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Ermişoğlu, Ergun and Akcelik, Yasin and Oduncu, Arif

Central Bank of the Republic of Turkey

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Ergun Ermişoğlu Yasin Akçelik Arif Oduncu[ψ]

Abstract

It is a well-known fact that there is a strong relationship between bank credits and economic activity. Thus, it is a reasonable question whether credit data can be used in nowcasting GDP growth. It is important for policymakers to make on-time decisions with the most available data and nowcasting is an important tool when policies in question are needed to be made based on current figures. Most macroeconomic variables are made available to public after a considerable delay; however, banking credit data may be very valuable for the early estimate of current GDP as it is available only with a few days delay. In this paper, we aim to investigate the feasibility of using credit data in explaining the variability in Turkish GDP growth and as well as nowcasting it. For this purpose, we use credit impulse and new borrowing, two measures of credit flows. We show that credit impulse and new borrowing are significant in explaining the pattern of the Turkish GDP growth and they have significant contribution to nowcasting it.

Keywords: Nowcasting GDP, Credit Impulse, New Borrowing

JEL classification: C22, C53, E37

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Correspondence address: Central Bank of the Republic of Turkey, İstiklal Cad. 10, 06100 Ulus Ankara, Turkey.▪ ergun.ermisoglu@tcmb.gov.tr ▪ yasin.akcelik@tcmb.gov.tr ▪ arif.oduncu@tcmb.gov.tr.

1 Introduction

It is a well-known fact that there is a strong relationship between banking credit and economic activity. Hence, it is a reasonable question whether credit data can be used in nowcasting GDP growth. It is important for policymakers to make on-time decisions with the most available data and nowcasting is an important tool when policies in question are needed to be made based on current figures. Therefore, banking credit data may be very valuable for the early estimate of current GDP since it is available only with a few days delay, whereas the actual GDP data arrives with 70-90 days delay.

The relation between growth of credit stock and GDP growth has been studied in the economic literature. Calvo et al. (2006) claim that after the financial crises, economic activity recovers without a growth in credit stock in emerging markets. This phenomenon came to be known as “credit-less recovery” or “Phoenix Miracle” in the literature. Claessens et al. (2008) verify this for 21 OECD countries. On the other hand, Biggs et al. (2012) argue that it is more relevant to investigate the relationship between the change in credit stock, called new borrowing, and GDP since they are both flow variables. They examine the correlation between the new borrowing and the change in new borrowing, called credit impulse, and GDP growth. They find that both new borrowing and credit impulse were statistically significant in explaining quarterly GDP growth in US from 1954Q4 to 2008Q4. Moreover, they show that a rebound in economic activity is closely related to a rebound in the credit impulse, i.e. banking credit grows at accelerated speeds in US recovery periods.

Kara and Tiryaki (2013) examine the annual GDP growth and credit impulse for Turkey and they claim that the reference point of 15% nominal growth in total credit stock is compatible with the projection of 4% annual GDP growth in 2013 according to the government's Medium Term Program. Akkoyun and Günay (2012) calculate nowcasts for quarter-on-quarter Turkish GDP growth by using Turkish PMI as soft data; industrial production, import and export quantity indices as hard data. They find that using PMI improves the performance of the model in nowcasting GDP growth.

In this paper, we model quarterly Turkish GDP growth using PMI as soft data and credit information as hard data. We prefer not to use other commonly used hard data, since they arrive with a long delay, at least a month or more. However, both the credit and PMI data is available with one week delay. Through the use of Turkish PMI, retail and business loan data, we aim to investigate the contribution of credit data in nowcasting GDP growth. We find that credit data contains significant information in explaining the movements of quarterly GDP growth and credit flow measures are quiet useful in nowcasting Turkish GDP. To the best of our knowledge, this is the first paper using credit data in nowcasting quarter-on-quarter Turkish GDP growth.

The remainder of the paper is organized as follows. Next section details the motivation that set us to investigate the relation between banking credit and GDP. Section 3 presents the data and Section 4 shows the methodology used and empirical results and Section 5 concludes.

