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The Scapegoat Theory of Exchange Rates: The First Tests*

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Abstract

The scapegoat theory of exchange rates (Bacchetta and van Wincoop 2004, 2013) suggests that market participants may attach excessive weight to individual economic fundamentals, which are picked as “scapegoats” to rationalize observed currency fluctuations at times when exchange rates are driven by unobservable shocks. Using novel survey data that directly measure foreign exchange scapegoats for 12 exchange rates, we find empirical evidence that supports the scapegoat theory. The resulting models explain a large fraction of the variation and directional changes in exchange rates in sample, although their out-of-sample forecasting performance is mixed.

Keywords: scapegoat; exchange rates; economic fundamentals; survey data.

JEL Classification: F31; G10.

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1 Introduction

A central conjecture of the work by Meese and Rogoff (1983a,b, 1988) is that the presence of time-varying parameters may be a key explanation for the failure of exchange rate models to predict future currency movements. Furthermore, time-varying parameters may not only help explain the weak out-of-sample predictive power of exchange rate models, but also the ex-post instability in the relationship between exchange rates and macroeconomic fundamentals, as pointed out by a growing literature. For example, Sarno and Valente (2009) show empirically that the relevance of information contained in fundamentals changes frequently over time, while in a survey of US foreign exchange (FX) traders Cheung and Chinn (2001) document that the importance attached by traders to different fundamentals changes over time.

Bacchetta and van Wincoop (BvW, 2004, 2013) propose a scapegoat theory to explain the weakness of and instability in the relationship between exchange rates and fundamentals. The scapegoat theory suggests that this instability is not explained by frequent and large changes in structural parameters, but rather by *expectations* about these structural parameters.¹ The scapegoat theory starts from the premise that, even though agents may have a fairly accurate idea about the relationship between fundamentals and exchange rates in the long run, there is substantial uncertainty about the structural parameters over the short to medium term. This implies that when currency movements over the short to medium term are inconsistent with their priors about the underlying structural relationships, agents search for scapegoats to account for these inconsistencies. Such currency movements may be driven by unobservable fundamentals, yet for agents it is rational to assign additional weight to some observable fundamentals, thus making them scapegoats for exchange rate changes.

In fact, there is ample anecdotal evidence – as illustrated in the quote below – that financial market participants blame individual fundamentals for exchange rate movements, with such blame often shifting across different fundamentals over time:

“The FX market sometimes seems like a serial monogamist. It concentrates on one issue at a time, but the issue is replaced frequently. Dollar weakness and US policy have captured its heart. But uncertainties are being resolved ... The market may move back to an earlier love ...” [Financial Times, November 8, 2010]

The scapegoat theory entails that a particular macroeconomic variable is more likely to become a scapegoat the larger the (unexplained) FX rate movement *and* the more this particular fundamental is out of line with its long-run equilibrium. Over the short run, both the scapegoat fundamental as well as the unobservable fundamental may thus help explain FX movements. BvW (2009, 2013) also calibrate their model for five currencies of industrialized countries, using monetary fundamentals, to investigate its ability to match the moments of macro variables and exchange rates.

The present paper constitutes - to our knowledge - the first empirical test of the scapegoat theory of exchange rates. An important difficulty in designing an empirical test in this context involves finding a suitable proxy for the weight assigned to individual economic fundamentals by market participants (needed to identify scapegoats), and a proxy for the unobservable fundamental. This is made possible by exploiting novel data on FX scapegoats from surveys of a broad set of investors, as well as FX order flow to proxy unobservable exchange rate determinants.²

Exchange rate scapegoats stem from monthly surveys of 40-60 financial market participants, who are asked to rate on a quantitative scale the importance of six key variables (short-term interest rates, long-term interest rates, growth, inflation, current account, and equity flows) as drivers of a country’s exchange rate *vis-a-vis* its reference currency.³ This survey data allows us to extract quantitative scapegoat measures for each of these six fundamentals over time and across currencies. It is also worth noting that real-time data, taken from the OECD, is used for all these time series. Further, FX order flow data proxies for unobservable factors driving exchange rates since order flow contains information that is not public given the over-the-counter institutional features of the FX market and is empirically powerful in explaining exchange rate movements, as documented in a vast literature on FX microstructure (e.g. Evans, 2010). The order flow series are constructed from high-frequency data obtained from the Reuters electronic trading platform D2000-2 on special order.⁴ The empirical estimations are conducted for 12

¹In fact, Bacchetta, van Wincoop and Beutler (2010) show that allowing for time-varying structural parameters has only a small effect on the predictive power of fundamentals for exchange rates.

²This paper may thus be seen as a companion paper to the theory of BvW (2009, 2013) and their calibration exercises in that we test empirically, rather than calibrate, the scapegoat model by using data on FX scapegoats.

³Specifically, with the exception of the current account all variables are measured as differentials relative to the country of the reference currency. The reference currency is mostly the US dollar.

⁴Reuters is one of the two major FX dealing platforms and Evans and Lyons (2002) were the first to use Reuters order

51 exchange rates over the period 2000-2011, using data at monthly frequency.

