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A REAL ECONOMIC ACTIVITY INDICATOR FOR TURKEY

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ABSTRACT This paper presents a monthly indicator of real economic activity for historical accounting and real-time monitoring of business cycles in Turkey. Business conditions, an unobserved component implied by the interaction and co-movement of various macroeconomic variables, are related to a number of observables at multiple frequencies and estimated within a dynamic factor model. We introduce a recession indicator and thereby compare the severity of turbulence/crisis periods during 1987-2011. High degree of uncertainty embodied in the end-of-sample factor estimates complicates real time detection of recessions and thus points to the need for timely information in a forward-looking policy framework.
JEL C01, C22, E32, E37
Keywords Business cycle, Expansion, Contraction, Recession, Dynamic factor model, Unobserved component, State space model, Macroeconomic forecasting, Real-time analysis

ÖZ Bu çalışmada, Türkiye'de iş çevrimlerinin tarihsel muhasebesinin yanı sıra gerçek-zamanlı analizi için düzenli olarak güncellenebilecek aylık bir reel iktisadi faaliyet göstergesi türetilmiştir. Birçok makroiktisadi değişkenin etkileşimi ve ortak hareketini yansıtan iş çevrimleri gözlenmeyen bir bileşen olarak tanımlanmış ve farklı frekansta gözlenen bir grup değişken ile ilişkilendirilerek bir dinamik faktör modeli çerçevesinde tahmin edilmiştir. Faktör tahmini kullanılarak bir durgunluk göstergesi oluşturulmuş ve 1987-2011 arasında yaşanan çalkantı/krizler derinlik itibarıyla karşılaştırılmıştır. Örneklem sonlarının yüksek belirsizlik içermesi durgunluk dönemlerinin gerçek-zamanlı tespitini zorlaştırırken, ileriye dönük politika uygulamasında zamanlı bilginin önemini ortaya koymuştur.
TÜRKİYE İÇİN BİR REEL İKTİSADİ FAALİYET GÖSTERGESİ
JEL C01, C22, E32, E37
Anahtar Kelimeler İş çevrimi, Genişleme, Daralma, Durgunluk, Dinamik faktör modeli, Gözlenmeyen bileşen, Durum uzay modeli, Makroiktisadi tahmin, Gerçek-zaman analizi

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1. Introduction

Indicators of business cycles are of great interest to policy makers, businesses and academics. Trends in economic activity emerge as a critical input for decision making in inflation-targeting regimes based on demand and expectations management. An accurate interpretation of the economic outlook and market conditions with respect to current and prospective trends necessitates the estimation and measurement of expansion, contraction, overheating, and slowdown phases of the business cycle. However, summarizing business conditions with a single indicator is clearly not sufficient. For instance, while real gross domestic product (GDP) is a widely followed economic indicator, it does not provide a full picture of some aspects of real activity such as the labor market. According to Lucas (1977) business cycles are all about the interaction and co-movement of several variables instead of being represented by a single measure of activity. From this point of view and consistent with economic theory, identifying business cycles by a factor that is the underlying driving force for many economic indicators seems to be right approach.

In this study, business conditions are modeled as an unobserved variable and related to a number of observables. A dynamic factor model is used for the estimation and extraction of a factor that reflects the common behavior of key macroeconomic variables such as GDP, industrial production and employment. The innovative aspect of the methodology is the flexibility of including variables in the model at multiple frequencies. This allows incorporating high frequency data in the analysis, which is crucial for decision makers in need for timely information. Considering the characteristics peculiar to the Turkish economy as well as the limitations on data availability, we produce a real economic activity indicator at monthly base frequency. The inclusion of high frequency data along with quarterly GDP allows our methodology to produce up-to-date information on economic outlook.

The main motivation of this study is the absence of a commonly-agreed on real activity indicator for Turkey, not only to make an objective historical account of business cycles but also to monitor in real-time with regular updates. The practical success of the Aruoba, Diebold and Scotti (2009) index in capturing the business cycles of the US economy as well as providing policy makers timely information about the state of the economy provides the basis for this study. Besides, most of the existing studies on the Turkish economy suffer from data limitations, thus perform poorly in

capturing the business cycles of the entire economy. While data on the industrial sector is widely available, the absence of long time series on other sectors is a major problem confronted by analysts. Against this background, we estimate a composite indicator for real economic activity in Turkey by using GDP, industrial production, imports of intermediate goods, electricity production and employment data.