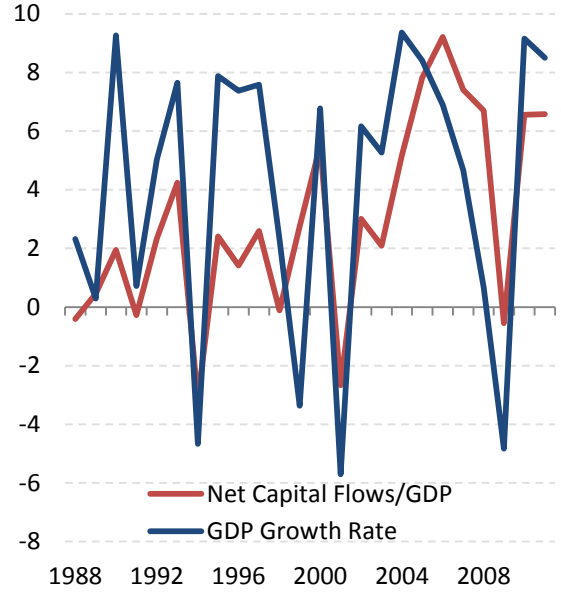
2 Motivation

Ever since the breakdown of the Bretton Woods in 1971, money and credit have become more and more alike within the ever-more globalized financial system. Due to cross border capital flows, controlling money growth is not a viable tool as a monetary policy for many central banks now. Using policy rates to target inflation has replaced instead in modern central banking, affecting both money and credit demand as well as cross border flows. This policy eventually has implications on employment and production. To make things more concrete, Figure 1 depicts how capital flows and GDP growth are closely linked to each other in Turkey — high volatility in capital flows is more or less reflected in the volatility of GDP growth. Also, Figure 2 shows that the change in credit moves in parallel with the current account deficit over time, which is financed with capital flows.

Figure 1

Capital Flows and GDP Growth

(Percent, Annual)

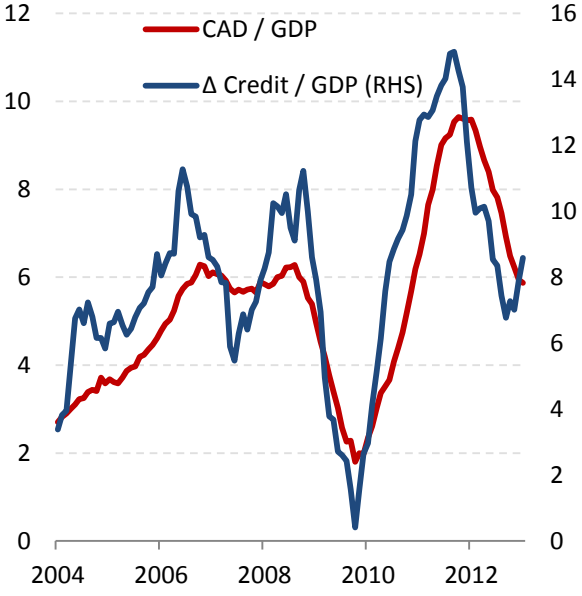


Source: CBRT, Turkstat.

Figure 2

Current Account and Credit Growth

(Percent, Annual)



Source: CBRT, Turkstat.