52 The test of the scapegoat theory of exchange rates rests on two main hypotheses. The first hypothesis
53 inherent in the theory is that the inclusion of scapegoats (surveys) improves the power of fundamentals
54 to explain exchange rate movements. We test this hypothesis by examining two specifications of the
55 scapegoat model: one based on constant parameters following BvW (2013), and (a more general) one
56 based on time-varying parameters as in the earlier version of BvW (2009). Although the unobservable
57 fundamental is essential for the presence of scapegoat effects, simplified versions of the scapegoat models
58 without our proxy are also estimated in order to evaluate the marginal contribution of the scapegoats
59 versus the unobservable fundamental (order flow). Specifically, the following four models with constant
60 parameters are estimated: a model that conditions only on macroeconomic variables (CP-M), which is
61 tested against a model that conditions on scapegoats in addition to the same macroeconomic variables
62 (CP-MS); a model that conditions on both macroeconomic variables and order flow (CP-MO), which
63 is tested against a model that conditions on the scapegoats in addition to the same macro and order
64 flow information (CP-SCA). The same four specifications, termed TVP-M, TVP-MS, TVP-MO and
65 TVP-SCA, are then estimated allowing for time-varying parameters with Bayesian updating. Finally,
66 the models are evaluated on several criteria – based on the adjusted R^2 , root mean squared errors,
67 information criteria, and market-timing (directional accuracy) tests.

68 Starting from the scapegoat models with constant parameters, the empirical analysis provides strong
69 empirical evidence that these models generally outperform their respective benchmark models, i.e. the
70 scapegoats add explanatory power to macroeconomic and order flow information. There is even stronger
71 evidence supporting scapegoat effects when looking at the more general scapegoat model with time-
72 varying parameters (TVP-SCA), which performs better than all alternative models across all performance
73 criteria. Moreover, the magnitude of the improvement in the performance of TVP-SCA over the other
74 models is substantial, leading to – on average across currencies – a hit ratio of correctly explained
75 directional FX changes of about 75 percent and an adjusted R^2 of about 36 percent.

76 To shed light on the relative contribution of scapegoat effects and order flow, it is useful to note that
77 the adjusted R^2 for the scapegoat exchange rate model that does not include order flow can be as high
78 as 30 percent. This suggests that the use of scapegoat variables *per se* can be sufficient to capture a
79 substantial fraction of the unstable relationship between fundamentals and exchange rates, especially for
80 models with time-varying parameters. Thus, the improvement in explanatory power of the scapegoat
81 model does not only stem from the inclusion of the order flow variable, but also from the scapegoat
82 parameters themselves.

83 Although the focus of the paper is on testing the direct implications of the scapegoat theory of
84 exchange rates, we also carry out an out-of-sample exchange rate forecasting exercise by using the same
85 set of models and lagging the conditioning information to move from contemporaneous to one-month-
86 ahead forecasting regressions. Moreover, at this point the driftless random walk benchmark is also
87 added to the horse race since the random walk is the most common benchmark in the FX forecasting
88 literature (see Rossi, 2013, and the references therein). The results suggest that the out-of-sample
89 forecasts produced by the scapegoat models are not better than a random walk using some statistical
90 criteria (e.g. root mean squared errors), but strongly beat the random walk in terms economic metrics
91 of forecast evaluation (e.g. Sharpe ratios).

92 The second hypothesis of the scapegoat theory relates to the determinants of the scapegoat factors
93 themselves, and the question about which macroeconomic fundamental becomes a scapegoat, and at
94 which point in time. The scapegoat theory states that a macro fundamental may become a scapegoat if
95 there is a sizable shock to the unobservable fundamental, and at the same time the size of the deviation
96 of the macro fundamental from its equilibrium is large and theoretically consistent with the observed
97 direction of change in the exchange rate. Indeed this hypothesis is supported by our empirical analysis.
98 Specifically, a macroeconomic fundamental is picked and identified by market participants as a scapegoat
99 at times when (i) the unobservable fundamental experiences a large shock, (ii) the observable fundamental
100 tends to show a large deviation from its long-term equilibrium, and (iii) moves in a direction that is
101 consistent with the observed movement in the exchange rate.

102 Finally, a key insight of BvW (2009) is that the derivative of the exchange rate with respect to the
103 fundamentals is disconnected from the true underlying structural parameters in the short to medium
104 term. In particular, this effect takes place when a macro fundamental receives an unusually large weight,

flow data for FX analysis. Electronic brokers have become the preferred means of settling trades, and 50–70% of turnover is settled through the two main electronic platforms, Reuters and Electronic Brokerage System (EBS). The relative size of Reuters versus EBS varies across currencies, but Reuters generally dominates EBS for all currencies except the euro, the Japanese yen, and the Swiss franc.

105 and therefore is made the scapegoat for exchange rate changes. However, as a result of the investors’
 106 learning process, the expectation of the structural parameter should converge to the structural parameter
 107 in the long run. Our estimates support this prediction of the scapegoat theory: the expectation of the
 108 structural parameter converges toward the structural parameter as the scapegoat effect wears off.

109 Overall, the empirical evidence provides strong support in favor of the scapegoat theory of exchange
 110 rates. The findings of the various tests are mutually consistent and suggest that the high degree of
 111 instability in the relationship between exchange rates and fundamentals can be largely explained by the
 112 presence of scapegoats. In turn, this suggests that a more accurate understanding of exchange rates is
 113 achieved by taking into account the role of scapegoat factors, and their time-varying nature.

114 The rest of the paper is organized as follows. Section 2 outlines the main elements of the scapegoat
 115 theory of exchange rates, and describes its testable empirical implications. Section 3 describes the data
 116 used for the empirical analysis. The empirical findings are then presented in Section 4, going through
 117 the two hypotheses outlined above. Section 5 concludes.

