

The Turkish Current Account Deficit

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Abstract

During the 2011-2015 period, Turkey's current account deficit as a percentage of GDP was one of the largest among the OECD countries. In this paper, we examine if this deficit can be considered optimal using the Engel and Rogers (2006) approach. In this framework, the current account of a country is determined by the expected discounted present value of its future share of world GDP relative to its current share. A country, whose income is anticipated to rise relative to the rest of the world is expected to borrow now and run a current account deficit. Our findings suggest that Turkey's current account deficit in 2015 may be considered optimal if the Turkish economy's share in the world economy could continue to grow at rates similar to the past or to the predictions from professional forecasts. The same approach, however, indicates that the current account deficit in 2011, at its peak, was unlikely to be optimal.

Keywords: Current account; open economy macroeconomics; growth

JEL Classification: F32; F41; F43

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1 Introduction

Turkey's current account deficits, reflecting the country's growing liabilities to the rest of the world, have been a topic of concern among academicians, politicians, and practitioners.¹ From 2011-2015, Turkey's current account deficit as a percentage of GDP was one of the largest among the OECD countries.² After 2011, where the current account deficit reached its peak of 9.6%, the Central Bank of the Republic of Turkey (CBRT) started instituting unconventional monetary policies that included measures to limit the credit growth and achieve financial stability. The Banking Regulation and Supervision Agency (BRSA) also imposed measures aimed at curbing consumer credit.³ In 2015, the current account deficit was reduced to 4.47% of GDP.

According to Milesi-Ferretti and Razin (1996a), current account deficits that exceed 5% of GDP are a cause for concern, especially if they are financed with short-term debt or foreign exchange reserves. From 1990-2001, the Turkish current account had a mix of surpluses and modest deficits that were lower than this threshold while Turkey had some of its major economic crises in its history. After 2001, the Turkish current account deficits exceeded the 5% threshold multiple times together with an increased reliance on short-term debt and declining national savings.⁴ Akkaya and Gürkaynak (2012) address a series of concerns about these deficits with an extensive documentation of the recent economic developments, some of which cast doubt on current account sustainability.

Under a commonly used definition, Milesi-Ferretti and Razin (1996a, 1996b, 1996c) include the creditors' willingness to lend in the definition of sustainability in addition to a country's ability to service its debt. In this paper, we take a different approach and focus on a country's ability to pay by asking whether the observed current account deficits can be a consequence of agents' optimizing behavior as in Engel and Rogers (2006). In this framework, the current account of a country is determined by the expected discounted present value of its future share of world GDP relative to its current share. The framework is a two-country general equilibrium model with a single composite consumption good that is traded internationally. In each country, households choose consumption optimally over an infinite horizon. The country, whose income is expected to rise relative to the rest of the world, may borrow to consume during that period and run a current account deficit. Using this key theoretical implication

¹See, for example, Sekmen (2008); Oğuş and Sohrabji (2008); Akat and Yazgan (2013); İnel and Kayıkçı (2012); Röhn (2012); Edgerly (2013); Kara (2013); Harvey and Gökölük (2014); and Özata (2014), among others.

²In 2013 and 2014, Turkey's current account deficit relative to GDP was the largest among OECD countries. During 2011-2015, it was also larger than those of the Latin American countries such as Argentina and Brazil. (Source: World Development Indicators)

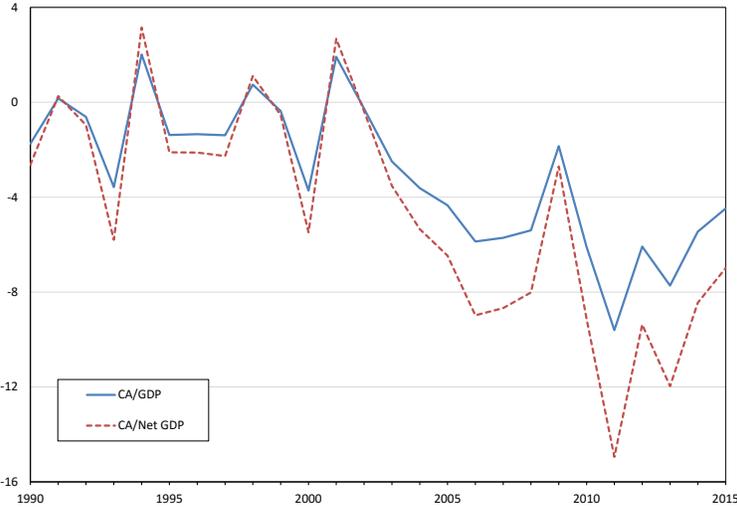
³Increasing concerns about financial stability led to the foundation of the Financial Stability Committee (FSC) in 2011, with the aim of improving the coordination and cooperation among institutions that play a role in maintaining financial stability such as BRSA, Treasury, and the Capital Markets Board. FSC made policy recommendations to these institutions to bring down household indebtedness that appeared to be strongly connected to the current account deficit (Kara (2016)). See also Barçın (2012); Başçı and Kara (2011); and the International Monetary Fund (2012).

⁴Clark et al. (2012) note that some of the national savings are presumably "under the mattress" due to the underdevelopment of financial markets, and hence not reported.

of the model, we calculate the future growth path for Turkey relative to the rest of the world that would justify the consumption decisions and, hence, the current account deficit observed in the data at a given point in time. With that growth rate, Turkey’s current account deficit at the steady state is eliminated. We then ask if such a growth rate seems “reasonable” based on Turkey’s past performance and the predictions on future growth rates from professional forecasts.

In our quantitative analyses, we use an equilibrium relationship between the net GDP share growth of a country and its external imbalances, implied by the open-economy growth model in Engel and Rogers (2006).⁵ We then calculate the net GDP share that Turkey needs to reach in the long run, given the current account-to-net GDP ratio of -6.99% in 2015 (See Figure 1). Next, we calculate the model’s equilibrium-implied share growth and compare it with the observed growth performance in the past and the predictions on future growth rates from professional forecasts to assess the extent to which such a growth rate may be deemed “reasonable.”

Figure 1: Current account to GDP (%)



Our main findings can be summarized as follows. Under a plausible calibration of the model, the 2015 level of the current account at -6.99% of net GDP can be justified if Turkey’s income share could rise to around 1.96% in the long-run. In 2015, this share was 1.83%. If the Turkish economy’s share were to grow at annual growth rates of 0.52% to 0.32%, reaching its new steady state in 14 to 23 years, then the current account deficit observed in 2015 could be reconciled with the optimizing behavior of the agents.

Is it realistic to assume Turkey’s income share will grow at such rates in the next 14 to 23

⁵Following Engel and Rogers (2006), the series we focus on is the net GDP (i.e., GDP net of government spending and investment) since this is a more accurate measure of household income available for consumption. The rest of the world consists of Turkey’s top 50 trade partners.

years? While it is impossible to answer this question with confidence, such growth rates are not unprecedented. The average annual share growth rate observed in Turkey in the 1990-2015 period was 0.42%. In the later higher growth period of 2001-2015, it was 0.73%. Thus, if Turkey's share of world GDP could grow at rates similar to the past, then the current account deficit observed in 2015 could be deemed consistent with the optimizing behavior of the agents. In addition, we compare the model-implied growth rates to those from professional forecasts by the Economist Intelligence Unit (EIU) and the IMF. Using a conservative difference between the growth rates of GDP between Turkey and its trading partners of one percent leads to a 0.97% average annual growth rate in Turkey's share of the world GDP. This is higher than what the model implies (0.52%) for the current account deficit in 2015 to be consistent with the optimizing behavior of the agents.

These back-of-the-envelope calculations suggest that the current account deficit observed in Turkey in 2015 may be reconciled with optimal savings behavior if the future growth of the Turkish economy relative to its trading partners continues to resemble its performance in the past or the predictions from professional forecasts.⁶ We also present evidence that not every trading partner of Turkey experienced an increase in their GDP shares in the world. For example, GDP shares of South Africa, Brazil, and Mexico in the world fell between 1990 and 2015. Thus, the same approach applied to these countries is likely to yield inconsistencies with the optimizing behavior of the agents.

Repeating the same exercise starting in 2011 for Turkey generates more negative results. In 2011, Turkey had the highest current account deficit in its history, with 15% of net GDP (9.6% of GDP). According to our findings, for this level of a deficit to be consistent with the optimizing behavior of the agents, the average annual share growth rate of the Turkish economy would have to be between 0.59% and 0.93% depending on the rate of speed of convergence. These model-implied annual share growth rates are not significantly out of line from what is implied by the professional forecasts. For example, using the EIU 2015 forecast, and assuming that the differences in growth rates between Turkey and the rest of the world lasts for 16 years, yields an average share growth of 0.97% while the model-implied share growth rate is 0.93%. However, given the uncertainty about the period of time these growth rates can persist and the fact that these growth rates are significantly higher than what has been observed in Turkey previously, the level of the current account deficit in 2011 could be considered alarming.

The analysis so far misses important aspects of the Turkish economy such as exchange rate fluctuations or sudden stops. To examine some of these issues, we extended the model economy with borrowing constraints to incorporate sudden stops as in Durdu et al. (2009) and Calvo (2003). We conduct two different sudden stop scenarios, anticipated versus unanticipated. To be consistent with our earlier analysis, we take 2015 as our base year. We consider a

⁶These results are similar to what Engel and Rogers (2006) conclude for the U.S. They report that if the U.S. income share is expected to rise gradually from 44% in 2004 to 47% by 2029, then their current account deficit of 7% of net GDP in 2004 can be considered optimal and sustainable. Engel and Rogers (2006) consider the rest of G7 countries as well as Sweden, Switzerland and Norway in constructing the world net GDP share of the U.S.

tightening of the borrowing constraint in 2020. Our results indicate that if the tightening of the borrowing constraint is anticipated households foresee a potential limitation to their consumption smoothing ability in 2020 and start borrowing less today (while the economy grows at a positive rate) and this immediately dampens the current account deficit. Depending on the level of tightening on the borrowing limit, the current account declines from -7% to -3.37% (or -2.58% under a tighter limit). This exercise indicates that the behavior of the Turkish households in 2015 should have been different if they were to anticipate a sudden stop. In case of an unanticipated sudden stop, more drastic effects on the macroeconomic variables at the time of the shock take place. The shock reduces the ability to do consumption smoothing dramatically. We show that in 2020 when the sudden stop happens, consumption declines by 2.36% compared to the year before and the CA balance increases to 2.56% under a relatively tight borrowing constraint.