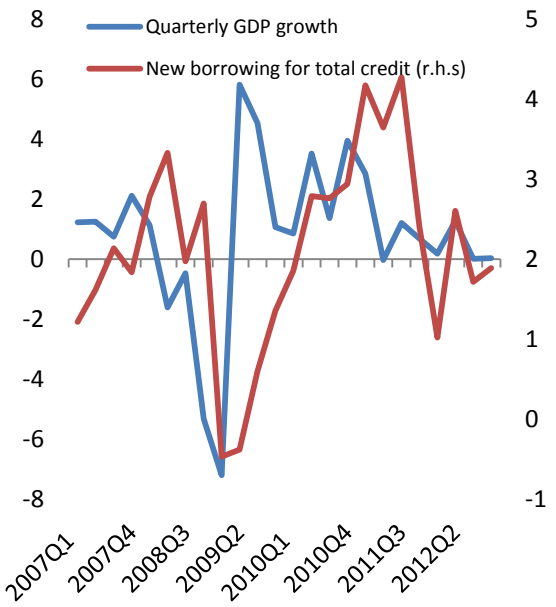
The intuition is that the surge in foreign capital inflows fuels the credit demand, and accelerates the flow of credit during the boom part of the business cycle. Higher credit demand means higher domestic demand for goods and services, and eventually higher current account deficit, in an environment with low domestic savings. Higher demand yields higher production and hence higher GDP. During the bust cycle, on the other hand, capital flows reverse and financing conditions worsen for both business and households, resulting with decelerated flow of credit. With low credit supply and/or demand, low consumption and low investment would ensue along with lower GDP growth.

Figure 3 depicts the quarterly GDP growth and the new borrowing data for total credit. Similarly, Figure 4 shows the same relation but with credit impulse data for total credit.

Figure 3

New Borrowing and GDP Growth

(Percent, Quarterly)

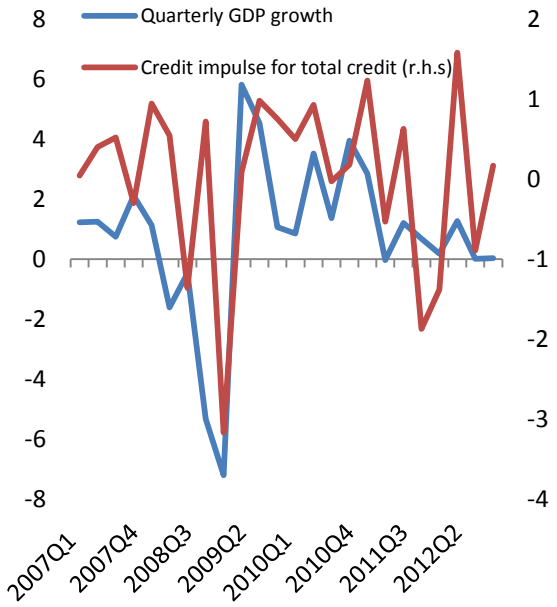


Source: CBRT, Turkstat.

Figure 4

Credit Impulse and GDP Growth

(Percent, Quarterly)



Source: CBRT, Turkstat.

These graphs show that there is valuable information in credit data to explain the movements in GDP growth. Consequently, in this paper, we investigate more whether credit data has a significant contribution in nowcasting GDP growth.

3 Data

Nowcasting is particularly important with low frequency data that is published with a relatively long delay. Quarterly Turkish GDP data is published on average 80 days after the end of the respective quarter. However, weekly credit data has a one week delay. Similarly, monthly PMI values are available within a week after the end of the month. For illustration purposes, data availability by the first week of each respective month for year 2013 is listed in Table 1.

Table 1 Data Availability

2013	January	February	March	April	May	June
GDP	2012 Q3	NA	NA	2012 Q4	NA	NA
Credit Data	Stock as of Dec 31, 2012	Stock as of Jan 31, 2013	Stock as of Feb 31, 2013	Stock as of Mar 31, 2013	Stock as of Apr 31, 2013	Stock as of May 31, 2013
PMI	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May2013

To give an example, 2011 Q4 Turkish GDP figure is published in April 2013; however, credit and PMI data for the last quarter of 2012 is already available by the end of first week in January. Our purpose is to estimate the 2012 Q4 quarterly GDP growth in the beginning of January with the available information that is contained within the credit and PMI data.

