q, \varepsilon)\right], \tag{8}$$

where $a_1 = 1$ and for $m > 1$, m is m_1, m_2 or m_3, as appropriate, $a_m = c(\alpha, 1) / c(\alpha, m)$, in which $c(\alpha, m)$ is the asymptotic critical value of the supremum statistic $\sup F_T(m, q, \varepsilon)$ at significance level α, in which[7]

$$\sup F_T(m, q, \varepsilon) = \sup_{(\boldsymbol{\lambda}_1, ..., \boldsymbol{\lambda}_m \in \Lambda_\varepsilon)} \left[\frac{\left(T - (m+1)q\right)}{T} \hat{\boldsymbol{\beta}}' \boldsymbol{R}' [\boldsymbol{R} \hat{\boldsymbol{V}}(\hat{\boldsymbol{\beta}}) \boldsymbol{R}']^{-1} \boldsymbol{R} \hat{\boldsymbol{\beta}} \right], \tag{9}$$

is a Wald-type test statistic for structural change at m unknown break dates, $\hat{\beta}$ is the vector of coefficients, that is, $\hat{\mu}$, $\hat{\boldsymbol{\delta}}$ or $\hat{\boldsymbol{\phi}}$, for m breaks at given dates with estimated covariance matrix

[7] The statistic as given by Qu and Perron (2007), specifically their equation (20), differs from (9) in omitting the denominator term T, which is irrelevant for obtaining the supremum. However, (9) is the form employed in their computer code used for inference.

$V(\hat{\beta})$, $\boldsymbol{R}$ is a non-stochastic matrix such that $(\boldsymbol{R\beta})' = (\boldsymbol{\beta}_1' - \boldsymbol{\beta}_2', ..., \boldsymbol{\beta}_m' - \boldsymbol{\beta}_{m+1}')$, q is the number of coefficients that are allowed to change, λ_i (i = 1, …, m) indicate the break dates as fractions of the sample size, that is, $0 < \lambda_1 < ... < \lambda_m < 1$ with $T_i = [T\lambda_i]$ and finally Λ_ε denotes all permissible sample partitions. When HAC inference is employed, this uses the quadratic spectral kernel with automatic bandwidth selection as in Andrews (1991).

If the *WD*max test of (8) rejects the null of no breaks at the 5% significance level, a sequential *F*-type test is used to determine the number of breaks and their locations. In particular, the test statistic is defined as

$$\sup SEQ_T(l+1|l) = \max_{1 \le j \le l+1} \left[\sup_{\tau \in \boldsymbol{\Lambda}_{j,\varepsilon}} F_T(\hat{T}_1, ..., \hat{T}_{j-1}, \tau, \hat{T}_j, ..., \hat{T}_l) - F_T(\hat{T}_1, ..., \hat{T}_l) \right], \qquad (10)$$

where $\Lambda_{j,\varepsilon} = \{\tau; \hat{T}_{j-1} + (\hat{T}_j - \hat{T}_{j-1})\varepsilon \le \tau \le \hat{T}_j + (\hat{T}_j - \hat{T}_{j-1})\varepsilon\}$ for l = 1,2,…, and F_T is given by (9). The test statistic in (10) is applied for l = 0, 1, …, M until the test fails to reject the null hypothesis of no additional structural breaks. Note that, for each value l, the estimates of all break dates are re-estimated to find those corresponding to the global maximum of the likelihood function.

The null hypothesis of no break in conditional volatility, $H_0 : \sigma_i^2 = \sigma_0^2 \ (i = 1, ..., m_4 + 1)$, is tested using a likelihood ratio test statistic. In particular, the Sup*F* statistic of (8) is replaced by the Sup*LR* statistic defined as

$$\sup LR_T(m,q,\varepsilon) = \sup_{(\lambda_1,\ldots,\lambda_m \in \Lambda_\ell)} 2\ln\left(\frac{\hat{L}_T(T_1,\ldots,T_m)}{\tilde{L}_T}\right), \tag{11}$$

where $\ln \hat{L}_T(T_1,\ldots,T_m) = -\frac{T}{2}(\ln 2\pi + 1) - \sum_{j=1}^{m+1} \frac{T_j - T_{j-1}}{2} \ln \hat{\sigma}_j^2$ and $\hat{\sigma}_j^2 = \frac{1}{T_j - T_{j-1}} \sum_{t=T_{j-1}+1}^{T_j} \hat{u}_t^2$ with $\hat{u}_t$ (t = 1, …., T) the residual series from (4), while ~ represents the corresponding quantities computed under the null hypothesis of no volatility breaks. Similarly, the sequential test of (10) is replaced by

$$\sup SEQ_T(l+1|l) = \max_{1 \le j \le l+1}\left[\sup_{\tau \in \Lambda_{j,\varepsilon}}\left(\ln\left(\frac{\hat{L}_T(T_1,\ldots,T_{j-1},\tau,T_j,\ldots,T_l)}{\hat{L}_T(T_1,\ldots,T_l)}\right)\right)\right]. \tag{12}$$

Having obtained the number of structural breaks using (10) or (12), as appropriate, the break dates are estimated as those that maximise the corresponding F-type or LR-type statistic.

From a practical point of view the maximum number of breaks, M, needs to be specified, as well as the minimum fraction ε of the sample in each regime. Critical values of the tests depend on both the number of coefficients allowed to change and ε. In general ε has to be chosen large enough for tests to have approximately correct size and small enough for them to have decent power. Moreover, when the errors may be autocorrelated and/or heteroskedastic, ε has to be larger than when these features are absent. In order to balance these issues, our empirical analysis of Section IV sets ε = 0.2 and M = 2 when the tests are applied for the seasonal component[8] and $\varepsilon = 0.15$ with M = 5 otherwise. Critical values for all tests employed are obtained from Bai and Perron (2003b) for a 5 percent level of significance.

[8] Of course, only one observation per year is available on monthly seasonal effects, implying that relatively few structural changes can be realistically allowed in these.

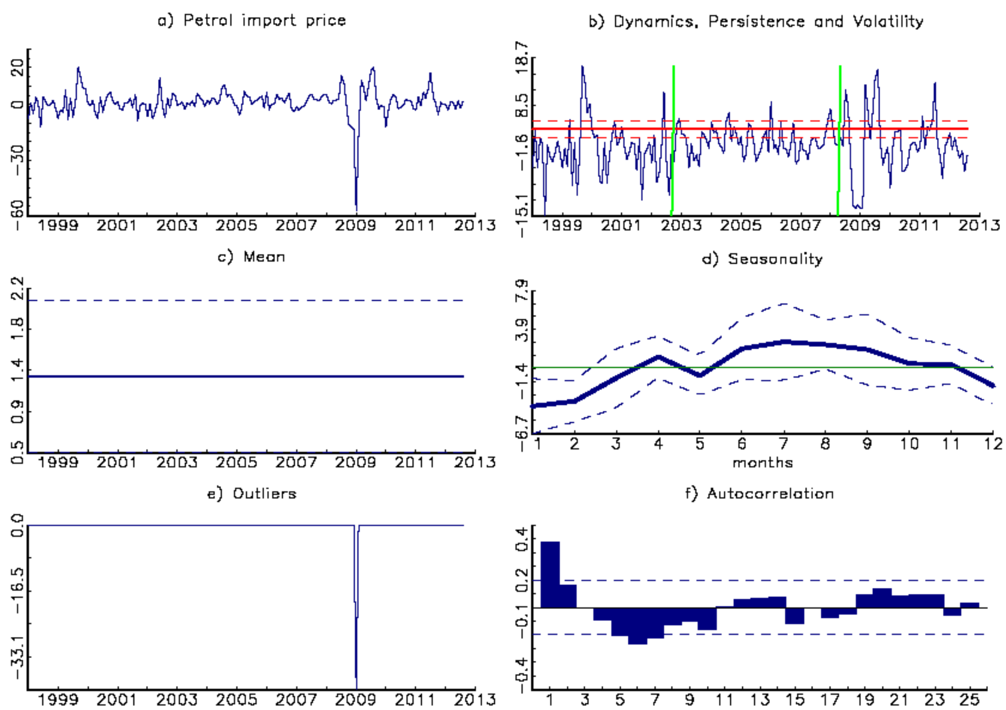


Figure 1. Notes: Panels show: a) observed time series, b) dynamic component, persistence (red line) and volatility break dates (green vertical lines); c) regime means, d) deterministic seasonal component for regime 1 in blue, regime 2 in red and regime 3 in pink, e) outliers and f) correlogram for the estimated dynamic component, with 95% confidence intervals shown as dashed lines. If relevant, the correlogram is shown over sub-periods identified by dynamic breaks, with regime 1 in blue and regime 2 in red.

Summary results that are obtained from the application of the iterative decomposition methodology are shown in graphical form in Figure1 (for the remaining of the series see Figures 1-42 of the Appendix 1). Our principal empirical results concern the presence of structural breaks in different characteristics of monthly and quarterly time series that are considered potential candidates for the CLI component over the period October 1997 to August 2012. These charts provide: (i) the original unadjusted growth rates of the relevant time series; (ii) the estimated dynamic component y_t (constructed by removing outliers, mean and seasonal components) together with its estimated persistence, defined as the sum of the autoregressive coefficients in (4) and corresponding ± 2 standard error bands (in red), and volatility break dates (vertical green lines); (iii) the level component L_t with ± 2 standard error bands; (iv) the estimated seasonal component for each seasonal regime (again with ± 2 standard error bands); (v) outliers O_t that are removed; and (vi) the correlogram of the dynamic component y_t within each dynamic regime *j*, together with an approximate 95% confidence interval of $\pm 2/\sqrt{(T_j - T_{j-1})}$. With the exception of the correlogram, all standard errors are obtained using the White (1980) HC covariance matrix in the corresponding regression over the regime defined by the appropriate estimated break dates. Where relevant, the graphs showing the seasonal components and the correlograms for the dynamic component are colour-coded with the first regime (that is, the sub-sample to the first break date) in blue, the second in red and the third in pink.

More detailed numerical results are printed out into a Gauss output file.

C. Estimation of long term trend and short term noise

Once seasonality and outliers in the growth rates of the economic time series have been removed, as described in Section B, I convert them back into their levels. For quarterly data I linearly interpolate them into monthly frequency by assuming the growth rate in each month is the same in a given quarter, following the OECD's leading indicator methodology. But there will still be a trend in the most of the time series and a high frequency noise in all of the series. The presence of a trend in economic activity can distort evaluations of cyclical events. Removing these trends (de-trending) provides a better measure of underlying movements in the business cycle. Policy designed to affect trend growth is very different from policies reacting to business cycle fluctuations.

Importantly, and this is particularly relevant in the context of the current economic climate where the recent developments associated with the mining has created uncertainty about trends, if estimates of trend economic activity changes, the output gap changes and, so, values of the GDP greater or lower than 100 can arise during periods of trend change. A trend change means possibilities of temporary and permanent level changes in the growth changes. Temporary changes are treated in Section B as outliers and permanent changes are modeled as the growth mean changes.

Since the outliers detected are removed a priori to the analysis and there was no mean breaks as can been seen from the graphs in the Appendix 1, I use the conventional Hodrick-Prescott filter which is a model-free approach to decompose a time series into its trend and cyclical components. The Hodrick-Prescott filter is in effect an algorithm that "smoothes" the original time series y_t to estimate its trend component, τ_t. The cyclical component is the difference between the original series and its trend, i.e.,

$$y_t = \tau_t + c_t$$

where τ_t is constructed to minimize:

$$\sum_{1}^{T}(y_t - \tau_t)^2 + \lambda\sum_{2}^{T-1}[(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2$$

The first term is the sum of the squared deviations of y_t from the trend and the second term, which is the sum of squared second differences in the trend, is a penalty for changes in the trend's growth rate. The larger the value of the positive parameter λ, the greater the penalty and the smoother the resulting trend will be. If for example, $\lambda = 0$, then $y_t = \tau_t$, $t = 1,\ldots,t$, while $\lambda \to \infty$ means τ_t is the linear trend obtained by fitting y_t to a linear trend model by OLS.

Following Hodrick and Prescott (1998) I use λ = 14400 when extracting the long term trend from the monthly time series. The results are plotted in Figures 1-6 of the Appendix 2.

The cyclical component obtained by subtracting this trend term from the seasonality and outlier removed series contain both fluctuations related to the business cycle and high frequency noise. This can be inferred from the above figures. To remove the noise I again follow the OECD CLI methodology. The default setting there is to remove cyclical components that have a cycle length shorter than 12 months. This is equivalent to setting λ = 13.93. Going from frequencies to λ parameter is achieved by substituting into the formula $\lambda = \left(4(1-\cos(w0)^2\right)^{-1}$ where $\omega 0$ is the frequency expressed in radians, and τ denotes the number of periods it takes to complete a full cycle. The two parameters are related through $\omega 0 = 2\pi/\tau$. So the λ values above correspond to τ=12 months. The OECD suggests first de-trending and then smoothing (using the larger and then smaller smoothing parameter, respectively). After the first application of the HP filter (de-trending, larger parameter), one is left with a cyclical and a trend component. The original series is de-trended by dividing it by the trend component, thus implying a multiplicative approach. Multiplicative methods seem to be the most popular and the Bank of Spain explains this in its TRAMO/SEATS literature. This de-trended series is used in the second application of the HP filter (smoothing, smaller parameter) and one is left with a smoothed and de-trended series which fluctuates around 1.

Given the wide variability in amplitudes across series, forming the CLI with a simple average of non-standardized variables may generate distortions in the construction of the final index. To avoid this problem a normalization is applied to the business cycle of the prospective CLI component series. I normalize each series by subtracting its mean and multiplying by 100 and then adding 100; so that a value of 100 represents its long term state.

4. Evaluation

A. Cyclical conformity

Although not a necessary condition for a CLI its cyclical similarity with the reference series is a useful feature. If the cyclical movements between them are highly correlated, the indicator will provide a signal, not only to approaching turning points, but also to developments over the whole cycle. The cross correlation function between the reference series and the candidate components (or the composite leading indicator itself) provides invaluable information on cyclical conformity. The location of the peak of the cross correlation function is a good alternative indicator of average lead time. Whereas the correlation value at the peak provides a measure of how well the cyclical profiles of the indicators match, the size of correlations cannot be the only indicators used for component selection. As a cross-check the average lead of the cyclical indicator, measured by the lag at which the closest correlation occurs, should not be too different from the median lag if the composite leading indicator is to provide reliable information about approaching turning points and the evolution of the reference series. The cross correlations between the reference and some candidate component series are plotted in Figure 2 (See Appendix 3 for the remaining cross-correlations).

Cross correlegram of the business cycle movements of the GDP and prospective components of the Composite Leading Indicator

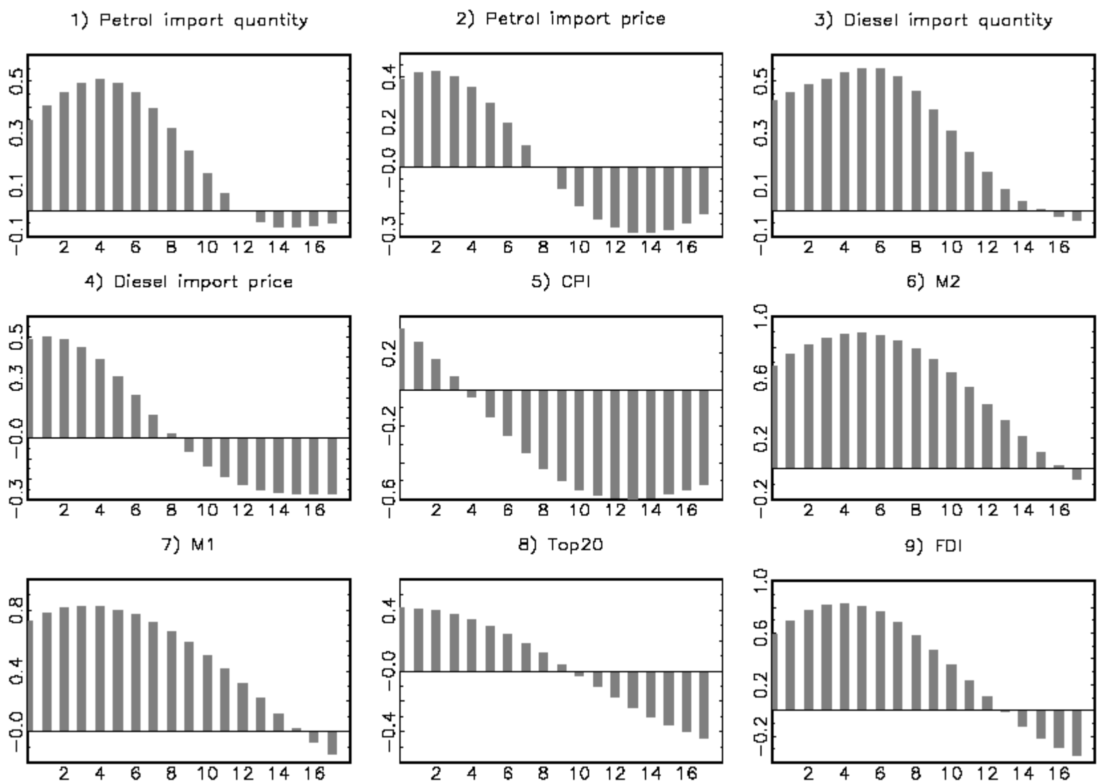


Figure 2. Note: Cross correlegram of the business cycle movements of the GDP and prospective components of the Composite Leading Indicator. Leads of the prospective component are on the horizontal line so that the correlegram is between its past and the current GDP cycle.

In fact one can select those component series that have similar cyclical fluctuations with the reference series using some criteria and form quick CLI's at each lead, i.e. the component series qualitatively predicting movements in the reference series. Table 2 provides a list of components that have correlations of at least 70% with the reference series while Figure 3 illustrates CLI's based on them at each lead.

Lead time	Series name (and correlation, %)
Contem-poraneous	Import (78), M1 (73)
1 month	Import (82), M1 (78), M2 (75), Industrial loan (73)
2 months	Import (83), M2 (82), M1 (81), Wholesale loan (77), FDI (77), Industrial loan (75), Electricity loan (74), Real estate loan (73), Imported trucks (72)
3 months	M2 (86), M1 (83), Wholesale loan (83), FDI (81), Import (81), Real estate loan (77), Electricity loan (77), Industrial loan (75), Imported trucks (73), Consumer loan (73)
4 months	M2 (89), Wholesale loan (86), FDI (83), M1 (82), Electricity loan (78), Real estate loan (77), Import (77), Consumer loan (73), Imported trucks (72), Budget current income (71), Industrial loan (71), Total loan(70)
5 months	M2 (89), Wholesale loan (88), FDI (81), M1 (80), Electricity loan (77), Budget current income (76), Real estate loan (72), Loan rate in MNT (72), Consumer loan (71) Import (70),
6 months	M2 (88), Wholesale loan (87), Budget current income (79), M1 (77), FDI (76), Loan rate in MNT (74), Electricity loan (74)
7 months	M2 (84), Wholesale loan (84), Budget current income (80), Loan rate in MNT (76), M1 (72)
8 months	Budget current income (79), M2 (79), Wholesale loan (78), Loan rate in MNT (76),

Table 2. Name of the series whose cross-correlations with the reference series are at least 70%.

Two series are selected for their close contemporaneous relationship with the GDP while budget current income, M2, new wholesale and retail loan and loan rate in Mongolian togrog have the strongest 8-month-leading relationship between the GDP. Although alternative methods could be applied in the construction of the composite index the CLI's shown in Figure 3 is based on simple averages. The variables in the Table 2 appear to be effective in predicting recent movements in the reference series both contemporaneously and in advance. It is important to note that these components are by no means definitive. Their relevance must be re-evaluated in terms of their predictive ability of turning points and should be reevaluated from time to time. In other words inclusion in the above table does not guarantee a series to be included into the formal CLI.

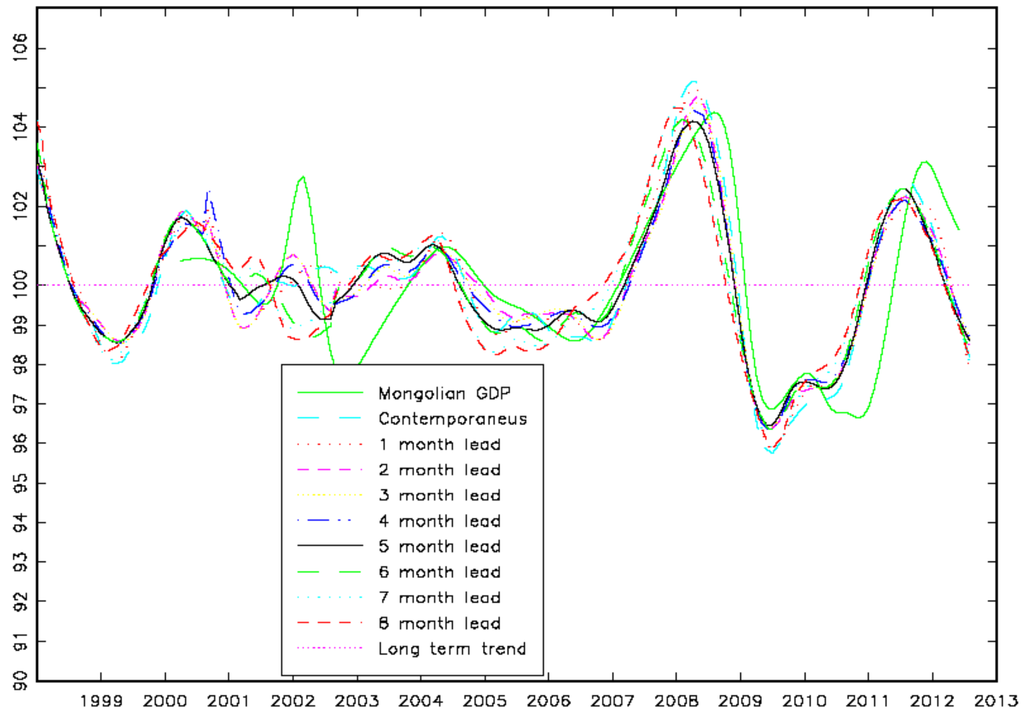


Figure 3. Mongolian GDP and quick CLI's based on cyclical conformity at each lead.

B. Bry- Boschan algoritm of turning point detection

The Bry and Boschan (1971) technique for determining business cycle turning points (or simplifications of it) is used by both the Conference Board and the OECD. It consists of consists of the following steps[9]:

I. Determination of extremes and substitution of values.

II. Determination of cycles in 12-month moving average (extremes replaced).

A. Identification of points higher (or lower) than 5 months on either side.

B. Enforcement of alternation of turns by selecting highest of multiple peaks (or lowest of multiple troughs).

III. Determination of corresponding turns in Spencer curve (extremes replaced).

A. Identification of highest (or lowest) value within ±5 months of selected turn in 12-month moving average.

[9] Since the methodology as a textbook can be freely downloaded from the NBER website I refrain from discussing it in length.

B. Enforcement of minimum cycle duration of 15 months by eliminating lower peaks and higher troughs of shorter cycles.

IV. Determination of corresponding turns in short-term moving average of 3 to 6 months, depending on MCD (months of cyclical dominance).

A. Identification of highest (or lowest) value within ±5 months of selected turn in Spencer curve.

V. Determination of turning points in unsmoothed series.

A. Identification of highest (or lowest) value within ±4 months, or MCD term, whichever is larger, of selected turn in short-term moving average.

B. Elimination of turns within 6 months of beginning and end of series.

C. Elimination of peaks (or troughs) at both ends of series which are lower (or higher) than values closer to end.

D. Elimination of cycles whose duration is less than 15 months.

E. Elimination of phases whose duration is less than 5 months.

VI. Statement of final turning points.

A turning-point in the CLI is generally expected to signal a turning-point in the business cycle in 6-9 months. However lead times sometimes fall outside of this range and turning points are not always correctly identified, sometimes missing the reference series turning points and sometimes flagging false turning points. The composition of the CLI should be so that to avoid such pitfalls as much as possible. The Bry-Boschan procedure is applied to each series coming from the analysis in Section 3 and the identified peaks and troughs are in Panels A and B of Table 3 in index form: 1 is for April 2000 while 149 is for August 2012.

The first column in Panel A of the table contains peak dates in the GDP at 24, 51, 101 and 141 which translate into calendar dates of March 2002, June 2004, August 2008 and December 2011. An ideal CLI component's peak should have happened 6-8 months before these dates. The first column in Panel B has trough dates at August 2001, November 2002, June 2006 and November 2010. An ideal component's turning points should also have happened before these dates. Visual illustrations of how well they are doing are provided in Figures 1-6 of the Appendix 4.

A. Peak dates

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
24	46	13	17	10	32	48	50	29	20	24	28	47	19	27	11	16	43	10	29	7	45	15	34	14	34
51	98	57	48	36	62	95	94	95	40	49	48	76	50	42	66	53	81	28	61	48	74	52	74	43	49
101	116	74	73	61	102	135	138	116	94	82	80	102	98	105	88	86	115	50	92	76	96	100	99	94	90
141	142	100	95	101	122				136	97	95	118	136		125	116		77	132	97	138	132	133	132	
		115	119	140						135	137							99		131					
		138																133							

26	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
53	28	22	51	6	67	49	16	18	13	18	28	46	35	8	32	23	52	14	47	39	27	20	26	35	36
85	55	60	76	67	110	95	38	58	40	44	44	90	69	24	61	50	96	36	67	71	52	56	51	56	70
104	101	112	109	89		129	57	97	67	80	79	117	95	95	89	70	136	54	94	104	88	98	98	96	100
				121			104	133	108	122	122		135	115	115	96		93	135	135	141	135	118	130	134
							133		138					136	135	140		136					135		

B. Trough dates

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
17	24	5	31	28	27	20	17	78	10	15	15	32	13	33	40	29	8	21	21	40	13	39	21	27	5
32	59	43	61	47	50	70	79	108	28	43	36	66	43	87	76	62	57	41	39	64	64	81	44	68	44
75	106	66	79	87	86	112	112	126	81	62	65	85	72	131	111	105	103	65	77	83	87	110	83	108	66
128	126	88	105	110	115				123	88	87	108	111			136	127	83	110	107	105		107		123
		108	124		134					111	109							108							
		129																							

26	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
4	19	36	14	32	22	12	30	12	24	34	16	20	15	17	10	11	35	24	41	21	10	27	17	41	56
62	44	90	59	81	82	57	49	31	58	65	36	60	62	56	41	33	78	48	56	54	45	86	42	66	80
90	85	134	90	102	133	108	74	76	84	104	66	104	77	107	81	60	110	72	75	91	69	120	75	112	109
126	120		130	132			116	112	114		100		109	122	107	79		112	110	116	110		110		
											136				125	110							126		

Table 3. Business cycle turning point dates in the reference and prospective CLI component series (in indexes). Numbers in bold represent each series, where 0 means the reference series while numbers 1-51 are those ordered in Table 1. The numbers immediately below them (2- 6 numbers) represent the peak dates index: 1 is April 2000 while 149 is August 2012.

C. Length and consistency of the lead

Lead times are measured in months, reflecting the time that passes between turning points in the component and reference series. Of course lead times vary from turning point to turning-point but the aim is to construct leading indicators whose lead times are on average between 6 to 9 months and that have relatively small variances. To evaluate the length of leads, both mean and median leads are used, because the mean lead on its own can be strongly affected by outliers. The consistency of leads is measured by the standard deviation from the mean lead. One can see from the graphs 1-6 in Appendix 4 how well each series perform in predicting turning points in the reference series (GDP).

Based on the results of the turning point dates in Table 3 the system then identifies cases where a turning point in the reference series preceded by a turning point in the components series 2- 8 months in advance. Because of the counter-cyclicality of some series here a peak in the component series could precede a trough in the reference series and vice versa. If a component series successfully predicts the turning points in such manner a certain proportion of the time (currently it is 40%) then that series is further considered for inclusion in the CLI. It has to be noted that as this proportion increases a fewer and fewer series will satisfy the restriction. On the other hand a combination of component series, however imperfect, can result in a CLI that perfectly predict turning points of the reference series. The quantity of diesel imported, M2, FDI, total import, international gold price and new real estate loan pass this criteria (Numbers 3, 6, 9, 13, 21 and 48 in Table 3). It is interesting to note from this result and the ones in Table 2 that although international gold price is not highly correlated with Mongolia's business cycle its turning points precede those of the business cycle.

Notice also that a casual observation of Table 3 reveals that none of them perfectly predicts the turning points in business cycle. But the Composite Leading Indicator that is constructed by simple averaging of these series has peaks at 19, 47, 96 and 136 (24, 51, 101 and 141 in the reference series) and troughs at 12, 30, 63 and 109 (17, 32, 75 and 128 in the reference series). Figure 4 illustrates this final CLI (in continuous red line) together with the business cycle (in blue dashes).

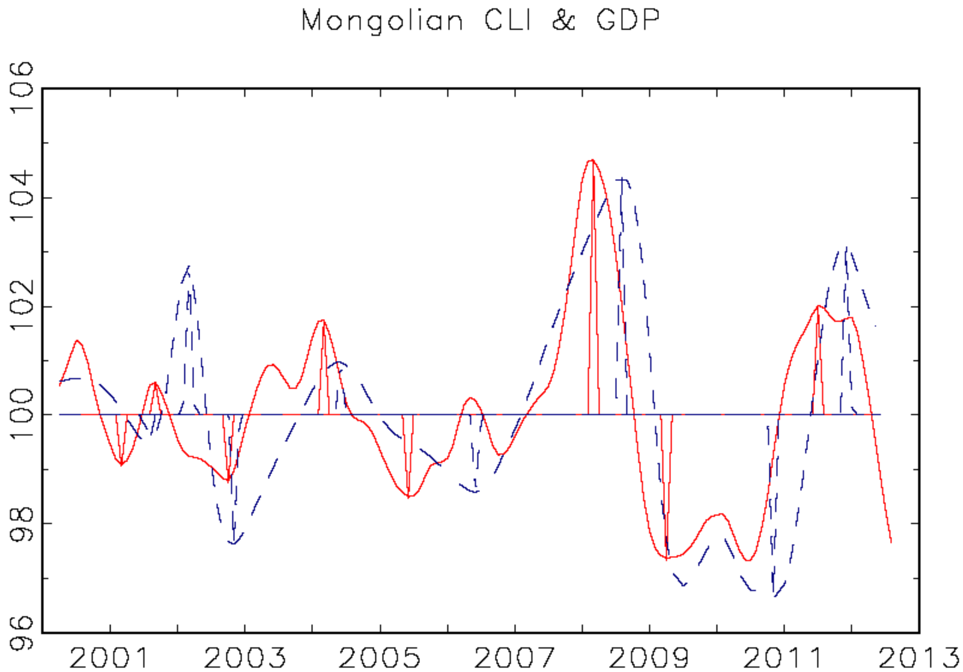


Figure 4. Mongolia's CLI (continuous red line) and economic activity (blue dashes); (long term trend=100)

Cyclical conformity of the CLI with Mongolia' business cycle is extraordinary fine. Figure illustrates cross correlations between the CLI (contemporaneous at zero and leading at positive horizontal value) and the business cycle of economic activity measured by the GDP. The peak correlarion of 91% occurs at lead time of 4 months but it stays above 75% up to 7 months.

