The Likely Impact of Extended Turkish Treasury Single Account System on Public Finance in Turkey

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Abstract

Treasury Single Account (TSA) is a cash pooling system that enables public cash resources to be managed centrally and efficiently. Having a comprehensive cash pooling system is vital for countries seeking ways to increase effectiveness of their treasury cash management. For this cause, the regulation on expansion of TSA in Turkey was made in Law No. 4749 on 21 March 2018. With the latest amendment in relevant Law, the President of the Republic of Turkey has the authority to extend the scope of TSA. Within the limits of the powers conferred by the Law, the President of the Republic issued Presidential Decree on the scope of new TSA, dated on August 8, 2018. In this study, likely effects of extended scope of TSA on Turkish public finance is analysed by using a new cash management model which is derived from Miller-Orr cash management model. The results allege that comprehensive TSA is favourable for Turkish public financial management since it paves the way for significant amount of public resources to be managed by Turkish Treasury and it allows the Treasury to gain a considerable amount of additional interest revenue from its deposit.

Keywords: *Treasury Cash Management, Public Financial Management, Treasury Single Account.*

JEL Classification: *G11, G18, H11*

Öz - Tek Hazine Hesabı Sisteminin Genişletilmesinin Türkiye Kamu Maliyesine Etkisi

Tek Hazine Hesabı (THH) kamu nakit kaynağının merkezi ve etkin bir şekilde yönetilmesine imkan sağlayan nakit havuz sistemidir. Hazine nakit yönetiminin etkinliğini arttırmayı amaçlayan ülkeler için kapsamlı bir nakit havuz sistemine sahip olmak oldukça önemlidir. Bu amaçla, ülkemizde 21 Mart 2018 tarihinde THH'nin genişletilmesine yönelik 4749 sayılı Kanunda düzenleme yapılmıştır. THH'nin genişletilmesine yönelik yapılan düzenleme ile THH kapsamına alınabilecek kurumları belirleme yetkisi Cumhurbaşkanına verilmiştir. Kanunla verilen bu yetki uyarınca, THH kapsamına alınacak kamu idareleri, 8 Ağustos 2018 tarihli Cuhmhurbaşkanı Kararı ile belirlenmiştir. Bu çalışmada, Miller-Orr nakit yönetim modelinden türetilen Hazine nakit yönetim modeli ile Cumhurbaşkanı Kararı ile belirlenen THH kapsamının genişletilmesinin ülkemiz kamu maliyesine etkisi analiz edilmiştir. Çalışmada, ülkemizin geniş kapsamlı bir THH'ye sahip olması ile, önemli büyüklükte kamu kaynağının Hazinenin kullanımına sunulacağı ve tek elde toplanan kamu kaynağından daha yüksek nema geliri elde edileceği saptanarak THH kapsamının genişletilmesinin ülkemiz kamu maliyesi için faydalı olacağı sonucuna varılmıştır.

Anahtar Kelimeler: *Hazine Nakit Yönetimi, Kamu Mali Yönetimi, Tek Hazine Hesabı.*

JEL Sınıflandırması: *G11, G18, H11*

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1. Introduction

Treasury Single Account (TSA) is a cash pooling system that empowers treasury to manage significant amount of government cash resources centrally and efficiently. TSA can also be defined as a unified structure of government bank accounts which allows consolidation and optimum utilization of government cash resources. TSA is based on the ground of cash unity that all revenues are gathered in single account and all disbursements are realized through single account. Among IMF researchers, Pattanayak and Fainboim (2010) described TSA as;

"TSA is a bank account or a set of linked accounts through which the government transacts all its receipts and payments."

Williams (2004) stated it as;

A TSA is a prerequisite for modern cash management. It involves the consolidation of all government cash balances into a single account, usually and preferably at the central bank. This consolidation allows the MoF to minimize the volume of idle balances in the banking system, with consequent cost savings.[1] *These derive from the interest saved from using cash surpluses in one area of government activity to cover cash shortages in another. If cash is not consolidated, the additional cash requirement has to be financed by borrowing.*

As can be understood from above definitions, TSA, which allows treasury to equalize cash inflows and outflows and prevent unnecessary borrowing, is one of the most important tools that makes a major contribution to public cash management. Adoption of comprehensive TSA by countries, therefore, may be considered as a significant improvement especially for those countries with traditionally dispersed cash management structure. Recently, while countries without TSA have initiated to establish extended TSA system, others that have TSA but not work properly have also commenced to improve their TSA.

Considering the international best practices, it is seen that TSA, which aims to include all public resources as much as possible, has a comprehensive scope that includes social security institutions, revolving funds and extra budgetary funds in addition central government administrations. On the other hand, the scope of TSA in Turkey was quite narrow, which covered merely general budget administrations.

1 MOF: Ministry of Finance. Williams assumes that MOF is responsible for cash management in this study.

Accordingly, extension of scope of Turkish TSA agenda came forward as a priority in order to increase the effectiveness of government cash management in Turkey. In parallel with this aim, numerous studies, meetings and technical works on expansion of Turkish TSA have been done. Following structural and technical matters on this subject were complemented, amendment to the Law No. 4749, which gives the authority to the President of the Republic of Turkey to redesign the scope of Turkish TSA system, was enacted on March 21, 2018. Based on his authority, the President of the Republic of Turkey constituted new (extended) TSA by issuing the Presidential Decree on the scope of TSA. With the extended scope of TSA in Turkey, it is aimed to increase the total amount of remuneration income received on the public financial resources.

The motivation for writing this paper is to investigate the contribution of extended TSA system to Turkish public financial management. In order to assess likely return of extension of TSA, the working capital management approach is adopted in this study. And then, a new cash management model for Turkish Treasury is generated by modifying Miller-Orr cash management model in order to determine the optimum cash interval for the Treasury. The new cash management model is so crucial for this study because it determines at what intervals the Treasury should hold cash reserve and how much cash resources should be invested on the Treasury's short-term (1-month) time-deposit accounts. Namely, it gives an opportunity to calculate likely return of the extended scope of TSA to Turkish public financial management under the certain assumptions. This study makes a significant contribution to the existing literature on government cash management since there have been quite a few studies that attempt to estimate likely effect of extension scope of TSA.

The remainder of the paper is organized as follows. In Section 2, the concept of TSA is explained; its characteristics and advantages are revealed. This section also reveals selected countries' TSA practices. Section 3 summarizes the evolution of Turkish TSA systems and explains the coverage of extended TSA which is determined by the President of the Republic of Turkey. Section 4 presents the adopted methodology of the study for analysing likely effects of extension scope of TSA on public financial management and introduces the new cash management model which is created by modifying the Miller-Orr model. Furthermore, the details of data are revealed and estimation results are discussed in this Section. Finally, Section 5 concludes.

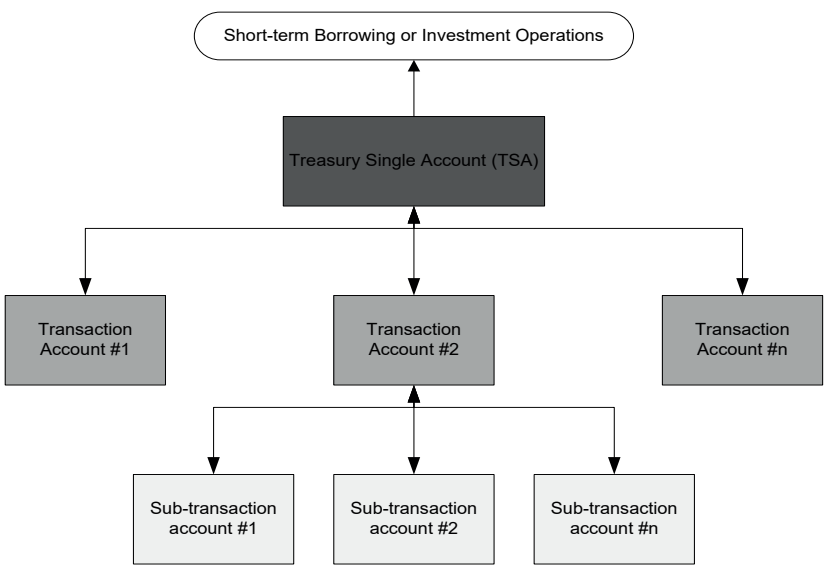
2. Literature Review on Treasury Single Account

2.1. TSA concept

Throughout the history, depending on their sovereign rights, governments have collected some revenues such as tax or quasi-tax from their citizens to finance their expenditures. That task is generally performed by government treasuries. Treasuries which are responsible for equalizing cash inflows and outflows in view of time and location are subject to face mismatching cash flows problem since their cash flows moves dissonantly, namely, their collections and disbursements vary from region to region and from time to time. For that reason, establishment of TSA which can be regarded as one of most important tools for equalizing cash flows is crucial to solve the disparity of cash flows.

TSA system which has been in practice since the nineteenth century was initially created by Count Mollien, financial consultant of Napoleon, upon the need for equalizing the public cash resources in terms of time and location. It works as balancing mechanism in which surplus of some institutions are used for compensating cash needs of other institutions (Besette, 2011). The structure of TSA is illustrated as below.

Figure 1. The Structure of TSA



Source: Mu, 2006.

TSA is also one of the most important tools for reforming public financial management systems. It is based on cash unity principle and refers to a banking arrangement system in which governments' collections can be gathered and from which governments' expenditures can be made (General Guidelines for the Development of Government Payment Programs, 2012). Actually, TSA does not refer just a bank account, but it is a system/banking arrangement that can contribute to improve government cash management efficiency by automating processes, enforcing internal controls and by providing timely and reliable information for decision-making (Guide to Public Financial Management-USAID, 2014).

2.2. Characteristic of TSA and its advantages

According to Pattanayak and Fainboim (2011), a full-fledged TSA needs to have six following main characteristics.

Table 1. Characteristic of TSA

Characteristic of TSA	
Location	TSA should be held at central bank rather than commercial banks in order to prevent some risks such as counterparty risk, credit risk and moral hazard risk.
Timely information	Units responsible for managing TSA should access to information about government's aggregate cash position on time so that they can make better cash plan, and they can make daily operations in the financial markets.
Timely transactions	All transactions should be realized on time as possible.
Concentration or unified structure	The unified structure of government bank accounts provides a consolidated view of government cash resources and allows government cash resources to be managed centrally.
Fungibility	This feature is the ability to use the cash surplus of an entity for financing cash deficit of the other entity.
Coverage	TSA coverage should be comprehensive as to include all general government cash resources and even loans from the multilateral institutions and donor aid resources, to ensure full consolidation of cash balances of all government entities[2]

Source: Pattanayak and Fainboim, 2011 - adjusted by the Author.

2 In general, state enterprises (businesses) should operate their activities outside TSA because they work as private corporation. Integrating them into TSA may hamper their competitiveness in the market.

The advantages of TSA can be listed as follows;

- Enables efficient cash management and ensures effective aggregate control government cash balances by equalizing cash flows in terms of time and place,
- Allows complete and timely information on government cash resources,
- Helps preparation of accurate and reliable cash flow forecasts,
- Enhances transparency and quality of fiscal data and bank reconciliations,
- Facilitates accounting of cash flow statements,
- Prevents public cash resources from being idle,
- Improves operational control during budget execution,
- Provides more accurate accounting and improved reporting,
- Paves the way transition to modern cash management,
- Regiments government expenditure process (Pattanayak and Fainboim, 2010).

