CBT RESEARCH NOTES IN ECONOMICS

Monetary Policy and Output Gap: Mind the Composition[1]

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Özet: Bu çalışmada Bayesçi yöntem kullanılarak Türkiye'de çıktı açığını temel bileşenlerine ayrıştıran bir çerçeve sunulmaktadır. Sonuçlarımız, Lehman krizini takip eden süreçte Türkiye'de iç ve dış talep arasında ciddi bir ayrışma yaşanırken, ekonomi genelinde aşırı bir ısınma olmadığını göstermektedir. Bu bulgular, Türkiye Cumhuriyet Merkez Bankası'nın (TCMB) yeni politika çerçevesine zemin hazırlayan ve kayda değer bir enflasyon baskısı olmaksızın hızlı kredi büyümesi ve artan cari işlemler açığı ile tanımlanabilecek iktisadi görünüme ilişkin görüşlerini desteklemektedir. Bu koşullar altında salt toplam çıktı açığına dayandırılan geleneksel para politikası yaklaşımı finansal istikrar ile uyumlu olmayan bir politika önermesinde bulunabilecektir. Bu bağlamda, çıktı açığı bileşenlerinin türetilmesi, tutarlı politikaların tasarlanmasında karar alıcılara yardımcı olacaktır.

Abstract: We estimate an output gap measure for Turkey in a Bayesian framework with special reference to its components. Our results suggest that Turkey experienced a notable divergence between domestic and external demand with no sign of overheating for the whole economy in the post-Lehman crisis period. This finding confirms the basis for the new policy framework of the Central Bank of Turkey (CBT), which was characterized by rapid credit expansion and growing current account deficit without significant inflationary pressures. Under these circumstances, conventional monetary policy practice focusing solely on *aggregate* output gap may suggest policy prescriptions inconsistent with financial stability. In this regard, extracting the components of output gap would help policymakers make a suitable policy design to avoid any contradiction among objectives.

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1.   Introduction

Attempts to infer the relative position of economic activity with respect to a latent noninflationary threshold lie at the heart of inflation analysis. The adoption of inflation targeting and a higher reliance on inflation forecast models have motivated the estimation of output gap as a fairly standard tool in monetary policy implementation in pre-crises central banking. However, recent global crisis has broadened the conventional framework of monetary policy and brought financial stability to forefront in addition to price stability objective.

Literature on emerging market economies points to a number of issues leading to vulnerabilities of these economies to external shocks in the form of sudden stops.[2] Notwithstanding the notable progress in the last decade in terms of reforming its fiscal accounts, strengthening the banking sector and maintaining political stability, Turkey—as an open emerging economy—still faces volatile capital flows due to global liquidity cycles. Against this backdrop, during the post-crisis period, Turkey has inevitably confronted with this risk. The strong rebound during the post-crisis period driven by domestic demand and capital inflows along with a sustained real appreciation of Turkish lira (TL) raised concerns on current account sustainability, which were in turn perceived as a threat for macroeconomic and financial stability over the medium term.[3] As the composition of aggregate demand accumulates risks on the economy, monetary policy has confronted with a new challenge, requiring a multi-objective policy framework.[4]

In this environment, it would be optimal to design a policy which aligns *aggregate* output gap consistent with price stability while keeping the *components* of output gap consistent with macroeconomic and financial stability. To this end, a suitable policy setting necessitates an appropriate combination of available policy tools so as to ensure the consistency between these objectives. Hence, financial stability concern of monetary policy, consistent with the ultimate goal of price stability, raises the need for a more comprehensive analysis of output gap incorporating the investigation of its individual components. This note addresses this concern in a Bayesian framework via simultaneous estimation of an aggregate output gap measure for Turkey with special reference to its domestic and external components.

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[2] See Calvo (1998) and Mendoza (2010).
[3] Note also that the deterioration in terms of trade has been another contributing factor to the widening of the current account deficit during this period.
[4] See Başçı and Kara (2011) for a comprehensive discussion on the policy framework.