The framework employed here is reminiscent of the theoretical literature that centers around present value models of the current account (see for example, Sachs (1982) and Obstfeld and Rogoff (1995)). In these models, the current account emerges as an outcome of optimal savings and investment decisions of forward-looking households and is defined in relation to the expected future net GDP. This theoretical expression of the current account is then used as a testable implication of an open-economy growth model, which has been the approach followed by the empirical literature.⁷

Our framework also relates to Bohn (1998, 2005) that takes a model-based approach to the sustainability of the U.S. fiscal policy. He shows that government debt is sustainable since primary surplus responds positively to changes in debt-to-GDP ratio. In an open economy application of Bohn's approach, Durdu et al. (2013) shows that net exports react to net foreign asset positions negatively in the long run, satisfying the solvency of external balances. Our approach is analogous to the portrayal of sustainability in these studies in the sense that an intertemporal budget constraint must be satisfied for optimality, but differs from them as we take a forward looking approach and evaluate the optimality of current account on the basis of expected growth rates.

In section 2, we describe the model and the key relationship for our analysis. In section 3, we describe the data. In section 4, we present our findings. In Section 5, we extend our analysis to include sudden stops, in Section 6 we present sensitivity analysis and in section 7 we conclude.

⁷Obstfeld and Rogoff (1995); Calderon, Chong, and Loayza (2002); and Edwards (2002, 2004b), among others, provide an extensive review of the theoretical and empirical work on the current account that considers an intertemporal approach. In particular, the empirical literature uses the present value tests of Campbell (1987) and Campbell and Shiller (1987) to test these models. Some examples include Sheffrin and Woo (1990); Otto (1992); Ghosh (1995); Bergin and Sheffrin (2000); and Nason and Rogers (2006). The literature, in general, tests the hypothesis that the current account is equal to the forecast of its present value, where the forecast is obtained by the vector autoregression of the current account and the net GDP. Based on a similar methodology, Oğuş and Sohrabji (2008) find that Turkey violates intertemporal solvency in the 1992-2004 period.

2 Model

In this section, we summarize the key features of the model used in Engel and Rogers (2006). Consider a perfect foresight, two-country growth economy. In each country $i \in \{1, 2\}$, there are households with N_t^i working-age members at date t who maximize

$$\sum_{t=0}^{\infty} \beta^t N_t^i \log c_t^i \quad (1)$$

subject to

$$B_{t+1}^i + C_t^i \leq B_t^i(1 + r_t^B) + Y_t^i, \quad (2)$$

given B_0^i , where $\beta \in (0, 1)$ is the discount factor, $c_t^i = C_t^i/N_t^i$ is per-member household consumption, and B_t^i is the beginning of period bond holdings by residents in country i at date t . The real world interest rate on bonds is given by r_t^B . Neither investment in physical capital, nor government spending is modeled explicitly; thus, Y_t^i is defined as the value of output net of investment and government spending.

The consolidated budget constraint of the household in country i in period t can be written as:

$$\begin{aligned} C_t^i + \frac{C_{t+1}^i}{1 + r_{t+1}^B} + \frac{C_{t+2}^i}{(1 + r_{t+1}^B)(1 + r_{t+2}^B)} + \dots \\ \leq B_t^i(1 + r_t^B) + Y_t^i + \frac{Y_{t+1}^i}{1 + r_{t+1}^B} + \frac{Y_{t+2}^i}{(1 + r_{t+1}^B)(1 + r_{t+2}^B)} + \dots \end{aligned} \quad (3)$$

This maximization problem results in the following Euler equation:

$$\frac{c_{t+1}^i}{c_t^i}(1 + g_{t+1}^i) = \beta(1 + r_{t+1}^B) \quad (4)$$

where the population growth rate is given by $1 + g_{t+1}^i = N_{t+1}^i/N_t^i$.

Goods market clearing condition is given by:

$$C_t^1 + C_t^2 = Y_t^1 + Y_t^2 = Y_t^w \quad (5)$$

where Y_t^w is the world net GDP. Engel and Rogers (2006) define $\gamma_t^i = Y_t^i/Y_t^w$ as country i 's share of world net GDP at time t , and $\bar{\gamma}^i$ as the same share at the steady-state. Home country's net GDP share is assumed to follow:

$$\gamma_{t+h}^i = \alpha^h \gamma_t^i + (1 - \alpha^h) \bar{\gamma}^i. \quad (6)$$

where γ_{t+h}^i is the h -period-ahead net GDP share of country i . In equation 6, α represents the speed of convergence of country i 's share of the world GDP to its steady state share. Notice that taking the world interest rate as given, equations (1) and (3) for each country i and equation (4) characterize an equilibrium under financial integration. Using (2), (3), and (4), in addition to the law of motion for share growth (5), and the definition of the current account, Engel and Rogers (2006) derive the following equation for the current account of Home relative to its net output (here we drop country superscripts as we focus only on Home):

$$\frac{CA_t}{Y_t} = 1 - \left[\frac{1 - \beta}{1 - \alpha\beta} + \frac{\beta(1 - \alpha) \bar{\gamma}}{1 - \alpha\beta \gamma_t} \right] \quad (7)$$

Converting equation 7, it is possible to obtain:

$$\frac{\bar{\gamma}}{\gamma_t} = 1 - \frac{1 - \alpha\beta}{\beta(1 - \alpha)} \frac{CA_t}{Y_t}. \quad (8)$$

This is the equilibrium condition for our analysis that fleshes out the link between share growth and current account relative to net GDP for Home. Note that the expression does not depend on the absolute level of Home's net GDP share but only on its long-run share relative to the current share. Therefore, the expectation about how much the share will grow.⁸ Using easily calibrated values for α and β , one can calculate the expected increase in a country's share of world GDP, $\bar{\gamma}/\gamma_t$, that would make its current account-to-net GDP ratio, CA_t/Y_t , at a given year consistent with the optimizing behavior of the agents in the economy.

According to this model, the country that is expecting to grow faster than the rest of the world will borrow from the rest of the world and run a current account deficit. As this country reaches a higher GDP share in the world, it will service its debt, obtaining a steady decline in this deficit. At the steady state the current account will be balanced. The equilibrium condition in equation 8 calculates the future growth rate in the GDP share of a country that would make this kind of a transition feasible. Our approach is composed of calculating the growth rates needed for the current account deficit to be eliminated under different assumptions for the length of the transition period. In our benchmark experiment, we consider three cases with $\alpha = 0.7$, $\alpha = 0.75$, and $\alpha = 0.8$ to evaluate transition paths of 14 to 23 years for a benchmark value of $\beta = 0.98$.⁹

Predicting future growth rates of the GDP share of a country is of course very challenging. Therefore, assessing the likelihood of the growth rates found from equation 8 is difficult. Our approach is to compare the model-generated future growth rates with the observed growth rates in the past and with the growth rate predictions from professional forecasts. Turkey's world GDP share, where the world is composed of Turkey's top 50 trading partners displayed

⁸The analysis also does not require to feed in any real world interest rate series to the model, which is known to be difficult to construct in the small open economy models of emerging countries (see Neumeyer and Perri (2005) for a detailed discussion). While the real interest rate appears in the budget constraint of the household's problem, the key equation of the analysis focuses on the relationship between the expected share growth and the current account relative to net GDP.

⁹In Section 6.1, we provide sensitivity analysis to the discount factor and the α that affects the transition paths.

in Figure 2, increased from 1.64% in 1990 to 1.83% in 2015, an 11.6% increase in 25 years. We use this growth rate in our subsequent analysis to assess the likelihood of the optimality of the current account deficit observed in 2015.

Figure 2: Turkey’s net GDP share in the world (%)



3 Data

We define the “rest of the world” for the Turkish economy as Turkey’s top 50 trade partners. Some interesting observations emerge from Figure 9 in Appendix A that displays Turkey’s top 20 trade partners in 1990 and 2015.¹⁰

For example, between 1990 and 2015, there is a significant decline in the share of trade with Germany and a rise in the share of trade with the Russian Federation.¹¹ China, which is not among the top 20 partners in 1990, appears as Turkey’s third most important trade partner in 2015. In addition, Turkey’s top 20 trading partners decline from accounting for 82% of the trade in 1990 to 73% in 2015.

We measure the world net GDP as GDP net of investment and government expenditures of Turkey’s top 50 trade partners in 2015.¹² In calculating the world output, several issues have to be dealt with. First, Engel and Rogers (2006) use 1990 real exchange rates to measure GDP in each country for all years. We use gross domestic product in constant 2011 international

¹⁰We focus on the period since the 1990s as providing a more accurate picture of Turkey’s future potential. For an analysis of Turkish growth experience starting from the 1950s see İmrohoroğlu, İmrohoroğlu, and Üngör (2015).

¹¹Share of trade is defined as the share of each country’s sum of imports from and exports to Turkey in each year. The data is from Foreign Trade Statistics of the Turkish Statistical Institute. To make data across years comparable, we define the Russian Federation in 2013 as the sum of Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan; we define Former Yugoslavia as the sum of Bosnia and Herzegovina, Croatia, Kosovo, Macedonia, Montenegro, Slovenia, and Serbia.

¹²These countries constitute 91% of Turkey’s trade volume with the rest of the world. Data on GDP, investment, and government expenditures are from World Bank’s World Development Indicators database.

dollars.¹³ Second, in defining the rest of the world for the U.S., Engel and Rogers (2006) only consider the sum of GDP for advanced economies. In particular, they do not include China and East Asian emerging economies that have experienced rapid growth. The shares model implies that these economies should be borrowing from the rest of the world and running current account deficits. Given the inability of the model to explain the behavior of these economies, Engel and Rogers (2006) drop them from the definition of the world GDP. We do not follow this approach and instead provide data on Turkey's world GDP share with China as China is likely to continue to be an important trade partner for Turkey.¹⁴

Finally, we use the current account-to-GDP and the current account series for Turkey for the 1990-2015 period to calculate the current account as a percentage of GDP and net GDP.¹⁵ In the next section, we present the results of our quantitative experiments.