In the next section we introduce the model and methodology with detailed explanation of our framework allowing the inclusion of variables at multiple frequencies. Section 3 describes the data set in detail and Section 4 contains empirical findings and interprets our estimated indicator from a historical perspective of Turkish business cycles. Section 5 concludes with general remarks and policy implications.

2. Model and Methodology

Construction of our real activity indicator for Turkey is based on the work of Aruoba, Diebold ve Scotti (2009). They develop a methodology that allows us to assess economic outlook in a systematic and timely manner and in a statistically optimal way. It is based on four principles: First, business conditions are modeled as an unobserved variable that influences all observed variables and are extracted using a dynamic factor model. Second, the proposed framework enables us to use observed variables of multiple frequencies. Third, in order to improve the timeliness of our indicator, we include high-frequency observables in our analysis. Finally, the latent business conditions indicator is extracted using a linear and optimal filter. In short, this approach provides a flexible way of handling problems like missing observation, unbalanced sample and multiple frequencies.

2.1.A Dynamic Factor Model at Monthly Base Frequency

While economic conditions change at any moment (hourly, daily, etc.), economic data cannot be observed at such high frequencies. Most macroeconomic variables are observed at lower frequencies such as weekly, monthly or quarterly. We assume that business conditions evolve at the highest possible frequency, which, in the present paper, is monthly.

Let x_t denote unobserved business conditions, the latent factor, at month t. The unobserved factor evolves according to the transition equation

$$x_t = \rho_1 x_{t-1} + \rho_2 x_{t-2} + \rho_3 x_{t-3} + \eta_t \quad (1)$$

where $\eta_t \sim N(0, \sigma_\eta^2)$ and $(\rho_1, \rho_2, \rho_{3,} \sigma_\eta^2)$ are such that $\sigma_x^2 = 1$. This allows for the units of the factor to be interpreted as standard deviations from the mean.

The vector of observables, all expressed as annualized growth rates, are denoted as $\hat{y}_t^i$. These variables are related to the unobserved factor linearly. For i-th monthly variable, the measurement equation is

$$\hat{y}_t^i = c^i + \beta^i x_t + \varepsilon_t^i \tag{2}$$

where ε_t^i is an idiosyncratic component that follows

$$\varepsilon_t^i = \gamma_1^i \varepsilon_{t-1}^i + \gamma_2^i \varepsilon_{t-2}^i + \gamma_3^i \varepsilon_{t-3}^i + v_t^i \tag{3}$$

with $v_t^i \sim N(0, \sigma_{v^i}^2)$.

Since GDP is used as a growth rate, it is a flow variable where the quarterly variable is approximately the sum of its (unobserved) monthly counterparts. Hence, the measurement equation for GDP will be the sum of the right hand side of (2) and will be given by

$$y_t^i = \begin{cases} \sum_{j=0}^{2} \hat{y}_{t-j}^i = 3c^i + \beta^i (x_t + x_{t-1} + x_{t-2}) + (\varepsilon_t^i + \varepsilon_{t-1}^i + \varepsilon_{t-2}^i) & if\ y_t^i\ is\ observed \\ NA & otherwise \end{cases} \tag{4}$$

For employment, in periods where monthly data are available we use (2). In periods where only quarterly data are available, we use

$$y_t^i = \begin{cases} \sum_{j=0}^{2} \hat{y}_{t-j}^i = c^i + \frac{\beta^i}{3} (x_t + x_{t-1} + x_{t-2}) + \frac{1}{3}(\varepsilon_t^i + \varepsilon_{t-1}^i + \varepsilon_{t-2}^i) & if\ y_t^i\ is\ observed \\ NA & otherwise \end{cases} \tag{5}$$

since all growth rates are annualized and quarterly data are essentially the average of monthly data. Note that we divide certain terms by 3 to ensure the monthly and quarterly measurement equations are consistent.

2.2. State Space Representation and Estimation

State-space form of the model is

$$\alpha_{t+1} = T\alpha_t + Ru_t \tag{6}$$

$$y_t = c + Z\alpha_t, \tag{7}$$

where α_t stands for the state vector including x_t, ε_t, and their lags, y_t denotes the vector of observables, u_t represents the shock vector including η_t and v_t, c shows the constant term vector and $\mathcal{T}$ defines the sample size for $t = 1, \ldots, \mathcal{T}$. The shock vector is distributed as $u_t \sim (0, Q)$.

Once the model is cast in state space form standard tools are used: Kalman filter with the forecast error decomposition and maximum likelihood to estimate the model and Kalman smoother to obtain an estimate of the factor.