118 2 Scapegoat theory and hypotheses

119 The essence of the scapegoat theory of exchange rates is that at times some macroeconomic factors receive
 120 an unusually large weight and thus are made scapegoats of exchange rate movements. This scapegoat
 121 effect arises because of agents’ “rational confusion” as they make inference on the true parameters of
 122 the model only conditioning on observable fundamentals and exchange rate movements at times when
 123 the exchange rate is instead driven by unobservables (e.g. large order flows).⁵ Thus, when exchange
 124 rates move strongly in response to unobservables, it is rational for agents to blame factors that they can
 125 actually observe, and more precisely those macro fundamentals that are out of sync from their longer
 126 term equilibrium values and move consistently with observed exchange rates. This scapegoat effect can
 127 generate an unstable relationship between exchange rates and macro fundamentals, driven mainly by
 128 the expectation of the structural parameters and not by the structural parameters themselves. The next
 129 section describes such effects, and then introduces the main hypotheses for the empirical test of the
 130 scapegoat theory of exchange rates.

131 2.1 The scapegoat model of exchange rates

132 BvW describe the scapegoat effect in a series of papers (2004, 2009, 2013). These papers differ for
 133 several reasons, but they have the same central theme. Specifically, BvW (2004) assume that agents have
 134 heterogeneous information, whereas BvW (2009, 2013) develop a dynamic model where the exchange
 135 rate is forward looking and depends on expectations of future fundamentals. BvW (2009) examine the
 136 case where parameters are unknown and *time-varying*, whereas BvW (2013) show that the scapegoat
 137 effect can arise also with unknown and *constant* parameters. In practice, there are many ways in which
 138 parameter uncertainty can be generated. What is crucial to generate a scapegoat effect, however, is the
 139 uncertainty of the structural parameters attached to fundamentals, combined with the role of unobserved
 140 fundamentals: put simply, agents do not know the coefficients of the model and do not observe one of
 141 the fundamentals.

142 It is useful to start by presenting the key equation describing the scapegoat effect when parameters
 143 are constant but unknown. Then, the more general case with time-varying parameters is described.
 144 Starting with a standard present-value equation for the exchange rate (e.g. Engel and West, 2005), BvW
 145 (2009, 2013) derive the following equation:

$$146 \Delta s_t \cong \mathbf{f}'_t((1 - \lambda)\beta + \lambda E_t\beta) + (1 - \lambda)b_t, \quad (1)$$

147 where s_t is the log nominal exchange rate (the foreign price of the domestic currency), $\mathbf{f}_t = (f_{1,t}, f_{2,t}, \dots, f_{N,t})'$
 148 is a vector of N observed macro fundamentals (in first differences), $\beta = (\beta_1, \beta_2, \dots, \beta_N)'$ is the vector
 149 of true structural parameters, $E_t\beta$ is the vector of expected structural parameters, b_t is the unobserved
 150 fundamental, and λ is the discount factor ($0 < \lambda < 1$).⁶ Thus, the true structural parameters β are
 151 constant but are unknown to investors, who learn over time about β through observing the exchange
 152 rate and the macro fundamentals. Precisely, each period t they observe the signal $\mathbf{f}_t\beta + b_t$. However,

⁵In this paper the words agents and investors are used interchangeably.

⁶Note that, although BvW’s (2013) scapegoat model is presented for the exchange rate level, it also holds in first differences (see BvW, 2009, eq. 8). This paper follows the specification in first differences given that exchange rates are highly persistent variables and the focus is on modeling empirically their fluctuations rather than the exchange rate level.

153 both the parameters β and the fundamental b_t are unknown to them. As a result, although they can
 154 eventually learn about the structural parameters, this can only happen *slowly* over time.

155 Equation (1) also shows that the fundamentals \mathbf{f}_t are multiplied by a weighted average of actual and
 156 expected parameters. However, since the discount factor λ is close to unity (see Engel and West, 2005;
 157 Sarno and Sojli, 2009), higher weights are attached to the expected values of the parameters rather than
 158 the actual values. Moreover, even though the parameters themselves are constant, the expectations of
 159 the parameters can change substantially over time. Precisely, the impact of macro fundamentals on the
 160 exchange rate in the scapegoat model can be formulated as:

$$161 \quad \frac{\partial \Delta s_t}{\partial f_{n,t}} \cong (1 - \lambda)\beta_n + \lambda E_t \beta_n + \lambda \mathbf{f}'_t \frac{\partial E_t \beta}{\partial f_{n,t}}. \quad (2)$$

162 Interestingly, equation (2) shows that the derivative of the exchange rate with respect to the fundamentals
 163 not only depends on the expectation of the structural parameters, but also on the derivative of the
 164 expected structural parameters with respect to the fundamentals. The latter term reflects a transitory
 165 effect which can generate high-frequency fluctuations, which complement the short- to medium-term
 166 deviations generated by variations in the expectation of the structural parameters. As a result, the
 167 uncertainty about the parameters can determine transitory fluctuations in the exchange rate and induce
 168 instability in the model.

169 BvW (2013) show that the scapegoat effect can exist even if the true structural parameters are
 170 constant. By contrast, when making the more realistic assumption that structural parameters vary over
 171 time, BvW (2009) derive the following equation for exchange rate changes:

$$172 \quad \Delta s_t = \mathbf{f}'_t((1 - \lambda)\beta_t + \lambda E_t \beta_t) + (1 - \lambda)b_t + \lambda \sum_{i=1}^T \mathbf{f}'_{t-i} (E_t \beta_{t-i} - E_{t-1} \beta_{t-i}), \quad (3)$$

173 where $\beta_t = (\beta_{1,t}, \beta_{2,t}, \dots, \beta_{N,t})'$ is the vector of time-varying true structural parameters, and $E_t \beta_t =$
 174 $(E_t \beta_{1,t}, E_t \beta_{2,t}, \dots, E_t \beta_{N,t})'$ is the vector of expected parameters at time t . The true structural param-
 175 eters β_t now vary over time but are, again, unknown to investors. While investors may know the value
 176 of these structural parameters over the long run, they do not know their value and time variation in the
 177 short to medium term. For this reason, some observable macro fundamentals may at times be given an
 178 “excessive” weight by investors over the short term. This fundamental then becomes a natural scapegoat
 179 and influences the trading strategies of investors. As a result, in equation (3), changes in expectations
 180 of structural parameters directly determine changes in the exchange rate.

