The role of expectations for currency crisis dynamics - the case of the Turkish lira

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The Role of Expectations for Currency Crisis Dynamics - The Case of the Turkish Lira*

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Abstract

This paper examines whether and how expectations have contributed to the turbulent path of the Turkish lira since 2008. We derive uncertainty measures surrounding GDP growth, inflation, the interest rate, and exchange rates based on survey data from Consensus Economics. Our results illustrate that forecasts have affected realized exchange rates and stock market returns via increased uncertainty. We also show that expectations regarding monetary policy have changed throughout the sample period. In line with a gradual adjustment of expectations professionals have accounted for the violation of the Taylor rule.

Keywords: Disagreement, Expectations, Foreign exchange, Survey data, Taylor rule, Turkish lira, Uncertainty
JEL: F31, F41

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1 Introduction

Exchange rate fluctuations are notoriously difficult to explain given the weak and unstable link between exchange rates and macroeconomic fundamentals (Sarno, 2005). Various strands of the literature have assessed this relationship and provided evidence for a nonlinear relationship between fundamentals and exchange rates. The literature suggests that such a pattern especially emerges in times of currency crisis in the sense that macroeconomic fundamentals and the corresponding expectations are more important in turbulent times (Sarno, 2000a,b; Taylor *et al.*, 2001). Exchange Market Pressure Indices (EMPIs) are also based on this idea and rely on fundamentals and official currency reserves to derive potential warning signals (Kaminsky *et al.*, 1998; Frankel and Saravelos, 2012).

Turkey provides an interesting example in this context given its rich history of currency turbulence. Turkey introduced a flexible exchange rate regime in 1994 after sustainable pressure emerged as a result of speculative attacks. The lira suffered another strong depreciation against the US dollar in 2001 following a period of disinflation. The period since 2016 has been characterized by an enormous and accelerated depreciation of the lira which has lost over 300 percent of its value against the US dollar over this period. The most recent period has attracted significant attention due to the simultaneous occurrence of high inflation, high interest rates and strong depreciation. Both political tensions with the US and serious doubts about the actual independence of the Central Bank of the Republic of Turkey as a result of political interference have contributed to the tumbling of the lira (Kyriazis and Economou, 2022). The central bank has intervened in December 2021 but there are little signs that it will change its overall policy path and increase interest rates in order to fight inflation.[1]

[1]More precisely, the Turkish central bank not only failed to raise its policy rate at the end of 2021 but actually even cut it which is in contrast with standard theory. See also the discussion by

Various theoretical models of currency crises postulate expectations as an important propagation mechanism (Prati and Sbracia, 2010). However, disentangling the role of expectations is challenging from an empirical point of view. The complexity of expectation building and the rich evidence of information rigidity and delayed adjustment of expectations might result in a bidirectional causality between expectations and financial market developments (Bacchetta *et al.*, 2009). Dispersion across professional forecasters also has the potential to result in substantial exchange rate pressure (Prati and Sbracia, 2010).

This paper uses Turkish data to shed some light on the role of expectations in a currency crisis between 2008 and 2021. In doing so, we assess whether and how expectations contribute to exchange rate and stock market movements during a currency crisis. This issue has not been explicitly addressed and we use a rich set of survey data provided by Consensus Economics to assess the role of expectations regarding exchange rates, GDP growth, inflation, and interest rates. Following the work of Prati and Sbracia (2010) who focus on the effect of forecast dispersion on exchange rate pressure, we provide a new perspective on the role of expectations by adopting survey-based uncertainty measures which account for both global and domestic uncertainty. We use local projections to disentangle the underlying dynamics. Our analysis also sheds some light on the expectation building mechanism. We analyze exchange rate expectations and also evaluate whether expectations regarding monetary policy have changed throughout the sample period based on an expectation-based Taylor rule.

The remainder of this paper is organized as follows. The next section provides a brief literature review on currency crises and especially the Turkish currency crisis. We proceed by introducing our data set in Section 3 before presenting and discussing our empirical results in Sections 4 and 5. The final section concludes.

Gürkaynak *et al.* (2022).

2 Literature Review

In a very broad sense the present paper refers to the literature on the expectation formation and the heterogeneity of forecasters on foreign exchange markets based on surveys of professional forecasters (see e.g. Marsh and Power, 1996; Bacchetta *et al.*, 2009; Reitz *et al.*, 2010; Cavusoglu and Neveu, 2015; Prat and Uctum, 2015; Beckmann and Czudaj, 2017a,b; Kunze, 2020, among many others). More specifically, the following brief discussion summarizes the literature on currency crises and specific explanations for the Turkish currency crisis. First generation models of currency crises argue for example that crises emerge if realized exchange rates deviates significantly from a shadow exchange rate which reflects macroeconomic fundamentals (Krugman, 1979). Such a scenario arises if internal and external policy aims are incompatible with each other, for example if an economy establishes a fixed exchange rate regime and expansionary monetary policy finances government debt.

More sophisticated models provide a different perspective on government behavior based on loss functions in the presence of stochastic shocks (Sbracia and Zaghini, 2001). Both generations also emphasize the role of expectations as an important factor and propagation mechanism. One idea is that market expectations pay attention to the underlying fundamentals and are responsible for the resulting depreciation in first generation models while an expectation shock affects the government loss function in second generation models. Expectations can also trigger self-fulfilling currency devaluations regardless of macroeconomic fundamentals (Obstfeld, 1996; Tamgac, 2011). An increase in uncertainty over expected fundamentals also has the potential to trigger a currency crisis (Sbracia and Zaghini, 2001). Prati and Sbracia (2010) have illustrated the empirical relevance of forecast dispersion for exchange rate pressure but we go beyond their approach by extending both the underlying set of dispersion measures via the inclusion of exchange rate disagreement and the dimension of uncertainty by considering forecast errors, disagreement, and a combination of both. Models which propose additional explanations for currency crises such contagion and sunspots also emphasize the relevance of unobservable shifts in agents' beliefs (Fratzscher, 2003; Ari and Cergibozan, 2018). Regardless of the currency crises literature, adopting survey data as a proxy for exchange rate expectations is widely established.

Previous research has also analyzed determinants of the Turkish lira against the US dollar and currency crises in Turkey (Karabulut *et al.*, 2010; Tamgac, 2011; Saraç and Karagöz, 2016; Bilgin *et al.*, 2019; Kassouri and Altintaş, 2020; Sabri *et al.*, 2022; Kyriazis and Economou, 2022). The proposed determinants of the currency crisis in 2000 include political instability, disagreement with the International Monetary Fund, fragility in the banking system and macroeconomic as well as geopolitical uncertainty (Alper and Alper, 2003; Mariano *et al.*, 2004; Akyürek, 2006; Çeşmeci and Önder, 2008; Bilgin *et al.*, 2019; Kyriazis and Economou, 2022). A notable fact is that the Turkish banking system highly relies on debt denominated in US dollar which increases the fragility to exchange rate movements (Alper and Alper, 2003; Akyürek, 2006). The most recent crisis period has attracted less explicit attention so far, but the failing commitment of the central bank to fight inflation via higher interest rates provides an obvious explanation for the strong depreciation.

3 Data

Expectations are proxied by monthly survey data on forecasts made by professionals taken from Consensus Economics (see `https://www.consensuseconomics.com/`) which is widely used (see e.g. Marsh and Power, 1996; Reitz *et al.*, 2010; Prat and Uctum, 2015; Kunze, 2020, among many others) given that the names of participants and their competitive forecast adequacy are published (Beckmann and Czudaj, 2018). Consensus Economics surveys a large number of financial institutions and research institutes for a large number of economies. While data for some major economies is available from 1989, monthly data for Turkey is only available from 2007.

This data set includes 12-month-ahead fixed horizon forecasts for the TRY/USD exchange rate denominated in Turkish lira per one unit of the US dollar (i.e., an increase of the exchange rate indicates a depreciation of the lira) and for the 3-month interest rate. In addition, Consensus Economics also provides forecasts for inflation and GDP growth as fixed event forecasts, which means that they are made for the current and the next year at each point in time. This implies that the uncertainty about the current year naturally decreases over time (for example it is much lower in November than in January). Therefore, to transform fixed event into fixed horizon forecasts we apply the weighted averaging approach established by Patton and Timmermann (2011) and used in the related literature since then (Dovern *et al.*, 2012; Beckmann and Czudaj, 2018, 2021). The simple idea is to use the weighted average of fixed event forecasts for the current $\hat{f}_{1,0}$ and the next year $\hat{f}_{2,1}$ with the weight ω of the former (latter) linearly decreasing (increasing) as time evolves. According to this approach $\hat{f}_{t,t-12}$ gives the approximated fixed horizon 12-month-ahead forecasts

$$\hat{f}_{t,t-12} = \omega \hat{f}_{1,0} + (1-\omega)\hat{f}_{2,1}, \quad \omega = (24-t)/12 \quad \text{for} \quad t = 12, 13, \ldots, 23. \tag{1}$$

Thus, besides exchange rate forecasts, our study relies on forecasts for the 3-month interest rate, inflation, and GDP growth for Turkey and the US for a sample period running from May 2007 to May 2021. The start of the sample period is restricted by data availability. We include US survey data to disentangle the effects of global and country-specific uncertainty following the work of Mumtaz and Theodoridis (2017) and Mumtaz and Musso (2021). We rely on the mean forecast across forecasters as a proxy for market expectations and the corresponding standard deviation as a measure of disagreement among forecasters. To be also able to compute ex post forecast errors as well as realized exchange rate and stock market returns, we also include realized end-of-period data on the TRY/USD exchange rate, the MSCI stock market index for Turkey (measured in Turkish lira) as well as 3-month interest rates, inflation, and GDP growth for Turkey and the US taken from Thomson Reuters Datastream. GDP growth on a monthly level is approximated by the growth of industrial production.[2]