2.3. Selected countries' TSA practices

Pattanayak and Fainboim (2010) presents selected countries' TSA with various structure models as below[3]:

3 For detail, see working paper, "Treasury Single Account: Concept, Design, and Implementation Issues.", prepared by Pattanayak, Saliendra and Israel Fainboim. (June 2010).

Table 2. Selected Countries with TSA Models

Country	Coverage	Degree of Centralization
France	National and regional/local governments and quasigovernmental bodies. Social Security Fund is managed by the treasury, but held in a state-owned savings bank.	Fully centralized architecture, with regional subaccounts of the TSA
UK	National government	Fully centralized architecture
Australia	National government	A mixed architecture (with elements of both centralized and decentralized models of TSA)
United States	National government	Fully centralized architecture
Sweden	Central/national government	Decentralized architecture
New Zealand	National	Fully centralized architecture
United States	Federal government	Decentralized architecture, with Federal Reserve Banks acting as the main government banks for agencies, who are given responsibility for accounting control and use of funds
Brazil	National government	Fully centralized architecture
Russia	National government	Fully centralized architecture, with regional Treasury offices
India	Federal and State governments	A mix of centralized and decentralized architecture, with subaccounts for line ministries maintained at the central bank.

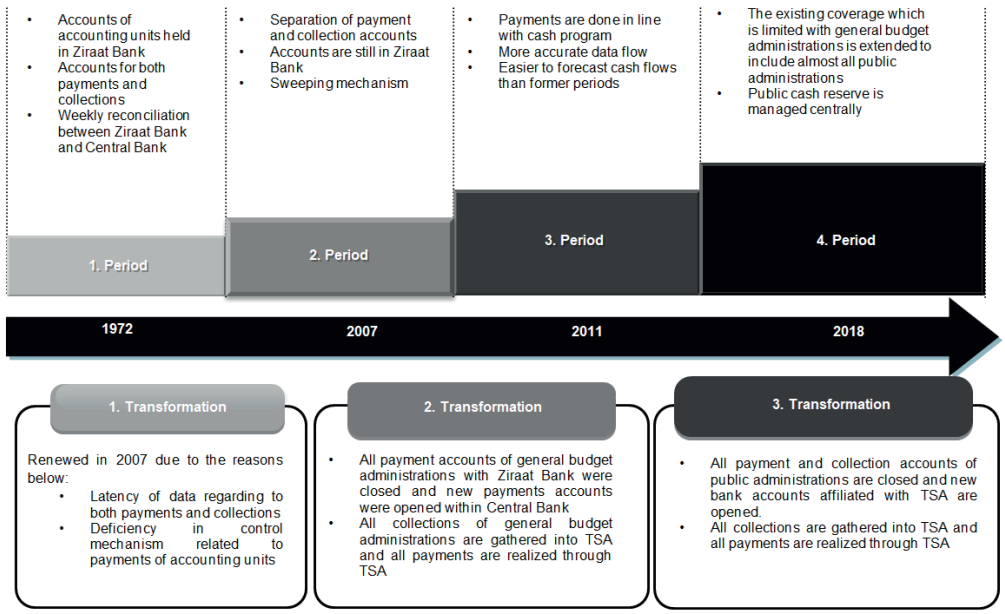
Source: Pattanayak and Fainboim, 2010 - adjusted by the Author.

As can be inferred from Table 2, each country has different TSA scope. This situation raises the question of what the ideal scope should be. Actually, the ideal scope of TSA should be comprehensive as to cover almost all public resources as possible. However, each country should take into consideration that TSA scope should be designed in accordance with their regime or polity in order to construct an effective TSA system.

3. TSA Practices in Turkey

TSA system which has been in practice in Turkey since 1972 was initially established upon the need for equalizing government cash flows in terms of time and location. However, the TSA established in 1972 was behind the international practices in many aspects. Therefore, TSA system in Turkey has been revised many times in parallel with the technological progress to converge international best practices since its establishment. The evolution of TSA system in Turkey can be summarized in four periods (Figure 2).

Figure 2. Transformations of TSA in Turkey



Source: Author.

The first transformation was realized in 2007 when First Treasury Single Account (FTSA) system was updated, and Treasury Single Current Account (TSCA) was established. With TSCA, it was aimed to increase the Treasury's control over general budget institutions' payment and collection processes. However, due to technological impediments such as underdeveloped payment and collection system, the desired objective of TSCA was not achieved entirely. In 2011, through technological advance, the second transformation was realized when Public Electronic Payment System (PEPS) was introduced. With PEPS, payment accounts of spending units were transferred from a commercial state bank (Ziraat Bank (ZB)) to the Central

Bank of Republic of Turkey (CBRT), and by doing so, the payment structure of the TSA system has become more centralized. Thus, the TSA has become one step closer to international best practices. Although many revisions were carried out, TSA in Turkey was still behind the full-fledged TSA system because of its limited scope. The scope of TSA in Turkey just covered the general budget administrations while the ideal scope of TSA should cover general government sector which comprises the subsectors of central government, state government, local government and social security funds. In this regard, with the latest amendment to Law No. 4749 by the Law No. 7103, dated on March 21, 2018, the scope of TSA system in Turkey is redesigned to cover almost whole public resources. The legislation entitles the President of the Republic of Turkey to extend the TSA and to decide on institutions whose resources to be managed under the scope of new (extended) TSA system. These institutions are stated as below:

i) Central Government Administrations (General Budget Administrations, Special Budget Administrations, Regulatory and Supervisory Agencies (RSAs))

ii) Social Security Institutions

iii) Extra-Budgetary Funds (EBFs) (Excluding Unemployment Insurance Fund (UIF))

iv) Revolving funds and special accounts of these institutions

v) Local Administrations

vi) State-Owned Enterprises (SOEs)

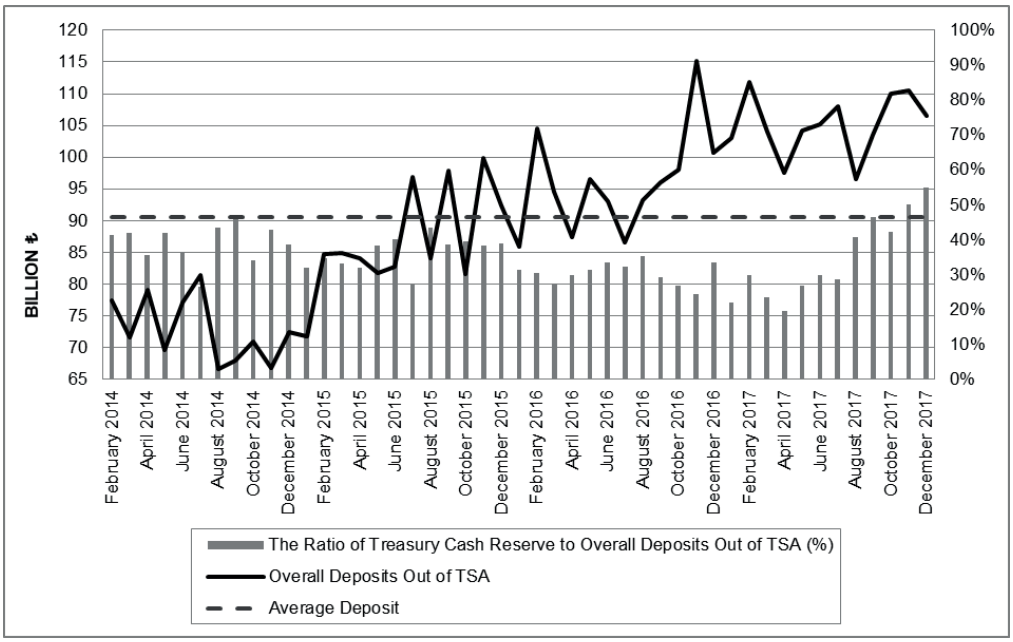
Figure 3 shows the evolution of the overall public deposits managed out of the TSA system during 2014-17.[4] According to the Deposits and Securities Statistics of Institutions within the Scope of General Communiqué for Public Treasurership, total deposits (as of the last business day of each month) out of the scope of the TSA was approximately ₺ 90.5 billion on average.[5] During the period 2014-17, total deposits managed out of the scope of the TSA fluctuated between ₺ 115.2 billion and ₺ 66.5 billion. The figure shows that during the four-year period there was significant

4 In this study, public deposits from February, 2014 to December, 2017 is analysed since statistics which indicate financial resources of the public institutions as deposits have been disseminated monthly since February, 2014.

5 In this study, data related to deposits of institutions are on monthly basis and cover the period 2014-17. These data, which reflect deposits of institutions at the last business day of relevant months, indicate the financial resources of public institutions which are held at current and/or participation accounts denominated in Turkish Lira and in foreign currency.

amount of cash reserve which was almost twice of the Treasury cash reserve (Figure 3).[6]

Figure 3. Overall Deposits Managed Out of the Scope of the TSA



Source: Author's calculations.

As stated above, the substantial amount of public cash resources, managed outside of the scope of TSA, thereby out of control of the Treasury, could be managed by the Treasury centrally and more efficiently via extended scope of TSA. Therefore, the latest regulation related to enlargement of the scope of the TSA can be seen as a sea-change in Turkish TSA.

3.1. The scope of Extended TSA

Within the limits of the powers conferred by the Law, the President of the Republic issued Presidential Decree on determining institutions to be included in the extended TSA, dated on August 8, 2018. According to Presidential Decree, the extended TSA covers financial resources of following institutions; central government administrations, social security institutions, EBFs and revolving funds and special accounts of these institutions. Although the Law No. 4749 entitles the President of the Republic of Turkey to determine almost all public resources except UIF, the Pres-

6 The total deposits represented in Figure 3 may be overrated since the total deposits might include some collections of Revenue Administrations which are later transferred to TSA. So, deposits of Revenue Administrations should be weeded up from total deposits in order to determine net amount, which is managed out of TSA.

ident did not decide to include financial resources of local administrations, SOEs and Saving Deposit Insurance Fund (SDIF) in the scope of the extended TSA. The reason of excluding local administrations, SOEs, and SDIF can be grounded on following reasons: i) SOEs perform their activities in the market conditions and they should take their own decisions independently and implement them quickly; ii) local administrations have idiosyncratic organizational structure, functions, and powers which are guaranteed by the law in accordance with the principle of decentralization; iii) SDIF, which has a potential to make a long-term investment opportunity and a wider investment perspective, should be excluded from the extended TSA because such funds can invest their resources in financial instruments which offer much higher returns. In this respect, it is better to manage these funds with a separate investment strategy rather than within the scope of the extended TSA.