181 It is now possible to state the empirical hypotheses to test this scapegoat theory. The first research
 182 hypothesis is that scapegoat effects are empirically powerful in explaining exchange rate movements.
 183 In order to test this hypothesis, we estimate specifications of the scapegoat model of exchange rates
 184 both with constant and time-varying parameters, and evaluate them against benchmark models that
 185 do not allow for scapegoats. Our second main hypothesis relates to the determinants of the scapegoat
 186 parameters $E_t \beta_t$. The papers by BvW (2009, 2013) show that a particular macro fundamental is more
 187 likely to become a scapegoat when there are large shocks to the unobservable b_t and this fundamental
 188 is out of sync with its longer term equilibrium value. The empirical test for this hypothesis is discussed
 189 below.

190 2.2 Empirical scapegoat model with constant parameters

191 The first scapegoat regression model with constant parameters is the empirical counterpart to equation
 192 (1) and is written as follows:

$$193 \quad CP - SCA : \Delta s_t = \mathbf{f}'_t \beta + (\tau_t \mathbf{f}_t)' \gamma + \delta x_t + u_t, \quad (4)$$

194 where τ_t is the vector of scapegoat parameters $E_t \beta$. The latter is identified by using survey data, and the
 195 theoretical unobserved fundamental b_t is proxied by FX order flow x_t ; the measurement of both τ_t and x_t
 196 is described in detail in Section 3. The scapegoat model requires γ to be non-zero and correctly signed,
 197 although for some variables the interpretation of the sign is not clear-cut (e.g. equity flows). Moreover,
 198 the parameters γ and β should be consistent with each other, and the order flow parameter δ should be
 199 negative, implying that buying pressure for the foreign currency is associated with a depreciation of the
 200 domestic currency (Evans and Lyons, 2002).

201 The second model estimated is a simplified version of CP-SCA:

$$CP - MS : \Delta s_t = \mathbf{f}_t' \beta + (\tau_t \mathbf{f}_t)' \gamma + u_t, \quad (5)$$

where the unobserved fundamental (x_t) is now absent from the conditioning information set, and is therefore captured in the error term. This model specification is important as it allows us to gauge the relative contribution of the scapegoats versus the unobservable fundamental.

An important issue is how to benchmark the scapegoat models to assess their explanatory power. The benchmark models are chosen so that in each comparison the only difference between the benchmark and the scapegoat model is that the latter allows for scapegoat effects. A natural candidate to benchmark CP-MS is a macro fundamental model with constant and known parameters, consistent with the present-value model of exchange rates (Mark, 1995; Engel and West, 2005; Engel, Mark and West, 2008). This model takes the form:

$$CP - M : \Delta s_t = \mathbf{f}_t' \beta + u_t. \quad (6)$$

However, when evaluating the explanatory ability of CP-SCA, which includes both the scapegoat variables and the unobserved fundamental (proxied by order flow), it is reasonable to ask how much of the additional explanatory power stems from the scapegoat variables and how much from order flow. Therefore, CP-SCA is evaluated against a benchmark model, termed CP-MO, which augments CP-M with order flow:

$$CP - MO : \Delta s_t = \mathbf{f}_t' \beta + \delta x_t + u_t. \quad (7)$$

In sum, the test of the scapegoat model rests on the comparison of the empirical estimation of model (4) with the benchmark model (7), and of model (5) with the benchmark model (6), using several metrics of evaluation.

2.3 Empirical scapegoat model with time-varying parameters

The more general specification estimated is the empirical counterpart to equation (3):

$$TVP - SCA : \Delta s_t = \mathbf{f}_t' \beta_t + (\tau_t \mathbf{f}_t)' \gamma + \delta x_t + u_t, \quad (8)$$

where the structural parameters are now time-varying, and τ_t denotes the vector of scapegoat parameter $E_t \beta_t$.⁷ A simplified version of equation (3) that excludes the unobservable fundamental from the conditioning information set is also considered:

$$TVP - MS : \Delta s_t = \mathbf{f}_t' \beta_t + (\tau_t \mathbf{f}_t)' \gamma + u_t. \quad (9)$$

Defining n as a generic macro variable, consider the case where each structural parameter $\beta_{n,t}$ evolves as a driftless random walk, $\beta_{n,t} = \beta_{n,t-1} + v_{n,t}$, which is common in the relevant literature (e.g. see Cogley and Sargent, 2002; Primiceri, 2005; Rossi, 2005; BvW, 2009). Assuming homoskedastic errors and uncorrelated factors, \mathbf{v}_t is a vector of normally distributed error terms with zero mean and diagonal covariance matrix \mathbf{Q} . Both these assumptions can be relaxed, and are not crucial to our analysis.

