

Tunisia – State of The Economy Index

TUN-SEI

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Acknowledgments of the Author

- ▶ To the best of my knowledge, this is the first attempt to construct a composite index of the state of the economy in Tunisia. This index is designed to signal any turning point (e.g., peaks and troughs) in the business cycle;
- ▶ I hope this project will endure over time and will become a reliable benchmark for those interested in monitoring the evolution of the Tunisian Business conditions as close to real time as possible;
- ▶ We are ready to share its outcome (i.e., monthly indicator of the business cycle in Tunisia) with everyone who wants to monitor the state of the business conditions in Tunisia, including, inter alia, Tunisian authorities, scholars, researchers, private entities, etc.

Acknowledgments of the Author (Cont.)

- ▶ I'm confident that the present project will lay the groundwork for future similar projects initiated by fellow Tunisians;
- ▶ It's never too late to catch up with best practices in advanced economies that have been implementing these kind of measures since the pioneering work of Mitchell and Burns (1938)...some 75 years ago!
- ▶ Last but not least, I'm grateful to the staff of the Reserve Bank of Philadelphia for sharing their internal data and for their valuable advice during the construction phase of this index .

Objective : Why a monthly index ?

- ▶ Construct a single indicator that captures all information contained in multiple macro and financial sub-indicators;
- ▶ Provide regular updates (monthly) on the economic activity to a large audience;
- ▶ Understanding the state of the economy is crucial to facilitate an informed decision-making process for government officials. Moreover, local and international investors need an anchor to elaborate their business forecasts and to make investment decisions;
- ▶ This type of index is often considered a “handy summary measure” of the business conditions;

Why a monthly index (Cont.)

- ▶ *“Real economic agents , making real decisions, in real time, want accurate and timely estimates of the state of real activity”* (Aruoba, Diebold and Scotti , 2009) ;
- ▶ Predict with minimal lag the phases of the business cycle; recession and recovery after removing any noise related for instance to seasonal or short term fluctuations;
- ▶ The reference indicator currently used in most developing countries (GDP data) to analyze economic activity and business cycle is insufficient ;



Why the GDP data is insufficient

- ▶ *“Since the GDP data is released with considerable lag and contains measurement errors and seasonal effects, constructing a smoother and timely indicator of the (..) business cycle can be good analytical and empirical tool for the policymakers and the business community” (Al-Hassan , 2009) ;*
- ▶ GDP data Only available with long lag (several quarters) ;
- ▶ Very often subject to multiple revisions afterwards which reduces its accuracy at the time of initial publication;
- ▶ Does not provide a timely snapshot (real time indicator) of where the economy is heading;

The importance of a the State of the Economy Index

(Literature Review)

- ▶ “Cyclical indicators receive regular press coverage and attention from economists because they tend to provide additional information on the direction of a business cycle” (Gaudrealut, Lamy and Liu, 2003)
- ▶ “Business cycle indicators should be able to describe cyclical economic development in a timely and accurate fashion (...) A composite indicator combines several individual indicators to summarize the economic condition in a single statistic” (Abberger and Nierhaus, 2011)
- ▶ “Business cycle indicator can be a valuable instrument for policy makers, since it would synthesize information coming from different sources and provide a clear signal as to the current business situation. Ideally, this indicator should exploit information on the correlation structure of many macroeconomic variables ” (Altissimo, Bassanetti, Cristadore, et al., 2001)



The importance of a the State of the Economy Index (Literature Review)

- ▶ The assessment of the financial conditions on an ongoing basis has become critical for policymakers, regulators, market financial participants, and researchers, who have increasingly worked to construct financial conditions indices that can be used as operational tools to better understand the macro-financial linkages” (Gumata, Klein and Ndou , 2012)
- ▶ Aggregate business conditions are of central importance in the business, finance, and policy communities worldwide, and huge resources are devoted to the assessment of the continuously evolving state of the real economy (Aruoba, Diebold and Scotti , 2009)
- ▶ A clear understanding of the state of macroeconomic activity is important to economic policy making. In light of this, government agencies, central banks and economic research institutes across the world are routinely producing indicators on the overall macroeconomic condition to be used to assess GDP growth in real time (Gerlach and Yiu, 2004)

What are the practices out there ?