3. Data

The analysis covers the period of 1987-2011. The estimation of the factor is based on four monthly variables (industrial production, electricity production, imports of intermediate goods, employment) and the quarterly GDP series.

Industrial value added constitutes almost one-third of national income in 2010. Once inter-industrial linkages with related sectors (wholesale and retail trade, transportation and communication, etc.) are taken into account, industrial sector accounts for more than half of the total value added in the Turkish economy. Industrial production index is a natural candidate for this analysis not only for its wide coverage, but also due to its timely release schedule. In addition, the well-known import intensity of the production process in Turkey, leads us to add imports of intermediate goods to our analysis. While these two variables will proxy industrial activity, the need for representing other segments of the economy brings the electricity production, GDP and employment variables in the analysis. Once again, electricity production is selected due to its historical availability and its timeliness. On the other hand, GDP and employment variables stand out with their comprehensiveness as being key macroeconomic indicators with the broadest scope at sectoral basis.[1]

Table 1. Data Definitions

Variable	Sources	Frequency	Sample	Definition
Electricity Production	TETC	Monthly	1985-1/2011-3	Single series
Industrial Production	TURKSTAT	Monthly	1986-1/2011-3	Three series (1992, 1997, 2005)
Intermediate Good Imports	TURKSTAT	Monthly	1994-1/2011-3	Two series (1994, 2003)
Employment	TURKSTAT	Monthly Quarterly	2005-1/2011-3 2000-1/2004-4	Single series Single series
GDP	TURKSTAT	Quarterly	1987-1/2011-1	Two series (1987, 1998)

All variables are obtained from their official sources and then adjusted for seasonal and calendar effects using the Tramo/Seats method and converted to annualized monthly/quarterly growth rates.[2] Since we use growth rates, changes in base years and/or methodology are handled by simply combining

[1] Similar studies use retail sales as well. Although qualitative information embodied in various survey indicators for sales is available, we chose to avoid complications with interpreting survey-based data.

[2] Seasonally and working day adjusted data for 1998-based GDP and 2005-based industrial production index are officially published by Turkish Statistical Institute (TURKSTAT). However, as the data set in this study is constructed by combining series with different base years, seasonal adjustment process is conducted by the authors.

the data and inserting a missing observation for the period of conversion. In particular, 2005-based industrial production index was iterated backwards with the monthly growth rates of 1992 and 1997-based indices. Similarly, imports of intermediate goods data were constructed by merging 1994 and 2003-based indices, while 1987 and 1998-based national income data are linked to generate the whole GDP series. Electricity production has been announced since 1985 with no changes in methodology and has not been subject to any modification.

Building the employment data has not been straightforward due to major revisions in coverage and methodology.[3] For the period 2000-2004, the employment series is available at a quarterly base frequency and we use quarterly growth rates. For the period 2005-2011, the data is released as a three-months moving average.[4] Thus, once we know two initial months, we can deduce monthly information. We interpolate the last quarter of 2004 and the first quarter of 2005 to extract monthly data for December 2004 and January 2005.

The list of variables used in the analysis is in Table 1. We choose an estimation sample where at least three variables are available. Hence, the factor estimates are based on GDP, industrial production and electricity production for the period of 1987-1993. The power of the model in representing the economy as a whole is extended by introducing intermediate goods imports and employment series in the system starting from 1994 and 2000 respectively.

4. Estimation Results

In this section, we discuss the real economic activity indicator estimated through a five-variable system. We also replicate the estimation procedure by excluding the GDP, in order to assess the performance of the four-variable factor in tracking economic activity. Finally, we evaluate the success of factor estimates in tracking historical recessions as well as detecting them in real-time.

4.1. Historical Perspective

The common factor extracted as explained above can be thought of an indicator of economic activity. Figure 1 demonstrates the factor estimate with black line and standard error bands for 95 percent confidence interval

[3] Base frequency for employment data is semi-annual for 1989-1999, quarterly for 2000-2004 and monthly since 2005. We do not use the data before 2000.

[4] For instance February data for employment cover January-February-March period and March data cover February-March-April period. As such, one needs at least two initial points to extract monthly information from this moving average form.

with red lines. The values of the indicator above (below) zero indicate expansion (contraction) periods, whereas absolute values give information on the rate of expansion (contraction). A stable course of the index in the same direction clarifies the picture about the phase of the business cycle. A prolonged movement below zero signals a contraction phase for the economy, while a sustained movement in the positive territory signifies a solid growth episode. Hence, when interpreting the severity of an economic crisis one should take into account for how long the index level is sustained below zero, rather than solely focusing on the index value itself. At this point, the width of the grey shaded areas will be a useful guide for the assessment of past turbulence/recession episodes. The criteria for deciding whether a period corresponds to a turbulence/crisis episode will be introduced in the following sections.