Appropriate benchmarks for our time-varying parameter scapegoat models also need to be models that account for parameter instability, which may be rationalized on a number of grounds (e.g. see Schinasi and Swamy, 1989; Rossi, 2005, 2006; Mark, 2009; Sarno and Valente, 2009). Following the same logic outlined in the previous section for constant parameter models, the following benchmark specifications are used to assess time-varying scapegoat models:

$$TVP - M : \Delta s_t = \mathbf{f}_t' \beta_t + u_t \quad (10)$$

$$TVP - MO : \Delta s_t = \mathbf{f}_t' \beta_t + \delta x_t + u_t. \quad (11)$$

Specifically, the analysis uses TVP-M as benchmark against TVP-MS, and TVP-MO as benchmark against TVP-SCA, so that in each comparison the difference between the benchmark and the scapegoat

⁷Note that the last term in equation (3), which captures the change in the expectations of past parameters interacted with past fundamentals, is missing from equation (8) as data on current and lagged expectations of past parameters are hard to measure empirically. This means that the additional channel whereby current fundamentals lead to changes in the expectation of both current and past parameters is neglected. Thus, if the hypothesis holds for the simplified model it should hold more strongly if one were also to include the last term.

242 model is solely due to the scapegoat variables. Note that all the benchmark models in equations (6),
243 (7), (10) and (11) assume that parameters are known to the investors and therefore are not scapegoat
244 models. However, the benchmark models (10) and (11) also allow parameters to vary over time. From
245 an econometric point of view our empirical scapegoat models require estimation of both time-varying
246 parameters (β_t) and time-invariant parameters (γ and δ). All empirical exchange rate models are esti-
247 mated using Bayesian methods, following e.g. Kim and Nelson (1999) and Cogley and Sargent (2002,
248 2005).⁸

249 3 Data

250 This section first describes the data used for the scapegoats and economic fundamentals, it then presents
251 the order flow data, providing a discussion on why order flow can be interpreted as the unobservable
252 fundamental.

253 3.1 Scapegoats and fundamentals

254 A novel dataset is used to measure when and which fundamentals are used as scapegoats for exchange
255 rate movements by financial market participants. The aim is to extract a quantitative measure of the
256 importance that investors attach to different macroeconomic fundamentals to explain exchange rates at
257 a particular point in time.

258 The data is based on the cross-sectional average, at every point in time, of surveys involving 40-60
259 FX market participants from major financial institutions (mostly asset managers) conducted monthly by
260 Consensus Economics. These market participants reside in many different locations globally, though the
261 majority is located in the US, the UK and other advanced economies. The participants are asked to “rank
262 the current importance of a range of different factors in determining exchange rate movements” for each
263 of a broad set of currencies bilaterally *vis-a-vis* a reference currency, which mostly is the US dollar except
264 for some European currencies for which the euro is the reference currency. More precisely, participants
265 are asked to rank six macroeconomic factors on a scale from 0 (no influence) to 10 (very strong influence).
266 The six variables are short- and long-term interest rates, growth, inflation, trade/current account, and
267 equity flows. The survey explicitly stresses that the weights should be for the variables relative to those
268 of the country of the reference currency.⁹

269 Consensus Economics conducts the surveys every month, with the same financial market participants
270 wherever possible. However, Consensus Economics conducts several surveys on exchange rates with
271 these market participants (e.g. on short-term forecasts, longer-term forecasts, expected trading ranges,
272 and market uncertainty), and alternates across these surveys throughout the year. This means that
273 the surveys about FX scapegoats are conducted only between every 3 to 6 months, though at regular
274 intervals over the years. The data for missing months are interpolated so as to arrive at a dataset with
275 monthly observations. This is done by assigning the last available survey values to the months for which
276 the survey is not conducted. In this way only information available to the investor at any point in time
277 is used.¹⁰

278 Overall, the survey data on FX scapegoats are available over a 12-year period (2000-2011) for a
279 sample of 12 currencies, 6 being currencies of advanced countries (Australian dollar, Canadian dollar,
280 euro, Japanese yen, Swiss franc, and UK pound) and 6 less industrialized and emerging market (EM)
281 currencies (Czech koruna, Mexican peso, Polish zloty, South African rand, Singaporean dollar, and New
282 Zealand dollar). Note that all exchange rates are defined with respect to the US dollar, except for the
283 Swiss franc, the Czech koruna and the Polish zloty, which are defined with respect to the euro.

284 Tables I and II in the Internet Appendix show summary statistics about the scapegoat surveys (raw
285 and interpolated, respectively) for the 12 currencies in our sample. A first interesting fact is that the
286 six macro variables have mostly similar means and standard deviations across all 12 currencies and
287 over time. A somewhat higher mean is recorded for short-term interest rates, and a somewhat lower

⁸The use of Bayesian methods in this context is particularly appropriate given our relatively small number of observations and the persistence of the fundamentals, which are known to complicate statistical inference in exchange rate regressions. Markov Chain Monte Carlo (MCMC) methods are used to simulate draws from the posterior distribution, under diffuse priors. The MCMC algorithm is described in detail in the Internet Appendix.

⁹Of course, the six macro fundamentals at our disposal only comprise a subset of the macro variables potentially relevant for FX rates (see Andersen, Bollerslev, Diebold and Vega, 2003). However, the variables in the survey are all standard in the literature on exchange rate determination.

¹⁰The results were qualitatively and quantitatively similar when experimenting with a simple linear interpolation and a Kalman filter smoother, and when using quarterly rather than monthly data.

288 mean for inflation as scapegoat. Also, interest rates (especially short-term) and inflation have been the
289 dominant scapegoats, in the sense that they have been more frequently considered by investors as the
290 main scapegoats. Figure 1 also shows the time variation of the scapegoat factors for some advanced and
291 EM currencies, which is useful to illustrate how the weights investors attach to macro fundamentals can
292 change substantially over time, and the main scapegoat changes fairly frequently.