- ▶ In contrast to developing countries, most advanced economies have routinely produced real time indicators to capture the business fluctuations (cycles);
- ▶ Indices are very often published by government agencies, universities, research institutes and multinational banks ;
- ▶ The United States, the European Union and other countries of the OECD are among the countries that heavily rely on the results of those coincident indicators to adjust their economic decisions;
- ▶ *“Literally thousands of newspapers, newsletters, television shows, and blogs, not to mention armies of employees in manufacturing and service industries, including the financial services industries, central banks, government, and non government organizations , grapple constantly with the measurement and forecasting of evolving business conditions”* (Aruoba, Diebold and Scotti , 2009)

Methodology for constructing the Tun_Se

- ▶ We follow numerous authors' (Stock and Watson (1989, 1991); Gaudreault, Lamy and Liu, (2003); Gumata, Klein and Ndou (2012); Al-Hassan (2009); Aruoba, Diebold and Scotti , (2009), Fukuda and Onodera (2001)) and government agencies' (Federal Reserve, BLS, OECD, European Union, IMF, etc..) methodology
- ▶ *“we work with a dynamic factor model, treating business conditions as an unobserved variable, related to observed indicators. Latency of business conditions is consistent with the economic theory, which emphasized that the business cycle is not about any single variable, whether GDP, industrial production, sales, employment, or anything else. Rather, the business cycle is about the dynamics and interactions (“co-movements”) of many variables”* Aruoba, Diebold and Scotti , 2009
- ▶ We estimate a state space model (Dynamic factor model) to analyze a set of monthly time series of cyclical indicators;
- ▶ We assume that the fluctuations of many macroeconomic variables are influenced by a common unobservable factor;

This **unobservable factor can be used as a proxy for the state of the economy**

- The present model is constructed as follows ;

$$\Delta y_{i,t} = \lambda_i + \gamma_i \Delta(\tau - Sei)_t + \mu_{i,t} \quad \text{Measurement Equation}$$

$$\Delta(\tau - Sei)_t = \Phi_1 \Delta(\tau - Sei)_{t-1} + \Phi_2 \Delta(\tau - Sei)_{t-2} + \dots + \Phi_p \Delta(\tau - Sei)_{t-p} + \eta_t \quad \text{State Equation}$$

$$\mu_{i,t} = \delta_1 \mu_{i,t-1} + \delta_2 \mu_{i,t-2} + \dots + \delta_{i,q} \mu_{i,t-q} + \vartheta_{i,t}$$

$\Delta y_{i,t} = y_{i,t} - y_{i,t-1}$ with $y_{i,t}$ is the macroeconomic indicator (i) at time (t). It's assumed to have two stochastic components; the common unobserved index and an idiosyncratic shock.

$\Delta(\tau - Sei)_t = (\tau - Sei)_t - (\tau - Sei)_{t-1}$ With $(\tau - Sei)_t$ is the common unobserved factor (the Tunisian State of the economy index) under study. According to the state equation we assume that $(\tau - Sei)$ follows an autoregressive process of order AR (p)

$\mu_{i,t}$ is an idiosyncratic shock that follows an AR (q) process and is uncorrelated with $\Delta (t-Sei)_t$ at all lags and leads.

$$E(\mu_{i,t}, \eta_t) = 0$$



- The model is then written in a state space form and estimated using the kalman filter (since the model is linear in the unobserved variable) to construct the Gaussian likelihood function and to estimate the unknown parameters by maximum likelihood ;

▶ (a) Measurement Equation

$$\begin{bmatrix} \Delta y_{1,t} \\ \Delta y_{2,t} \\ \Delta y_{3,t} \\ \Delta y_{4,t} \end{bmatrix} = \begin{bmatrix} \gamma_1 & 0 & 0 & 1 & 0 & 0 & 0 \\ \gamma_2 & 0 & 0 & 0 & 1 & 0 & 0 \\ \gamma_3 & 0 & 0 & 0 & 0 & 1 & 0 \\ \gamma_4 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \Delta t - Sei_t \\ \Delta t - Sei_{t-1} \\ \Delta t - Sei_{t-2} \\ \mu_{1,t} \\ \mu_{2,t} \\ \mu_{3,t} \\ \mu_{4,t} \end{bmatrix}$$

► State Equation

$$\begin{bmatrix} \Delta(t-Seq)_t \\ \Delta(t-Seq)_{t-1} \\ \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \\ \mu_{4t} \end{bmatrix} = \begin{bmatrix} \Phi_1 & \Phi_2 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \delta_t & 0 & 0 & 0 \\ 0 & 0 & 0 & \delta_t & 0 & 0 \\ 0 & 0 & 0 & 0 & \delta_t & 0 \\ 0 & 0 & 0 & 0 & 0 & \delta_t \end{bmatrix} \otimes \begin{bmatrix} \Delta(t-Seq)_{t-1} \\ \Delta(t-Seq)_{t-2} \\ \mu_{1,t-1} \\ \mu_{2,t-1} \\ \mu_{3,t-1} \\ \mu_{4,t-1} \end{bmatrix} \oplus \begin{bmatrix} \eta_t \\ 0 \\ \vartheta_{1t} \\ \vartheta_{2t} \\ \vartheta_{3t} \\ \vartheta_{4t} \end{bmatrix}$$

