



TURKEY

December 2014

SELECTED ISSUES

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SELECTED ISSUES

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Approved By
European Department

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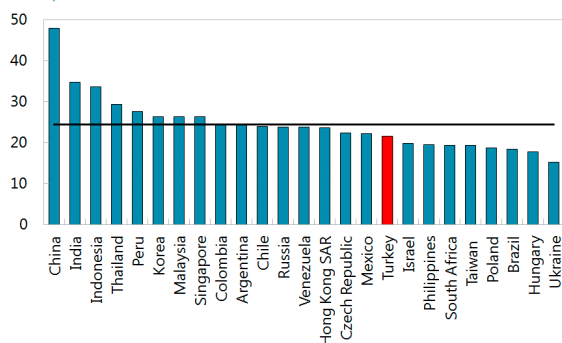
THE EXTERNAL IMBALANCE: BOOSTING NATIONAL SAVINGS WILL LIMIT THE BURDEN OF ADJUSTMENT¹

Turkey's current account deficit is expected to remain elevated at around 5½–6 percent of GDP through 2019. Reducing the deficit to a more sustainable level around 2½–3 percent of GDP should be a key policy priority. Active policies that boost national savings will allow for a gradual adjustment of the imbalance instead of running the risk of a disruptive one through external financing constraints. Applying the Global Integrated Monetary and Fiscal Model (GIMF), we quantify the impact of four different approaches to reducing the current account deficit. The analysis shows that policies that directly increase private or public savings can reduce the external imbalance without reducing private investment and have relatively modest negative growth implications. If instead the adjustment is left to monetary policy tightening or happens automatically via an increased country risk premium—as has been the case recently—the rebalancing will be on account of a large fall in private investment and a larger slump in real GDP.

A. The Policy Objective: Boosting National Savings while Maintaining Investment

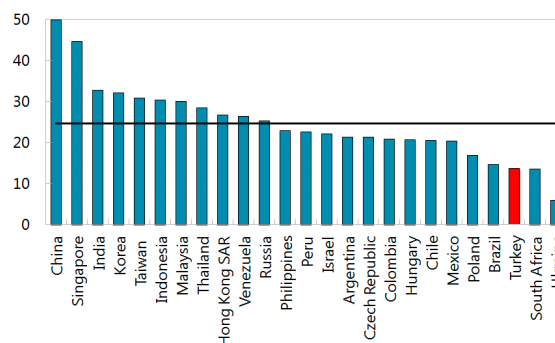
1. Turkey's current account deficit is predominantly a result of low national savings and not high investment. Turkey's national savings rate of less than 14 percent in 2013 was one of the lowest among emerging market economies. Investment stood at 22 percent of GDP—slightly below the emerging market average. Policies to reduce the current account deficit should therefore aim at boosting national savings without lowering investment.

Total investment, 2013
(percent of GDP)



Sources: IMF World Economic Outlook

Gross national savings, 2013
(Percent of GDP)



Sources: IMF World Economic Outlook

¹ Prepared by Uffe Mikkelsen.

B. The GIMF Model—A Global Dynamic Stochastic General Equilibrium Model

2. For the analysis, we apply a version of the Fund’s Global Integrated Monetary and Fiscal (GIMF) model—a fully micro founded dynamic stochastic general equilibrium (DSGE) model—comprising three regions: Turkey, the euro area, and the rest of the world. The main assumptions and features of the model include:

- Monetary policy analysis
- Nominal and real rigidities make monetary policy non-neutral
- The monetary policy reaction function for Turkey assumes that the monetary authority reacts only to inflation with a weight on inflation less than that of the euro area but similar to the rest of the world.
- Fiscal policy analysis
- Households are non-Ricardian: For emerging market economies 50 percent of households are assumed to be liquidity constrained (i.e., they spend their entire disposable income). The remaining households are overlapping generations with a planning horizon of 20 years.
- A fiscal rule stipulates that the government targets a fiscal balance that will stabilize debt and that it does this by adjusting transfers while also reacting counter cyclically to the output gap (e.g. by allowing automatic stabilizers to work).
- Macro-financial linkages
- Corporate balance sheet effects are modeled through a financial accelerator channel with an endogenous financing premium and leverage for firms. This makes the model suited for analyzing macro-financial linkages.
- The model consists of two sectors: a tradable sector and a non-tradable sector.
- International trade: Each region exports and imports final goods for consumption and investment as well as intermediate goods for use in production. Trade elasticities are assumed to be 1.5 for all regions (i.e., 1 percent higher relative import prices reduce imports by 1.5 percent).

C. Four Ways of Improving the Current Account

Policies to Increase Private Savings

3. Policies that seek to increase the private savings rate would lead to an improved current account. Such policies could include tightened regulation for credit card and consumer credit (as recently implemented by the authorities), and bolder and more effective measures such as pre-funding of the severance pay system, tax incentives to discourage borrowing and incentivize

saving, improved pension infrastructure (including introducing auto enrollment into voluntary schemes), or compulsory private pension participation. To capture such an adjustment the impact of an exogenous increase in households' savings by 2 percent of GDP is shown in Figure 1. The increased household savings will initially lead to a fall in real private consumption by more than 3 percent. However, as lower domestic demand leads to lower price inflation and thereby allows for lower interest rates, the currency will depreciate. This improves net exports enough that the impact on GDP is neutral in first year and positive thereafter. As interest rates begin to decline, real investment will increase. Consumption tax revenue will fall by almost ½ percent of GDP due to the decline in consumption. For the government budget to remain roughly unchanged (following the fiscal rule), fiscal transfers adjust by about the same amount.

Increasing Public Savings

4. An increase in public savings will directly improve the current account through higher overall national savings. Figure 2 shows the impact of a permanent fiscal consolidation of 2 percent through a mix of lower public consumption, lower government transfers, and higher consumption tax (VAT). Since lower transfers and higher VAT reduce disposable incomes, private consumption falls. The lower aggregate demand allows for lower interest rates, which depreciates the exchange rate and brings higher exports and lower imports. GDP declines in the first year, with the fiscal multiplier estimated at 0.3 percent², and subsequently it improves and returns to a level close to before the shock. The current account improves by less than 2 percent (about 1.5 percent in the medium term) as some private savings will be crowded out as higher VAT and lower transfers reduce disposable incomes.

Higher Real Interest Rates Due to Tighter Monetary Policy

5. In the absence of policies to directly increase public or private savings, higher real interest rates by tightening monetary policy (Figure 3) could stimulate savings. This will slow down domestic demand, in particular private investment. The improvement in the current account will be limited and temporary as higher interest rates have two opposite effects on net exports. The reduction in domestic demand reduces imports, which strengthens net exports. However, higher real interest rates also lead to appreciation of the real effective exchange rate (from the model's interest rate parity condition), which weakens net exports through lower exports and higher imports. The combined effect of a two percentage point higher policy rate for one year is a small and temporary increase in net exports. GDP would be 2.5 percent lower in the year with higher interest rates. The temporary improvement in the current account is driven mainly by lower investment and much of the effect is countered by lower government savings. The government budget worsens due to lower tax revenues as GDP declines as well as higher interest payments on the government's debt. The

² The fiscal multiplier would be higher at around 0.6 percent if the consolidation was done only through government consumption.

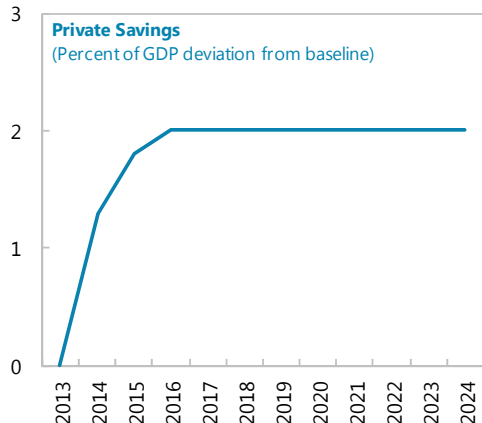
fiscal policy rule implies that transfers adjust to counter the effect but at the same time also reacts counter cyclically to the decline in GDP. The net impact is that transfers are reduced by about 1 percent of GDP from the year after the shock, and the budget balance is $\frac{1}{2}$ percent of GDP lower in the year with higher interest rates.

Tighter External Financing Conditions

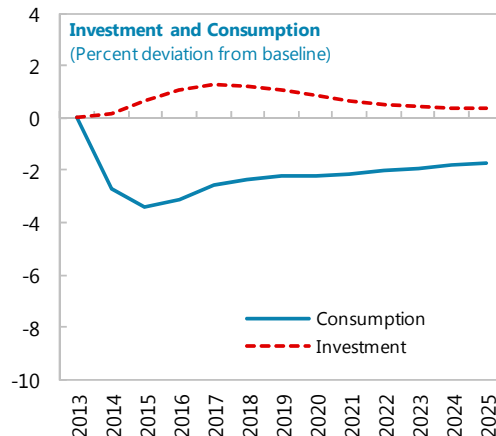
6. Finally, in the absence of policies to reduce the external imbalance, a likely outcome would be an increased country risk premium. Figure 4 shows the impact of a temporary increase of 4 percentage points in the first year followed by a gradual decline to a level $\frac{1}{2}$ percentage points higher than before the shock. The increased country risk premium increases all domestic interest rates (except the policy rate), which leads to a large decline in investment. The resulting currency depreciation improves net exports but the overall GDP impact is negative both in the short run but also in the long run as investment is lower. The saving-investment balance shows that the current account improvement is mainly driven by lower investment with private savings increasing only slightly. The government's interest expenses increase by about 1–1 $\frac{1}{2}$ percent of GDP in the short run, which leads to a reduction in government transfers of a similar magnitude. As the shock persists, the composition of the government budget shifts such that transfers are permanently about $\frac{1}{2}$ percent of GDP lower mainly on account of higher interest rate expenses.

Figure 1. Permanent Increase in Private Savings (2 percent of GDP)

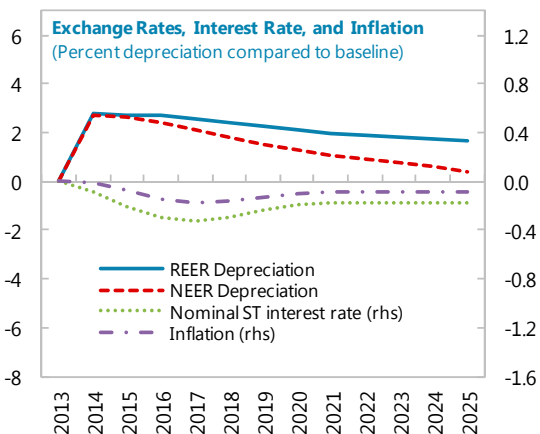
Higher private savings...



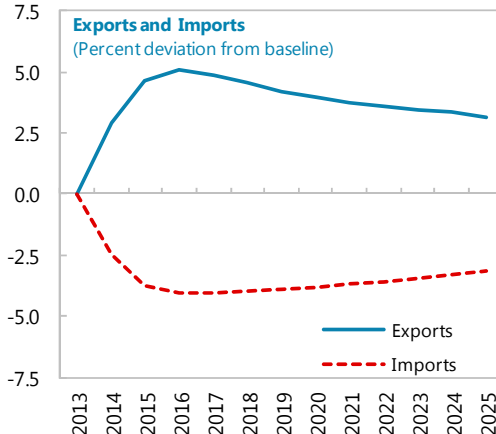
...slow consumption but not investment...



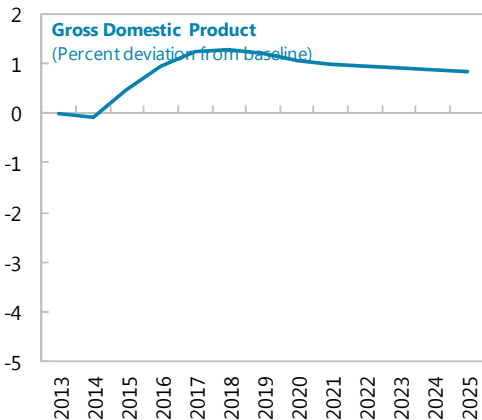
...and depreciates the real effective exchange rate...



...which leads to higher exports and lower imports.



The overall impact on GDP is neutral in the short term but positive in the medium term...



...and CA improves slightly less than private savings as private investment increase slightly.