Figure 1. Economic Activity Indicator for Turkey

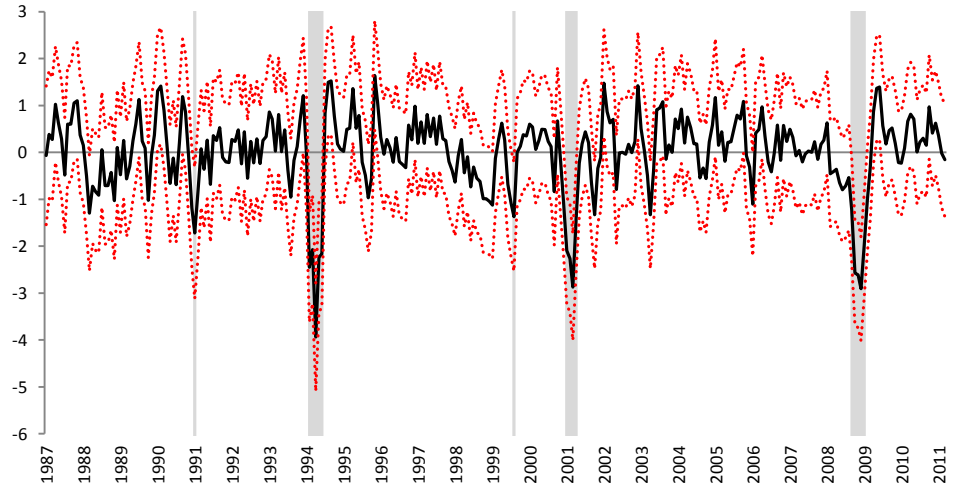
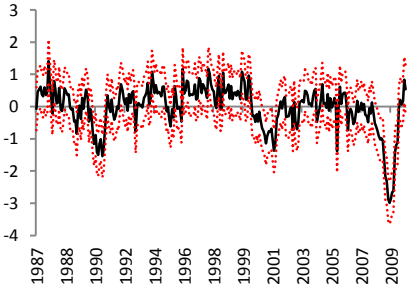
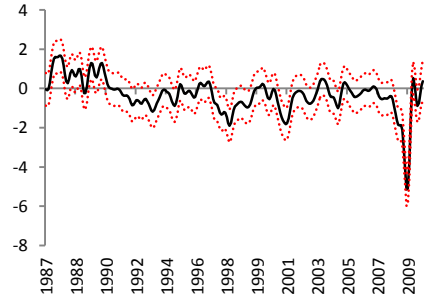


Figure 2. Economic Activity Indicator for USA



Source: Aruoba, Diebold, Kose and Terrones (2011)

Figure 3. Economic Activity Indicator for Japan



Source: Aruoba, Diebold, Kose and Terrones (2011)

Putting sharp contraction and subsequent rapid recoveries aside, the factor typically remains within the interval [-1,1]. Considering the historical growth performance in the Turkish economy, the factor estimates close to 1 point to a robust upward trend in economic activity. The findings indicate that the Turkish economy succeeded in sustaining strong growth for two years starting from April 2009 and economic activity remained still robust as of the end of 2010.

Historically, the factor frequently changes direction around the zero-line, occasionally quite sharply. These are due to the unsustained nature of economic growth in the Turkish economy during the last twenty years. There are various studies pointing out the leading role of capital flows in the unsuccessful stabilization efforts and resulting boom-bust characteristic of the growth cycle in Turkey as being a small-open emerging economy. In fact, international experience confirms that developing countries tend to have a more volatile growth performance compared to developed ones. Using the same methodology, Aruoba, Diebold, Kose and Terrones (2011) estimate dynamic factors for US and Japanese economies (Figure 2 and 3) and these have relatively more persistent expansion and contraction periods than the Turkish economy. Besides, the factor estimate for the Turkish economy displays a more volatile pattern with larger standard error bands. Beside the unstable growth pattern peculiar to Turkey as a developing country, these findings further imply that high volatility of the underlying data set hurdles against making accurate economic assessments and policy implementation in these economies.