The CLI has four peaks and four troughs as can be seen from Figure 4. That is the same number of turning points in Mongolia's business cycle meaning that there are no missing or extra cycles. The average lead time of the peak is 4.75 months while that of the trough is 9.5 months. As can be seen from the Figure Mongolia's economic activity reached its recent peak in December 2011 and currently is proceeding towards its trough based on the second quarter of 2012 GDP growth. The CLI estimated using data up to August 2012 shows no turning points yet, meaning that the economic situation will worsen at least for 9 months before improving. This however may change if the copper production of Ouy Tolgoi alters completely the past relationship among economic variables.

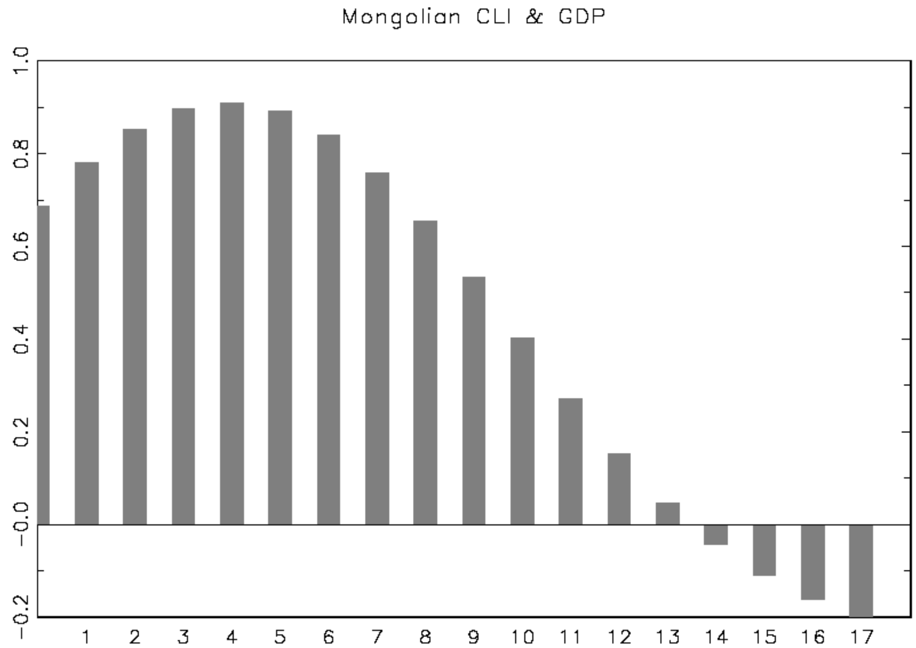


Figure 5. Note: Cross correlegram of the business cycle movements of the GDP and the Composite Leading Indicator. Leads of the CLI are on the horizontal line so that the correlegram is between its past and the current GDP cycle.

5. Implementation guideline

The system of Mongolia's Composite Leading Indicator comes with two GAUSS run files and a dozen sets of procedures that are capable of producing results in both Mongolian (using Latin alphabet) and English languages. Two run files could be modified if and when the system is adjusted, for example to add more prospective component series. The procedures should not be modified unless there is a very good reason for it. If the procedures are to be modified internal consistency of the system should be maintained. The main steps involved in the execution and update of the CLI system are sketched below:

Step 1. It is necessary to update databases in *MoF_CLI_database.xls* (this contains all monthly data), *LoanReport.xls* (these are quarterly data) and gdp2005SA_2000Aug.txt (that contains Mongolian real GDP data since 2000 in 2005 prices, seasonally adjusted by the NSO) from the sources detailed in Table 1 of Section 2. The updating process consists of adding the most recent value of each variable to the file.

Step 2. Then *CLI_processing.prg* program is run. It performs analysis described in Section 3. Some of the outputs of the program are reported in Appendices in 1-3. Whole output of the program is written to an output file *experiment_big.out* and what the program is capable of producing is detailed in Bataa *et al.* (2012b). Another output of the program is *trends.out* which contains business cycle fluctuations of all the relevant series.

Step 3. Finally *Mongolian_CLI.prg* program is run. The program reads in *trends.out* carries out the steps detailed in Section 4 and provides with the Mongolian CLI.

References

Andrews, D.W.K. (1991). 'Heteroskedasticity and autocorrelation consistent covariance matrix estimation', *Econometrica*, Vol. 59, pp. 817–858.

Andrews, D.W.K. (1993). 'Tests for parameter instability and structural change with unknown change point, *Econometrica*, Vol. 61, pp. 821-856.

Bai, J.S. and Perron, P. (1998). 'Estimating and testing linear models with multiple structural changes', *Econometrica*, Vol. 66, pp. 47-78.

Bai, J.S. and Perron, P. (2003a). 'Computation and analysis of multiple structural change models', *Journal of Applied Econometrics*, Vol. 18, pp. 1-22.

Bai, J.S. and Perron, P. (2003b). 'Critical values for multiple structural change tests', *Econometrics Journal*, Vol. 6, pp. 72-78.

Bai, J.S. and Perron, P. (2006). 'Multiple structural change models: A simulation analysis', in D. Corbea, S. Durlauf and B. E. Hansen (eds), *Econometric Theory and Practice: Frontiers of Analysis and Applied Research*, Cambridge University Press, Cambridge.

Bataa, E., Osborn, D.R., Sensier, M. and van Dijk, D. (2012). 'Structural breaks in the international dynamics of inflation', *Review of Economics and Statistics*, forthcoming.

Bataa, E., Osborn, D.R., Sensier, M. and van Dijk, D. (2012). 'Identifying Changes in Mean, Seasonality, Persistence and Volatility for G7 and Euro Area Inflation', *Oxford Bulletin of Economics and Statistics*, forthcoming.

Beziz P. and G. Petit (1997), "The 1994 Mexican Crisis: Were Signals Inadequate?" OECD, Statistics Directorate.

Bikker J.A. and N.O. Kennedy (1999), "Composite Leading Indicators of Underlying Inflation for Seven EU Countries," *Journal of Forecasting*, 18, 225-258.

Bry G. and C. Boschan (1971), Cyclical Analysis of Time Series: Selected Procedures and Computer Programs, NBER.

Burns A. and W. Mitchell (1946), Measuring Business Cycles, NBER.

Canova, F. and Hansen, B.E. (1995). 'Are seasonal patterns constant over time: A test for seasonal stability', *Journal of Business and Economic Statistics*, Vol. 13, pp. 237-252.

Cullity J. And A. Banerji (1996), “Procedures for Constructing Composite Indexes: A Re-Assessment,” OECD, mimeo.

Franses, P.H. and Haldrup, N. (1994). 'The effects of additive outliers on tests for unit roots and cointegration', *Journal of Business and Economic Statistics*, Vol. 12, pp. 471-478.

Ghysels, E. and Perron, P. (1996). 'The effect of linear filters on dynamic time series with structural change', *Journal of Econometrics*, Vol. 70, pp. 67-97.

Gómez, V. and Maravall, A. (1996). 'Programs TRAMO and SEATS: Instructions for the User', Working Paper 9628, Bank of Spain.

Hansen, B.E. (2000). 'Testing for structural breaks in conditional models', *Journal of Econometrics*, Vol. 97, pp. 93-115.

Harvey, A.C. (1989). *Forecasting, Structural Time Series Models and the Kalman Filter*. Cambridge University Press, Cambridge.

Hodrick R. and J. Prescott (1997), “Postwar U.S. Business Cycles: An Empirical Investigation,” *Journal of Money, Credit, and Banking*, vol.29, No.1.

Levin, A.T. and Piger, J.M. (2004). 'Is inflation persistence intrinsic in industrial economies?', Working Paper No. 334, European Central Bank.

Marques, C.R. (2005). 'Inflation persistence: Facts or artefacts?', *Bank of Portugal Economic Bulletin*, Summer, pp. 69-79.

OECD (1987), OECD Leading Indicators and Business Cycles in Member Countries: 1960-1985, Department of Economics and Statistics, Sources and Methods No. 39.

Pitarakis, J.-Y. (2004). 'Least squares estimation and tests of breaks in mean and variance under misspecification', *Econometrics Journal*, Vol. 7, pp. 32-54.

Qu, Z.J. and Perron, P. (2007). 'Estimating and testing structural changes in multivariate regressions', *Econometrica*, Vol. 75, pp. 459-502.

Stock, J.H. and Watson, M.W. (2003). 'Forecasting output and inflation: The role of asset prices', *Journal of Economic Literature*, Vol. 41, pp. 788-829.

Tsay, R.S. (1988). 'Outliers, level shifts and variance changes in time series', *Journal of Forecasting*, Vol. 7, pp. 1-20.

White, H. (1980). 'A heteroskedasticity-consistent covariance matrix estimator and a direct test for hetereskodasticity', *Econometrica*, Vol. 48, pp. 817-838.

Appendix 1. Summary results from the iterative decomposition of Section 3.B.

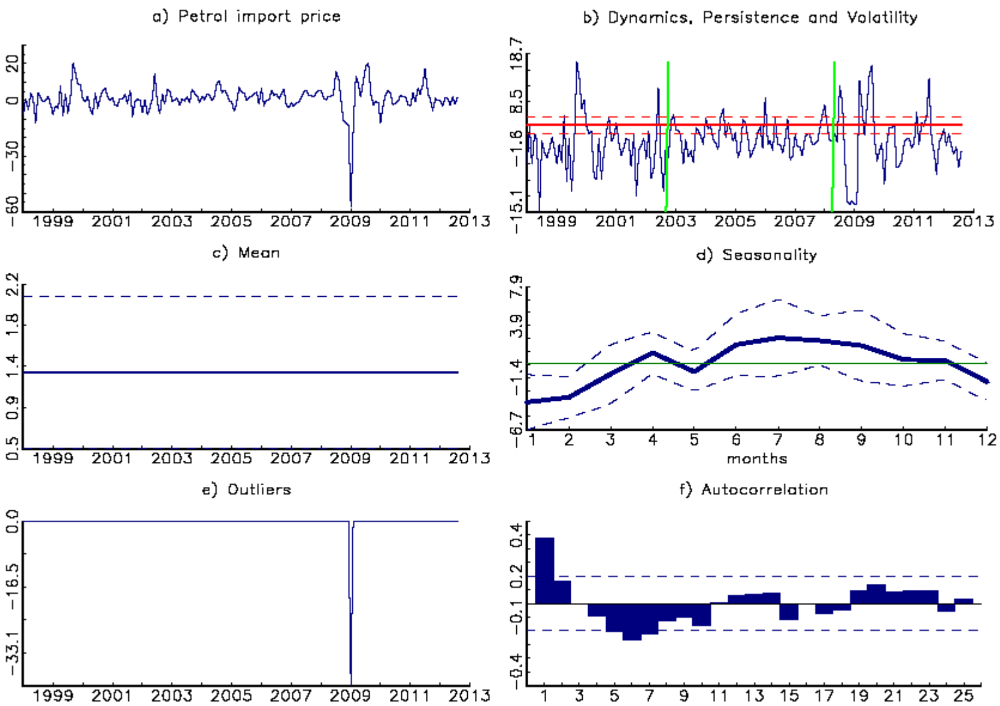
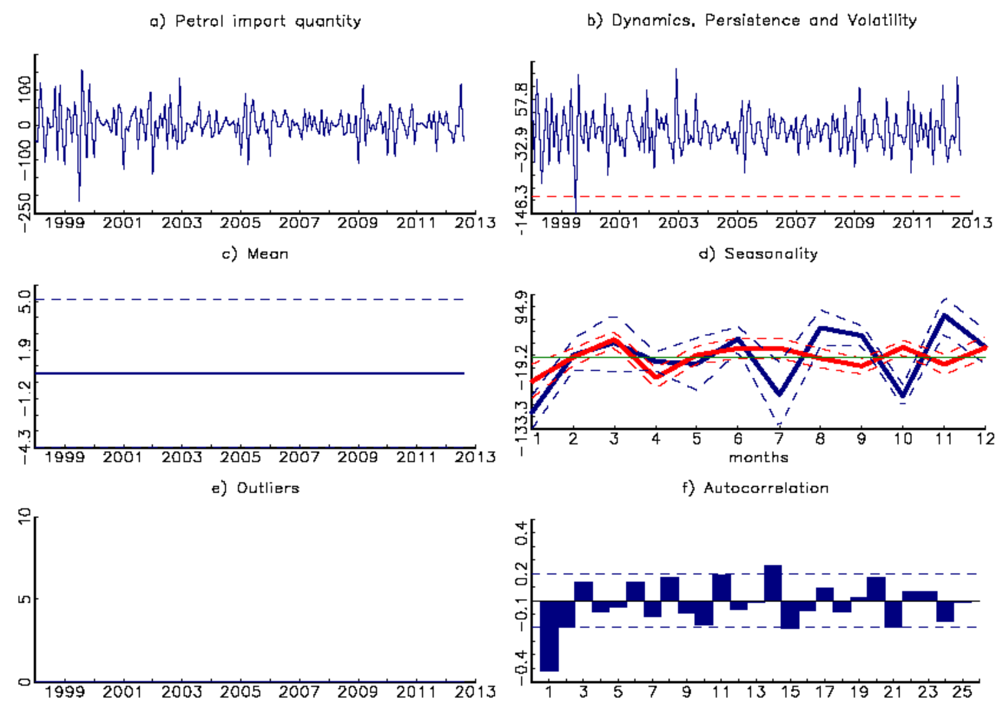


Figure 1. Notes: Panels show: a) observed time series, b) dynamic component, persistence (red line) and volatility break dates (green vertical lines); c) regime means, d) deterministic seasonal component for regime 1 in blue, regime 2 in red and regime 3 in pink, e) outliers and f) correlogram for the estimated dynamic component, with 95% confidence intervals shown as dashed lines. If relevant, the correlogram is shown over sub-periods identified by dynamic breaks, with regime 1 in blue and regime 2 in red.



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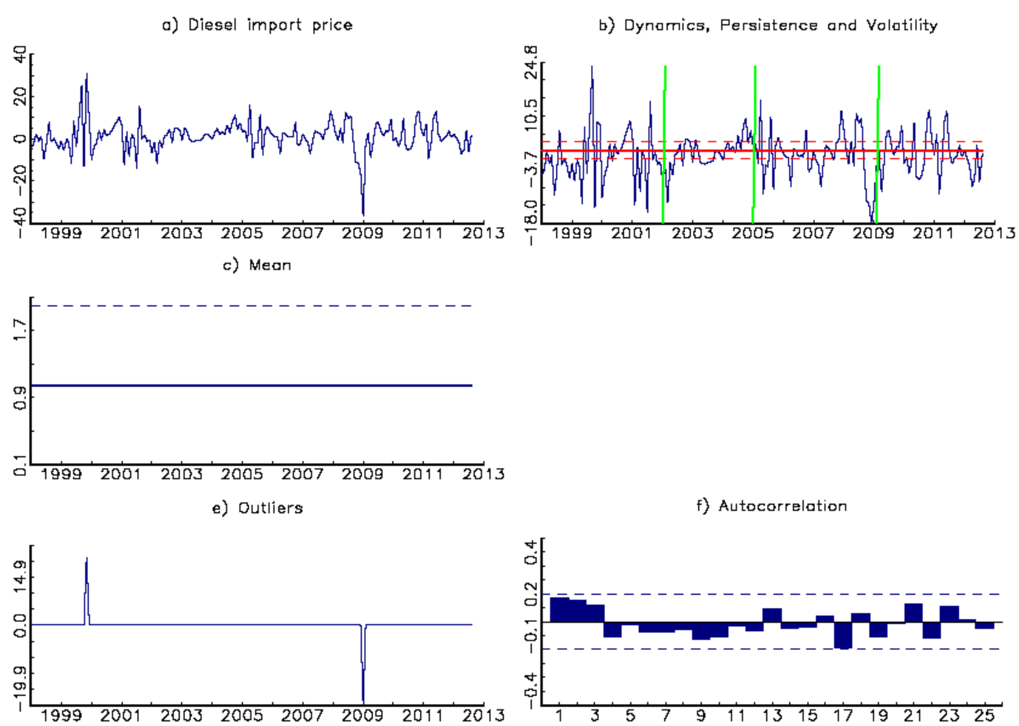

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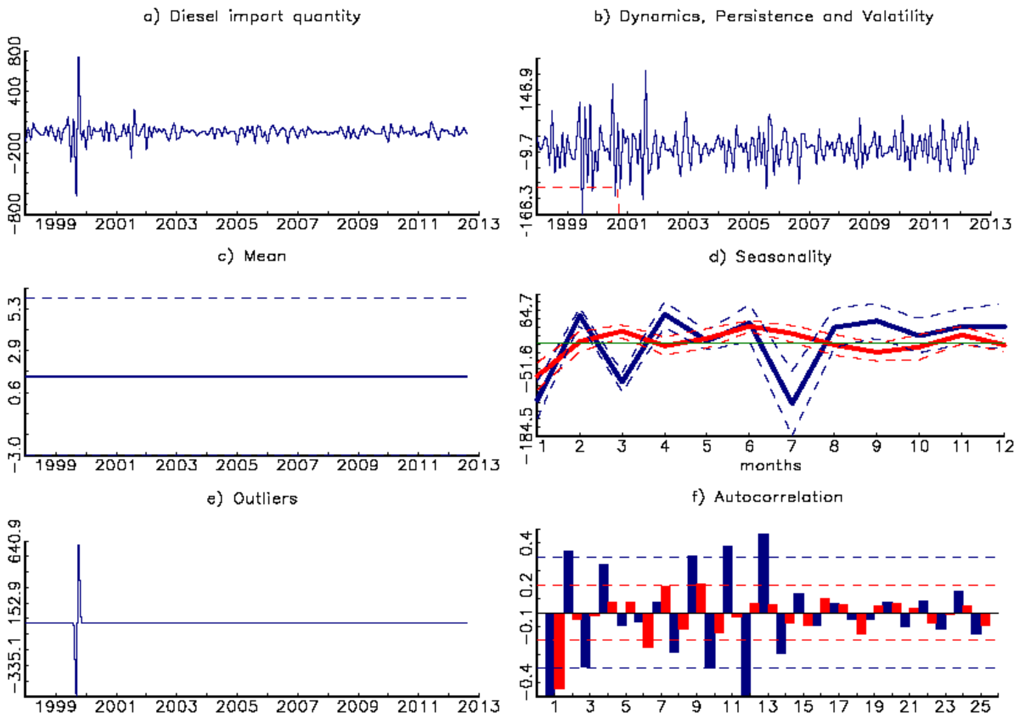

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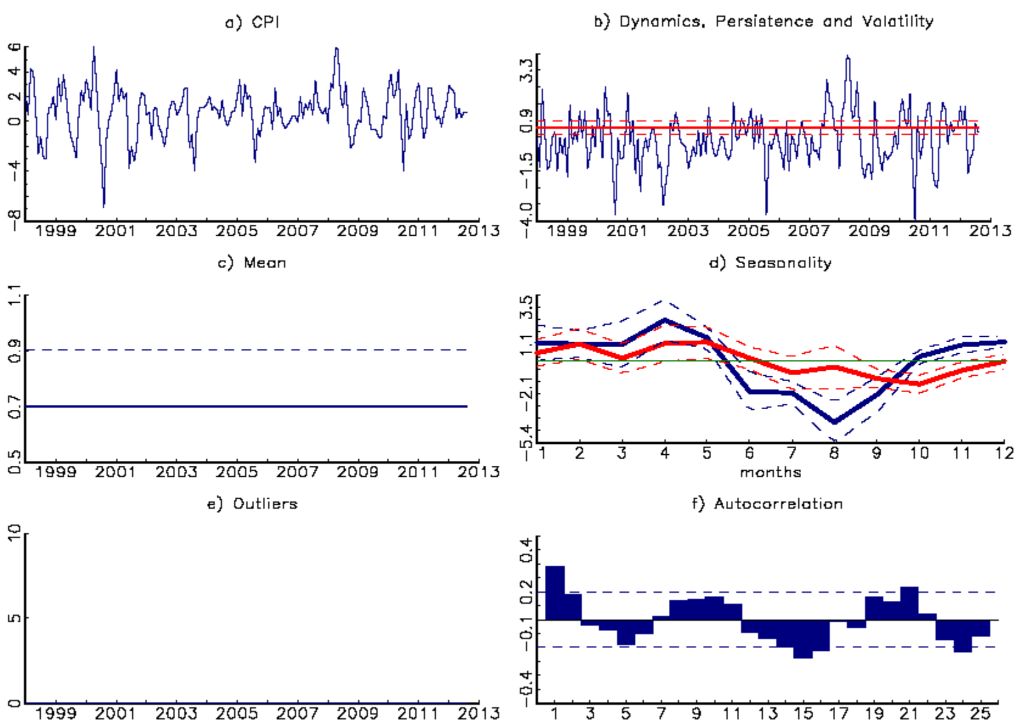

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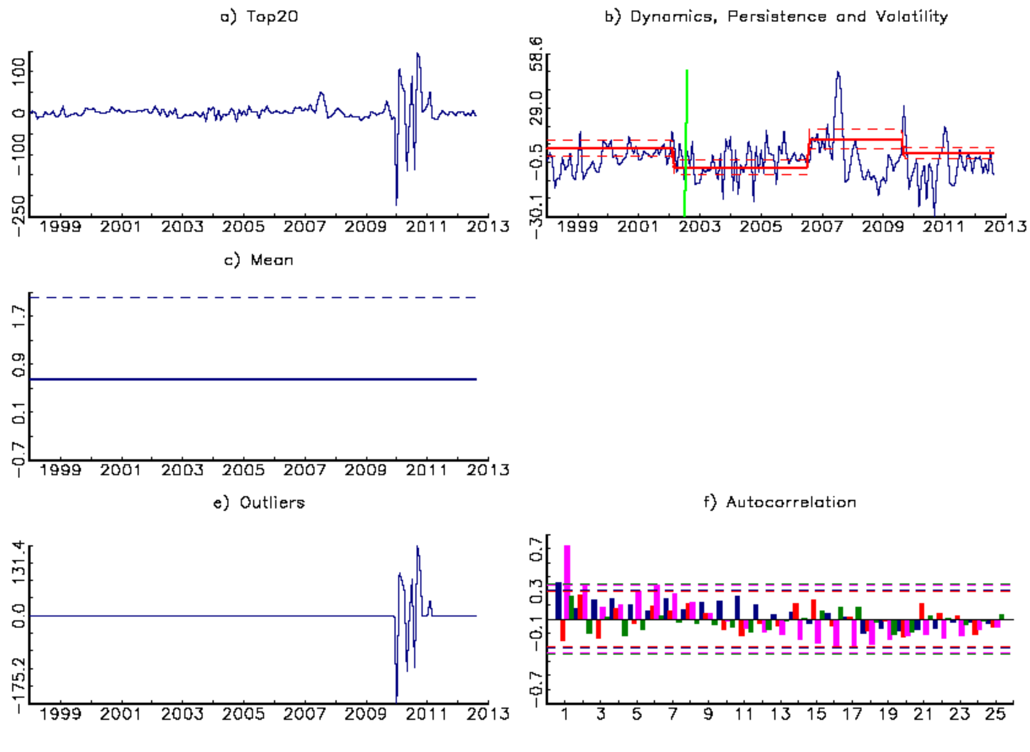

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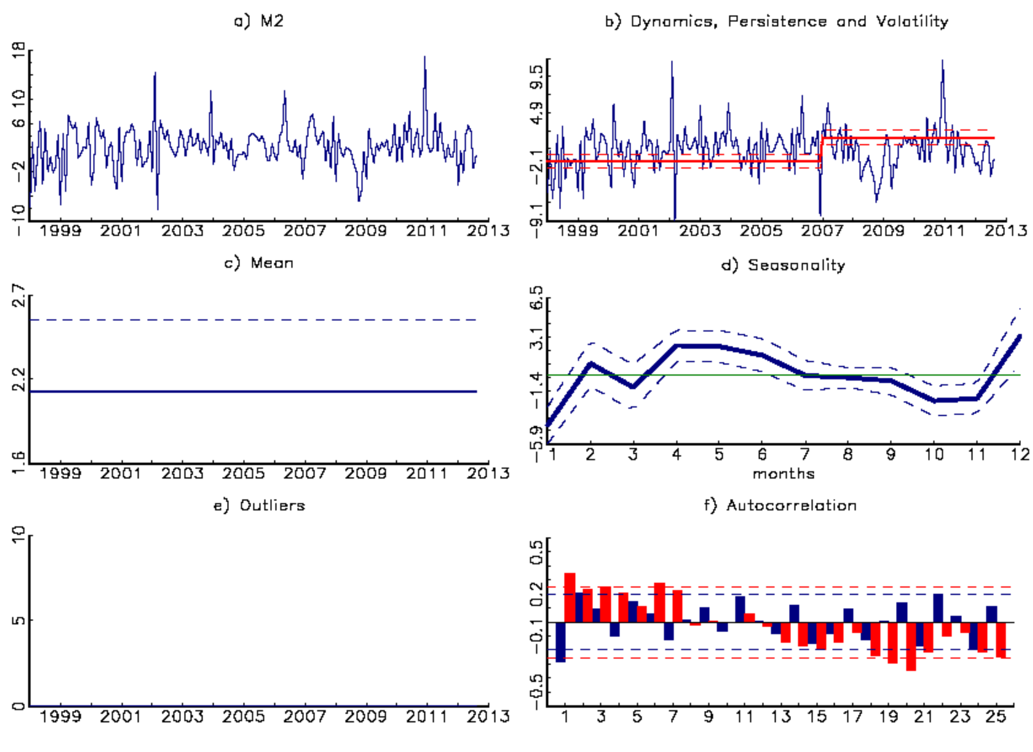

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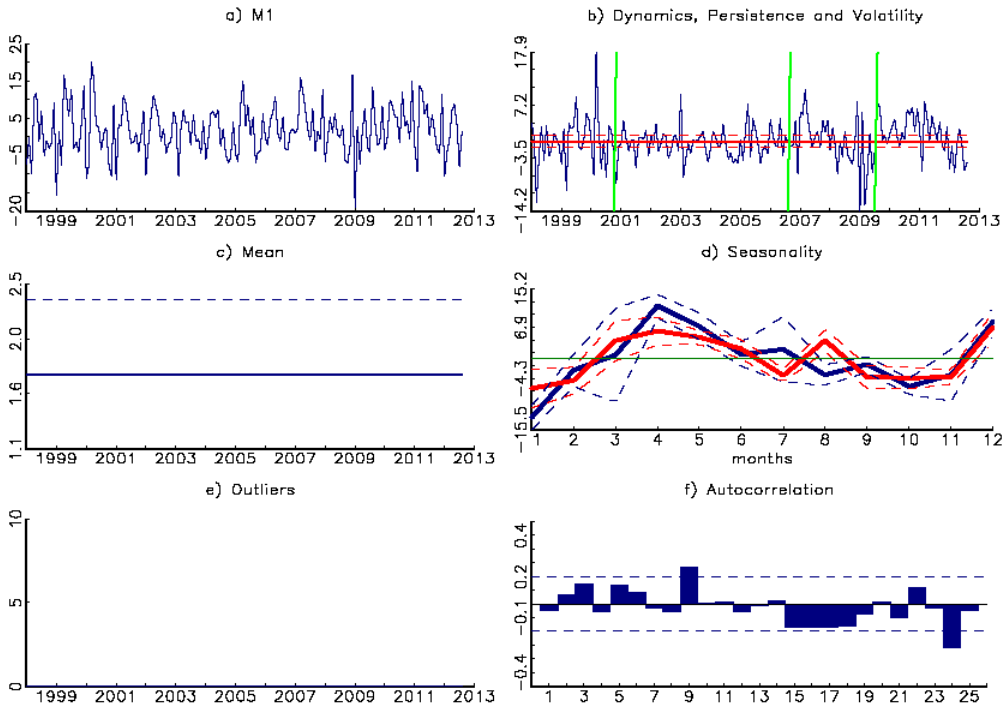