Table 3. Comparison of Former TSA Coverage and Extended TSA Coverage Determined by Presidential Decree

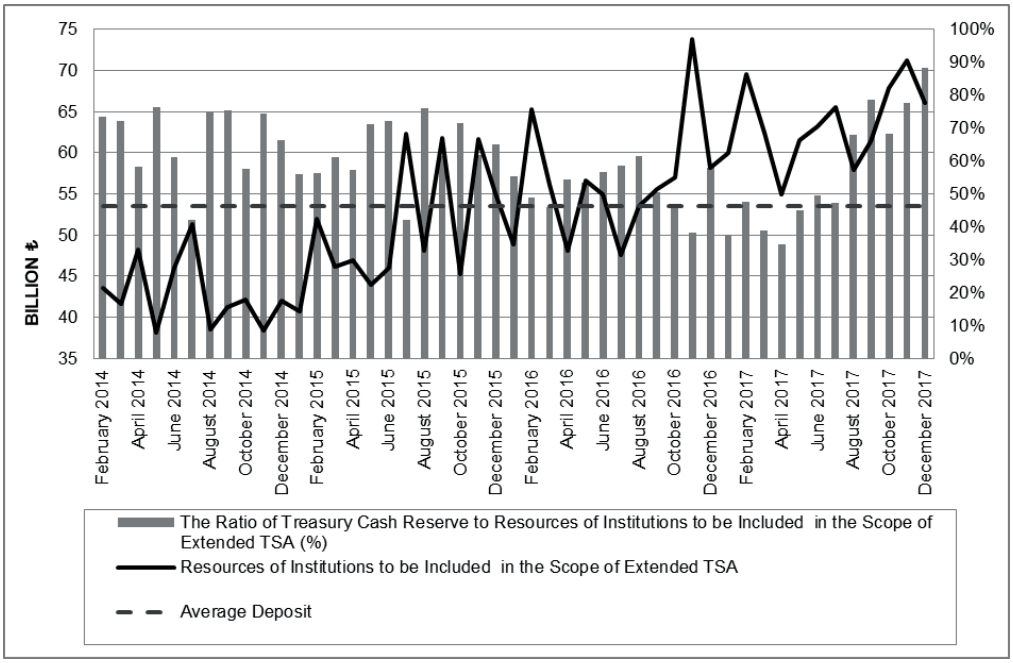
	Former TSA	Extended TSA
Coverage	*General Budget Administrations	*Central Government Administrations (General Budget Administrations, Special Budget Administrations, Regulatory and Supervisory Agencies), *Social Security Institutions, *Extra-budgetary funds (excluding UIF and SDIF), *Revolving funds and *Special accounts of these institutions
Degree of Centralization	Fully centralized architecture	Fully centralized architecture

Source: Author

As seen from the Table 3, the majority of public sectors, which are outside of the scope of TSA, will be involved in the extended TSA. Total deposits, managed out of the scope of the TSA but to be included in extended TSA, was ₺ 53.6 billion on average. During the four-year period, these total deposits had a similar pattern with total deposits represented in Figure 3. Starting with ₺ 43.5 billion at the beginning of the four-year period, the total deposits ended up with just over ₺ 66 billion. Total deposits for the four years had followed a fluctuating course within the range of ₺ 38.2 billion - ₺ 73.8 billion. Especially, total deposits had remained above the average since August 2016. This indicates that the amount of cash reserve held beyond

the TSA system significantly increased recently (Figure 4).[7] As it is understood from Figure 4, there is a substantial amount of cash reserve that could be managed by the Treasury with the extended TSA system.

Figure 4. The Resources of Institutions to be Included in the Scope of Extended TSA



Source: Author's calculations.

4. Model Estimation

4.1. Estimation method

With the extended TSA system, Turkish Treasury is expected to make public cash management more effective in two ways. First, the Treasury will have the opportunity to manage a considerable amount of public cash resources without bearing cost. Second, due to scale of economics, it will be possible to obtain a higher return on extended resources of the TSA.

This paper aims to estimate the likely effects of expansion of the TSA system to public financial management by assuming that the Treasury adopts working capi-

7 The total deposits represented in Figure 4 may be overrated since the total deposits might include some collections of Revenue Administrations which are later transferred to TSA. And it also includes deposits of UIF and SDIF. However, since there is no any data regarding those deposits and collections, it could not weed them up from total deposits shown in the Figure 4.

tal management approach when managing its cash resources.[8] In working capital management approach, there are two main goals: the first one is related to the determination of optimal cash balance and the second one is relevant to the remuneration of cash surplus with most productive instruments. In other words, the Treasury manages institutions' cash resources that will be gathered into the extended TSA along with its cash resources. When managing those resources, the Treasury determines the optimal cash interval as target cash range at first, and then applies following actions:

- it remunerates its cash surplus with time-deposit account if it has cash surplus,

- it borrows as much as needed cash from money market if it has cash deficit.

Concisely, this paper aims to find answers to following questions:

1) "What would be the optimal cash level for the Treasury if it had extensive TSA as large as determined by the Presidential Decree?"

2) "What would be the possible return if cash surplus was remunerated in the market conditions?"

4.2. New Cash Management Model

This paper dwelled on some operating cash management models in order to estimate the likely effects of expansion of the TSA system to public financial management. There is a myriad of studies related to cash management models in the literature. Various cash management models in the distinguished studies are reviewed to pin down optimum cash buffer level for the Treasury (Table 4).

8 Working capital approach is about the management of the short-term investment and financing of a company.

Table 4. Selected Studies on Stochastic Cash Flow Management Models

Authors	Research Summary
Baumol (1952)	Proposes that the available cash balance is a commodity inventory
Tobin (1956)	Adjusts the Baumol model, so the number of transactions becomes a positive integer value
Miller and Orr (1966)	Analyze the cash balance as having a random variable with an irregular fluctuation and proposed a stochastic model for managing the cash balance
Whalen (1966)	Presents a model based on the concept of inventory considering the cost of illiquidity, the opportunity cost of maintaining a precautionary cash balance and the average volume and variability of inflows and outflows
Daellenbach (1974)	Concludes that in cases where cash flows are non-stationary series, the optimization models cannot make significance gains if the transfer costs are low
Gregory (1976)	Presents a survey by the models until the mid-1970s focused on variants of the Miller and Orr (1966)
Tapiero and Zuckerman (1980)	Present a stochastic model based on the premise that cash inflows and outflows have random behavior
Milbourne (1983)	Presents a model separating the transfer costs into two categories, in other words, cost for currency units to adjust the cash balance up and cash balance down
Srinivasan and Kim (1986)	Present the principles of deterministic models until the mid- 1980s
Smith (1986)	Develops a stochastic dynamic model, considering the cash flow as a diffuse process
Ogden and Sundaram (1998)	Propose the utilization of a credit line if the firm gets a cash deficit considering an interest rate associated with this credit line and the assumptions of Baumol
Pacheco et al. (2000)	Develop a genetic algorithm to determine investments in financial products available on the market based on the projected cash flow
Hinderer and Waldmann (2001)	Propose the utilization of Markov chains in the problem
Barbosa and Pimentel (2001)	Develop and applied a model in civil construction projects very successfully
Baccarin (2002)	Proposes a modeling variation that changes the focus of the optimization problem
Premachandra (2004)	Shows a model considering the assumptions of normal distribution of net cash flows and that the fixed transfer costs are relaxed in order to obtain a model closer to reality
Volosov et al. (2005)	Develop a stochastic programming model in two states, based on scenario trees, for the problem of cash balance
Yao et al. (2006)	Show a single-period model, considering the demand for money according to fuzzy logic concepts, for the problem of cash balance
Gormley and Meade (2007)	Propose the utilization of dynamic policy for cash balance that minimizes transfer costs when cash flows are not independent or identically distributed in a general cost structure
Liu and Xin (2008)	Propose an adaptive algorithm with characteristics of changing the management policies at the beginning of each period to know the upper and lower demands for money
Baccarin (2009)	Presents a standard n-dimensional Wiener process using the impulse control method, for the problem of cash balance
Mierzejewski (2010)	Develops a stochastic model considering the premise of the demand for cash balance with normal distribution and applied the value at risk (VaR)
Melo and Bilich (2011)	Propose the use of dynamic programming to minimize the cost of cash, considering the cost de rupture cash

Source: M.B. Da Costa Moraes et al. 2015.

As seen from the Table 4, although there are various complicated cash management models established to produce a more realistic approach, the applicability of some of them are quite hard. This paper intends to choose the model that meets the objectives of this study and is easily applicable without being too complex. For this reason, this study focuses on following cash management models: Baumol cash management model, Miller-Orr cash management model and Stone cash management model.

Baumol (1952) suggested that cash may be managed in the same way as any other inventory and he asserted that a cash inventory is an inventory of a specific form of exchange. Therefore, he developed a cash management model based on the Economic Order Quantity (EOQ).[9] The Baumol cash management model is based on the assumption that cash flows' pattern are completely deterministic.

M. H. Miller and Daniel Orr (1966) expanded on the Baumol model and developed a cash management model for firms with uncertain cash inflows and cash outflows. The Miller-Orr model is based on stochastic pattern of cash flows and it aims to find optimum cash level for firms which could not predict day-to-day cash inflows and outflows clearly.

The Stone model is a modification of the Miller-Orr model. It is separated from the Miller-Orr model in view of foreseeability of cash flows. For Stone (1972), a firm could forecast some, if not all of them, short-term cash flows.

Among cash management models, Stone model which relies on data regarding forecasting of cash flows is eliminated since there is no any data related to forecasting cash flows in this study. And, the Baumol model is also eliminated because of its underlying assumptions which are not compatible with reality. Lastly, the Miller-Orr model is chosen in this study to determine optimal cash balance as a range of values since it is applicable and straightforward; and it could overcome the shortcomings encountered in other models. However, the Miller-Orr model is also not fully suitable for analysing likely effects of expansion scope of the TSA. Thus, there needed to be some revisions in the Miller-Orr model in order to make it suitable for treasury cash management. For this reason, the new cash management model was generated by modifying the Miller-Orr model in this study.

9 Economic order quantity (EOQ) is an equation for inventory that determines the ideal order quantity a company should purchase for its inventory given a set cost of production, demand rate and other variables.

Adopted method to finding target cash balance in the new cash management model is slightly different from that of the Miller-Orr model in three ways:

i) the adopted model estimates the optimal cash balance as a range of values for the Treasury whereas the Miller-Orr model aims to find optimal cash balance for a firm. It would not be wrong to say that treasuries, compared to firms, are more prone to manage their cash resources cautiously. In this regard, some assumptions and equations in the Miller-Orr model are modified a bit.

ii) the adopted policy or instruments used in the cash management are slightly different from that of the Miller-Orr model. As mentioned before, according to the Miller-Orr model, a firm adopts "simple policy", which defines how to react in case of cash surplus or cash deficit, and how to manage its cash resources in accordance with simple policy. Simple policy says that if there is cash surplus, a firm should buy securities in order to gain return; yet, in case of cash shortage, a firm should sell his securities to get cash. However, this paper assumes that the Treasury adopts "government cash management policy" instead of simple policy that a firm adopts. According to government cash management policy, if the Treasury has cash surplus, it invests its cash surplus on short-term deposits account with 1-month maturity in order to yield a return instead of buying securities as in the Miller-Orr model; yet, if the Treasury faces cash shortage problem, it issues a short-term cash borrowing instrument (1-month maturity at most) to find sufficient cash resources instead of selling securities as in the Miller-Orr model. In other words, a firm faces a trade-off between opportunity cost of holding cash and transaction cost in the Miller-Orr model, whereas the Treasury faces a trade-off between opportunity cost of holding cash and short-term cash borrowing cost in the new cash management model.

iii) the Miller-Orr model assumes that lower limit is determined exogenously by a firm itself and it does not clarify which criteria a firm should consider when determining its lower limit; however, the new cash management model assumes that the Treasury determines its lower limit in accordance with mismatching cash flows, revenue and expenditure deviations, re-financing risk etc.