Figure 1 illustrates monthly ex post mean forecast errors for 12-month-ahead forecasts made by professional forecasters for the period from May 2008 to May 2021 for inflation (solid black line), GDP growth (dashed blue line), the 3-month interest rate (violet dotted line), and the TRY/USD exchange rate (red dotted-dashed line). In case of inflation, GDP growth, and the interest rate forecast errors are simply given by the difference between their forecasts made 12 months in advance and their realized values and are therefore given in percentage points. Exchange rate forecast errors are computed by the difference of the corresponding natural logarithms multiplied by 100 and thus are displayed in percent per annum for visualization purpose. Figure 1 clearly shows that all forecast errors have increased since 2018. Especially, the strong depreciation of the Turkish lira has resulted in forecast errors for the exchange rate of up 53% per year. However, interest rate and inflation forecast errors have also increased substantially and exceeded the 2008 level. The substantial exchange rate forecast errors have important implications since they illustrate that expectations are not propagated

[2]We adopt GDP growth forecasts since the corresponding forecasts for industrial production are not available within the dataset with a number of forecasters comparable to GDP growth forecasts. To match the data frequency of monthly GDP growth forecasts (as well as of all other variables we use), we adopt the realized growth rate of industrial production for the computation of forecast errors on a monthly level. Of course this is an approximation, which might induce some sort of measurement error. However, the mean growth rate of GDP over our entire sample period is 4.75% compared to 4.61% for the growth of industrial production. Therefore, we think this is the best we can do given the data availability.

into realized exchange rates. This is in line with the overall evidence that survey forecasts are subject to substantial forecast errors. In turbulent times, it might even be more costly to acquire new information about exchange rates so that inattention to incoming information is rational. Our remaining analysis will focus on the question whether uncertainty arising from the identified forecast errors and disagreement has substantial effects on exchange rate and stock returns.

*** Insert Figure 1 about here ***

4 Taylor Rule Forecast Regressions

As a first step, to study the connection between expectations on the different macroeconomic variables, we regress interest rate expectations on the expectations of conventional fundamentals according to a Taylor rule relationship[3]

$$E_t(i_{t+12}) = \beta_0 + \beta_1 E_t(\pi_{t+12}) + \beta_2 E_t(\Delta y_{t+12}) + \beta_3 E_t(s_{t+12}) + \varepsilon_{t+12}, \tag{2}$$

where $E_t(.)$ is proxied by the mean 12-month-ahead forecasts across forecasters made in t, i_t stands for the 3-month interest rate, π_t represents the inflation rate, Δy_t denotes GDP growth, and s_t is the TRY/USD exchange rate.[4] The first column of Table 1

[3]Eq. (2) can be seen as a forward-looking version of the Taylor rule and can also be used to assess whether professionals believe that the central bank acts in line with such a Taylor rule. It should also be noted that we rely on GDP growth expectations instead of the deviation of output from its potential as expectations on the output gap are not available.

[4]When considering the regression model given by Eq. (2), the stationarity of the time series, especially for interest rate and exchange rate expectations is debatable. We refer to Siklos and Wohar (2006) for a discussion of this issue. To check for the presence of a unit root in all time series under consideration, we have conducted Augmented Dickey-Fuller (ADF) tests. The corresponding results are reported in the Appendix (see Table A.1) and show that except of exchange rate expectations (and disagreement) the unit root null can be rejected for all time series at least at the 10% significance level. Solely the stationary of exchange rate expectations (and disagreement) can be questioned. Due to the

provides the full sample OLS estimation results while Figure 2 accounts for potential structural changes due to crises periods and therefore allows for variation over time by illustrating coefficient estimates for rolling-window regressions with a window size of 30 months.[5] The Turkish lira was due to several turbulence over the entire sample period we are focusing on. Therefore, a flexible time-varying coefficient approach which allows for both large jumps and gradual changes in the coefficients seems to be more suitable to study the dynamics compared to regression models allowing or testing for one or more structural breaks.

*** Insert Table 1 about here ***

The full sample results reported in Table 1 establish a significant association between interest rate and inflation expectations on a 1% level while the coefficient is larger than unity and therefore in line with the Taylor principle. All other coefficients are insignificant at a 5% level while the TRY/USD exchange rate turns out to be borderline significant at the 10% level with a negative coefficient indicating that an expected appreciation of the domestic currency against the US dollar lets professionals expect the

strong depreciation of the Turkish lira, the unit root null cannot be rejected for the period between May 2007 and May 2021. However, due to large crises within the sample period, the relatively low number of time series observations ($T = 165$) in the sample period, the usually strong persistence of exchange rates, and the well-known low power of unit root tests to reject the null in the near-unit root case, the reliability of unit root tests can also be questioned in this context.

[5]The choice of a window size of 30 months is motivated by the trade-off of finding a window size that on the one hand-side is most flexible due to potential structural changes and time-variation but on the other hand-side also allows us to make inference. However, we have also provided a sensitivity check by varying the window size. In doing so, we have re-run the rolling-window regressions with windows sizes of 24 and 40 months. The corresponding results are provided in the Appendix (see Figures A.1 to A.4). Overall, the patterns for all time-varying coefficients as well as the R^2 do not change across the considered window sizes (i.e., 24, 30, and 40 months). Therefore, our results seem to be very robust to the choice of the window size.

Turkish central bank to lower interest rates. The R^2 around 0.6 illustrates that expectation regarding future monetary policy are strongly related to expectations regarding other macroeconomic variables.

Hasanov and Omay (2008) argue in favor of a potential asymmetry in the monetary policy reaction function of the Central Bank of Turkey due to the finding of a more aggressive reaction towards output stabilization during recession periods compared to expansion periods. To account for this asymmetry in the Taylor rule, we have conducted a sensitivity check by including an interaction term between GDP growth expectations and a dummy variable indicating recession periods for the Turkish economy. In doing so, we rely on OECD based recession indicators measuring recessions based on turning points from the period following the peak through the trough. The corresponding data has been downloaded from Federal Reserve Economic Data (FRED). The additional results are provided in the second column of Table 1 and clearly show the robustness of our baseline specification. In line with Hasanov and Omay (2008), the interaction term has a much larger coefficient than GDP growth expectations in general, which indicates a stronger reaction towards output stabilization during recessions periods. However, this coefficient is not statistically significant. All other coefficients remain unchanged compared to the initial specification, which demonstrates the robustness of our findings.

Figure 2 shows that the assumption of a constant relationship is not reliable due to the recent crises of the Turkish economy by estimating the regression model given in Eq. (2) using a rolling-window for the entire sample period. It can be seen that the association of interest rate expectations with the expectations of Taylor rule fundamentals strongly varies over time and covers periods, in which all three fundamentals turn out to be significant at the 5% level as indicated by red dots within the graphs. The coefficient for inflation expectations is positive for (nearly) the entire sample period and in most cases even above unity. However, it becomes mostly insignificant between 2015 and 2019 before turning significant again after 2019 (see Panel (a)).

The coefficient for GDP growth expectations displays a large drop below zero between 2014 and 2018 with a trough in 2016 (see Panel (b)). The estimated coefficient is reversed compared to the original Taylor rule in line with the Taylor rule principle, suggesting that forecasters believe that an interest rate decrease coincides with higher growth rates. This is in line with the overall policy path which is designed to bolster economic growth via lower interest rates even when confronted with high inflation. The fact that the coefficient becomes insignificant after 2017 is also in line with the perception that interest rates do not increase in case of higher growth rates. The impact of exchange rate expectations on interest rate projections also fluctuate around zero several times (see Panel (c)). Panel (d) also shows the explanatory power of the variance of interest rate expectations by the corresponding regression model illustrated by the R^2. In general, the R^2 is quite high and lies above 0.75 most of the time. However, it clearly drops around 2016 and 2018. This illustrates that the expected path of monetary policy is less strongly related to expectations regarding GDP growth, inflation, and exchange rates, suggesting that non-fundamental determinants of monetary policy have become more important. After 2018 the explanatory power has clearly increased again to values slightly below 0.9.

*** Insert Figure 2 about here ***

If professional forecasters believe in the Taylor rule concept and also believe that the central bank sets its policy rate in response to uncertainty regarding macro variables such as inflation, GDP growth, and the exchange rate, then we would also expect to see an association between forecasters' disagreement regarding the policy rate and Taylor rule fundamentals (Czudaj, 2021).[6] Therefore, following Dräger and Lamla (2017) and Czudaj (2021), we also exploit the cross-sectional variation of the dataset and study the relationship given in Eq. (2) among the disagreements of professional forecasters regarding the four variables

$$\sigma_t(i_{t+12}) = \beta_0 + \beta_1\sigma_t(\pi_{t+12}) + \beta_2\sigma_t(\Delta y_{t+12}) + \beta_3\sigma_t(s_{t+12}) + \varepsilon_{t+12}, \tag{3}$$

where $\sigma_t(.)$ represents the standard deviation of 12-month-ahead forecasts across forecasters made in t instead of the means. The third and fourth column of Table 1 report the full sample estimation results while Figure 3 illustrates coefficient estimates for rolling-window regressions.