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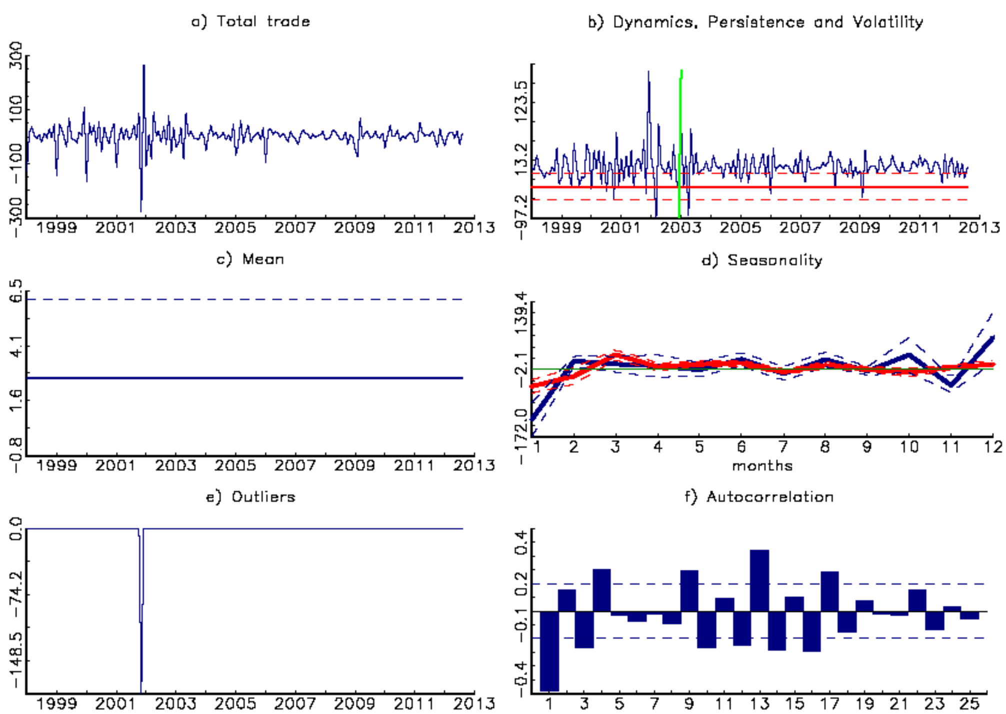

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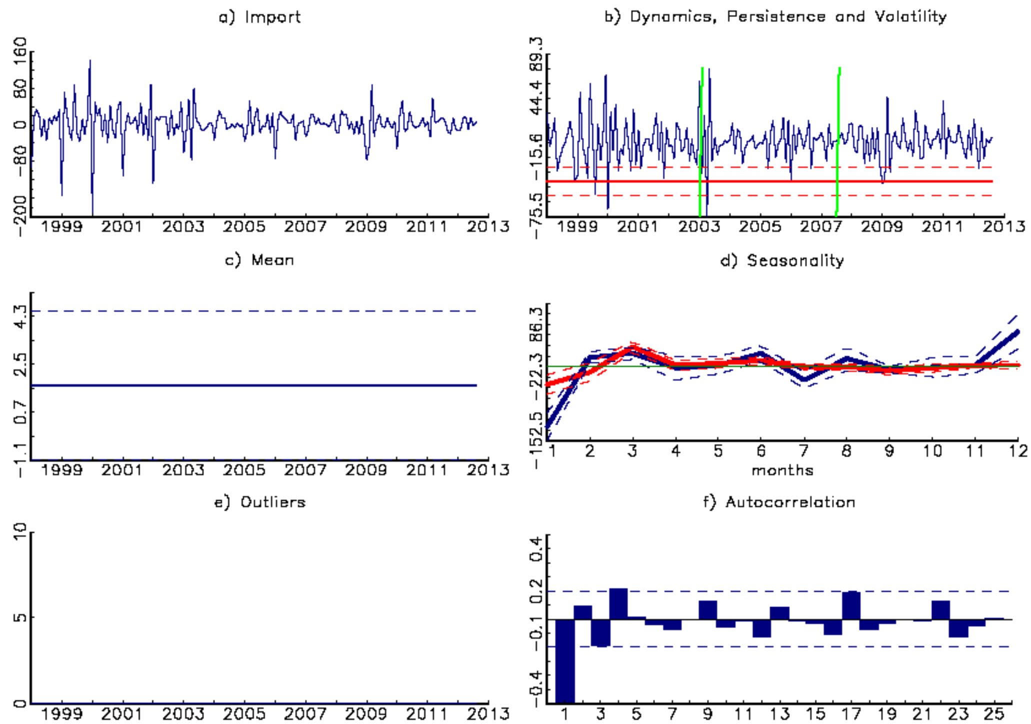

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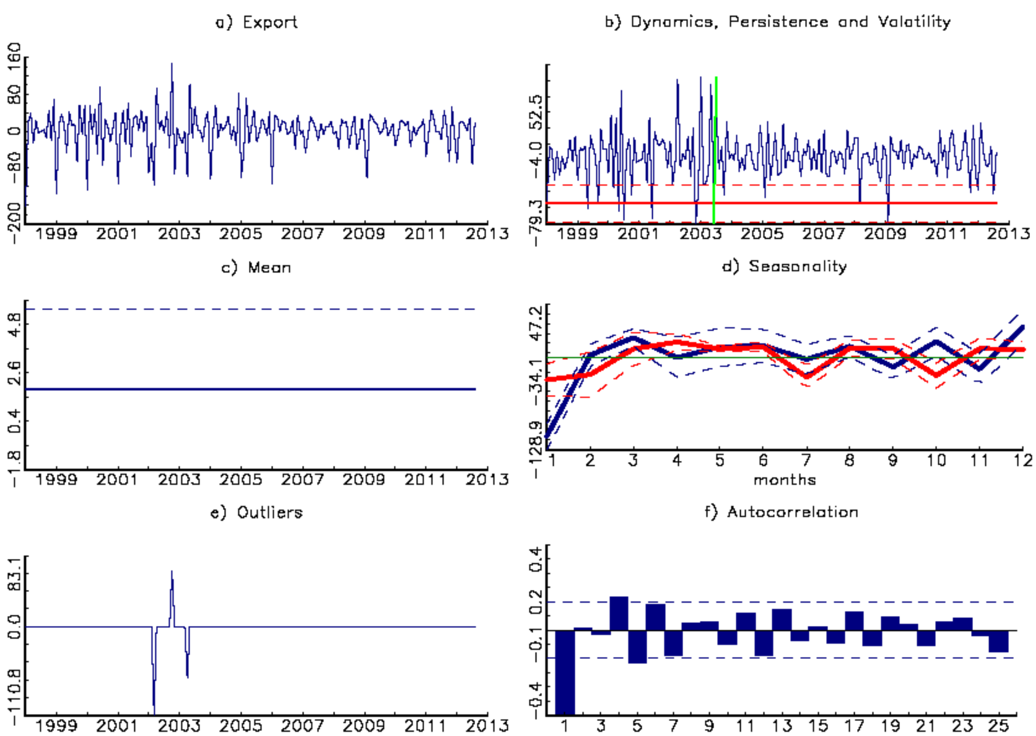

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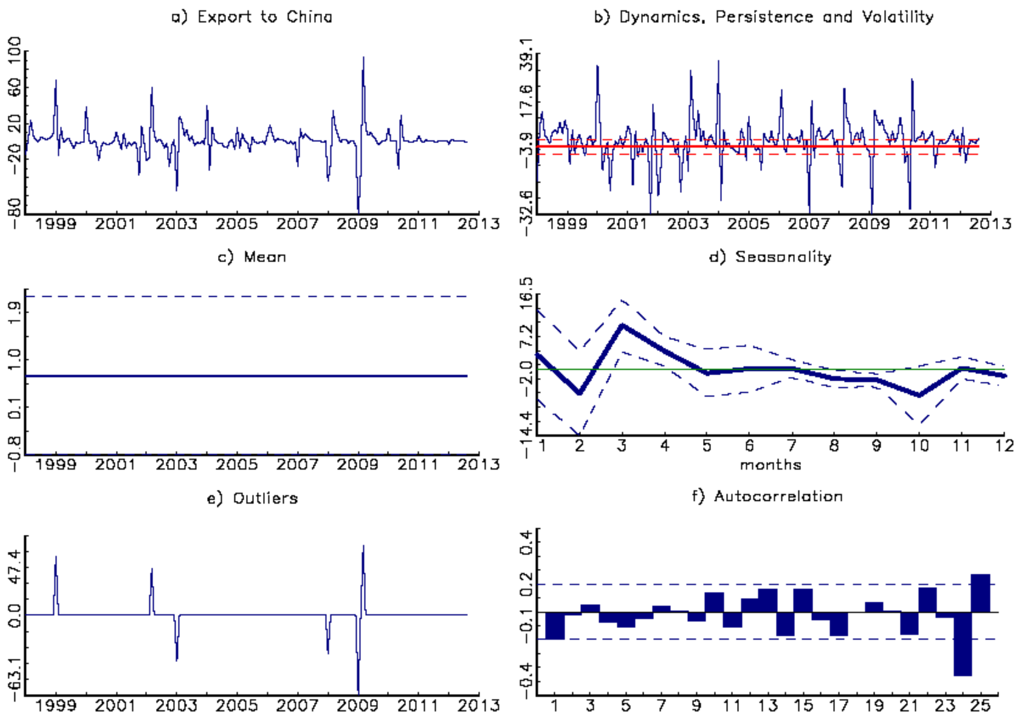

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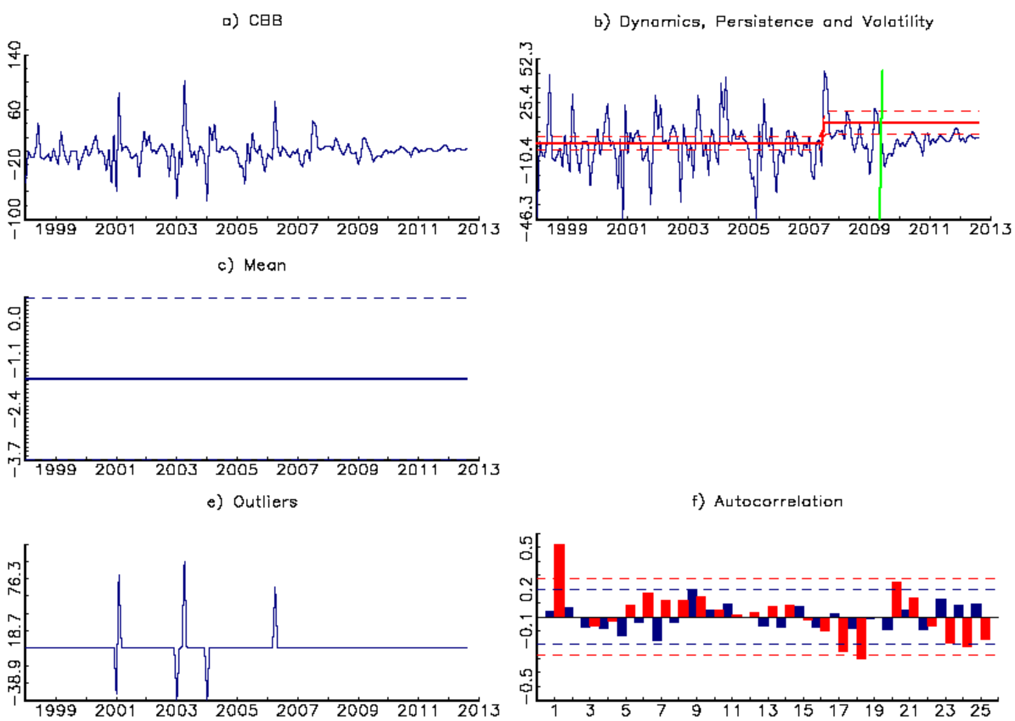

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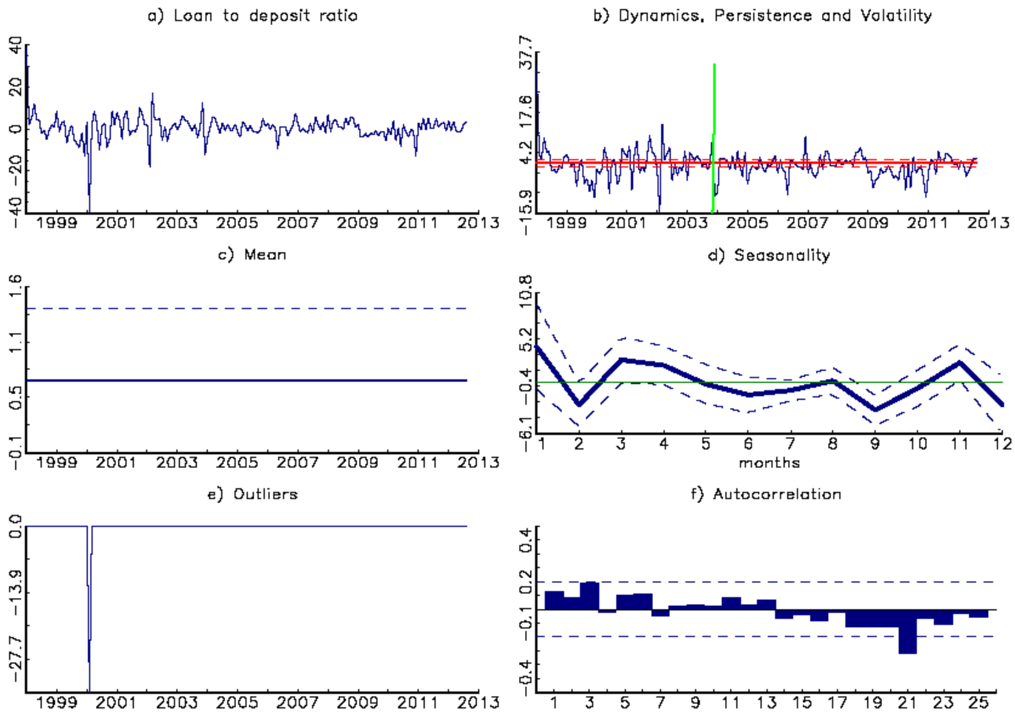

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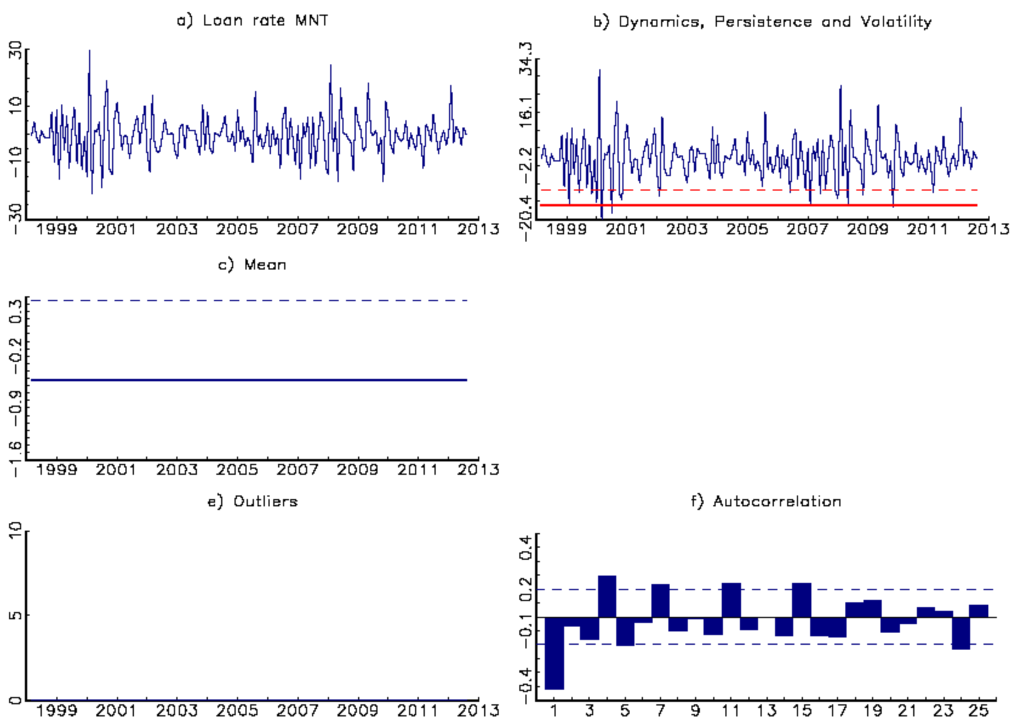

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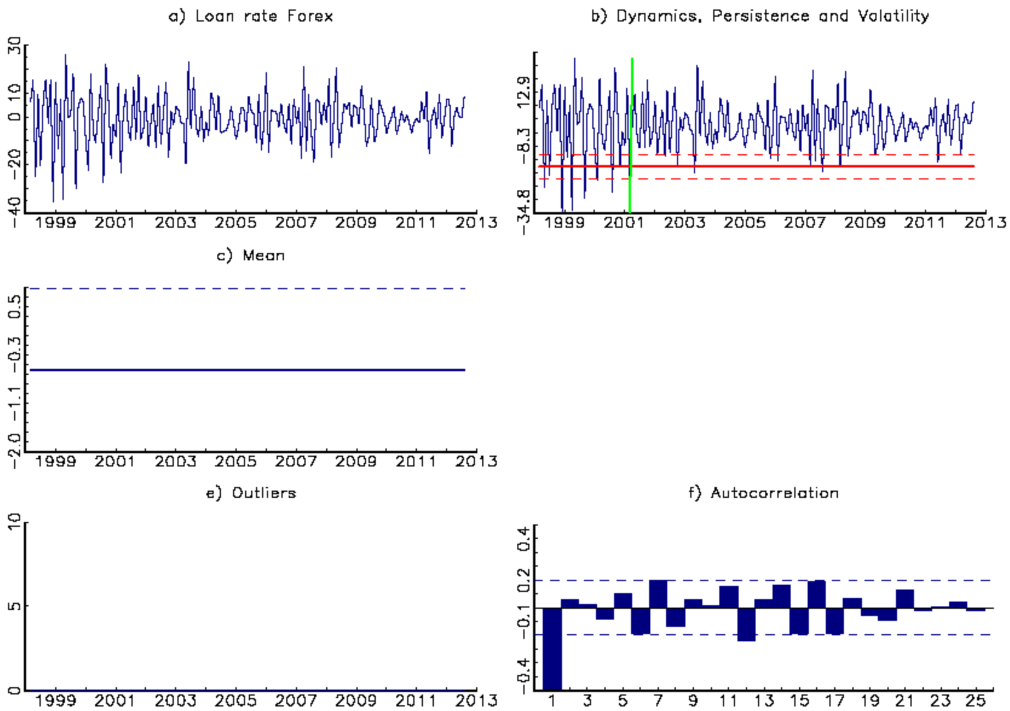

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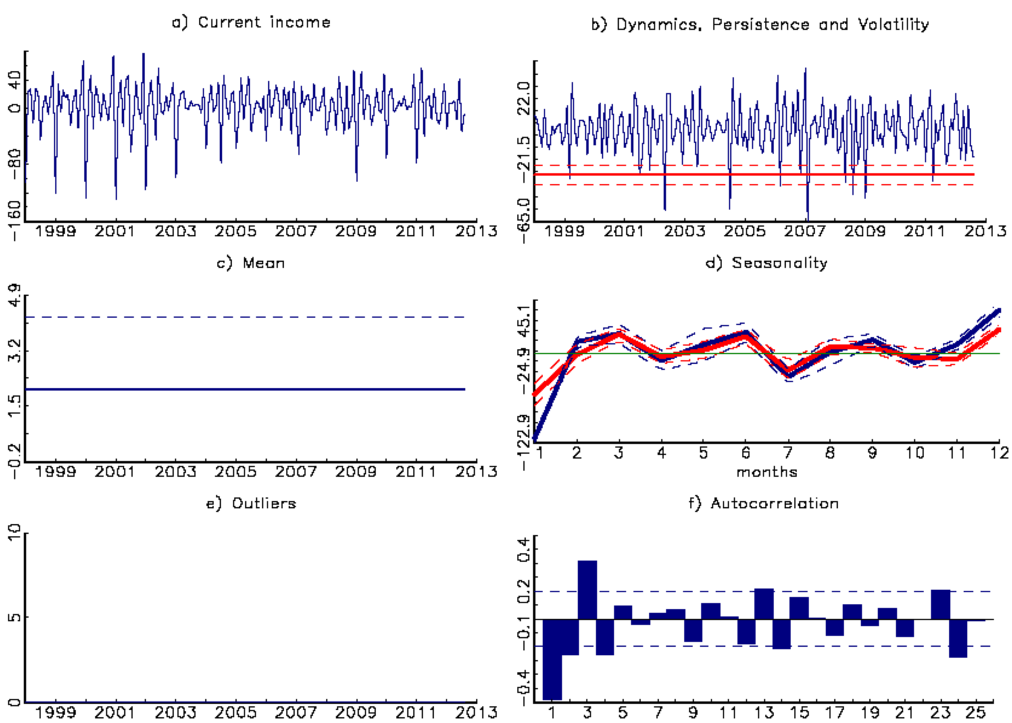

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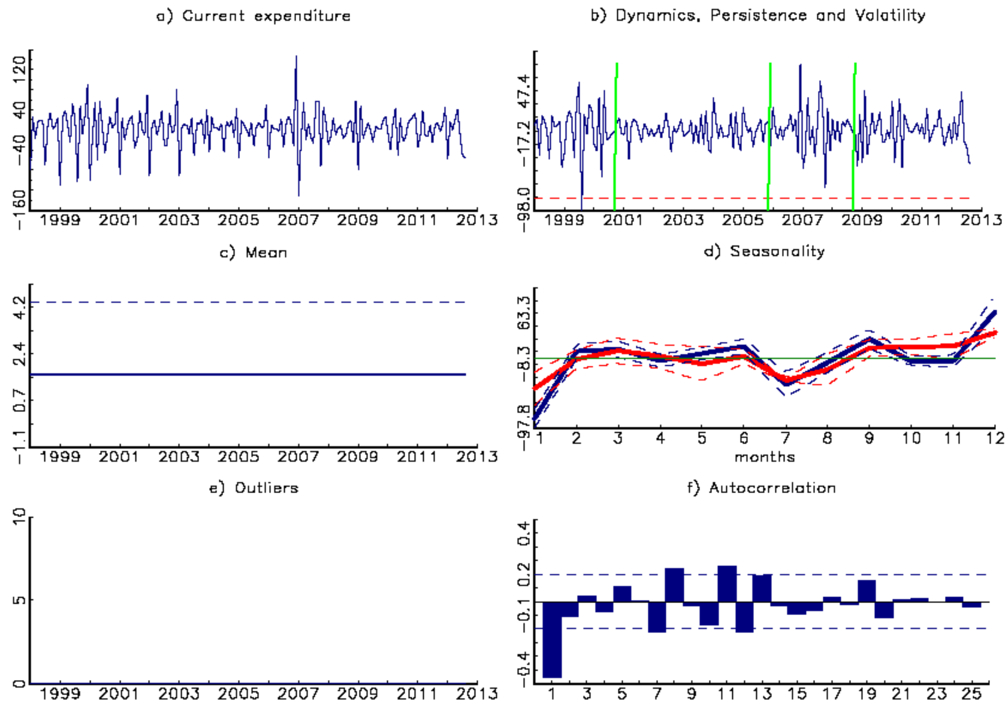

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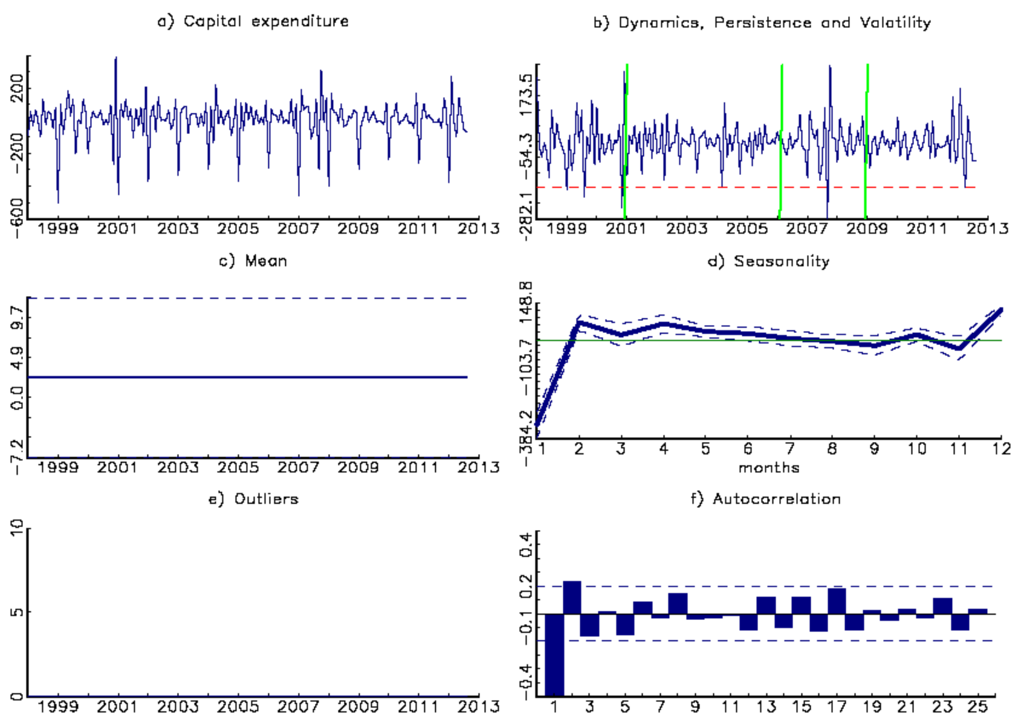

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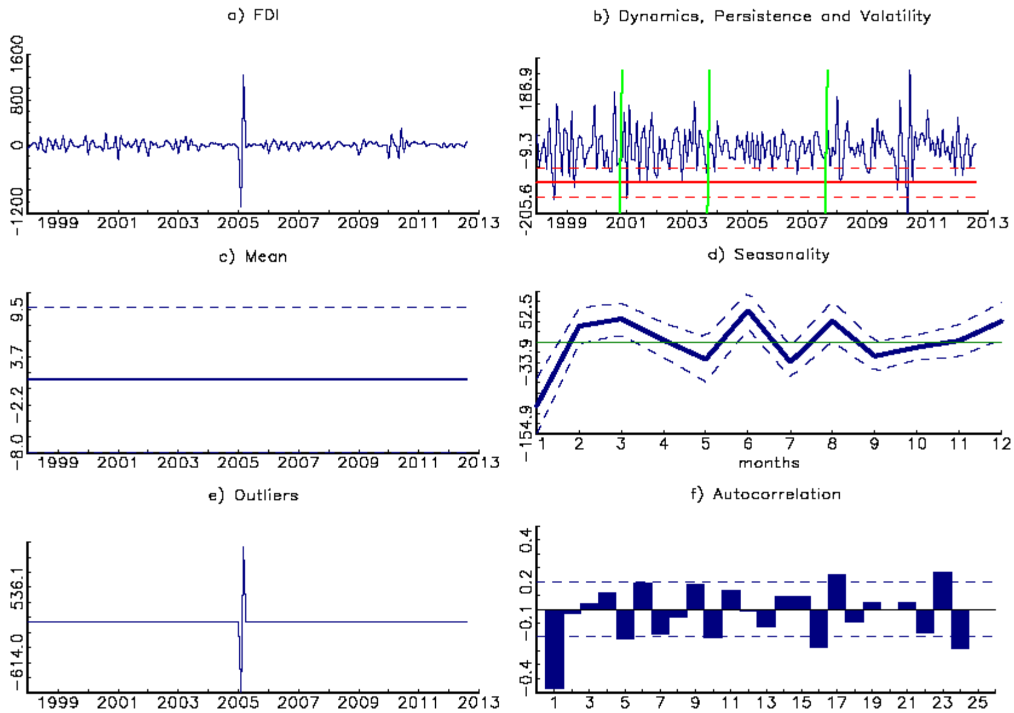

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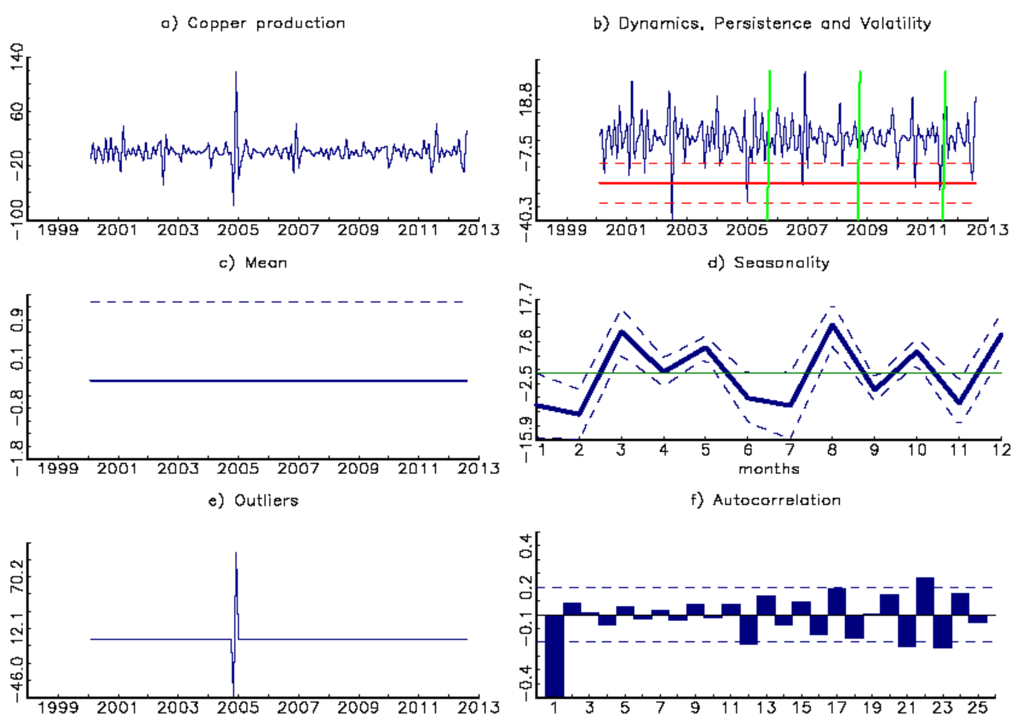