Table 2. Correlation of the Factor with Observables

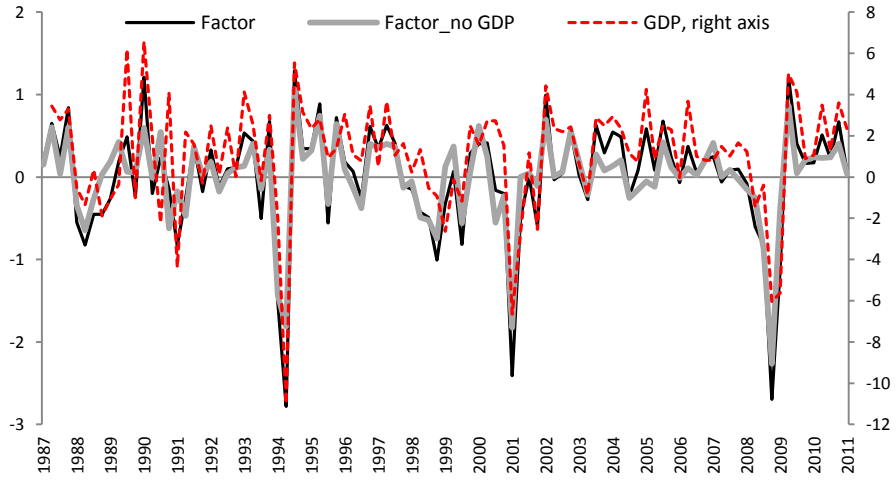
Industrial Production	Electricity Production	Intermediate Goods Imports	GDP	Employment (monthly)	Employment (quarterly)
0.67	0.35	0.58	0.58	0.41	0.10

Table 2 shows the simple correlations of the indicators with the extracted factor. We see that industrial production and intermediate goods imports seem to be highly correlated with the factor, while additional information delivered by the employment data is relatively limited. We also find that each of the indicators provides statistically significant value added to the index. On the other hand, considering the need for timely information in policy conduct, making use of high frequency data emerges as an essential element. Moreover, the factor is also highly correlated with GDP, a broad measure of economic activity.[5] Since GDP is available only quarterly, it is useful to also consider an alternative system which does not include GDP. In

[5] The correlation between the factor and GDP proved to be stronger at quarterly basis than the monthly results in Table 2. The contemporaneous correlation between the quarterly factor and quarterly GDP growth is calculated as 0.87.

fact, extracting an up-to-date and statistically well-behaved indicator excluding the additional information provided by the national income data would contribute to the policy making process in real-time.

Figure 4. Real Activity Indicators Including/Excluding GDP (Quarterly Average) vs. Quarterly Growth Rate



The factor extracted from a smaller system with the remaining four variables is shown in Figure 4. This monthly factor is transformed into quarterly basis by taking its simple average and compared to the quarterly GDP growth in Figure 4. The contemporaneous correlation of 0.67 indicates a close relationship between the two. Our findings suggest that the factor still has valuable information content even when we do not observe the GDP. Confidently, we can conclude that the four-variable factor estimate emerges as a good coincident indicator of overall economic activity.

The next question we tackle is identifying periods of recessions using the factor. By construction, factor values below zero indicate a slowdown in economic activity. However, we need to take into account two additional issues. First, since we do not observe the true factor but an estimate, we need to have a methodology that eliminates periods of negative factors due to estimation error. We accomplish this by focusing on the periods where the 95% confidence band around the estimated factor falls below zero, or, equivalently, where the upper bound of this band is below zero. Second, a recession is more than just a slowdown in economic activity. We focus on episodes that are more than one period in length to eliminate any temporary events.

The recession indicator presented in Figure 5 is designed so as to have the value 1 (0) when the upper bound is above (below) zero-line. Accordingly,

eight spikes are detected in the recession indicator based on upper band. Five of these spikes are of temporary nature with a one-month length for each, whereas the remaining three prevailed for longer time periods demonstrated as plateaus at the top. Focusing on the episodes that are at least two periods in length, we identify three recession episodes for the Turkish economy during the last twenty five years: in 1994, 2001 and 2008-2009.