Which macroeconomic and business indicators to use (stepwise procedure)

- ▶ We used the economic theory as a first “screening tool” to select a set of relevant benchmark variables;
- ▶ Given the limited availability of highly frequent business related indicators in Tunisia (e.g., weekly job data, retail sales, housing starts, manufacturing shipments, etc..), we selected only monthly time series which are released with only a gap of 2 months on average;
- ▶ Like other small open economies, the business cycle in Tunisia is influenced by fluctuations of both internal and external sectors;

Which macroeconomic and business indicators to use (stepwise selection procedure) (Cont.)

- ▶ While larger set of time series was initially tested, we decided to include for the final analysis only 4 macroeconomic indicators we consider reliable, timely available, frequent and contain relevant information about the economic activity;
- ▶ The selected indicators are found to be greatly influenced by the current state of the economy. They cover real sector, financial sector, trade sector and foreign exchange market.
- ▶ The data used to construct the present model is monthly data and spans over a period from Jan-1994 to the present (*note:* latest time series are usually released with a lag of 2 months)

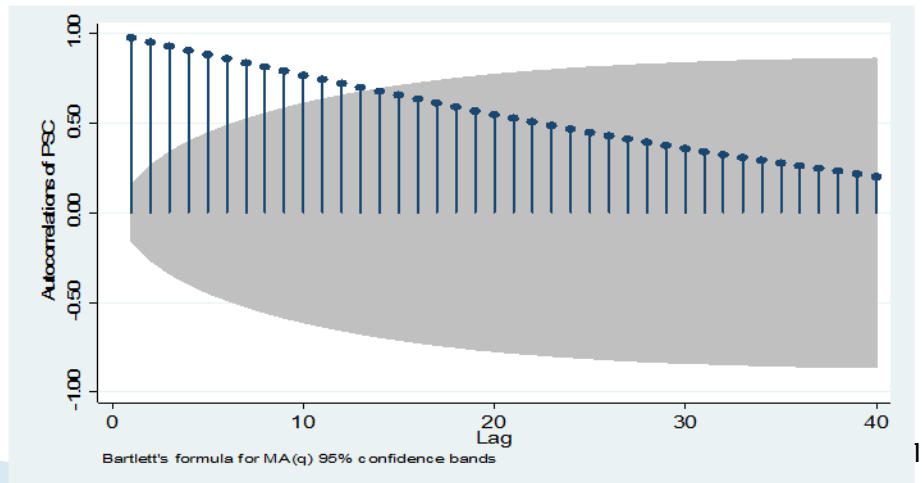
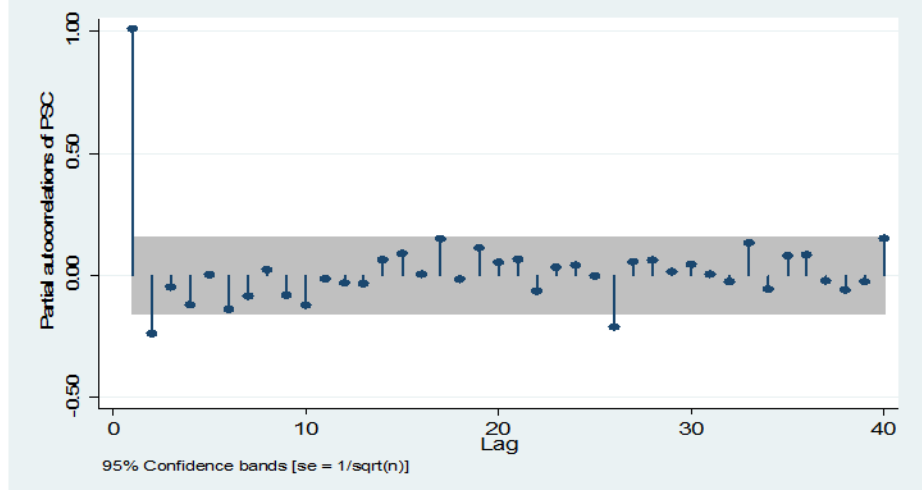
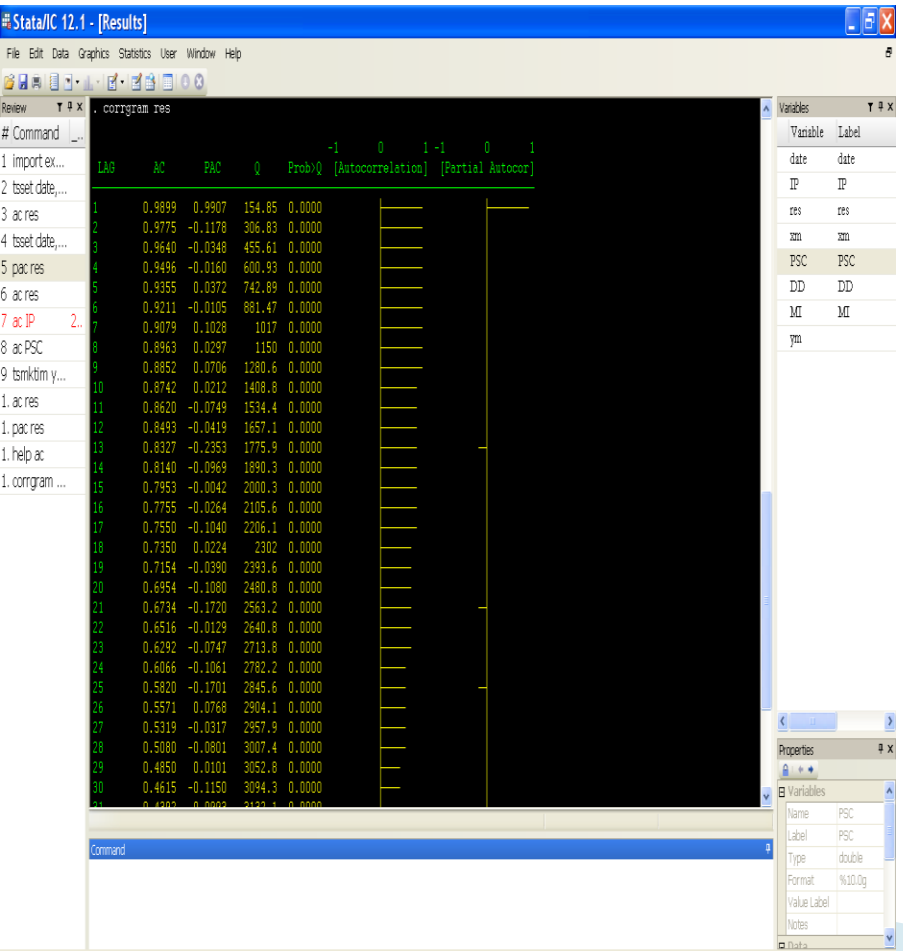