*** Insert Figure 3 about here ***

According to the findings reported in Table 1 for the full sample period solely inflation disagreement shows a significantly positive association to interest rate disagreement. This finding is in line with results provided by Dräger and Lamla (2017) for the US that disagreement regarding the interest rate is explained by disagreement regarding inflation. Rolling-window regression estimates also show a strong degree of time-variation. Similar to the case of the forecast mean model, the disagreement regarding all three macro variables is also significantly different from zero at the 5% level for several periods of time. Unsurprisingly, in most periods the disagreements show a positive association to each other. Essentially all coefficients are positive with inflation and interest rate disagreement strongly related at the end of the sample. Taking the positive inflation coefficient into account, this points to uncertainty whether the central

[6] In this case disagreement among forecasters is considered as a proxy for ex ante uncertainty.

bank will adjust its monetary policy towards the Taylor principle at some point. The R^2 indicates a clearly increased explanatory power of the regression model in the most recent period starting in 2018, which was characterized by higher uncertainty. In this period variations in interest rate disagreement are significantly explained by inflation and exchange rate disagreement.

5 Macroeconomic Uncertainty and its Effect on Financial Markets

As a next step, we rely on different measures of uncertainty derived from survey data and study their impact on the foreign exchange and the stock market in Turkey. Following Lahiri and Sheng (2010) we measure common or aggregated uncertainty U_t^h by the sum of ex ante uncertainty given by the disagreement among forecasters D_t^h and ex post uncertainty proxied by the volatility of forecast errors based on mean forecasts V_t^h:

$$U_t^h = D_t^h + V_t^h, \tag{4}$$

where $h = 12$ denotes the forecasting horizon of 12 months. To approximate V_t^h, we fit GARCH(1,1) models of forecast errors and take the estimated conditional standard deviation. D_t^h is proxied by the standard deviation of 12-month-ahead forecasts across forecasters made in t already used above and denoted by $\sigma_t(.)$. A related approach has been used by Istrefi and Mouabbi (2018) and Ozturk and Sheng (2018).

To study the effect of macroeconomic uncertainty, we compute the three different components of Eq. (4) for the TRY/USD exchange rate as well as GDP growth, inflation, and 3-month interest rates for both economies, Turkey and the US, based on survey data. We use each of the three components separately to study the impact of different dimensions of macroeconomic uncertainty. In doing so, Y_{t+j} defines a vector of time series including nine variables for period $t+j$ (in this particular order): Turkish

GDP growth uncertainty, Turkish inflation uncertainty, US GDP growth uncertainty, US inflation uncertainty, Turkish short-term interest rate uncertainty, US short-term interest rate uncertainty, TRY/USD exchange rate uncertainty, realized percentage change of the TRY/USD exchange rate, and realized MSCI stock market returns for Turkey.[7] Realized exchange rate changes and stock market returns are computed based on a 12-month difference of natural logarithms multiplied by 100 to match the horizon of 12-month-ahead forecasts used to calculate the uncertainty measures.

Then, impulse responses are computed based on local projections according to Jordà (2005) by projecting each variable on its own lags and the lags of all other variables and using a recursive Cholesky identification strategy.[8] In doing so, we run a sequence of OLS regressions for each j to estimate

$$Y_{t+j} = \mu + \Phi_0 Y_t + \Phi_1 Y_{t-1} + \ldots + \Phi_p Y_{t-p} + u_{t+j} \quad \text{with} \quad \Theta_j^{LP(p)} = \Phi_0 A_0^{-1}, \quad j = 1, \ldots, J, \tag{5}$$

where A_0^{-1} is a lower triangular matrix derived by a Cholesky decomposition using the covariance matrix of the residuals from a corresponding VAR model and $\Theta_j^{LP(p)}$ gives the impulse responses for j (see Jordà (2005) and also Kilian and Kim (2011) for details). This specification differs from the work of Prati and Sbracia (2010) who adopt disagreement regarding macroeconomic fundamentals to explain fluctuations in a three-component index of exchange rate pressure.

Figure 4 visualizes the orthogonalized impulse responses based on local projections for uncertainty measures U_t^h according to Eq. (4). The impulses are one standard deviation shocks of the variables given in rows (e) GDP growth uncertainty, (f) inflation uncertainty, (g) interest rate uncertainty as well as (h) TRY/USD exchange rate un-

[7] This ordering is used within the recursive Cholesky identification strategy below. We have ordered real variables first and financial variables last as the latter are known to react much faster.

[8] Our computations are based on one lag of each variable selected according to the Bayesian information criterion but we have also verified that our findings are not sensitive to this choice and also not sensitive to the ordering of variables within the recursive identification scheme.

certainty and the response variables are given in columns (a) interest rate uncertainty, (b) TRY/USD exchange rate uncertainty, (c) realized exchange rate changes and (d) stock market returns. As outlined previously, the US variables are considered as control variables within the model to account for the role of global uncertainty. The reaction is represented by the solid red line and the corresponding 95% (68%) confidence bands by blue (dark blue) shadings. The dashed black line displays the zero line. In columns (a) and (b) we basically find that both interest rate and exchange rate uncertainty significantly increase due to an uncertainty shock of all four macro variables, at least in the very short-run. These results align with our previous findings that interest rate disagreement is associated with disagreement related to the remaining variables. While this result corresponds to common dynamics related to expectations, we also provide evidence for effects on macroeconomic variables. We find that realized exchange rate changes are also positively affected by all four kinds of uncertainty (see column (c)). This positive effect indicates a depreciation of the Turkish lira against the US dollar. Column (d) indicates that uncertainty regarding GDP growth, inflation and the exchange rate also significantly lowers stock market returns in Turkey, although this effect is less pronounced. The negative effects on stock market returns are intuitive since stock markets and exchange rates often show stronger co-movements in crisis periods, a pattern which has for example been analyzed for Asian Economies (Lin, 2012). Moreover, it is widely established that stock markets respond negative to uncertainty shocks.

Our findings overall complement the results of Prati and Sbracia (2010) who find that survey-based uncertainty heightens speculative pressures when expected fundamentals are good and eases them when they are bad. Their results suggest that higher expected GDP growth reduces exchange rate pressures while uncertainty about GDP growth has a potential negative effect depending on the level of expected GDP growth.

Our result suggests a direct influence of survey-based uncertainty on stock markets and exchange rates. As a next step, we distinguish between the two underlying sources of this uncertainty.

*** Insert Figure 4 about here ***

Figures 5 and 6 illustrate the same impulse responses but instead of uncertainty measures U_t^h they rely on the volatility and disagreement measures V_t^h and D_t^h according to Eq. (4), respectively. The findings for the disagreement measure D_t^h are fully in line with the results for the uncertainty measure U_t^h discussed above while the outcomes for the volatility measure V_t^h are less clear-cut. This suggests that the forward-looking nature of disagreement is responsible for the previous findings. This is intuitive given that the forecast errors are realized 12 months later.

*** Insert Figures 5 and 6 about here ***

Finally, Figure 7 provides the same impulse responses for the uncertainty measures U_t^h as shown in Figure 4 but omit the three US variables. Overall, the responses do not differ much from the ones reported in Figure 4, which indicates that the findings are mainly driven by domestic uncertainty. This is an interesting result given that Turkish banks are strongly dependent on dollar-denominated assets, implying that a depreciation increases pressure on banks via the financial channel. This illustrates that uncertainty regarding the lira is dominant while general uncertainty regarding the global economy is less important in the specific case of Turkey. This finding is completely in line with other examples of currency crises where domestic monetary policy is responsible as the main driver of depreciation periods (Kiguel and Liviatan, 1994). It is also fairly obvious that contagion effects, which have for example been relevant during the Asian currency crisis, are not of great relevance for the case of Turkey.

*** Insert Figure 7 about here ***

6 Summary and Concluding Remarks

Complementing previous research on currency crises this paper addresses the role of expectations for exchange rate and stock market movements in Turkey between 2008 and 2021 based on survey data. We have shown that expectation-based uncertainty has contributed to exchange rate and stock market movements during the turbulent path of the Turkish lira since 2008. We have also shown that expectations regarding monetary policy have changed throughout the sample period and account for the violation of the Taylor rule by the Turkish central bank.

Conventional currency crises models postulate expectations as an explanation for currency crises. Our findings do not provide a direct test of mechanisms such as unobservable shifts in agents' beliefs. However, we contribute to a new perspective on the role of expectations by showing that resulting uncertainty acts as a propagation mechanism. In this regard, our findings also shed some light on the different dimensions of uncertainty. Forward-looking disagreement has slightly stronger effects compared to the variance of ex-post forecast errors, a pattern which is compatible with the idea and the result that the forward-looking nature of expectations has significant effects. Our result that exchange rate expectations are subject to substantial errors is in line with the existing evidence and suggests that mean expectations are not directly propagated into realized exchange rate. Our findings related to expectation building have illustrated the slow adjustment of forecasts which might simply be explained by rational inattention in turbulent times. However, we show that uncertainty surrounding the exchange rate, monetary policy, and GDP growth significantly affects both stock prices and exchange rates. Our finding that accounting for uncertainty related to the US do not change our results aligns with the fact that domestic factors are the main drivers of the Turkish currency crisis.

The empirical lessons and our results raise the question how the fall of the lira can be stopped. The recent interventions have acted as a short-term stabilization but interventions are hardly successful if the overall policy is not considered credible by market participants. Given that the stance of interest rate policy remains unchanged, market participants are unlikely to reverse their opinion and high inflation as well as uncertainty about the lira will prevail.