293 The monthly scapegoat data are then matched with the real-time data on macroeconomic fundamen-
294 tals for these six variables. To obtain monthly data, the trade balance is used instead of the current
295 account, and industrial production is used as a measure of output to proxy GDP. The data source for
296 the real-time macro series is the OECD's *Main Economic Indicators*, where it is possible to track both
297 data for original release (i.e. in real time) and final release for all the countries examined.¹¹ Specifically,
298 real time data are used for growth, inflation and trade balance. Then, interest rate and equity flow data
299 are obtained from the IMF's *International Financial Statistics*. Note that, although equity flow data
300 are not revised, they are published with a lag. To control for this, the final release equity flow data
301 are lagged. Using data in real time implies that only information that was available historically at a
302 particular point in time is used, allowing therefore both for measurement errors and release delays that
303 affect macroeconomic data.¹² To be as consistent as possible with the surveys, actual macroeconomic
304 fundamentals are calculated relative to those of the country of the reference currency.

305 A final point concerns the exchange rate data. Given the survey questions, it is preferable to use
306 nominal bilateral exchange rate changes *vis-a-vis* the reference currency, in the benchmark specification
307 using changes over the past month. Exchange rates (expressed as the foreign price of the reference
308 currency) are downloaded from *Datastream*.¹³

309 3.2 Order flow

310 The other important data for the empirical test of the scapegoat theory of exchange rates is on order
311 flow, defined as the net of buyer- and seller-initiated FX transactions for the foreign currency. BvW's
312 papers stress the key role of unobservables, in particular unobservable trades, as drivers of exchange
313 rates. FX order flow is used as a proxy for unobservable factors.

314 Data on bilateral order flow is *vis-a-vis* the reference currency over the period from January 2000 to
315 November 2011. The order flow data are created based on tick-by-tick data from the Reuters electronic
316 trading platform D2000-2. To match the order flow data to the scapegoat data, the order flow is
317 aggregated over the previous month. Table IV provides some summary statistics of the order flow series
318 for each of the 12 currencies in our sample, indicating that order flow fluctuates considerably over time.¹⁴

319 The FX market is an opaque market with little regulations, like e.g. disclosure requirements seen in
320 other asset markets. Trading is organized in two main segments: (i) the customer-bank segment where
321 end-user customers trade with banks, and (ii) the interdealer segment where banks trade with each
322 other. Trades in the customer-bank segment are only observed by the two parties involved. Since dealers
323 typically do not accumulate large inventory of currency, the trading in the interdealer market is then a
324 derivative of the trading with customers. This interdealer order flow is not easily available to end-user
325 customers like investors. Moreover, dealers typically only observe this order flow at very high frequency.
326 Further analysis of this order flow requires both expensive subscriptions and calculations based on large
327 amounts of data, since Reuters does not provide data on aggregate order flow. In practice this amounts
328 to aggregate order flow being unobservable.¹⁵

329 Evans and Lyons (2002) first documented that order flow explains a substantial proportion of the
330 fluctuations in two major exchange rates. In their setting, order flow is derived from a customer portfolio
331 shift independent of the current state of the economy, and as such closely resembles the unobservable

¹¹For Australia and New Zealand, however, only quarterly data are available for output and hence the data are interpo-
lated by using the latest value available until a new data point is released. Note also that real time data for Singapore are
not available. As a result, it is not possible to control for the data revisions. However, the final release data are lagged to
account for the delay at which macro data are released.

¹²Several researchers have used real-time data for exchange rate models (e.g. Sarno and Valente, 2009; Molodstova,
Nikolsko-Rzhevskyy and Papell, 2011).

¹³Table III presents summary statistics for the macro fundamentals with all variables, except the current account, being
measured relative to the reference currency. Table IV presents exchange rate summary statistics.

¹⁴Specifically, daily data are constructed from tick data and include the most active part of the trading day between
7:00 and 17:00 GMT. In addition, weekends and holidays are excluded. Order flow is measured as the aggregated difference
between the number of buyer-initiated and seller-initiated transactions; positive (negative) order flow implies net purchases
(sales) of the foreign currency. The daily order flow data are then aggregated to the monthly frequency.

¹⁵In essence, utilization of this data first requires a special order and authorization to download tick data via a live feed.
Then it is necessary to aggregate the data from tick frequency to generate signed daily order flow data, from which data
at lower frequency can finally be derived.

332 fundamental suggested in BvW (2004, 2006, 2009, 2013). Such a portfolio shift can in principle also be
333 linked to shifts in preferences and risk premia.

334 Subsequent papers have further investigated the possible drivers of order flow. Evans (2010) and
335 Evans and Lyons (2013) study how order flow reflects and aggregates information at the micro level
336 (e.g. from firms and households), hence capturing information on macroeconomic fundamentals not yet
337 observable in real time. Consistent with such a view, Rime, Sarno and Sojli (2010) find that order flow is
338 linked to updates in expectations about the macroeconomy. Similarly, Dominguez and Panthaki (2006),
339 Berger, Chaboud, Chernenko, Howorka and Wright (2008), Love and Payne (2008) and Evans and Lyons
340 (2008) have linked the information content of order flow to macroeconomic news.¹⁶ Finally, it seems
341 reasonable that order flow also captures information about (shocks to) liquidity and risk-aversion which
342 are not observable in real time; for example, one would expect that demand for riskier, high-interest
343 rate currencies drops at times of lower market liquidity and higher risk-aversion. Indeed in Kyle's (1985)
344 model, which has inspired much of the subsequent theory in equity and FX microstructure, the impact
345 of order flow on asset returns also depends on liquidity.