Even though Turkish PMI data is available from May 2005, starting point for our analysis is dictated by the availability of the weekly credit data that is available from January 2006. Total credit data is composed of business loans and retail loans that include credit cards.[1] The reason we disaggregate total credit into retail and business loans is to extract different information from different types of credit, since retail and business loans might have different effects on GDP growth.[2]

We transform the variables to match their frequencies; we take simple average of weekly credit stock data and monthly PMI data to match with the quarterly GDP values. Averaging weekly and monthly values prevents any abrupt changes in high frequency data to skew the estimation results. Following Biggs et al. (2009), we redefine credit stock in flows: "new borrowing" is the first difference of the credit stock divided by the GDP,

$$New\ Borrowing_t = \frac{(Credit\ Stock_t - Credit\ Stock_{t-1})}{GDP_{t-1}}$$

where t represents quarters. Similarly, "credit impulse" is the first difference of new borrowing as shown below;

$$Credit\ Impulse_t = New\ Borrowing_t - New\ Borrowing_{t-1}$$

As discussed in Biggs et al. (2010), the change in the flow of credit (credit impulse) has more explanatory power on changes in GDP, especially during recovery from recessions, than flow of credit (new borrowing). We calculate the new

[1] Stock of weekly total credit data includes total banking sector loans and credit cards; excludes non-performing loans and credits to financial sectors.
[2] Indeed, the regressions show that disaggregating total credit into retail and business loans improves estimation results.

borrowing and the credit impulse for both retail and business loans and their figures are shown below.

Figure 5

Business Loans New Borrowing

(Percent, Quarterly)

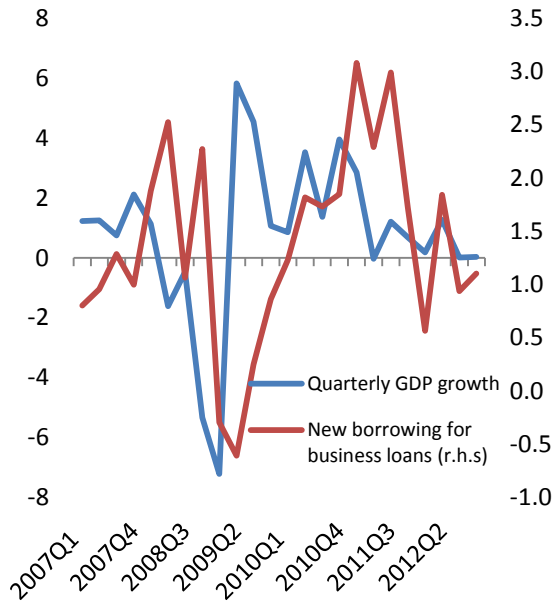


Figure 6

Business Loans Credit Impulse

(Percent, Quarterly)

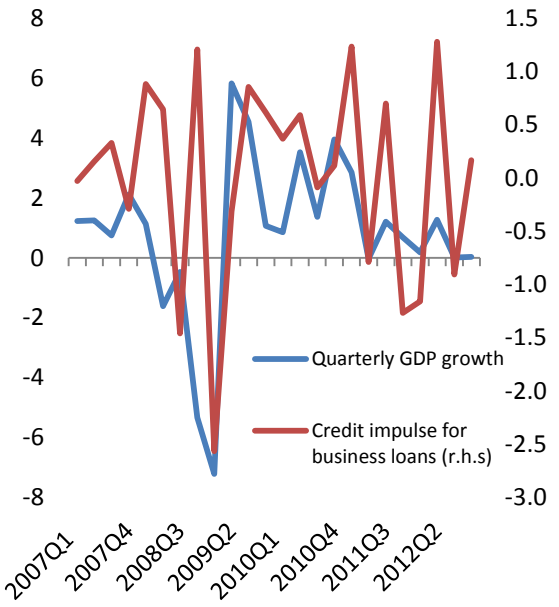


Figure 7

Retail Loans New Borrowing

(Percent, Quarterly)

