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Leading Indicators of Real Activity and Inflation for Turkey, 2001-2010

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Abstract

This paper develops a set of leading indicators of industrial production growth and consumer price inflation for the period 2001-2010. The choice of indicators is based on pseudo out-of-sample forecasting exercise implemented by Stock and Watson (2003), amongst others. We find that asset prices that reflect expectational factors or interest rates that capture the costs of borrowing for the Turkish economy tend to have the greatest predictive power for future real activity and inflation. Our findings provide evidence on the factors determining real activity and inflation in a period of disinflation and normalization for the Turkish economy.

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1 Introduction

The notion of developing a leading indicator to predict real activity goes back to the work of Mitchell and Burns (1938). In a comprehensive analysis, Stock and Watson (1999) examine the cyclical behavior of the main U.S. macroeconomic time series over the period 1946-1996. They categorize the behavior of 71 economic time series into leading, lagging and coincident indicators. Their analysis involves examining the cross-correlations of the filtered versions of each series with a suitably filtered version of real GDP as well as predictive regressions to assess the lead-lag relations between each series and aggregate output. Stock and Watson (2003) examine the efficacy of asset prices for predicting output and inflation for seven OECD countries over the period 1959-1999. As these authors note, much of the research on using asset prices for forecasting purposes was motivated by the apparent instability in forecasts of output and inflation based on the performance of monetary aggregates or the (non-expectational) Phillips curve during the 1970's and early 1980's. Their study uses quarterly data on up to 43 variables for the G7 countries. Among their salient results is that asset prices are more useful for forecasting inflation than output. While the behavior of individual forecasts tends to be unstable, combination forecasts appear to work well in circumventing the instability problems.

The literature on developing leading indicators for emerging economies is more recent.[1] While macroeconomic relations tended to undergo significant changes in the 1970's and early 1980's in developed countries, high levels of volatility, structural shifts, and changes in policy regimes have made identifying leading indicators for emerging economies difficult. Nevertheless, these exist studies that have derived leading indicators for emerging economies. Chauvet (2000) uses a stochastic Markov switching model with seasonal effects to determine the turning points in inflation for Brazil. She considers two periods, the first corresponding to the post "Real Plan" period of 1994-1999 and the longer period of 1980-1999 to account for changes in policy regimes in Brazil.[2] She then fits a dynamic factor model to extract common cyclical movements in a set of variables useful for predicting inflation.[3] She finds that for the 1994-1999 period the leading indicators perform well in signaling the future phases of the inflation cycle out-of-sample. However, considering the

[1]There is a large literature involved in identifying early-warning indicators of banking and currency crises (see, for example, Goldstein and Turner, 1996; Kaminsky and Reinhart, 1999). This arose due to the experience of banking and currency crises, abrupt reversals in capital flows due to "Sudden Stop" phenomena, and issues of debt sustainability and proper fiscal management that emerging economies faced in the 1980's and 1990's. Uluceviz and Yildiran (2010) analyzed whether and how international interbank loans affected the probability of crises in the period 1980-2002. After the 1990's, they find that short term capital flows significantly increased the likelihood of crises in developing countries suggesting the existence of coordination failures among international banks.

[2]The "Real Plan" was instituted under the Brazilian Finance Minister Fernando Cardoso in 1994, and it intended to curb both inertial inflation in Brazil and combat loose fiscal policy. A combination of an overvalued currency and high interest rates led to an inflow of foreign capital, which helped to finance local expenditures and to curb domestic prices through cheap import prices. The 1999 currency crisis put an end to the Real Plan, after which Brazil embarked on an inflation targeting regime.

[3]This is similar to the approach in Stock and Watson (1989,1991) except that Chauvet (2000) implements a recursive estimation procedure and chooses models based on their out-of-sample fit.

longer sample 1980-1999, the resulting indicators exhibit weaker ability to anticipate inflation turning points. Chauvet (2001) develops an indicator of Brazilian GDP at the monthly frequency by using a Markov switching dynamic factor model. In this specification, the dynamic factor captures the co-movement of the different series but it also displays regime switching as in Hamilton (1989) to account for potential asymmetries in the different phases of the business cycle. Chauvet constructs the Markov-switching dynamic factor using a set of variables that display coincident movements with changes in real GDP across three different periods, and finds that the monthly indicator predicts all Brazilian recessions in- and out-of-sample and has better predictive performance relative to a linear autoregressive model for GDP. Chauvet and Morais (2008) use a time-varying autoregressive probit model for predicting recessions in Brazil. These authors identify leading indicators for the Brazilian economy by matching the turning points of Brazilian GDP with the turning points of candidate leading indicators as well as by examining the adequacy of models with alternative indicators. They find that among the best indicators are variables measuring the early stages of production processes, demand and supply pressures, changes in fiscal and monetary policy, and changes in the expectations of the private sector.

There are various papers that have developed leading indicators for Turkey. One approach has been to construct a composite leading indicator. Atabek, Coşar and Şahinöz (2005a,b) use the OECD methodology to develop a composite leading indicator for the Turkish economy. Their approach involves identifying the turning points of economic activity measured in terms of the cyclical component of the industrial production index and determining a set of leading indicators of industrial production using cross-correlations, Granger causality tests, and peak/trough analysis. Their results indicate that imports of intermediate goods, discounted Treasury auction interest rates, electricity production and responses to various survey questions from the Central Bank of the Republic of Turkey's (CBRT) Business Survey are among the best indicators, a finding to which we will return later. Following the approach in Stock and Watson (2003), Leigh and Rossi (2002) use out-of-sample forecasting techniques to examine the efficacy of 42 candidate indicators for growth and inflation over the period 1986-2002 for Turkey. Their period of study encompasses two major recessions or crises, the 1994 financial crisis and the banking and financial crisis of 2000-2001. Their main focus is to understand the predictors of real activity and inflation for an economy with volatile inflation and output growth.

In this paper, we develop a set of leading indicators to predict real activity and inflation at the monthly level for Turkey. We examine 47 real and financial candidate indicators for forecasting industrial production growth and inflation between 2006:1-2010:12. The period in question features some noteworthy developments in the Turkish economy. First, Turkey enacted a series of important reforms and institutional changes after the 2000-2001 crisis as part of an IMF-sponsored stabilization plan, which also stipulated fiscal discipline. These reforms include widespread banking and financial sector reform and more importantly, a move to central bank independence. Second, after 2002, Turkey also started on a transition to an inflation targeting regime, which occurred officially in 2005. Kara (2006) provides a discussion of the process by which Turkey moved from a regime of implicit inflation targeting to a full fledged inflation targeting regime. In their study, Leigh and Rossi (2002) state that another objective of their analysis is to identify the variables most useful for forecasting inflation and real activity during the transition to an inflation targeting regime. However, since their sample ends in 2002, it does not permit a thorough identification of leading indicators under the new policy regime after 2001. By contrast, our study is based on data from the post-reform period and is useful for determining the variables for predicting inflation and real activity during the period of normalization for the Turkish economy. The role of alternative institutional arrangements such as inflation targeting in affecting average business cycle characteristics is studied by Altug, Emin and Neyapti (2011). de Carvalho Filho (2011) further examines the role of inflation targeting in affecting economic performance during the recent global financial crisis. However, neither author examines the issue of identifying leading indicators under the transition to an inflation targeting regime.

The remainder of this paper is organized as follows. Section 2 presents the methodology while Section 3 describes the data. The results regarding the bivariate forecasts are presented in Section 4. Section 6 concludes.

2 Methodology

Our methodology follows Stock and Watson (2003) and Leigh and Rossi (2002). Our goal is to develop forecasting models for real activity and inflation using a sample of monthly observations. We measure real activity by the industrial production index (IP) and the price level by the consumer price index (CPI). In contrast to real GDP, the choice of industrial production as a measure of real activity is due to its availability on a monthly basis.[4] The forecasting models examine the role of a candidate predictor, X_t, for forecasting the variable of interest h period ahead, y^h_{t+h}. We consider horizons of $h = 1, \ldots, 12$ for both variables, though we report results only for $h = 3, 6, 9, 12$. The model that we examine can be written as follows:

$$y^h_{t+h} = \mu + \alpha(L)y_t + \beta(L)X_t + \epsilon^h_{t+h}, \tag{2.1}$$

where $\alpha(L)$ and $\beta(L)$ are lag polynomials. All the forecasting models include the own lags of the dependent variable, y_t. They differ with respect to the candidate predictor that is considered. This approach differs from the standard approach of estimating one-step predictions and then iterating forward to obtain the h-step ahead forecasts. By keeping the estimation and forecast period the same, this approach has the advantage of reducing the specification error in the one-step ahead model.