The new created model is based on following assumptions:

(i) the Treasury, which is responsible for managing government's cash reserves, aims to determine optimal cash level as a range of values;

(ii) the Treasury's cash reserves are not kept idle as the Treasury remunerates its cash resources in two ways: demand deposit account or time-deposit account. When the Treasury put its cash resources in its demand-deposit account, those resources held in this account are remunerated on a daily basis with the one-week repo interest rates[10]. When the Treasury put its cash surplus in its time-deposit accounts, those resources held in this account are remunerated with weighted average interest rates for deposits in ₺. If the Treasury come across cash shortage, it borrows as much cash as needed on money market;[11]

(iii) the Treasury manages its cash prudently, so it holds prudential cash reserve, referred as kb;

(iv) the Treasury sets a minimum cash level covering its compulsory expenses and prudential cash reserve;

(v) the Treasury is credible as it could borrow cash easily on money market at the beginning of the month (with maximum 30 day maturity) by bearing cash borrowing cost $(DCBC)$ that is not fixed and depends on average rate of cost of domestic cash borrowing, referred as (i_b);

(vi) the opportunity cost of holding cash is equal to the net interest rates that is greater than or equal to zero (the weighted average interest rates for deposits in ₺ minus CBRT's policy interest rate)[12];

(vii) the Treasury remunerates its cash surplus in short-term (1-month) time-deposit accounts with the weighted average deposit interest rate while it remunerates the rest of resources in demand deposit account with CBRT's policy rate on an overnight basis;

(viii) the Treasury remunerates its cash surplus at the beginning of the month, and its interest revenues from investment are accumulated at the beginning of the next month;

(ix) the Treasury does not pay any expenses in response to remuneration transactions;

10 In this study, CBRT's policy rate refers one-week repo interest rate of CBRT.

11 In this study, weighted average interest rates for deposits in ₺ refers weighted average interest rates up to one-month deposits in ₺.

12 During 2014-17, net interest rates have usually been greater than zero. However, they have fallen below zero for some months. In the study, net interest rates which is negative have taken as 0.

(x) net cash flows are entirely stochastic;

(xi) the behaviour of cash flows can be categorized as a sequence of independent "Bernoulli trials";

(xii) as number of observations increases, the distribution of daily net cash flows will be normally distributed and expected net cash flow will be zero;

(xiii) standard deviation of daily net cash flow is known;

(xiv) the Treasury implements "government cash management policy" in which Treasury do not take an action when its cash balance wanders within upper and lower limits; it manages its cash surplus in line with assumptions of (vii) when its cash balance is higher than upper limits; it borrows needed cash from money market in line with assumptions of (v) when its cash balance is lower than lower limits (Can, 2018).

In order to find optimal target cash reserve for the Treasury as a range of values, following steps are applied in this study; first one is to determine lower limit for Treasury cash reserve, second one is to determine spread level for Treasury cash reserve by taking borrowing cost, the opportunity cost of holding cash and variance of cash flows into consideration.[13] After the calculation of the spread, target cash reserve and upper limit for the Treasury is set respectively. After that, net interest return of Treasury is calculated to evaluate the likely effects of expansion of the TSA system.

The Treasury aims to minimize cost of managing its cash balance per day during the T days. Its objective function is slightly different from that of the Miller-Orr model because of the assumption that the costs of number of transactions differentiate depending on the nature of transaction so there are two different transaction costs, ø and $DCBC$.

$$\mathcal{E}(c) = \mathrm{DCBC}\,\frac{\mathcal{E}(\mathrm{N}_1)}{\mathrm{T}} + \text{ø}\,\frac{\mathcal{E}(\mathrm{N}_2)}{\mathrm{T}} + \mathrm{netR}\;\mathcal{E}(\mathrm{M}) \qquad (1)$$

where $\mathcal{E}(N_1)$ = the expected number of short-term cash borrowing during the period; $DCBC$ = the monthly average cost of domestic cash borrowing cost[14];

13 Cash spread refers cash interval between lower and upper bounds.

14 DCBC refers the amount of that the monthly average cost of domestic cash borrowing cost times monthly standard deviation of Treasury cash reserve.

$\mathcal{E}(N_2)$= the expected number of remuneration transactions during the period; ø = fixed cost per each remuneration transaction; $netR$ = the net interest rate where $netR = i_w - i_{pr}$, i_w = weighted average deposit interest rate and i_{pr}= CBRT's policy rate.

This study assumes that there is no cost per each remuneration transaction, in other words, ø is zero since the Treasury does not bear any cost for bank order to put its cash in time-deposit accounts. Thus, new modified expected cost equation (2) is used in the most of subsequent discussion through the study.

$$\mathcal{E}(c) = DCBC\ \frac{\mathcal{E}(N_1)}{T} + netR\ \mathcal{E}(M) \qquad (2)$$

In the new cash management model, cash spread equation for the Treasury with extended TSA is generated by modifying spread equation in the Miller-Orr model. The cash spread equation is stated as below;

$$S_{tsa} = 3\left[\frac{3(DCBC)[Var.(TCR_{tsa})]}{4 * netR}\right]^{\frac{1}{3}} \qquad (3)$$

where S_{tsa} = the Treasury cash reserve spread with the extended TSA; $Var(TCR_{tsa})$ = the variance of Treasury cash reserve with the extended TSA.

After calculating spread, an optimal level for the Treasury's target cash balance is calculated as;

$$TTCR_{tsa} = 3\left[\frac{3(DCBC)[Var.(TCR_{tsa})]}{4 * netR}\right]^{\frac{1}{3}} + L_{tsa} \qquad (4)$$

where $TTCR_{tsa}$ = Treasury target cash reserve with the extended TSA; L_{tsa} = lower limit for the extended TSA cash reserve.

The lower limit is determined exogenously in the Miller-Orr model. However, unlike Miller-Orr model, the lower limit for the Treasury in the new cash management model is calculated by using formula which considers following parameters:

i) time differences between cash inflows and outflows

ii) revenue-based deviations

iii) expenditure-based deviations

iv) re-financing risk and

v) short-term bond auction volatilities.

In this regard, this paper takes the lower limit (L) for the Treasury as sum of compulsory payment of all institutions included in the extended TSA (CP^{tsa}), which is composed of personnel expenditures (PE^{tsa}), premiums to Social Security Agencies (P^{tsa}), transfers to Households from Social Security Agencies (TRH^{tsa}) and interest expenditures (INE), plus prudential cash reserve (kb) held by the Treasury in order to avoid default-risk.

$$L_{tsa} = \sum_{t=1}^{n} (CP_t^{tsa} + kb_t) \qquad (5)$$

where $CP_t^{tsa} = PE_t^{tsa} + P_t^{tsa} + TRH_t^{tsa} + INE_t$

This study assumes that the Treasury holds prudential cash reserve to be used in case it could not pay off its debt payment by borrowing. Under the assumptions, prudential cash reserve is calculated as;

$$kb = \sum_{t=1}^{n} (PP_t - ß * DB_t) \qquad (6)$$

where PP_t = monthly cash amount of debt services in principal; ß = the coefficient of deviation from borrowing projections (assuming that the Treasury could borrow from the market at least half of its projections released in the financing program even in the worst-case scenario. Thus, ß is assumed to be 1/2)[15]; DB_t = monthly cash borrowing.

After setting the Treasury target cash balance with the extended TSA, upper limit (H_{tsa}) is calculated as;

15 ß choices definitely affect the lower limit significantly. However, when the Treasury borrowing strategy is analyzed historically, it is noticed that no less than half of the borrowing amount envisaged in the financing program is borrowed from the market. In this study, ß is determined as ½ based on the worst scenario. The lower ß, the more the debt service will be met with the treasury reserve rather than borrowing, prudential cash reserve will increase, hence the lower limit will rise further.

$$H_{tsa} = L_{tsa} + S_{tsa} \quad (7)$$

This study also calculates average cash balance (A_{tsa}) in the same way as in the Miller-Orr model and the monthly average of daily Treasury cash reserve with the extended TSA ($AVTCR_t^{tsa}$) by using time-series of daily Treasury cash reserve and institutions' cash reserves to be managed in the extended TSA.

Finally, with the assumption that the Treasury implements government cash management policy, it is estimated what net interest return of the Treasury would be if it had the extended TSA. According to this policy, if Treasury's $AVTCR_{tsa}$ is higher than the upper limit, the Treasury remunerates ($AVTCR_{tsa} - TTCR_{tsa}$) cash amount with weighted average interest rates for deposits in ₺ in a short-term time-deposit (1-month maturity) account. By doing so, Treasury cash level will go down to $TTCR_{tsa}$ level. On the contrary, if Treasury's $AVTCR_{tsa}$ is below than lower limit, the Treasury borrows ($TTCR_{tsa} - AVTCR_{tsa}$) that amount of cash from money market. By doing so, Treasury cash level will go up to $TTCR_{tsa}$ level. Under the assumption that the Treasury implements government cash management policy, the expected Treasury's net interest revenue from its deposits with the extended TSA is calculated as;

$$\mathcal{E}(NIR^{tsa}) = \mathcal{E}(IR_{GCMP}^{tsa}) - IR_R^{tsa} \quad (8)$$

where $IR_R^{tsa} = IR_R^{GB} + IR_R^{SB} + IR_R^{RSAs} + IR_R^{SS} + IR_R^{EBFs} + IR_R^{RVF}$

where $\mathcal{E}(NIR)$ = the expected net interest revenue from deposit; $\mathcal{E}(IR_{GCMP})$ = the expected interest revenue from deposit if the Treasury adopted government cash management policy; IR_R^{tsa} = realized interest revenue from deposit of all institutions to be included in the extended TSA, which comprises IR_R^{SB} = realized interest revenue from deposit of special budget administrations; IR_R^{RSA} = realized interest revenue from deposit of RSAs; IR_R^{SS} = realized interest revenue from deposit of social security institutions; IR_R^{EBFs} = realized interest revenue from deposit of EBFs; IR_R^{RVF} = realized interest revenue from deposit of revolving funds.[16]

16 To identify additional interest revenue from deposit to be gained by adoption government cash management policy, realized interest revenue from deposit is substracted. Realized interest revenue from deposit is acquired from "General Government Statistics". However, since there is no any data regarding the realized interest revenues on deposit of revolving funds and extra-budgetary funds, those funds' interest revenues based on their deposits are hypothetically calculated.