Figure 5. Recession Indicator Based on Upper Band

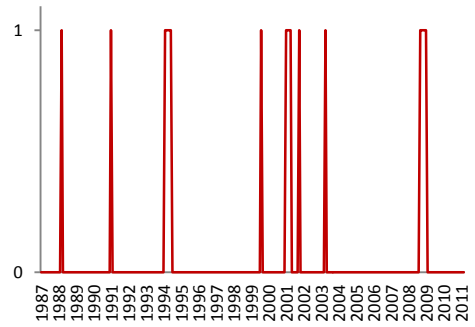


Figure 6. 1994 Recession

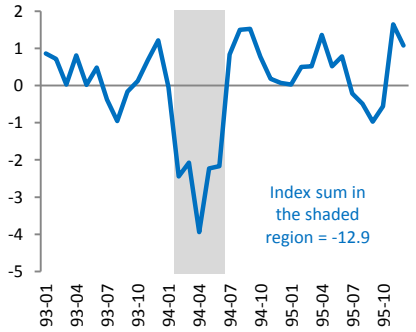


Figure 6-8 allow us to take a closer look at the aforementioned crisis episodes. Real activity indicator reaches its lowest values for 1994, 2001 and 2008-2009 periods. At the same time, the upper band remains in the negative region for a long time during these years, demonstrated by relatively large grey-shaded regions. According to the upper band criterion, while these three episodes exhibit similarity in terms of the duration of recessions, the last crisis displays a notable distinction in terms of pre-crisis behavior. Specifically, during 1994 and 2001, notorious sudden-stops rapidly dragged the economy into recessions, whereas still-prevailing global crisis is characterized by a gradual worsening in economic activity.

Figure 7. 2001 Recession

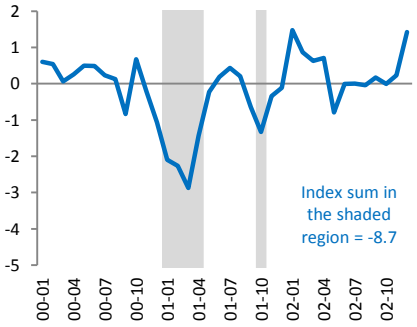
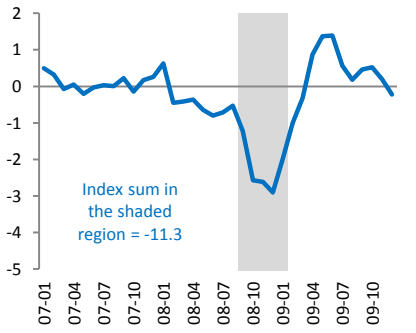


Figure 8. 2008-09 Recession



Accumulating the factor values in the grey-shaded regions allows us to make a comparative analysis of the severity of these crises. In this way, not only the amplitude of the contraction (the fall in the index) but also its duration (for how long the index preserved its negative values) can be taken into account. Factor estimates imply that the temporary contraction periods of 1991 and 1999 can be called as more of a turbulence rather than a recession. The decline of the factor remained relatively limited during these periods where the economy was exposed to several external shocks independent from domestic economic fundamentals, such as the Gulf crisis, Marmara earthquake and Iraq War (Figure 9 and 10).[6]

Figure 9. 1991 Turbulence

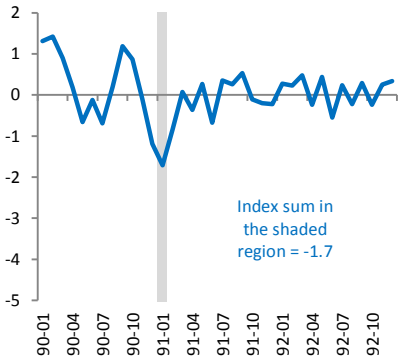
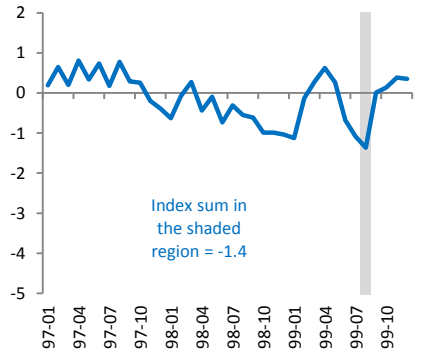


Figure 10. 1999 Turbulence



A final remark worth mentioning is that the recession indicator based on upper band introduces a very stringent criterion so that prolonged slowdown periods without a sharp decline in activity may not be eligible to be labeled as a recession. In other words, our recession criterion is a tight one as it puts the quantitative magnitude rather than the duration of a contraction in the forefront. Early phases of the 2008 crisis as well as the Asian and Russian crises during 1997 and 1998 are good illustrations for this case. Undoubtedly, it would be challenging to interpret such states of the economy in real-time policy implementation.