Key Components of the Tun-Sei

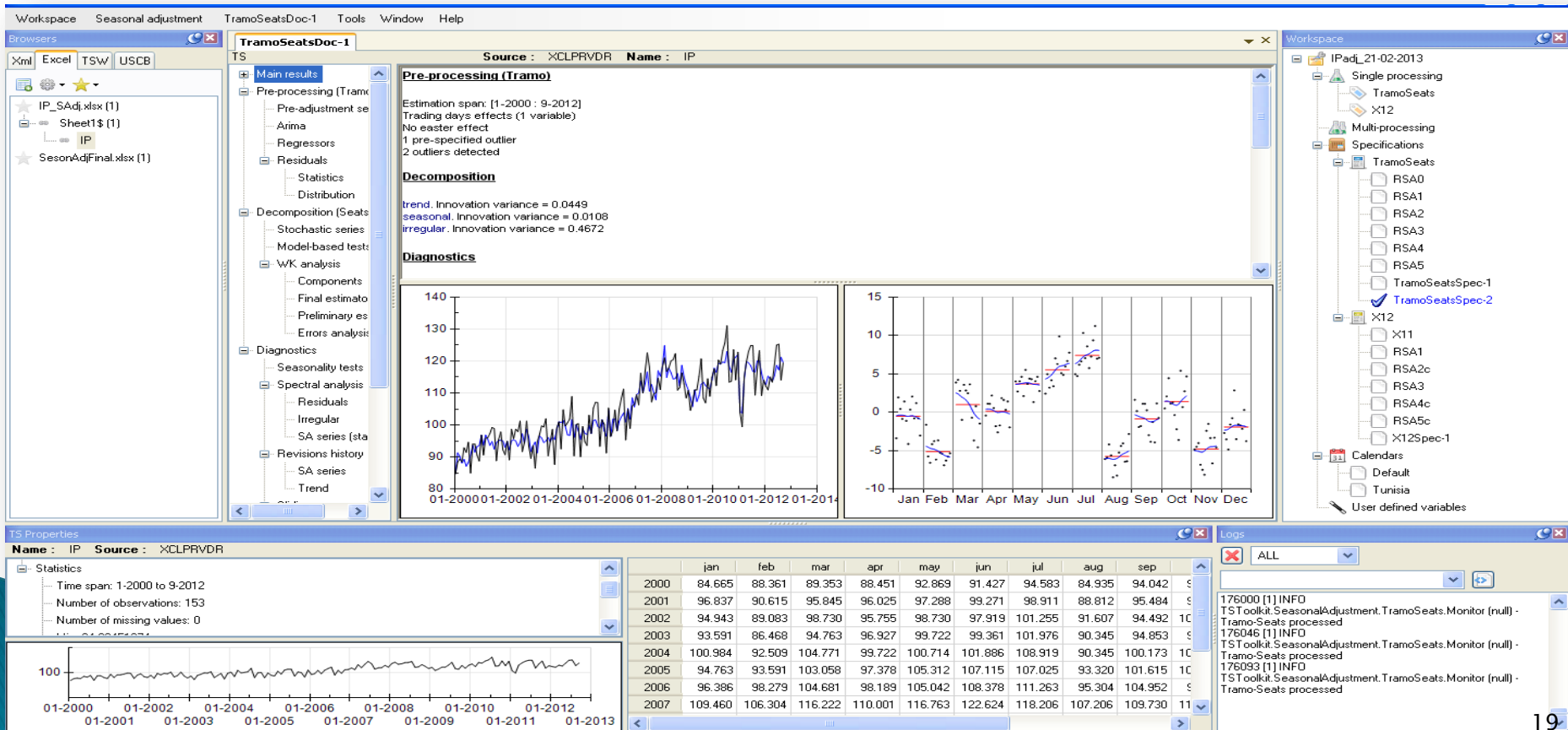
- ▶ Following the procedures and constraints outlined in the previous slides, we identified 4 benchmark indicators which provide valuable information about the current position of the economic activity in Tunisia within the business cycles ;
- ▶ More importantly, such indicators are expected to provide useful insight into where the economy is heading by detecting potential turning points, ie., peaks and troughs;
- ▶ The four variables compiled to construct the Tun-Sei are;
 - ▶ (a) **Index of Industrial Production**
 - ▶ (b) **Total Volume of Exports**
 - ▶ (c) **Foreign Currency Reserves**
 - ▶ (d) **Private sector claims (Bank loans)**