The expected interest revenue from deposit is calculated as in the equation (9);

$$\mathcal{E}(IR_{GCMP}^{tsa}) = \begin{cases} \sum_{t=1}^{n}\left(\left[\frac{(AVTCR_t^{tsa} - TTCR_t^{tsa}) * i_t^{w}}{12*100}\right] + \left[\frac{TTCR_t^{tsa} * i_t^{pr}}{12*100}\right]\right), & H_t^{tsa} < AVTCR_t^{tsa} \\ \sum_{t=1}^{n}\left(\frac{AVTCR_t^{tsa} * i_t^{pr}}{12*100}\right), & L_t^{tsa} < AVTCR_t^{tsa} < H_t^{tsa} \\ \sum_{t=1}^{n}\left(\left[\frac{(TTCR_t^{tsa} * i_t^{pr})}{12*100}\right] - \left[\frac{(TTCR_t^{tsa} - AVTCR_t^{tsa}) * i_t^{b}}{12*100}\right]\right), & AVTCR_t^{tsa} < L_t^{tsa} \end{cases}$$

4.3. Data and sources

This section presents the data used in the analysis. Daily and monthly data covering the period from February 3, 2014 to December 31, 2017 are used in this study. The data is mainly collected from two sources: Ministry of Treasury and Finance and the Central Bank of the Republic of Turkey.

In this study, following data related to the Treasury reserves, other public resources, the Treasury cash realizations the general government budget realizations, weighted average interest rates for deposits in Turkish Lira, CBRT's policy interest rates, average cost of domestic cash borrowing are used to analyze likely effects of the extended TSA to public financial management in Turkey. Data related to Treasury reserves[17] are procured from CBRT's analytical balance sheet published on a daily basis on the website (www.tcmb.gov.tr), and data concerning other public resources and Treasury cash realizations are collected from "Deposits and Securities Statistics of Institutions within the Scope of General Communiqué for Public Treasurership" and "Treasury Cash Realizations Statistics", respectively, published on a monthly basis on the website (https://en.hmb.gov.tr).

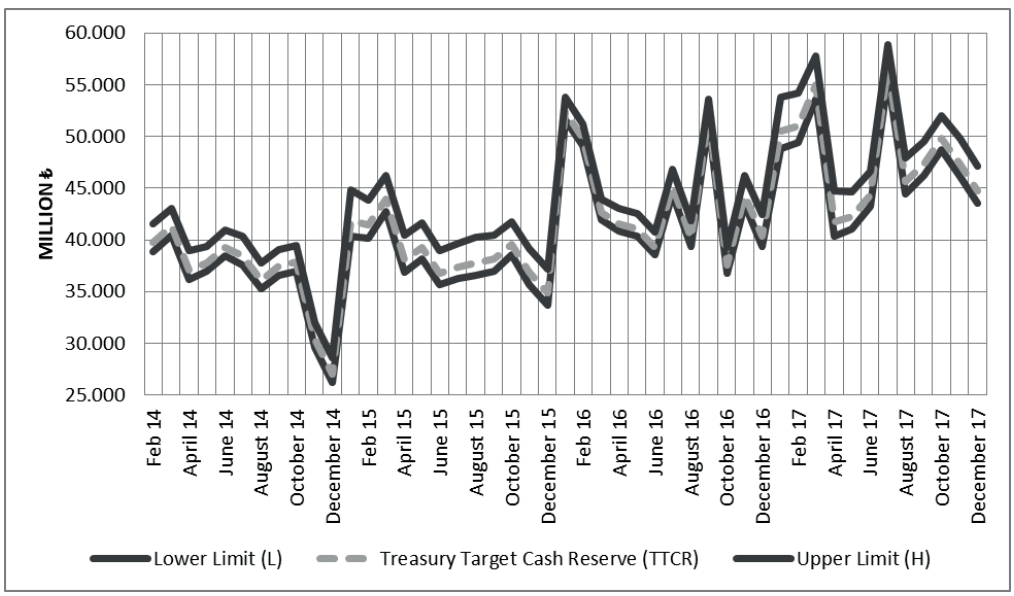
Data of the general government budget realizations are acquired from "General Government Statistics" published on a monthly basis on the website (https://en.hmb.gov.tr). Data of weighted average interest rates for deposits in Turkish Lira and data of CBRT's policy rates are acquired from CBRT and data of an average cost of domestic borrowing are collected from Ministry of Treasury and Finance.

17 Sum of Data of Deposits of Public Sector and Public Sector and Other FX Deposits are used as Treasury reserves.

4.4. Estimation results

According to the analysis, during 2014-17, if the Treasury with the extended TSA implemented the "government cash management policy", it would adjust its target cash balance as ₺ 41.9 billion on average and its lower and upper bound as ₺ 40.9 billion, ₺ 44.0 billion on average, respectively. During the four-year period, the Treasury would let its cash balance (₺ 41.9 billion on average) to oscillate between lower and upper bounds (Figure 5) (Table 5).

Figure 5. Treasury Cash Reserve Interval with Extended TSA



Source: Author's calculations.

Table 5. Analysis For Treasury Cash Reserve with Extended TSA

New Cash Management Model Analysis of Treasury Cash Reserve with the Extended TSA																	
New Cash Management Model Analysis	Spread (S)	Compulsory Payments (CP)	kb	Lower Limit (L)	Treasury Target Cash Reserve (TTCR)	Upper Limit (H)	Average Cash Balance Calculated by Miller-Orr Model (A)	Average Cash Balance in Fact (AVTCR)	Cash Amount Outside of Cash Balance Range	Cash Amount Proposed to be Invested on Time-Deposits	Cash Amount Proposed to be borrowed by Short-Term Cash Borrowing Intruments	Cost of Borrowing Cash Amount	Interest Revenue on Time-Deposit	Interest Revenue on Current Accounts	Total Interest Revenue on Deposit	Average Cash Amount When Adopting Gov't Cash Management Policy
Feb 14	2,746	30,743	8,082	38,825	39,741	41,571	40,046	66,597	25,026	26,856	0	0	214	331	545	39,741
March 14	2,564	33,092	7,407	40,500	41,354	43,064	41,639	62,656	19,593	21,302	0	0	179	345	523	41,354
April 14	2,761	30,326	5,828	36,155	37,075	38,916	37,382	67,815	28,899	30,740	0	0	251	309	560	37,075
May 14	2,430	33,744	3,179	36,923	37,733	39,352	38,002	58,985	19,633	21,253	0	0	164	299	463	37,733
June 14	2,410	28,492	10,007	38,499	39,303	40,909	39,570	59,078	18,169	19,776	0	0	144	287	431	39,303
July 14	2,725	31,564	6,028	37,592	38,500	40,317	38,803	51,600	11,283	13,100	0	0	89	265	353	38,500
August 14	2,496	29,584	5,697	35,281	36,112	37,776	36,390	57,739	19,963	21,626	0	0	144	248	393	36,112
September 14	2,525	32,274	4,308	36,582	37,424	39,107	37,704	63,296	24,189	25,872	0	0	181	257	438	37,424
October 14	2,495	33,891	3,096	36,987	37,819	39,482	38,096	56,586	17,104	18,767	0	0	131	260	391	37,819
November 14	2,389	30,146	-520	29,626	30,422	32,015	30,688	56,998	24,982	26,575	0	0	186	209	396	30,422
December 14	2,393	26,249	17	26,266	27,064	28,659	27,329	60,025	31,367	32,962	0	0	253	186	439	27,064
Av. - 2014	2,539	30,919	4,830	35,749	36,595	38,288	36,877	60,125	21,837	23,530	0	0	176	272	448	36,595
January 15	4,491	38,064	2,317	40,381	41,878	44,872	42,377	54,298	9,426	12,420	0	0	91	270	361	41,878
Feb 15	3,676	37,093	3,083	40,176	41,401	43,852	41,810	65,822	21,970	24,421	0	0	179	259	438	41,401
March 15	3,469	34,949	7,839	42,788	43,944	46,257	44,330	65,004	18,747	21,059	0	0	160	275	435	43,944
April 15	3,577	36,827	3	36,830	38,022	40,407	38,420	64,365	23,958	26,343	0	0	202	238	440	38,022
May 15	3,538	33,441	4,687	38,129	39,308	41,666	39,701	66,063	24,396	26,755	0	0	205	246	451	39,308
June 15	3,342	31,272	4,383	35,655	36,769	38,997	37,140	70,072	31,074	33,303	0	0	264	230	494	36,769
July 15	3,390	36,402	-162	36,240	37,370	39,630	37,747	66,016	26,386	28,646	0	0	227	234	461	37,370
August 15	3,676	34,228	2,324	36,552	37,777	40,228	38,186	76,085	35,857	38,308	0	0	297	236	533	37,777
September 15	3,411	38,209	-1,191	37,018	38,155	40,429	38,534	80,085	39,656	41,930	0	0	354	238	592	38,155
October 15	3,250	33,825	4,695	38,520	39,603	41,770	39,964	68,747	26,977	29,144	0	0	240	248	487	39,603
November 15	3,457	34,807	895	35,702	36,854	39,159	37,238	80,240	41,081	43,385	0	0	358	230	588	36,854
December 15	3,427	30,703	3,021	33,723	34,866	37,151	35,247	81,644	44,493	46,778	0	0	399	218	617	34,866
Av. - 2015	3,559	34,985	2,658	37,643	38,829	41,201	39,224	69,870	28,668	31,041	0	0	248	243	491	38,829
January 16	2,167	46,382	5,258	51,639	52,362	53,807	52,603	65,856	12,050	13,495	0	0	113	327	440	52,362
Feb 16	2,140	41,125	7,981	49,106	49,820	51,247	50,058	77,705	26,459	27,886	0	0	234	311	545	49,820
March 16	1,954	44,441	-2,456	41,984	42,636	43,938	42,853	70,677	26,738	28,041	0	0	240	266	507	42,636
April 16	2,224	39,823	989	40,812	41,553	43,035	41,800	63,783	20,748	22,230	0	0	182	260	442	41,553
May 16	2,152	42,078	-1,709	40,368	41,086	42,521	41,325	75,853	33,332	34,767	0	0	279	257	536	41,086
June 16	2,185	39,399	-840	38,559	39,287	40,744	39,530	74,560	33,816	35,272	0	0	276	246	521	39,287
July 16	2,411	40,982	3,478	44,460	45,263	46,871	45,531	63,917	17,046	18,654	0	0	142	283	425	45,263
August 16	2,444	39,977	-610	39,367	40,181	41,811	40,453	74,405	32,594	34,223	0	0	254	251	505	40,181
September 16	2,326	42,636	8,630	51,266	52,041	53,592	52,300	71,673	18,082	19,632	0	0	147	325	472	52,041
October 16	2,424	39,093	-2,285	36,809	37,617	39,233	37,886	70,550	31,317	32,933	0	0	244	235	479	37,617
November 16	2,801	40,361	3,073	43,433	44,367	46,235	44,678	74,061	27,826	29,694	0	0	218	296	514	44,367
December 16	3,083	36,559	2,781	39,340	40,368	42,424	40,711	79,167	36,743	38,799	0	0	283	269	552	40,368
Av. - 2016	2,359	41,071	2,024	43,095	43,882	45,455	44,144	71,851	26,396	27,969	0	0	218	277	495	43,882
January 17	4,984	51,032	-2,193	48,839	50,500	53,822	51,053	70,560	16,737	20,060	0	0	148	337	485	50,500
Feb 17	4,726	47,113	2,337	49,450	51,026	54,177	51,551	81,962	27,785	30,936	0	0	234	340	574	51,026
March 17	4,177	48,893	4,717	53,610	55,002	57,787	55,466	73,284	15,498	18,282	0	0	147	367	513	55,002
April 17	4,390	43,547	-3,233	40,315	41,778	44,704	42,266	61,351	16,646	19,573	0	0	165	279	443	41,778
May 17	3,539	44,024	-2,969	41,055	42,234	44,594	42,628	75,460	30,866	33,225	0	0	295	282	577	42,234
June 17	3,309	42,013	1,259	43,272	44,375	46,581	44,743	81,686	35,105	37,310	0	0	342	296	638	44,375
July 17	3,277	47,839	7,718	55,557	56,649	58,834	57,014	81,465	22,630	24,815	0	0	231	378	608	56,649
August 17	3,436	47,434	-2,953	44,480	45,626	47,917	46,008	84,551	36,634	38,925	0	0	354	304	658	45,626
September 17	3,285	51,257	-4,998	46,259	47,354	49,544	47,719	78,946	29,402	31,592	0	0	291	316	607	47,354
October 17	3,257	45,618	3,115	48,733	49,819	51,991	50,181	83,725	31,734	33,906	0	0	322	332	654	49,819
November 17	3,694	47,463	-1,330	46,133	47,365	49,827	47,775	93,356	43,529	45,991	0	0	440	316	756	47,365
December 17	3,601	41,157	2,356	43,513	44,713	47,114	45,114	91,951	44,837	47,238	0	0	453	298	752	44,713
Av. - 2017	3,806	46,449	319	46,768	48,037	50,574	48,460	79,858	29,284	31,821	0	0	285	320	605	48,037
Average	3,077	38,514	2,407	40,921	41,947	43,999	42,289	70,645	26,647	28,698	0	0	233	278	511	41,947
Total											0	0	10,946	13,086	24,031	