The dependent variables were transformed to be stationary. We ran Augmented Dickey Fuller (ADF) tests for the entire sample period of 2001:1-2010:12. We fail to reject the null hypothesis of a unit root for the log of industrial production. There is some evidence in favor of the trend stationary model for the level of the CPI, but this is most likely

[4]This is consistent with the practice of the OECD for developing composite leading indicators of economic activity. See the OECD publication "OECD System of Composite Leading Indicators" (2008).

due to the short sample since 2001. However, the non-stationarity of the differenced variables is strongly rejected. Leigh and Rossi (2002) reject the non-stationarity of the first difference of the CPI at the 1% level based on the ADF test. However, they find that the pseudo out-of-sample forecasting results tend to be more accurate for the second differences of the CPI (the first difference of inflation) and report only those results. Given the disinflationary environment over our sample period, we also consider the differences of CPI inflation (or second differences of the level of the CPI) in our forecasting exercise. Thus, the variable y_t is defined as the growth rate of industrial production and changes in CPI inflation at an annual rate, respectively. The multi-step forecasts investigate the predictability of the log of the level of the variable, after imposing the $I(1)$ or $I(2)$ transformations. For IP growth, this is $y^h_{t+h} = (1200/h)\log(IP_{t+h}/IP_t)$ and for CPI inflation, it is $y^h_{t+h} = (1200/h)\log(CPI_{t+h}/CPI_t) - h\log(CPI_t/CPI_{t-1})$.

Previous studies have considered second differenced versions of the CPI, as inflation has tended to be a persistent process. However, there is recent evidence suggesting that both inflation and inflation *persistence* have become low and stable processes in the sample period that we study. Oliveira and Petrassi (2010) examine the persistence of CPI inflation for 23 industrial and 17 emerging economies in a sample that begins in 1995 and find that even countries that experienced near "hyperinflations" such as Argentina, Brazil, Bolivia, Peru, Mexico, Turkey, Israel and Poland have witnessed a decline in the persistence of their inflationary processes.[5] Even if this phenomenon holds for Turkey, however, using the second difference of CPI inflation as the relevant variable improves the forecasting performance in the disinflationary period since 2001.

The approach used in this paper is based on the pseudo out-of-sample forecasting proposed by Stock and Watson (2003). The model estimation and selection is recursive in that it uses all available prior data as the forecasting exercise proceeds through time. The out-of-sample forecasting exercise begins in 2006:1 and continues through the end of the sample period of 2010:12. Thus, the first forecast is approximately based on five years of data, after accounting for differencing and initial conditions, while the subsequent forecasts are based on samples that increase over time. At each stage of the forecasting exercise, the lag lengths in the benchmark model and the model with the candidate indicator for IP growth and inflation are chosen to minimize the Akaike Information Criterion (AIC). The lag lengths of the polynomial $\alpha(L)$ are chosen to be between zero and twelve while the lag lengths for $\beta(L)$ are chosen to be between one and twelve. We iteratively add exogenous variables including all their possible lagged values up to twelve lags and choose the optimal lag length by using AIC. To identify a leading indicator, we compare the mean squared forecast error (MSFE) of the autoregressive specification comprising own lags only with the specification including the candidate exogenous variable and its lags. A leading indicator is

[5] They examine a variety of empirical specifications to capture inflation dynamics, including models with lags of inflation with and without an output gap, New Keynesian Phillips curves with foreign exchange rates, and reduced forms derived from structural specifications that allow for some form of wage rigidity. They attribute their finding to the anchoring of expectations under inflation targeting regimes adopted by many industrial and emerging economies and the commitment to price stability pursued by the Federal Reserve, the European Central Bank, and other monetary authorities.

identified if the relative mean squared forecast error of the specification with the exogenous variable is less than the one with the own lags only of the predicted variable.

An alternative methodology is to use in-sampling techniques based on examining cross-correlations of a set of indicators with the variables in question, say, IP growth and CPI inflation, and Granger causality tests. As various authors have argued, however, such in-sampling techniques can lead to overfitting in the sample at hand and provide little guidance regarding future predictive performance. Stock and Watson (2003) examine Granger causality tests and tests of sample stability for the 71 variables used in their study. They find that the Granger causality tests frequently reject, indicating that many of the variables in question have predictive content for such quantities as output growth or inflation. Second, they find that they can reject in-sample stability of the estimated relations. Third, they show that a finding of significant Granger causality does not make it more likely that a given indicator will outperform a benchmark autoregressive model for a variable in question in different parts of a sample. Taken together, their results suggest that in-sampling techniques are of little value in determining indicators for forecasting future economic performance. Chauvet (2000) also emphasizes the role of out-of-sample techniques for developing a leading indicator of inflation in Brazil that can be used as an aid in real-time monitoring of monetary policy.

3 Data

The universe of variables that are available for constructing leading indicators is potentially very large. Our choice of variables is motivated by (i) whether there are economic/empirical reasons for their predictive content, (ii) their availability at the monthly frequency, and (iii) their sample length. We use indicators of real activity, monetary aggregates and asset prices. Table 1 provides a list of the variables used in our study as well as their sources. A further description of the data is available in the Appendix.

Our series include variables measuring

- activity in the economy including capacity utilization, electricity production, production of agricultural machines, production of buses, the unemployment rate, total employment, exports, imports, intermediate goods imports, and VAT revenue;
- prices such as CPI, PPI, unit export and import values, the oil price index, and the US CPI;
- measures of nominal and real monetary aggregates, total credit, and reserves at the central bank;
- asset prices including various interest rates, the return, price-earnings ratio and dividend yield on the Istanbul Stock Exchange ISE-100 index, the spread between the Turkish sovereign rate and U.S. T-bill rate, the return on foreign currency denominated Turkish bonds, the dollar and the real exchange rate, and the price of gold.

The variables that we use are similar to those examined by Stock and Watson (2003) and Leigh and Rossi (2002). However, our study includes core variables seeking to measure real activity in the economy. In this respect, our study has more in common with Chauvet (2001), who considers different measures of industrial production, capacity utilization, real wages, compensated hours, retail sales, employment, the unemployment rate, fuel consumption and electricity consumption. The variables in our study can also be categorized in terms of whether they represent supply, demand, policy, or expectational factors. Variables such as the capacity utilization rate, the producer price index (PPI), imports, especially imports of intermediate goods, and production of certain durable goods may represent supply side influences. Exports and the Consumer Price Index may be indicative of demand side influences while revenue from the value-added tax may reflect effects from both the demand and supply sides.[6] Policy variables are represented by interest rates, monetary aggregates, or international reserves while expectations are captured through variables measuring the return on the stock market, the return on foreign currency denominated Turkish bonds, or the spread between Turkish and US bonds. Unlike other studies, however, we do not include survey measures of business sentiment on alternative aspects of real activity.

Several transformations are applied to the explanatory variables. The first issue has to do with seasonal variation. As the Appendix shows, some of the variables were available from the source in seasonally adjusted form. For the remainder, we conduct tests of seasonality by regressing (a suitably differenced version of) the series on seasonal dummies. For those series that exhibit seasonal variation, we implement de-seasonalization using the linear X-11 method. In some cases, logarithms are taken of the original variables. Differencing or second differencing is used to remove trends from persistent variables. For some variables such as interest rates or dividend yields, it is unclear whether they should be included as levels or in difference form. Hence, we include both versions for such variables. Real and nominal versions of various quantities are also included in our analysis. Models with nominal rigidities such as the New Keynesian model (see, for example, Gali, 1999) predict that nominal quantities may have an effect over and above those of real variables.

4 Results

In this section, we first describe the selection of leading indicators for IP growth and inflation based on the pseudo out-of-sample forecasting using the results in Tables 2 and 3. Next, we provide a discussion of the results in light of existing results and the developments in the Turkish economy up to and following the 2000-2001 economic crisis. The last section describes the performance of the combination forecasting exercise.