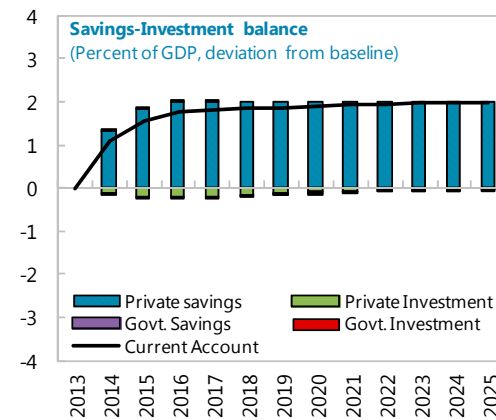
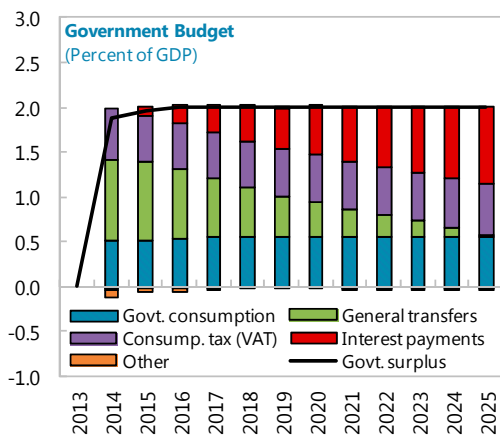
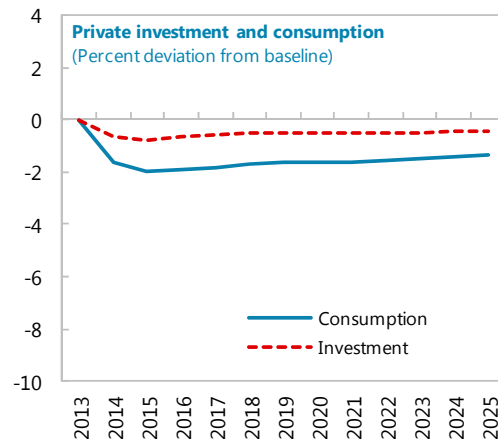


Figure 2. Permanent Fiscal Consolidation (2 percent of GDP)

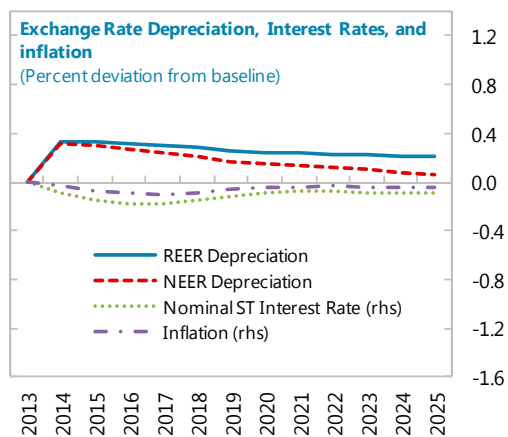
Permanent fiscal consolidation: combination of higher VAT and lower govt. consumption and transfers...



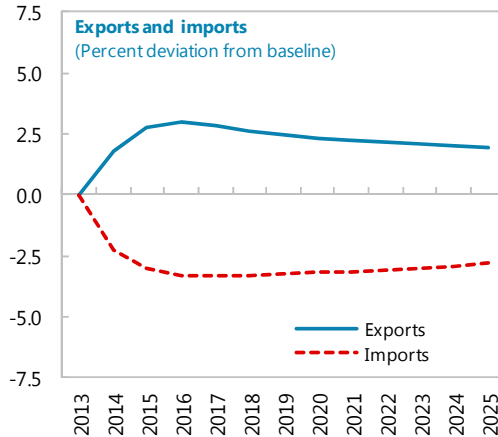
...slows investment and consumption...



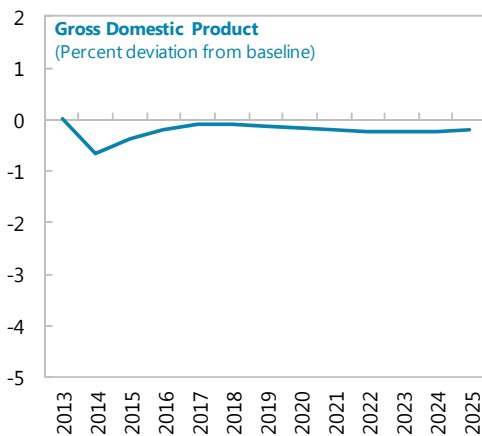
...the REER depreciates slightly due to lower interest rates...



...which leads to higher exports and lower imports.



GDP contracts 0.6 percent first year (ST multiplier of 0.3)...



...and the CA improves, with higher VAT and lower transfers crowding out some private savings.

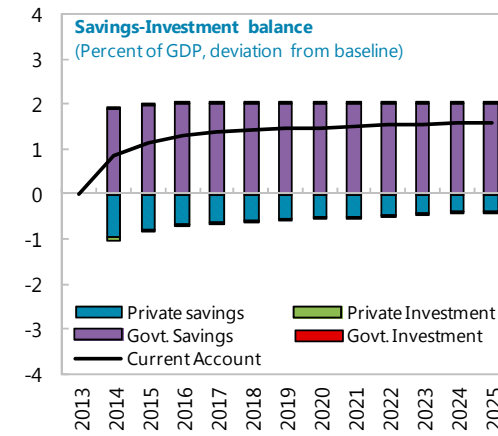
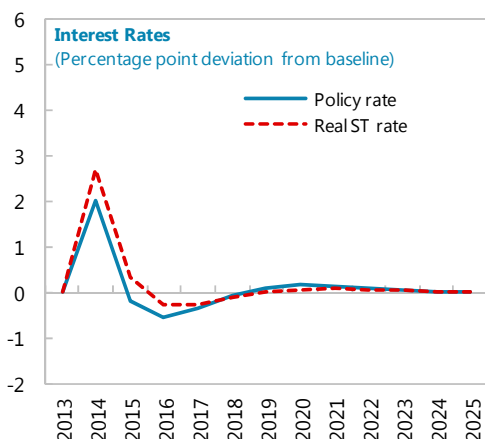
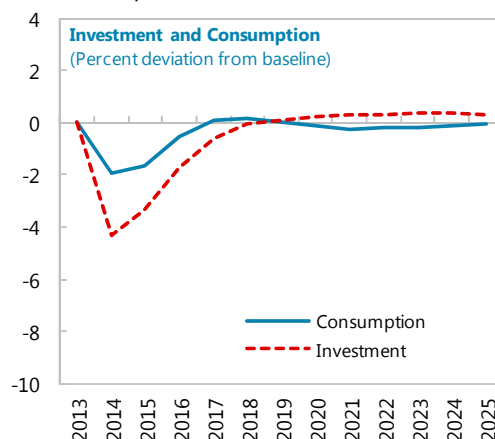


Figure 3. Increase in Monetary Policy Rates (2 percentage point for 1 year)

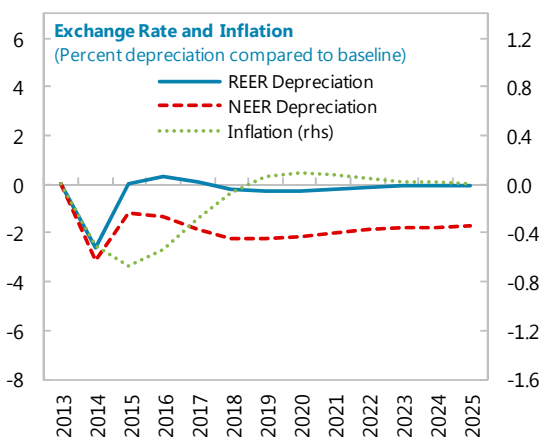
Higher nominal and real interest rates...



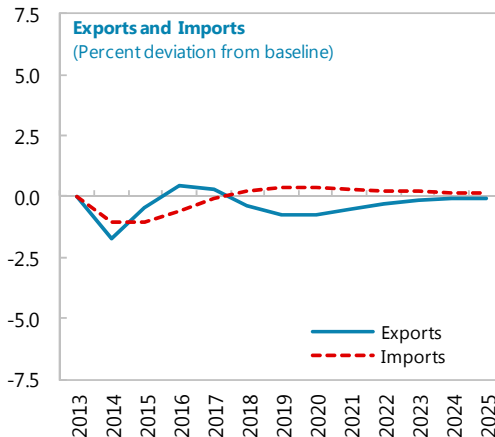
...leads to large slowdown in investment in particular but also in consumption...



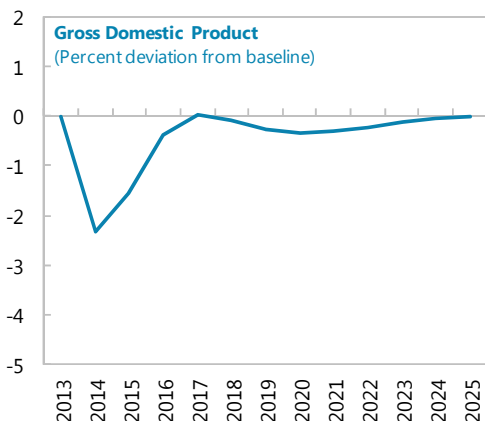
...and causes the exchange rate to appreciate and inflation to fall...



...which leads to lower exports but also lower imports due to reduced domestic demand...



The overall impact is a sharp GDP decline...



...and only temporary and moderately higher CA mainly due to lower private investment.

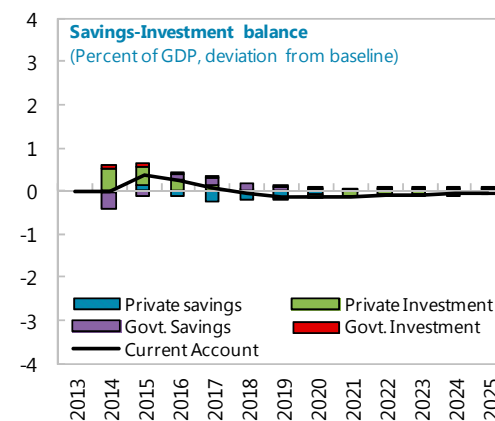
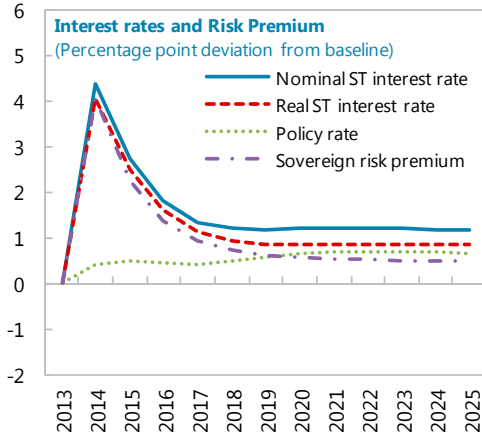
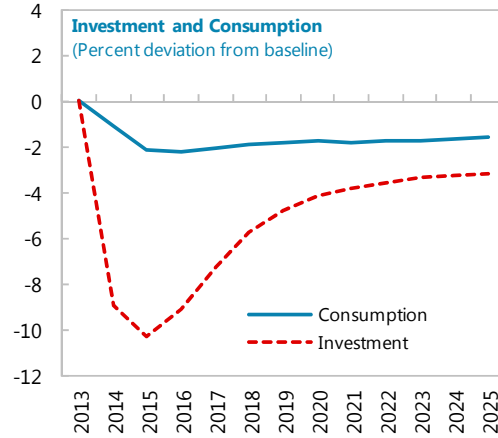


Figure 4. Increase in Country Risk Premium

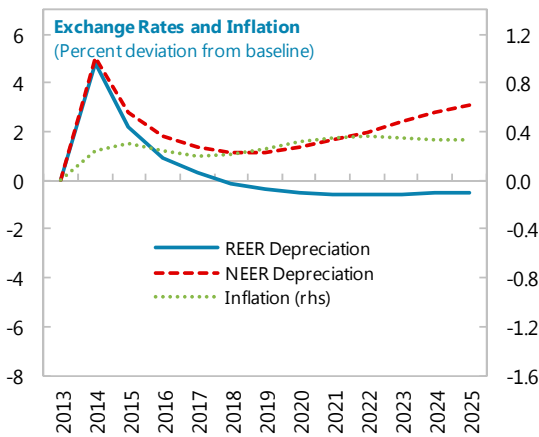
Higher country risk premium increases nominal and real interest rates...