Source: Author's calculations.

The result shows that during the four-year period, if the Treasury remunerated its surplus with weighted average interest rates for deposits in ₺, it would have gained approximately ₺ 14.9 billion (roughly yearly ₺ 3.7 billion) additional interest revenue from its deposit without bearing additional borrowing cost (Table 6).

Table 6. Estimated Additional Interest Revenue from Deposit with New TSA

Million ₺

	Estimated Interest Revenue*	Realized Interest Revenue	Expected Net Interest Revenue
2014	4,931	1,548	3,383
2015	5,897	2,131	3,766
2016	5,938	2,440	3,498
2017	7,265	2,989	4,276
Total	**24,031**	**9,108**	**14,923**

* It refers estimated interest revenue to be gained by the Treasury with extended TSA if the Treasury adopted "government cash management policy".

Source: Author's calculations.

The result shows strikingly that during the four-year period, the Treasury with the extended TSA could gain significant amount interest revenue from its deposits than the current one. However, it is worth noting again that the expected revenue may be calculated more than it should be because of the weakness of adopted assumptions in this study:

i) the Treasury with the extended TSA remunerates its deposits with weighted average interest rates for deposits in ₺, but the Treasury might decide to remunerate its surplus with lower rates than the weighted average interest rates for deposits to favor markets by subsidizing state banks (in this case, the expected revenue would certainly be lower than that this study calculated);

ii) data regarding public deposits in CBRT balance sheet is used as the Treasury cash reserve, but the Treasury cash reserve might, in fact, be lower than public deposits held in CBRT, because there are other public institutions' deposit accounts in CBRT apart from the Treasury's account[18];

iii) the study assumes that the Treasury would not change its borrowing strategies although it had strong cash reserve. However, it would probably change its borrowing strategy if it had strong cash reserve (for example, it would borrow less

18 It is considered that cash reserves of other public institutions kept in deposit accounts in CBRT are at a low level.

so Treasury's cash reserve might be less than analyzed in this study);

iv) the study uses the monthly data of deposits of the instutitons to be included in the extended TSA (as of a last working day of the relevant month) as there is no daily data regarding deposits of the institutions to be included in the extended TSA.

In order to make a more realistic estimation, other scenario is also taken into the consideration that the Treasury with the new TSA remunerated its surplus in time-deposit accounts with the interest rates (approximately 70 percent of the weighted average deposit interest rate) to favor markets by subsidizing state banks. For this scenario, the average additional expected revenue from its deposits without bearing additional borrowing cost would be approximately ₺ 2.9 billion (Table 7).

Table 7. Estimated Additional Interest Revenue from Deposit with New TSA with Lower Interest

Million ₺

	Estimated Interest Revenue*	Realized Interest Revenue	Expected Net Interest Revenue
2014	4,348	1,548	2,800
2015	5,000	2,131	2,869
2016	5,150	2,440	2,710
2017	6,232	2,989	3,243
Total	**20,730**	**9,108**	**11,622**

* It refers estimated interest revenue to be gained by the Treasury with extended TSA if the Treasury adopted "government cash management policy".

Source: Author's calculations.

As a result, in any case, the results reveal that the extended TSA system provides a significant value added to public financial management since the Treasury with comprehensive TSA could generate additional substantial amount revenue without taking the risk.

In addition, it is sure that the extended TSA will make a significant contribution on financing policy as well although this study does not analyze likely effects of the extended TSA to the Treasury's borrowing costs. With the extended TSA, the Treasury is able to draw on cash resources, which are managed within the scope of extended TSA, to cover short-term cash deficit without bearing borrowing cost. In other words, extended TSA allows the Treasury to use substantial amount of cash

resources without bearing cost for alleviating short-term cash needs. However, TSA is not a financing tool for budget although it gives the Treasury the opportunity to finance short-term cash deficit. Therefore, extending the scope of TSA will not cause a significant decrease in the Treasury's long-term borrowing amount, thereby it may not mitigate the possible crowding out effect of the Treasury in domestic debt market. However, it enables debt management units to prepare their financing programs without considering short-term cash shortage. Namely, the Treasury could follow its borrowing strategies and implement its financing program without considering short-term cash shortage by the means of the extended TSA. And, by using its strong cash reserve as a trump card, it becomes more powerful against other players (creditors) when borrowing. Hence, the extended TSA might have indirect impact on reducing short-term borrowing costs.

Extended TSA may also have positive impact on the banking sector although at first thought otherwise. Sweeping almost whole public resources into TSA, at CBRT, may create a concern for liquidity withdrawal among public banks especially which hold a major of public resources in themselves. However, this type concerns are groundless. Because, the Treasury with the extended TSA is able to remunerate whole public cash resources in an effective way without disturbing their liquidity positions. The latest amendment made it possible for the Treasury to utilize the resources collected within the extended TSA in state-banks as well as the CBRT. This amendment also gives alternative investment opportunities to Treasury when managing the government cash resources. And, it may also induce to strenghten the liquidity position of state-banks since the Treasury can put its resources in state-bank for a longer-term thanks to having much resources via the extended TSA.

5. Conclusion

Modern cash management is the strategy and whole processes for managing cost-effectively the government's short-term cash flows and cash reserve. With the adoption of modern cash management approach, it is possible to meet governments' obligations in an effective and timely manner with lowest possible costs and risks. To achieve those purposes, establishing comprehensive TSA system, which is a pooling cash system enabling consolidation and optimum utilization of government cash resources, is essential.

TSA system in Turkey, which is the most crucial step to make the transition from traditional to modern cash management, was started to be implemented in 1972; but in that time, the function of the TSA was different from its international practices. Since its establishment, the TSA has been revised many times to converge to international best practices in line with requirements and technological development. The latest revision is related to extending the scope of TSA which was limited with general budget administrations. With this revision, the President of the Republic of Turkey has authority to redesign the scope of Turkish TSA system. Based on his authority, the President of the Republic of Turkey issued the Presidential Decree on the scope of TSA, which constituted new extended scope of TSA. The motivation for expanding the scope of TSA is to manage government cash resources centrally and efficiently. With the extended TSA, public cash resources will be evaluated more effectively due to economies of scale. In addition, gathering the cash resources of public institutions in the extended TSA allows the Treasury to use these resources for short-term cash needs. Consequently, the Treasury will not have to maintain a high level prudential reserve to manage short-term cash flows. And, it also certainly affects the Treasury's long-term borrowing strategy.

This study aims to assess the above considerations quantitatively. To this end, this paper estimates likely impacts of the extended TSA on Turkish public financial management by employing the new cash management model, which is created for the Treasury cash management by modifying the Miller-Orr cash management model. The results confirmed that the extended TSA gives the Treasury the opportunity to gain much more interest revenue. The results strikingly show that the Treasury could manage significant amount of public resources with the adoption of the extended TSA (approximately ₺ 70 billion on average), which is almost two times of Treasury

cash reserve. Besides, this study shows that the Treasury could gain a considerable amount of additional interest revenue from its deposit (annual average varies from ₺ 2.9 billion to ₺ 3.7 billion) if it had the extended TSA.

In conclusion, the study asserts that public resources are utilized better with the appropriate rate of return and instruments if all public resources are managed by a single hand. Furthermore, this paper alleges that the Treasury with extended TSA will be able to manage a significant amount of cash reserve without bearing any cost. Thus, TSA may affect the Treasury's short-term borrowing strategies and even it may have positive impact on reducing short-term borrowing cost. Besides, in addition to its tangible benefits, it will also contribute to achieving efficiency, discipline, and transparency in public financial management considerably since it paves the way for centralization of government cash balance.

*This study is derived from the master thesis "The Impact of Expansion of Turkish Treasury Single Account System on Public Financial Management in Turkey" prepared by Barış Can under the consultancy of Prof. S. Fatih Özatay.

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APPENDIX A: DEPOSITS AND SECURITIES STATISTICS OF INSTITUTIONS WITHIN THE SCOPE OF GENERAL COMMUNIQUÉ FOR PUBLIC TREASURERSHIP

(Million ₺)