Prior to analyzing the results in these tables, however, it is important to note that some of the improvements in forecasting performance may have to do with sampling variability as opposed to statistical significance of the leading indicators. It is possible to test formally

[6] The implementation of the value-added tax in Turkey is in the form of a "credits" system, that is, a tax is levied on the total value of sales at each stage of production and a credit for any VAT is paid on inputs in production. See, for example, Metcalf (1995) or PriceWaterhouseCoopers (2004).

the null hypothesis that the MSFE is equal to one versus the alternative that it is less than one using the Clark and McCracken (2001) approach. Alternatively, standard errors can be computed for the MSFE's using the approach in Diebold and Mariano (1994), for example. However, there are conceptual and computational issues regarding both approaches.[7]

4.1 IP growth

Keeping in mind the issue of the statistical significance of the results, Table 2 shows that several financial variables stand out in terms of forecast ability for IP growth across both short and long horizons for the 2001-2010 period. These include:

- changes in the the dividend yield on the ISE100 (difference of "divpr"),
- the change in EMBI Turkey index (difference of "embi-tr"),
- changes in the interest rate spread on short-term Turkish government bonds relative to the U.S. T-bill rate (the difference of "irspread")

Both the dividend yield on the ISE-100 and changes in the EMBI Turkey index provide significant improvements in the forecasts of IP growth relative to the autoregressive benchmark. In unreported results, we also found that these two variables improve the forecasts of IP growth relative to those obtained from its own lags only across almost all the monthly horizons. The dividend yield on the ISE-100 provides the greatest improvement relative to the autoregressive benchmark at a horizon of three months (9%) while the EMBI Turkey return improves the IP growth forecast at a horizon of nine months (7%). The third variable that has the greatest predictive power for IP growth is changes in the interest spread rate on short-term Turkish government bonds relative to US government bonds (difference of "irspread"). This produces an improvement of 5% at horizons of three and six months relative to the autoregressive benchmark.

Aside from these variables, the nominal and real returns on the ISE (difference of "ise100" or "rise100") also lead to improvements in the forecasts of IPI growth at the shortest horizon of three months compared to forecasts based on own lags of IP growth only. Though not as pronounced, interest rates such as the discount rate ("dr") as well as changes in the three month deposit rate (difference of "depo3M") and the Treasury auction rate (difference of "traucrate") are also associated with better forecasting performance relative to the autoregressive benchmark. However, the improvement in the MSFE performance due to the discount rate, the three deposit rate or the Treasury auction rate are only 2-3%, suggesting that there is no significant improvement from including these variables. Interestingly, when the period 1985-2003 is considered, the Treasury auction rate emerges as a key leading indicator of IP growth. See Atabek *et al* (2005).

[7] As Stock and Watson (2003) note, the Clark-McCracken null distribution is computed under the assumption of constant lags in the out-of-sample forecasting exercise whereas in our approach, the lags change as the model is re-estimated with the accumulation of additional data. With regards to computing standard errors for the MSFE's, this typically requires a long time series of predictions based on regression estimates. As in Leigh and Rossi (2002), we do not calculate such standard errors due to the size of our data set.

The predictive power of the EMBI return for Turkey points to the role of capital inflows in stimulating in real activity in Turkey since 2001. As is well known, the Emerging Markets Bond Index (EMBI) for Turkey tracks total returns for its traded external or foreign currency denominated debt instruments. The EMBI Turkey return provides an indicator of the risk premium for the Turkish economy and hence, its ability to attract capital flows. The role of capital flows in affecting economic performance is studied by Calvo, Liederman and Reinhart (1999). Using a structural VAR analysis, Culha (2006) finds that the relative role of "push" versus "pull" factors in determining inflows to Turkey has shifted in the post 2000-2001 crisis, with "pull" factors such as domestic interest rates, stock prices, inflation, domestic credit, etc. becoming more important.[8] These results appear to coincide with our findings regarding the importance of changes in the EMBI index for Turkey as well as the indicators related to the stock market such as the dividend yield on the ISE100 for predicting IP growth. The fact that the interest rate spread on Turkish debt relative to U.S. short-term also appears as another important predictor of IP growth shows that the changes in Turkey's cost of borrowing contributed to growth in real activity over the forecast period of 2006-2010. More generally, the role of various asset returns in affecting real economic activity is consistent with the environment of economic and political stability experienced in Turkey since 2001.[9]

Another important predictor of IP growth is changes in gross electricity production (difference of "grelpr"). This variable yields reductions of 12% and 6% in the forecast error relative to the autoregressive specification for IP growth at horizons of six and nine months, respectively. The role of electricity production can be explained by noting that it is an important industrial input.[10] Atabek *et al* (2005a,b) also attribute a strong role to electricity production when contructing a composite leading indicator for Turkish real activity based on IP growth. Altinay and Karagol (2005) provide evidence on the role of electricity consumption in economic growth for the period between 1950-2000 for Turkey. While they use in-sample Granger causality tests as opposed to the out-of-sample forecasting approach used in the leading indicators literature, their results nevertheless provide additional evidence on the role of this variable for determining real economic activity in Turkey.

Other supply side variables also help to predict IP growth at various horizons. Changes in the production of tractors provide some minor improvements relative to the autoregressive benchmark at horizons greater than three months. Changes in trade-related variables such

[8] He finds that while 22.5% of the variance on capital flows (measured as portfolio and short-term flows) can be accounted for by shocks to the real interest rate over the 1992:1-2001:12 period in Turkey, this quantity falls to 0.5% during 2002:1-2005:12. Likewise, the contribution of shocks to the Istanbul Stock Exchange Index ISE-100 increases to 26.14% in the latter period relative to 0.97% in the earlier period.

[9] Çulha (2006) provides another indicator of this normalization process based on the impact of an increase in U.S interest rates on capital flows to Turkey. He argues that in the period 1992:1-2001:12, an increase in U.S. interest rates was accompanied by an *increase* in capital flows to Turkey, as low U.S. interest rates coincided with the periods in which Turkey itself experienced financial crises (or there were contagionary effects of the East Asian and Russian crises). By contrast, in the period after 2002, an increase in U.S. interest rates is accompanied by a capital outflow from Turkey, as predicted by standard economic analysis.

[10] The study by Altug, Ashley and Patterson (1999) uses electricity production as a proxy for the capital input when testing for nonlinearities in US output and productive inputs.

as total imports and imports of intermediate goods (differences of "musd" and "imusd") also outperform the autoregressive benchmark at a horizon of a year. It is worth noting that Atabek *et al* (2005) include imports of intermediate goods in their composite leading indicator for Turkey constructed over the period 1985-2003. Despite its lack of predictive power overall, we can provide an interpretation of the role of imports and imports of intermediate goods, in particular, by noting that the structure of Turkish manufacturing is heavily dependent on the imports of intermediate goods. (See, for example, Yükseler and Türkan, 2008). Thus, an increase in intermediate goods imports today translates into higher IP growth a year ahead.

Other variables that capture the effect of demand/supply or policy factors also have some predictive power for IP growth. Changes in the unemployment rate (difference of "unemp"), domestic CPI inflation and its changes (level and difference of "lcpi"), and U.S. CPI inflation (differences of "uscpi") appear useful for predicting IP growth at horizons of nine months to a year. Finally, we find some role for changes in the foreign exchange reserves or the gross international reserves held by the central bank (differences of "lirescb" and "lires") at a horizon of six months. However, with the exception of the three financial indicators that we discussed above, none of the other variables lead to improvements relative to the autoregressive benchmark for a majority of the horizons.

4.2 CPI

Table 3 shows that there a variety of predictors that improve on the autoregressive benchmark forecasts for changes in CPI inflation. A subset of these variables are also useful for predicting IP growth. The variables that lead to significant improvements at all the horizons reported in Table 3 include:

- the level and change in the price-earnings ratio on the ISE100 (the level and first difference of "ise-pe")
- the three-month deposit interest rate (the level of "depo3m")
- changes in the dividend yield on the ISE100 (difference of "divpr")

Changes in the price-earnings ratio on the ISE100 (difference of "ise-pe") accounts for nearly 50% reduction in the MSFE of CPI inflation at a horizon of one year, and reductions of nearly 20% and 40% at horizons of six and nine months, respectively. (Slightly lower reductions are achieved by the level of the price-earnings ratio ("ise-pe") on the ISE100 itself.) These results point to the strong expectational effects associated with the changes in inflation in the post-2001 period. The overnight interest rate ("onir") leads to improved forecasting performance at the shortest horizon of three horizon whereas longer term interest rates such as the three-month deposit rate ("depo3m") and the Treasury auction rate ("traucrate") are associated with significant reductions in the SMFE of changes in CPI inflation at a horizon of a year. Finally, changes in the dividend yield (difference of "divpr") on the ISE100 also lead to improvements relative to the autoregressive benchmark at all horizons but the improvements are smaller compared to the other financial variables mentioned above.

The level of PPI inflation (difference of "lppi") also emerges as an important predictor of changes in CPI inflation at horizons greater than three months, suggesting relatively rapid pass-through from producer to consumer prices. Changes in the capacity utilization index appear as a predictor at a horizon of a year, suggesting the role of real factors in determining inflationary performance. Likewise, overdrafts at the central bank are associated with 20-30% reductions in the MSFE of changes in inflation at horizons of six and nine months. Aside from these variables, we find some role for the effect of monetary aggregates such as changes in M3 (difference of "lm3") or changes in real credit (difference in "rll0") at different horizons but the improvements are minor compared to the stock market variables or interest rates in predicting changes in future inflation.