4.1. Real-Time Application

Historical accounting of business cycles in Turkey allows for a comparative analysis of prominent recession periods in the last two decades. While the real activity indicator proved to be useful for ex-post evaluations, policy makers have a limited amount of information in real time. Lags in the announcement of data as well as frequent revisions in the subsequent periods

[6] We do not mention 1988 and 2003 crises separately, as these periods encounter similar durations of contraction with those in 1991 and 1999 crises.

lead policy makers to focus on the real-time properties of economic indicators.

The variables used in the construction of the index are announced at different times and lags in the announcement differ for each statistic. A typical release schedule in a month for five selected variables is presented in Table 3. For instance, for February and March, the real activity indicator utilizes information only coming from electricity production even at the end of the first quarter. In other words, the indicator will mostly be shaped by January developments even when the first quarter is completed. In this case, the values of the factor near the end of the sample would contain higher uncertainty.

Table 3. Release Schedule for March 20124

Variable	Source	Frequency	Announcement Date	Last Observation	Lag
Electricity Production	TETC	Daily	Everyday	Previous Day	1 Day
Industrial Production	TURKSTAT	Monthly	8th of March	January 2012	2 Months
Employment	TURKSTAT	Monthly	15th of March	January 2012	2 Months
Intermediate Goods Imports	TURKSTAT	Monthly	19th of March	January 2012	2 Months
GDP	TURKSTAT	Quarterly	31st of March*	2011-4	1 Quarter

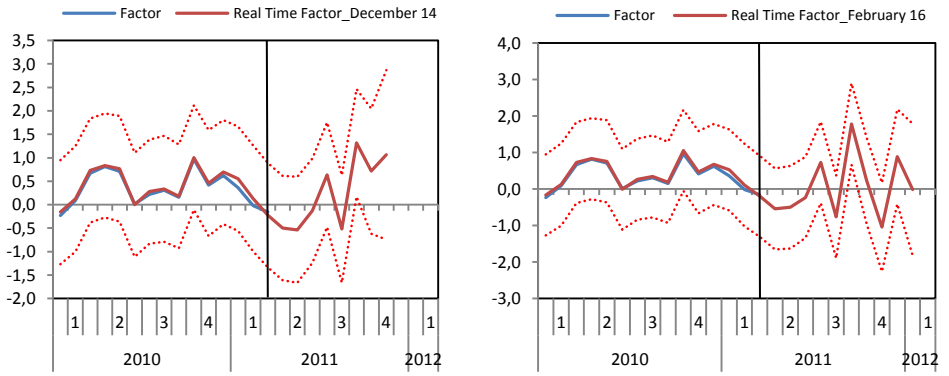
* Corresponds to the weekend, so it will be announced on the first following working day, 2nd of April, Monday.

In practice, the model is re-estimated less frequently (say, once a year) than data announcements, where the indicator can be re-calculated using fixed parameters when new data arrive. In this way, using up to date information set, assessments on economic stance can be made in real-time. For an illustrative example Figure 11 presents the real time factor updates for December 2011 and February 2012 using the parameters of the model estimated until March 2011.

In the left panel, the indicator, mostly fluctuating in the positive territory, points to a stable growth in economic activity during 2010. Notwithstanding the modest course in the third quarter, real activity accelerated through the end of the year. For the subsequent periods, the indicator signals a gradual slowdown until the mid-2011, while a fairly volatile pattern is observed afterwards. Larger standard error bands (red-dotted lines) illustrate the increased data uncertainty for the factor estimates at the end of the sample, which requires a cautious stance in evaluating economic stance. The two consecutive real-time updates of the factor confirm this view. The real time indicator based on the information available in December points to a strong

activity for October-November period (end-sample in the left panel), whereas new information set as of February implies a weaker underlying trend for the same period.

Figure 11.A. Real Time Application*



* Index shows the factor estimate based on five variables including the GDP. The differences between the estimated factor and updated real time factor reflect bacward revisions in the data. For both update periods, GDP data end by 2011Q3. Monthly variables lag with two months, except electricity production available with a one-month lag.

Here we have demonstrated two alternative paths for the real time factor based on two different information sets. We showed that for a given time T, the assessments on economic outlook may differ to a great extent. High uncertainty at the end of the samples, which in fact include the most valuable information for policy makers, complicates the determination of the exact timing of recessions or recoveries.

5. Concluding Remarks

We derived a real economic activity indicator for Turkey based on the idea that business cycles can be defined as a common component determined by dynamic interaction and co-movement of several macroeconomic variables. In doing so, five indicators −GDP, industrial production, intermediate goods imports, electricity production and employment− are selected to represent the Turkish economy in a broad sense. A dynamic factor model is utilized in estimating the common factor assumed to influence the selected indicators. Business cycles are modeled as an unobserved component in this setting allowing us to incorporate variables at multiple frequencies as a major innovative aspect.