Our results also offer interesting avenues for future research. An interesting question corresponds for example to the long-run effects of exchange rate uncertainty on different components of Turkish GDP, such as services.

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Tables

Table 1: **Full sample Taylor rule forecast regressions**

	Mean E_t		**Disagreement σ_t**	
β_1	1.4839	1.4366	0.6181	0.6449
SE	(0.2074)	(0.1878)	(0.1163)	(0.1425)
p-value	[0.0000]	[0.0000]	[0.0000]	[0.0000]
β_2	0.1169	0.0539	0.1866	0.2250
SE	(0.2709)	(0.3050)	(0.1681)	(0.1486)
p-value	[0.6666]	[0.8600]	[0.2688]	[0.1319]
β_3	-0.7313	-0.7017	0.0758	0.0714
SE	(0.4337)	(0.3968)	(0.0540)	(0.0536)
p-value	[0.0936]	[0.0789]	[0.1623]	[0.1844]
β_4		0.2843		-0.0519
SE		(0.1837)		(0.1314)
p-value		[0.1236]		[0.6936]
β_0	-0.5680	-0.2987	0.4669	0.4358
SE	(1.6354)	(1.7339)	(0.1293)	(0.1282)
p-value	[0.7288]	[0.8635]	[0.0004]	[0.0009]
$\overline{R}^2$	0.5966	0.6053	0.4964	0.4945
T	165	165	165	165

Note: The table reports ordinary least squares (OLS) coefficient estimates and adjusted R^2s ($\overline{R}^2$) for the following two regression models

$$E_t(i_{t+12}) = \beta_0 + \beta_1 E_t(\pi_{t+12}) + \beta_2 E_t(\Delta y_{t+12}) + \beta_3 E_t(s_{t+12}) + \beta_4 REC_t * E_t(\Delta y_{t+12}) + \varepsilon_{t+12},$$

and

$$\sigma_t(i_{t+12}) = \beta_0 + \beta_1 \sigma_t(\pi_{t+12}) + \beta_2 \sigma_t(\Delta y_{t+12}) + \beta_3 \sigma_t(s_{t+12}) + \beta_4 REC_t * \sigma_t(\Delta y_{t+12}) + \varepsilon_{t+12},$$

where $E_t(.)$ denotes the mean 12-month-ahead forecasts across forecasters made in t, $\sigma_t(.)$ represents the corresponding standard deviation of 12-month-ahead forecasts across forecasters, i_t stands for the 3-month interest rate, π_t represents the inflation rate, Δy_t denotes GDP growth, s_t is the TRY/USD exchange rate, and REC_t is a dummy variable, which equals unity for periods classified as recessions according to the OECD (measured based on turning points from the period following the peak through the trough) and zero otherwise. T stands for the sample size.

Figures

Figure 1: **Ex post mean forecast errors made by professionals**

The graph shows monthly time series of ex post mean forecast errors for 12-month-ahead forecasts made by professional forecasters for the period from May 2008 to May 2021 for inflation (solid black line), GDP growth (dashed blue line), the 3-month interest rate (violet dotted line), and the TRY/USD exchange rate (red dotted-dashed line). Forecast errors for the former three are given in percentage points while exchange rate forecast errors are displayed in percent per annum.

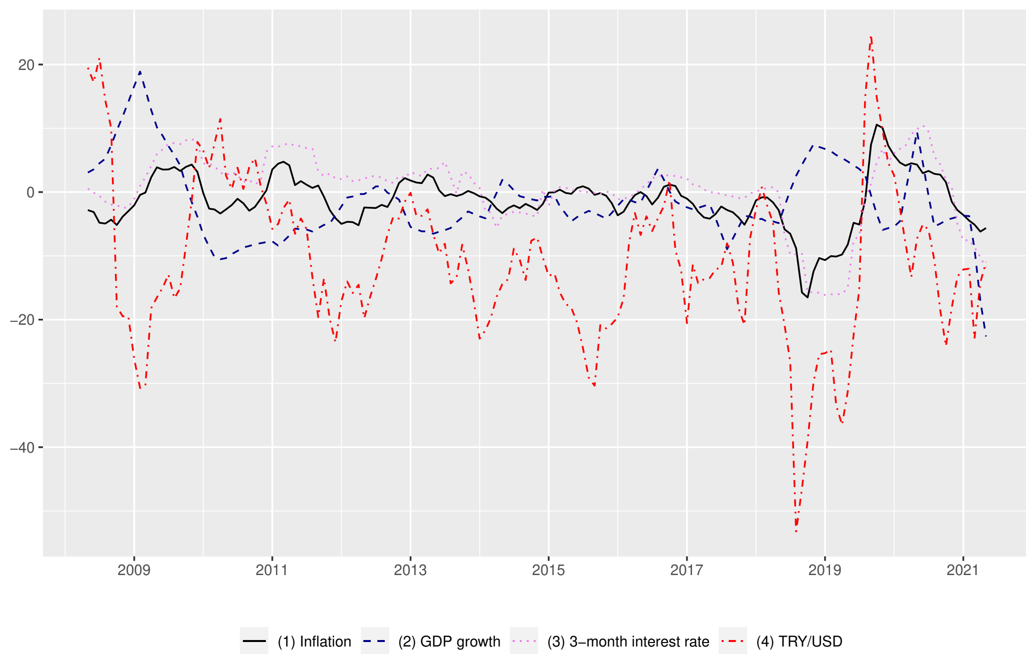


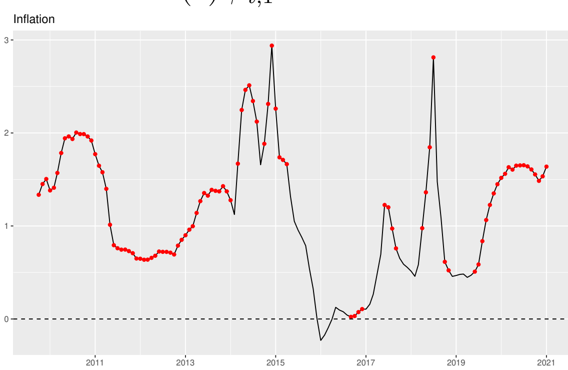
Figure 2: **Rolling-window Taylor rule forecast mean regressions**

The graphs visualize rolling-window ordinary least squares (OLS) coefficient estimates and R^2s for the following regression model

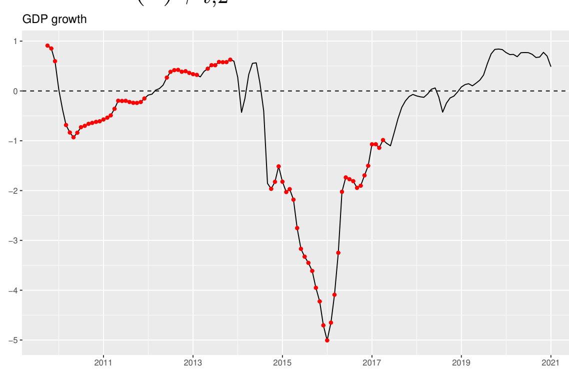
$$E_t(i_{t+12}) = \beta_{t,0} + \beta_{t,1}E_t(\pi_{t+12}) + \beta_{t,2}E_t(\Delta y_{t+12}) + \beta_{t,3}E_t(s_{t+12}) + \varepsilon_{t+12},$$

where $E_t(.)$ denotes the mean 12-month-ahead forecasts across forecasters made in t, i_t stands for the 3-month interest rate, π_t represents the inflation rate, Δy_t denotes GDP growth, and s_t is the TRY/USD exchange rate. Panels (a), (b), and (c) report OLS estimates for $\beta_{t,i}$ for $i = 1, 2, 3$ plotted over time t. The window size is 30 months. Red dots represent coefficient estimates, which are significantly different from zero at a 5% level. Panel (d) displays the R^2 of the regressions.

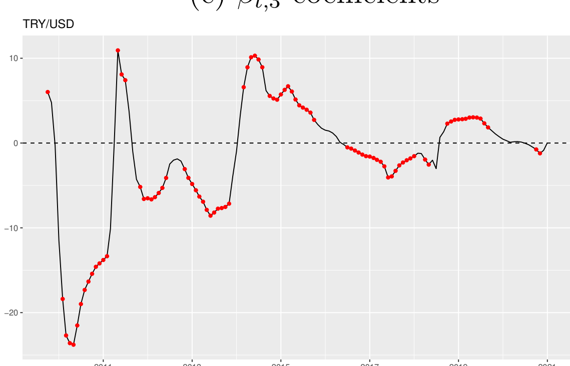
(a) $\beta_{t,1}$ coefficients



(b) $\beta_{t,2}$ coefficients



(c) $\beta_{t,3}$ coefficients



(d) R^2

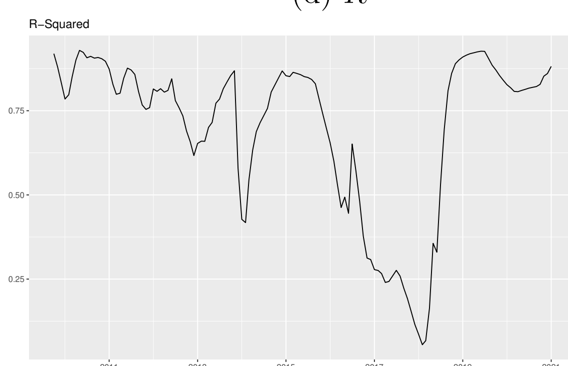


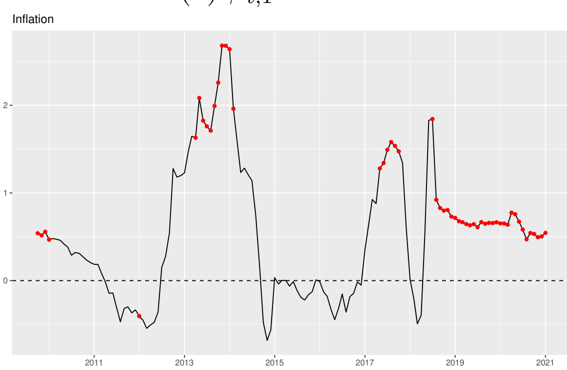
Figure 3: **Rolling-window Taylor rule forecast disagreement regressions**