5 Discussion

It is worth comparing these results with those of others. Beginning with IP growth, our results concerning the role of asset prices are comparable to the findings of Leigh and Rossi (2002). However, we also attribute strong roles to the return on foreign-currency denominated Turkish bonds represented by EMBI Turkey return as well as the interest rate spread on Turkish bonds relative to US bonds. These findings can be explained by the process of normalization that Turkey has been experiencing in the post-2001 period. It also appears that expectations of future growth are reflected in the predictive power that asset prices have for Turkey's economic performance during 2006-2010. However, we find less of a role for the reserves of the central bank in determining future IP growth. This is in contrast to the findings of Leigh and Rossi (2002), who attribute a strong role for variables such as changes in the foreign exchange reserves of the central bank and commercial banks or the ratio of the foreign exchange reserves of commercial banks to the central bank's foreign exchange reserves in predicting IP growth in the short-term as well as at longer horizons. We can understand these results by noting that large declines in real economic activity and crises during the 1992-2001 period were typically accompanied by capital flight and the loss of foreign exchange reserves by both commercial banks and the central bank.[11]

For changes in CPI inflation, we find much less of a role for monetary aggregates or reserves than the findings of Leigh and Rossi (2002). In their analysis, changes in monetary aggregates such as reserve money, M2Y, M3, M3Y, and M2Y plus residents' foreign exchange-denominated deposits lead to increases in the forecasting performance for changes in CPI inflation of 7-10% relative to the autoregressive benchmark. Likewise, they find that the growth rate of foreign exchange reserves of commercial banks and the gross international reserves at the central bank, including the reserves of gold, are associated with improve-

[11] In the pre-2002 period, Turkey followed a crawling peg or managed floating exchange rate regime. The IMF-supported Exchange Rate Based Stabilization program adopted in 2000 sought to anchor inflationary expectations through a nominal exchange rate target. However, with the collapse of this program in the aftermath of the 2001 financial crisis, Turkey moved to a regime of floating exchange rates.

ments in the forecasting performance of changes in CPI inflation on the order of 6-12%. It is well known that inflationary finance associated with monetizing fiscal deficits was widely practiced in the pre-2001 period.[12] Furthermore, Turkey typically experienced large increases in inflation as a result of the 1994 and 2000-2001 financial crises, which were also accompanied by runs on the Turkish lira and a major decline in reserves of the central bank and the banking system as Turkey tried to maintain a managed floating exchange rate system.[13] By contrast, the post 2001 period has been characterized by fiscal discipline and the adoption of a floating exchange rate regime. Turkey has transited from an implicit inflation targeting regime to a formal inflation targeting regime in 2006, where the central bank has made achieving and maintaining price stability as its primary target. As a consequence, our results suggest it is not the behavior of monetary aggregates or foreign exchange reserves that has determined inflation performance in the post 2001 period but expectational phenomena captured by the movement of alternative financial variables. Evidently, the decline in inflation that occurs after 2001 is achieved by anchoring expectations and maintaining credibility under an inflation targeting regime.

Recently, various papers have sought to identify a set of leading indicators for the 2007-2008 crisis. While our analysis does not specifically examine the period of the global financial crisis, it is worth discussing some results in this regard. Frankel and Saravelos (2010) seek to determine leading indicators for the 2008-2009 crisis for a broad cross section of countries. They consider six different variables to measure the incidence of the crisis such as drops in real GDP and industrial production, currency depreciation, stock market performance, reserve losses, and participation in an IMF program. They use a review of the literature on early warning indicators of previous crises to determine a set of potential predictors of economic activity during 2008-2009. In contrast to other recent papers, they find that the level of reserves in 2007 to be a "consistent and statistically significant leading indicator of who got hit by the 2008-2009 crisis," a result which is also consistent with the earlier literature. They further argue that the level of reserves appears as a robust indicator of alternative measures of crisis incidence whereas exchange rate overvaluation matters when the crisis is defined in terms of the behavior of the currency.

One of the noteworthy findings of our study is that alternative measures of reserves have little predictive power for IP growth. It is worth noting that Turkey suffered one of the largest declines in real activity compared to a variety of countries during 2008-2009. Frankel and Saravelos (2010) show that between the second quarter of 2008 and the second quarter of 2009, Turkey was among the ten worst performing countries in terms of a real GDP decline (though not a similar decline in industrial production). However, in contrast to other countries that displayed significant declines in real economic activity such as the Baltic countries, Turkey did not pursue a fixed exchange rate regime. This may explain why our study does not attribute a greater importance to reserves in predicting real activity. In

[12]For a discussion of the factors that led to the 1994 financial crisis, including policy mistakes, see Özatay (1996).

[13]See, for example, Özatay and Sak (2002) for a discussion of the events surrounding the 2000-2001 crisis in Turkey.

our study, we also did not consider exchange market behavior as a variable to be predicted. It would be of interest to extend this study to an analysis of early warning indicators of crises such as the 2008-2009 crisis.

6 Combination forecasts

The lack of uniform predictability of bivariate relations has prompted researchers to examine the efficacy of combination forecasts. The notion behind combining forecasts based on individual variables is that the combined forecast will pool the information contained in the individual forecasts, and therefore, should be more efficient. Stock and Watson (2003) argue that the "optimal" combination forecasts discussed by Bates and Granger (1969) and Granger and Ramanathan (1984) often fail to perform better than simple combinations of forecasts such as their mean or median. Hence, they advocate using the trimmed mean and the median of the individual forecasts, which eliminate the impact of outliers on the resulting combination forecast. We also follow a suggestion of Leigh and Rossi (2002) and consider a two-stage forecast comprised of the median of the top five forecasts.

The approach to generating the combination forecasts is as before. We accumulate five years of data prior to any forecasting of the relevant series and start the forecasting exercise in 2006:1 to simulate a real-time forecasting situation. We then calculate the trimmed mean, where the lowest and the highest forecasts are trimmed to mitigate the influence of outliers, and median of all the individual forecasts as well as the median of the top five forecasts for each forecast horizon. Using this procedure, we generate a sequence of pseudo forecast errors $y^h_{t+h} - \hat{y}^h_{t+h}$ and calculate the mean squared forecast error (MSFE) of the candidate indicator with the MSFE of the benchmark autoregressive specification. Notice that the top five indicators may change by forecasting horizon since there are less than five indicators which outperform the autoregressive benchmark at all horizons. The results are reported in Tables 4 and 5.

The reduction in the MSFE based on the trimmed mean and the median of all forecasts is greater for changes in CPI inflation than for industrial production growth. However, a much more significant reduction in MSFE is obtained for the median of the top five leading indicators. For changes in CPI inflation, there are reductions of approximately 50% at horizons of nine months and a year. By contrast, the improvement over a horizon of three months is similar for IP growth and changes in inflation. The superior predictability of changes in CPI inflation using the combination forecasts is also demonstrated by Leigh and Rossi (2002), who obtain improvements in the range of 20-25% relative to the autoregressive benchmark. The difference between their results and ours most likely stems from the fact that our study pertains to a period of disinflation and normalization for the Turkish economy.

Figures 1-8 plot actual IP growth and changes in CPI inflation cumulated over three, six, nine and twelve months over the period 2006-2010. They also show the two-stage combination forecasts of IP growth and changes in inflation three, six, nine and twelve months ahead. We observe that the forecasts of IP growth over a horizon of three months are relatively accurate. This is in line with the results in Tables 2 and 4, which show that the greatest improvement in the MSFE for this series is obtained at a horizon of three months. As the horizon gets longer, the forecasts of cumulative IP growth tend to deteriorate. Although the two-stage forecasts do predict a growth decline in the period associated with the 2008 global financial crisis, they cannot match the magnitude of the output decline over this period. However, this might be expected given that the associated recession for the Turkish economy was due to external factors.

For changes in CPI inflation, we observe that the two-stage forecasts show a clear pattern of leading the future changes in actual inflation cumulated over horizons of three to nine months or more, although the volatility in the actual changes in inflation is larger. Moreover, the forecasts of inflation over the period 2006-2010 derived in our study tend to be better relative to the forecasts in Leigh and Rossi's (2002) analysis, which includes the 2000-2001 crisis and the associated spike in inflation. This finding also attests to the normalization of the Turkish economy in the post 20001 period, with inflationary expectations being relatively contained even in times of a global crisis. Finally, we observe that the strong spurt of growth after the Turkish economy rebounded from the global crisis in 2010 is not captured by our forecasts of IP growth as these forecasts are based on data prior to this episode.