2. Modeling and the Estimation Strategy

We consider a stylized New Keynesian small open economy model that describes the joint determination of output gap, its domestic and external components along with inflation. We closely follow the modeling and estimation strategy employed in Öğünç and Sarıkaya (2011), except the fact that we introduce behavioral equations explicitly for the determination of domestic and external gaps into the model. The model economy is given by the following set of equations:

$$\tilde{d}_t = \alpha \tilde{d}_{t-1} + (1 - \alpha)\tilde{d}_{t+1} - \beta \tilde{r}_t + \varepsilon_t^d \tag{1}$$

$$\tilde{x}_t = \rho \tilde{x}_{t-1} + \gamma \tilde{y}_t^* - \delta \tilde{q}_{t-2} + \varepsilon_t^x \tag{2}$$

$$\widetilde{m}_t = \theta\big(\tau \tilde{d}_t + (1 - \tau)\tilde{x}_t\big) + \vartheta \tilde{q}_t + \varepsilon_t^m \tag{3}$$

$$\tilde{y}_t = \omega_1 \tilde{d}_t + \omega_2 \tilde{x}_t - \omega_3 \widetilde{m}_t \tag{4}$$

$$\pi_t = \varphi \pi_{t-1} + (1 - \varphi)\pi_{t+1} + \zeta \tilde{y}_{t-2} + \mu \tilde{s}_t + \varepsilon_t^\pi \tag{5}$$

Equation (1) describes the evolution of domestic demand gap (which can be considered as sum of consumption and investment), $\tilde{d}_t$, as a function of its past and expected realizations as well as fluctuations in the real interest rate gap, $\tilde{r}_t$. Equation (2) represents export demand gap, $\tilde{x}_t$, as a function of foreign output gap, $\tilde{y}_t^*$, and real exchange rate gap, $\tilde{q}_t$. Equation (3) characterizes the behavior of import demand gap, $\widetilde{m}_t$, depending on both domestic and export demand and real exchange rate gap.[5] Equation (4) is an identity relating the output gap, $\tilde{y}_t$, to its components, namely domestic, export and import demand gaps. In equations (3) and (4), the values of τ, ω_1, ω_2 and ω_3, are calibrated as 0.806, 1.019, 0.246, 0.265 respectively, based on the sample ratios of the period 2002-2010. Lastly, Equation (5) is the expectation augmented hybrid New Keynesian Phillips Curve for an open economy, including output gap and real import price gap, $\tilde{s}_t$, as real marginal cost components.

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[5] For import and export demand functions, alternative specifications regarding the lag structure of real exchange rate do not lead any significant change in estimation results.

The model is estimated with Bayesian methodology for the period 2002q1-2011q3.[6] Table 1 presents the mean and standard deviation of the prior and posterior distributions of the estimated parameters. In the estimation, the following eight time series are used: inflation rate, interest rate, the growth rates of GDP, exports and imports, foreign output gap, real effective exchange rate and real import prices.[7] For inflation measure, we use core inflation indicator SCA-H (CPI excluding energy, unprocessed food, alcoholic beverages, tobacco and gold). Interest rate is the ex-ante real commercial loan rate. Real effective exchange rate is the CPI based index published by the CBT. Real import price series is the import unit value index in domestic currency deflated by the core price measure SCA-H. We use HP filtered (1600) gap measures as a proxy for the deviations from the steady state for the real import prices, real interest rate and real exchange rate, whereas the foreign output gap measure is the OECD estimate of output gap for the total OECD region.

3. Results

In this section, we present our estimation results and discuss underlying dynamics of the divergence between demand components during the post-crisis episode in light of our model findings. Figure 1 displays the model-based output gap estimate and its uncertainty band derived from estimated parameter distributions. Estimation results indicate that global crisis dragged Turkey far below its potential at the beginning of 2009, but the economy quickly recovered and headed toward its long-run trend at a strong pace. While economic activity remained at disinflationary territory for almost two years until 2011, strong rebound has not come without problems due to heavy reliance on imported inputs and external financing. Eventually, trade imbalances have become apparent owing to both domestic and global policy stimulus in response to global crises and weak global outlook exacerbating the divergence between domestic and external demand.

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[6] In order to reduce the end-sample bias, data are extended to the third quarter of 2012 by applying the Box-Jenkins methodology (ARIMA model forecasts).
[7] Imports and exports are from national accounts including both goods and services.