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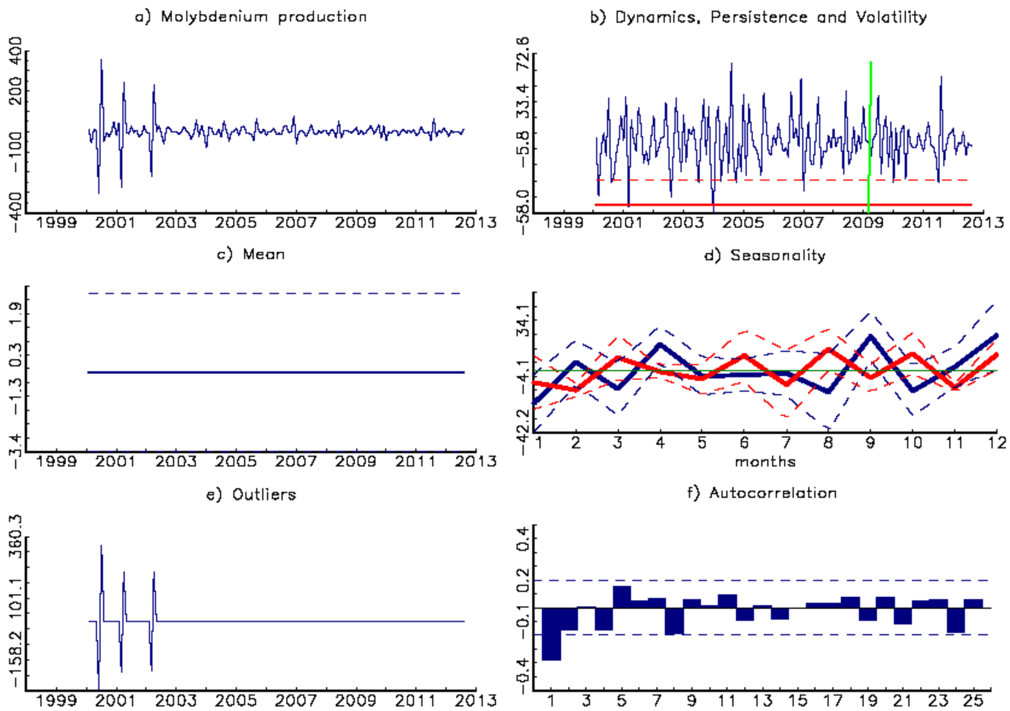

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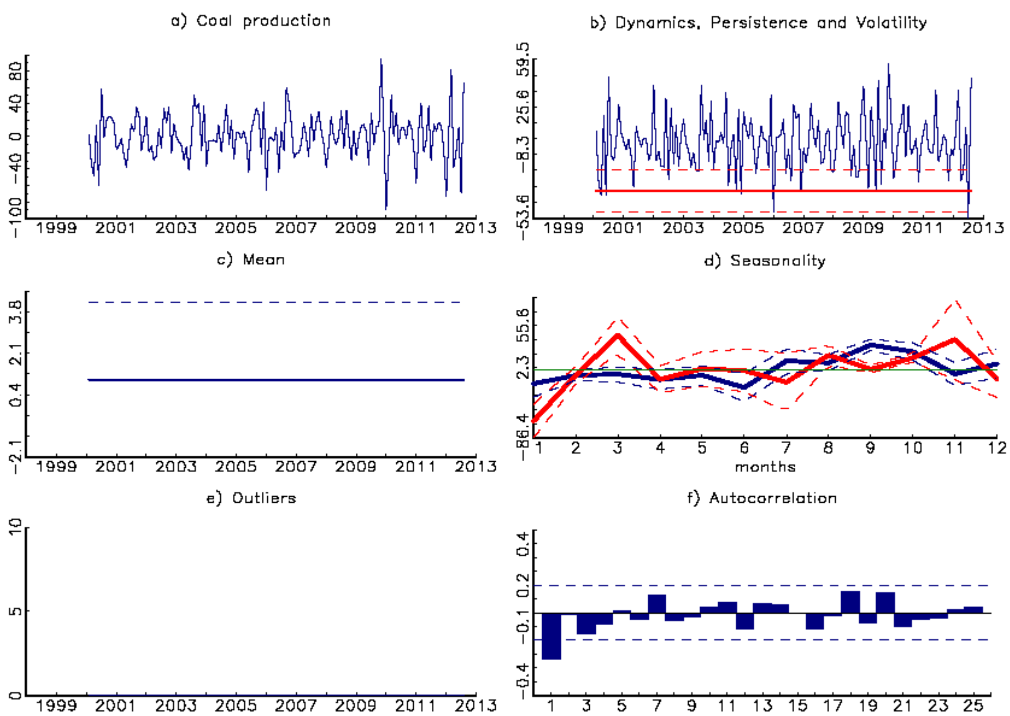

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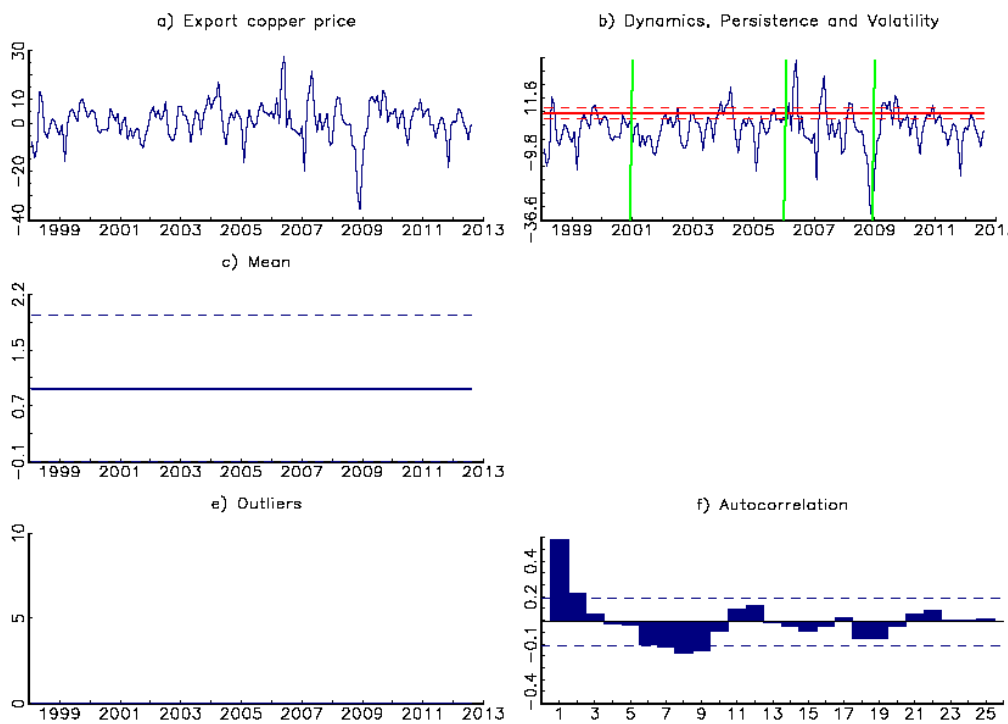

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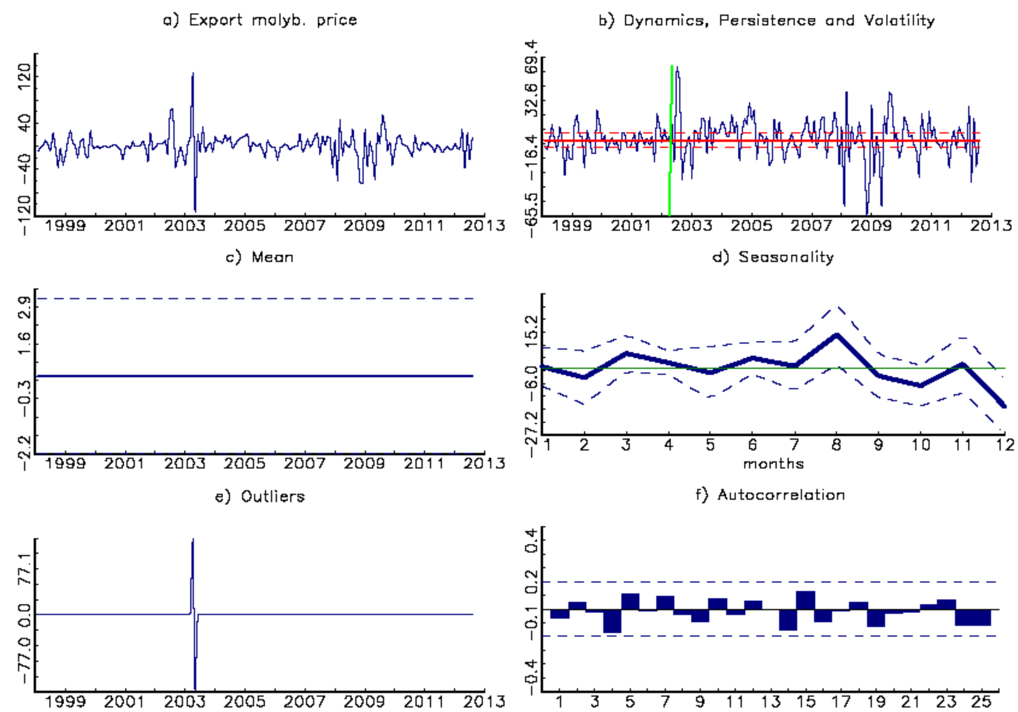

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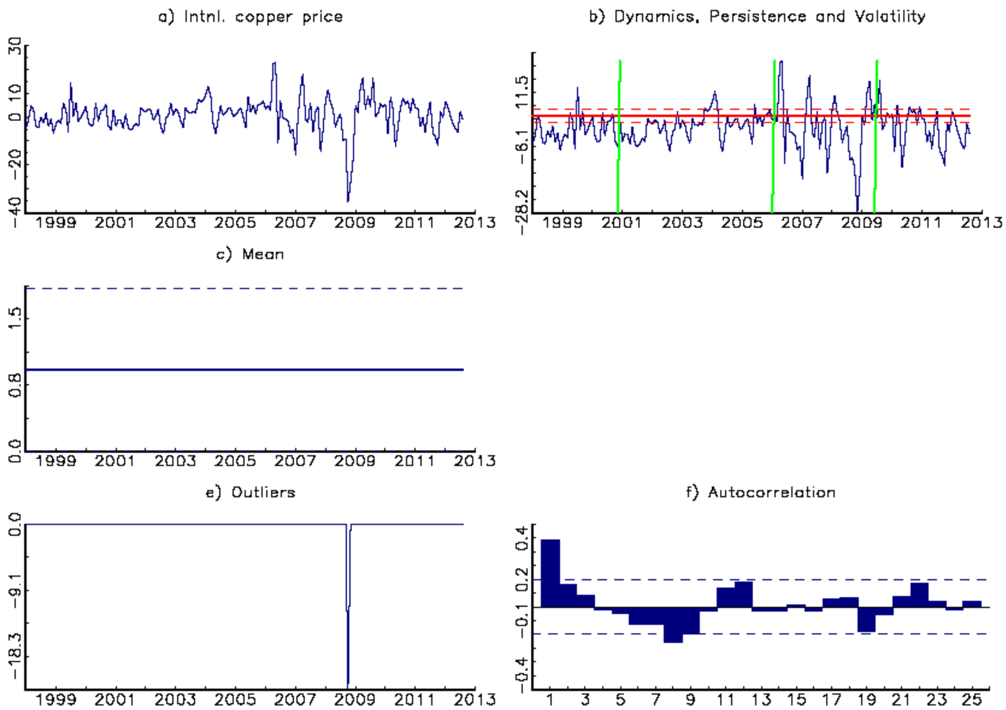

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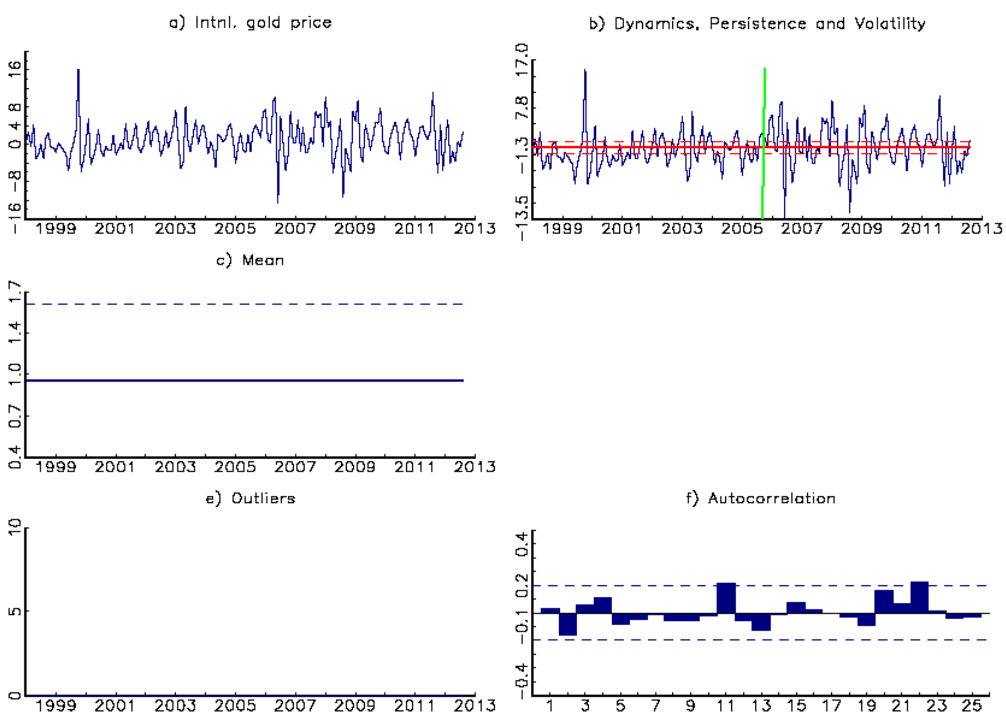

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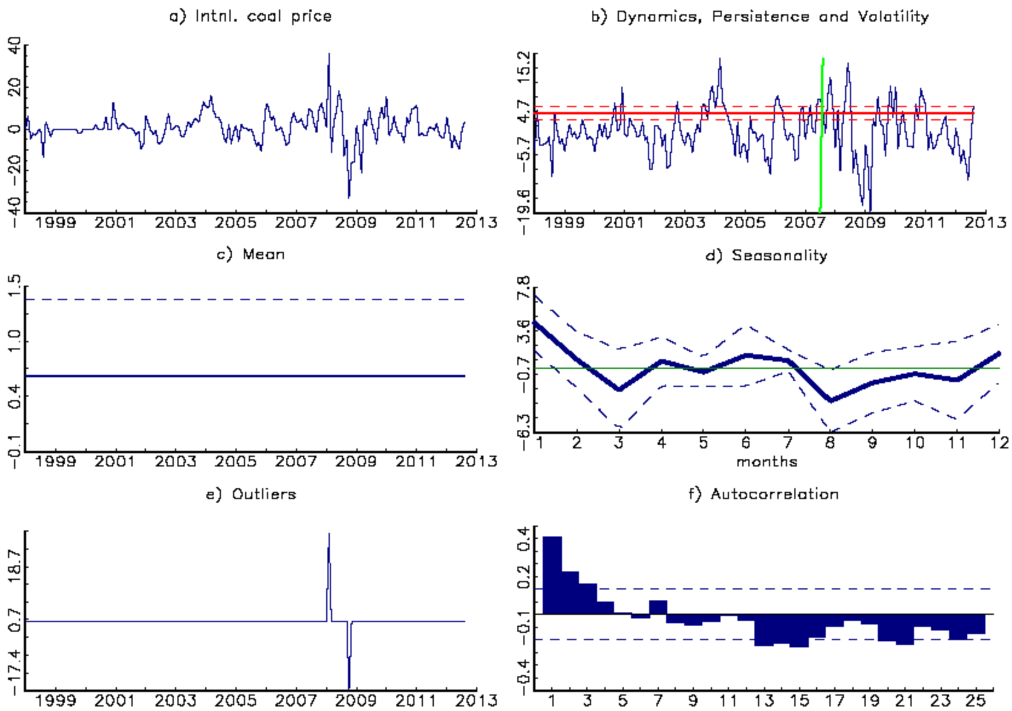

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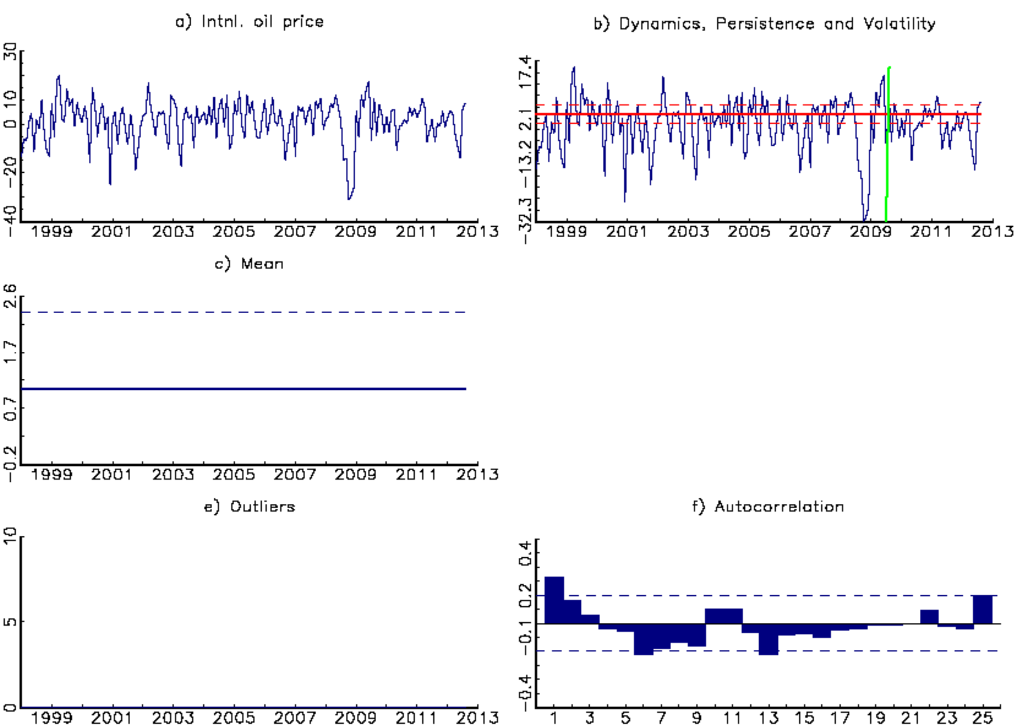

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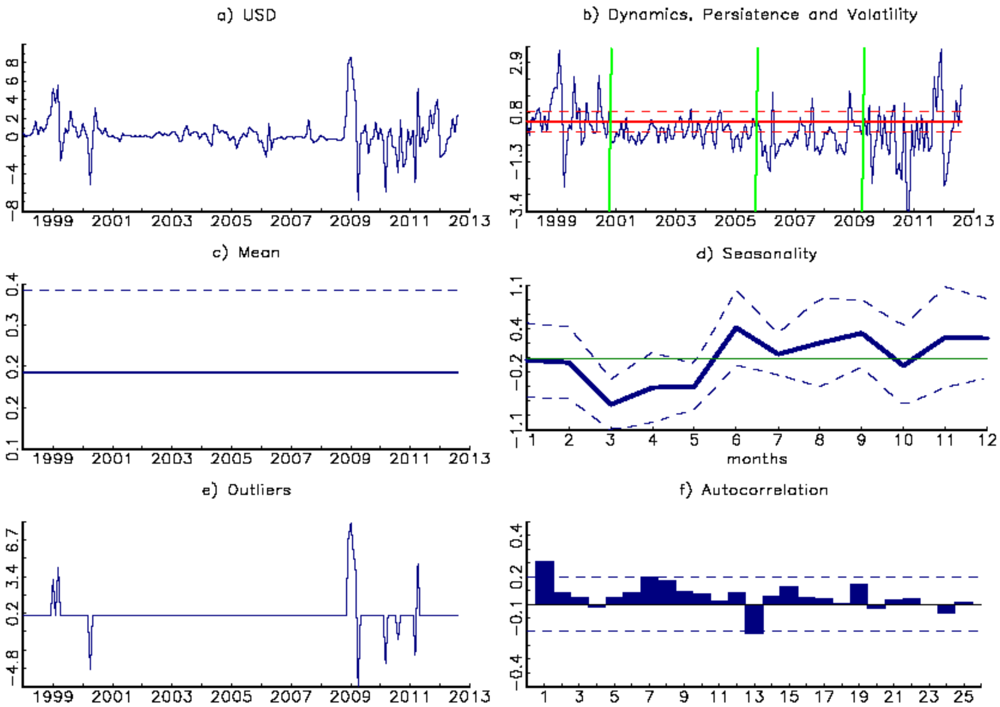

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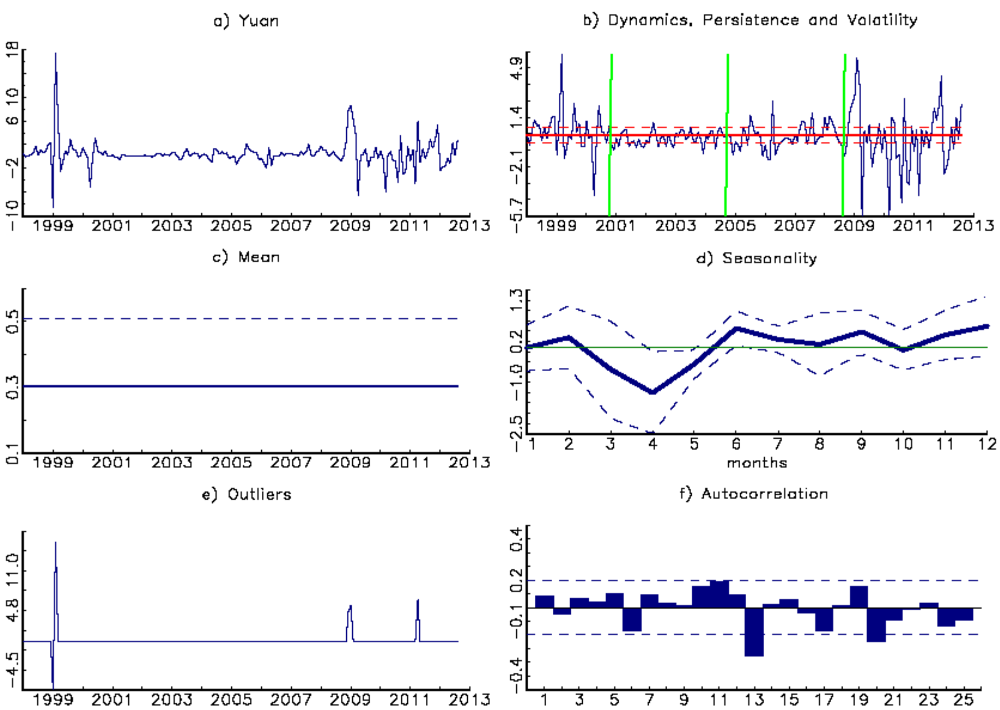

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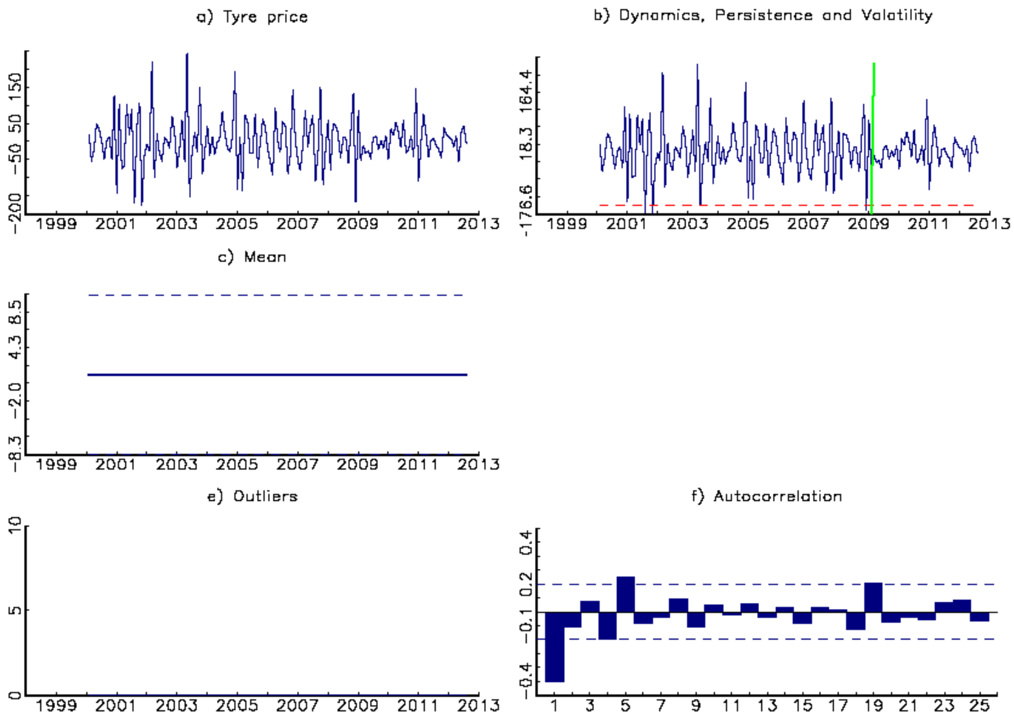

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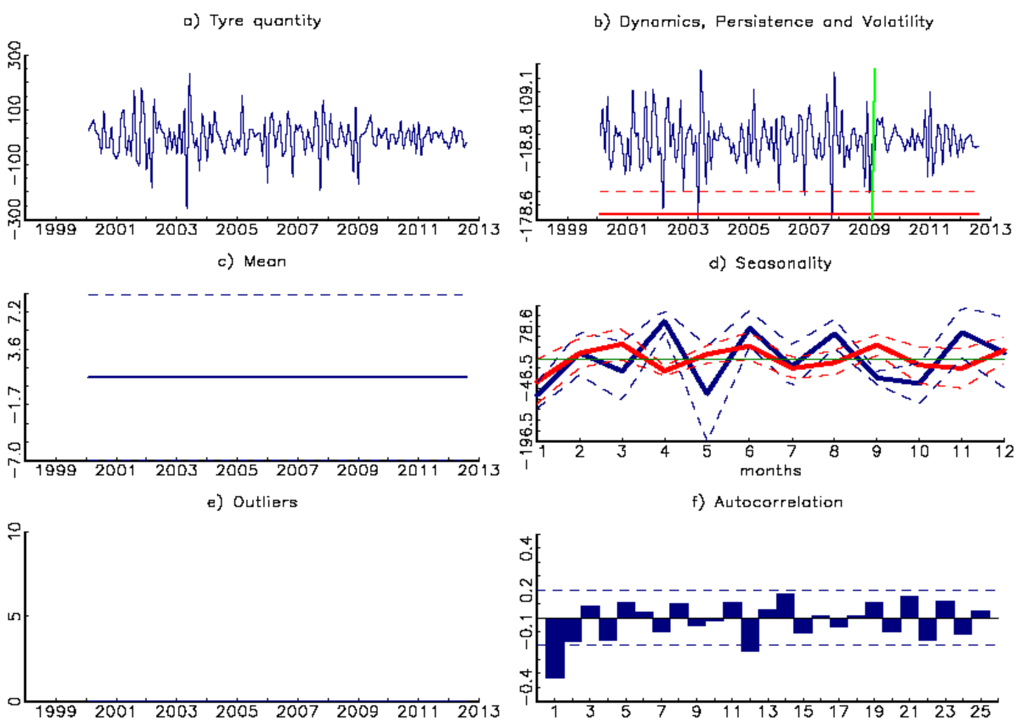

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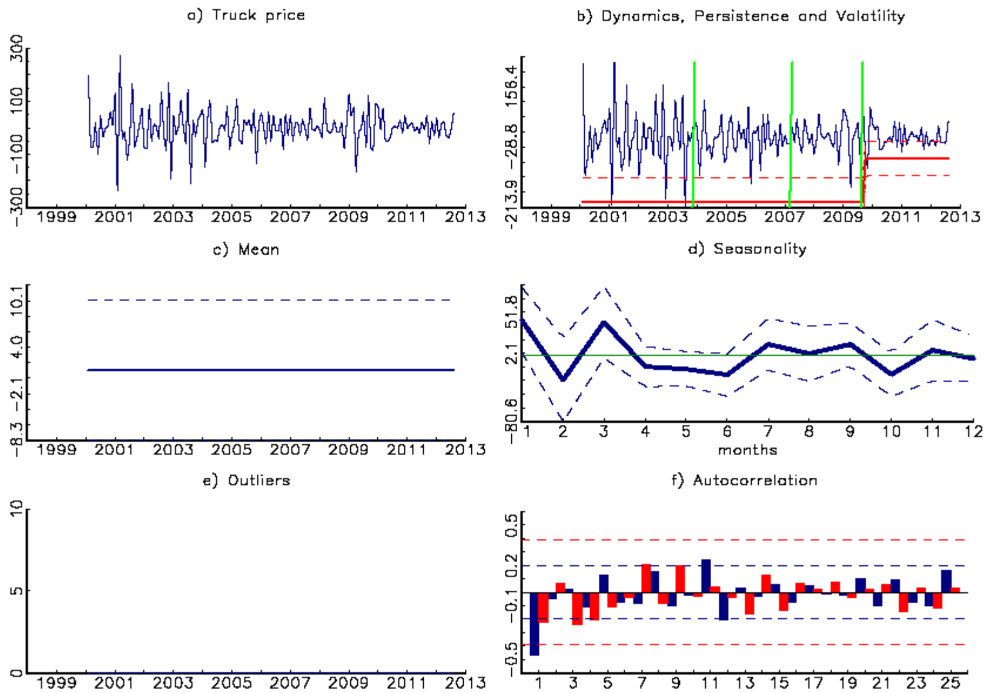