7 Conclusion

We have presented a systematic approach to identifying leading indicators for real activity and inflation in Turkey over post-2001 period. The period in question features a transition to a formal inflation targeting regime in Turkey beginning as of 2003, with the subsequent rapid decline in inflation and interest rates. Our analysis attributes a major role to expectational variables in predicting IP growth and changes in CPI inflation at different horizons. We find that combination forecasts help to improve on the individual forecasts. We also examine the performance of combination forecasts based on the median of the top five indicators. Our results show an improved performance in forecasting inflation relative to earlier studies which focused on the pre-2001 period.

In our analysis up to this point, we have only considered linear time series methods. Nonlinear methods that seek to identify and predict discrete turning points have been advocated by various authors. However, one problem with implementing them in the current context is that the post-2001 period features significantly different dynamics relative to the pre-2001 period. Hence, combining data from the pre- and post-2001 periods may present problems of regime change and structural breaks that are difficult to capture even in nonlinear modeling environments. Furthermore, unlike other cases such as Brazil where turning point analysis can be used due to the existence of frequent but short recessionary experiences, Turkey experienced only one significant downturn in the post-2001 period associated with the global financial crisis in 2008. As data accumulate over time under the new policy regime implemented since 2001, it may be possible to apply nonlinear methods to determine turning points and identify the indicators that can best anticipate them.

Other studies have also considered the "output gap" or the deviation of real output from a time-varying trend as another variable to be forecasted. In our analysis, we have not considered this variable as it is only available at the quarterly frequency and would lead to a significant reduction in our sample size. On the other hand, pooling data from the pre- and post-2001 period raises issues of regime changes and structural shifts in the series under study. However, as more data accumulate for the post-2001 period, it would be of interest to examine measures of the output gap in a similar forecasting exercise as such measures encompass the entire breadth of economic activity.

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Data Appendix

In this Appendix, we describe the variables used in our study and the data sources in more detail. SA and NSA denotes whether the individual series were seasonally adjusted at the data source or otherwise.

IPI: Seasonally adjusted IPI series. Base year = 2005. SA

CUR: Capacity Utilization Rate (CUR) of the Manufacturing Industry. Prior to 2007, only Turkstat was publishing the series Capacity Utilization Rate - Public and Private Enterprises and the combined total Capacity Utilization Rate series. Following the memorandum signed by Turkstat and Central Bank of the Republic of Turkey (CBRT), CBRT started publishing the new CUR series after 2007 after eliminating the Public and Private Enterprises differentiation. For the pre-2007 period, we use the CUR series provided by Turkstat, for the post-2006 period we use the series provided by the CBRT. NSA

GRELPR: Monthly gross electricity production data as provided by the Turkish Electricity Transmission Company (TETC) website. NSA

TRAC: Monthly production of tractors as provided by Automotive Manufacturers Association (AMA). NSA

BUS: Monthly production of buses as provided by Automotive Manufacturers Association (AMA). NSA

UNEMP: Prior to 2005, quarterly unemployment rate series was published. After 2005, monthly series was released on unemployment. To generate monthly series for the pre-2005 period, we interpolated the quarterly unemployment rates by using compounded monthly growth rates for each quarter, thus generating monthly series for the whole analysis period. NSA

TOTEMP: Prior to 2005, quarterly total employment series was published. After 2005, monthly series was released. To generate monthly series for the pre-2005 period, we interpolated the quarterly total employment by using compounded monthly growth rates for each quarter, thus generating monthly series for the whole analysis period. NSA

XUSD: Total Exports according to Broad Economic Classification (BEC). NSA

MUSD: Total Imports according to Broad Economic Classification (BEC). NSA

IMUSD: Total Intermediate Goods Imports according to Broad Economic Classification (BEC). NSA

VAT: Total monthly VAT revenue series was obtained from General Directorate of Budget and Fiscal Control of the Ministry of Finance. NSA

CPI: Consumer Price Index. Base year = 2005. NSA

PPI: Producer Price Index. Base year = 2005. NSA

XUVUSD: Export Unit Value Index in $. Base year = 2003. NSA

MUVUSD: Import Unit Value Index in $. Base year = 2003. NSA

OP: UK Brent Market Price Index from IFS. Base year = 2005. NSA

USCPI: Seasonally adjusted US CPI. Base year = 2005. SA

M1: Weekly monetary aggregates were provided by CBRT. Last week of each month is treated as the monthly value for the respective monetary aggregates. NSA

M2: Weekly monetary aggregates were provided by CBRT. Last week of each month is treated as the monthly value for the respective monetary aggregates. NSA

M2Y: M2+FX deposits. Weekly monetary aggregates were provided by CBRT. Last week of each month is treaded as the monthly value for the respective monetary aggregates. NSA

M3: Weekly monetary aggregates were provided by CBRT. Last week of each month is treated as the monthly value for the respective monetary aggregates. NSA

L0: Weekly monetary aggregates were provided by CBRT. Last week of each month is treated as the monthly value for the respective monetary aggregates. NSA

ONIR: Overnight Interbank Interest Rates provided by the Monthly Economic Indicators (MEI) database of OECD Statistics

DR: End of Period Discount Rate. NSA

DEPO3M: Averages of maximum deposit rates as reported by banks to be effective during the month of reporting and weighted by volume of deposits and number of days of maturity. NSA

TRAUCRATE: Yearly simple interest rates of Treasury discounted auctions. NSA

EX-RATE: Period average market rate of USD in terms of TRL. NSA

REX-RATE: CPI based REER. Base year = 2005. NSA

ISE100: ISE National-100 index. Daily ISE-100 closing values are used and the last day of each month is treated as the monthly value for the respective index value. NSA

IS-PE: Price-earning ratio on the ISE National-100 index. Net earnings are calculated based on quarterly financial tables. NSA

DIVPR: Dividend yield on ISE 100. NSA

IRSPREAD: Sovereign Bond Interest Rate Spreads, basis points over U.S. Treasuries. NSA