4 Results

We start this section by examining if Turkey's current account deficit in 2015 can be considered consistent with the optimizing behavior of the agents using the Engel and Rogers (2006) approach. This requires us to calculate the future growth rate of Turkey's GDP share in the world economy that would eliminate the current account deficit at the steady state. We then compare these model-generated growth rates that would deem the observed current account deficits sustainable with Turkey's past growth rates to evaluate their likelihood. Next, we repeat the same exercise by looking at the data in 2011 when Turkey reached the largest current account deficit in history, given by -9.6% of GDP.

4.1 The current account deficit in 2015

The first panel of Table 1 summarizes Turkey's net GDP share as well as the growth rates associated with its share between 1990 and 2015. Turkey's net GDP share in the world increased from 1.64% in 1990 to 1.83% in 2015. This implies a growth rate of 11.59% over the 1990-2015 period and an annual growth rate of 0.42%. Turkey's share in the world increased, indicating a somewhat faster net GDP growth relative to its top 50 trade partners, despite a turbulent period for Turkey with major recessions in 2000 and 2001. In the 2001-2015 post-crisis period, the share growth was 11.57% at an annual growth rate of 0.73%. In fact, Turkey's annual world GDP share growth has increased since 2001, the year the current account deficit started to increase dramatically.

The second panel of Table 1 provides Turkey's model-implied world net GDP share at the steady state and the growth rates needed to reach that level computed using equation (8). This exercise finds the future growth rates under which the current account deficit relative to net GDP equal to 6.99% in 2015 can be justified with the optimizing decision of the agents in

¹³Our main conclusions are insensitive to using 2004 as the base year.

¹⁴Excluding China makes it easier to justify higher current account deficits since Turkey's GDP share in the world grows faster in the absence of China. This is similar to what Engel and Rogers (2006) find for the U.S.

¹⁵These series come from World Bank's World Development Indicators database.

equilibrium.¹⁶ We make our analysis under three cases: $\alpha = 0.7$, $\alpha = 0.75$, and $\alpha = 0.8$ that induce the economy to converge to the steady state in 14, 18, and 23 years, respectively.¹⁷ If convergence is fast ($\alpha = 0.7$), then the economy reaches a long-run share of 1.96% in 2029, with a 7.47% increase in its net GDP share ($\frac{\bar{\gamma}}{\gamma_t} - 1 = 0.0747$) over these 14 years. This implies an annual growth rate of 0.52% during the 2015-2024 period. With an adjustment speed at $\alpha = 0.75$, it takes the economy 18 years to converge to its steady-state share of 1.97%, with an expected 7.56% increase in its net GDP share during its transition from 2015 to 2033. This implies an annual growth rate of 0.41% during the period. Along a slower adjustment path, with $\alpha = 0.8$, the model-implied share increase is 7.7% over 23 years, with an annual share growth rate of 0.32%.

Table 1: Results for the economy in 2015 (Benchmark)

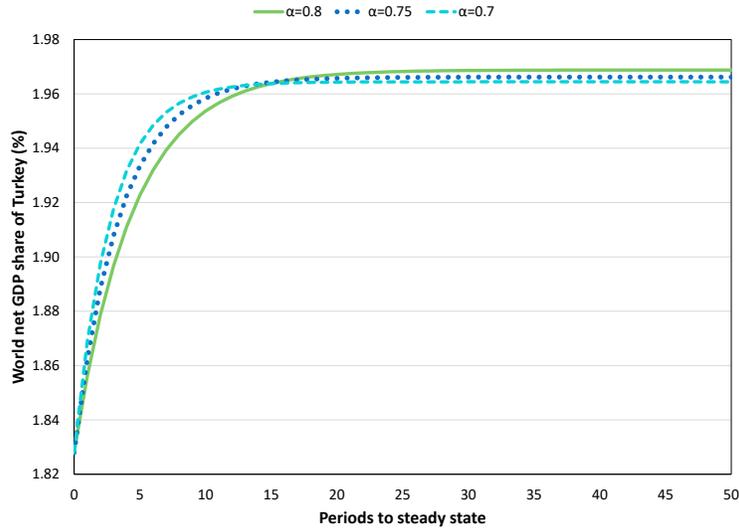
Data			
Net GDP share in 1990 (%)	1.64		
Net GDP share in 2015 (%)	1.83		
Share growth: 1990-2015 (%)	11.59		
Share growth: 2001-2015 (%)	11.57		
Annual share growth: 1990-2015 (%)	0.42		
Annual share growth: 2001-2015 (%)	0.73		
Model			
	$\alpha = 0.7$	$\alpha = 0.75$	$\alpha = 0.8$
Steady state share $\bar{\gamma}$ (%)	1.96	1.97	1.97
Share growth ($\frac{\bar{\gamma}}{\gamma_{2015}} - 1$) (%)	7.47	7.56	7.70
Years to convergence	14	18	23
Annual share growth (%)	0.52	0.41	0.32

The transition dynamics under these different speeds of adjustment are depicted in Figure 3. The country, expecting to grow faster than the rest of the world, borrows externally in 2015 to finance its consumption and stimulates its income growth and reaches a higher net GDP share in the world in the long-run, some of which is sacrificed to service the debt to the rest of the world. Depending on the value of the adjustment parameter, years to convergence as well as long-run shares vary.

¹⁶We also provide results using gross GDP in Appendix B with a current account-to-GDP ratio of -4.47% in 2015.

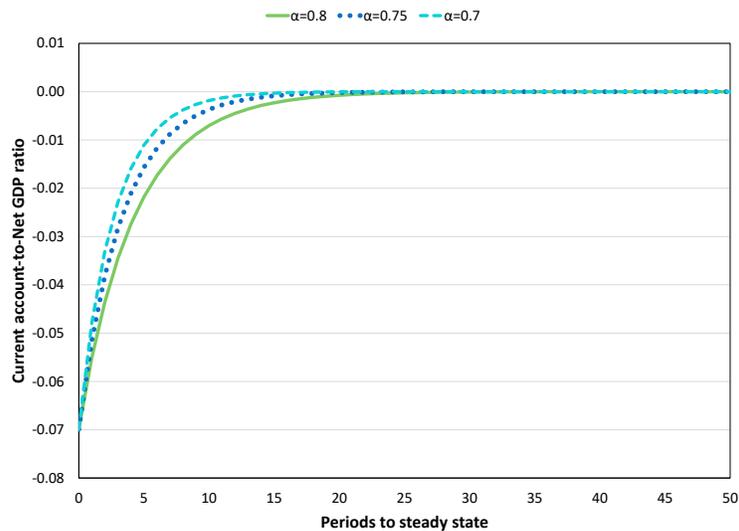
¹⁷In order to gain more evidence regarding the value of α , we consider the following strategy: In the spirit of the empirical analysis in Section 4 in Engel and Rogers (2006), we model the evolution of net GDP shares as a stationary AR(1) process: $\gamma_{t+1} = \alpha_0 + \alpha_1 \gamma_t + u_{t+1}$. We fit this model using the 1990-2015 net GDP series and get a statistically significant estimate for α_1 of 0.79 (st. error: 0.14). This estimate lies within the range of values (0.7-0.8) from our calibration. The estimate for α_0 is 0.0036 (st. error: 0.0024).

Figure 3: World net GDP share of Turkey after 2015



In Figure 4, the path of the current account (relative to net GDP) after 2015 (with different adjustment speeds) is shown. The model predicts a steady decline of the deficit in the current account that must eventually satisfy a balance in the long run. This reflects the model’s prescription for the economy on how to behave optimally in the long run. The model implies that if Turkey’s net GDP share were to grow on average between 0.32%-0.52% for an extended time period, then Turkey’s current account deficit would decline to zero in 14 to 23 years.

Figure 4: Turkish current account relative to net GDP after 2015



Is it realistic to expect Turkey’s share to grow at the rates implied by the model under these three convergence speeds? We use two approaches to answer this question. First, we argue

that based on Turkey’s recent growth experience, it is not impossible to imagine future growth rates that would justify the current account deficits observed in 2015. In Table 1 we provide the average annual share growth rate observed in Turkey over the entire period of 1990-2015 as well as a higher growth period of 2001-2015. The growth rates for these two periods are 0.42% and 0.73%. Growth rates in other periods are within this range, for example the growth rate between 2004 and 2015 is 0.63%. With $\alpha = 0.7$, the model implies that if Turkey’s share grows at an annual rate of 0.52% for 14 years, the current account deficit in 2015 would be paid back successfully. A comparison with the 2004-2015 (or 2001-2015) growth rate indicates that such a growth rate may be feasible. With $\alpha = 0.75$ and $\alpha = 0.80$, lower growth rates (0.41% and 0.32%), that last longer are sufficient to generate transition paths to steady state where the current account deficit is eliminated.

Next, we compare the model-implied growth rates to the rates implied by professional forecasts. These forecasts are available for a limited time span, often get revised significantly, and of course unlike the model, are not concerned about convergence in the long run. Nevertheless, interesting insights emerge from comparing them against the model-implied growth rates. For example, In January 2014, the Economist Intelligence Unit (EIU) forecasts for real GDP growth in Turkey are 3.8% for 2014, 4.6% for 2015, and 5% for 2016.¹⁸ World GDP growth rates forecasted by them, on the other hand, are 2.7% for 2014, and 2.8% for 2015 and 2016. Of course, a one or two percent difference in projected growth rates between Turkey and the rest of the world lead to significant changes in Turkey’s share in world GDP.¹⁹ Using a conservative difference between Turkey and its trading partners of one percent and assuming that it lasts for 14 years, for example, leads to a 0.97% average annual growth rate in Turkey’s share of the world GDP. This exercise is directly comparable to the annual share growth reported in Table 1 for $\alpha = 0.7$, the fastest convergence rate. In this case the model-implied annual share growth rate is smaller at 0.52%. In other words, the model-implied annual share growth rate that would justify the current account deficit in 2015 is smaller than the one implied by the professional forecasts. This exercise adds extra validation that the future growth rates needed to justify the current account deficit in 2015 may be “reasonable”.²⁰

Both of these back-of-the-envelope calculations suggest that the most recent current account deficit observed in Turkey may be reconciled with optimal savings behavior if the future growth of the Turkish economy relative to its trading partners continues to resemble its performance in the past or the predictions from professional forecasts. Our next question is whether we could have made a similar conclusion if we conducted this exercise for 2011, the year when

¹⁸We use the forecasts for GDP growth for Turkey and the world from EIU country reports for Turkey for January 2014, March 2014 and January 2016; forecasts for Turkey and advanced Europe from the IMF World Economic Outlook April 2015 and April 2016.