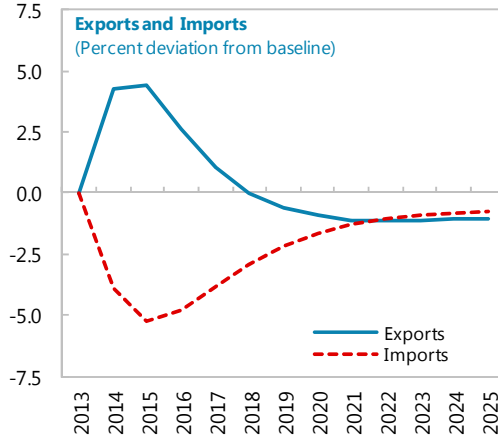
...leads to large drop in investment,...



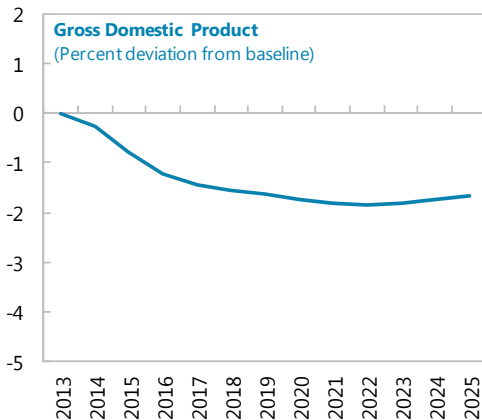
...causes REER depreciation and higher inflation,...



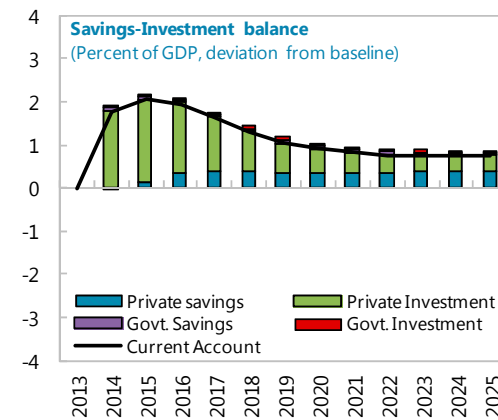
...and higher exports and lower imports.



The overall impact is a prolonged GDP decline...



...and improved CA; initially as result of lower private investment, over time also higher private savings.



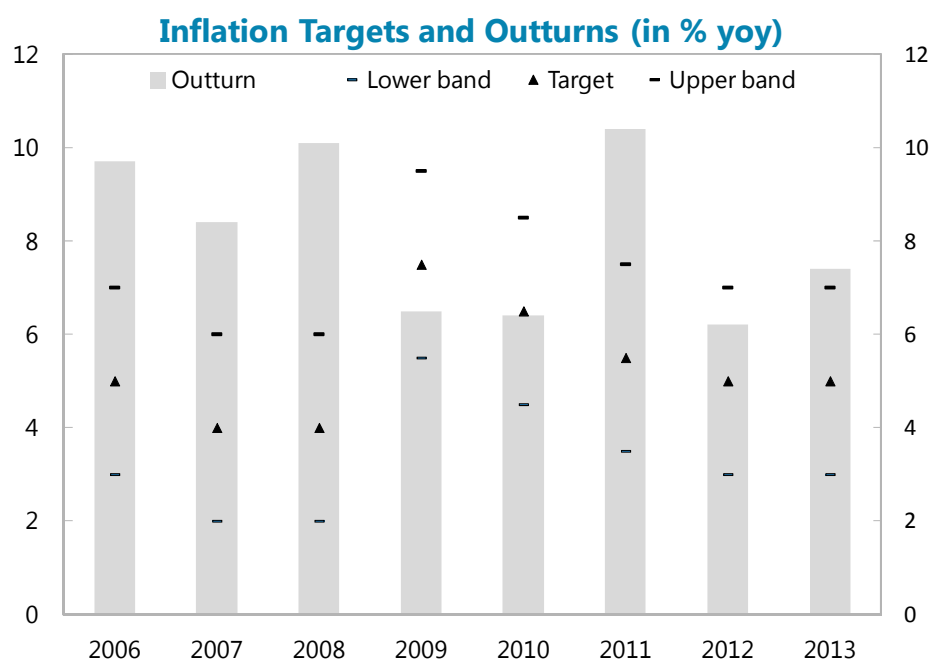
CREDIBILITY OF THE INFLATION TARGETING REGIME¹

The Central Bank of the Republic of Turkey (CBRT) has consistently missed its inflation target in the past and continues to run a lax monetary policy in the context of worsening expectations and inflation outlook. Markets do not believe the 5 percent inflation target can be met in the short term. A tighter monetary policy, as well as a strengthened framework and improved communication would help better anchoring expectations and reaching the target.

1. The Central Bank of the Republic of Turkey (CBRT) follows an inflation targeting regime for guiding monetary policy with an explicit target of 5 percent for headline inflation within a symmetrical band of ± 200 bps. While the most recent announcements indicate that the target will only be reached by end 2015, the same target has been in place since 2012.

A. Recent Implementation of the Inflation Targeting Regime

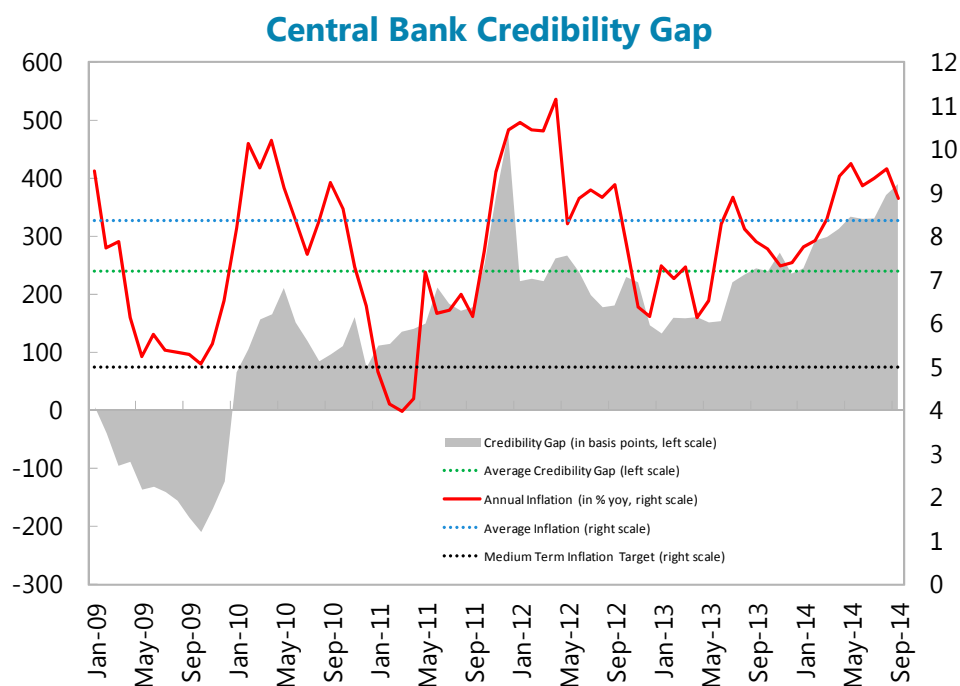
2. Implementation of the targeting regime has had a poor track record since its inception in 2006 (Figure 1). Over the 2006–13 period, ex-post headline consumer inflation fell in the inflation target band only in 2009, 2010 and 2012 while the CBRT was able to attain the inflation target only twice in 2009 and 2010. In the other 5 years, inflation outturns overshoot the upper limit of the inflation target band.



¹ Prepared by Recai Çeçen, Shan Chen, and Gregorio Impavido.

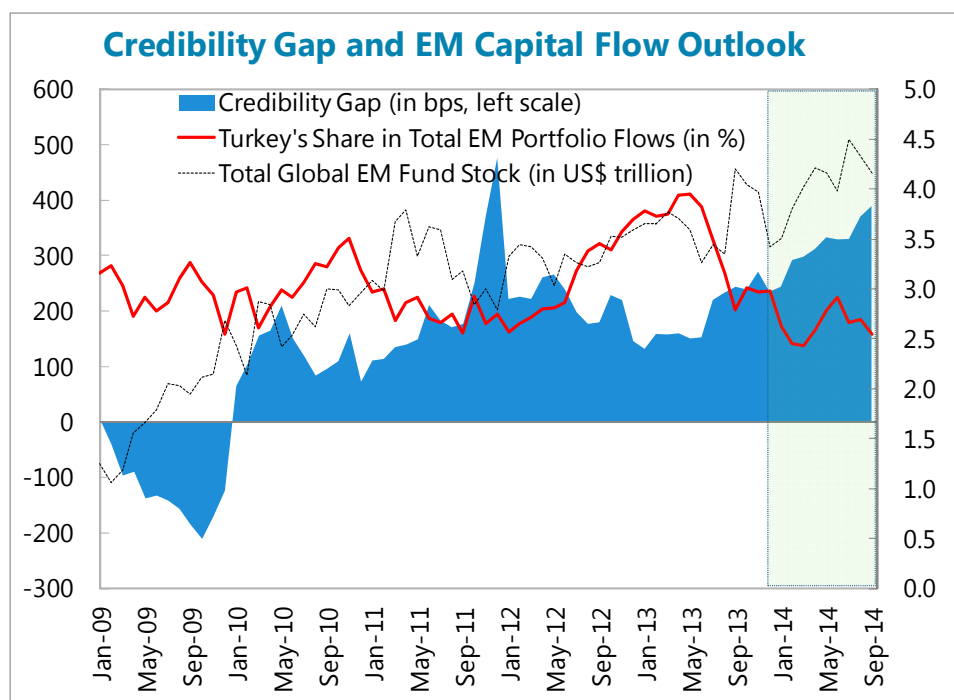
3. In addition, in 2010, the CBRT started to implement an unorthodox monetary policy framework. Conventional inflation targeting regimes use a single policy tool under a simple, predictable, and rule-based monetary policy framework. Instead, the CBRT monetary policy framework is based on provision of liquidity through multiple channels at multiple rates for multiple policy objectives, including financial stability. This creates a policy-induced spread between market rates and the one week repo rate (key policy rate). Combined with weak communication policy, the complicated unorthodox framework progressively undermines the monetary transmission mechanism and hampers markets' ability to gauge reaction function of CBRT.

4. Missing the target and complex framework generated a credibility gap for the CBRT (Figure 2). Average ex-post headline consumer inflation stood at 8.3 percent between 2006 and 2013, compared to the average inflation target of 5.3 percent and the current inflation target of 5.0 percent. The credibility gap, measured by the difference between end-year CPI inflation expectations and formal inflation targets, averaged 240 bps over the same period. As of September 2014, end-year CPI inflation expectations were 390 basis points above the inflation.



5. The credibility gap is also affected by the high exchange rate pass through. In general, the credibility gap increases amid less favorable capital flow outlook which tend to depreciate the currency and generate inflation. This highlights potential external funding risks in case of policy mistakes (Figure 3). For instance, after the 2014M1 global turmoil in emerging markets caused by concerns over the pace of monetary policy normalization in advanced economies, capitals inflows to emerging markets resurged. However, Turkey did not benefit from these higher capital inflows and

its share within global emerging market equity and bond fund stocks declined from 3.8 percent in mid-2013 to 2.6 percent in late September of 2014. Over the same period, CBRT's credibility gap rose from 153 bps to 389 bps.



6. In the face of worsened inflation outlook and poorly anchored expectations, the CBRT has progressively eased the monetary stance since March 2014. Pressed by the global market turmoil and domestic concerns for political stability, on January 28, the CBRT hiked interest rates by an effective 300 bps, normalized the monetary policy framework to a corridor of ± 200 bps around a 10 percent one week repo policy rate, and started providing liquidity at an average rate close to the upper band of the corridor. However, the monetary stance was relaxed since then in the face of worsening inflation expectations and a fiscal stance that remains procyclical. The CBRT lowered the one week policy repo rate from 10 percent to 8.25 percent between May and July (50, 75 and 50 bps, in May, June and July, respectively). The main rationale behind the decision was the decline in uncertainty, improvement in the risk premium indicators, the ongoing rebalancing of the economy and likely improvement in the inflation outlook.

7. The complex monetary policy has weakened the monetary transmission channel. Preliminary analysis suggests that lending rates on consumer and commercial loans in TL are in part determined by CBRT's overnight lending rate (top of the interest rate corridor) rather than the average cost of CBRT funding. This suggests that banks, with unpredictable funding rate environment, may tend to factor in the top rate of the interest rate corridor in pricing of lending products. In other words, the unorthodox monetary policy framework has increased the noise around the key policy and effective funding rates for banks.