The graphs visualize rolling-window ordinary least squares (OLS) coefficient estimates and R^2s for the following regression model

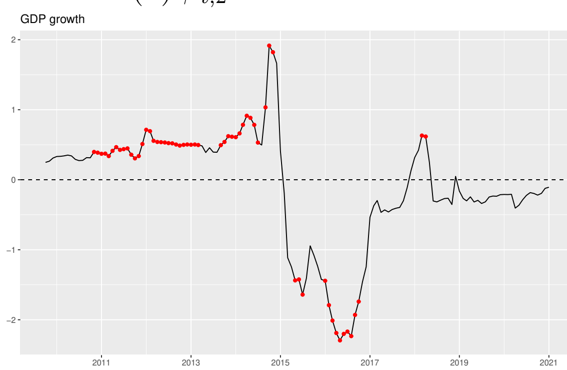
$$\sigma_t(i_{t+12}) = \beta_{t,0} + \beta_{t,1}\sigma_t(\pi_{t+12}) + \beta_{t,2}\sigma_t(\Delta y_{t+12}) + \beta_{t,3}\sigma_t(s_{t+12}) + \varepsilon_{t+12},$$

where $\sigma_t(.)$ denotes the standard deviation of 12-month-ahead forecasts across forecasters made in t, i_t stands for the 3-month interest rate, π_t represents the inflation rate, Δy_t denotes GDP growth, and s_t is the TRY/USD exchange rate. Panels (a), (b), and (c) report OLS estimates for $\beta_{t,i}$ for $i = 1, 2, 3$ plotted over time t. The window size is 30 months. Red dots represent coefficient estimates, which are significantly different from zero at a 5% level. Panel (d) displays the R^2 of the regressions.

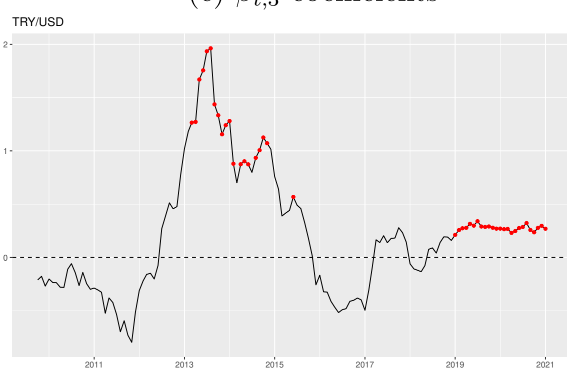
(a) $\beta_{t,1}$ coefficients



(b) $\beta_{t,2}$ coefficients



(c) $\beta_{t,3}$ coefficients



(d) R^2

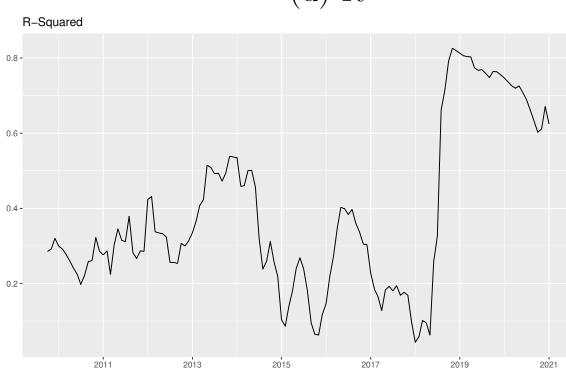
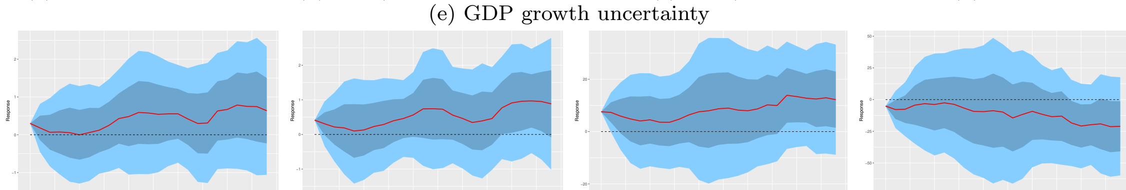


Figure 4: **Orthogonalized impulse responses for the uncertainty model**

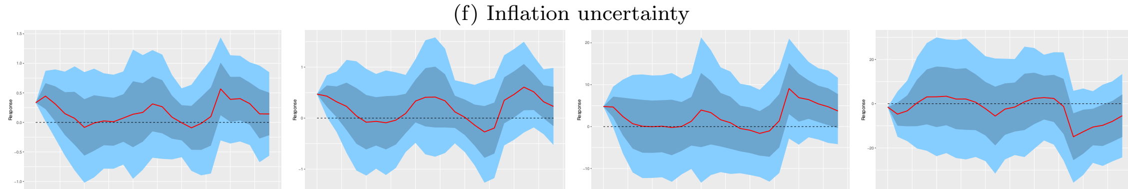
The graphs show different orthogonalized impulse responses based on local projections for the uncertainty model. Uncertainty is proxied by the sum of ex post mean forecast error volatility and ex ante forecast disagreement for 12-month-ahead forecasts for each variable and the model includes 9 variables: Turkish GDP growth uncertainty, Turkish inflation uncertainty, US GDP growth uncertainty, US inflation uncertainty, Turkish short-term interest rate uncertainty, US short-term interest rate uncertainty, TRY/USD exchange rate uncertainty, realized percentage change of the TRY/USD exchange rate, and realized MSCI stock market returns for Turkey. Realized exchange rate changes and stock market returns are computed for a horizon of 12 months. The reaction is represented by the solid red line and the corresponding 95% (68%) confidence bands by blue (dark blue) shadings. The dashed black line displays the zero line. The impulses are one standard deviation shocks of the variables given in rows (e), (f), (g), and (h) and the response variables are given in columns (a), (b), (c), and (d). IR stands for 3-month interest rate.

(a) IR uncertainty (b) TRY/USD uncertainty (c) TRY/USD return (d) Stock return

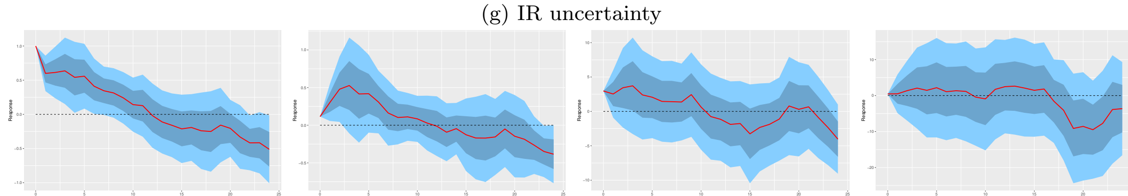
(e) GDP growth uncertainty



(f) Inflation uncertainty



(g) IR uncertainty



(h) TRY/USD uncertainty

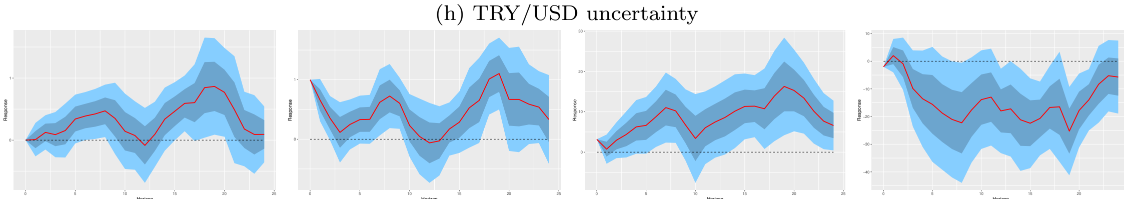
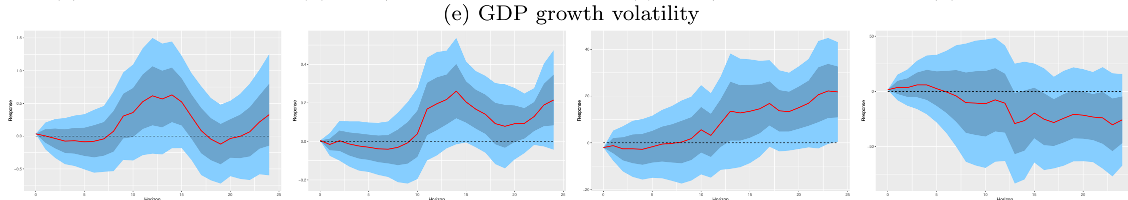