- ▶ While the selected indicators should give us a fair estimate of the state of the economy, we look forward to including more business cycle oriented indicators as they become available in the country;
- ▶ Monthly unemployment rates, retail/Wholesale, real estate construction, property price index, personal income, employees on Non-Agriculture payrolls are among the potential candidates for the inclusion in this index in the future as they start to be released on highly frequent basis;

- Multiple preliminary analyses were carried out to study each time series and to determine the optimal transformation and smoothing approaches (e.g., Ar(.), Unit root test, first difference filter, log, demean, etc..)



All series were seasonally adjusted (SA) using Standard International techniques of SA (CENSUS-X-12AARIMA or TRAMO/SEATS) by the author as the data compiled by the Tunisian authorities and disseminated by the international Organizations remain unfortunately non seasonally adjusted.



(a) Industrial production Index

- ▶ Most widely used indicator to construct composite coincident index. Its correlation with the GDP growth is often found to be the highest among all other business conditions indices;
- ▶ Provide full and accurate picture of trends in the output of the industrial sector;
- ▶ As Al-Hassan (2009, 25) points it out :“ *Since the level of industrial production is a narrower measure of the overall aggregate economic activity, the direction and timing of industrial production tend to coincide with the reference cycle*”

(b) Exports

- ▶ Like other small and open economies, many local businesses in Tunisia rely heavily on foreign markets to market their production;
- ▶ Textile, raw materials and certain agricultural products constitute the bulk of the exports volume in the country. These products represent the main added value created by the economy.
- ▶ Trade balance, foreign currency reserves and ultimately GDP growth depend to a large extent on the competitiveness of local firms and their ability to survive in very demanding international markets;
- ▶ Exporting companies remain the major actor in the domestic labor market as demonstrated by the size of the workforce they employ in this sector .

Claims on Private sector

- ▶ Unlike other more advanced economies, in Tunisia, bank loans play a major role in financing internal investments;
- ▶ Bank loans remain a key transmission channel through which local authorities try to influence and/or react to business conditions fluctuations;
- ▶ The recent global financial crises have demonstrated the importance of the credit market behavior as an indicator of the financial sector's and ultimately the economy's health;
- ▶ Numerous empirical studies have shown the close correlation that exist between the bank lending conditions and the weakness/strength of the financial sector