8. Weak transmission channel is also evidenced by the low correlations between funding costs and lending rates. Indeed, the effective rate at which the CBRT provides liquidity to banks is positively correlated with various lending rates, although the magnitude of the correlations is low, suggesting a weak transmission channel. Correlations are statistically greater than zero with a lag of up to 4 months for consumer loans including personal, vehicle, and housing loans but weaker for commercial loans (and only statistically different from zero for commercial overdrafts and credit card loans).

Funding costs and lending rates - correlations

	Personal	Vehicle	Housing	Commercial TL	Commercial EUR	Commercial USD
t	0.44	0.58	0.64	0.45	-	-
t+1	0.45	0.65	0.63	0.48	-	-
t+2	0.41	0.60	0.55	0.43	-	-
t+3	0.35	0.48	0.43	0.36	-	-
t+4	0.28	0.34	0.33	0.29	-	-
t+5	-	-	-	-	-	-

Notes: Only monthly correlations with p-val greater than 0.1 are reported

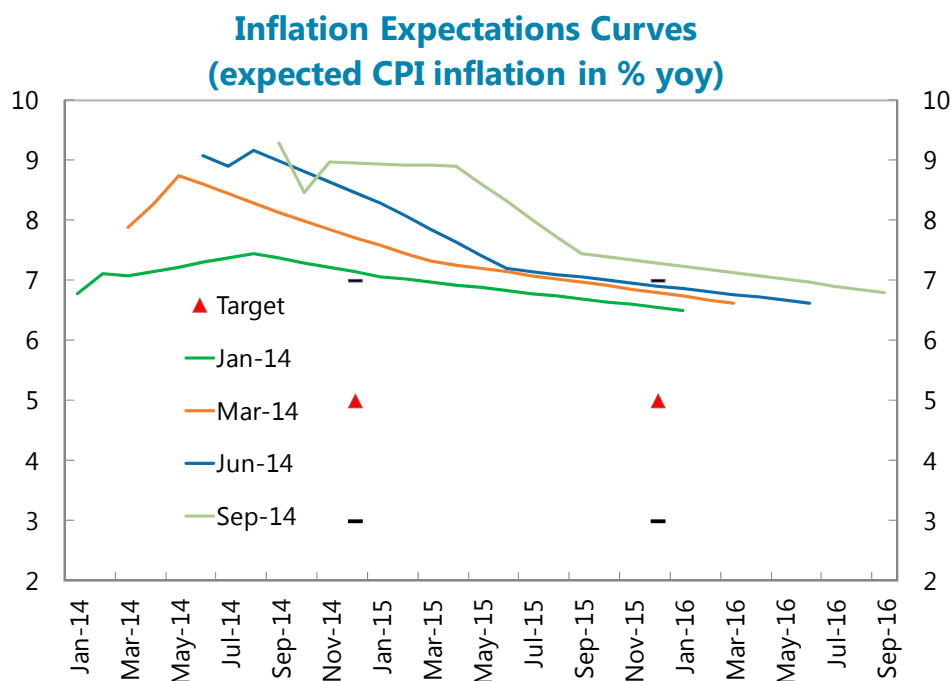
B. Short- and Medium-Term Credibility²

9. The announced inflation target of 5 percent is not credible at both short and medium term maturities and it is unclear whether inflation will fall within the target band in the same period. We assess the short and medium term credibility of the CBRT's explicit inflation target using the CBRT's monthly inflation expectation survey, break-even inflation rates and the real yields of CPI linkers traded on the secondary market.

10. CBRT's inflation expectations survey (Figure 4). In May 2014, end of year inflation expectations deteriorated to 8.3 percent from 8.1 percent in April 2014. Twelve months ahead expectations remained constant at 7.2 percent while twenty four months ahead expectation deteriorated from 6.6 to 6.7 percent. In September 2014, end year expectations had worsened further, jumping to more than 8 percent. Inflation expectation curves³ constructed on the basis of the CBRT's survey suggest that the market does not believe that the inflation target of 5 percent will be reached within the next twenty four months. Since September, inflation is not even expected to be below the upper limit of 7 percent of the inflation target band by July 2016.

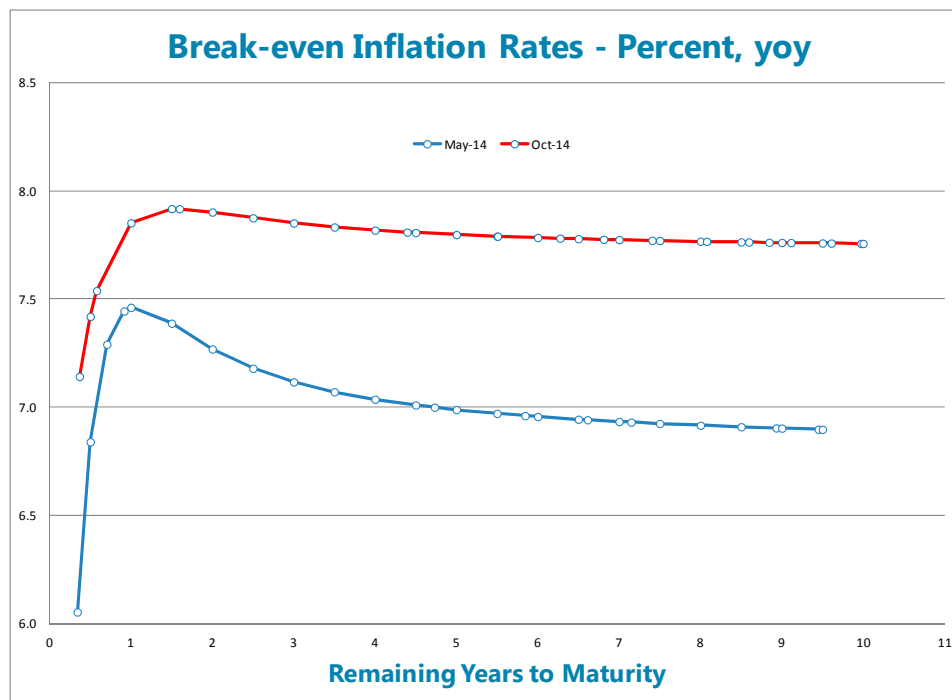
² Credibility is tested with data up to September 2014.

³ Based on inflation expectations for various maturities cited in the CBRT Inflation Expectations Survey, inflation expectations curves were constructed by linear interpolation method.



11. Break-even inflation rates (Figure 5). Using nominal and real yields observed for nominal bonds and CPI-linkers, break-even inflation rates—the rate of inflation that would give an investor the same return at maturity on a nominal security and CPI-linker, were estimated for May and October 2014⁴. Compared to CBT Expectations Survey which includes estimates by non-professionals, break-even inflation estimates provide a better gauge based on market pricing for future inflation expectations. As of May 2014, break-even inflation estimates see the 24-month ahead annual inflation rate at 7.3 percent (compared to the CBT Expectations Survey estimate of 6.7 percent) before converging towards almost 7 percent over the medium term. As of October 2014, the 24-month ahead annual inflation rate had worsened to 7.9 percent. Consistently with the previous results the market does not expect the inflation target to be reached in the medium term. In addition, this second method suggests that inflation is not expected to fall within the inflation targeting band in the foreseeable future.

⁴ Break-even inflation curve was constructed by applying Nelson-Siegel-Svensson Method on break-even inflation rates calculated by linear interpolation.

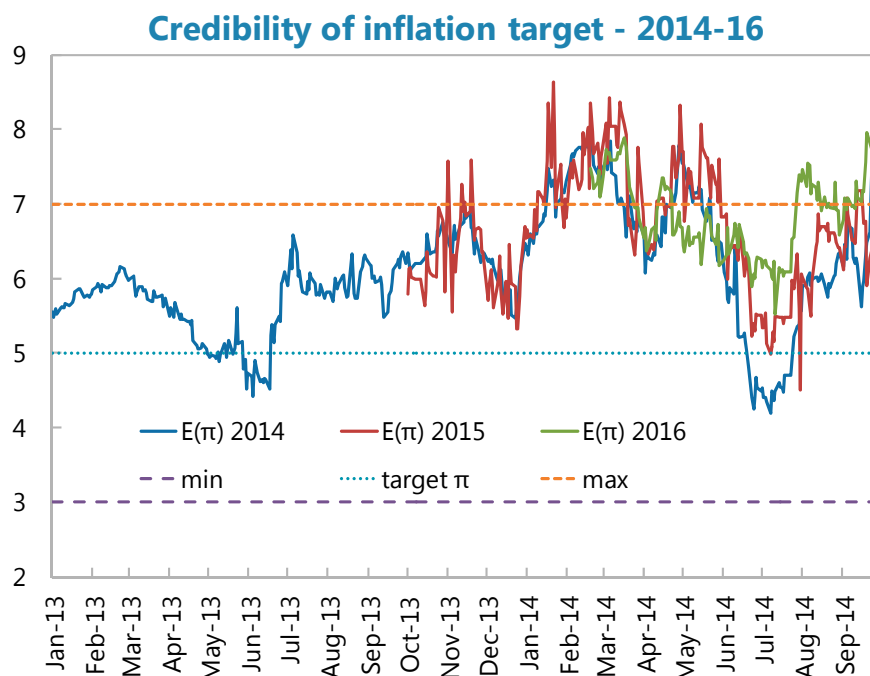


12. CPI linkers test. The test consists of computing, for a given horizon, target consistent maximum and minimum inflation rates; i.e., the maximum and minimum future inflation rates that are consistent with the inflation target. These target consistent maximum and minimum inflation rates are subtracted from the nominal yields to maturity for default-less nominal government bonds of corresponding maturity. This results in target consistent minimum and maximum real yields (on nominal bonds), that is, the minimum and maximum real yields to maturity that are consistent with the inflation target for the given horizon. We then take the real yields to maturity secondary market quotations of CPI linkers of corresponding maturity and compare them with the target consistent minimum and maximum real yields previously derived. If the market real interest rate falls outside the range of the target consistent minimum and maximum real yields, credibility is rejected.⁵ If the market real rates fall within the target consistent real yields band, credibility cannot be rejected.

13. We conduct this test for end of 2014, 2015 and 2016. Markets reject the credibility of the inflation target at end 2014 in the sense that they expect inflation to fall very close to the upper limit of the inflation target band (Figure 6). Until 2013H1, agents still believed that the inflation target of 5 percent would be met by end 2014. Starting with 2013H2, inflation expectations deteriorated compressing market real rates down. Markets still believed that the target could be met but only with end 2014 inflation falling within the upper portion (5-7 percent) of the inflation target band.

⁵ Indeed, if market agents believe with 100 percent probability that the target is credible, there would be a safe profit opportunity from borrowing (lending) real and lending (borrowing) nominal if the market real interest rate on real bonds falls below (above) the target consistent real yields band.

Starting with 2014H1, inflation expectation had worsened to the extent that real rates on CPI linkers maturing at end 2014 were below the target consistent minimum real yield on nominal bonds maturing at the same time. Similar conclusions can be drawn by using securities maturing in 2015.⁶



C. Summary and Policy Recommendations

14. The implementation of the inflation targeting regime in Turkey has had a poor track record since its inception in 2006. Headline ex-post inflation has consistently overshoot the target with the exception of a handful of years.

15. The track record is explained in part by the CBRT unorthodox monetary policy framework. The CBRT provides liquidity to banks at multiple rates and with multiple instruments, rather than using only the key policy rate. This hampers markets' ability to gauge the reaction function of CBRT, contributes to disanchoring inflation expectations, undermines monetary transmission mechanism and it generates a credibility gap for the CBRT.

16. Finally, preliminary evidence suggests that the credit channel of monetary policy is weak. The unorthodox monetary policy framework is likely to have altered, for the worse the nature of monetary transmission mechanism. Therefore, the recent easing in monetary stance could

⁶ The sudden decrease in implied inflation expectations for July is due to seasonality effect and illiquid securities market, especially the CPI linker maturing on October 1st, 2014.

undermine the positive impact of the recently introduced macro prudential measures to reduce retail credit growth.

17. Reducing the credibility gap would re-anchor inflation expectations, help contain the exchange rate pass through and improve the ability of the CBRT to meet the inflation target. To this aim, the following policies could be pursued:

Measures aimed at tightening the monetary policy

- The monetary policy stance should be consistent with the inflation target, requiring a positive real interest rate.
- Monetary policy should focus on reducing longer term positive inflation differentials with trading partners rather than targeting short term stability in nominal exchange rates which should be allowed to be aligned with fundamentals.