Figure 5: **Orthogonalized impulse responses for the volatility model**

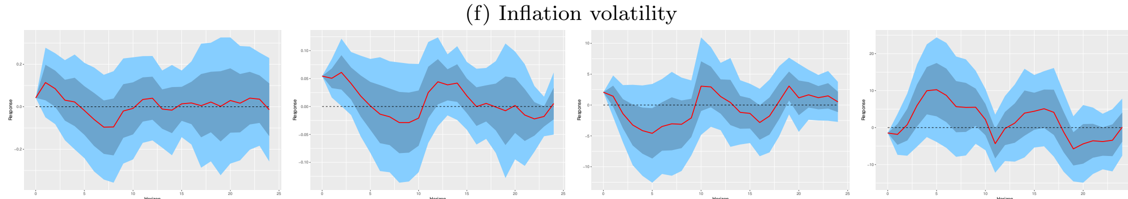
The graphs show different orthogonalized impulse responses based on local projections for the volatility model. Ex post forecast error volatility is estimated based on a GARCH(1,1) model fitted on 12-month-ahead mean forecast errors for each variable and the volatility model includes 9 variables: Turkish GDP growth volatility, Turkish inflation volatility, US GDP growth volatility, US inflation volatility, Turkish short-term interest rate volatility, US short-term interest rate volatility, TRY/USD exchange rate volatility, realized percentage change of the TRY/USD exchange rate, and realized MSCI stock market returns for Turkey. Realized exchange rate changes and stock market returns are computed for a horizon of 12 months. The reaction is represented by the solid red line and the corresponding 95% (68%) confidence bands by blue (dark blue) shadings. The dashed black line displays the zero line. The impulses are one standard deviation shocks of the variables given in rows (e), (f), (g), and (h) and the response variables are given in columns (a), (b), (c), and (d). IR stands for 3-month interest rate.

(a) IR volatility (b) TRY/USD volatility (c) TRY/USD return (d) Stock return

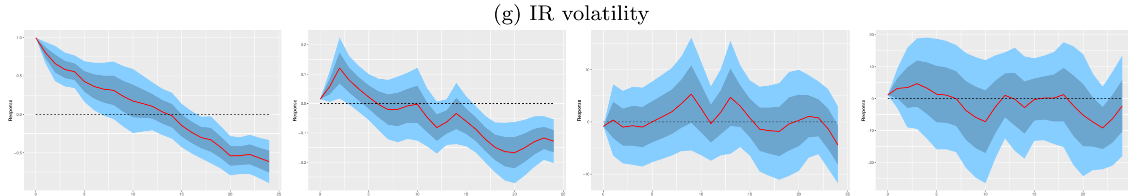
(e) GDP growth volatility



(f) Inflation volatility



(g) IR volatility



(h) TRY/USD volatility

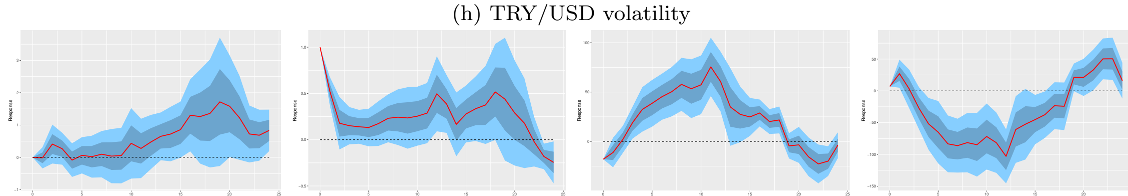


Figure 6: **Orthogonalized impulse responses for the disagreement model**

The graphs show different orthogonalized impulse responses based on local projections for the disagreement model. Ex ante forecast disagreement is proxied by the standard deviation of 12-month-ahead forecasts across forecasters for each variable and the disagreement model includes 9 variables: Turkish GDP growth disagreement, Turkish inflation disagreement, US GDP growth disagreement, US inflation disagreement, Turkish short-term interest rate disagreement, US short-term interest rate disagreement, TRY/USD exchange rate disagreement, realized percentage change of the TRY/USD exchange rate, and realized MSCI stock market returns for Turkey. Realized exchange rate changes and stock market returns are computed for a horizon of 12 months. The reaction is represented by the solid red line and the corresponding 95% (68%) confidence bands by blue (dark blue) shadings. The dashed black line displays the zero line. The impulses are one standard deviation shocks of the variables given in rows (e), (f), (g), and (h) and the response variables are given in columns (a), (b), (c), and (d). IR stands for 3-month interest rate.

(a) IR disagreement (b) TRY/USD disagreement (c) TRY/USD return (d) Stock return

(e) GDP growth disagreement

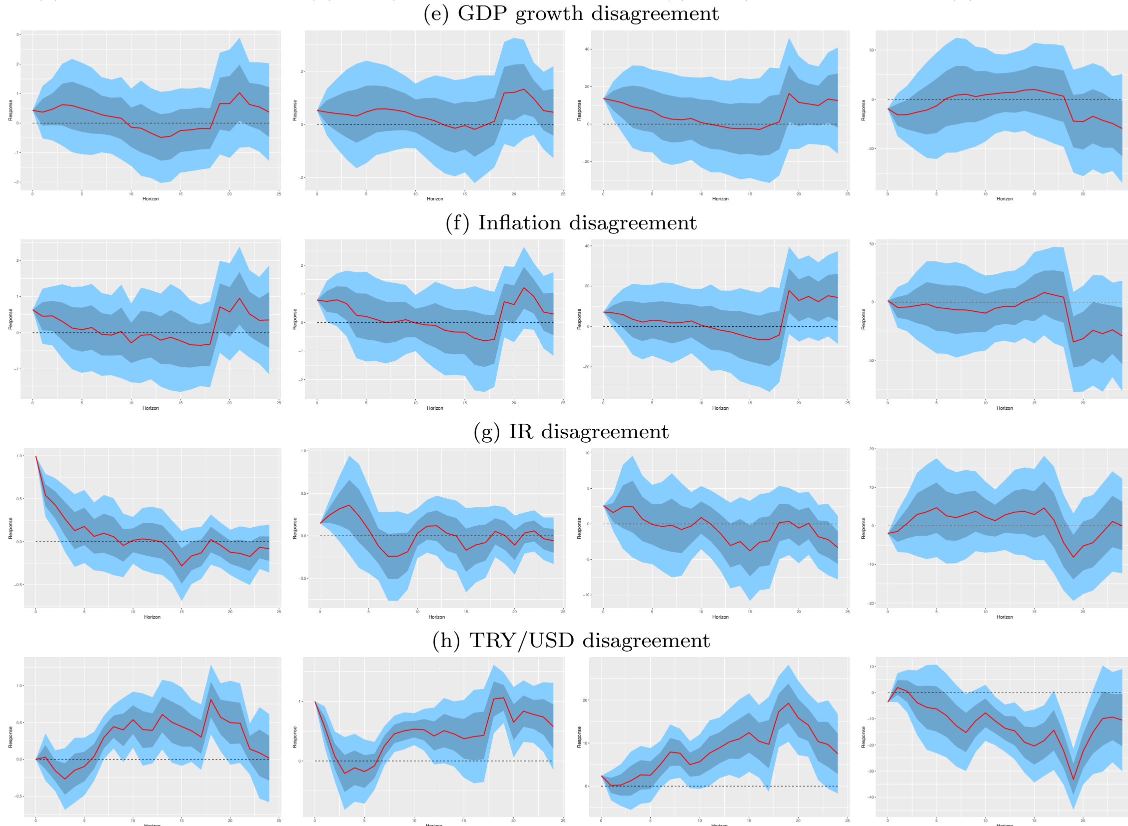
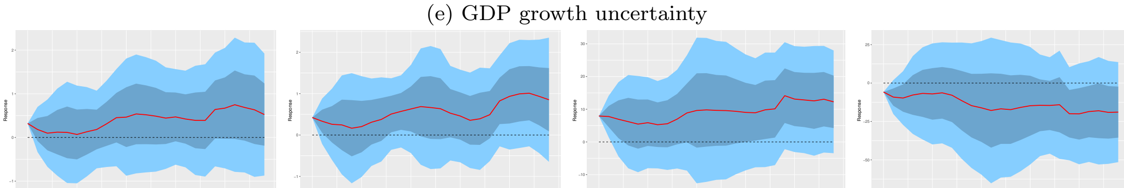


Figure 7: **Orthogonalized impulse responses for the domestic uncertainty model**

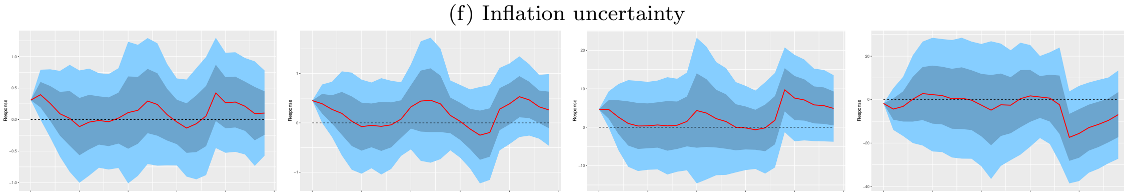
The graphs show different orthogonalized impulse responses based on local projections for the domestic uncertainty model. Uncertainty is proxied by the sum of ex post mean forecast error volatility and ex ante forecast disagreement for 12-month-ahead forecasts for each variable and the model includes only 6 variables: Turkish GDP growth uncertainty, Turkish inflation uncertainty, Turkish short-term interest rate uncertainty, TRY/USD exchange rate uncertainty, realized percentage change of the TRY/USD exchange rate, and realized MSCI stock market returns for Turkey. Realized exchange rate changes and stock market returns are computed for a horizon of 12 months. The reaction is represented by the solid red line and the corresponding 95% (68%) confidence bands by blue (dark blue) shadings. The dashed black line displays the zero line. The impulses are one standard deviation shocks of the variables given in rows (e), (f), (g), and (h) and the response variables are given in columns (a), (b), (c), and (d). IR stands for 3-month interest rate.