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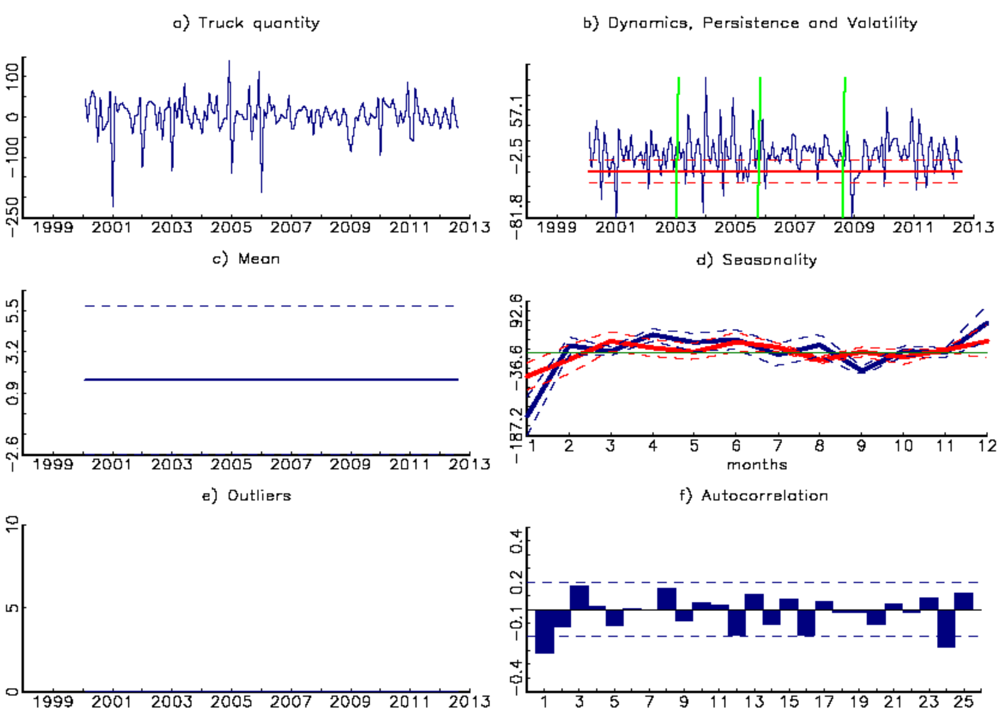

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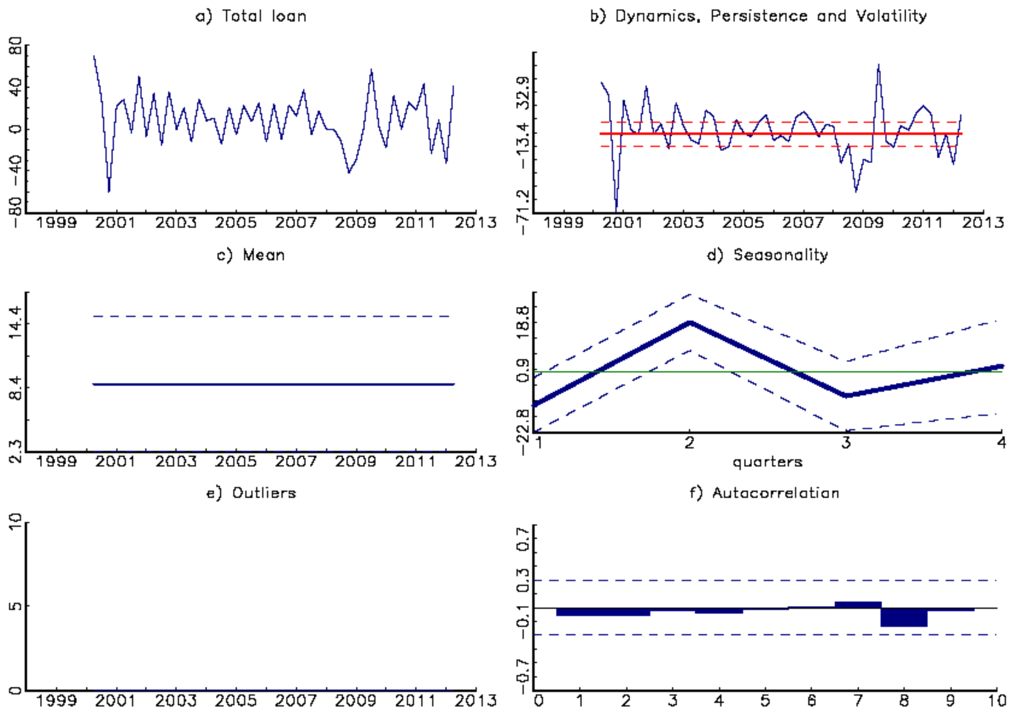

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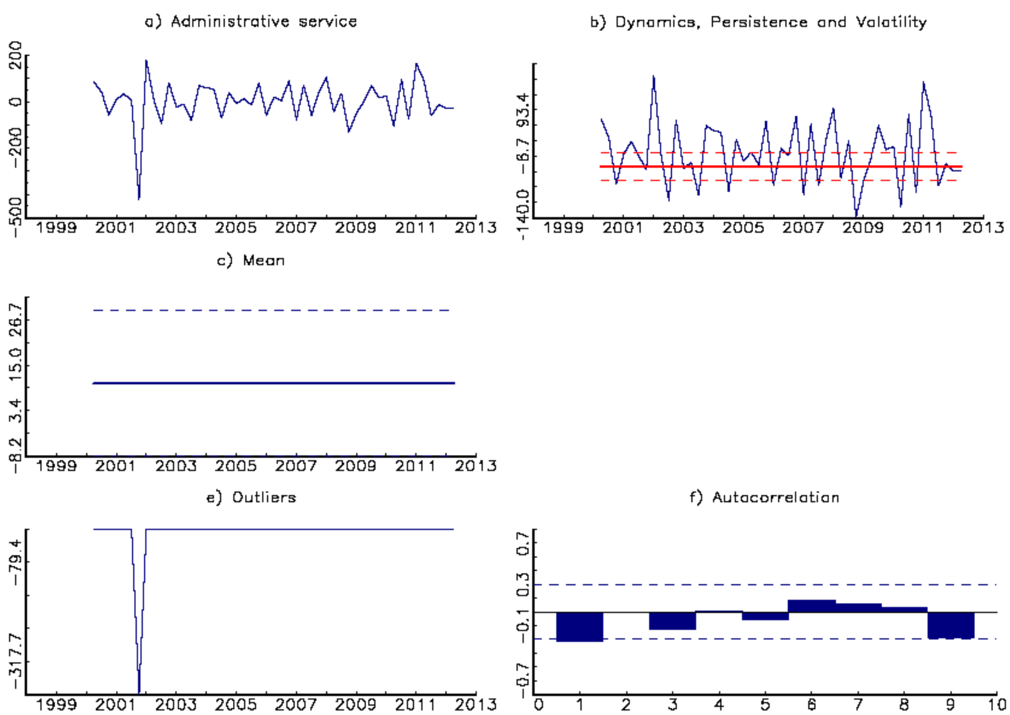

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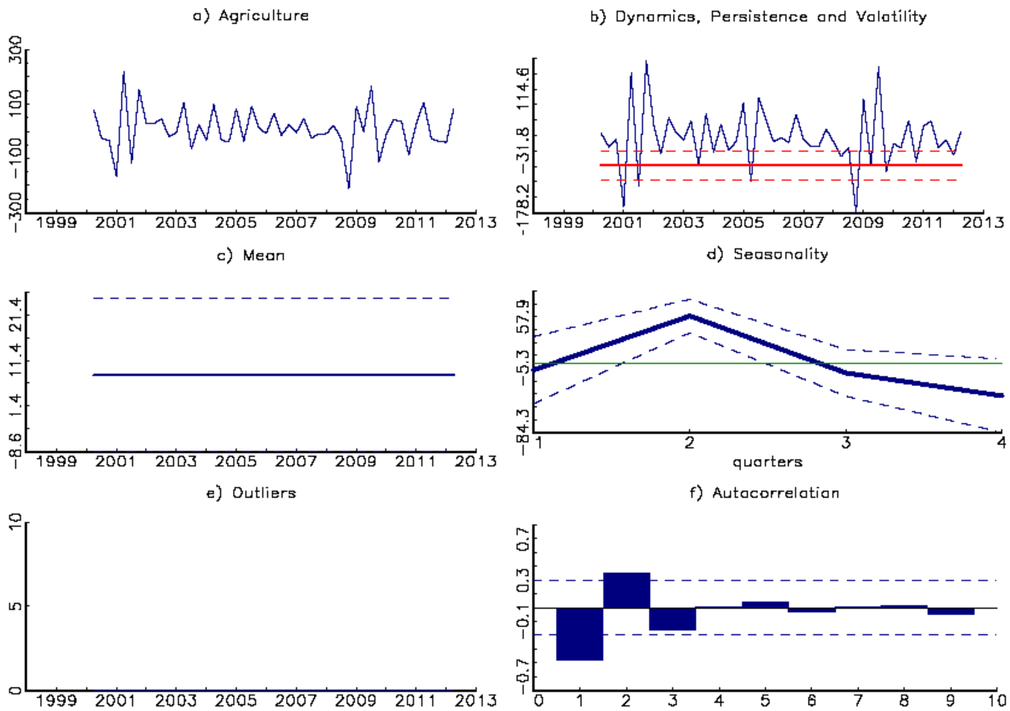

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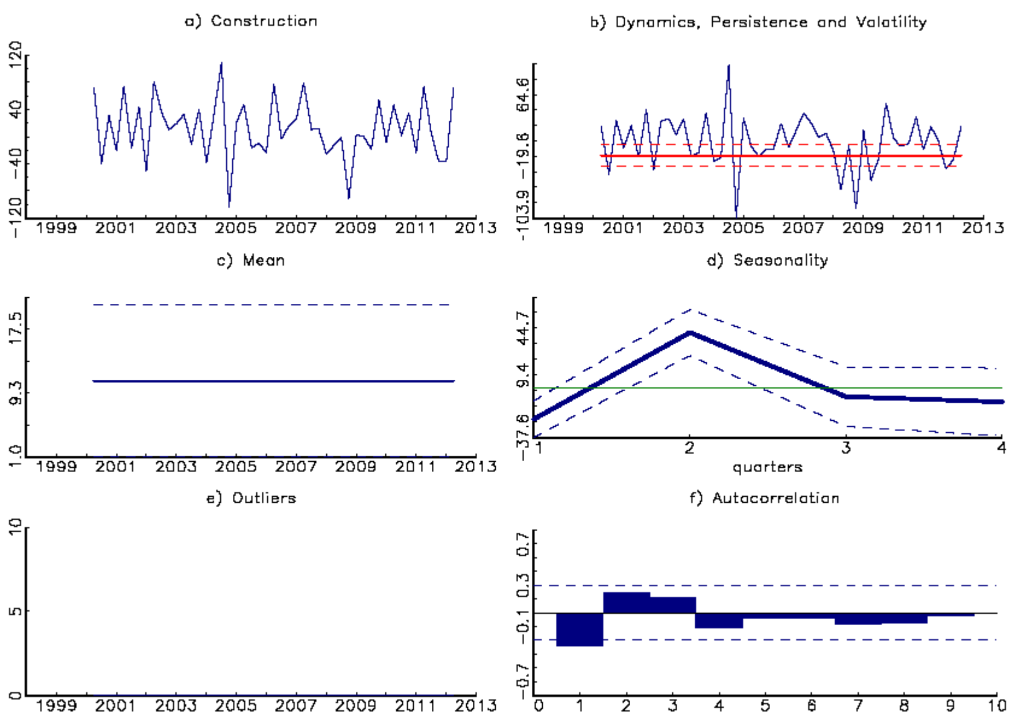

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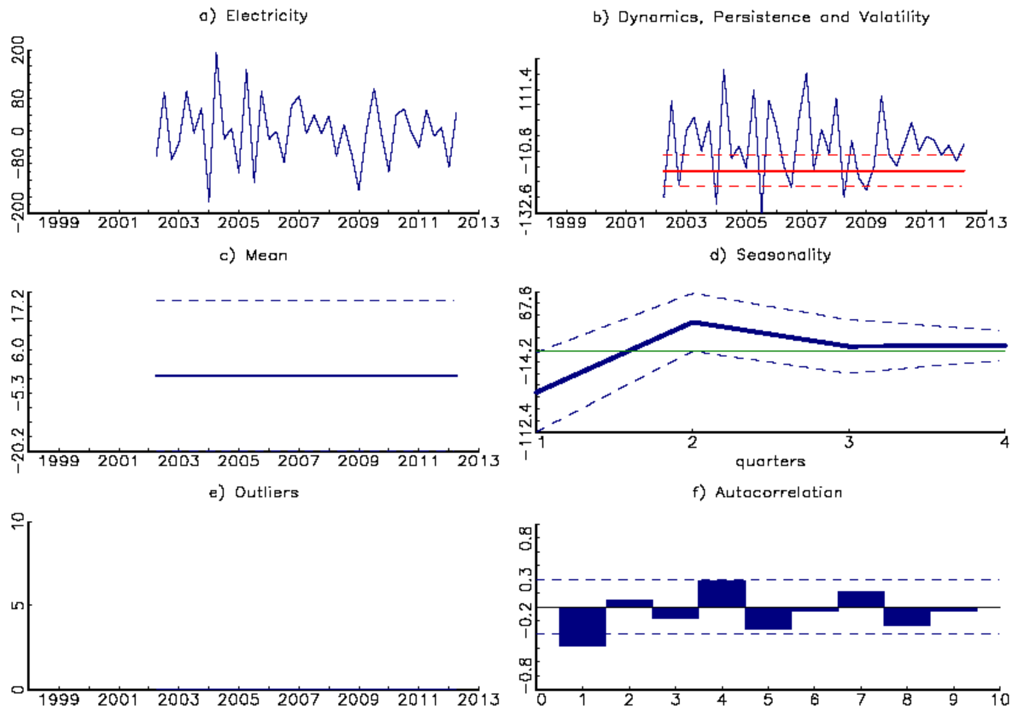

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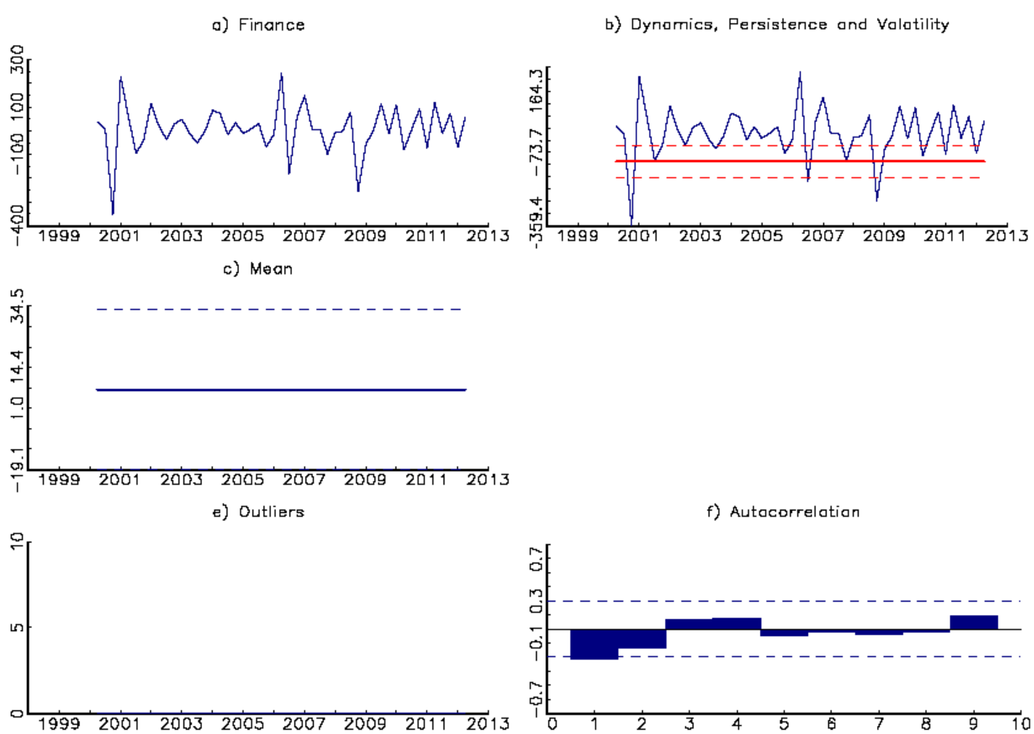

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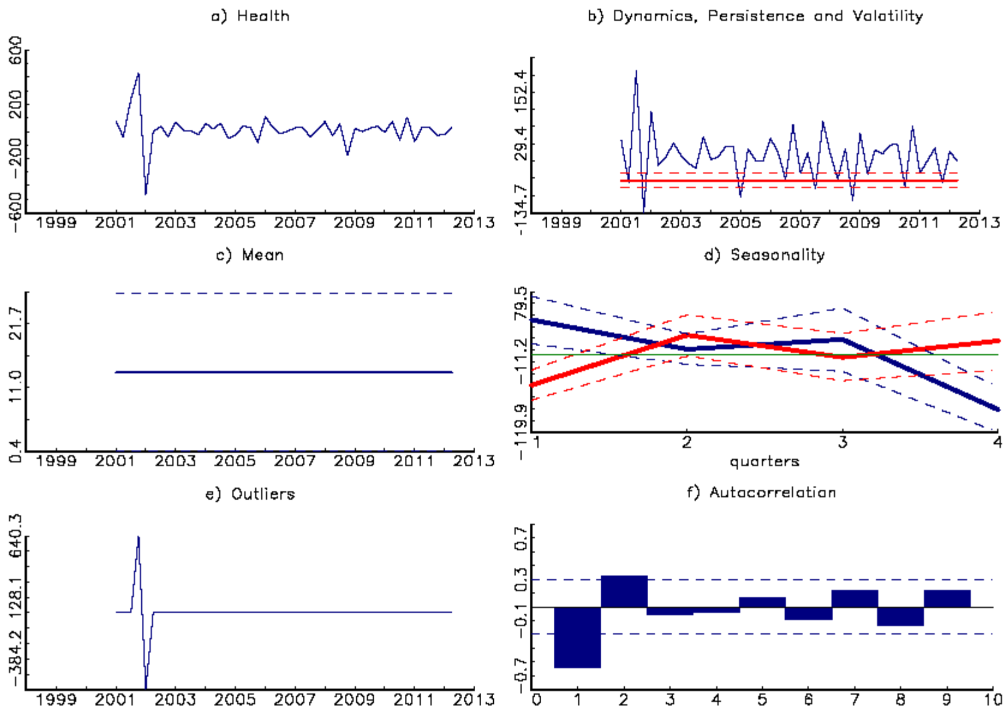

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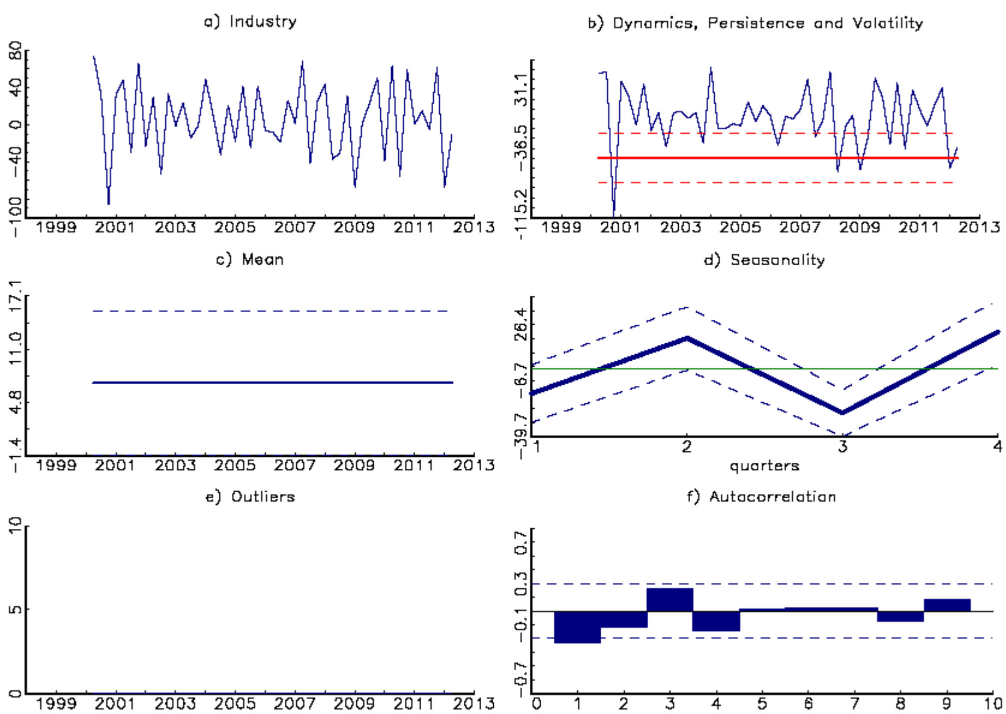

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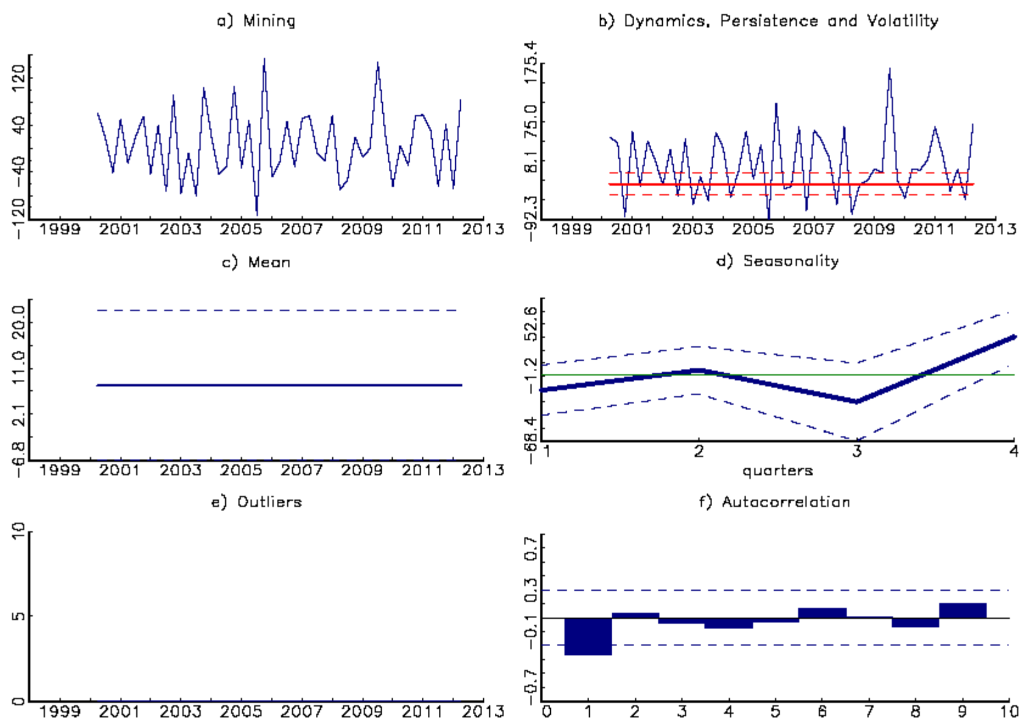

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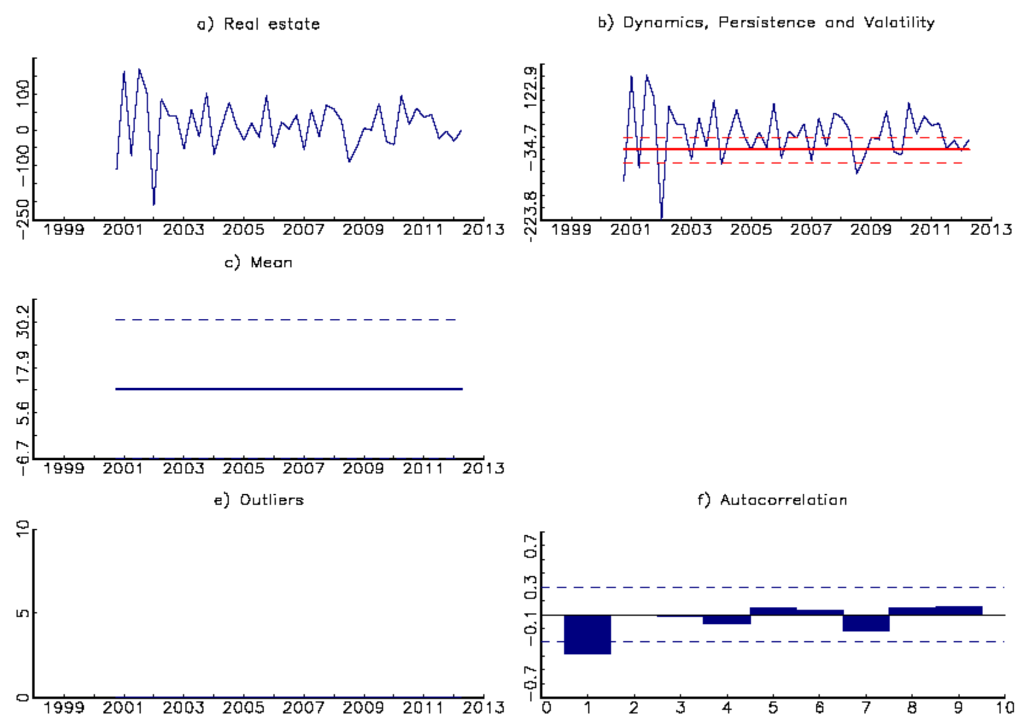

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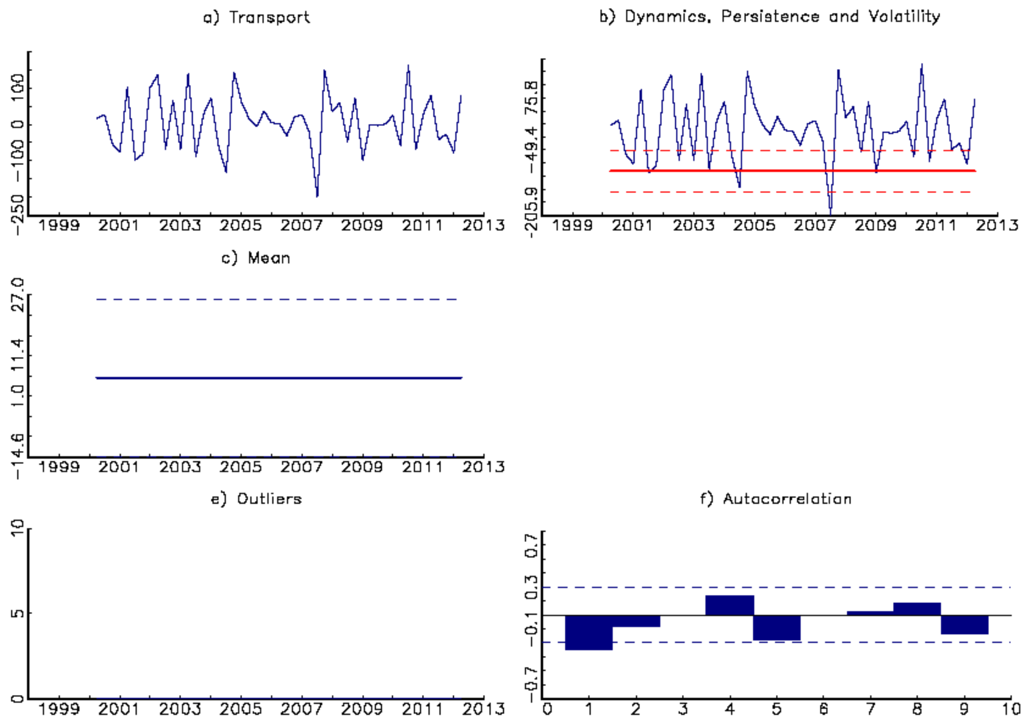

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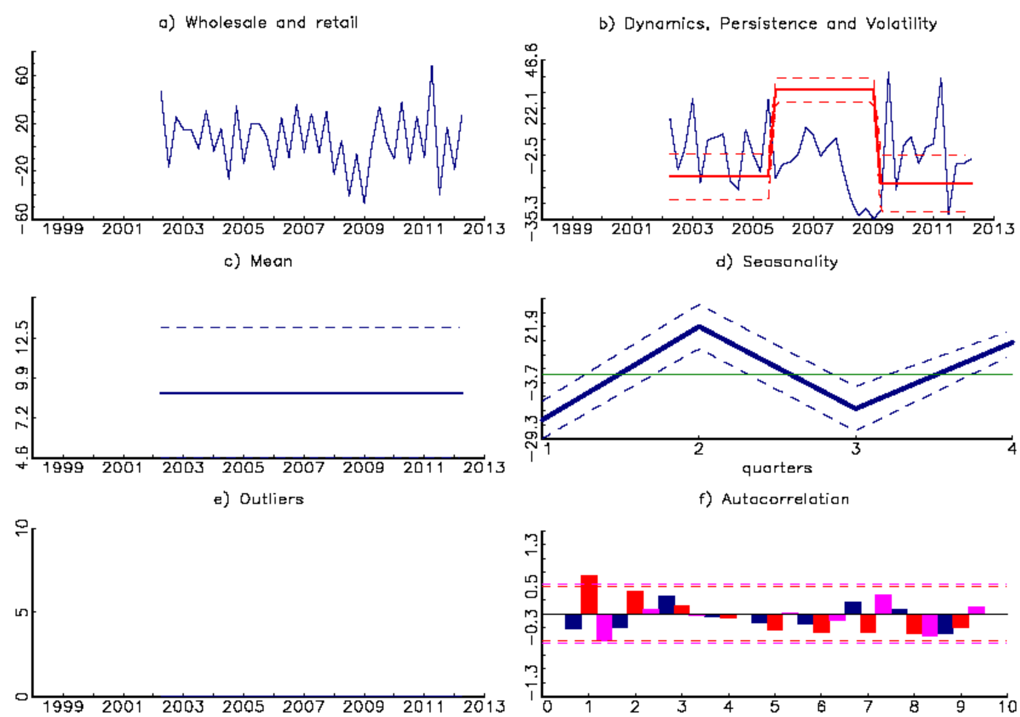

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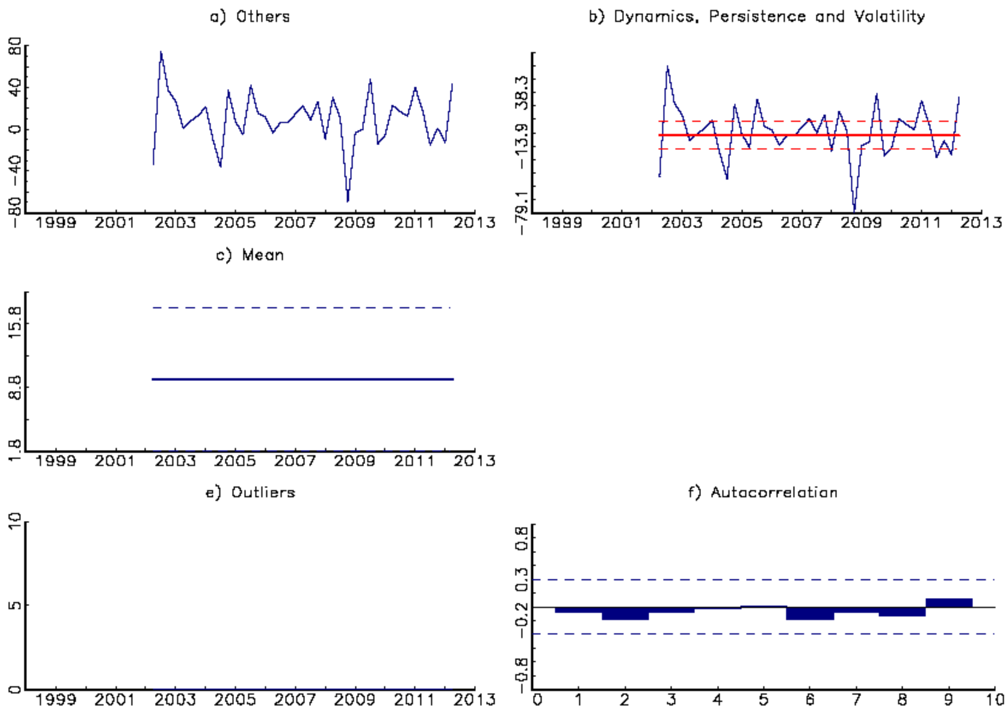


Figure 48. Notes: See Figure 1.