346 A key point is, however, that irrespective of the source giving rise to order flow, this creates a change
347 in exchange rates that is not immediately understandable for investors since order flow is not public
348 information. This is the underlying assumption in all the cases above, regardless of the specific source
349 of information that generates order flow.

350 4 Empirical results

351 This section describes the core empirical results. The focus is on the empirical model specifications
352 outlined above, with the six macro fundamentals available in the scapegoat survey data: growth, inflation,
353 short-term interest rate, long-term interest rate, current account, and equity flows. All these variables,
354 except the current account, are computed as differential with respect to the domestic variable.

355 Before turning to the estimation results, it is important to explain how the observed fundamentals
356 are chosen. Each regression includes only three macro fundamentals. The ideal would be to use all the
357 six macro fundamentals, so that each of the six observable variables has a chance of being selected as
358 the scapegoat by investors. However, the use of too many fundamentals would make the estimation
359 unfeasible (in particular when the parameters are time-varying). Thus, the attention is restricted to
360 only three fundamentals, which are allowed to be country specific, using the general-to-specific model
361 selection procedure of Hendry and Krolzig (2005). Precisely, the general unrestricted model is specified
362 as:

$$363 \Delta s_t = \gamma_1 \tau_{1,t} f_{1,t} + \dots + \gamma_6 \tau_{6,t} f_{6,t} + u_t, \quad (12)$$

364 whereby changes in the exchange rate (Δs_t) are related to the second term of equation (8). By applying
365 this general-to-specific model selection in order to produce an operational model, regression (12) is
366 implicitly used to pre-screen the scapegoats, reducing the number of potential scapegoats from six to
367 three.¹⁷

368 Table 1 summarizes the estimates of the model with constant parameters (CP-M in equation (6)).
369 The table contains point estimates and one-standard deviation Bayesian confidence intervals (in squared
370 brackets). Moreover, Table 1 also shows the set of variables selected by the general-to-specific method
371 for each country. Inflation and short-term interest rate differentials are the most frequently selected
372 scapegoats for industrialized countries, whereas growth is only chosen for the Japanese yen. By contrast,
373 there is less dominance of any specific scapegoats for EM countries, where short- and long-term interest
374 rates are each selected four times, inflation and growth three times, equity flows twice, and the current
375 account once.

¹⁶As Lyons (2001) describes very intuitively: "The observable relevant information is transmitted to exchange rates without any trading having to take place, while the macroeconomic part of order flow [...] represents the part that is unobservable and hence possible to trade upon."

¹⁷General-to-specific modeling has relatively low search costs, and there is accumulating evidence on its satisfactory performance (Campos, Ericsson, and Hendry, 2005). Hoover and Perez (1999) first showed that automated general-to-specific model selection procedures display sufficiently high power to detect many of the models hidden in very general unrestricted models. Hendry and Krolzig (2003) have then improved on the algorithm developed by Hoover and Perez (1999) in what has become the econometrics software package of PcGets. The Hendry and Krolzig algorithm is used to perform the general-to-specific procedure starting from the general unrestricted model (12) and excluding sequentially the variable associated with the lowest p -value, calculated to allow for multiple search paths as described in Hendry and Krolzig (2005). The procedure is repeated sequentially for each exchange rate until the three most significant variables are identified.

376 We proceed column-by-column, thus interpreting the coefficient of each macro fundamental in turn.
377 Growth has the expected negative (and statistically significant) coefficient for all four exchange rates
378 where it is selected as a scapegoat, so that the currency of the faster growing country appreciates.
379 In general, the foreign currency appreciates when inflation rises, with a couple of exceptions – the
380 Polish zloty and the Mexican peso, although in the latter case the coefficient is tiny and statistically
381 insignificant. The majority of the loadings on interest rate differentials are negative, implying that higher
382 interest rates are generally associated with an appreciation of the currency. Moreover, a current account
383 deficit is associated with a weaker currency in each case. Finally, with the only exception of the Canadian
384 dollar, as equity inflows in the domestic country rise relative to the inflows in the foreign country, the
385 domestic currency depreciates.¹⁸

386 Table 2 presents the estimates of the coefficients (β , γ and δ) of the scapegoat model with constant
387 parameters (CP-SCA in equation (4)). If the expectation of the structural parameters matters for the
388 exchange rate due to scapegoat effects, γ must be statistically different from zero. Also, defining n as a
389 generic macro variable, γ_n should intensify the effect of the true parameter β_n so that it should take the
390 same sign as the structural parameter. Overall, γ and β are strongly significant over both the country
391 and variable dimensions (with only one exception), and that the γ coefficients intensify the effect of the β
392 coefficients (i.e. they have the same sign). These results are consistent with the benchmark macro model
393 with constant parameters. Another comforting finding is the existence of a close link between monthly
394 exchange rate movements and order flow, so that net buying pressure for a currency is associated with its
395 appreciation. This result confirms that unobservable fundamentals, proxied by order flow, exert a strong
396 effect on exchange rates. This is a necessary condition for the scapegoat effect to exist, as outlined in
397 Section 2.