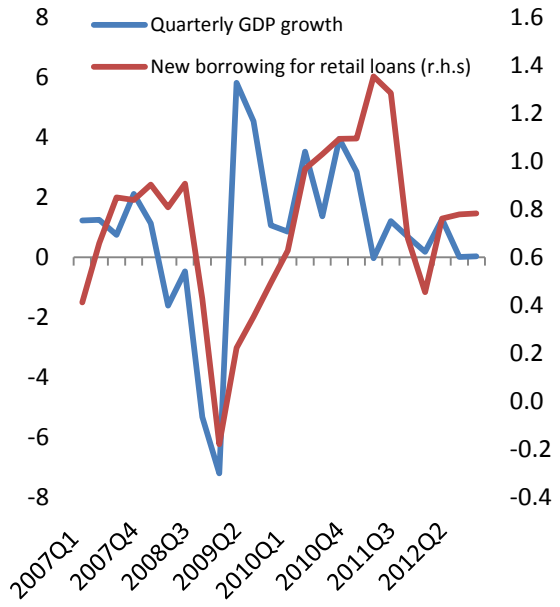
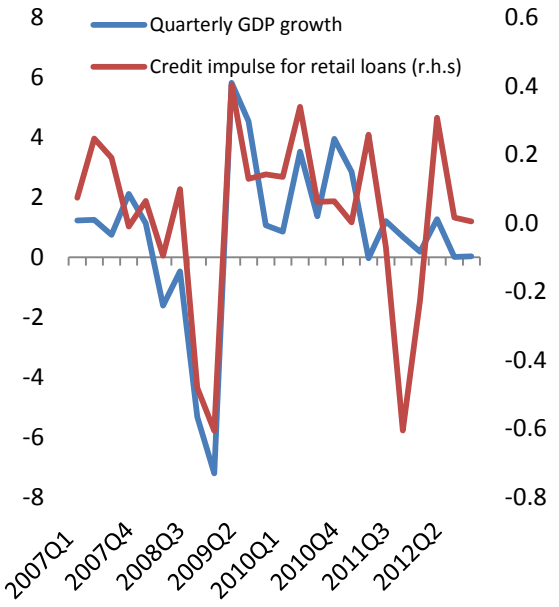


Figure 8

Retail Loans Credit Impulse

(Percent, Quarterly)



4 Methodology and Empirical Results

4.1 GDP Growth and Credit Flows

As we have illustrated intuitively before, credit flow measures and GDP growth are closely linked to each other. Before proceeding to more detailed analysis, we would like to see whether credit flow measures are helpful in estimating the GDP growth. For this purpose we construct Model 1 and Model 2.

$$y_t = \alpha_1 + \beta_1 RLNB_t + \beta_2 RLNB_{t-1} + \delta_1 BLNB_t + \delta_2 BLNB_{t-1} + \varepsilon_t \quad (1)$$

$$y_t = \alpha_2 + \theta_1 RLCI_t + \theta_2 RLCI_{t-1} + \theta_3 RLCI_{t-2} + \mu_1 BLCI_t + \mu_2 BLCI_{t-1} + \mu_3 BLNB_{t-2} + \gamma_t \quad (2)$$

Model variables are defined as below:

$y_t = quarter - on - quarter\ GDP\ growth$

$RLNB = New\ Borrowing\ for\ retail\ loans$

$BLNB = New\ Borrowing\ for\ business\ loans$

$RLCI = Credit\ Impulse\ for\ retail\ loans$

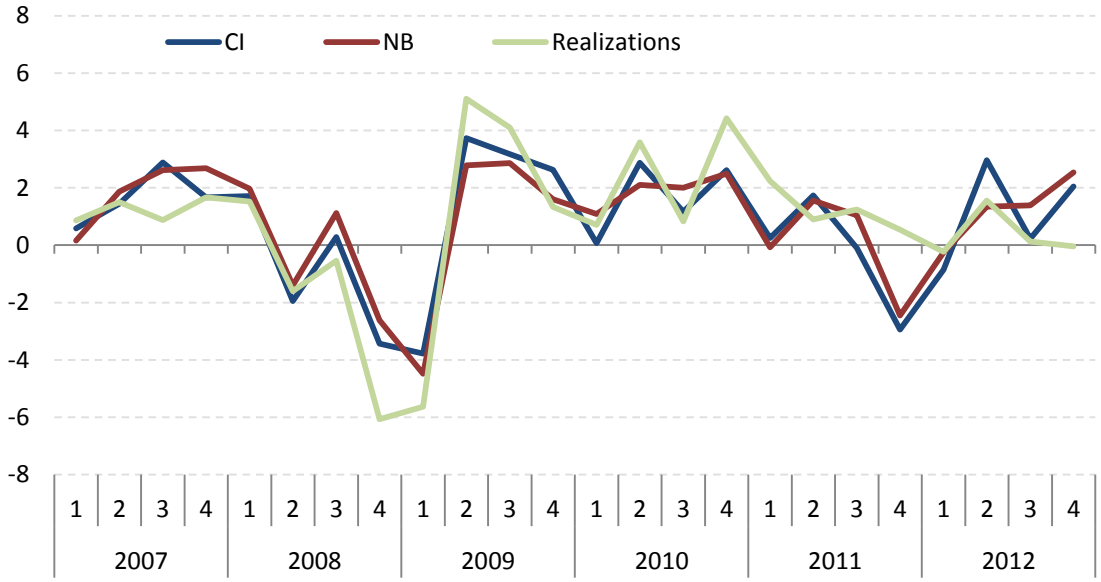
$BLCI = Credit\ Impulse\ for\ business\ loans$

Table 2

	Model 1 (New Borrowing)		Model 2 (Credit Impulse)	
GDP Growth	Coefficients	P-Values	Coefficients	P-Values
C	-0.38	0.67	0.47	0.20
RL	7.61	0.00	9.47	0.00
BL	-1.90	0.02	-0.83	0.18
RL [-1]	0.56	0.81	2.26	0.26
BL [-1]	-1.53	0.03	-1.99	0.02
RL [-2]	--	--	5.43	0.03
BL [-2]	--	--	-1.55	0.03
Adj. R-sqr	0.51		0.57	

Table 2 shows the results of Model 1 and Model 2. Both types of loans have significant effects on GDP growth and the goodness of fit results show that credit impulse is more useful in explaining the variation in quarterly GDP growth. We draw the fitted values of both regressions and the realizations of GDP growth in Figure 9.

Figure 9
(Percent, Quarterly Growth)



After showing the credit flow measures have significant information about the movements of the GDP growth, we test whether adding the credit flow measures to a benchmark model improve the performance of the model. For this purpose we define a benchmark model (Model 3) which uses only the PMI data. Then we construct Model 4 and Model 5 with new borrowing and credit impulse, respectively, in addition to the PMI data.

$$y_t = C + \beta_1 PMI_t + \beta_2 PMI_{t-1} + \omega_t \quad (3)$$

$$y_t = C + \theta_1 RLNB_t + \theta_2 RLNB_{t-1} + \alpha_1 BLNB_t + \alpha_2 BLNB_{t-1} + \beta_1 PMI_t + \beta_2 PMI_{t-1} + \varepsilon_t \quad (4)$$

$$y_t = C + \theta_1 RLCI_t + \theta_2 RLCI_{t-1} + \theta_3 RLCI_{t-2} + \alpha_1 BLCI_t + \alpha_2 BLCI_{t-1} + \alpha_3 BLNB_{t-2} + \beta_1 PMI_t + \beta_2 PMI_{t-1} + \varepsilon_t \quad (5)$$

Table 3 shows the regression results of Model 3 to 5. The goodness of fit results clearly show that although our benchmark model with the Turkish PMI data is very good in explaining the patterns of the GDP growth, adding credit flows data improve the performance of the benchmark model. Visual inspection of the fitted values of these regressions and the realizations of GDP growth in Figure 10 verifies this result.