Measures aimed at strengthening the monetary framework

- The monetary policy framework should be normalized by re-establishing a credible monetary nominal anchor as the sole focus of the monetary policy.
- Liquidity should be provided only at the key policy rate with the aim to align short term market rates in line with the key policy rate.

Other policies

- Communication policy should be enhanced and simplified with the aim to eliminate market perceptions that CBRT may have different objectives and priorities other than inflation.
- Macroprudential tools are no substitute for the monetary policy and should be used to ensure financial stability.

CONTAINING WHOLESALE FX FUNDING AND RISK IN THE BANKING SECTOR¹

Ample capital inflows intermediated by local banks have led to rapid leveraging in FX in the financial sector and increasing wholesale external banks' liabilities. This has complicated the Central Bank (CBRT) task of dealing with inflation while safeguarding financial stability. While capital inflows have allowed for financial deepening and supported growth, they have also put pressure on the exchange rate, promoted leveraging in FX, and excessive credit growth, potentially exposing the banking sector to direct and indirect FX risk. Reducing bank incentives to fund themselves in FX directly would improve financial stability and indirectly reduce the economy's exposure to the risk of BoP crises.

1. The Turkish banking sector is exposed to considerable indirect FX risk. As of 2014Q2, total banking sector on balance sheet assets amounted to TRL1,793 billion, or 102 percent of GDP. FX assets and liabilities account for 34 and 42 percent of total, respectively. FX indexed assets are only 3 percent of total assets while no FX indexed liabilities are reported. The sum of FX and FX indexed on-balance sheet assets and liabilities yields an on-balance sheet short net open position (NOP) of about 5 percent of total assets, or 5.3 percent of GDP (text table).

2. On-balance sheet FX NOP is almost fully hedged but at the cost of off-balance sheet counterparty and rollover risk. NOP are fully hedged with off balance sheet items leaving the unhedged position of 0.2 percent² of on-balance sheet assets and well within the regulatory limits (1.6 percent of the regulatory capital) (text table). Although direct FX risk is almost fully hedged through off-balance sheet items, the banking sector is still exposed to counterparty risk in its derivative transactions and to rollover risk as currency swaps used in the hedging have on average shorter duration than the on-balance sheet FX short NOP.

FX risk - (percent of banking sector on-balance sheet assets)

	Assets	Liabilities	NOP
FX on-balance sheet	33.5	42.1	-8.5
<i>o/w Loans/Deposits</i>	16.7	20.8	-4.1
FX indexed on-balance sheet	3.3	0.0	3.3
FX off-balance sheet	20.4	15.0	5.4
Total	57.3	57.1	0.2

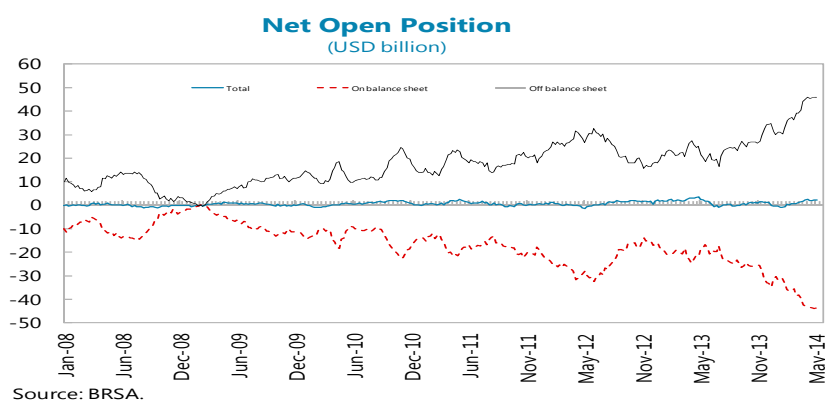
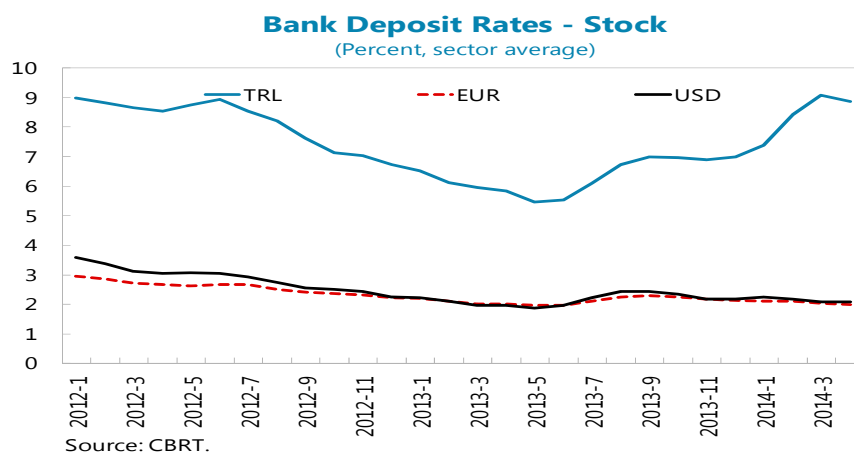
Source: BRSA.

¹ Prepared by Gregorio Impavido.

² All data used in this annex refer to April 2014.

3. Banks are exposed to indirect FX risk by lending to non financial corporates (NFC). FX loans and FX indexed loans represent about fifty percent of on balance sheet FX assets, or around TRL300 billion. These are concentrated in loans to NFCs in the form of working capital loans (40 percent of total), investment (20 percent), and export loans (14 percent). Banks face indirect FX risk stemming from this credit portfolio as the NFC sector net open FX position is large: around US\$170 billion at end-March 2014. Anecdotal evidence suggests that part of this NOP may be hedged or covered by FX collateral. However, aggregate data has been unavailable thus far.

4. FX exposures have increased overtime due to a large funding cost differential between FX and TRL liabilities. Funding cost differential between EUR or USD deposits and TRL deposits averaged 500bps in the period 2012–14 and since 2013H2 they have consistently increased to about 700 bps in 2014M5 (text chart). While this metric is restricted to deposits only, we believe that similar spreads apply to wholesale FX and TRL funds. As a result, on balance sheet FX exposures of the Turkish banking sector have increased from almost zero in 2008Q1 to about TRL95 billion (or USD44 billion) in 2014Q1 (text chart).



A. Current Regulatory Measures

5. Several measures have been introduced to limit banks' direct and indirect FX risk. These include reserve requirements to limit leveraging, limits on overall FX NOP aimed at limiting direct FX risk, and specific rules on FX and FX indexed lending aimed at limiting indirect FX risk and/or strengthening bank risk management practices.

6. Current reserve requirements on FX liabilities are very similar to TRL liabilities. For short term liabilities, the spread between FX and TRL liabilities is only 250bps. This increases to about 300bps for liabilities up to 3-year maturity and decreases to about 100bps for liabilities of more than 3-year maturity (text table). These spreads are unlikely to offset the strong incentives to borrow in FX generated by the current 700 bps spread between TRL and FX deposits.

Reserve Requirement Ratios (percent)	
Turkish lira	Ratios
Demand deposits, notice deposits and private current accounts, deposits/participation accounts with maturities up to 1-month and 3 months (including 1 and 3 months)	11.5
Deposits/participation accounts up to 6-month maturity (including 6-month)	8.5
Deposits/participation accounts up to 1-year maturity	6.5
Deposits/participation accounts with 1-year and longer maturity and cumulative deposits/participation accounts	5.0
Other liabilities up to 1-year maturity (including 1-year)	11.5
Other liabilities up to 3-year maturity (including 3-year)	8.0
Other liabilities longer than 3-year maturity	5.0
Foreign Exchange	Ratios
FX and precious metal demand deposits, notice deposits and FX private current accounts, deposits/participation and precious metal deposit accounts up to 1, 3, 6 months (including 1, 3, 6 months) and 1-year maturities	13.0
FX deposits / participation accounts with 1-year and longer maturity and cumulative FX deposits / participation account	9.0
Other FX liabilities up to 1-year maturity (including 1-year)	13.0
Other FX liabilities up to 3-year maturity (including 3-year)	11.0
Other FX liabilities longer than 3-year maturity	6.0

Sources: CBRT.

7. Limits on NOPs disregard off balance sheet risk and are ineffective at limiting on-balance sheet FX leverage. Since 2006, banks are subject to limits on consolidated NOPs. These include on balance sheet FX asset and liabilities, on balance sheet FX indexed assets and liabilities, and off-balance sheet assets and liabilities. Overall NOP have been capped at 20 percent of regulatory capital and the overall banking sector had a NOP of 1.6 percent of regulatory capital as reported in Table 1. These provisions are very effective at mitigating direct FX risks but do not limit on-balance sheet FX leverage to the extent that hedges can be easily rolled over. In particular, there appear to be no requirements to limit overall off-balance sheet risk.

8. Prudential limits on FX lending are very weak. Regulations stipulate that the household sector cannot borrow in FX while the corporate sector that can show export receipts can borrow freely, or else, can only borrow a minimum US\$5 million with at least 1-year maturity. However, there are no requirements for additional capital charges or higher general provisions for FX lending

relative to TRL lending. Finally, FX-indexed lending is not within the perimeter of these regulations, even though it carries similar risks.

9. Banks are required to routinely report on the quality of the FX lending portfolio or FX borrowers. Existing regulations on FX lending are aimed to minimize rollover risks, to benefit larger corporates with greater access to financial hedging, and to increase incentives for banks to do proper risk assessment. However, there appear to be no provisions for banks to routinely report on whether borrowers have, and maintain, a natural or financial hedge or else, have FX collateral that is posted against banks FX claims.

10. New rules are being adopted or drafted but unlikely to eliminate incentives to leverage in FX. A new guideline on credit risk management requires banks to evaluate the FX position of its customers and their ability to manage FX risk. In particular, Art 17 of the new guideline requires banks to use debt service capacity indicators such as LTV and DTI ratios, as well as debt service to income ratios for borrowers. Also, TRL reserve requirements will soon be remunerated with the aim of reducing incentives to borrow in FX. Finally, banks are now subject to new liquidity requirement covering also FX assets and liabilities and by end-2015, FX-indexed assets and liabilities will be treated as FX-denominated assets and liabilities in calculation of FX liquidity adequacy ratio. These requirements are likely to reduce on-balance liquidity risk and strengthen FX risk management by banks but not enough to offset the incentives to borrow in FX generated by the TRL and FX funding cost differential.

B. International Experience—Select Examples

11. Countries that have succeeded in reducing excessive FX risk in their banking sectors have used a variety of measures.

12. Korea adopted during the global financial crisis a financial stability charge (FSC) on banks' non-core FX liabilities and funding patterns of Korean banks improved. In August 2011, Korea adopted a price-based Pigouvian FSC, the so called Macroprudential Stability Levy (MSL), levied in proportion to each bank's marginal contribution to systemic risk, that is, on banks' daily average balance of non-deposit FX liabilities. A few types of liabilities (like FX deposits) already covered by the deposit insurance scheme are exempted. The perimeter of regulation covers only banks and the rate is risk based (as a function of liability maturity) and can be varied in a countercyclical manner. Finally, the Ministry of Finance along with the Bank of Korea is in charge of the levy, while the Bank of Korea takes the daily operation including collection and asset management (see Box 1 for FSC design good practices). In addition, other macroprudential measures were adopted to reduce FX leveraging by the banking sector (see Box 2 for a list). As a consequence, in the period 2010–2013, short term FX liabilities decreased from USD180 to USD120 billion reducing their share in FX liabilities from 45 to 30 percent.

Box 1. FSC Design Good Practices: Base and Rate

Financial institutions differ in how much they contribute to systemic risk and consequently in the potential social costs of their failure. This different contribution should be reflected in the choice of the base and rate. How to achieve this is not without some complexity, as account needs to be taken of interactions with deposit insurance and other regulatory reforms.

Base of the levy. The composition of the balance sheet of financial institutions captures risk considerations better than other variables (such as the volume of financial transactions or profitability). But what components of the balance sheet should be included? Two issues arise: (i) whether the base should be represented by assets or liabilities; and (ii) whether it should be broad or narrow (e.g., include or not off-balance sheet items).