Appendix 2. Seasonality and outlier adjusted monthly time series and its long term trend

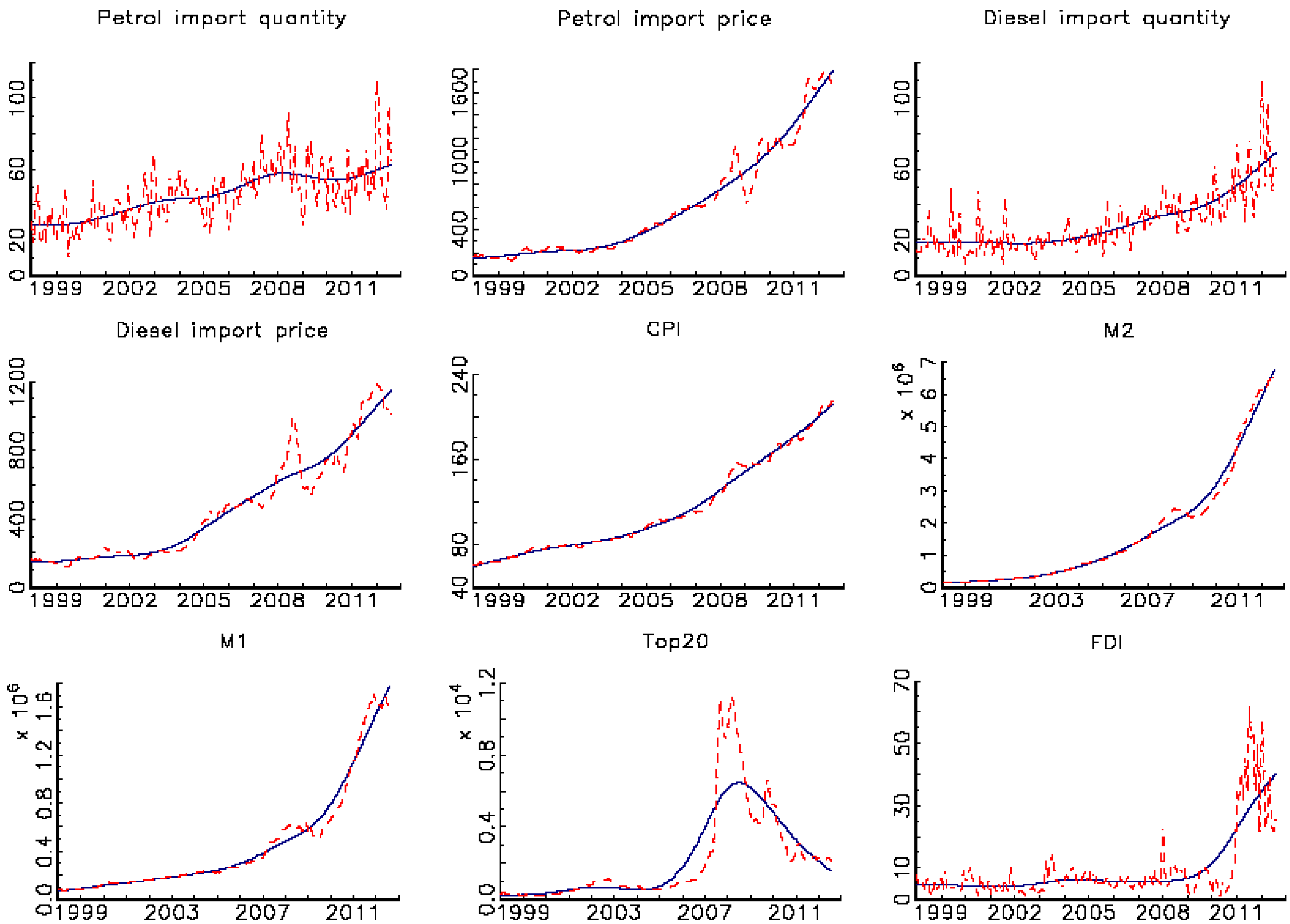
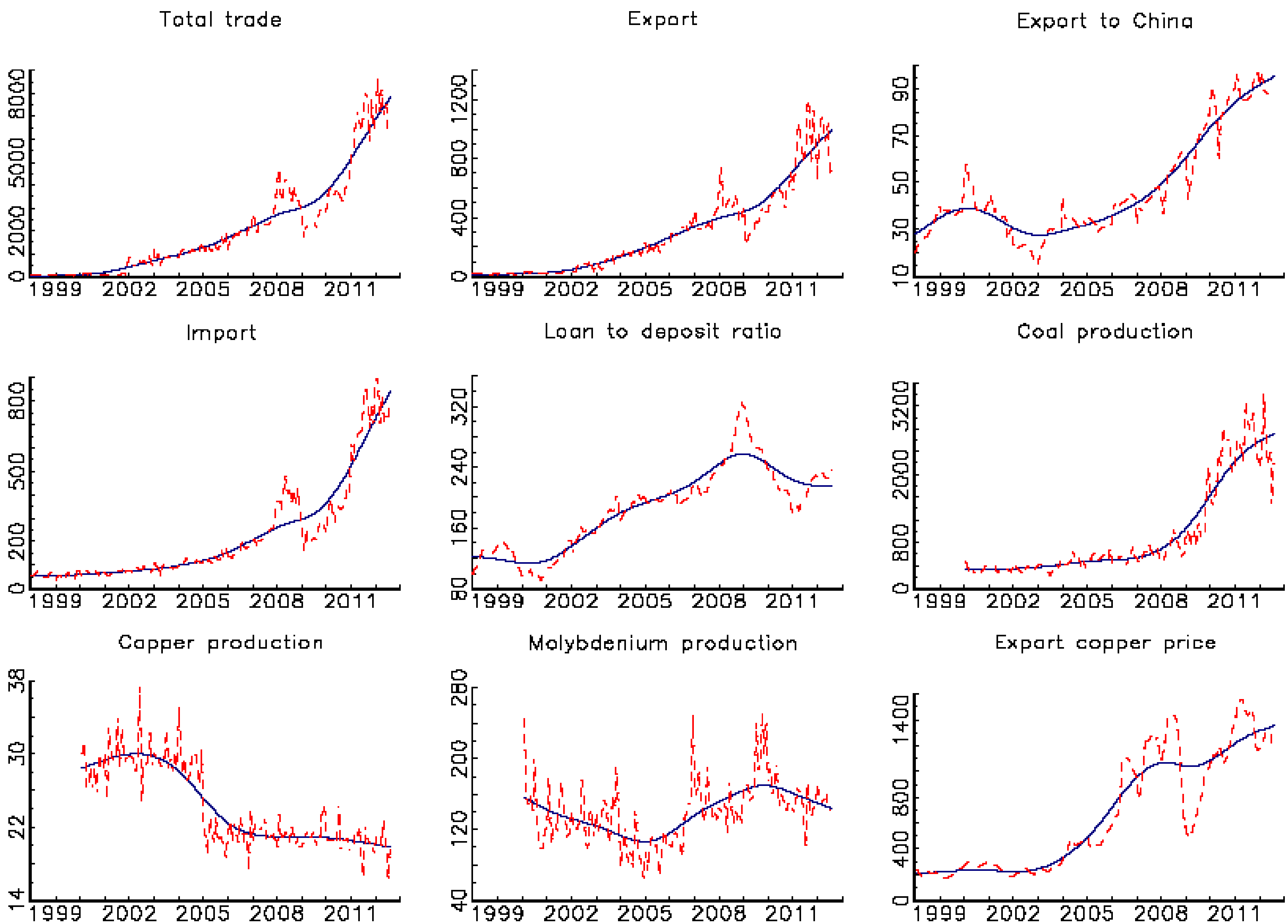


Figure 1. Note: Red dashed curves are the seasonality and outlier adjusted monthly time series. Their detailed description, coverage and source are detailed in Table 1. Blue continuous lines are the long term trends obtained using the Hodrick and Prescott filter described in Section 3.C.



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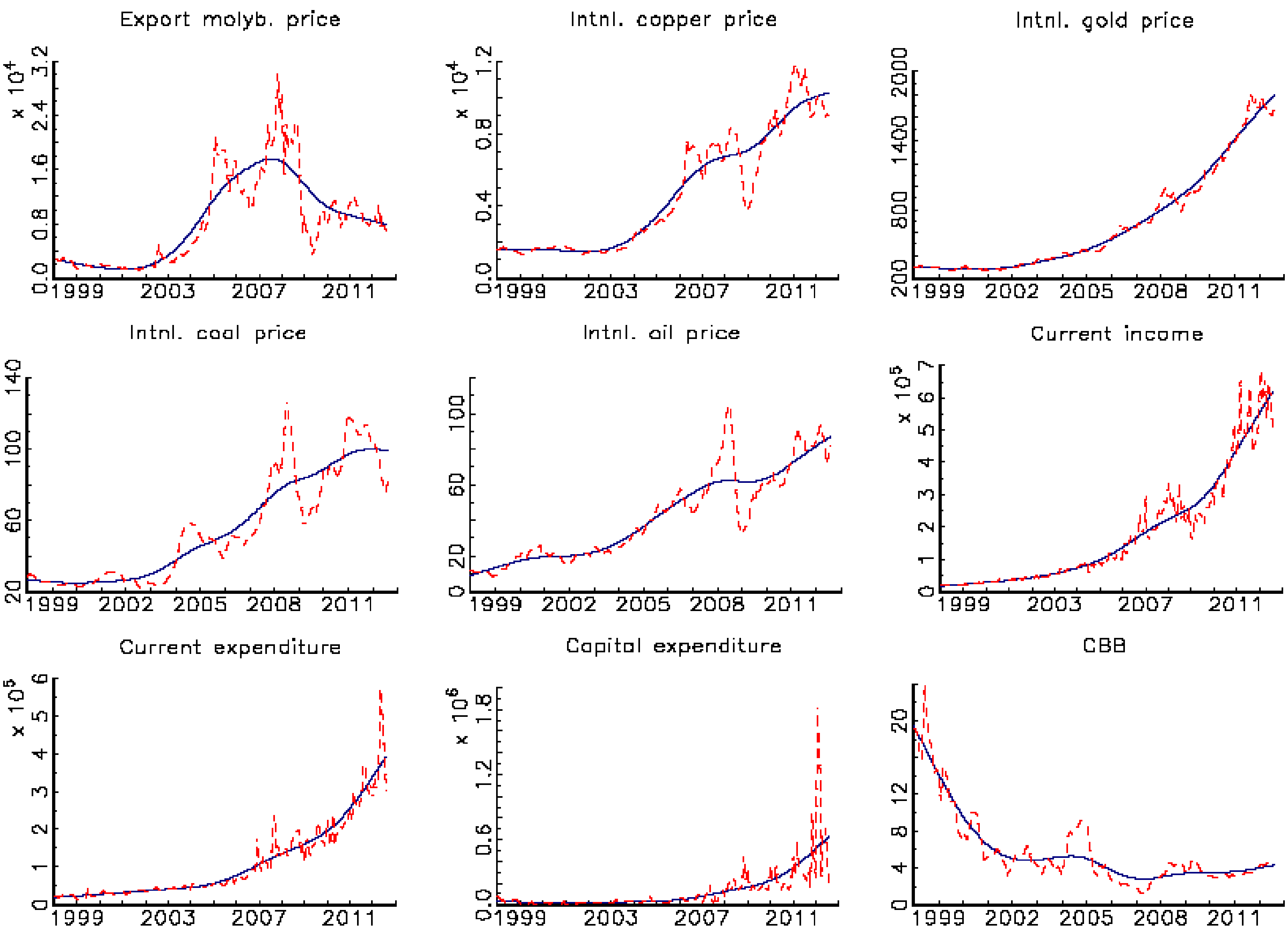

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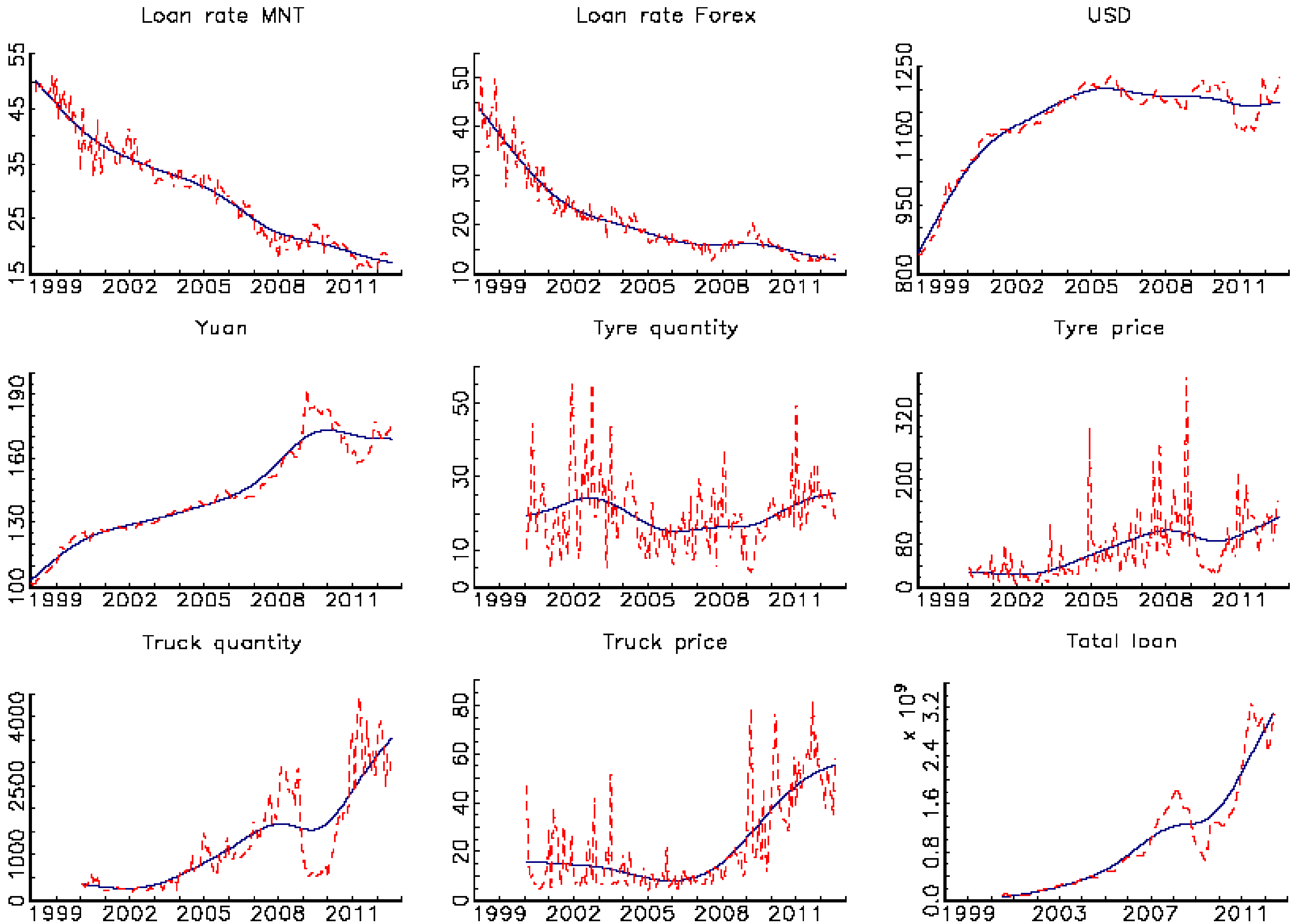

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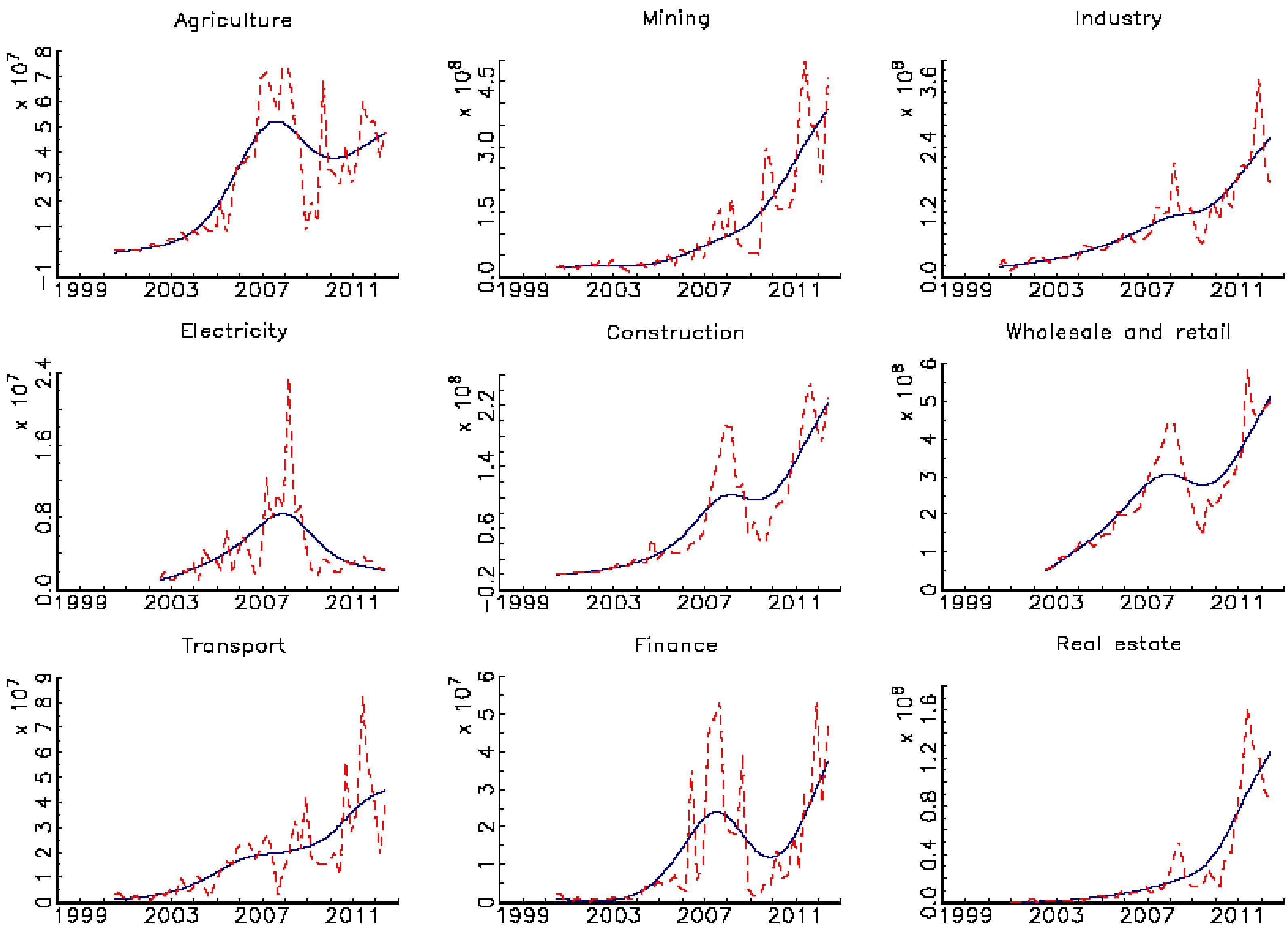

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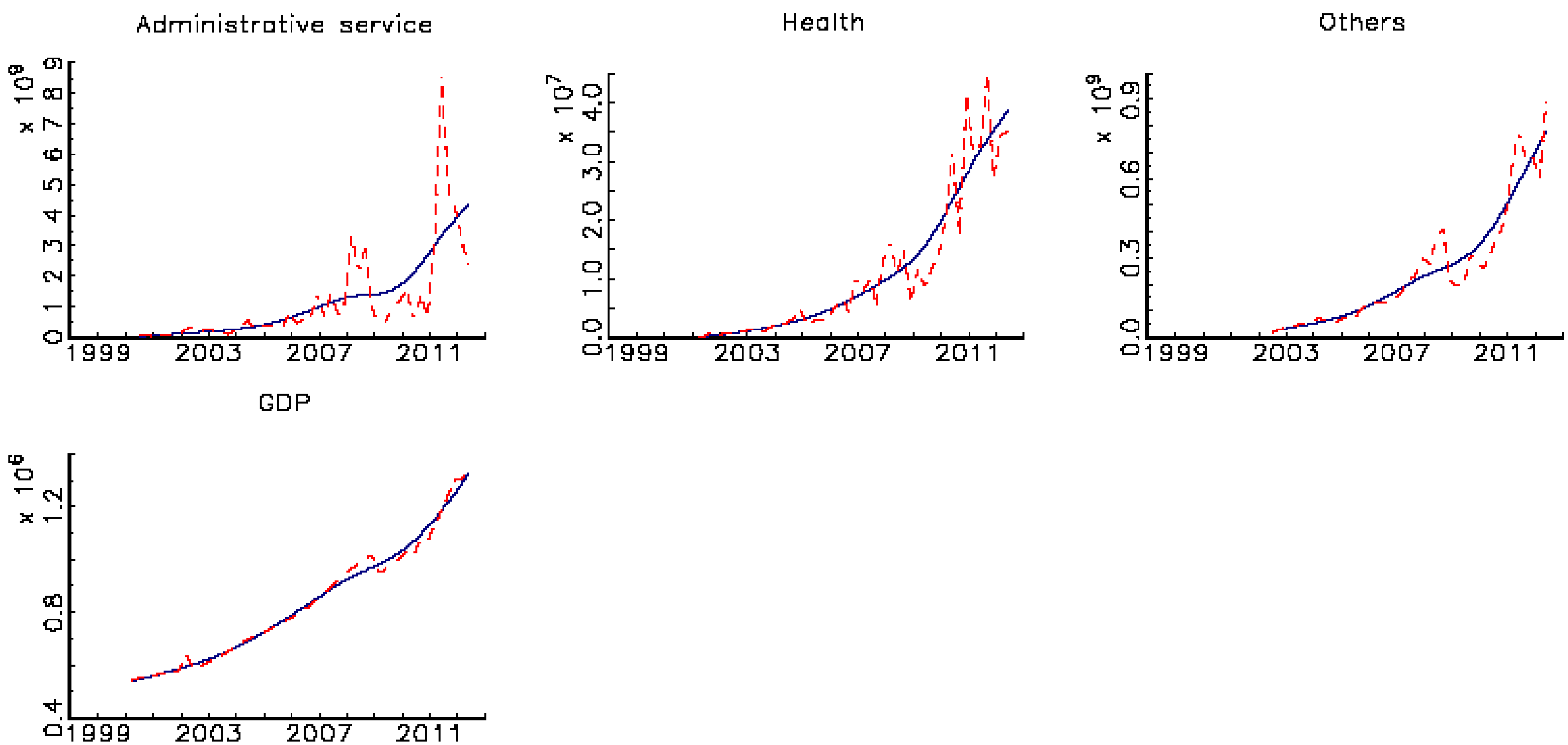
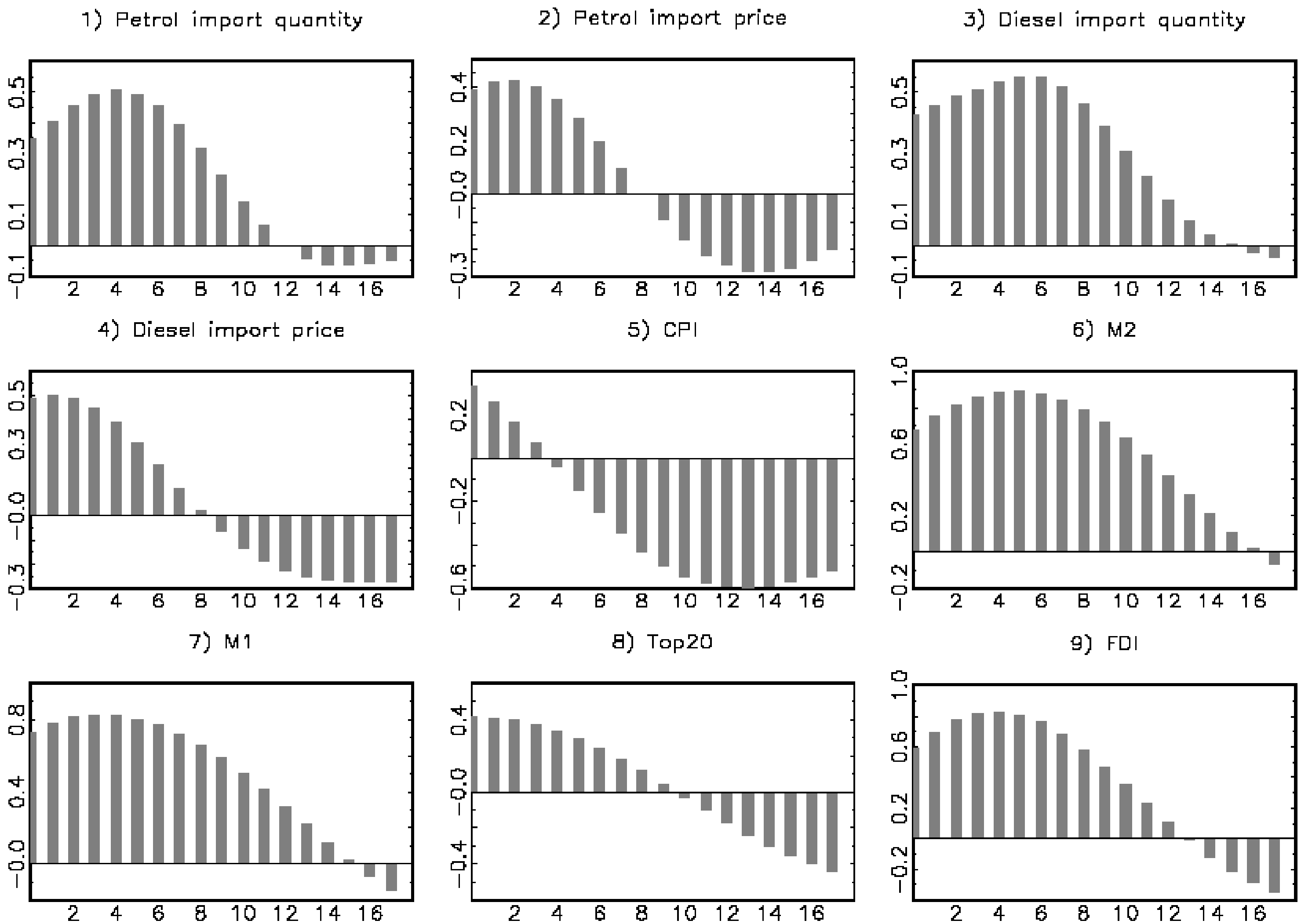
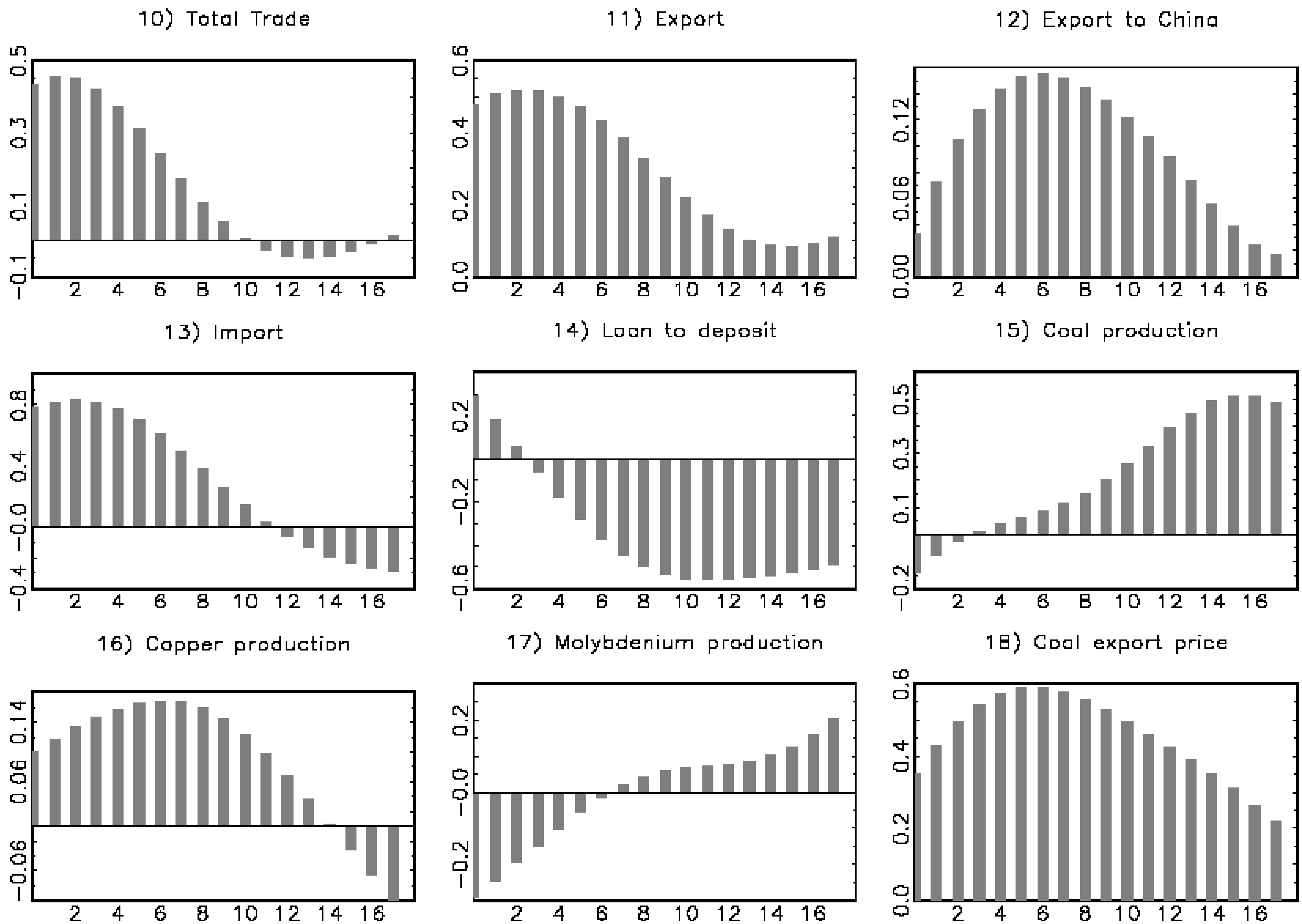


Figure 6. Note: See Figure 1.