(a) IR uncertainty (b) TRY/USD uncertainty (c) TRY/USD return (d) Stock return

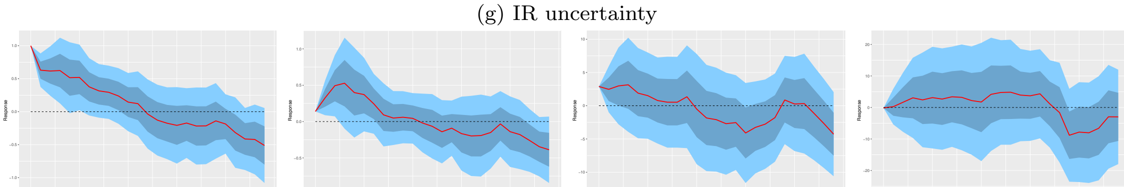
(e) GDP growth uncertainty



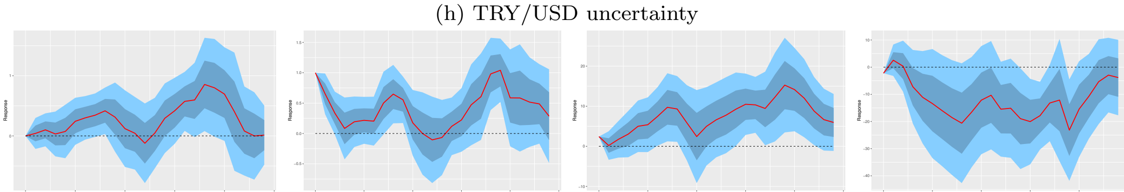
(f) Inflation uncertainty



(g) IR uncertainty



(h) TRY/USD uncertainty



Appendix

Table A.1: **Augmented Dickey-Fuller test results**

	ADF statistic	**Lags**	**Model**
$E_t(i_{t+12})$	-2.8554*	3	constant
$\sigma_t(i_{t+12})$	-3.7815***	1	constant
$E_t(\pi_{t+12})$	-3.4800**	1	trend
$\sigma_t(\pi_{t+12})$	-3.4578**	3	constant
$E_t(\Delta y_{t+12})$	-4.1251***	3	constant
$\sigma_t(\Delta y_{t+12})$	-3.3329**	1	constant
$E_t(s_{t+12})$	-1.1740	2	trend
$\sigma_t(s_{t+12})$	-1.9145	6	trend

Note: The table reports test statistics for the Augmented Dickey-Fuller (ADF) test, which tests the null of a unit root. $E_t(.)$ denotes the mean 12-month-ahead forecasts across forecasters made in t, $\sigma_t(.)$ represents the corresponding standard deviation of 12-month-ahead forecasts across forecasters, i_t stands for the 3-month interest rate, π_t represents the inflation rate, Δy_t denotes GDP growth, and s_t is the TRY/USD exchange rate. Each test regression includes a constant. For the time series showing a trending pattern such as inflation expectations ($E_t(\pi_{t+12})$) as well as exchange rate expectations and disagreement ($E_t(s_{t+12})$ and $\sigma_t(s_{t+12})$, respectively), we also include a trend regressor. The lag length of the endogenous variable in the test regression has been selected by minimization of the Akaike information criterion based on a maximum lag length of 12 months. ***/**/* indicates a rejection at the 1%/5%/10% significance level.

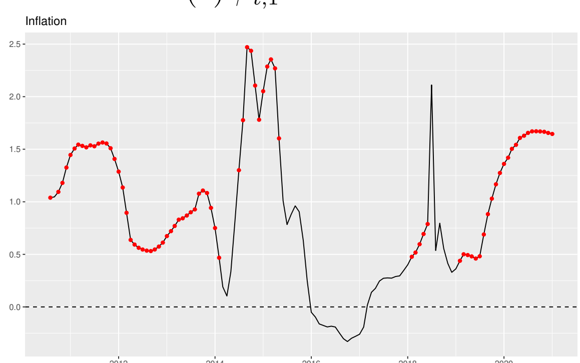
Figure A.1: **Rolling-window Taylor rule forecast mean regressions (window size = 40)**

The graphs visualize rolling-window ordinary least squares (OLS) coefficient estimates and R^2s for the following regression model

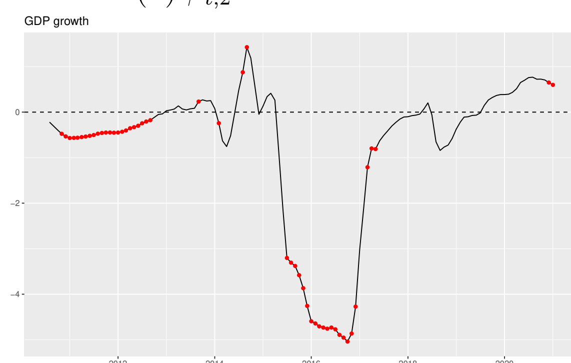
$$E_t(i_{t+12}) = \beta_{t,0} + \beta_{t,1}E_t(\pi_{t+12}) + \beta_{t,2}E_t(\Delta y_{t+12}) + \beta_{t,3}E_t(s_{t+12}) + \varepsilon_{t+12},$$

where $E_t(.)$ denotes the mean 12-month-ahead forecasts across forecasters made in t, i_t stands for the 3-month interest rate, π_t represents the inflation rate, Δy_t denotes GDP growth, and s_t is the TRY/USD exchange rate. Panels (a), (b), and (c) report OLS estimates for $\beta_{t,i}$ for $i = 1, 2, 3$ plotted over time t. The window size is 40 months. Red dots represent coefficient estimates, which are significantly different from zero at a 5% level. Panel (d) displays the R^2 of the regressions.

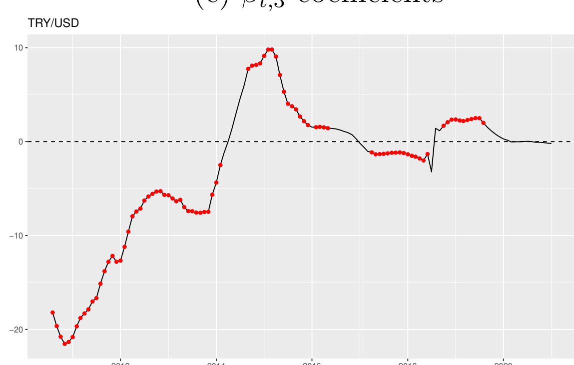
(a) $\beta_{t,1}$ coefficients



(b) $\beta_{t,2}$ coefficients



(c) $\beta_{t,3}$ coefficients



(d) R^2

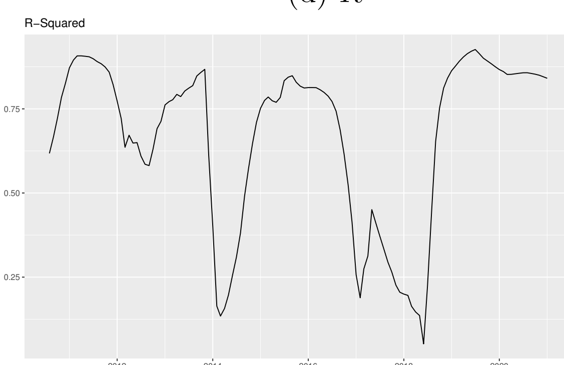


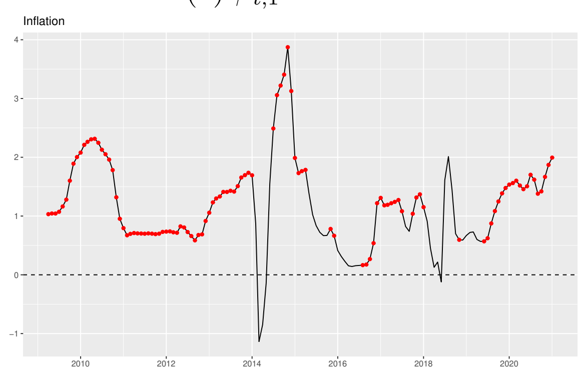
Figure A.2: **Rolling-window Taylor rule forecast mean regressions (window size = 24)**

The graphs visualize rolling-window ordinary least squares (OLS) coefficient estimates and R^2s for the following regression model

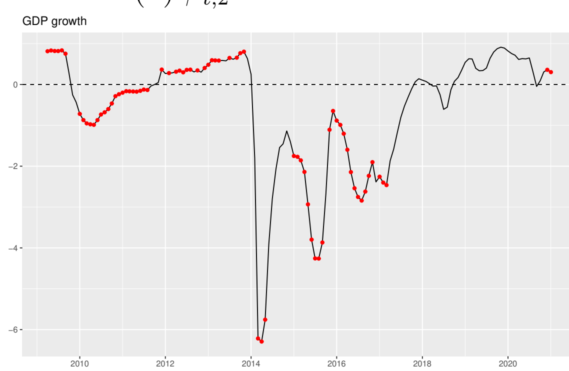
$$E_t(i_{t+12}) = \beta_{t,0} + \beta_{t,1}E_t(\pi_{t+12}) + \beta_{t,2}E_t(\Delta y_{t+12}) + \beta_{t,3}E_t(s_{t+12}) + \varepsilon_{t+12},$$

where $E_t(.)$ denotes the mean 12-month-ahead forecasts across forecasters made in t, i_t stands for the 3-month interest rate, π_t represents the inflation rate, Δy_t denotes GDP growth, and s_t is the TRY/USD exchange rate. Panels (a), (b), and (c) report OLS estimates for $\beta_{t,i}$ for $i = 1, 2, 3$ plotted over time t. The window size is 24 months. Red dots represent coefficient estimates, which are significantly different from zero at a 5% level. Panel (d) displays the R^2 of the regressions.