EMBI-TR: J.P. Morgan Emerging Markets Bond Index for Turkey. NSA

GOLD: London price of troy ounce of gold. NSA

OVER: Overdrafts. NSA

IRESCB: Central bank's gross foreign exchange reserves. NSA

IRES-GOLD: Central bank's international gold reserves. NSA

IRES: Central bank's gross international reserves. NSA

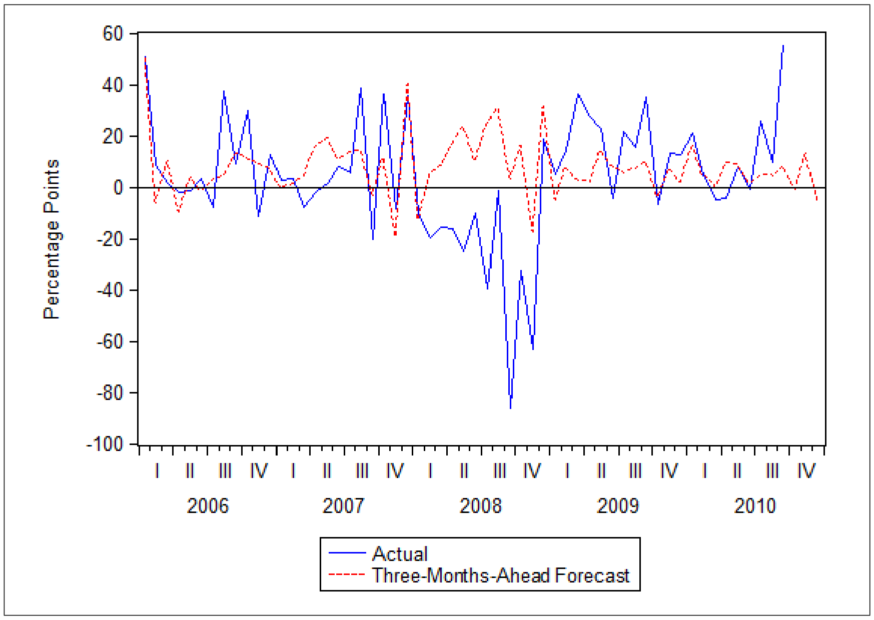

Figure 1: Cumulative IP Growth over Three Months

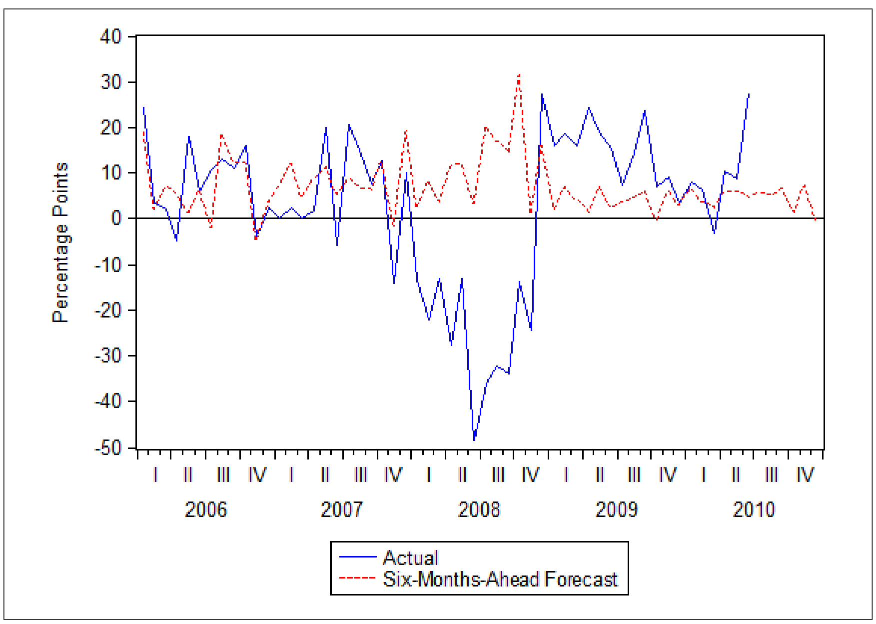

Figure 2: Cumulative IP Growth over Six Months

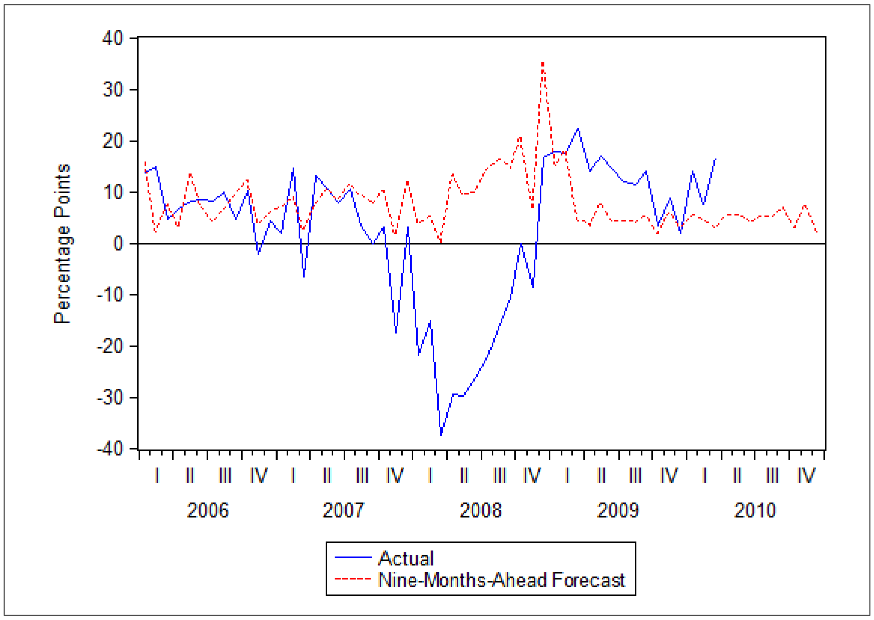

Figure 3: Cumulative Growth over Nine Months

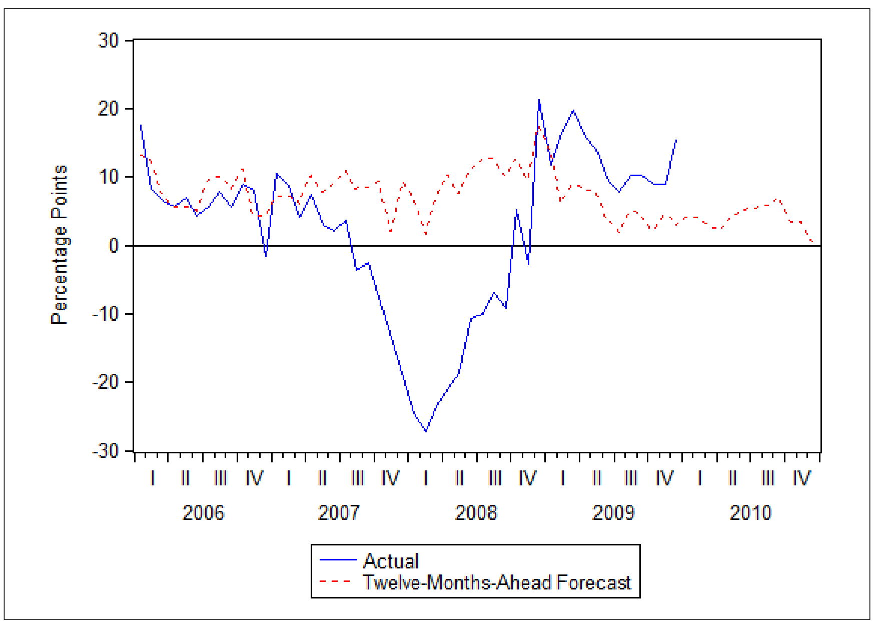

Figure 4: Cumulative Growth over A Year

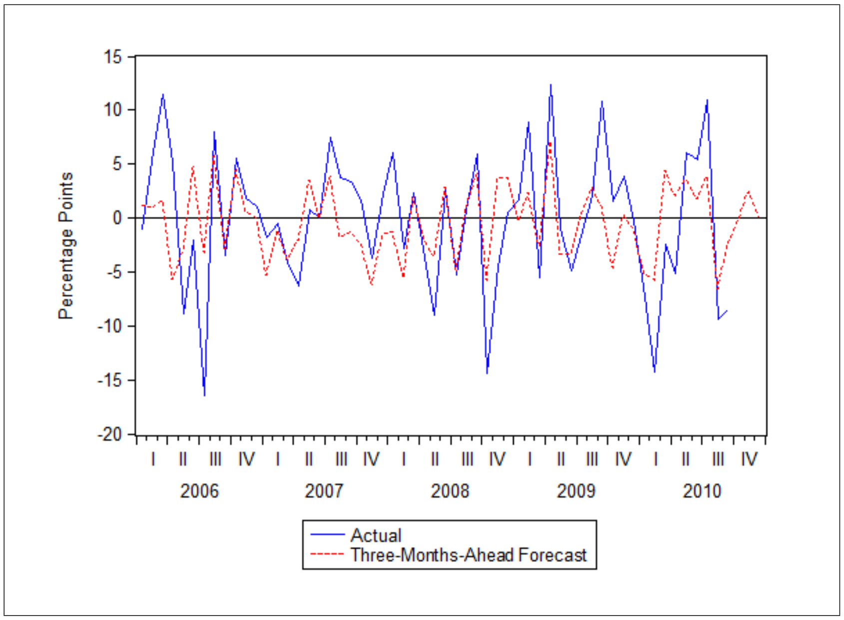

Figure 5: Changes in Inflation over Three Months

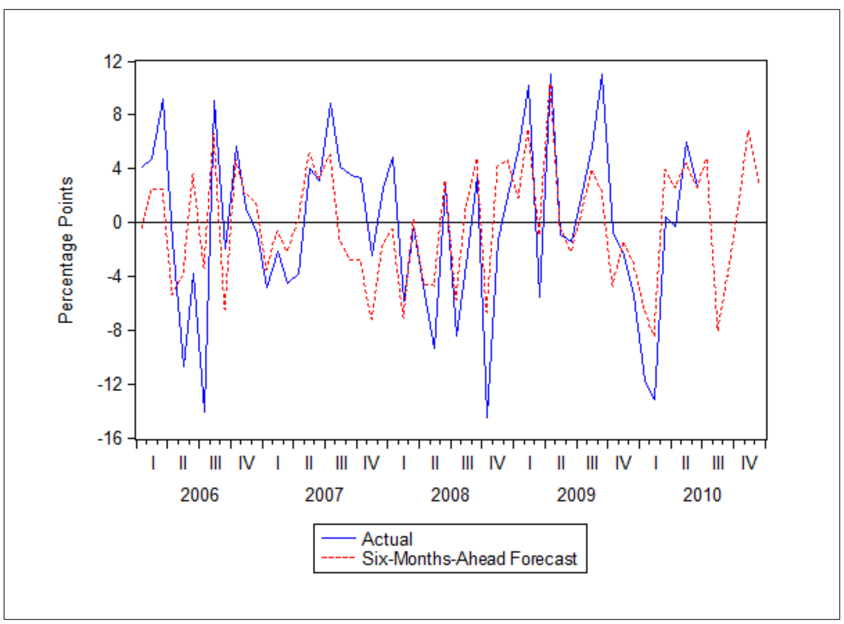

Figure 6: Changes in Inflation over Six Months

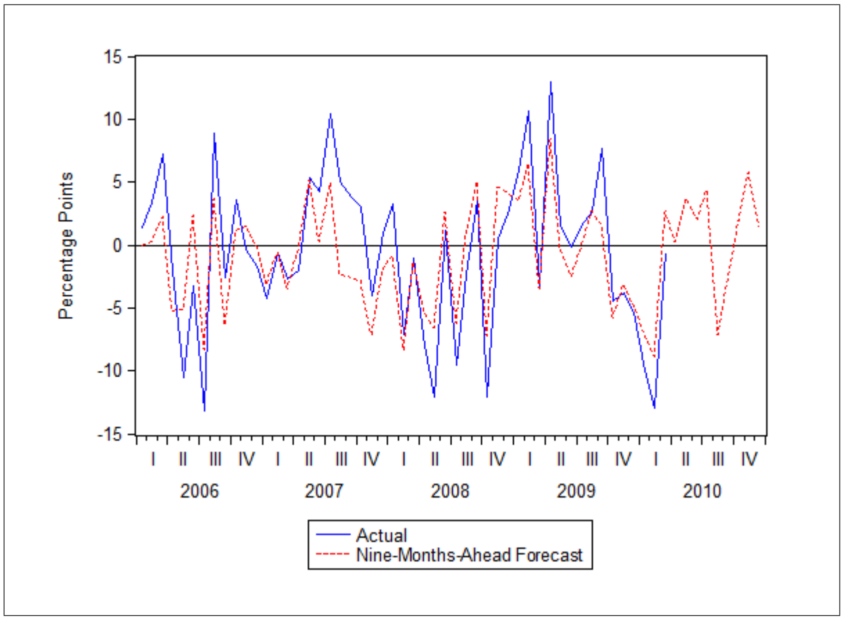

Figure 7: Changes in Inflation over Nine Months

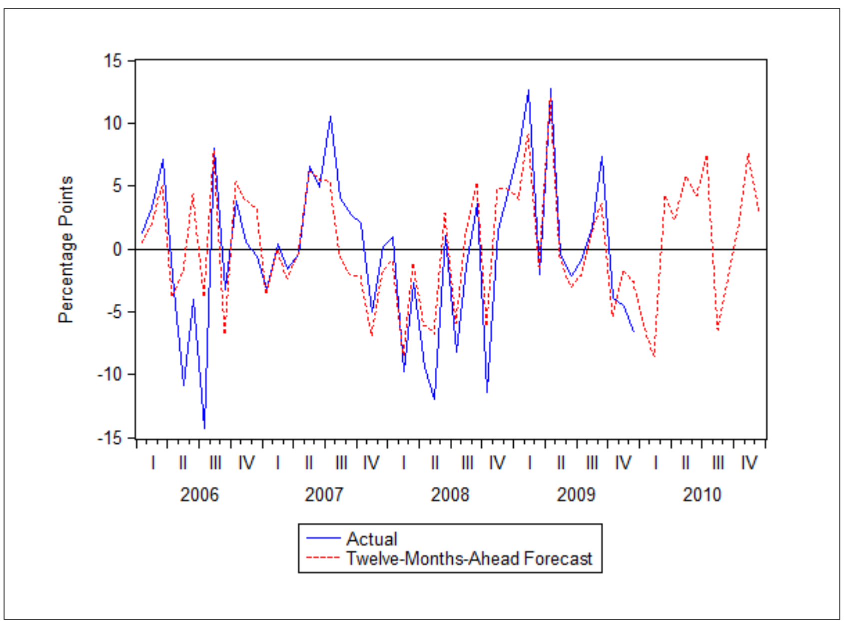

Figure 8: Changes in Inflation over A Year

Acronym	Description	Source
lipi	Log of Index Of Industrial Production	IFS[1]
cur	Capacity Utilization Rate	Turkstat[2]
grelpr	Log of Gross Electricity Production	TETC[3]
trac	Log of Production of Agricultural Machinery (tractors)	AMA[4]
bus	Log of Production of Buses	AMA
unemp	Unemployment Rate	Turkstat
totemp	Log of Total Employment	Turkstat
xusd	Log of Exports (in US $)	Turkstat
musd	Log of Imports (in US $)	Turkstat
imusd	Log of Intermediate Goods Imports (in US $)	Turkstat
lvat	Log of VAT Revenue	RTMF[5]
rlvat	Log of Real VAT Revenue	-
lcpi	Log of Consumer Price Index	IFS
lppi	Log of Producer Price Index	IFS
xuvusd	Log of Export Unit Value Index (in US $)	Turkstat
muvusd	Log of Import Unit Value Index (in US $)	Turkstat
lop	Log of Oil Price Index (UK Brent)	IFS
rlop	Log of Real Oil Price Index (UK Brent)	-
uscpi	Log of US CPI 2005=100	OECD[6]
lm1	Log of Money: M1	CBRT[7]
lm2	Log of Money: M2	CBRT
lm2y	Log of Money: M2Y	CBRT
lm3	Log of Money: M3	CBRT
ll0	Log of Credit	CBRT
rlm1	Log of Real Money: M1	-
rlm2	Log of Real Money: M2	-
rlm2y	Log of Real Money: M2Y	-
rlm3	Log of Real Money: M3	-
rll0	Log of Real Credit	-
onir	Interest Rate: Overnight	OECD
dr	Interest Rate: Discount	IFS
depo3m	Interest Rate: 3 Month Deposit	CBRT
traucrate	Interest Rate: Treasury Auction Rate	Treasury[8]
ex-rate	Log of Average US $/TL Nominal Exchange Rate	IFS