¹⁹Most recent forecasts report a one or two percentage point higher growth rate for Turkey relative to either the World economy or countries labeled as “Advanced Europe”. For example, in January 2015, the EIU forecasts for real GDP growth in Turkey are 4.0% for 2015, 4.2% for 2016, and 4.5% for 2017. World GDP growth rates forecasted are 2.9% for 2015, and 2016, 2.8% for 2017. 2015 publication: IMF forecast for Turkey’s GDP growth is 3.1% in 2015 and 3.6% in 2016 while it is 1.7% and 1.8% for the same years for Advanced Europe.

²⁰Of course, this is with the caveat that we assumed that the growth rate provided by the professional forecast lasted 14 years. Often, these forecasts are provided for 3-4 years only.

the current account deficit reached its peak level.

4.2 The current account deficit in 2011

In 2011, Turkey had the highest current account deficit in its history, where it reached 15% of net GDP (9.6% of GDP). In this section, we assess whether a deficit of this level could be consistent with the optimizing behavior of the agents under the Engel and Rogers (2006) approach. Table 2 shows the results of this exercise from the 2011 vantage point.

The model-implied annual share growth rates in this case are between 0.59%-0.93% for the three convergence speeds we consider. For instance, if Turkey could achieve a long-run share of 2.05%-2.06% in 16-20 years (with $\alpha = 0.70$ and $\alpha = 0.75$), then the current account deficit observed in 2011 could be considered optimal. This implies an annual share growth of 0.93% and 0.75%, respectively. Under a longer convergence path (with $\alpha = 0.80$), an annual growth rate of 0.59% that lasts for 26 years is needed for the current account deficit in 2011 to be deemed optimal. These model-implied annual share growth rates are not significantly out of line from what is implied by the professional forecasts. For example, the EIU 2015 forecast (assuming that the differences in growth rates between Turkey and the rest of the world lasts for 16 years) yields an average share growth of 0.97% while the model-implied share growth rate is 0.93%. However, given the uncertainty about the period of time these growth rates can persist and the fact that these growth rates are significantly higher than what has been observed in Turkey previously, the level of the current account deficit in 2011 could be considered alarming. Perhaps the actions taken by the Central Bank and the Banking Regulation and Supervision Agency aimed at reducing the current account deficit in 2011 reflected concerns that are justifiable with these findings.²¹

²¹Faced with the dramatic deterioration in the current account, CBRT framed a mix of unorthodox policies in late 2010. While keeping price stability as the main target, the CBRT introduced supplementary financial stability objectives and used general macro prudential policies to improve the current account and avoid potential risks of sudden stops. Throughout 2011 as well as in 2013 and 2014, BRSA introduced specific policies to curb consumer credit with higher credit card limits and regulations on housing loans, vehicle loans, and collateralized consumer loans. (See Kara (2016)).

Table 2: Results for the economy in 2011

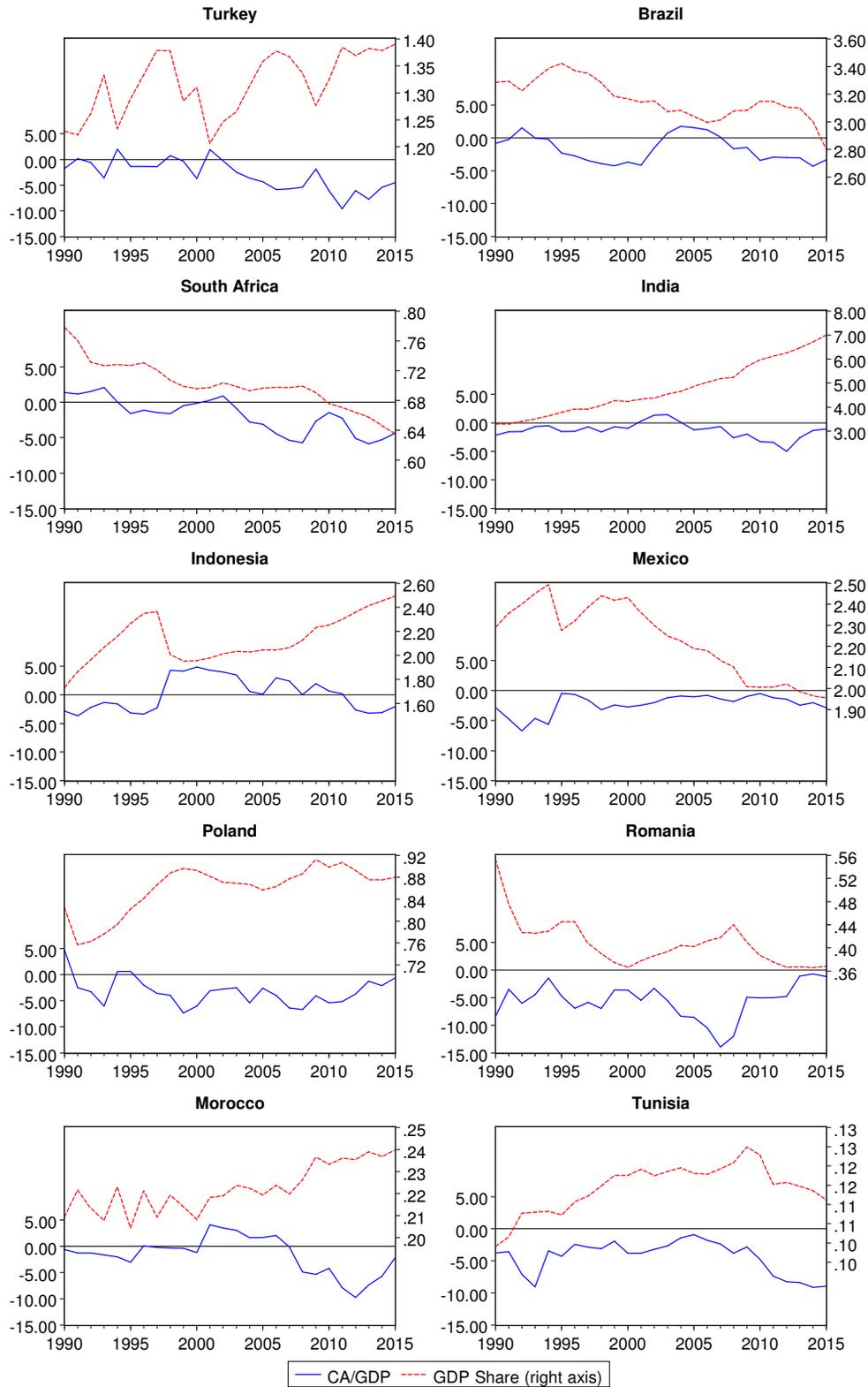
Data			
Net GDP share in 1990 (%)		1.64	
Net GDP share in 2011 (%)		1.77	
Share growth: 1990-2011 (%)		7.93	
Share growth: 2001-2011 (%)		7.91	
Annual share growth: 1990-2011 (%)		0.35	
Annual share growth: 2001-2011 (%)		0.69	
Model			
	$\alpha = 0.7$	$\alpha = 0.75$	$\alpha = 0.8$
Steady state share $\bar{\gamma}$ (%)	2.05	2.06	2.06
Share growth ($\bar{\gamma}/\gamma_{2011} - 1$) (%)	15.96	16.17	16.47
Years to convergence	16	20	26
Annual share growth (%)	0.93	0.75	0.59

4.3 Comparison across countries

In our analysis, we used the past growth rates of the Turkish economy's GDP share to assess if the model-implied future growth rates were reasonable. While this approach has its obvious limitations, it is interesting to examine the performance of countries from this perspective. In Figure 5, we compare Turkey with some of its trading partners since the 1990s. On the right scale of Figure 5, we provide data on the net GDP share of a country and on the left scale we display their current account balance.²² While Turkey's net GDP share increased in this time period, a number of its trading partners with current account deficits, such as Brazil, South Africa, and Mexico experienced a decline in their GDP shares. For their current account deficits to be consistent with the optimizing behavior of the agents based on the Engel and Rogers (2006) approach, the expectations of the agents about the future growth rates of these economies relative to the rest of the world would have to be significantly higher than what was observed in the past. In Turkey's case, we find that the current account deficit in 2015 could be reconciled with the optimizing behavior of the agents if they expected growth rates similar to the past.

²²For better comparison purposes, we provide data on each country's share in total world GDP. This measure is highly correlated but not the same as the data provided in Figure 2 that displayed Turkey's share in GDP across its top 50 trading partners.

Figure 5: Net GDP share in the world (%)



5 Sudden stops and current account reversals

In this section, we study the model with credit constraints to capture sudden stops as in Durdu et al. (2009) and Calvo (2003). Sudden stops and current account reversals in our model occur due to an exogenous tightening in the credit constraints facing domestic households. In this regard, our framework is related to Durdu et al. (2009) where sudden stops arise as a result of occasionally-binding credit constraints in a small open endowment economy subject to stochastic income shocks. In the current analysis, we abstract from any type of income uncertainty, and also take into account the possibility of anticipated shocks to credit constraints along with unanticipated shocks as in Calvo (2003).

Sudden stops are large reductions in the inflows of foreign capital. The literature adopts different identification strategies and quantitative criteria to detect such episodes. Calvo et al. (2004), among others, identify a sudden stop episode when there are large current account reversals *and* a recession.²³ Following the approach of Calvo et al. (2004), Hur and Kondo (2014) find three sudden stop cases for Turkey in 1994, 2001 and 2009. A different approach is to measure only the changes in net capital inflows—and not necessarily economic slowdowns or recessions—as in Edwards (2004a). In a more recent study, Forbes and Warnock (2012) focus on gross flows.²⁴

In our model, not every reduction in the current account deficit indicates a sudden stop episode. In particular, a gradual reduction in the current account deficit is not considered a sudden stop since it is in line with the consumption smoothing behavior of households. A sudden stop episode in our model is the one that arises from relatively larger changes in the current account that occur due to borrowing constraints. In addition, we do not differentiate between a current account reversal or a sudden stop since a binding credit constraint generates patterns that are consistent with the key aspects of these two situations. We also acknowledge that some sudden stops might be characterized by recessions and real depreciations.²⁵ We allude to economic slowdowns during a sudden stop episode by considering relatively low future growth rates for the economy along the transition path, but abstract from real exchange rate dynamics.²⁶

5.1 A two-country model with occasionally-binding credit constraints

More specifically, we extend the model in Engel and Rogers (2006) to investigate the implications of a sudden stop in Country 1, defined by a temporary decline in its ability to borrow

²³Current account reversals, which can also be measured as reductions in the current account deficit, are detected in various ways in the literature and can be considered closely related to sudden stops. Milesi-Ferretti and Razin (2000) and Edwards (2004a) provide an extensive discussion on current account reversals.