We also introduced a methodology to date recessions and detected three recessions in Turkey during the period 1987-2011. Comparative inferences on the severity of these crises could also be made through the use of this measure. Accordingly, regarding both the magnitude and duration of

contractions, 1994, 2001 and 2008-09 recessions emerged as having the most devastating effects on the economy. Other contraction periods picked up by our methodology have proved to be relatively mild and short-lived turbulences.

Our finding of a close relationship between the quarterly growth and the factor based on four variables excluding the GDP showed that the problem of lagging data could be resolved with high frequency variables. Nevertheless, a model with a monthly base frequency still requires questioning the accuracy of policy implications derived from the real-time indicator since even monthly variables become available with a lag of two periods. In this respect, putting the historical analysis of past recessions aside, we inspected the real-time information content of the indicator and showed that dating recessions in real time proved to be a challenging issue due to high data uncertainty especially under a stringent criterion. Real-time performance could be enhanced through incorporating representative variables at higher frequencies (daily, weekly, etc.).

All in all, the real activity indicator derived in this study will strengthen the technical background of monetary policy conduct in Turkey. One should keep in mind that the indicator is an estimate of economic stance, thus contains some uncertainty, and is exposed to revisions as new data arrive. Besides, as economic activity is not the sole determinant of inflation outlook, the index will just be a part of the existing set of coincident/leading indicators monitored to predict inflation and construct the future path of monetary policy accordingly.

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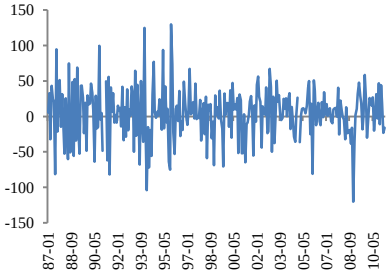
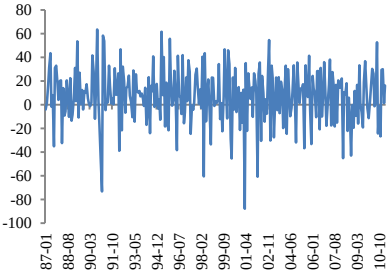
Appendix: Selected Indicators for the Turkish Economy

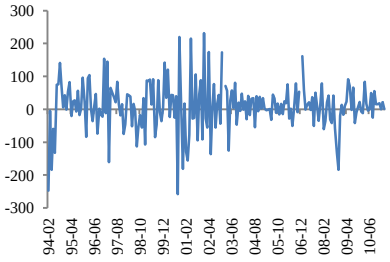
Industrial Production Index
(Seasonally Adjusted, Annualized Monthly Change, %)



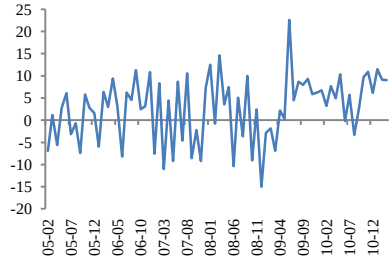
Electricity Production
(Seasonally Adjusted, Annualized Monthly Change, %)



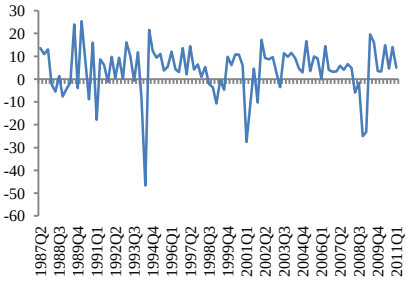
Intermediate Goods Imports
(Seasonally Adjusted, Annualized Monthly Change, %)



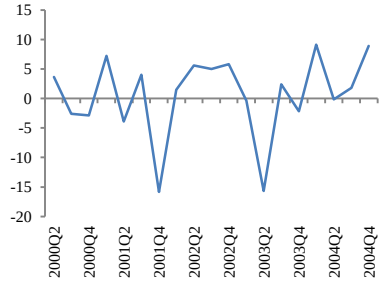
Employment
(Seasonally Adjusted, Annualized Monthly Change, %)



Gross Domestic Product
(Seasonally Adjusted, Annualized Quarterly Change, %)



Employment
(Seasonally Adjusted, Annualized Quarterly Change, %)



Source: TURKSTAT, TETC, CBRT.