rex-rate	Log of Real Effective Exchange Rate	BIS[9]

ise100	Log of Stock Price	ISE[10]
rise100	Log of Real Stock Index	-
is-pe	Price-Earnings Ratio on ISE 100	ISE
divpr	Dividend Yield on ISE 100	ISE
embi-tr	Log of JP Morgan EMBI Index for Turkey	WB[11]
irspread	Spread: Sovereign interest rate - US T-bill Rate	WB
gold	Log of Gold Price (in $)	IFS
rgold	Log of Real Gold Price	-
lover	Log of Overdrafts	CBRT
lirescb	Log of Central Bank's Gross FX Reserves	CBRT
lires-gold	Log of International Reserves: Gold	CBRT
lires	Log of Gross International Reserves	CBRT

Sources
[1] IFS: IMF International Financial Statistics
[2] Turkstat: Turkish Statistical Institute
[3] TETC: Turkish Electricity Transmission Joint Stock Company
[4] AMA: Automotive Manufacturers' Association
[5] RTMF: Republic of Turkey Ministry of Finance
[6] OECD: OECD Statistics
[7] CBRT: Central Bank of the Republic of Turkey
[8] Treasury: Undersectariat of the Treasury
[9] BIS: Bank for International Settlements
[10] ISE: Istanbul Stock Exchange
[11] WB: World Bank Global Economic Monitor

Table 1: Series Descriptions and Sources

Forecast Horizon		$h = 3$	$h = 6$	$h = 9$	$h = 12$
Univariate Autoregression		Root Mean Squared Forecast Error			
		25.86	20.22	16.66	14.01
Bivariate Forecasts		MSFE Relative to Univariate Autoregression			
Indicator	Transformation				
cur	d	1.31	1.04	1.02	1.67
grelpr	d	1.46	**0.88**	**0.94**	1.03
trac	d	1.06	**0.98**	**0.99**	**0.98**
buses	d	1.17	1.17	1.01	1.02
unemp	-	1.12	1.13	1.02	1.11
unemp	d	1.10	1.07	1.04	**0.96**
totemp	d	1.31	**0.99**	**0.99**	1.00
xusd	d	1.28	1.09	1.39	1.00
musd	d	1.05	1.01	1.29	**0.96**
imusd	d	1.28	1.46	1.72	**0.96**
lvat	d	1.00	**0.99**	**0.99**	1.03
lvat	2d	1.00	1.01	1.01	**0.98**
rlvat	d	1.02	1.00	1.00	1.08
lcpi	d	1.00	1.00	**0.95**	1.04
lcpi	2d	**0.98**	1.12	**0.96**	1.01
lppi	d	1.01	1.01	1.05	1.02
lppi	2d	1.03	**0.99**	1.07	1.00
xuvusd	d	1.32	1.40	1.39	1.12
muvusd	d	1.38	1.35	1.40	1.07
lop	d	1.48	1.25	1.54	1.03
lop	2d	**0.99**	**0.99**	1.19	**0.99**
rlop	d	1.48	1.27	1.53	1.02
uscpi	d	1.72	1.16	1.05	**0.95**
uscpi	2d	1.38	1.14	1.02	**0.98**
lm1	d	1.00	1.02	1.12	1.29
lm1	2d	**0.98**	1.03	**0.98**	1.00
lm2	d	1.19	1.15	1.24	1.21
lm2	2d	1.15	1.03	1.03	1.02
lm2y	d	**0.99**	1.01	1.00	1.00
lm2y	2d	1.01	**0.99**	1.00	1.00
lm3	d	1.16	1.18	1.13	1.12
lm3	2d	1.08	**0.99**	1.03	1.01
ll0	d	**0.98**	1.05	1.05	1.03
ll0	2d	1.02	1.00	**0.99**	1.03