²⁴Despite the differences in their methodologies, Forbes and Warnock (2012) document sudden stop episodes that largely overlap with those by Hur and Kondo (2014) which can be listed as follows: 1991Q1-Q4, 1994Q2-1995Q1, 2001Q1-2001Q4, 2007Q4-2008Q2, and 2008Q4-2009Q1.

²⁵See Kehoe and Ruhl (2009) and Durdu et al. (2009).

²⁶Perhaps it is possible to argue that not all current account reversals are associated with economic slowdowns or recessions. See, for example, the empirical findings of Milesi-Ferretti and Razin (2000) analyzing 100 current account reversal episodes.

from Country 2, which results in sizable increases in the current account.

The world net GDP, Y_t^w , grows exogenously at a rate $\frac{Y_t^w}{Y_{t-1}^w} - 1 = g_t^w$. Given Y_t^w , it is then possible to determine the exogenous paths of net GDP, Y_t^i , in each country $i \in \{1, 2\}$, evolving as described by the law of motion for net GDP share for Country 1 (6) with an initial level of world net GDP, Y_0^w and a net GDP share, γ_0 . The growth rate of the net GDP for an individual country i is given by $\frac{Y_t^i}{Y_{t-1}^i} - 1 = g_t^i$.

In the current model, we consider households with a constant measure of N^i working-age members in each country $i \in \{1, 2\}$ who maximize their life-time utility (1) subject to a budget constraint (2) and a credit constraint. In particular, the credit constraint can be considered a borrowing (lending) constraint facing Country 1 (Country 2). The constraint for Country 1 is given by

$$B_{t+1}^1 \geq -\phi_t Y_t^1, \quad (9)$$

for all $t \geq 0$. Accordingly, households in Country 1 may borrow up to an exogenous, time-varying fraction of their net GDP in each period, ϕ_t . A borrowing limit for Country 1 calls for a corresponding lending limit for Country 2 since the asset market clearing condition and (9) imply $B_{t+1}^2 = -B_{t+1}^1 \leq \phi_t Y_t^1$. Hence the constraint for Country 2 can be written as,

$$B_{t+1}^2 \leq \phi_t Y_t^1. \quad (10)$$

It can be inferred from these conditions that the lending constraint (10) for Country 2 is binding whenever the borrowing constraint (9) for Country 1 is binding and vice versa.

Denoting with μ_t^1, μ_t^2 the Karush-Kuhn-Tucker (KKT) multipliers on the borrowing constraint (9) and the lending constraint (10), respectively, we state the necessary conditions for an equilibrium under financial integration described by

$$\frac{1}{C_t^1} = \beta \frac{1}{C_{t+1}^1} (1 + r_{t+1}^B) + \mu_t^1 \quad (11)$$

$$\frac{1}{C_t^2} = \beta \frac{1}{C_{t+1}^2} (1 + r_{t+1}^B) - \mu_t^2 \quad (12)$$

$$B_{t+1}^1 \geq -\phi_t Y_t^1, \mu_t^1 \geq 0, \mu_t^1 (B_{t+1}^1 + \phi_t Y_t^1) = 0 \quad (13)$$

$$-B_{t+1}^2 \geq -\phi_t Y_t^1, \mu_t^2 \geq 0, \mu_t^2 (-B_{t+1}^2 + \phi_t Y_t^1) = 0 \quad (14)$$

$$B_{t+1}^i + C_t^i \leq B_t^i (1 + r_t^B) + Y_t^i, \quad i=1, 2 \quad (15)$$

;

$$C_t^1 + C_t^2 = Y_t^1 + Y_t^2 = Y_t^W \quad (16)$$

i.e., Euler equations (11)-(12), KKT conditions (13)-(14), the budget constraints (15), and the goods market clearing condition (16). Accordingly, we analyze two cases.

Case 1 : If the credit constraints are slack, then the Euler equations hold with equality and both countries can do consumption-smoothing,

$$\frac{C_{t+1}^1}{C_t^1} = \beta(1 + r_{t+1}^B) = \frac{C_{t+1}^2}{C_t^2} = \frac{Y_{t+1}^W}{Y_t^W} = 1 + g_t^w$$

implying an equal consumption growth rate across countries. From goods market clearing (16), it follows that consumption growth across countries must be equal to the world net GDP growth.

Case 2 : If the credit constraints are binding, there is an equilibrium where consumption growth of Country 1 exceeds that of Country 2.

$$\frac{C_{t+1}^1}{C_t^1} > \beta(1 + r_{t+1}^B) > \frac{C_{t+1}^2}{C_t^2}.$$

Country 1 can achieve this by borrowing at the limit, given by a fraction of its net GDP, and Country 2 keeps lending,

$$B_{t+1}^1 = -\phi_t Y_t^1,$$

$$B_{t+1}^2 = \phi_t Y_t^1.$$

It is possible to see the following scenarios under Case 2:

1. There is a positive consumption growth in both countries, $\frac{C_{t+1}^1}{C_t^1} > \frac{C_{t+1}^2}{C_t^2} > 1$ if $\beta(1 + r_{t+1}^B) > 1$ and $g_t^w > 0$.
2. Under $\beta(1 + r_{t+1}^B) = 1$, we get $\frac{C_{t+1}^1}{C_t^1} > 1$ and $\frac{C_{t+1}^2}{C_t^2} < 1$; consumption increases in Country 1 and decreases in Country 2 over time. In fact, it is possible that Country 2 consumption converges to zero and Country 1 consumption converges to the level of the world net GDP. Assuming that the credit constraints are binding temporarily, we can rule out a scenario where countries reach these consumption limits.
3. There is a negative consumption growth in both countries, $1 > \frac{C_{t+1}^1}{C_t^1} > \frac{C_{t+1}^2}{C_t^2}$, if we have both $\beta(1 + r_{t+1}^B) < 1$ and $g_t^w < 0$.

Furthermore, Case 2 can only be part of a transition path since a long run balanced growth path with binding credit constraints does not exist. This can be seen from the Euler equations (11) and (12) which together imply

$$\frac{C_{t+1}^1}{C_t^1} \geq \beta(1 + r_{t+1}^B) \geq \frac{C_{t+1}^2}{C_t^2},$$

in an equilibrium under financial integration. In the long run, if both countries grow at the same rates (which results in a balanced growth path), then we get

$$1 + g^w \geq \beta(1 + r^B) \geq 1 + g^w.$$

This implies the Euler equations can only hold with equality, ruling out Case 2. The steady-state world interest rate is given by

$$r^B = \frac{1 + g^w}{\beta} - 1.$$

In a realistic case with $g^w > 0$, we study a version of the model with detrended variables. Hence, we are able to reach a feasible numerical solution in a stationary environment. (See Appendix C for the transformed optimality conditions.) In our quantitative exercise with occasionally binding credit constraints, we investigate the implications of a sudden stop, as captured by a temporary tightening of the borrowing constraints in Country 1, that occurs as a one-time change in the ϕ_t parameter at a future period $0 < T_1 < \infty$. We study two versions of this exercise where the sudden stop can be anticipated and unanticipated taking into account different world growth rate scenarios.

5.2 Calibration and the quantitative experiment

To be consistent with our earlier analysis, we take 2015 as our base year. The baseline parameter values for the economy calibrated for 2015 are reported in Table 3. We borrow some of these parameter values from our earlier analyses and set the convergence speed parameter α to 0.75 and the discount factor β to 0.96. The long run net GDP share, $\bar{\gamma}$, becomes a free parameter in the current framework and therefore we determine its value from (8), which is 1.98% as in our earlier analysis. (Hence, this would be the same value for an economy that also starts from $\gamma_0 = 1.83\%$ and faces no borrowing constraints while converging to the steady state.)

We obtain the path for world net GDP, $Y_t^w = Y_{2015}^w(1 + g^w)^t$, by normalizing $Y_{2015}^w = 1$ and setting $g^w = 2.93\%$, which is the average annual net GDP growth rate for Turkey and its 50 trade partners for the 2001-2015 period. The next step is to generate an exogenous path for the net GDP series of the two countries, Y_t^1 and Y_t^2 , using the law of motion for shares in Equation (6), given the initial share $\gamma_{2015} = 1.83\%$. It is then possible to calculate the implied time-varying growth rates, g_t^1 and g_t^2 . The calibration implies that along the transition path g_t^1 is positive, but the growth slows down over time. Both countries' growth rates get aligned with the constant rate of world net GDP growth in the long run, i.e. $g^1 = g^2 = g^w$, as income shares become constant. Hence, the calibration for the long run of the economy becomes consistent with the balanced growth path.

We let Country 2 have a unit mass of population, $N^2 = 1$ and set $N^1 = 0.0198$ to match Turkey's population relative to the set of 50 countries in 2015 (World Development Indicators). We set $B_{2015} = -0.0128$ to match Turkey's net international investment position (NIIP relative

to net GDP), defined as the stock of the country’s foreign assets net of foreign liabilities. CBRT reports this ratio in 2015 as -69% .²⁷ The ad hoc credit constraint parameter, ϕ_t , is set at 1 in 2015 and onward in the baseline scenario. Hence, the maximum amount a country is able to borrow should be equal to its net GDP during normal times. This selection rests on the assumption that Turkey did not have a binding borrowing constraint in 2015 and based on our quantitative experiments, the limit is not binding in the initial equilibrium with this parameter value.

Table 3: Calibration of the model for 2015

Baseline parameter values for 2015 and beyond	
Convergence speed parameter	$\alpha = 0.75$
Discount factor	$\beta = 0.96$
Initial share (%)	$\gamma_{2015} = 1.83$
Steady state share (%)	$\bar{\gamma} = 1.98$
Annual world net GDP growth (%)	$g^w = 2.93$
Population ratio	$N^1/N^2 = 0.0198$
NIIP/net GDP	$B_{2015}/Y_{2015} = -0.69$
Borrowing limit parameter	$\phi_t = 1$

Finally, while it is not possible to target the current account-to-net GDP ratio in the model directly, the current benchmark calibration yields a very close match: the ratio in the model is -7% which was -6.99% in 2015 in the data.