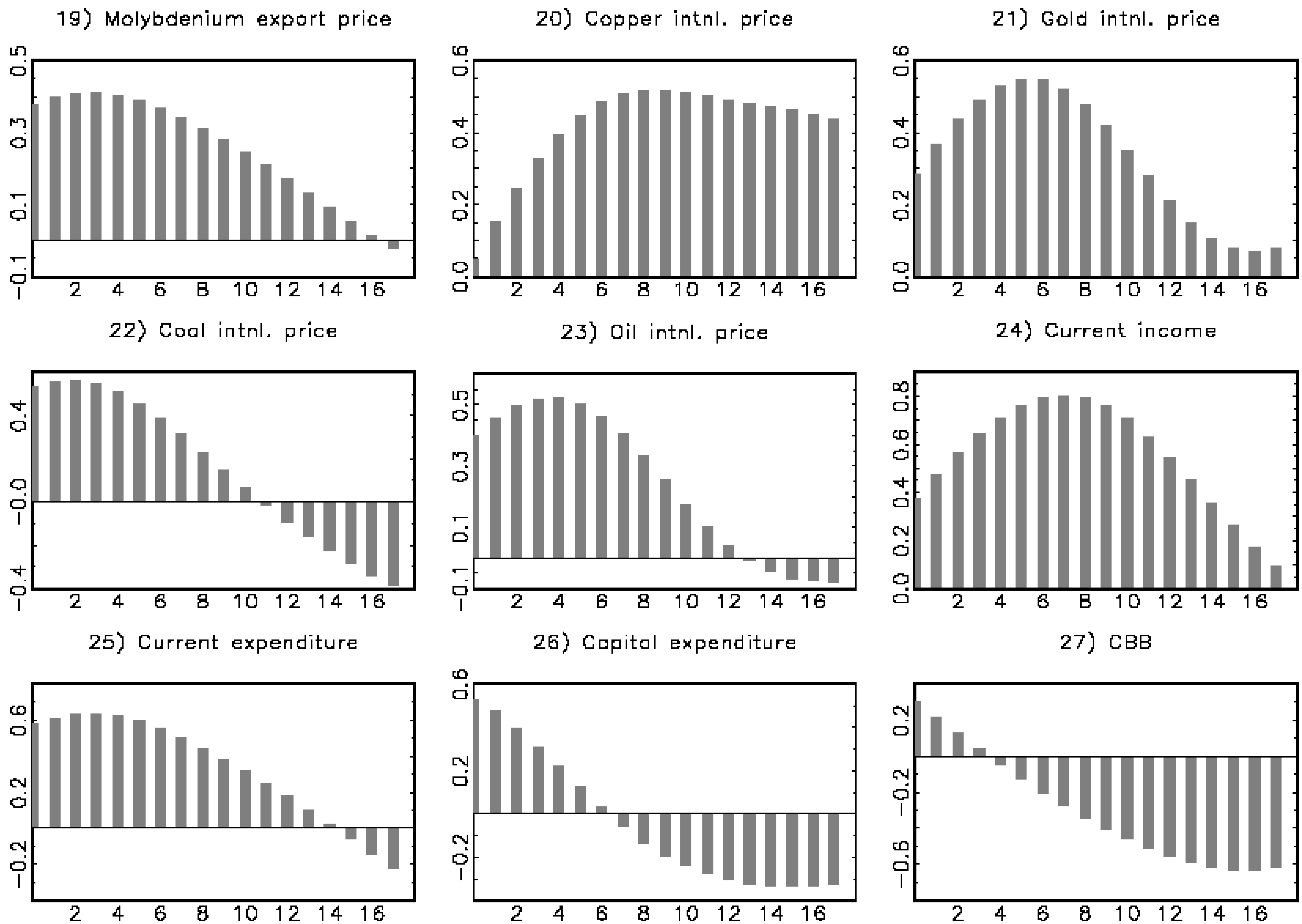
Appendix 3. Cross correlegram of the business cycle movements of the GDP and prospective components of the Composite Leading Indicator



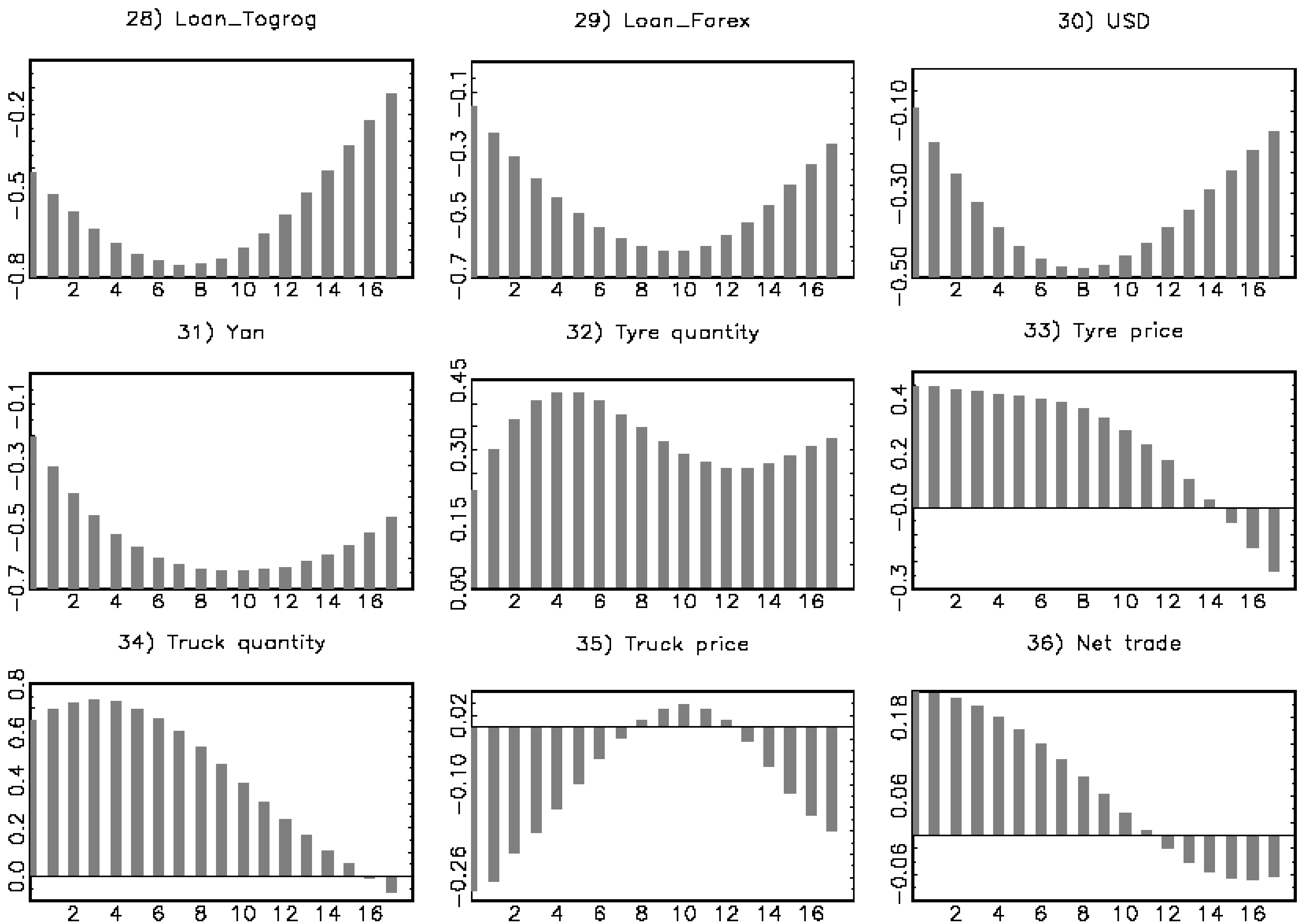
Note: Cross correlegram of the business cycle movements of the GDP and prospective components of the Composite Leading Indicator. Leads of the prospective component are on the horizontal line so that the correlegram is between its past and the current GDP cycle.

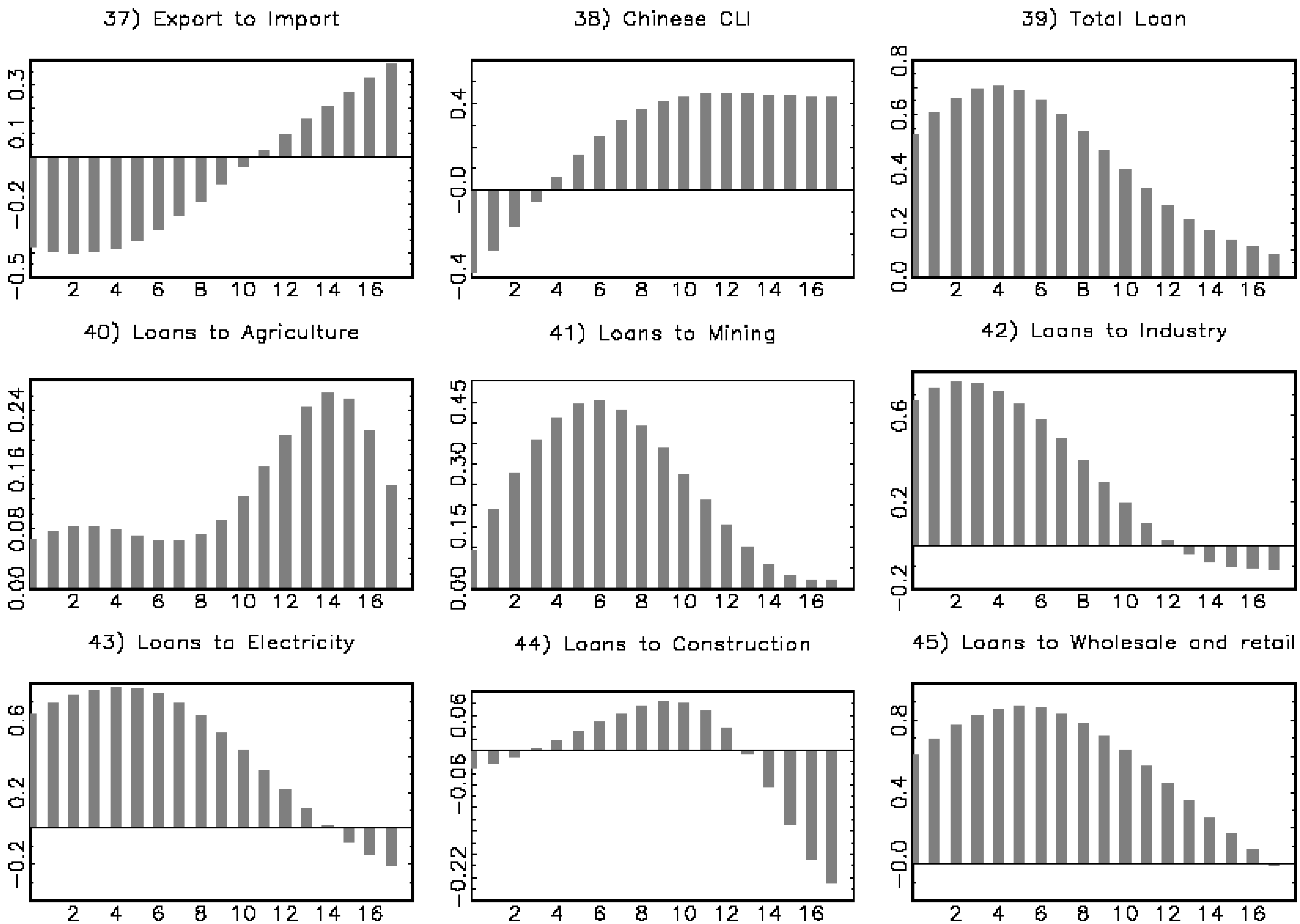


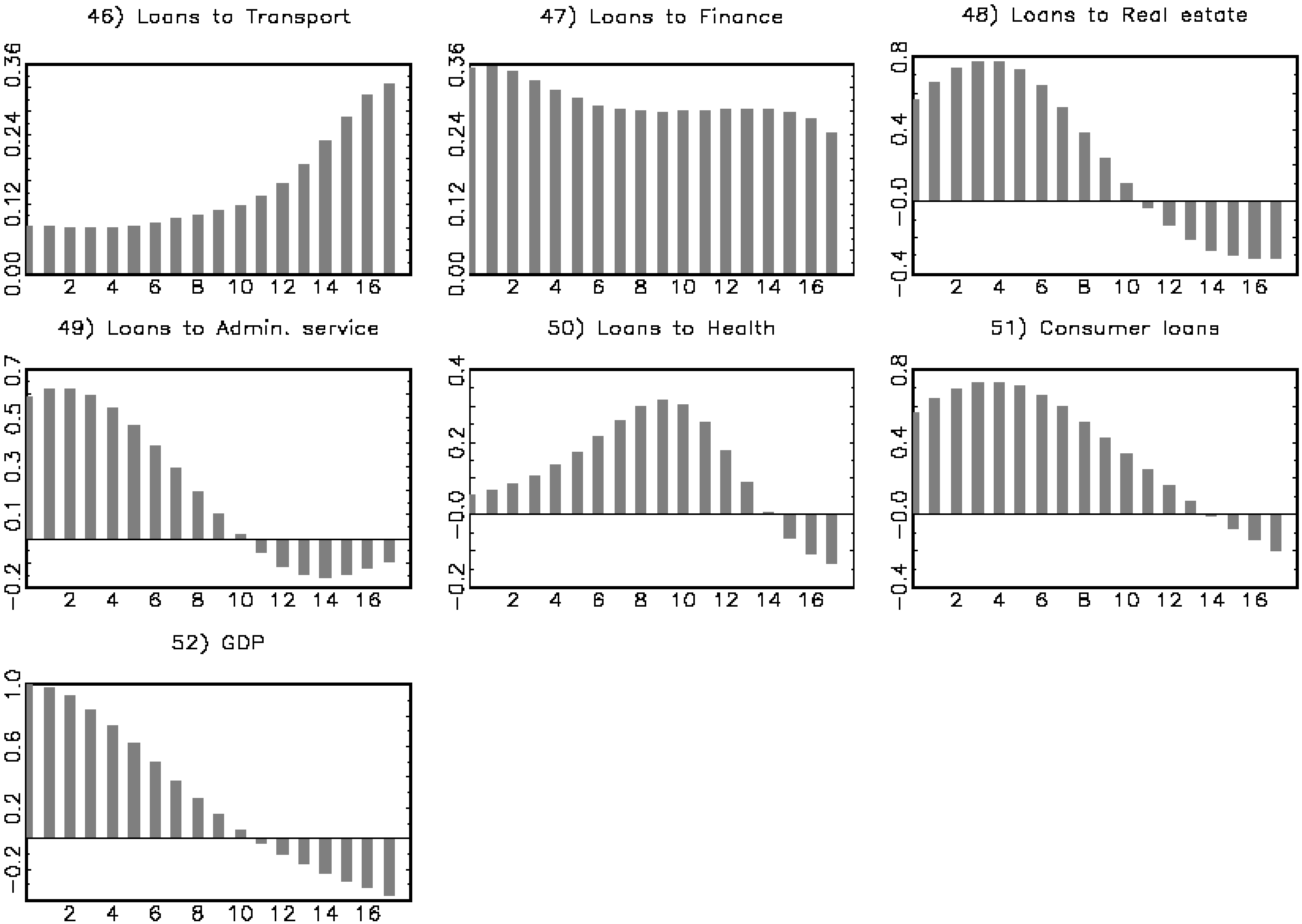
10) Total Trade
11) Export
12) Export to China
13) Import
14) Loan to deposit
15) Coal production
16) Copper production
17) Molybdenium production
18) Coal export price



19) Molybdenium export price
20) Copper intnl. price
21) Gold intnl. price
22) Coal intnl. price
23) Oil intnl. price
24) Current income
25) Current expenditure
26) Capital expenditure
27) CBB


28) Loan_Togrog
−0.8
−0.5
−0.2
2 4 6 8 10 12 14 16
29) Loan_Forex
−0.7
−0.5
−0.3
−0.1
2 4 6 8 10 12 14 16
30) USD
−0.50
−0.30
−0.10
2 4 6 8 10 12 14 16
31) Yen
−0.7
−0.5
−0.3
−0.1
2 4 6 8 10 12 14 16
32) Tyre quantity
0.00
0.15
0.30
0.45
2 4 6 8 10 12 14 16
33) Tyre price
−0.3
−0.0
0.2
0.4
2 4 6 8 10 12 14 16
34) Truck quantity
0.0
0.2
0.4
0.6
0.8
2 4 6 8 10 12 14 16
35) Truck price
−0.26
−0.10
0.02
2 4 6 8 10 12 14 16
36) Net trade
−0.06
0.06
0.18
2 4 6 8 10 12 14 16


37) Export to Import
38) Chinese CLI
39) Total Loan
40) Loans to Agriculture
41) Loans to Mining
42) Loans to Industry
43) Loans to Electricity
44) Loans to Construction
45) Loans to Wholesale and retail
2 4 6 8 10 12 14 16


46) Loans to Transport
0.00 0.12 0.24 0.36
2 4 6 8 10 12 14 16
47) Loans to Finance
0.00 0.12 0.24 0.36
2 4 6 8 10 12 14 16
48) Loans to Real estate
−0.4 −0.0 0.4 0.8
2 4 6 8 10 12 14 16
49) Loans to Admin. service
−0.2 0.1 0.3 0.5 0.7
2 4 6 8 10 12 14 16
50) Loans to Health
−0.2 −0.0 0.2 0.4
2 4 6 8 10 12 14 16
51) Consumer loans
−0.4 −0.0 0.4 0.8
2 4 6 8 10 12 14 16
52) GDP
−0.2 0.2 0.6 1.0
2 4 6 8 10 12 14 16

Appendix 4. Turning points in business cycle movements of the GDP and prospective components of the Composite Leading Indicator

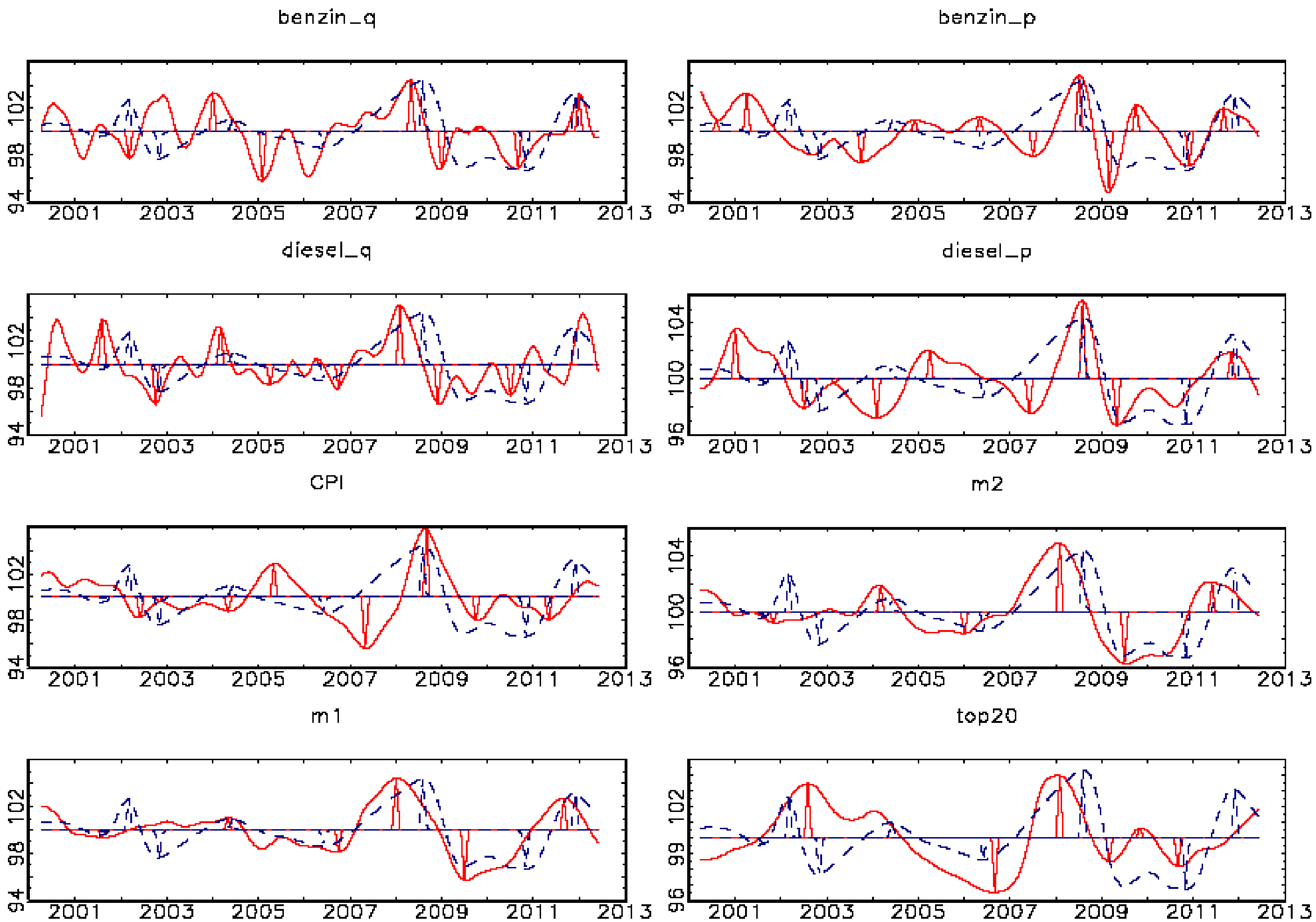


Figure 1. Business cycle movements of the GDP and prospective components of the Composite Leading Indicator along with their estimated turning points determined using Bry and Boschan (1971) routine. The plotted are petrol import quantity, petrol import price, diesel import quantity, diesel import price, consumer price index, M2, M1 and Top20 stock market index.

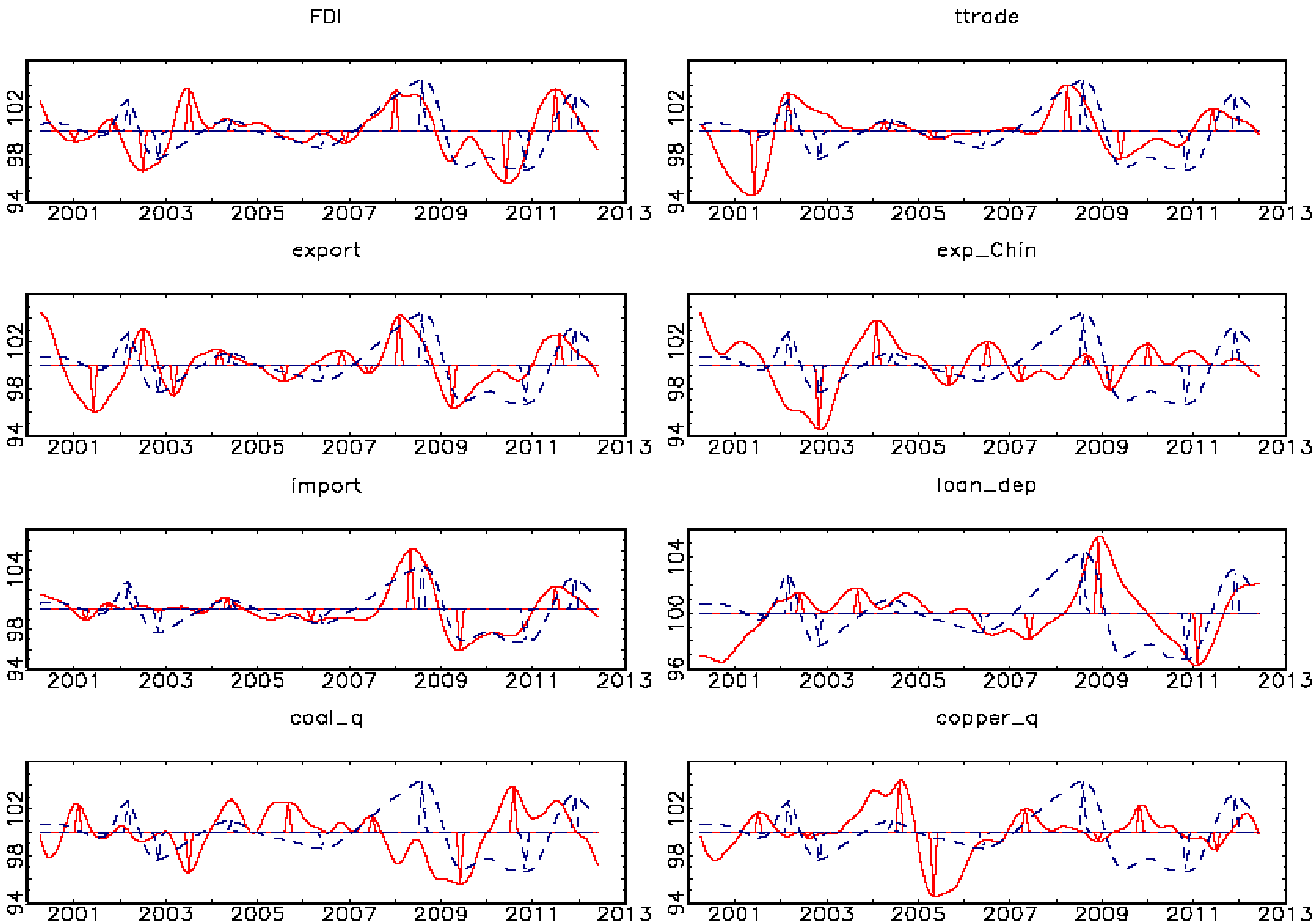


Figure 2. See Notes to Figure 1. The plotted are Foreign Direct Investments, total foreign trade, export, export to China, import, loan to deposit ratio, coal production and copper production.

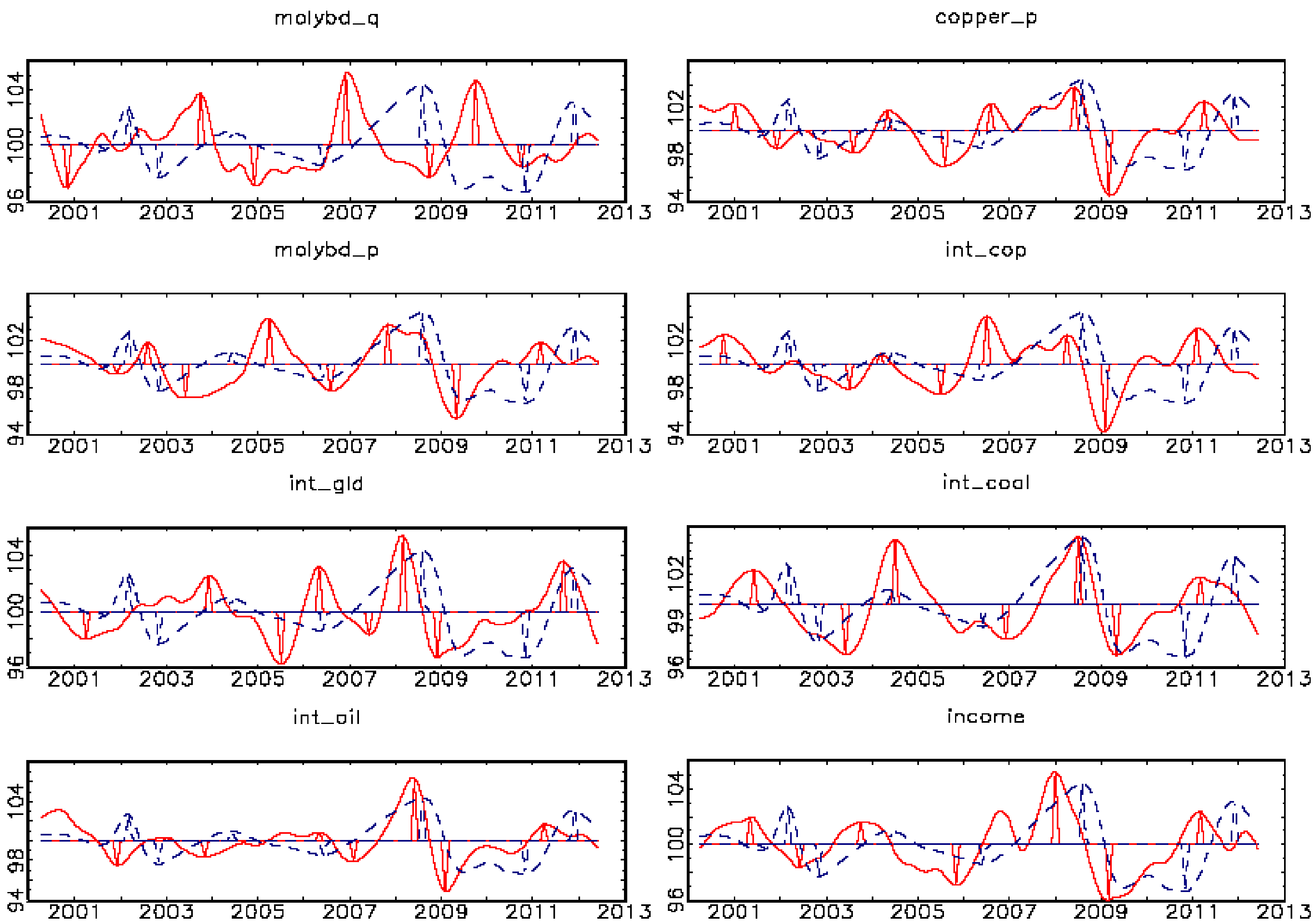


Figure 3. See Notes to Figure 1. The plotted are molybdenum production, export copper concentrate price, export molybdenum concentrate price, international copper price, international gold price, international coal price, international oil price and General government current income.