Regarding the breadth of coverage, a broad base on the liability side of the balance sheet may be preferable as it allows a lower rate (thus less distortionary). It would also reflect that the costs from resolving systemic financial institutions arise from the need to support the liabilities. However, it would be important to exclude equity (so to reward capital accumulation) and insured liabilities (to avoid double imposition). In principle, other liabilities could be excluded to reflect their risk-characteristics or to avoid double taxation, such as subordinated debt, government guaranteed debt and intra-group debt transactions (an approach taken by Sweden). Indeed, the levy could be applied only on select liabilities (such as wholesale funding, short-term debt or foreign funding) with the explicit objective of discouraging such activities. Another approach using a narrow base could be to apply the rate to the holding of level 2 and 3 trading assets, which could serve to discourage the buildup of assets that proved to be less liquid during the peak of the crisis

In sum, a broad balance sheet base, including possibly off-balance sheet items, but excluding capital (e.g., Tier one for banks) and insured liabilities is preferable.

Rate of the levy: A uniform rate has the benefit of ease of implementation, but does not contribute to reducing riskiness and systemicness. A risk-adjusted rate could be designed to address the contribution to systemic risk. Ideally, the rate would vary according to the size of the systemic risk externality, e.g., based on a network model which would take into account all possible channels of contagion. In practice, however, existing models are not able to fully capture all propagation channels. Therefore, the degree of systemic relevance has to be estimated based on a series of indicators, as also contemplated by the Basel Committee in designing a capital add-on charge for systemic banks. As with some deposit insurance schemes, risk-differentiation could reflect both quantitative information (e.g., compliance with capital requirements) and qualitative assessments (e.g., a scoring system based on supervisory information). Quantitative indicators could include measures such as size, interconnectedness and complexity. When systemic risk can be identified to arise from specific activities (e.g., excessive reliance on short-term and wholesale funding), the rate could be adjusted accordingly.

Box 2. Additional Measures Taken by Korea

In two separate stages, Korea adopted a long series of macroprudential measures to fight leveraging in FX by its banking sectors.

First stage (2004 and early 2008): In the wake of rapid surge of the short term external debt, the authorities employed several measures but they had no meaningful effect on capital market, and were later reversed. Macroprudential measures adopted in this stage included:

- Ceiling on the non deliverable forwards (NDF) position (2004). As NDF was seen as major causes of foreign exchange volatility, the authorities introduced the ceiling on the NDF position of domestic banks. However, they repealed this ceiling immediately since banks circumvented this regulation by using the option and futures market.
- Reduction of the ceiling of tax exemption on interest expenses (late 2007). The tax exemption limit on interest expenses decreased from 6 to 3 times the paid in capital in order to discourage FX short term borrowing by foreign bank branches. However, the ceiling could not be adjusted during the cycle and was repealed it in 2008.

Second stage (since 2009): After the crisis, the authorities started to focus more on the prevention of potential build-up of systemic risks. Macroprudential measures adopted in this stage included:

Cap on loans to deposits (LTD) ratio (2009). This regulation revived to reduce wholesale funding.

Ceiling on the bank's FX derivative positions (2010). The authorities imposed ceilings on bank's FX derivative positions to reduce the structural mismatch between sell and buy of long-term FX derivative, major drivers of rapid short term debt. Since October 2010, banks' FX derivatives positions are capped as a percentage of their previous month's capital. The ceiling is adjustable depending on credit cycle.

Bank levy on the non-deposit foreign currency (2011): A levy introduced on banks' non-deposit foreign currency liabilities to reduce the bank's short term debt. It is set at between 2–20 basis points, depending on the maturities of debt instruments. And the proceeds of the levy reserve to supply liquidity to the financial institutions in the event of a crisis.

Other prudential measures (2010): the measure includes the followings, regulations on foreign currency bank loans and prudential regulations for improving foreign exchange risk management of financial institutions, etc.

13. Austria adopted a stock and a flow variants of the loan to deposit ratio to monitor the funding business model of its banks. The stock Loan-to-Local-Stable-Funding Ratio (LLSFR) is defined as the ratio of total loans to nonbanks (net of provisions) to local stable funding sources defined as the sum of deposits from nonbanks, funding from supranational institutions, capital from third parties, and securities with an original maturity of at least one year issued to investors outside the bank's consolidated group. The flow LLSFR defined as the ratio of the first difference of the stock LLSFR's numerator and to the first difference of its denominator. To the extent that FX liabilities are also covered by the LLSFR, short term FX leveraging is also discouraged by these two measures.

14. Banks with high LLSFR were deemed to have an unsustainable funding model. The Austrian authorities noted that Austrian banks' subsidiaries that entered the 2008–09 financial crisis with a high LLSFR were significantly more likely to exhibit higher loan loss provisioning rates than those below that threshold. They concluded that a business model where a subsidiary's LLSFR is above 110 percent and the flow-LLSFR exceeds 110 percent “runs a high risk of not being sustainable and contributes to potential vulnerabilities in crisis situations”. Therefore, starting in 2012, subsidiaries' flow-LLSFR is being monitored; subsidiaries with both a LLSFR above 110 percent and the y-o-y change in net loans is greater than 1.1 times the y-o-y change in the local stable funding will receive particular supervisory attention. Supervisory action, if warranted, will take place within the framework of supervisory colleges.

15. New Zealand used a floor on core funding ratio (CFR) to reduce dependency on wholesale funding, including FX. In October 2009, the RBNZ introduced new quantity-based measures to increase banks' liquidity and reduce reliance on short-term cross-border funding. The one-year CFR is defined as core funding² divided by total loans and advances. A floor for this ratio encourages banks to hold sufficient retail and long-term wholesale funding to reduce their vulnerability to a severe liquidity shock. For the initial implementation (April 2010), the minimum CFR was set at 65 percent of total loans and advances, increasing to 70 percent from July 2011 and 75 percent from January 2013.

16. Core funding of New Zealand banks increased from 65 to 85 percent in 2008–11 period. A comparison with other countries suggests that the liquidity measure played a role. However, other factors were also at play. For instance, the uncertain and volatile environment or rating agencies putting pressure on New Zealand banks to reduce their exposure to rollover risk, may have played a role too.

17. Peru made heavy use of reserve requirements and caps on FX derivatives to contain short term FX funding. Peru raised reserve requirements on all FX liabilities from zero to 75 percent in 2010, during the upswing phase of the cycle to contain excessive credit growth and the associated build up of vulnerabilities and encourage a shift in banks funding structure towards the longer term liabilities. It then reduced it to 60 percent in 2011, while extending the application of reserve requirements to liabilities of off-shore branches of domestic financial institutions. Peru also introduced limits on NOPs as a share of T1 capital and, similarly to Korea, introduced a ceiling on the use of FX derivatives for hedging purposes that even today stands at 20 percent of T1 capital.³

²The one-year core funding is all funding with residual maturity longer than one year, including subordinated debt and related party funding, plus (i) 50 percent of any tradable debt securities issued by the bank with original maturity of at least two years, and residual maturity (at the reporting date) between six months and one year, (ii) “non-market funding” that can be withdrawn at sight or with residual maturity up to one year, where the percentage to be included decreases with size bank, and (iii) Tier 1 capital.

³ See SBS resolution No. 9076-2012.

C. A Proposal for Turkey and Its Calibration

Measures aimed at curbing FX funding

18. We consider reserve requirements on FX liabilities to reduce the opportunity cost differential between FX and TRL funding. Any macroprudential measure that introduces a wedge between FX liabilities and assets would increase the opportunity cost of FX funding and hence reduce it. We examine here only reserve requirements on FX liabilities but these could in principle be complemented by other measures.

19. The extent with which FX funding is reduced depends on the incidence of the macroprudential measure. Depending on market structure, the incidence of the tax falls differently on banks' creditors, debtors, and shareholders. I.e., by introducing a wedge between FX liabilities and assets, the macroprudential measure generally leads to higher spreads between interest bearing assets and liabilities, reduced profitability decreases, and intermediation (see appendix A for a formal discussion). If banks have sufficient market power in any given business line to fully offset the impact of the macroprudential measure, profitability, intermediation, and therefore FX funding are not reduced.

20. Hence, design and calibration requires estimating the elasticities of the demand for assets and supply of funding. This should be done by line of business and for various maturities using quantity and price information for both assets and liabilities. Addressing inevitable identification problems also requires detailed data on the quality of funding suppliers, bank intermediaries, and borrowers.

21. Due to data unavailability we use a parametric approach to design and calibration. In particular, we use case B developed in appendix A where we assume: (i) perfect competition in the liability market and market power in the asset market; (ii) no non-interest income and expenditures; and (iii) that the introduction of a macroprudential measure affecting FX liabilities will have an equal (negative) impact on FX and TRL assets. We calibrate parameters such that initial on balance sheet and income statement data correspond to what appears in the text table. Finally, we study the impact of higher reserve requirements on FX liabilities for two levels of market power and assuming that the slow down in credit growth takes place either only within FX assets, or only within TRL assets, or in both TRL and FX assets in order to maintain constant the current 2-to-1 ratio between them.

Banking sector data (TRL million)

	TRL	FX	Total
Assets	1,194,697	600,127	1,794,824
Liabilities	834,218	749,818	1,584,036
Sharholdes' equity	207,924	2,864	210,788
Net interest income	54,013	3,330	57,344
Net non-interest income	24,732	1,467	26,199
Net income	29,281	1,864	31,145

Sources: BRSA

22. Key results are as follows (Figure 1):

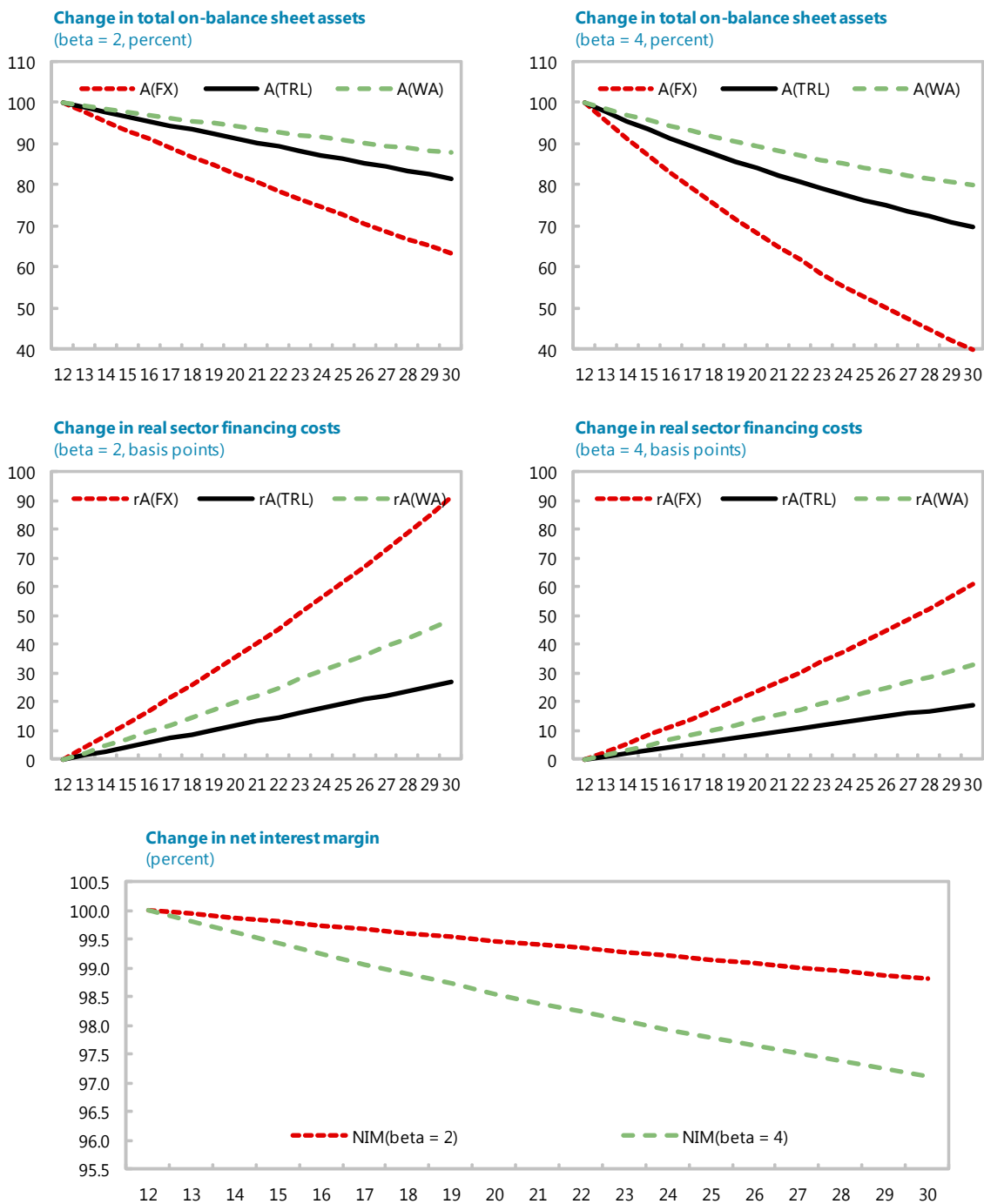
- The slow down in credit growth varies as a function of market power and the line of business that banks decide to cut. In a high market power scenario ($\beta = 2$) an increase in FX reserve requirements from 12 to 30 percent⁴ will cause total assets to decrease over time by 10 percent. Depending on reaction of the bank, this amounts to a decrease of almost 40 percent in FX assets or a decrease of slightly less than 15 percent in TRL assets. In a low market power scenario ($\beta = 4$) costs cannot be easily passed onto asset holders and disintermediation is higher. Total assets to decrease by almost 20 percent. This amounts to a decrease of almost 60 percent in FX assets or a decrease of slightly less than 30 percent in TRL assets.
- The impact on real sector financing costs also vary as a function of market power and the line of business that banks decide to cut. In a high market power scenario ($\beta = 2$) FX financing costs increase over time by 90 bps banks decide to slow down only FX credit growth. TRL financing costs increase by 20 bps when banks decide to slow down only TRL credit growth. Overall financing costs increase by 40 bps if banks decide to slow down both TRL and FX credit growth in such a way to maintain the current 2-to-1 ratio between them. In a low market power scenario ($\beta = 4$) financing costs increase by less as banks are less able to pass costs onto their asset clients.
- Overall profitability decreases by 1 percent in a high market power scenario ($\beta = 2$) and up to 3 percent in a low market power scenario ($\beta = 4$).