In the next section, we describe our quantitative analysis. While our main strategy is to investigate the implications of lower ϕ_t values in our numerical experiment, there are other channels that might affect the ability of the economy to lend or borrow. In particular, a country’s borrowing (or lending) limit is effectively a function of other parameters, along with ϕ_t , such as the countries’ expected income growth rates and relative sizes. (See equations (19)-(20) in Appendix C). Hence, before the catch-up in the growth rates occurs, the constraints facing the two countries vary over time due to changes in growth rates. Nevertheless, what we define a sudden stop is a shock to the ability of borrowing that arises due to changes in ϕ_t and causes drastic movements in the current account.

5.3 Credit constraints and the current account after 2015

We start the economy in 2015 and impose a tightening in the credit constraint Turkey (Country 1) faces in 2020. This is just a one-period shock, which corresponds to one year in the model. We consider two values for the parameter, which is in line with the recent realizations of Turkey’s NIIP relative to net GDP, which reached a value as low as -0.75 in the 1996-2015 period. More specifically, we treat this value like a borrowing limit and assume that the maximum amount the country can borrow may be limited at 75 or 80 percent of its net

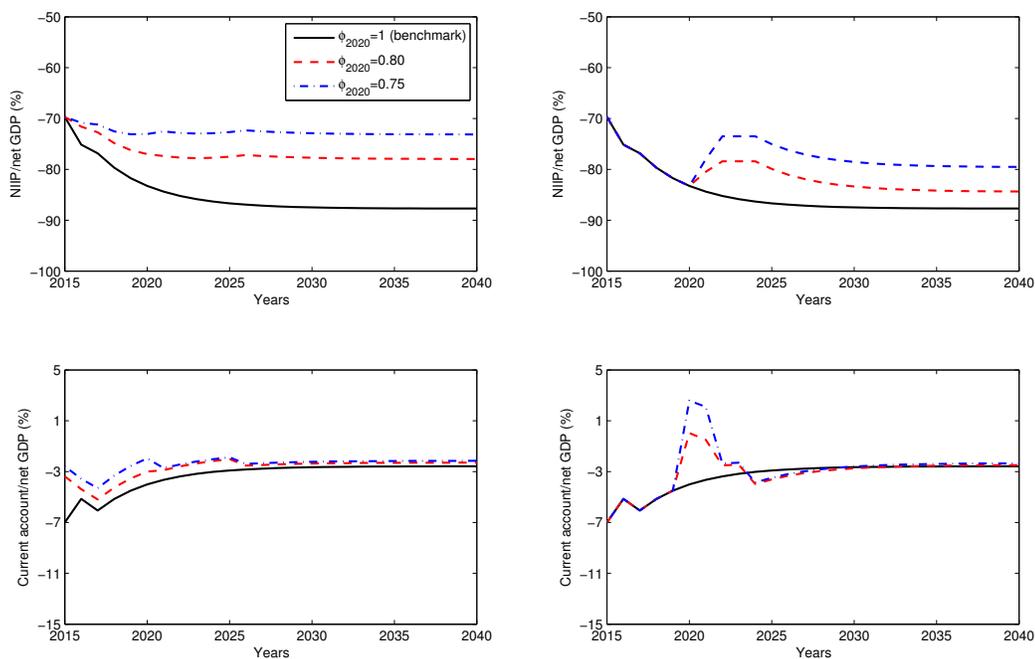
²⁷The NIIP/GDP ratio in 2015 was -44.6% . During the 1996-2015 period, NIIP relative to net GDP vary between -75% and -35% , deteriorating as the country became financially more open over time.

GDP. Then, at a particular borrowing limit, we consider two scenarios where the sudden stop hits the economy in a (i) perfectly anticipated or (ii) perfectly unanticipated manner. The motivation behind these experiments is that sudden stops might be mostly unanticipated in nature, but there may be some foresight regarding them as well. (See Calvo (2003) for a similar argument.) Both experiments can give us a deeper understanding on the limits of current account movements. To summarize, we conduct two experiments where:

1. Borrowing is restricted in 2020 with $\phi_{2020} = 0.75$ or $\phi_{2020} = 0.80$, and $\phi_t = 1$ in all other periods. The shock is perfectly anticipated in 2015.
2. Borrowing is restricted in 2020 with $\phi_{2020} = 0.75$ or $\phi_{2020} = 0.80$, and $\phi_t = 1$ in all other periods. The shock is unanticipated.

The dynamics for NIIP/Net GDP and CA/Net GDP are depicted for anticipated shocks on the left panel and for unanticipated shocks on the right panel of Figure 6.

Figure 6: External accounts after 2015 with credit constraints: (a) anticipated and (b) unanticipated shocks



Under the first case, the anticipation of a sudden stop in 2020 affects the economy immediately after 2015: households that foresee a potential limitation to their consumption smoothing ability in 2020 start borrowing less today (while the economy grows at a positive rate) and this immediately dampens the current account deficit. Depending on the level of tightening on the borrowing limit, the current account deficit declines from -7% to -3.37% (if $\phi_{2020} = 0.80$) or -2.58% (if $\phi_{2020} = 0.75$) in the initial period. During the 2015-2020 period, we observe a further reduction in the deficit reaching to the levels of 2.12 or 3% of net GDP. Notice that with a positive income growth, the long-run current account deficit reaches 2.15% of net GDP

with a tightening of $\phi_{2020} = 0.80$ (or -2.29% if the constraint is tightened to $\phi_{2020} = 0.75$).

With an unanticipated shock, there are more drastic effects on the macroeconomic variables at the time of the shock, which reduces the ability to do consumption smoothing dramatically. A sufficiently large shock might result in a current account reversal as depicted in the right panel.

In Table 4, we report the current account and consumption levels in 2015 and 2020, respectively, under all scenarios considered. The consumption values are normalized to 100 in 2015 in the baseline scenario.

Table 4: Shocks to the credit limit: Summary of results

	Baseline case		Anticipated shock				Unanticipated shock			
	$\phi = 1$		$\phi = 0.80$		$\phi = 0.75$		$\phi = 0.80$		$\phi = 0.75$	
	2015	2020	2015	2020	2015	2020	2015	2020	2015	2020
CA_t/Y_t	-7.00	-4.19	-3.37	-3.00	-2.58	-2.12	-7.00	0.03	-7.00	2.59
C_t	100	112.26	95.64	111.63	95.79	110.76	100	109.38	100	106.49

Note: Current account-to-net GDP ratio is reported in percentages. Consumption levels are normalized to 100 in 2015 under the baseline case. g^w is set to 2.93%.

The ability of households to do consumption smoothing is disrupted under both anticipated and unanticipated shocks, but the timing of the effects are different. In the perfect foresight case, consumption levels in 2015 decline immediately by 4.21% to 4.36% depending on the severity of the borrowing constraint ϕ . Low levels of consumption (relative to the benchmark) persist through 2020. Under the unanticipated shock, consumption smoothing is affected when the shock hits in 2020. The cumulative consumption growth from 2015 to 2020 under an unanticipated shock is 6.49% to 9.38% (depending on ϕ) as opposed to 12.26% under the baseline case with no shocks. Even though net GDP grows at positive rates (albeit with a slowdown) through these years, the country has to cut its consumption growth due to the credit tightening. In Section 6.3 we examine the sensitivity of our results under different world growth rates (and different implied growth rates for Country 1 and Country 2). We find that the key insights from our previous discussion still remain unaffected. A credit tightening affects the consumption smoothing ability of households (and the current accounts) with a different timing depending on whether there is perfect foresight or not. If the world growth rate is higher, then both countries naturally enjoy higher growth rates, the negative impact of credit tightening is more bearable and the country's consumption smoothing ability is affected by less. Under higher growth rates, the country is therefore able to run a (larger) deficit. If growth rates are lower, then consumption is cut down dramatically and there are sizable current account reversals.

6 Sensitivity Analysis

6.1 Discount factor in the Engel and Rogers (2006) analysis

Findings about the optimality of the current account deficit in a given year are not very sensitive to the discount factor used for the country. In our benchmark economy, we used a discount factor of 0.98. In theory, a lower discount factor, β , implies more impatient consumers, which suggests a higher interest rate at the steady-state, implying a higher cost of financing the current account deficit. In turn, for the current account deficit to be optimal, the country will need to reach a higher net income share, $\bar{\gamma}$, in the long run. The length of the transition path (years to convergence) depends on the adjustment parameter, α . However, the quantitative impact of a change in the discount factor is not significant.

In our sensitivity analysis, we consider discount factors equal to 0.95 and 0.97 as summarized in Table 5. For $\beta = 0.97$, the model-implied annual growth rates range between 0.34% and 0.53% with years to convergence between 14 and 23. Based on past experience, it is possible for Turkey's GDP share to grow at 0.53% for 14 years. Hence, this change in the discount factor implies similar growth rates to justify the current account deficit in 2015 since with $\beta = 0.98$, implied growth rates were between 0.32% and 0.52%. Even with a lower discount factor, $\beta = 0.95$, expected share growth rates in the model look robust and range between 0.37% to 0.53%

Table 5: Results for the economy in 2015: Sensitivity Analysis

Data			
Net GDP share in 1990 (%)		1.64	
Net GDP share in 2015 (%)		1.83	
Share growth: 1990-2015 (%)		11.59	
Share growth: 2001-2015 (%)		11.57	
Annual share growth: 1990-2015 (%)		0.42	
Annual share growth: 2001-2015 (%)		0.73	
Model ($\beta = 0.95$)			
	$\alpha = 0.7$	$\alpha = 0.75$	$\alpha = 0.8$
Steady state share $\bar{\gamma}$ (%)	1.98	1.98	1.99
Share growth ($\bar{\gamma}/\gamma_{2015} - 1$) (%)	8.22	8.46	8.83
Years to convergence	15	18	23
Annual share growth (%)	0.53	0.45	0.37
Model ($\beta = 0.97$)			
	$\alpha = 0.7$	$\alpha = 0.75$	$\alpha = 0.8$
Steady state share $\bar{\gamma}$ (%)	1.97	1.97	1.98
Share growth ($\bar{\gamma}/\gamma_{2015} - 1$) (%)	7.71	7.85	8.07
Years to convergence	14	18	23
Annual share growth (%)	0.53	0.42	0.34

6.2 Speed of convergence in the Engel and Rogers (2006) analysis

In our benchmark results, we assumed convergence speeds that led the economy to a steady state between 14 and 26 years at which time the current account deficit was eliminated. Assuming higher levels for α leads to longer time periods for convergence to the steady state and also a lower average share growth needed to eliminate the current account deficit. These results are provided in Table 6.