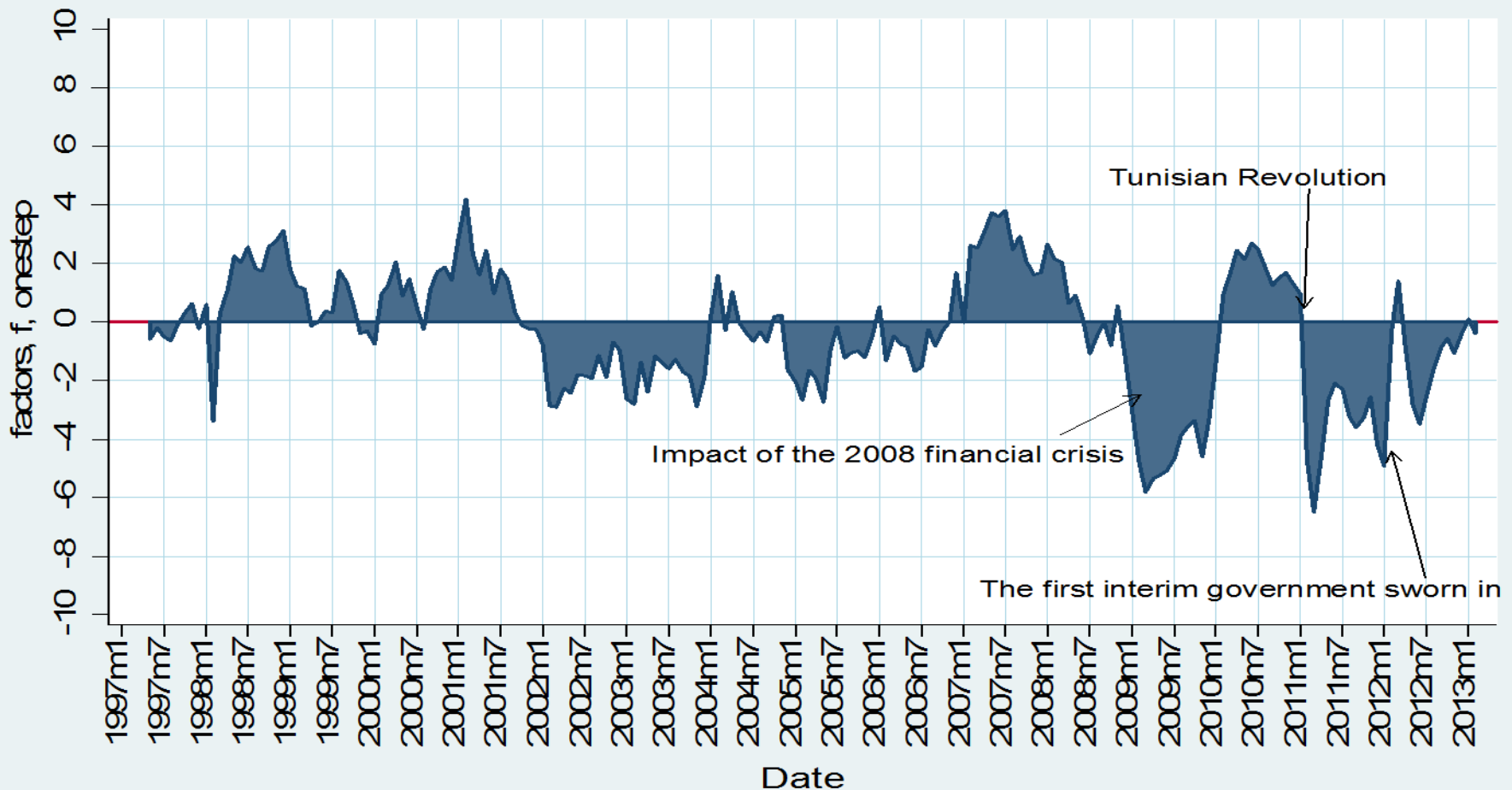
Claims of Private Sector (cont.)

- ▶ Very often the expansion phase of the business cycle is accompanied by a boom in the credit market which helps finance the investment decisions as domestic agents start making favorable expectation about recovery and business conditions outlook.
- ▶ By contrast, periods of credit rationing (steep fall of credit growth) describe often the contraction phase of the business cycle as financial institutions develop gloomy expectations about the future trend of the economy and as the risks of borrower's defaults surge