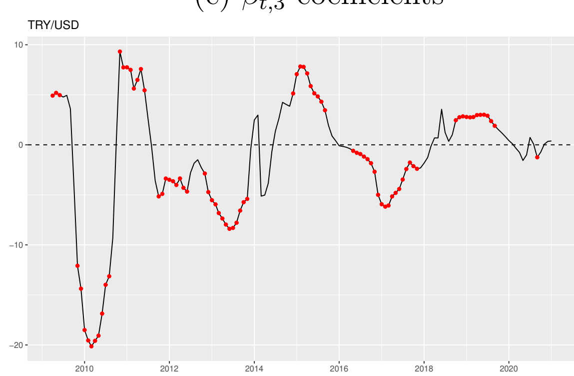
(a) $\beta_{t,1}$ coefficients



(b) $\beta_{t,2}$ coefficients



(c) $\beta_{t,3}$ coefficients



(d) R^2

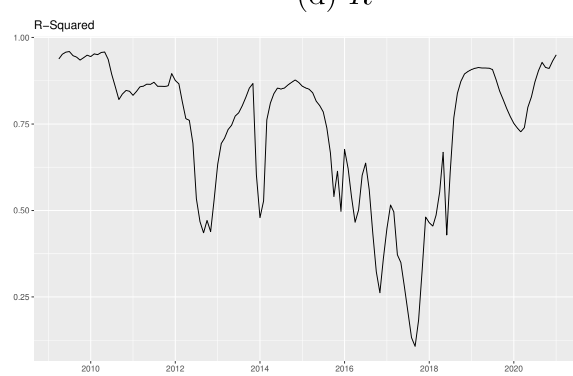


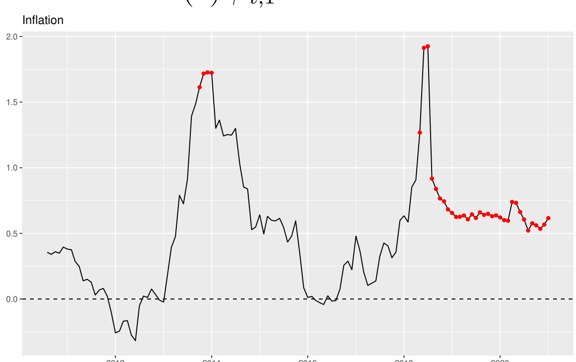
Figure A.3: **Rolling-window Taylor rule forecast disagreement regressions (window size = 40)**

The graphs visualize rolling-window ordinary least squares (OLS) coefficient estimates and R^2s for the following regression model

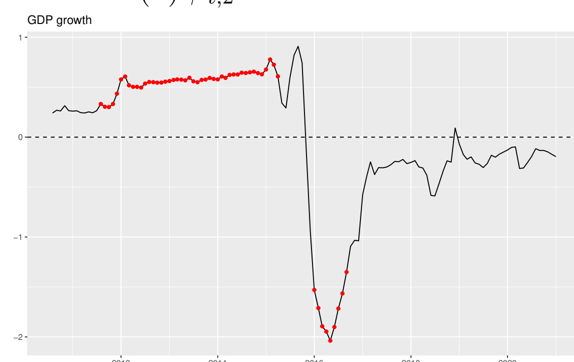
$$\sigma_t(i_{t+12}) = \beta_{t,0} + \beta_{t,1}\sigma_t(\pi_{t+12}) + \beta_{t,2}\sigma_t(\Delta y_{t+12}) + \beta_{t,3}\sigma_t(s_{t+12}) + \varepsilon_{t+12},$$

where $\sigma_t(.)$ denotes the standard deviation of 12-month-ahead forecasts across forecasters made in t, i_t stands for the 3-month interest rate, π_t represents the inflation rate, Δy_t denotes GDP growth, and s_t is the TRY/USD exchange rate. Panels (a), (b), and (c) report OLS estimates for $\beta_{t,i}$ for $i = 1, 2, 3$ plotted over time t. The window size is 40 months. Red dots represent coefficient estimates, which are significantly different from zero at a 5% level. Panel (d) displays the R^2 of the regressions.

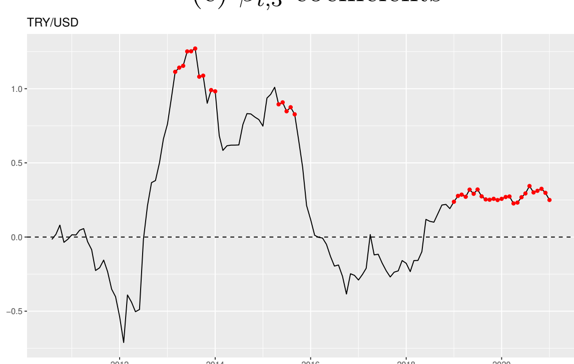
(a) $\beta_{t,1}$ coefficients



(b) $\beta_{t,2}$ coefficients



(c) $\beta_{t,3}$ coefficients



(d) R^2

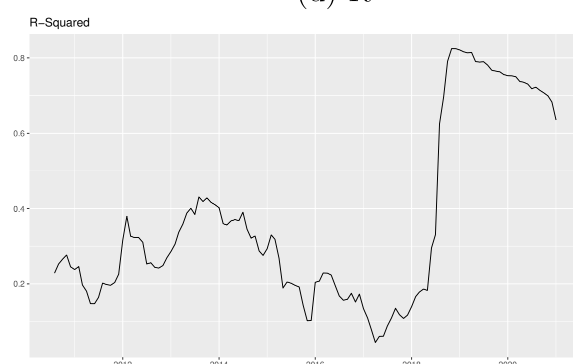


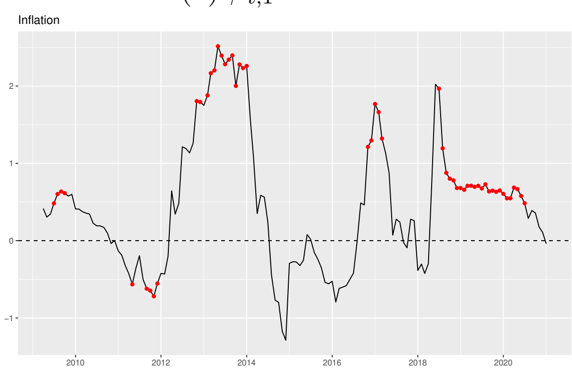
Figure A.4: **Rolling-window Taylor rule forecast disagreement regressions (window size = 24)**

The graphs visualize rolling-window ordinary least squares (OLS) coefficient estimates and R^2s for the following regression model

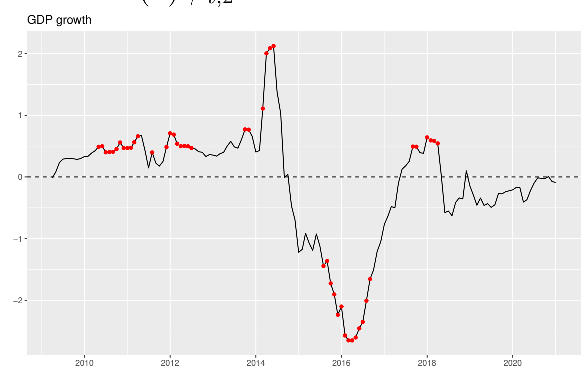
$$\sigma_t(i_{t+12}) = \beta_{t,0} + \beta_{t,1}\sigma_t(\pi_{t+12}) + \beta_{t,2}\sigma_t(\Delta y_{t+12}) + \beta_{t,3}\sigma_t(s_{t+12}) + \varepsilon_{t+12},$$

where $\sigma_t(.)$ denotes the standard deviation of 12-month-ahead forecasts across forecasters made in t, i_t stands for the 3-month interest rate, π_t represents the inflation rate, Δy_t denotes GDP growth, and s_t is the TRY/USD exchange rate. Panels (a), (b), and (c) report OLS estimates for $\beta_{t,i}$ for $i = 1, 2, 3$ plotted over time t. The window size is 24 months. Red dots represent coefficient estimates, which are significantly different from zero at a 5% level. Panel (d) displays the R^2 of the regressions.

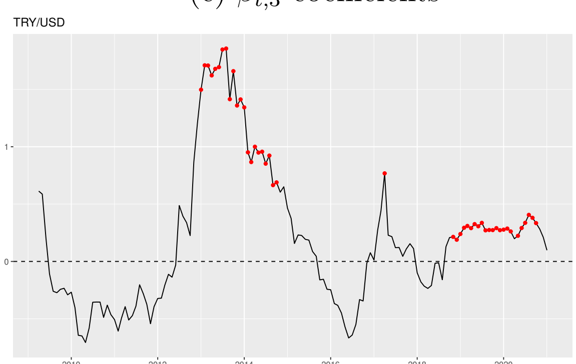
(a) $\beta_{t,1}$ coefficients



(b) $\beta_{t,2}$ coefficients



(c) $\beta_{t,3}$ coefficients



(d) R^2