Table 6: Results for the economy in 2015: Sensitivity Analysis

Model ($\beta = 0.98$)			
	$\alpha = 0.9$	$\alpha = 0.95$	$\alpha = 0.98$
Steady state share $\bar{\gamma}$ (%)	1.74	1.76	1.83
Share growth $(\bar{\gamma}/\gamma_{2015} - 1)$ (%)	8.42	9.84	14.12
Years to convergence	47	99	269
Annual share growth (%)	0.17	0.09	0.05

6.3 Sudden stops under different growth rates

We also look into experiments where the world net GDP growth rate is (i) 3.17% (equal to the annual average growth rate in the 1990-2015 period) and (ii) 0% in an extreme scenario, which along with the dynamics described in (6), translates into positive (albeit low) growth rates for Country 1 at the earlier years of transition and zero long run growth. Hence, these experiments help us understand the evolution of the current account under sudden stops and relatively high- and low-growth episodes. We report the results in Figures (7) and (8) and summarize the equilibrium values of key variables for 2015 and 2020 in Table 7. In the absence of a shock, the economy would still follow a path that gradually reduces its current account deficit over time and up to -2.77% of net GDP.

Table 7: Shocks to the credit limit: Sensitivity of results

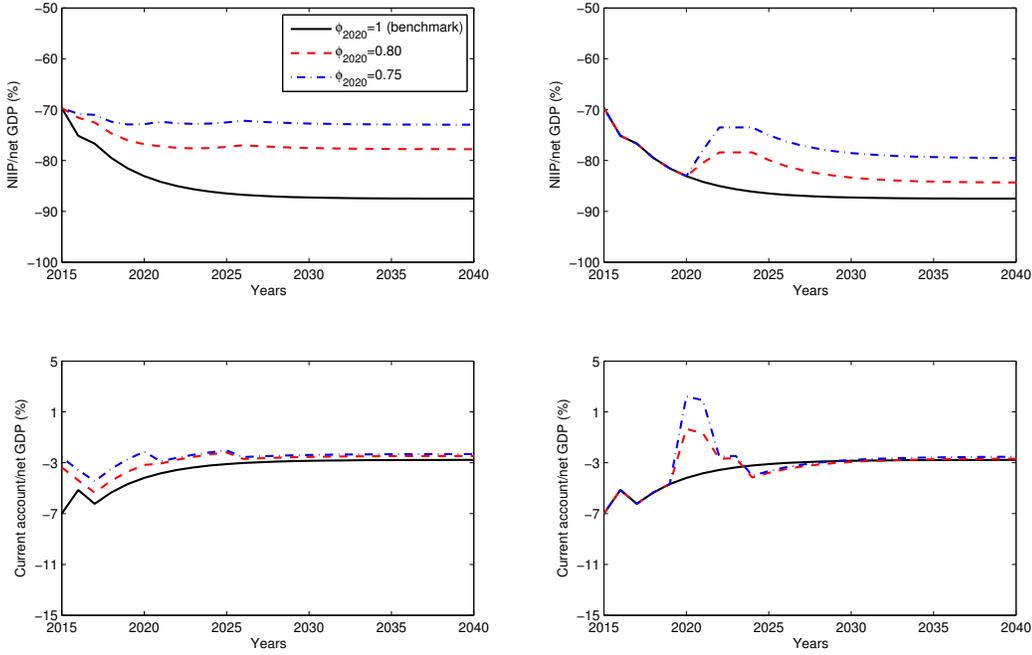
	Baseline case		Anticipated shock				Unanticipated shock			
	$\phi = 1$		$\phi = 0.80$		$\phi = 0.75$		$\phi = 0.80$		$\phi = 0.75$	
$g^w = 3.17\%$	2015	2020	2015	2020	2015	2020	2015	2020	2015	2020
CA_t/Y_t	-7.00	-4.19	-3.37	-3.17	-2.58	-2.12	-7.00	-0.34	-7.00	2.22
C_t	100	113.28	96.54	112.64	95.79	111.76	100	109.60	100	106.7
$g^w = 0\%$	2015	2020	2015	2020	2015	2020	2015	2020	2015	2020
CA_t/Y_t	-7.00	-1.56	-3.37	-0.74	-2.58	0.18	-7.00	4.80	-7.00	7.20
C_t	100	99.99	96.54	99.43	95.79	98.66	100	94.89	100	92.39

Note: Current account-to-net GDP ratio is reported in percentages. Consumption levels are normalized to 100 in 2015 under the baseline case.

Looking at the experiments under different world growth rates (and different implied growth rates for Country 1 and Country 2), we examine the evolution of the current account and consumption in response to a shock to the credit constraint. The shock limits the

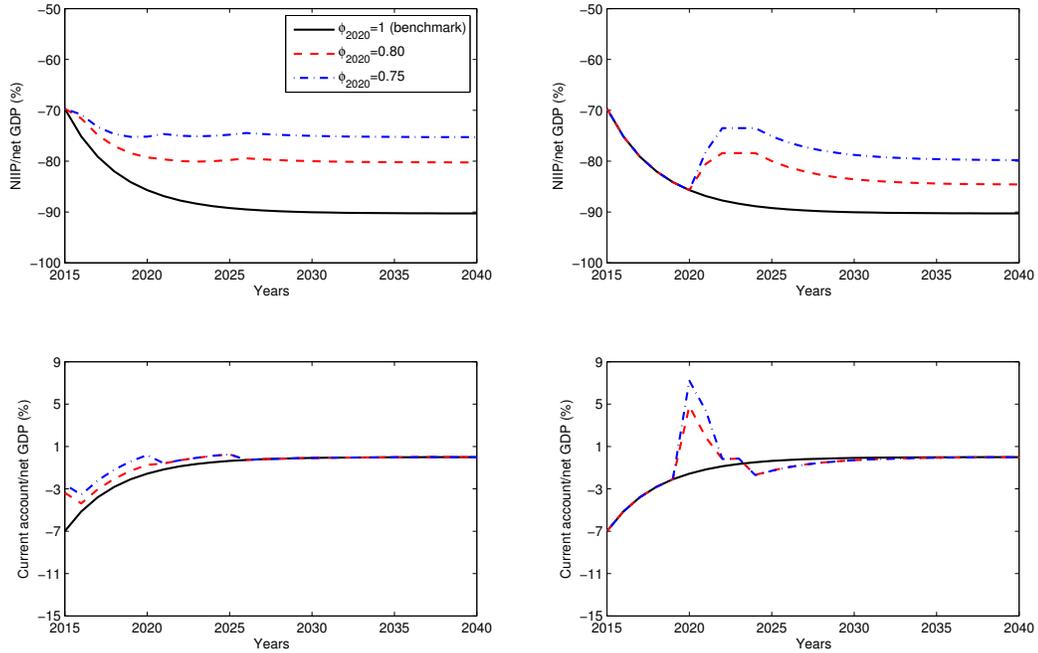
ability to do consumption smoothing; and reduces consumption growth. Higher world growth implies higher country-level growth, which alleviates the negative effects of credit tightening on consumption. This implies that the country is able to run a (larger) deficit. If growth rates are lower, then consumption is cut down dramatically and current account reversals occur. Again, whether the shock is anticipated or not affects the timing of these effects.

Figure 7: External accounts of Turkey after 2015 under high growth rates: (a) anticipated and (b) unanticipated shocks



In Figure (7), we depict the results from the experiment with borrowing limits where the world net GDP growth rate is 3.17%, which is equal to the annual average growth rate in the 1990-2015 period. In Figure (8) we show the results under an extreme assumption where the world net GDP growth is 0%.

Figure 8: External accounts of Turkey after 2015 under low growth rates: (a) anticipated and (b) unanticipated shocks



7 Conclusions

This paper uses the two country set-up of Engel and Rogers (2006) to examine to what extent the observed current account deficit in Turkey can be explained by agents' optimal savings behavior. In this framework, the current account of a country is determined by the expected discounted present value of its future share of world GDP relative to its current share. A country, whose income is anticipated to rise relative to the rest of the world, is expected to borrow now and run a current account deficit. The model calculates the needed growth rate in the future GDP share of a country that will lead to a steady decline of the current account deficit, eventually reaching zero at the steady state.

We find that the Turkish current account deficit in 2015 may be reconciled with optimal savings behavior if the future growth of the Turkish economy relative to its trading partners continues to resemble its performance in the past or the predictions from professional forecasts. We do not mean to ignore the potential dangers of borrowing, especially for a country like Turkey that is situated in a very turbulent area, exposed to many political and economic risks. As the International Monetary Fund (2013) points out, concerns related to inflation continue to be high in Turkey; current account deficits being financed by short-term flows as opposed to foreign direct investment or lower global demand for emerging market assets in the future can all result in a sudden stop in capital flows that would seriously hamper Turkey's future economic growth. We extend the model economy to examine the consequences of a sudden

stop in 2020, which if unanticipated, results in a disruption in consumption growth and a current account reversal. In addition, our main approach, indicates that the current account deficit in 2011, at its peak, was likely to be higher than levels that are consistent with the optimizing behavior of the agents. The expected growth rates needed for this case appear to be more challenging. We conclude that the decline in the deficit that took place since 2011 appears to be a change in the right direction.