Figure 10
(Percent, Quarterly Growth)

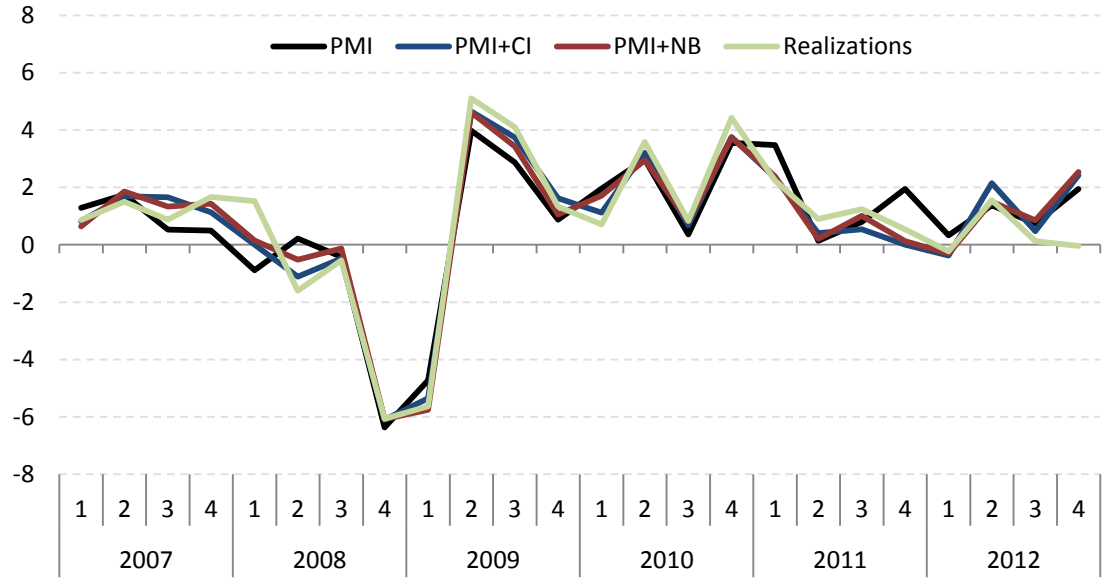


Table 3

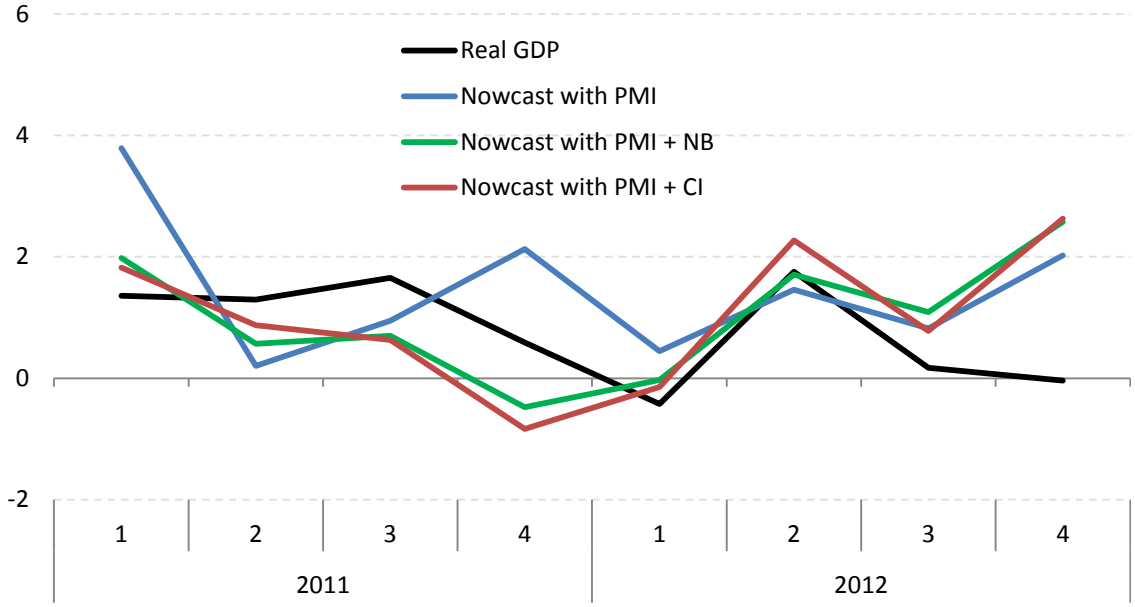
	PMI		New Borrowing		Credit Impulse	
GDP Growth	Coefficients	P-Values	Coefficients	P-Values	Coefficients	P-Values
c	-15.73	0.00	-10.72	0.00	-10.85	0.00
RL			3.49	0.00	4.35	0.00
BL			-0.83	0.05	-0.49	0.16
PMI	0.55	0.00	0.43	0.00	0.40	0.00
RL [-1]			0.73	0.56	1.74	0.12
BL [-1]			-0.88	0.02	-1.20	0.01
PMI [-1]	-0.23	0.00	-0.22	0.00	-0.18	0.01
RL [-2]			--	--	2.90	0.04
BL [-2]			--	--	-0.83	0.04
Adj. R-sqr	0.79		0.88		0.88	