Forecast Horizon		$h = 3$	$h = 6$	$h = 9$	$h = 12$
Bivariate Forecasts		MSFE Relative to Univariate Autoregression			
Indicator	Transformation				
rlm1	d	1.02	1.01	1.02	1.05
rlm2	d	1.07	1.11	1.01	1.01
rlm2y	d	1.18	1.06	1.12	1.10
rlm3	d	1.01	1.07	1.05	**0.98**
rll0	d	1.13	1.02	1.13	1.09
onir	-	1.08	1.07	1.04	1.12
onir	d	1.03	1.03	1.05	1.00
dr	-	1.21	1.20	1.16	1.14
dr	d	**0.98**	1.02	1.11	1.18
depo3M	-	1.03	1.01	1.01	1.06
depo3M	d	1.17	1.06	**0.97**	**0.98**
traucrate	-	1.11	1.08	1.04	1.09
traucrate	d	1.16	1.01	**0.97**	**0.98**
ex-rate	d	1.15	1.00	1.00	1.02
rex-rate	d	1.23	1.00	**0.99**	1.02
ise100	d	**0.97**	1.02	1.02	1.17
rise100	d	**0.95**	1.14	1.13	1.07
ise-pe	-	1.03	**0.99**	**0.99**	**0.99**
ise-pe	d	1.02	1.00	1.01	**0.96**
divpr	-	1.15	1.12	1.41	1.26
divpr	d	**0.91**	**0.96**	**0.94**	**0.98**
embi-tr	d	**0.98**	**0.95**	**0.93**	**0.96**
irspread	-	1.02	1.04	**0.96**	1.05
irspread	d	**0.95**	**0.95**	**0.97**	1.14
gold	d	1.35	1.29	1.06	1.08
gold	2d	1.06	1.01	1.01	**0.99**
rgold	d	1.17	1.20	1.07	1.04
lover	-	1.28	1.10	1.14	1.52
lover	d	1.08	1.02	1.09	1.03
lirescb	-	1.09	1.21	1.06	1.14
lirescb	d	**0.98**	**0.95**	**0.98**	1.01
lires-gold	-	1.44	1.36	1.37	1.28
lires-gold	d	1.07	**0.99**	1.00	**0.99**
lires	-	1.57	1.79	1.84	1.43
lires	d	1.00	**0.94**	1.00	1.01

Table 2: IP Growth Out-Of-Sample Forecasting Results for 2001-2010 Sample

Forecast Horizon		$h=3$	$h=6$	$h=9$	$h=12$
Univariate Autoregression		Root Mean Squared Forecast Error			
		5.22	4.87	4.87	5.14
Bivariate Forecasts		MSFE Relative to Univariate Autoregression			
Indicator	Transformation				
lipi	d	1.25	1.01	1.05	**0.99**
lipi	2d	1.35	1.00	1.04	1.04
cur	d	1.43	1.55	1.46	**0.86**
grelpr	d	1.29	1.62	3.18	3.57
trac	d	1.22	1.36	1.34	1.25
buses	d	1.13	1.12	1.07	1.07
unemp	-	1.27	2.08	3.27	5.75
unemp	d	1.02	1.01	**0.98**	5.75
totemp	d	1.58	1.09	1.36	1.82
xusd	d	1.00	1.02	1.01	1.01
musd	d	**0.96**	1.00	1.06	1.01
imusd	d	1.02	1.01	1.01	1.01
lvat	d	1.15	1.24	1.15	1.03
lvat	2d	1.03	1.00	1.00	1.00
rlvat	d	1.00	1.35	1.96	2.23
lppi	d	1.03	**0.79**	**0.63**	**0.67**
lppi	2d	1.14	1.11	1.07	1.03
xuvusd	d	1.27	1.35	1.76	2.52
muvusd	d	1.07	**0.99**	**0.96**	**0.98**
lop	d	1.39	2.01	1.83	1.83
lop	2d	1.20	1.68	1.62	1.45
rlop	d	1.36	1.93	1.51	1.94
uscpi	d	1.07	1.19	1.08	1.02
uscpi	2d	1.14	1.02	1.02	1.05
lm1	d	1.07	1.04	1.03	**0.99**
lm1	2d	1.00	1.04	1.01	1.00
lm2	d	1.01	1.02	1.03	1.00
lm2	2d	1.00	1.04	1.00	1.00
lm2y	d	1.15	1.23	1.43	1.21
lm2y	2d	1.27	1.33	1.27	1.18
lm3	d	**0.97**	**0.97**	1.00	**0.98**
lm3	2d	1.00	1.00	1.00	**0.99**
ll0	d	1.08	1.05	1.17	1.14
ll0	2d	1.20	1.19	1.22	1.16

Forecast Horizon		h = 3	h = 6	h = 9	h = 12
Bivariate Forecasts		MSFE Relative to Univariate Autoregression			
Indicator	Transformation				
rlm1	d	1.04	1.26	2.02	2.13
rlm2	d	1.08	1.24	1.30	1.30
rlm2y	d	1.15	1.11	1.09	1.02
rlm3	d	1.25	1.23	1.46	1.44
rll0	d	1.07	**0.97**	**0.94**	**0.93**
onir	-	**0.89**	**0.92**	1.05	**0.93**
onir	d	1.14	1.17	1.27	1.39
dr	-	1.11	1.03	1.48	2.17
dr	d	1.32	1.38	3.21	4.96
depo3m	-	**0.95**	**0.93**	**0.90**	**0.72**
depo3m	d	1.11	1.08	**0.99**	**0.99**
traucrate	-	**0.99**	**0.91**	1.00	**0.84**
traucrate	d	1.08	1.03	1.01	1.04
ex-rate	d	1.05	1.19	1.72	1.71
rex-rate	-	1.29	1.50	1.57	1.36
ise100	d	1.29	2.12	2.69	3.21
rise100	d	1.34	1.93	2.38	2.56
ise-pe	-	**0.96**	**0.82**	**0.67**	**0.57**
ise-pe	d	**0.94**	**0.82**	**0.61**	**0.52**
divpr	-	1.54	1.60	4.32	8.80
divpr	d	**0.97**	**0.94**	**0.90**	**0.92**
embi-tr	d	1.22	1.36	1.12	1.23
irspread	-	1.18	**0.98**	**0.97**	**0.98**
irspread	d	1.21	1.45	2.27	2.68
gold	d	1.13	2.58	5.49	1.19
gold	2d	1.01	**0.99**	**0.99**	**0.98**
rgold	d	**0.97**	1.81	4.00	**0.98**
lover	-	1.00	**0.78**	**0.67**	2.35
lover	d	1.14	1.43	1.44	2.24
lirescb	-	1.13	1.95	1.69	2.86
lirescb	d	1.46	1.93	3.19	4.11
lires-gold	-	1.30	1.85	2.86	3.85
lires-gold	d	1.08	1.09	1.04	1.10
lires	-	1.59	1.68	2.92	4.53
lires	d	1.44	1.80	1.81	2.56

Table 3: Changes in CPI Inflation Out-Of-Sample Forecasting Results, 2006-2010

Forecast Horizon	$h = 3$	$h = 6$	$h = 9$	$h = 12$
Combination Forecasts		Relative MSFE		
Combination (Trimmed Mean of All Forecasts)	1.01	0.97	0.99	1.00
Combination (Median of All Forecasts)	0.99	0.99	0.99	1.00
Combination (Median of Top 5 Forecasts)	0.91	0.93	0.95	0.96

Table 4: Out-Of-Sample Forecasting Accuracy, 2006-2010 – IP Growth

Forecast Horizon	$h = 3$	$h = 6$	$h = 9$	$h = 12$
Combination Forecasts		Relative MSFE		
Combination (Trimmed Mean of All Forecasts)	0.98	0.86	0.80	0.72
Combination (Median of All Forecasts)	1.00	0.97	0.95	0.94
Combination (Median of Top 5 Forecasts)	0.91	0.74	0.53	0.45

Table 5: Out-Of-Sample Forecasting Accuracy, 2006-2010 – CPI Inflation