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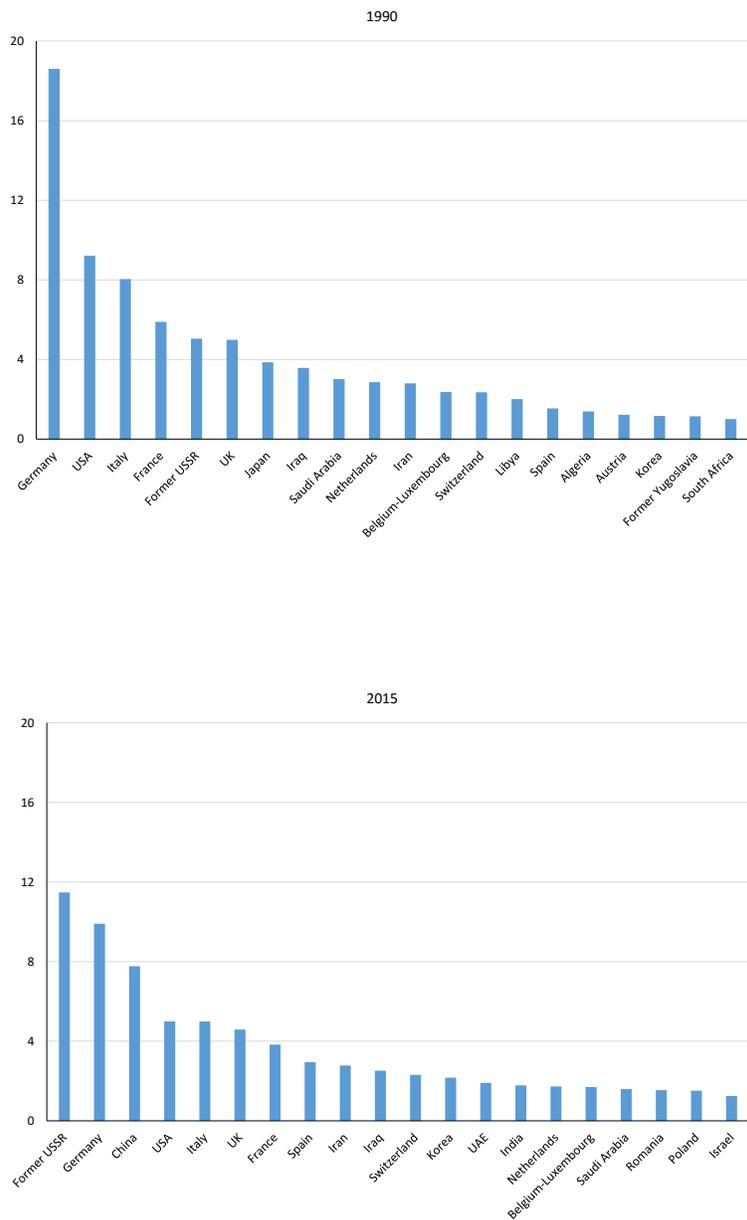
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Appendix A Turkey's Top Trade Partners

The rest of the world consists of Turkey's top 50 trade partners in each year. In 2015, these countries, ordered according to trade shares (in descending order), were: Former USSR, Germany, China, U.S., Italy, U.K., France, Spain, Iran, Iraq, Switzerland, Korea, United Arab Emirates, India, Netherlands, Belgium, Luxembourg, Saudi Arabia, Romania, Poland, Israel, Egypt, Bulgaria, Former Yugoslavia, Japan, Greece, Czech Republic, Sweden, Austria, Algeria, Brazil, Taiwan, Morocco, Hungary, Vietnam, Indonesia, Denmark, Malaysia, Libya, Canada, Syria, South African Republic, Slovakia, Thailand, Ireland, Finland, Mexico, Portugal, Bangladesh, Norway, Turkish Republic of Northern Cyprus.

Figure 9: Top 20 Trade Partners and Trade Shares in 1990 and 2015



Appendix B Engel and Rogers (2006) Analysis Using Gross GDP

In this section, we consider the Engel and Rogers (2006) exercise using gross GDP, rather than net, to determine whether a current account-to-GDP ratio of -4.47% in 2015 can be justified. We plot Turkey's GDP share growth in the world in Figure 10 below.

Figure 10: World GDP share of Turkey (with gross GDP, %)

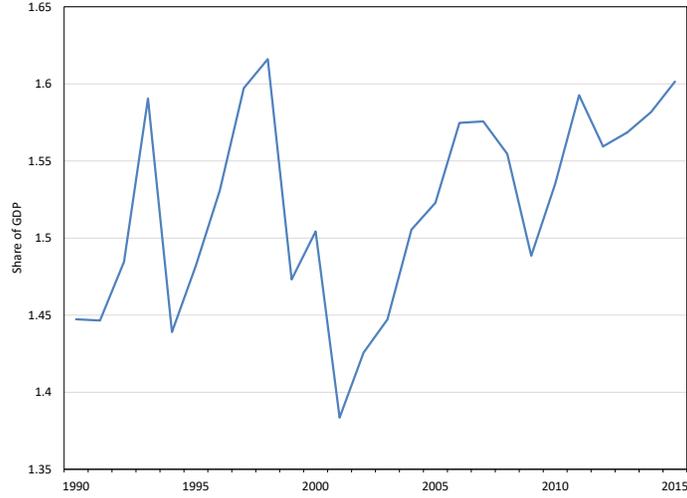


Table 8 summarizes the results from our analysis using Turkey’s world GDP share. According to this experiment, the current account deficit in 2015 might be considered an outcome of optimal decisions under certain assumptions. For instance, if we set $\alpha = 0.7$, the steady-state GDP share is calculated as 1.68%, implying a total growth rate of 4.78% and an annual growth rate of 0.36% in a period of 13 years. This appears plausible since Turkey’s GDP grew 8.37% in the 1990-2015 period with an annual growth rate of 0.57%. Hence, our conclusions from the benchmark experiment with net GDP shares remain robust when the analysis is conducted with a broader income measure.

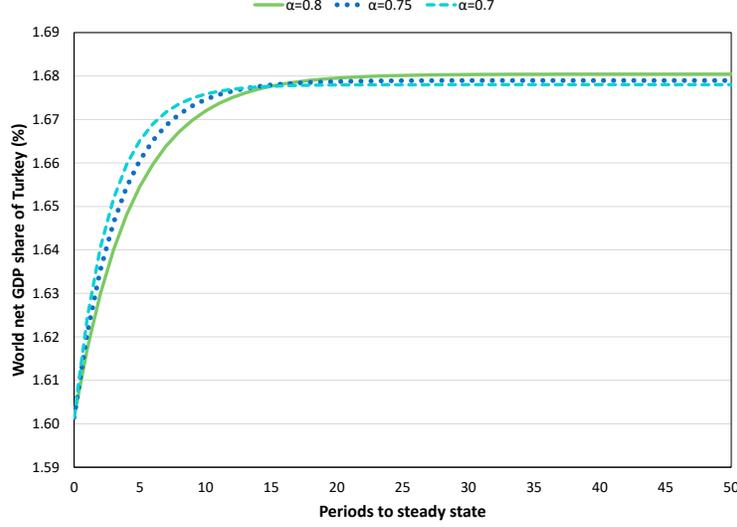
Table 8: Results with gross GDP

Data			
GDP share in 1990 (%)			1.45
GDP share in 2015 (%)			1.60
Share growth: 1990-2015 (%)			8.37
Share growth: 2001-2015 (%)			15.75
Annual share growth: 1990-2015 (%)			0.57
Annual share growth: 2001-2015 (%)			0.45
Model			
	$\alpha = 0.7$	$\alpha = 0.75$	$\alpha = 0.8$
Steady state share $\bar{\gamma}$ (%)	1.68	1.68	1.68
Share growth $(\bar{\gamma}/\gamma_{2015} - 1)$ (%)	4.78	4.84	4.93
Years to convergence	13	16	20
Annual share growth implied by the model (%)	0.36	0.30	0.24

Model-implied transition paths from a GDP share of 1.6% in 2015 under three different α 's are graphed in Figure 11. Under the scenario where adjustment occurs slowly ($\alpha = 0.8$),

convergence takes 20 years and the economy reaches a world GDP share of 1.68%.

Figure 11: Future world GDP share of Turkey



Appendix C Detrending the two-country model with credit constraints

To induce stationarity, we detrend variables and consider the following conditions for optimality. Accordingly, a variable X_t^i for a country i , can be detrended as $\hat{x}_t^i = \frac{X_t^i}{Y_t^i N^i}$. Also, we denote the size of Country 1 relative to Country 2 by $s_t = \frac{Y_t^1 N^1}{Y_t^2 N^2}$.

$$\frac{\hat{c}_{t+1}^1}{\hat{c}_t^1} \geq \beta \frac{1 + r_{t+1}^B}{1 + g_{t+1}^1} \quad (17)$$

$$\frac{\hat{c}_{t+1}^2}{\hat{c}_t^2} \leq \beta \frac{1 + r_{t+1}^B}{1 + g_{t+1}^2} \quad (18)$$

$$\hat{b}_{t+1}^1 \geq -\frac{\phi_t \hat{y}_t^1}{1 + g_{t+1}^1} \quad (19)$$

$$\hat{b}_{t+1}^2 \leq \frac{\phi_t \hat{y}_t^1 s_{t+1}}{1 + g_{t+1}^2} \quad (20)$$

$$(1 + g_{t+1}^i) \hat{b}_{t+1}^i + \hat{c}_t^i \leq \hat{b}_t^i (1 + r_t^B) + \hat{y}_t^i, \quad i=1, 2 \quad (21)$$

$$s_t \hat{c}_t^1 + \hat{c}_t^2 = s_t \hat{y}_t^1 + \hat{y}_t^2 \quad (22)$$

$$s_{t+1}\hat{b}_{t+1}^1 + \hat{b}_{t+1}^2 = 0 \quad (23)$$

The current account can now be defined as $\hat{c}a_{t+1}^i = (1+g_t^i)\hat{b}_{t+1}^i - \hat{b}_t^i$. Under these conditions, it can be inferred that the initial interest rate, r_0^B has no closed form solution. An arbitrary value for this variable does not necessarily result in a feasible solution, or even if a solution exists, it may yield unrealistic current account dynamics in the initial period. To circumvent this problem, we consider an approximation where we let $r_0^B \approx r_1^B$ since the net foreign asset positions in the first two periods of the economy must be close and these interest rates would be consistent with asset market clearing. Note that r_1^B can be determined by the Euler equations in $t = 0$ if the borrowing constraint is not binding. In other words, it is possible to find a feasible solution to the problem if the ad hoc borrowing parameter is sufficiently large and does not bind initially. Finally, we must set a terminal condition, and hence let $\hat{b}_{T+1}^i = \hat{b}_T^i$. We solve this system of equations and inequality constraints using Knitro, a nonlinear solver suitable for large scale problems.