23. Banks appear to have sufficient buffers to withstand much higher FX reserve requirements than currently the case. Results are obviously sensitive to elasticity estimate: a much higher elasticity used in our simulation would result in lower profitability. But banks have other means to pass on costs than those considered in our simulation. For instance, they can always adjust non-interest net margins and are likely to have also some market power on the liability side so that costs can also be passed onto banks' asset claimants. All this suggests that banks can withstand much higher FX reserve requirements than the current effective 12 percent.

24. Non-price measures could also be used to complement FX reserves. In case FX reserve requirements alone do sufficiently not skew funding incentives, non-price measures could also be adopted. For instance, a ceiling on the use derivatives for hedging purposes, or on a non-core to core foreign exchange liabilities ratio would have the obvious impact of containing wholesale foreign exchange funding. Alternatively, a ceiling on the Lira LTD ratio would force banks to reduce wholesale foreign exchange funding to the extent that this is used to fund Lira loans.

⁴ We ignore for simplicity the desirability to lengthen the maturity of liabilities. This can be achieved by risk basing reserve ratios as a function of maturity.

Figure 1. Impact of an Increase in FX Reserve Requirement



Source: IMF Staff calculations

Measures aimed at curbing FX lending

25. In addition to reducing FX funding, FX lending can be discouraged through higher capital requirements. The authorities may increase capital requirements for FX lending in several ways. Banks may be instructed to increase the risk weights by a fixed add-on or a multiplier. A minimum limit may be set for the risk weights estimated by banks applying the Internal Ratings-Based (IRB) approach. The authorities may also lay down stricter guidelines for how the IRB models or risk parameters used by IRB-banks to assign risk weights are estimated. In what follows we focus on risk weights only.

26. Higher risk weights reduce FX lending directly by decreasing expected return and indirectly by increasing costs of funding. Higher risk weights reduce FX lending directly by reducing the expected return on equity behind these assets relative to equity behind the bank's other assets. The return on equity falls when banks have to hold more equity against a specific asset class, but also if the authorities' decision to increase risk weights leads to a more conservative subjective assessment of risk and expected return for this asset class. Profit-maximizing banks will normally reduce their investments in FX lending if its expected return on equity becomes lower. Finally, higher risk weights would also reduce FX lending indirectly by increasing the cost of funding for banks that have now lower capital adequacy ratios.

27. It is difficult to assess the impact of changes in risk weights based on publicly available data. In order to assess how changes in risk weights affect a bank's optimal asset mix, it is necessary to estimate banks' risk adjusted return on equity for the various asset classes before and after the change in regulatory risk weights. It is then necessary to estimate the elasticity of the demand and supply of alternative asset classes to assess the likely magnitude of the disintermediation in the FX and other asset classes.

28. Instead, we simply assess the impact on industry CAR as an indication of the space available to authorities to increase capital requirements. In the short run, higher weights decrease CAR. In order to assess their impact on CAR we need to know the distribution of the risk weighted FX items in the value at credit risk (VCR) module of the risk weighted assets (RWA).⁵ Then we need to shock the risk weights applied to this distribution. The data on risk weighted items in VCR are only available for both TRL and FX assets together. Hence, we need to assume their separate distributions while maintaining constant the ratio of unweighted FX and TRL assets as well as the total VCR. We do so in the next table under 3 scenarios:

- CAR(66,66) where FX and TRL assets risk weighted assets have the same distribution. This yields an average risk weight of 66 percent for both TRL and FX assets.

⁵ RWA are defined as the sum of the VCR in TRL and FX, value at market risk (VMR), and value at operational risk (VOR).

- CAR(54,89) where their distribution is shifted to higher (lower) weighted items for FX (TRL). This yields an average risk weight of 54 and 89 percent for TRL and FX assets, respectively.
- CAR(42,112) where their distribution is further shifted to higher (lower) weighted items for FX (TRL). This yields an average risk weight of 42 and 112 percent for TRL and FX assets, respectively.

Risk weighted items in value at credit risk (TRL million, alternative distribution assumptions)

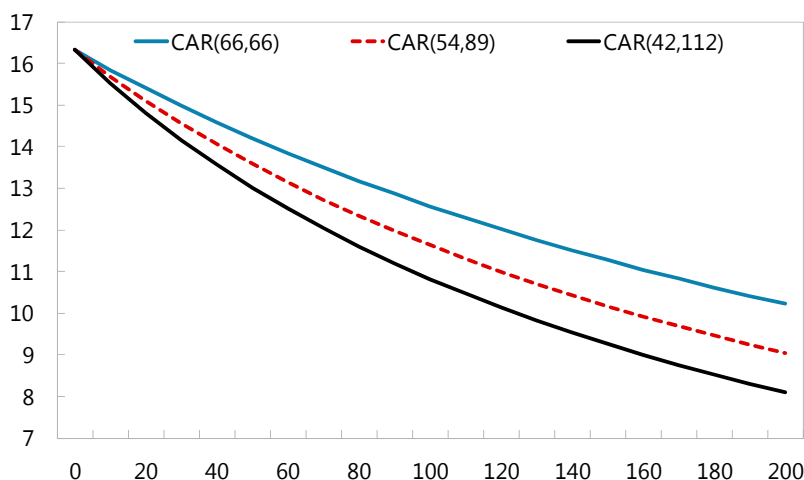
		CAR(66,66)		CAR(54,89)		CAR(42,112)	
Weights	Total	TRL	FX	TRL	FX	TRL	FX
0.0	495,110	329,562	165,547	509,219	82,774	688,875	-
0.1	-	-	-	-	-	-	-
0.2	71,595	47,656	23,939	39,254	11,969	30,853	-
0.5	183,687	122,269	61,419	100,713	30,709	79,158	-
0.5	142,440	94,813	47,627	78,098	23,813	61,383	-
0.8	302,475	201,338	101,137	165,843	50,568	130,348	-
1.0	716,562	476,968	239,593	392,881	411,956	308,793	584,319
1.5	26,688	17,765	8,924	14,633	15,343	11,501	21,763
2.0	83,488	55,573	27,916	45,775	47,998	35,978	68,080
2.5	4,029	2,682	1,347	2,209	2,316	1,736	3,286
12.5	-	-	-	-	-	-	-
Total VCR	1,337,881	890,540	447,341	733,542	604,340	576,543	761,338

Sources: BRSA and IMF Staff assumptions.

29. CAR is likely to remain above minimum regulatory limits even if FX risk weights are trebled. The following chart shows that in our 3 scenarios, CAR falls below the 8 percent regulatory minimum only for the most aggressive distribution of FX assets and when FX risk weights are all increased by 200 percent. This is an extreme and implausible scenario but it gives an idea of the buffers available to absorb the cost of the regulatory measure.

CAR and Increases in FX Capital Risk Weights

(Different assumptions of average risk weights, percent)



Sources: IMF Staff calculations.

30. Other risk weight calibration considerations include an assessment of NOPs in the real sector and banks' market power. Since, the whole purpose to reduce FX lending is to reduce

indirect FX risk stemming from potentially unhedged borrowers (information currently publicly unavailable), a detailed study on the magnitude of the problem would be required. Complementary, the BRSA would need to establish a reporting mechanism for banks to inform on the quality of its FX credit portfolio and on the quality of the hedge by its creditors so that risk weights can be adjusted over time. In addition, a study on banks' market power would be required to assess the impact of higher charges on profitability and therefore on bank's optimal asset mix.

31. Finally, non-price measures could also be needed. If banks' market power does not allow for a satisfactory price response to regulatory measures, current rules on FX lending could be tightened. For instance, the minimum threshold of USD5 million for lending to unhedged borrowers could be raised and, in any case, FX-linked lending should be subject to same regulatory treatment.

D. Summary and Policy Recommendations

32. Current macroprudential measures have failed to contain direct and indirect FX risk. Banks continue to leverage in FX to sustain profitability in the context of a slowing economy, fast credit growth in recent years that will result in higher NPLs going forward, and recently introduced macroprudential measures for retail lending. This is optimal from the private point of view of banks but such behavior implies a large negative externality for the society at large as FX risk in the economy increases. The negative externality justifies policy intervention.

33. Reserve requirements could be increased to contain FX funding but non price measures may also be needed. Preliminary analysis suggests that FX reserve requirements could be raised from the current effective 12 percent rate to 30 percent without significant loss in profitability and intermediation. In addition to increasing the reserve requirement differential between FX and Lira liabilities the authorities could consider remunerating Lira reserve requirement while leaving reserve requirement on FX liabilities unremunerated. Also, reserve requirement rates could be further risk weight adjusted with the objective of discouraging banks' short term FX wholesale borrowing. The overall aim of all these price measure would be to reduce the existing cost funding cost differential that favors foreign exchange of Lira funding. Finally, if banks' market power does not allow for a satisfactory price response to regulatory measures, non-price measures should be adopted. Caps on the use of derivatives for hedging purposes or a floor on a core funding ratio could also be introduced.

34. Capital requirements could be increased to contain FX lending but non price measures may also be needed. FX lending will likely to be reduced if FX funding becomes more costly. In addition, preliminary analysis suggests that risk weights on FX assets could be increased substantially without significant impact on CAR. If banks' market power does not allow for a satisfactory price response to regulatory measures, non-price measures should be adopted. For instance, the minimum threshold of USD5 million for lending to unhedged borrowers could be raised. Irrespectively, FX and FX-linked lending should be subject to same regulatory treatment.

35. A study on the risk associated with the FX credit portfolio is needed. The desirability to reduce indirect FX risk is inherently linked to the magnitude of the problem. Preliminary CBRT

analysis suggests that the NFC sector may be hedged more than originally thought. However, this does not diminish the magnitude of the indirect FX risk born by banks, and associated with the progressive dollarization of their balance sheets.

36. A mechanism for monitoring the quality of the FX credit portfolio is needed. Going forward, banks should be required to periodically report on the quality of their FX credit portfolio, including on the quality of the FX hedge by its creditors. This would allow the BRSA to fine tune capital charges as a function of this data.

37. Any macroprudential measure needs to be supported by an impact study. Price and non-price measures aimed at curbing FX funding or lending need to take into consideration the ability of banks to pass on the additional costs to creditors or debtors and generally, the impact on profitability and available buffers.

38. Any additional macroprudential measure needs to be introduced gradually. Turkey does not export capital to the rest of the world so further macroprudential measures aimed at reducing FX wholesale funding will need to be accompanied by increased aggregate savings. To the extent that gross capital inflows and outflows cannot be reduced simultaneously, further macroprudential measures will need to be introduced gradually so as to avoid engineering too an abrupt reduction in capital inflows.