	DEPOSITS AND SECURITIES STATISTICS OF INSTITUTIONS WITHIN THE SCOPE OF GENERAL COMMUNIQUÉ FOR PUBLIC TREASURERSHIP(*) (million TL)	GENERAL BUDGET INSTITUTIONS	SPECIAL BUDGET INSTITUTIONS	REGULATORY AND SUPERVISORY AGENCIES	SOCIAL SECURITY INSTITUTIONS	FUNDS	REVOLVING FUNDS	LOCAL ADMINISTRATIONS	STATE-OWNED ENTERPRISES	OTHER PUBLIC INSTITUTIONS AND ESTABLISHMENTS	TOTAL
February-14	DEPOSITS	9.740	9.891	1.442	7.603	11.884	2.980	16.320	14.262	3.341	**77.461**
	TOTAL	9.826	10.065	1.447	7.603	88.981	3.055	16.440	15.939	3.607	**156.962**
March-14	DEPOSITS	11.054	9.922	1.447	6.376	9.959	2.891	12.281	14.431	3.191	**71.552**
	TOTAL	11.147	10.081	1.450	6.376	87.658	2.967	12.357	15.288	3.527	**150.852**
April-14	DEPOSITS	17.683	9.756	629	7.721	9.612	2.870	12.757	14.528	3.550	**79.106**
	TOTAL	17.778	9.951	633	7.721	89.613	2.964	12.807	15.275	3.944	**160.686**
May-14	DEPOSITS	10.023	9.433	728	3.675	11.596	2.745	13.101	14.944	3.402	**69.646**
	TOTAL	10.114	9.626	733	3.675	93.533	2.842	13.148	14.956	3.783	**152.410**
June-14	DEPOSITS	17.021	9.142	873	7.145	9.265	2.567	13.209	14.390	3.402	**77.016**
	TOTAL	17.098	9.221	878	7.145	91.524	2.655	13.258	14.394	3.851	**160.024**
July-14	DEPOSITS	22.623	8.642	763	6.656	10.107	2.525	12.405	14.262	3.479	**81.462**
	TOTAL	22.694	8.736	766	6.657	90.704	2.610	12.469	14.269	3.906	**162.810**
August-14	DEPOSITS	9.608	9.610	843	3.115	12.803	2.545	12.916	11.756	3.348	**66.544**
	TOTAL	9.701	9.770	850	3.634	97.084	2.660	13.139	14.351	3.828	**155.017**
September-14	DEPOSITS	9.606	9.548	859	7.368	11.181	2.719	11.601	11.518	3.590	**67.990**
	TOTAL	9.714	9.701	863	7.368	95.761	2.860	11.837	11.568	4.057	**153.729**
October-14	DEPOSITS	9.877	10.089	564	7.894	10.872	2.798	12.724	12.906	3.224	**70.949**
	TOTAL	10.029	10.300	568	7.895	96.930	2.886	12.975	12.957	3.690	**158.228**
November-14	DEPOSITS	10.592	9.801	578	4.257	10.297	2.858	12.693	12.332	3.436	**66.843**
	TOTAL	10.746	9.997	579	4.257	99.505	2.979	12.971	12.378	3.858	**157.272**
December-14	DEPOSITS	9.589	9.029	983	8.193	11.684	2.591	14.043	12.818	3.485	**72.414**
	TOTAL	9.771	9.220	992	8.194	101.545	2.721	14.301	12.824	3.905	**163.473**
January-15	DEPOSITS	9.717	10.188	813	4.795	12.895	2.372	14.908	13.340	2.793	**71.821**
	TOTAL	9.905	10.406	815	4.795	104.511	2.442	15.205	14.829	3.463	**166.370**
February-15	DEPOSITS	16.540	10.602	1.842	4.723	15.117	3.159	15.792	13.864	3.173	**84.811**
	TOTAL	16.721	10.843	1.844	4.724	107.565	3.273	16.106	15.282	3.906	**180.264**
March-15	DEPOSITS	10.736	9.759	1.834	7.139	13.463	3.198	17.455	17.521	3.762	**84.867**
	TOTAL	10.922	9.940	1.835	7.140	107.119	3.332	17.750	17.601	4.700	**180.341**
April-15	DEPOSITS	11.751	9.777	1.096	8.065	13.092	3.090	18.230	14.910	4.062	**84.075**
	TOTAL	11.958	9.893	1.101	8.066	108.162	3.228	18.537	14.982	4.991	**180.918**
May-15	DEPOSITS	10.096	10.094	1.178	3.752	15.972	2.873	18.774	14.884	4.148	**81.772**
	TOTAL	10.297	10.228	1.180	3.754	111.680	3.031	19.122	14.888	5.025	**179.204**
June-15	DEPOSITS	11.275	9.261	1.323	7.740	13.624	2.820	18.421	14.218	4.100	**82.782**
	TOTAL	11.455	9.385	1.326	7.740	111.103	2.974	18.806	14.229	5.190	**182.208**
July-15	DEPOSITS	25.381	9.064	835	10.657	13.726	2.638	17.567	12.949	4.023	**96.839**
	TOTAL	25.561	9.236	838	10.657	112.690	2.793	18.016	13.918	5.032	**198.740**
August-15	DEPOSITS	11.465	9.579	922	8.381	15.252	2.523	17.927	13.733	4.255	**84.037**
	TOTAL	11.609	9.744	926	8.382	114.487	2.663	18.350	13.899	5.240	**185.300**
September-15	DEPOSITS	22.006	9.639	978	9.411	17.053	2.663	17.590	14.373	4.218	**97.931**
	TOTAL	22.157	9.807	983	9.412	116.238	2.727	17.959	14.378	5.194	**198.857**
October-15	DEPOSITS	9.691	10.122	709	4.412	17.568	2.702	17.873	14.130	4.317	**81.525**
	TOTAL	9.968	10.285	712	4.413	118.638	2.841	18.253	14.135	5.254	**184.500**
November-15	DEPOSITS	20.265	9.959	840	8.939	18.677	3.015	18.022	15.682	4.414	**99.813**
	TOTAL	20.410	10.161	841	8.940	120.094	3.190	18.393	15.688	5.339	**203.056**
December-15	DEPOSITS	10.227	9.801	1.217	8.749	21.953	3.127	18.343	14.178	4.851	**92.446**
	TOTAL	10.372	9.902	1.218	8.750	124.356	3.187	18.660	14.181	5.510	**196.138**
January-16	DEPOSITS	11.869	10.570	924	4.449	17.839	3.161	18.409	14.460	4.192	**85.874**
	TOTAL	12.025	10.775	927	4.450	121.591	3.333	18.803	15.280	5.117	**192.300**
February-16	DEPOSITS	20.366	10.971	1.860	10.068	18.397	3.601	18.364	16.177	4.674	**104.479**
	TOTAL	20.559	11.150	1.863	10.069	122.944	3.750	18.742	16.357	6.126	**211.559**
March-16	DEPOSITS	12.147	11.081	1.850	10.110	16.715	4.185	18.533	15.358	4.519	**94.498**
	TOTAL	12.330	11.187	1.850	10.111	123.200	4.228	18.936	15.364	5.973	**203.178**
April-16	DEPOSITS	11.722	10.291	1.341	3.916	16.883	3.889	18.321	16.520	4.500	**87.384**
	TOTAL	11.898	10.441	1.344	3.917	125.069	4.071	18.756	16.526	5.874	**197.896**
May-16	DEPOSITS	12.330	10.484	1.458	9.534	18.920	3.880	19.140	16.213	4.522	**96.481**
	TOTAL	12.472	10.633	1.461	9.534	127.488	4.022	19.575	16.215	5.959	**207.359**
June-16	DEPOSITS	12.933	10.653	1.681	10.189	16.441	3.007	17.661	15.638	4.798	**93.001**
	TOTAL	13.082	10.732	1.682	10.190	126.277	3.164	18.054	15.640	6.323	**205.144**
July-16	DEPOSITS	12.010	10.774	797	3.652	17.680	2.635	18.032	15.815	5.233	**86.629**
	TOTAL	12.153	10.888	799	3.653	128.192	2.805	18.420	16.433	6.952	**200.295**
August-16	DEPOSITS	11.600	10.165	873	8.813	19.309	2.782	17.568	16.715	5.309	**93.001**
	TOTAL	11.744	10.297	876	8.814	130.029	2.957	17.959	16.715	6.891	**206.283**
September-16	DEPOSITS	11.327	10.909	959	9.496	19.427	3.490	16.925	18.117	5.458	**96.108**
	TOTAL	11.474	11.055	965	9.497	131.527	3.587	17.324	18.118	7.017	**210.562**
October-16	DEPOSITS	12.939	11.594	705	8.130	20.106	3.608	16.602	19.027	5.406	**98.117**
	TOTAL	13.086	11.741	709	8.130	132.358	3.741	16.970	19.028	7.134	**212.898**
November-16	DEPOSITS	27.173	11.855	832	8.967	21.634	3.364	17.429	18.686	5.278	**115.218**
	TOTAL	27.326	12.027	837	8.968	133.528	3.512	17.804	18.686	7.218	**229.907**
December-16	DEPOSITS	12.752	11.535	1.299	4.859	24.589	3.162	17.716	20.206	4.633	**100.752**
	TOTAL	12.909	11.638	1.306	4.860	135.653	3.203	18.132	20.825	7.613	**216.140**
January-17	DEPOSITS	17.285	11.833	1.031	6.439	19.764	3.653	18.223	20.988	3.779	**102.996**
	TOTAL	17.453	12.013	1.033	6.440	133.238	3.694	18.660	21.003	7.290	**220.824**
February-17	DEPOSITS	24.106	13.796	2.025	6.797	19.112	3.738	18.479	20.609	3.153	**111.814**
	TOTAL	24.260	13.950	2.030	6.798	133.279	3.788	18.919	21.211	7.467	**231.701**
March-17	DEPOSITS	17.052	12.807	2.307	7.053	19.574	3.659	18.623	20.170	2.816	**104.060**
	TOTAL	17.195	12.969	2.307	7.054	135.637	3.739	19.106	21.009	7.338	**226.352**
April-17	DEPOSITS	16.894	11.607	1.082	3.677	18.213	3.522	18.520	21.381	2.690	**97.585**
	TOTAL	17.036	11.747	1.085	3.678	135.217	3.576	18.993	21.792	7.199	**220.326**
May-17	DEPOSITS	18.204	11.703	1.195	9.076	17.727	3.576	19.364	20.812	2.450	**104.106**
	TOTAL	18.351	11.836	1.201	9.077	136.051	3.631	19.837	20.924	7.070	**227.978**
June-17	DEPOSITS	16.769	11.620	1.400	11.360	18.596	3.462	18.773	20.474	2.709	**105.163**
	TOTAL	16.970	11.775	1.411	11.361	136.931	3.531	19.272	20.822	7.033	**229.106**
July-17	DEPOSITS	19.668	12.112	858	9.254	20.077	3.531	18.492	21.208	2.742	**107.942**
	TOTAL	19.816	12.233	861	9.255	139.867	3.565	19.000	21.422	6.999	**233.020**
August-17	DEPOSITS	15.870	11.601	967	5.162	20.685	3.595	16.666	19.456	2.610	**96.612**
	TOTAL	16.009	11.726	973	5.162	141.712	3.635	17.053	19.558	6.570	**222.399**
September-17	DEPOSITS	17.644	12.522	1.020	4.382	22.338	3.445	18.027	21.465	2.711	**103.555**
	TOTAL	17.844	12.599	1.028	4.383	144.542	3.489	18.439	21.567	6.762	**230.653**
October-17	DEPOSITS	17.417	12.895	749	10.218	23.016	3.609	17.384	21.758	2.955	**110.002**
	TOTAL	17.628	13.036	754	10.219	146.567	3.652	17.754	21.860	7.210	**238.681**
November-17	DEPOSITS	19.354	12.416	877	11.302	23.524	3.767	17.394	19.029	2.775	**110.437**
	TOTAL	19.570	12.486	881	11.303	148.624	3.810	17.766	19.030	7.038	**240.508**
December-17	DEPOSITS	17.952	14.791	1.111	4.764	23.982	3.440	17.699	19.755	3.024	**106.519**
	TOTAL	18.149	14.842	1.117	4.765	149.050	3.461	18.106	19.905	7.403	**236.799**

APPENDIX B: TREASURY CASH REALIZATIONS

(₺Million)