Figure 1: Output Gap

(Percentage Deviation of Actual Output from its Trend)
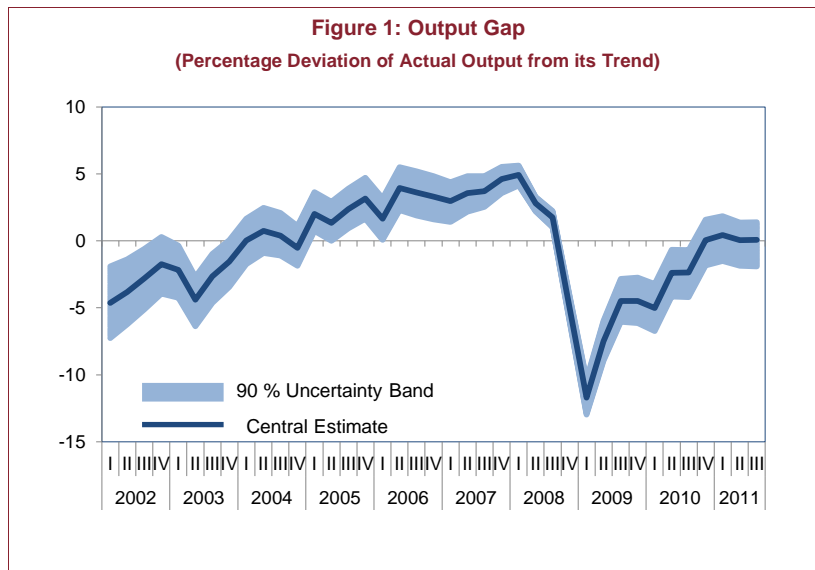
Estimated components of output gap, demonstrated in Figure 2, complement the post-crisis story. Evidence points to a persistent downward level shift in exports while domestic demand displayed a robust convergence to its potential following the crisis. Strong recovery coupled with the sustained real appreciation of TL also stimulated the import component of aggregate demand. As of the third quarter of 2010, even the upper bound estimate of the output gap implied no sign of overheating. For the same period, each individual component is estimated to remain below its trend and there was no clear evidence on a significant degree of decoupling between imports and exports.

Figure 2: Breakdown of Output Gap

(Percentage Deviation of Each Demand Component from its Trend)
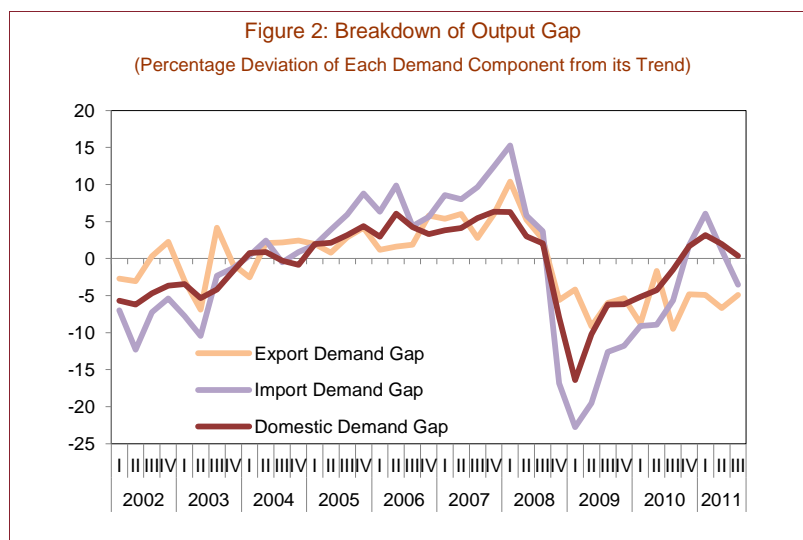
The outlook that would not appear as problematic as of the third quarter of 2010 changed to a great extent in the subsequent period where the economy slightly overreached its

potential according to our central estimate of output gap.[8] Early 2011 involved a relatively higher contribution of economic activity to inflation. Thus, the conventional practice focusing solely on inflation would call for a policy rate increase to contain demand pressures. However, a further glance at the individual components of output gap would cast doubt on such a policy response. It would be questionable that tightening through a single policy instrument would be a remedy for the divergence between external and domestic demand, as higher interest rates would attract capital inflows and would accumulate financial risks by further worsening the trade balance. In this case, while the need for monetary tightening seems evident, the choice of instruments for a consistent policy framework is an open question.

All in all, our findings suggest that steering monetary policy by a single instrument based on a measure of aggregate output gap may result in a conflict between multiple objectives in certain circumstances. Keeping an eye on the cyclical positions of aggregate demand components would help decision makers choose a proper combination of policy tools to secure the consistency of intermediate targets serving to the ultimate objective of price stability. In this respect, our estimation results also confirm the rationale behind the monetary policy design of the CBT.[9]

4. Conclusion

Global crisis has redefined the priorities of monetary policy conduct for central banks. While promoting economic growth, recognition of financial stability as one of the pillars of macroeconomic stability led policy makers to consider unconventional regulatory and macroprudential measures without jeopardizing the credibility of inflation targeting framework. CBT pioneered the policy stream in Turkey by highlighting accumulating risks on

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[8] Central estimate of the output gap is calculated by using the most-likely value (mode) of the estimated parameter space.