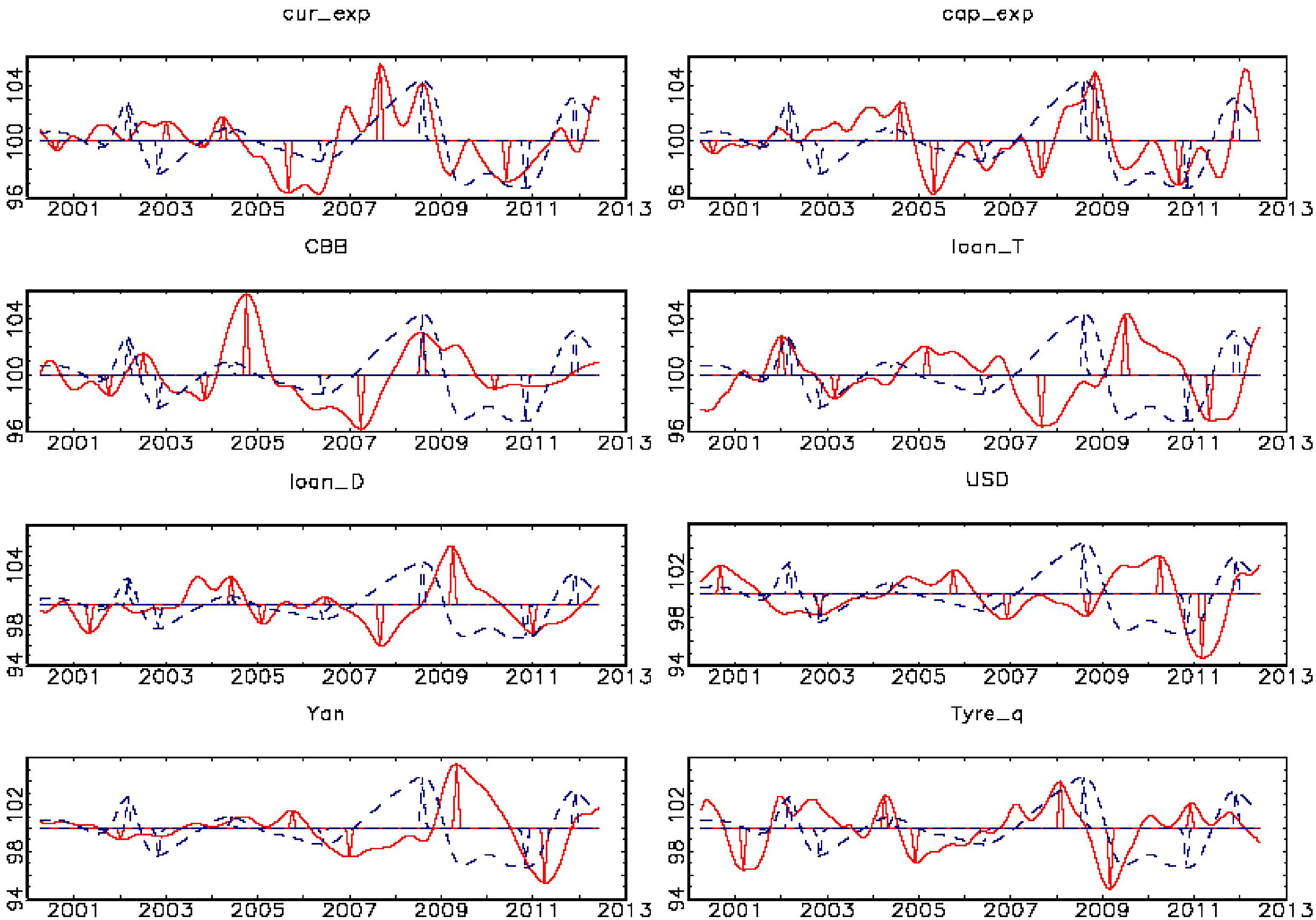


Figure 4. See Notes to Figure 1. The plotted are General government current expenditure, General government capital expenditure, Central Bank bill rate, commercial banks average MNT loan rate, commercial banks average foreign exchange loan rate, USD exchange rate (MNT/USD), Chinese Yuan exchange rate and imported tyre quantity.

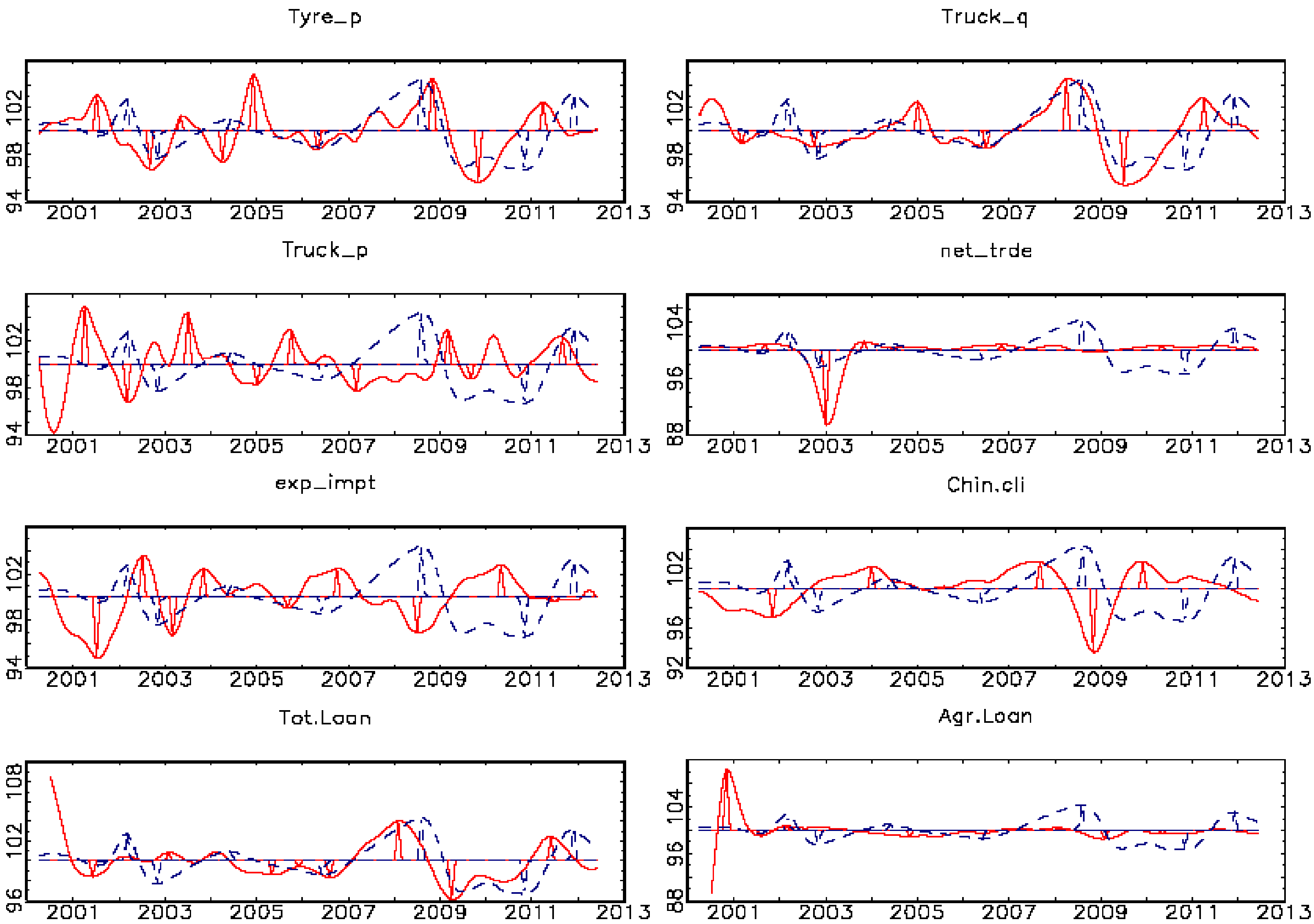


Figure 5. See Notes to Figure 1. The plotted are import tyre price, import truck quantity, import truck price, net trade (export minus import), export to import ratio, Chinese CLI (OECD), Total new loan and new agricultural loan.

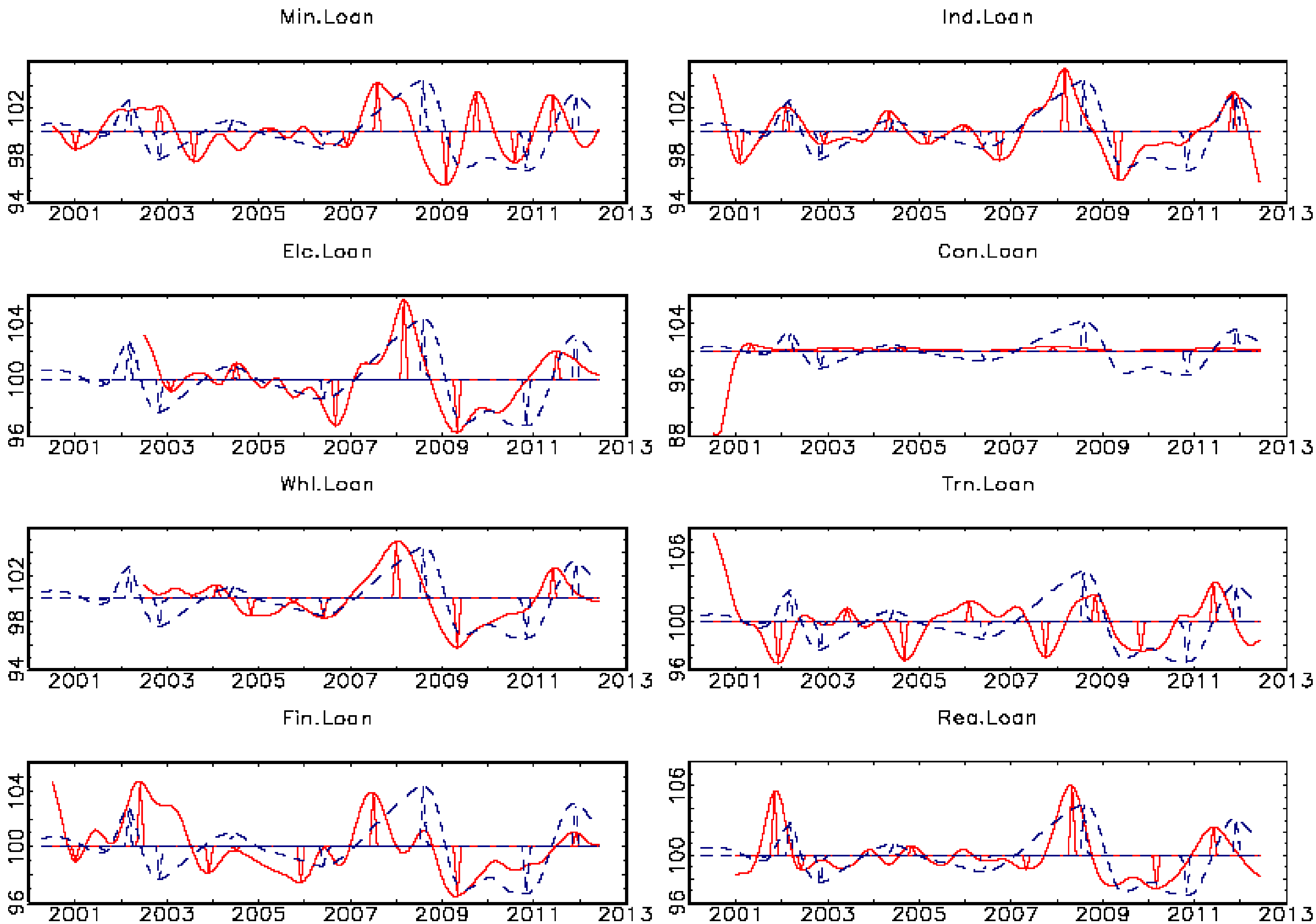


Figure 6. See Notes to Figure 1. The plotted are new mining loan, industrial loan, loans to electricity generation, consumer loan, wholesale and retail loan, new transport loan, new loans to financial sector and new real estate loan.

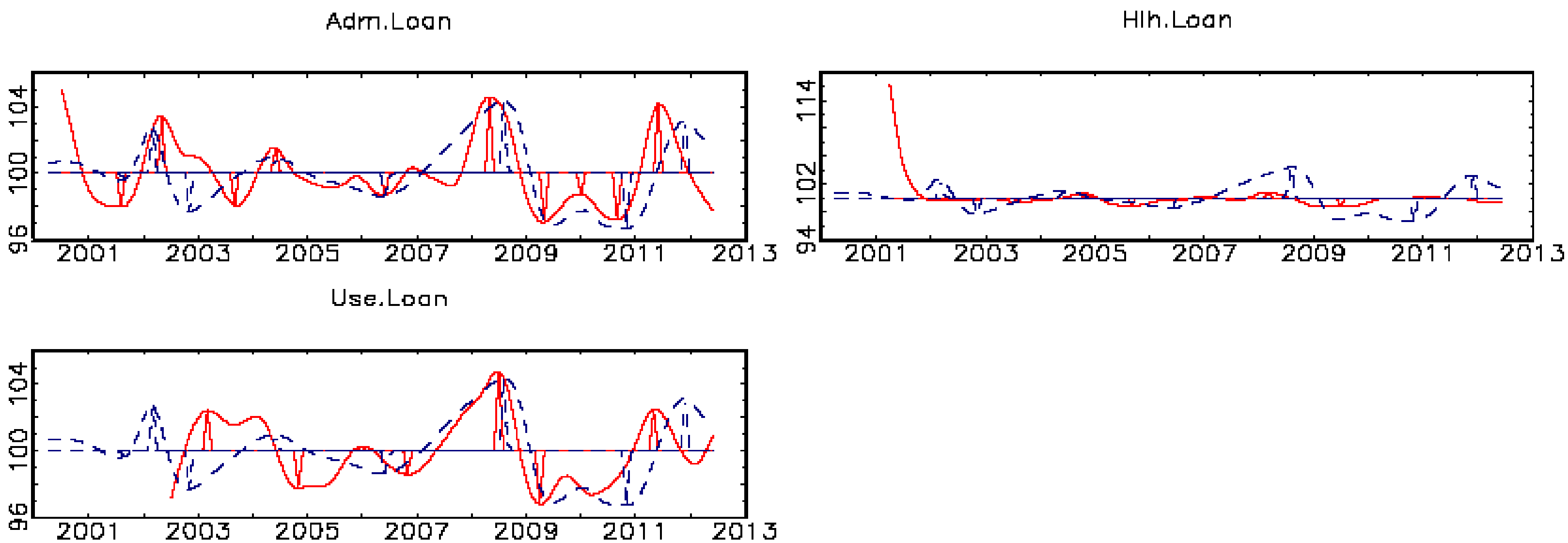


Figure 6. See Notes to Figure 1. The plotted are new loans to administrative service sector, new loans to health sector and new consumer loan.

Appendix 5. Current components in the CLI of the World countries

Australia (OECD) Dwelling permits issued (number) Orders inflow (manufact.): tendency (bs) (% balance) Production (manufacturing): tendency (bs) (% balance) Employment (manufacturing): tendency (bs) (% balance) Share price index (all industrials) (2000=100) Terms of trade (2000=100) Yield 10-year commonwealth government bonds (% per annum) Inverted	**Chile (OECD)** Production of copper sa (tones) Consumer confidence indicator – Retail trade sa (% balance) Production (manufacturing): tendency sa (% balance) Monetary aggregate: M1 sa (CLP) Share prices (2005=100) Net trade (f.o.b. - c.i.f.) sa (CLP)
Australia (Conference Board) building approvals, rural goods exports money supply stock prices yield spread sales to inventories ratio gross operating surplus	**Canada (OECD)** Deflated money supply (m1) sa (1995 cad) Housing starts large cities sa (number) USA business climate indicator (pmi) sa (normal=50) Consumer confidence sa (2000y) Spread of interest rates (% a.r.) Ratio of inventories to shipments (ratio), inverted Share prices (S&O/TSX composite index) (2005y)
Czech (OECD) BOP Capital account, debit (czk) Demand evolution (Services): future tendency (% balance) Production (Manufact.): tendency (%) CPI Harmonised All items inverted Consumer confidence indicator (% balance) ITS Exports f.o.b. total Share prices: PX-50 index (2005=100)	**Austria (OECD)** Production: future tend. (manufact.) (% balance) Order books: level (manufacturing) (% balance) Ifo business climate indicator for Germany (normal=100) Consumer confidence indicator (% balance) Unfilled job vacancies (persons) Spread of interest rates (% per annum)
Belgium (OECD) New passenger car registrations (number) Employment (manufacturing): future tend. (% balance) Export orders inflow (manufact.): tendency (% balance) Demand (manufact.): future tendency(% balance) Production (manufacturing): tendency(% balance) Consumer confidence indicator(% balance)	**Denmark (OECD)** Total volume of retail sales (2000=100) New passenger car registrations (number) Employment: future tendency (manufact.) (% balance) Production: future tendency (manufact.)(% balance) Official discount rate (% per annum), inverted Deflated money supply m1 (dkk) Petrol exports deflated by consumer price index (dkk) Consumer confidence indicator (% balance)
Estonia (OECD) Manufacturing - Export order books: level sa (% balance) Total retail trade (Value) sa (2005=100) Passenger car registrations sa (2005=100) CPI Food excl. Restaurants (2005=100) inverted Share prices: OMX Tallin index (2005=100 ITS Net trade (f.o.b. - c.i.f.) (Eur)	**Finland (OECD)** CPI All items (2005=100), Inverted Consumer confidence indicator(% balance) Spread of interest rates (% a.r.) Production tendency (manufacturing)(% balance) PPI Total (2005=100) Finished goods stocks (manufacturing)(% balance) **inverted** Share prices (HEX All Share index) (2005=100)
France (OECD) New passenger car registrations (number) Consumer confidence indicator (% balance) Production: future tendency (manufact.) (% balance) SBF 250 share price index (2005=100) CPI Harmonised All items (2005=100) **inverted** Export order books: level (manufact.) (% balance) Selling prices: future tendency (Construction) (% balance) its issued for dwellings (2005=100) PermExpected level of life in France (CS) (% balance)	**France (Conference Board)** yield spread building permits (residential) inverted new unemployment claims industrial new orders production expectations stock price index ratio of the deflator of manufacturing value added to unit labor cost in manufacturing.
Germany (OECD)	**Germany (Conference Board)**

Ifo business climate indicator (normal=100) Orders inflow/demand: tendency (manufact.) (% balance) Export order books : level (manufacturing) (% balance) Total new orders (manufacturing) (2000 = 100) Finished goods stocks: level (manufacturing)(% balance) inverted Spread of interest rates (% per annum)	yield spread inventory change gross enterprises and properties income stock prices new residential construction orders new orders in investment goods industries consumer confidence.
Greece (OECD) Cost of residential construction (2005=100), inverted Bank credit to the manufact. sector deflated(eur 2001) Services - employment: future tendency (% balance) Production: future tendency (% balance) Production of manufactured non-durable consumer goods (2000y) Volume of retail sales sa (2000y) Retail trade - volume of stocks: level (% balance), inverted Wholesale prices: all items (2005=100), inverted	**Hungary (OECD)** Production (manufacturing): future tendency (% balance) Unemployement registered (numbers) Monthly hours of work in manufacturing (hours) Money supply m1 (huf) Share prices: budapest stock exchange (2000=100) Central bank base rate (% per annum) Total imports c.i.f (huf)
Ireland (OECD) Value of exports to Northern Ireland (EUR) Exports: agricultural products to other EU Member States other than UK (EUR) Passenger cars registration (2005=100) Total PPI mining and quarrying activities (2005=100) ISEQ share price index (2005=100) Reel effective exchange rate based on CPI (2005=100), inverted Money supply M2 to Euro area (EUR)	**Israel (OECD)** Business confidence - all businesses - Expected net balance sa Total retail trade (Volume) (2005=100) Domestic PPI Manufacturing (2005=100) Share prices: The TA-Composite Index (2005=100) Tourism - Total Departures of Israelis sa (number) Exports in manufacturing - diamonds
Italy (OECD) Component Series (Unit) Consumer confidence indicator (% balance) Production: future tendency (manufacturing) (% balance) Deflated net new orders (2005 = 100) Order books: level (manufacturing) (% balance) CPI All items (2005=10) inverted Imports from Germany Cif (USD)	**Luxemburg (OECD)** OECD CLI for Germany (trend restored) OECD CLI for Belgium (trend restored)
Japan (OECD) Inventories to shipments ratio (mining and manufacturing) (2005=100) Inverted Ratio imports to exports (2000=100), Ratio loans to deposits (%) Inverted Monthly overtime hours (manufacturing) (2000=100) Construction: dwellings started (2000=100) Share price index (TOPIX) Tokyo (2000=100) Spread of interest rates (% annual rate) Small business survey: Sales tendency (% balance)	**Japan (Conference Board)** dwelling units started interest rate spread real money supply Tankan business conditions survey index of overtime worked six-month growth rate of labor productivity stock prices, (inverted) business failures real operating profits new orders for machinery and construction
Korea (OECD) Business situation (manufact.): future tendency (% balance) Share prices KOSPI index Stocks of total investment manufactured goods (volume)Inverted Inventory circulation indicator (manufacturing) Interest rate spread (3 year treasury bonds less overnight rate) Net Barter Terms of trade (2005=100) sa	**Korea (Conference Board)** Stock Prices Value of Machinery Orders Letter of Credit Arrivals Index of Shipments to Inventories Export FOB Yield of Government Public Bonds Private Construction Orders

Mexico (OECD) Monthly changes in manufacturing employment (%) Employment: tendency (manufact.) (BS) (% balance) Finished goods stocks: tendency (mfc.) (BS) (% balance) Inverted Production: tendency (manufacturing) (BS) (% balance) Yield >10-year US federal government securities (composite) (% per annum) inverted Cost managing deposits for banks (% per annum) inverted Real effective exchange rate (2000=100)	**Mexico (Conference Board)** stock prices net insufficient inventories US refiners' acquisition cost of domestic and imported crude oil (inverted) real exchange rate industrial production construction (inverted) federal funds rate
Netherlands (OECD) Order books: level (manufacturing) (% balance) Production: future tendency (manufact.) (% balance) Finished goods stocks: level (manufact. (bs) (% balance) inverted Orders inflow: tendency (manufact.) (% balance) Ifo business climate indicator for Germany (normal=100) Share prices: total index (2005=100)	**New Zealand (OECD)** Business situation (manufac.): future tend. (% balance) Consumer confidence indicator (% balance) Total retail sales (value) (nzd) Unemployed persons less than 1 month (persons) inverted Monetary aggregate m1 (2005=100) Yield of 90-day bank bills (% per annum) inverted
Norway (OECD) Exports to UK (USD) Stocks of orders for exports (manuf., mining, quarrying) (% balance) Production (manuf.): tendency (% balance) General judgement of the outlook for the enterprise in next quarter (manuf., mining, quarrying) (% balance) CPI All items (2005-100) Share price index (industrials) oslo (2005=100)	**Poland (OECD)** Real effective exchange rate (2000=100) Inverted Interest rate: 3-month wibor (% per annum) Inverted Production (manufacturing): tendency (% balance) Unfilled job vacancies (number) Production of coal (tonnes)
Portugal (OECD) Industrial production:electricity, gas & water (2005=100) Production:future tendency (manufact.) (% balance) Order books/demand:level (manufact.) (% balance) Export order books/demand: tendency (mfk) (% balance) Share prices: BVL general share price index Unfilled job vacancies (number)	**Slovak (OECD)** Confidence indicator (Retail trade) (% balance) Total retail trade (Volume) (2005=100) Expected economic situation (CS Consumer) (% balance) Share prices: SAX index Imports f.o.b. total (USD)
Slovenia (OECD) Manufacture Basic Metals sa (2005=100) Manufacturing - Order books: level sa (bs) (% balance) Production: tendency mfg. sa (bs) (% balance) CPI All items (2005=100) inverted EUR/USD exchange rate monthly average Expected economic situation sa	**Spain (OECD)** Rate of capacity utilisation (BTS manufact.) (% balance) Production of total construction (2005=100) CPI Services less housing inverted (2005=100) Share prices: IGBM general index (2005=100) Passenger car registrations (2005=100)
Sweden (OECD) 5-year government bonds yields (% p.a.) inverted Overtime hours worked mining & mfg. (%) new orders mining & mfg. sa (2005=100) Order books: level (% balance) Finished goods stocks: level (% balance) inverted AFGX share price index sa (2005=100)	**Switzerland (OECD)** Finished goods stocks: level (manufact.) (% balance) inverted Orders inflow: tendency (manufact.) (% balance) Production: tendency (manufacturing) (% balance) UBS 100 share price index (2000=100) Consumer surveys: expected economic situation sa Silver prices CHF/kj
Turkey (OECD) Production amount of electricity (gw hours) Finished goods stocks: level (manufacturing) (% balance) inverted new orders from domestic market: future tendency (manufacturing) (% balance) Employment: future tendency (manufact.)(% balance)	**UK (OECD)** Business climate indicator (% balance) new car registrations sa (number) Consumer confidence indicator sa (% balance) 3-month eligible bank bills (% p.a.) inverted Production: future tendency (% balance) Finished goods stocks: tendency (% balance) Inverted

Prospects for exports (manufacturing) (bs) (% balance) Discounted treasury auction interest rate (% per annum) inverted Imports of intermediate goods (usd)	FTSE-A non financial share price index (2000y)
USA (OECD) Dwellings started (number) Net new orders for durable goods (us dollar - million) Share prices: NYSE composite (2005=100) Consumer sentiment indicator (normal = 100) Weekly hours of work : manufacturing (hours) Purchasing managers index (BS) (% balance) Spread of interest rates (% per annum)	**USA (Conference Board)** Average weekly hours, manufacturing Average weekly initial claims for unemployment insurance Manufacturers' new orders, consumer goods and materials ISM Index of New Orders Manufacturers' new orders, nondefense capital goods excluding aircraft orders Building permits, new private housing units Stock prices, 500 common stocks Leading Credit Index™ Interest rate spread, 10-year Treasury bonds less federal funds Average consumer expectations for business conditions
Brazil (OECD) Share price index: all shares (2005=100) Manufacturing - Production: future tendency (BS) (% balance)) Manufacturing - Order books: level (BS) (% balance) Monetary Aggregate M2 inverted Discount rate inverted Net Trade (f.o.b. - f.o.b.) with EU	**India (OECD)** Industrial production of durable goods (2005=100) Prodcution of manufactured non metalic mineral products (2005=100) Passenger car sales (number) Monetary aggregate m1 (inr) Share prices: BSE dollex (2005=100) call money rate (% per annum) inverted
China (OECD) Production of chemical fertilizer (tonnes) Monetary aggregate m2 (cny) Production of manufactured crude steel (tonnes) 5000 Industrial Enterprises: Diffusion Index: Overseas order level (%) Production of buildings (m2) Production of motor vehicles (number) Shanghai Stock Exchange: Turnover (cny)	**China (Conference Board)** Total Loans Issued by Financial Institutions Enterprises Diffusion Index Raw Materials Supply Index NBS Manufacturing PMI Sub-Indices: PMI Supplier Deliveries Consumer Expectations Index Total Floor Space Started NBS Manufacturing PMI Sub-Indices: Export Orders
Indonesia (OECD) Share prices: jsx index (2005=100) Central Bank Discount rate (% per annum) inverted IDR/USD exchange rate (end of period) (idr/usd) inverted Producer Price Index/Wholesale Price Index (2005=100) inverted Consumer confidence index (normal = 100) Production of paper and paper products (2000=100) Production of paper and paper products (2005=100)	**Russia (OECD)** US imports from Russia inverted Order books: level (BS) (% balance) Share prices: rts index (2005=100) World market price of crude oil (2005=100) Production: trend observed in recent month (BS) (% balance) Assessment of export order books: present level (BS) (% balance)
South Africa (OECD) Orders inflow (manufacturing): tendency (% balance) Industrial confidence indicator (% balance) Permits issued: dwellings (2005=100) Sales of motor cars (2005=100) ShaShare prices: ftse/jse index (2005=100) Spread of interest rate (% per annum)	**Euro Area (Conference Board)** Economic Sentiment Index Index of Residential Building Permits Granted EURO STOXX Index Money Supply (M2) Interest Rate Spread Eurozone Manufacturing Purchasing Managers' Index Eurozone Service Sector Future Business Activity Expectations Index

Source: OECD and Conference Board.