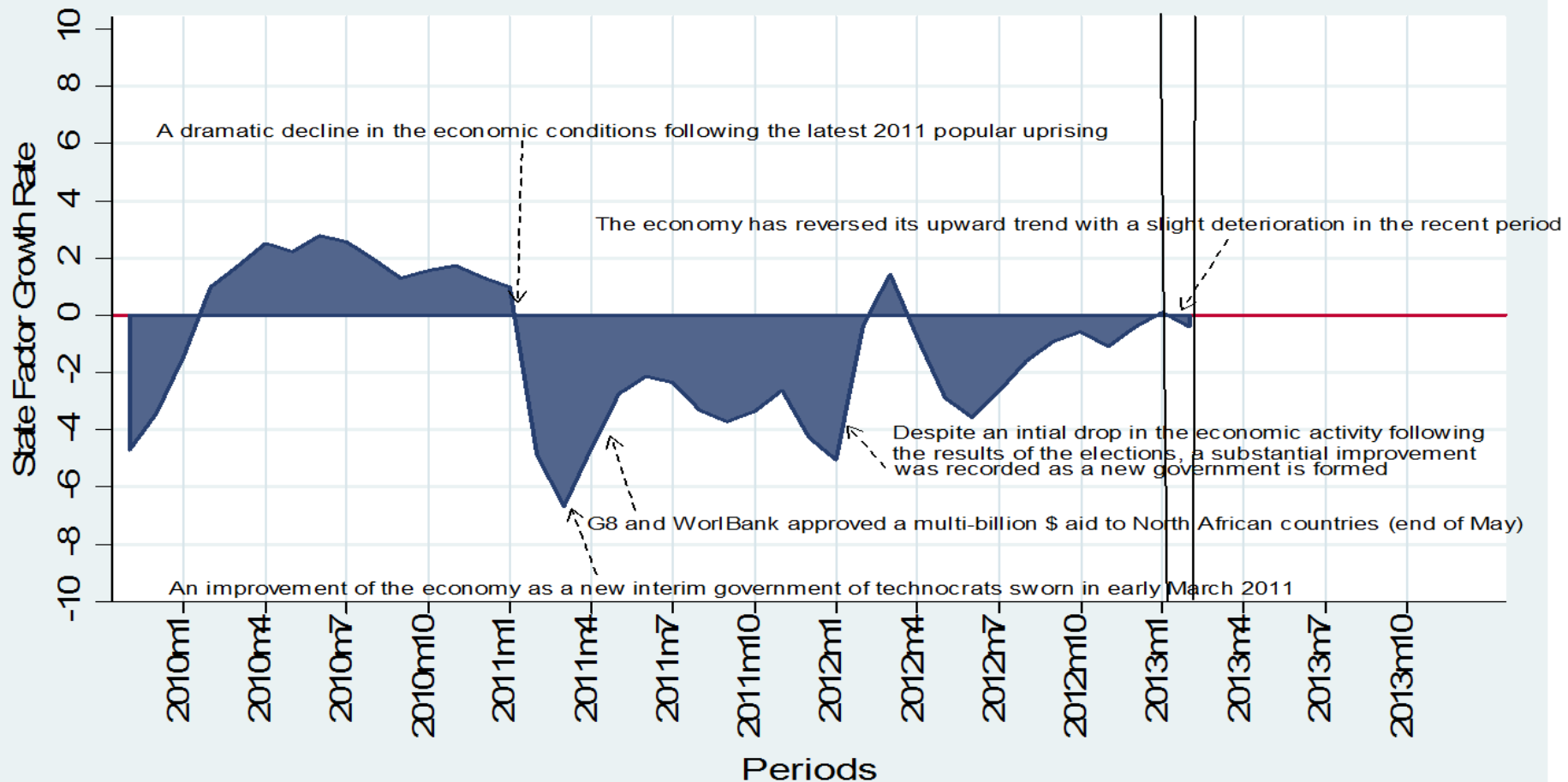
International Reserves

- ▶ International Reserves are used for multiple purposes, e.g., transaction demand, precautionary motives, collateral asset argument and mercantilist behavior.
- ▶ Empirical studies have demonstrated that the adequacy of the international reserve levels remain a critical factor to promptly respond to any external shocks that could occur through the trade channels particularly in difficult economic conditions. This indicator is a fundamental determinant of external sustainability.
- ▶ As recent experiences have shown, a high level of international reserves can play a major role to immune countries from recurrent risks of capital flows volatility (e.g. capital flight) particularly in those economies that rely heavily on external sources to finance debt services, FDI or portfolio investments.
- ▶ As a component of the Net Foreign Assets, international reserves can be used as a measure of foreign investor's confidence in the fundamentals of the economy.