[9] Against the summarized backdrop, CBT emphasized its growing concern on financial stability explicitly for the first time in November 2010: "The surge in capital inflows exacerbates the divergence between the growth rates of domestic and external demand, widening the current account deficit through rapid credit growth and increasing import demand, thereby highlighting the risks regarding financial stability." Subsequently CBT decided to switch from its accustomed policy conduct to a new design incorporating the active use of unconventional policy instruments in its toolkit, i.e. required reserve ratios and liquidity management facilities, in order to curb domestic demand while at the same time to deter capital inflows [See CBT (2010) for the quoted statement and see Başçı and Kara (2011), Kara (2011) and CBT (2011a) for a detailed discussion on the basic principles of the recent monetary policy design of the CBT]. The need for adopting further macroprudential measures to cope with excessive credit use and widening current account deficit gradually led other regulatory institutions to display cooperative efforts as well. With the objective to maintain a sustainable growth for consumer loans, on June 20, 2011, the Banking Regulation and Supervision Agency (BRSA) introduced regulations on risk weights underlying general provision and capital adequacy estimations for consumer loans excluding housing and automobile loans [For a more comprehensive assessment of the BRSA measures, see CBT (2011b)].

external accounts as a potential threat to price stability and adjusting its policy setting accordingly.

Our findings reveal the rationale behind the monetary policy design of the CBT implemented since late 2010. They suggest that conventional monetary policy practice overlooking the individual components of output gap may result in a conflict between multi-objectives when growth dynamics involve systemic risks threatening financial stability. To the extent that global liquidity conditions and resulting capital inflows generate domestic imbalances, central banks may consider revising their policy framework while still serving to their ultimate objective of price stability.

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Appendix: Parameter Estimates

Table 1. Parameter Estimates

Parameter	Prior Distribution			Posterior Distribution	
	Dist.	Mean	Standard Deviation	Mean	% 95 Confidence Interval
Phillips Curve					
φ	Beta	0.60	0.2	0.8048	(0.6622, 0.9636)
ζ	Beta	0.15	0.05	0.1225	(0.0547, 0.1871)
μ	Beta	0.25	0.1	0.1938	(0.0876, 0.3031)
Domestic Demand					
α	Beta	0.50	0.2	0.5402	(0.3808, 0.7201)
β	Beta	0.50	0.2	0.4465	(0.2388, 0.6442)
Export Demand					
γ	Gamma	0.50	0.2	0.8649	(0.4003, 1.2996)
δ	Gamma	0.50	0.2	0.2292	(0.1048, 0.3450)
ρ	Gamma	0.50	0.2	0.4164	(0.1891, 0.6387)
Import Demand					
θ	Gamma	2.00	1.0	1.8671	(1.5928, 2.1368)
ϑ	Gamma	0.25	0.2	0.1117	(0.0138, 0.1970)
Shocks					
σ_{ε^π}	InvGam	0.032	Inf	0.0319	(0.0237, 0.0397)
σ_{ε^d}	InvGam	0.006	Inf	0.0155	(0.0112, 0.0199)
σ_{ε^x}	InvGam	0.033	Inf	0.0295	(0.0231, 0.0357)
σ_{ε^m}	InvGam	0.028	Inf	0.0172	(0.0129, 0.0216)

Notes: The choice of priors is as follows: we believe that backward-looking behavior has to be predominant. Thus, we set the prior mean of φ (the backward-looking component in the Phillips curve) to 0.6 based on the finding of Çebi (2011), even though the results of Öğünç and Sarıkaya (2011) suggest higher inflation persistence. Coefficient of the output gap in the Phillips curve is set to 0.15 considering the recent findings (Öğünç and Sarıkaya, 2011). The prior for μ is shaped in accordance with import and exchange rate pass-through findings. We stay agnostic for domestic and export demand dynamics by setting the prior means equal to 0.5 and assume relatively higher standard deviations for those parameters in order to allow for both up and downward deviations from this mean. For import demand, our prior belief is that the imports are elastic in aggregate demand. Therefore, our prior mean for the coefficient of aggregate demand is 2. We also allow for a substantial role for this feature based on the findings reported by Aydın, Çıplak and Yücel (2004).