4.2 Nowcasting GDP Growth with Credit Flows

Having shown that credit flow measures are significant in explaining the variability in GDP growth, now we would like to investigate if credit flow measures are successful in nowcasting GDP growth in an out-of-sample evaluation context. We choose 2011Q1-2012Q4 period as the evaluation period[3]. We work with real time data as suggested by Akkoyun and Günay (2012) and Croushore and Stark (2001). Using real time data enables us to replicate the estimation that we would have done if we were making the analysis at that period. Through the out-of-sample analysis, we aim to show the true capabilities of our model to nowcast the GDP growth with the given data at any time. The Figure 11 shows nowcasts obtained from Model 3 to Model 5, along with the realizations of GDP growth for the evaluation period.

[3]Since our whole sample period includes only 24 observations, out-of-sample period covers only 8 quarters starting from 2011Q1.

Figure 11
(Percent, Quarterly Growth)



Although visual inspection of the performance of the models shows that adding credit flow measures improves the performance of the model, it is necessary to use a formal measure to assess the forecast accuracy of the models. For this purpose, we use the mean absolute error (MAE) as defined below.

$$Mean\ Absolute\ Error = \sum_{t=2011Q1}^{2012Q4} \left| \frac{\hat{y}_t - y_t}{T} \right|$$

where $\hat{y}_t$ is the predicted GDP growth and y_t is the actual value. Table 4 shows the calculated MAEs for the period between 2011 Q1 and 2012 Q4 for Model 3 to 5.

Table 4

	Mean Absolute Error
PMI (Model 3)	1.21
New Borrowing (Model 4)	1.00
Credit Impulse (Model 5)	1.03

Compared to the benchmark model, the models with credit flow measures have significantly lower MAEs. Thus, using credit data significantly improves the forecast performance in nowcasting GDP growth.

5 Conclusion

Banking credit may have valuable information about GDP growth and this information might be very important since it will be used policymakers to make on-time decisions. This study investigates the feasibility of using credit data in explaining the variability in Turkish GDP growth as well as nowcasting it. To the best of our knowledge, this is the first paper using credit data in nowcasting quarter-on-quarter Turkish GDP growth.

In this paper, we model quarterly GDP growth by using PMI as soft data and credit information as hard data. Most macroeconomic variables are made available to public after a considerable delay, at least a month or more. Both the credit and PMI data is available after a week and this make them quite useful since they are the earliest data available for the economy.

We explore the relation between the quarter-on-quarter GDP growth and both the change in credit stock and the credit impulse by using Turkish data. The reason we use separately retail and business loans rather than the total credit data is to extract different information from the different types of credit, since retail and business loans might have different effects on GDP growth.

Our analysis shows that credit flow measures are significant in explaining the pattern of the Turkish GDP growth. Moreover, we show that using credit data significantly improves the forecast performance of the models using in nowcasting Turkish GDP growth. Therefore, it can be concluded credit data can be used both in explaining the movements of the GDP and in nowcasting quarter-on-quarter GDP growth.

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