2017 CASH REALIZATIONS	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
BORROWING (NET)	**12.532**	**3.639**	**4.199**	**7.402**	**8.775**	**8.272**	**506**	**8.091**	**13.948**	**6.120**	**4.512**	**384**	**78.380**
FOREIGN BORROWING (NET)	**7.862**	**-1.505**	**-432**	**3.832**	**5.504**	**3.168**	**-8.774**	**-514**	**3.697**	**-689**	**800**	**-551**	**12.398**
Borrowing	8.465	4.651	0	4.593	6.182	3.905	0	0	5.996	0	1.556	2.737	38.085
Payment	602	6.157	432	761	678	737	8.774	514	2.298	689	756	3.289	25.687
DOMESTIC BORROWING (NET)	**4.669**	**5.145**	**4.631**	**3.570**	**3.271**	**5.104**	**9.280**	**8.606**	**10.250**	**6.809**	**3.712**	**935**	**65.982**
Borrowing	12.212	7.302	17.832	3.745	5.429	15.157	16.448	10.276	11.904	18.471	4.809	2.742	126.327
Payment	7.542	2.157	13.201	175	2.158	10.053	7.168	1.670	1.654	11.661	1.097	1.807	60.344

2016 CASH REALIZATIONS	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
BORROWING (NET)	**1.925**	**-1.666**	**6.905**	**548**	**6.797**	**3.538**	**1.647**	**2.895**	**-1.592**	**5.898**	**2.645**	**-250**	**29.290**
FOREIGN BORROWING (NET)	**-388**	**-2.661**	**2.732**	**-669**	**3.882**	**2.521**	**-429**	**-245**	**-6.288**	**3.943**	**-372**	**-678**	**1.349**
Borrowing	0	0	4.332	0	4.210	2.896	0	0	0	4.621	0	0	16.058
Payment	388	2.661	1.600	669	328	374	429	245	6.288	678	372	678	14.709
DOMESTIC BORROWING (NET)	**2.313**	**994**	**4.174**	**1.217**	**2.914**	**1.017**	**2.076**	**3.141**	**4.696**	**1.955**	**3.017**	**429**	**27.942**
Borrowing	14.365	12.630	4.566	3.074	5.965	2.500	10.250	4.571	14.076	2.607	11.435	5.063	91.101
Payment	12.052	11.636	392	1.857	3.050	1.483	8.174	1.430	9.380	652	8.418	4.634	63.159

2015 CASH REALIZATIONS	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
BORROWING (NET)	**4.787**	**4.035**	**-5.592**	**7.982**	**210**	**109**	**3.552**	**260**	**2.716**	**-992**	**974**	**-990**	**17.050**
FOREIGN BORROWING (NET)	**2.502**	**-181**	**-7.525**	**3.227**	**-335**	**-360**	**-431**	**-275**	**-334**	**-631**	**-280**	**-1.371**	**-5.995**
Borrowing	3.432	0	0	4.053	0	0	1	0	0	0	0	0	7.486
Payment	931	181	7.525	827	335	360	432	275	334	631	280	1.371	13.482
DOMESTIC BORROWING (NET)	**2.285**	**4.216**	**1.934**	**4.755**	**545**	**469**	**3.984**	**536**	**3.050**	**-361**	**1.253**	**381**	**23.046**
Borrowing	10.775	14.235	4.494	11.917	9.795	8.983	6.779	5.168	3.050	7.405	3.737	4.062	90.401
Payment	8.490	10.019	2.560	7.162	9.250	8.514	2.796	4.632	0	7.766	2.484	3.681	67.355

2014 CASH REALIZATIONS	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
BORROWING (NET)	**4.161**	**617**	**1.106**	**2.427**	**2.640**	**-4.172**	**-321**	**-1.168**	**2.057**	**3.191**	**4.339**	**529**	**15.405**
FOREIGN BORROWING (NET)	**1.403**	**65**	**-375**	**2.083**	**-354**	**-199**	**-144**	**-280**	**1.304**	**500**	**1.836**	**-561**	**5.277**
Borrowing	5.618	3.234	0	2.892	0	217	289	0	1.854	1.325	2.224	2	17.656
Payment	4.215	3.169	375	809	354	417	433	280	549	826	389	563	12.379
DOMESTIC BORROWING (NET)	**2.758**	**552**	**1.481**	**344**	**2.993**	**-3.973**	**-177**	**-888**	**753**	**2.691**	**2.504**	**1.090**	**10.129**
Borrowing	11.205	14.164	17.027	13.619	11.636	11.452	11.125	9.058	10.878	11.249	5.415	1.090	127.917
Payment	8.447	13.612	15.546	13.274	8.643	15.425	11.302	9.946	10.124	8.557	2.911	0	117.788

APPENDIX C: AVERAGE COST OF DOMESTIC BORROWING

Average Cost of Domestic Borrowing

		Zero Coupon		Fixed Interest		Cash Borrowing	
		Monthly Average Cost (Annual Compound, %)	Cumulative Cost (Annual Compound, %)	Monthly Average Cost (Annual Compound, %)	Cumulative Cost (Annual Compound, %)	Monthly Average Cost (Annual Compound, %)	Cumulative Cost (Annual Compound, %)
2014	January	10,22	10,22	10,81	10,81	10,39	10,39
	February	11,19	10,64	10,87	10,84	10,21	10,29
	March	11,34	10,78	11,07	10,93	10,47	10,36
	April	9,96	10,59	10,43	10,82	9,87	10,24
	May	8,72	10,16	9,17	10,52	9,13	10,04
	June	8,37	9,89	8,67	10,24	8,94	9,88
	July	8,33	9,72	8,57	10,02	8,79	9,74
	August	9,55	9,70	9,24	9,93	9,67	9,74
	September	9,22	9,62	9,35	9,87	9,74	9,74
	October	8,80	9,55	9,82	9,86	9,26	9,69
	November	-	9,55	8,28	9,76	8,28	9,63
	December	8,81	9,48	8,81	9,75	8,81	9,62
2015	January	7,77	7,77	7,83	7,83	7,71	7,71
	February	8,39	8,07	8,06	7,96	7,90	7,82
	March	-	8,07	8,20	8,01	8,20	7,87
	April	9,03	8,34	9,70	8,44	9,27	8,26
	May	9,88	8,72	9,64	8,66	9,28	8,46
	June	10,10	8,97	9,85	8,85	9,50	8,61
	July	-	8,97	9,63	8,95	9,63	8,71
	August	11,02	9,28	10,47	9,09	10,47	8,84
	September	-	9,28	11,33	9,18	10,92	8,92
	October	11,09	9,50	10,84	9,32	10,25	9,04
	November	10,32	9,58	10,26	9,38	10,26	9,09
	December	-	9,58	10,93	9,46	10,93	9,17
2016	January	11,19	11,19	11,14	11,14	10,76	10,76
	February	11,13	11,17	10,95	11,05	10,51	10,64
	March	-	11,17	10,13	10,87	10,13	10,56
	April	-	11,17	9,56	10,71	9,56	10,47
	May	9,36	10,67	9,63	10,51	9,63	10,34
	June	-	10,67	9,32	10,42	9,32	10,28
	July	9,18	10,34	9,11	10,15	8,65	9,94
	August	-	10,34	9,73	10,11	9,73	9,92
	September	8,63	9,93	9,25	9,97	9,15	9,77
	October	-	9,93	9,66	9,96	9,66	9,77
	November	9,94	9,94	10,66	10,05	10,56	9,87
	December	-	9,94	11,42	10,14	11,42	9,95
2017	January	10,98	10,98	11,33	11,33	10,63	10,63
	February	11,36	11,18	11,10	11,22	11,10	10,81
	March	11,67	11,34	11,42	11,31	10,89	10,84
	April	-	11,34	10,92	11,27	10,92	10,85
	May	11,65	11,40	11,23	11,26	11,23	10,90
	June	11,25	11,36	10,79	11,15	10,60	10,82
	July	11,56	11,40	11,00	11,12	10,83	10,82
	August	-	11,40	11,03	11,11	11,15	10,86
	September	11,83	11,46	11,10	11,11	10,62	10,83
	October	12,40	11,59	11,96	11,22	11,25	10,90
	November	-	11,59	13,22	11,31	13,22	10,98
	December	-	11,59	13,02	11,35	13,02	11,03

APPENDIX D: WEIGHTED AVERAGE INTEREST RATES FOR DEPOSITS IN TURKISH LIRA BY BANKS (STOCK DATA, ALL DEPOSITS TYPES INCLUDED)

Year-Month	Up to 1 Month	Up to 3 Month	Up to 6 Month	Up to 1 Year
2014-02	9,54	10,41	9,56	9,63
2014-03	10,06	11,30	10,27	9,91
2014-04	9,81	11,12	10,92	10,20
2014-05	9,25	10,65	10,91	10,48
2014-06	8,74	10,14	10,59	10,38
2014-07	8,12	9,43	10,05	10,27
2014-08	8,01	9,11	9,73	10,12
2014-09	8,40	9,18	9,36	9,80
2014-10	8,37	9,34	9,44	9,51
2014-11	8,42	9,48	9,39	9,36
2014-12	9,22	9,87	9,67	9,25
2015-01	8,76	9,89	9,74	9,23
2015-02	8,80	9,70	9,89	9,25
2015-03	9,13	9,95	9,71	9,30
2015-04	9,20	10,18	9,70	9,35
2015-05	9,21	10,26	10,04	9,45
2015-06	9,52	10,47	10,48	9,62
2015-07	9,52	10,64	10,61	9,85
2015-08	9,30	10,86	10,55	10,17
2015-09	10,13	11,32	10,59	10,38
2015-10	9,88	11,50	10,73	10,46
2015-11	9,89	11,23	11,03	10,50
2015-12	10,26	11,77	11,59	10,72
2016-01	10,04	11,90	11,84	11,10
2016-02	10,05	12,02	12,44	11,51
2016-03	10,28	12,09	12,58	11,65
2016-04	9,84	11,82	12,50	11,63
2016-05	9,62	11,41	12,02	11,57
2016-06	9,38	11,16	11,48	11,43
2016-07	9,15	10,88	11,19	11,13
2016-08	8,90	10,87	11,10	10,91
2016-09	8,98	10,90	10,97	10,57
2016-10	8,89	10,82	10,88	10,21
2016-11	8,80	10,54	10,77	10,17
2016-12	8,76	10,57	10,62	10,32
2017-01	8,86	10,64	10,75	10,34
2017-02	9,08	10,91	10,86	10,42
2017-03	9,63	11,26	10,96	10,71
2017-04	10,10	11,78	11,45	11,12
2017-05	10,66	12,58	12,37	11,71
2017-06	11,00	13,09	13,24	12,39
2017-07	11,15	13,17	13,53	12,90
2017-08	10,90	13,01	13,51	13,21
2017-09	11,06	13,03	13,42	13,37
2017-10	11,40	13,08	13,29	13,50
2017-11	11,49	13,15	13,25	13,53
2017-12	11,52	13,59	13,55	13,53

APPENDIX E: CBRT'S POLICY RATES (1 ONE WEEK REPO)

DATE	Borrowing	Lending
20.05.2010	-	7.00
17.12.2010	-	6.50
21.01.2011	-	6.25
05.08.2011	-	5.75
19.12.2012	-	5.50
17.04.2013	-	5,00
17.05.2013	-	4.50
29.01.2014	-	10.00
23.05.2014	-	9.50
25.06.2014	-	8.75
18.07.2014	-	8.25
21.01.2015	-	7.75
25.02.2015	-	7.50
25.11.2016	-	8.00