Appendix I. Incidence of Macroprudential Measures—A Simple Framework

1. The incidence of the measure varies depending on market structure and banks' market power. While attempting to preserve profitability banks will attempt to pass the intermediation tax onto either customers on the asset or the liability side by widening the intermediation spread in proportion to their market power. If the pass through is not complete, the residual cost is passed onto shareholders. The following simple framework considers two extreme cases of either perfect competition in the asset market and market power in the liability market, or perfect competition in the liability market and market power in the asset market.

A. Perfect Competition in the Asset Market and Market Power in the Liability Market

2. In this set up, the bank's problem is:

$$\begin{aligned} \text{Max}_{r^L} \quad & \pi = Ar^A - Lr^L \\ \text{s.t.} \quad & A = (1 - \mu)L \\ & r^A = \overline{r^A} \\ & L = C(r^L)^\alpha \end{aligned}$$

where $\pi = Ar^A - Lr^L$ is the profit function that the bank maximizes, μ is the macroprudential measure that introduces a wedge between asset and liabilities so that $A = (1 - \mu)L$, A is aggregate demand for asset at the exogenous interest rate $\overline{r^A}$, $L = C(r^L)^\alpha$ is the aggregate supply of liabilities, and α the elasticity of the supply wrt the interest rate r^L .

3. By substituting the various constraints into the objective function we obtain

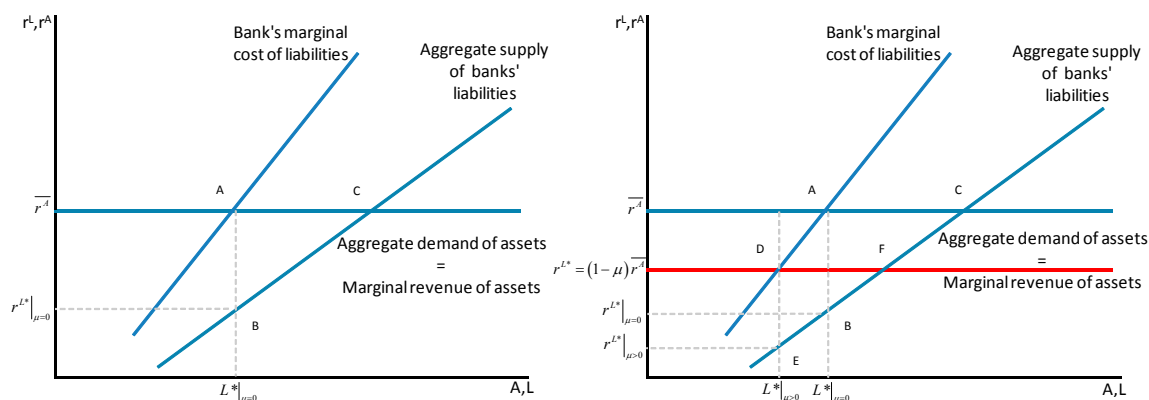
$\pi = (1 - \mu)\overline{r^A}C(r^L)^\alpha - C(r^L)^{\alpha+1}$ as the difference between total revenues and costs. Profits are maximized when marginal revenues equal marginal costs. Hence, the F.O.C. becomes

$\alpha(1 - \mu)\overline{r^A}C(r^L)^{\alpha-1} = (\alpha + 1)C(r^L)^\alpha$, which yields the equilibrium liability rate

$r^{L*} = \alpha(\alpha + 1)^{-1}(1 - \mu)\overline{r^A}$, an equilibrium liability level $L^* = C(r^{L*})^\alpha$, an equilibrium asset level

$A^* = (1 - \mu)L^*$, and an equilibrium profit level $\pi^* = (\alpha + 1)^{-1}(1 - \mu)\overline{r^A}C(r^{L*})^\alpha$.

4. Graphically, each bank faces an upward sloping marginal cost of liabilities and a perfectly elastic demand for assets. Each bank collects enough funds $L^*|_{\mu=0}$ until the exogenous marginal revenue of assets $\overline{r^A}$ equals the marginal cost of funding in point A. It then uses its market power to determine the rate at which it pays for funding $r^{L^*}|_{\mu=0}$, along the aggregate supply of funds at point B (left hand side panel).



5. The introduction of a macroprudential measure forces the bank to set aside a non-remunerated buffer in the proportion of μ of its liabilities that would have earned the marginal rate $\overline{r^A}$. Hence, the marginal return on asset is reduced to $(1 - \mu)\overline{r^A}$ and the profits are maximized in point D where marginal costs equal marginal revenues. The cost of holding a non remunerated buffer is passed onto each bank's debtors in the form of lower interest rate $r^{L^*}|_{\mu>0}$ in point E which, in turn, reduces the amount of funding supplied to $L^*|_{\mu>0}$ (right hand side panel).

6. The same chart can be used to study the market equilibrium where the market faces an upward sloping supply of funds and an infinitely elastic demand for assets. If banks are small enough to compete away among themselves their market power, the equilibrium interest rate on liabilities is then given by $\lim_{\alpha \rightarrow \infty} r^{L^*} = (1 - \mu)\overline{r^A}$. With no macroprudential measure, $\overline{r^A} = r^{L^*}|_{\mu=0}$, and the market equilibrium is given at point C, where the aggregate supply of funds to the banking sector intersects the aggregate demand for assets from the banking sector. The introduction of a macroprudential measure moves the equilibrium from C to F (right hand side panel).

7. Few results are worth mentioning. Notice that the more onerous the macroprudential measure, the lower the equilibrium liability interest rate and therefore, the higher the impact on disintermediation; i.e. $\frac{\partial r^{L*}}{\partial \mu} = -\alpha(\alpha+1)^{-1} \bar{r}^A < 0$ and $\frac{\partial L^*}{\partial \mu} = \alpha C(r^{L*})^{\alpha-1} \frac{\partial r^{L*}}{\partial \mu} < 0$. Notice also that the lower the market power on the liability side the lower the change in the equilibrium interest rate as the bank cannot pass the cost of the macroprudential measure on its creditors; i.e., $\frac{\partial r^{L*}}{\partial \alpha} = (\alpha+1)^{-2} (1-\mu) \bar{r}^A > 0$. Finally, notice that introduction of the macroprudential measure reduces profitability since $\frac{\partial \pi^*}{\partial \mu} < 0$ and that such reduction, is a positive function of the elasticity of supply of liabilities wrt the interest rate r^{L*} .

B. Perfect Competition in the Liability Market and Market Power in the Asset Market

8. In this set up, the bank's problem is:

$$\begin{aligned} \text{Max}_{r^A} \quad & \pi = Ar^A - Lr^L \\ \text{s.t.} \quad & A = (1-\mu)L \\ & r^L = \bar{r}^L \\ & A = C(r^A)^{-\beta} \end{aligned}$$

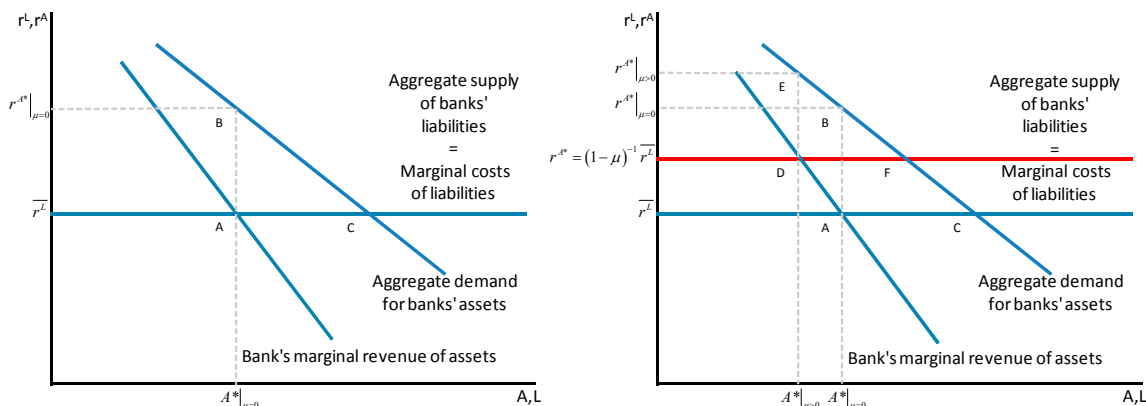
where $\pi = Ar^A - Lr^L$ is the profit function that the bank maximizes, μ is the macroprudential measure that introduces a wedge between asset and liabilities so that $A = (1-\mu)L$, L is aggregate supply of liabilities at the exogenous interest rate \bar{r}^L , $A = C(r^A)^{-\beta}$ is the aggregate demand for bank assets, and β the elasticity of demand wrt the interest rate r^A .

9. By substituting the various constraints into the objective function yields

$\pi = C(r^A)^{-\beta+1} - (1-\mu)^{-1} \bar{r}^L C(r^A)^{-\beta}$ as the difference between total revenues and costs. Profits are maximized when marginal revenues equal marginal costs. Hence, the F.O.C. becomes $(\beta+1)C(r^A)^{1-\beta} = \beta(1-\mu)^{-1} \bar{r}^L C(r^A)^{-\beta-1}$, which yields the equilibrium asset rate

$r^{A*} = \beta(\beta - 1)^{-1} (1 - \mu)^{-1} \bar{r}^L$,¹ an equilibrium asset level $A^* = C(r^{A*})^{-\beta}$, an equilibrium liability level $L^* = (1 - \mu)^{-1} A^*$, and an equilibrium profit $\pi^* = (\beta - 1)^{-1} (1 - \mu)^{-1} \bar{r}^L C(r^{A*})^{-\beta}$.

10. Graphically, each bank faces an infinitely elastic supply of funds and a downward sloping marginal revenue on assets. Each bank collects enough funds to sell assets $A^*|_{\mu=0}$ until the exogenous marginal cost of funding \bar{r}^L equals the marginal revenue on assets in point A. It then uses its market power to set $r^{A*}|_{\mu=0}$, the price these funds in the asset market along the aggregate demand for assets at point B (left hand side panel).



11. The introduction of a macroprudential measure forces the bank to set aside a non-remunerated buffer in the proportion of μ of its liabilities. This increases the marginal (opportunity) cost to raise funds to $(1 - \mu)^{-1} \bar{r}^L$ and profits are maximized in point D where marginal revenues are equal to marginal costs. The cost of holding a non remunerated buffer is passed onto each bank's debtors in the form of lower interest rate $r^{A*}|_{\mu>0}$ in point E which, in turn, reduces the amount of asset demanded to $A^*|_{\mu>0}$ (right hand side panel).

¹ This constrains the admissible values of β to $\beta > 1$.

12. Again, the same chart can be used to study the market equilibrium where the market faces a downward sloping asset demand and an infinitely elastic supply of funds. If banks are small enough to compete away among themselves their market power, the equilibrium interest rate on assets is then given by $\lim_{\beta \rightarrow \infty} r^{A*} = (1 - \mu)^{-1} \bar{r}^L$. With no macroprudential measure, $\bar{r}^L = r^{A*} \Big|_{\mu=0}$, and the market equilibrium is given at point C, where the aggregate supply of funds to the banking sector intersects the aggregate demand for assets from the banking sector. The introduction of a macroprudential measure moves the equilibrium from C to F (right hand side panel).

13. Few results are worth mentioning. Notice that the more onerous the macroprudential measure, the higher the equilibrium asset interest rate and therefore, the impact on

disintermediation; i.e., $\frac{\partial r^{A*}}{\partial \mu} = \beta(\beta - 1)^{-1} (1 - \mu)^{-2} \bar{r}^L > 0$ and $\frac{\partial A^*}{\partial \mu} = -\beta C(r^{A*})^{-\beta-1} \frac{\partial r^{A*}}{\partial \mu} < 0$.

Notice also that the lower the bank's market power, the lower is the increase in the equilibrium

interest rate and therefore, the impact on disintermediation; i.e., $\frac{\partial r^{A*}}{\partial \beta} = -(\beta - 1)^{-2} (1 - \mu)^{-1} \bar{r}^L < 0$.

This, because the bank cannot pass onto debtors the cost of the macroprudential measure. The

change in profitability is a priori undetermined since $\frac{\partial \pi^*}{\partial \mu} = \frac{\partial A^*}{\partial \mu} r^{A*} + \frac{\partial r^{A*}}{\partial \mu} A^* - \frac{\partial L^*}{\partial \mu} \bar{r}^L$. However,

it can be shown that it is negative for admissible values of $\beta > 1$ given that in equilibrium it must be the case that $\pi^* > 0$ and $r^{A*} > 0$. I.e., the lower the bank market power the lower the ability to pass onto debtors the cost of the macroprudential measure and hence, the lower the profitability.