- ▶ LT movement of the Tun-Sei since 1997. The index seems to be evolving in a cyclical trend (as expected) around its long run equilibrium (*steady state*) as represented by the 0 in the Y-axis

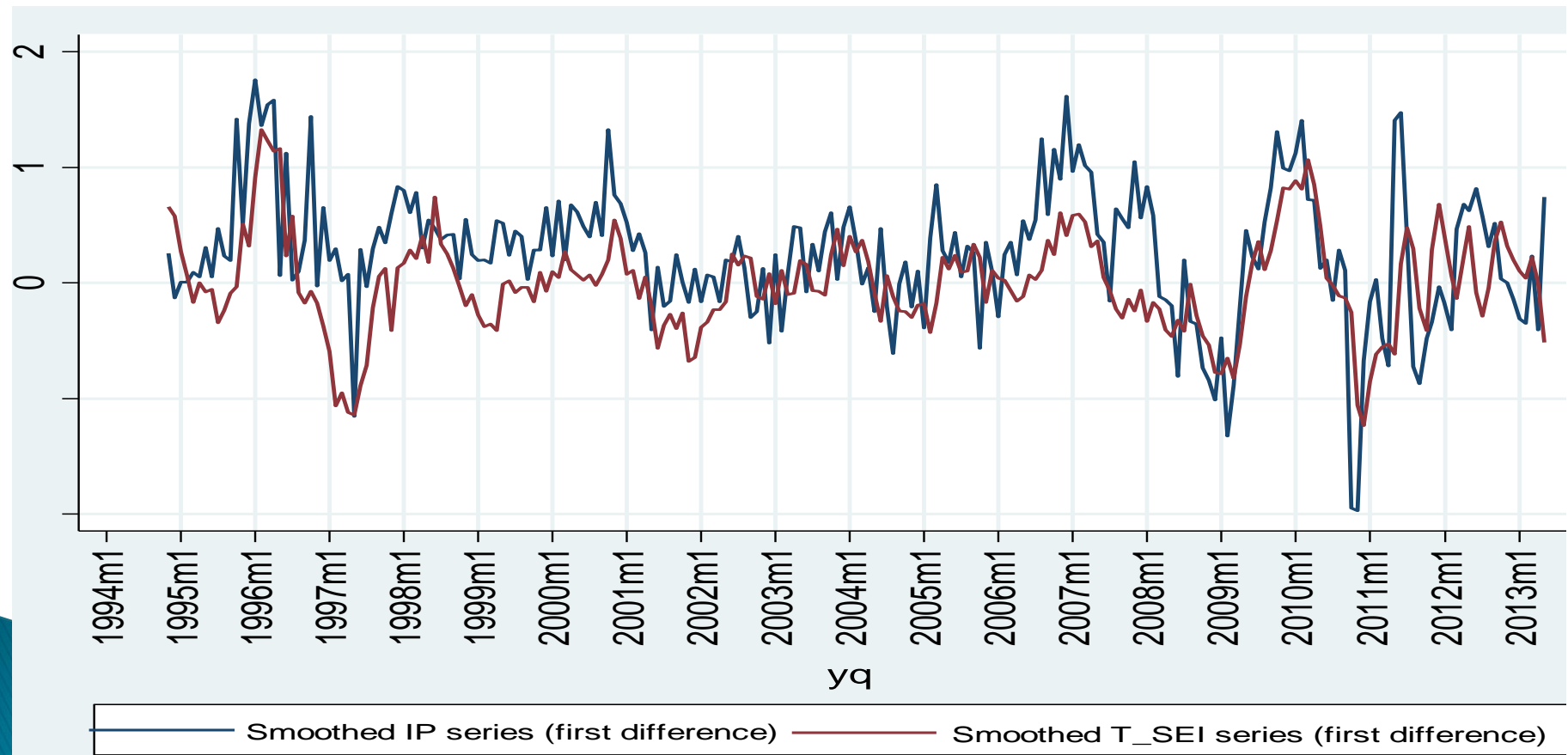


- ▶ The chart below plots the movement of T-Sei over the last three years. As seen, the index appears to react instantly to the major political and economic events that occurred during the last period in particular since the revolution.





As we can see in the chart below the State factor series (T-Sei) has evolved, over the period under consideration, very close (despite some sporadic deviations) to the major indicator of the economy (i.e., industrial production). Overall, our index has captured most of the turning points in the business cycle of the Tunisian business cycle.



Concluding remarks

- ▶ This is a first attempt toward constructing a robust and reliable index capturing the state of the economy/business conditions in Tunisia;
- ▶ This index is by no means a final or a cast-in-stone product;
- ▶ On the contrary, such a product will be constantly subject to revisions and improvements particularly in terms of adding new coincident indicators of the business cycle, as they become available;
- ▶ Our goal is to ensure that this index is released toward the end of each month . Each update should reflect the latest information available for all indicators that are used for its construction.
- ▶ Additional interpretations of the latest trend will also be provided to help explain the recent movement of this index;
- ▶ We welcome all suggestions and remarks aiming at improving this output;
- ▶ We hope that others could build upon this work to produce more creative outputs using similar innovative approaches .

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