398 However, as also discussed in Section 2, the comparison between CP-SCA and CP-M does not make
399 clear the relative contribution of the scapegoats and order flow. Therefore, two additional models are
400 also estimated. Specifically, we estimate a simplified version of the scapegoat model that does not include
401 order flow (CP-MS in equation (5)). This model is essentially the same as CP-M augmented with the
402 surveys, hence helping us establish the importance of scapegoats in the absence of order flow information.
403 Table V in the Internet Appendix presents results for CP-MS, showing no qualitative difference worth
404 noting with respect to CP-SCA, regarding both the sign and significance of the coefficient estimates.
405 Finally, to conclude the estimation of constant parameter models, a model that augments CP-M with
406 order flow, namely CP-MO in equation (7), is also considered. Again, there are not major qualitative
407 differences relative to CP-SCA in that order flow always enters the regression with the correct sign and
408 is statistically significant (see Table VI in the Internet Appendix).

409 Table 3 presents the estimates of γ and δ for the scapegoat model with time-varying parameters (TVP-
410 SCA in equation (8)). For scapegoat effects to exist, also in this case γ and δ should be statistically
411 different from zero. Consistently, the results show that the γ coefficients are generally significant over
412 both the country and variable dimensions. The existence of a close link between exchange rate movements
413 and order flow is also confirmed as δ is statistically significantly different from zero. Table VII in the
414 Internet Appendix reports results for TVP-MS. Similar to the constant parameter case, there are no
415 substantial differences with TVP-SCA. Thus, one can conclude that also for the time-varying parameter
416 models there is evidence in support of the basic predictions of the scapegoat model in terms of statistical
417 significance of γ and δ .¹⁹

418 4.1 In-sample fit of scapegoat models

419 The first hypothesis of the scapegoat theory, as formulated in Section 2, is that scapegoat effects are
420 empirically powerful in explaining exchange rate movements. This requires that the scapegoat models
421 (with constant and time-varying parameters) perform satisfactorily in fitting exchange rate fluctuations,
422 and outperform the respective benchmark models, i.e. CP-MS and TVP-MS outperform CP-M and TVP-
423 M respectively, and CP-SCA and TVP-SCA outperform CP-MO and TVP-MO respectively. These model
424 comparisons should inform us about both the explanatory power of the scapegoat model for exchange
425 rate changes and the relative importance of scapegoat information (surveys) versus order flow. In this
426 sub-section, we present evidence on the statistical performance of the scapegoat models relative to the
427 benchmark models, using several conventional criteria of model evaluation – the (adjusted) R^2 , root

¹⁸This sign is consistent with the general equilibrium model of Hau and Rey (2006), and hence likely due to FX hedging demand when investors' portfolios become more exposed to FX risk.

¹⁹Estimations of $TVP - M$ and $TVP - MO$ are not reported, but their in-sample performance is evaluated alongside the scapegoat models later in this section.

mean square error, information criteria, and market timing tests. We first review the results for the case of constant parameter models, and we then turn to the more general case of time-varying parameters.

Table 4 presents the results for the models with constant parameters. In general, the first result worth noting is that the explanatory power of the scapegoat model CP-SCA is much larger than that of any other model considered. For some currencies the order of improvement is remarkable: we move from explaining very little of the variation in exchange rate changes to explaining a much larger proportion (e.g. the CP-SCA adjusted R^2 s are close to, or above, 30% for 7 out of 12 exchange rates). Then, by comparing the scapegoat model, CP-SCA with CP-MO, which includes macro and order flow information but not the surveys, it is possible to isolate the marginal contribution of order flow to the goodness of fit of the model. The comparison of adjusted R^2 between these two models reveals that CP-SCA always improves over CP-MO with the improvement ranging from 1-2% to about 8%, although CP-MO is typically the second best model in the horse race. Similarly, the comparison of CP-MS with CP-M, neither of which incorporates order flow information, reveals that the surveys add substantial explanatory power to a model that only conditions on macroeconomic information. In essence, the results suggest that the surveys (scapegoats) are powerful in explaining exchange rate fluctuations and allow us to improve over a macro model, and that it is important to include the unobserved fundamental (order flow) for the scapegoat model to *substantially* outperform the benchmark macro model.

In addition to the adjusted R^2 , Table 4 reports the root mean squared error (RMSE), two information criteria – the Bayesian information criterion (BIC) and the Akaike information criterion (AIC) – and two tests of market timing. In general, the RMSE and information criteria confirm the results of the R^2 , although there are isolated exceptions.

With respect to market timing tests, Table 4 reports the ‘hit’ ratio (HR) – calculated as the proportion of times the sign of the fitted value correctly matches the one of the realized change in the exchange rate – and the Henriksson and Merton (HM, 1981) test.²⁰ The hit ratios show that for most countries CP-SCA is the best performing exchange rate model, with CP-MO the second best model. For example, the HR is as high as 76% for the South African rand and the euro. Also, the performance of CP-MS is generally higher than CP-M. These findings, in terms of pecking order of the models, are largely corroborated by the results of the regression-based HM test. The φ_1^{HM} coefficient for the scapegoat model (CP-SCA) is the highest for most countries and generally strongly statistically significant. Overall, the stronger performance of the scapegoat model with constant parameters is fairly clear-cut for a number of currencies when looking at the adjusted R^2 , information criteria and market-timing tests. That said, it is also evident that the inclusion of the order flow variable is important to generate such superior performance, confirming the evidence reported in much empirical microstructure research.

The results for the time-varying parameter models are reported in Table 5. The results corroborate (and strengthen) the earlier finding that the scapegoat model (now TVP-SCA) outperforms all other models. Moreover, the pecking order is generally respected, as TVP-SCA outperforms TVP-MO, which is superior to TVP-MS, which in turn outperforms TVP-M. The results are particularly clear-cut for the adjusted R^2 , the RMSE and the information criteria, whereas the market timing tests display some exceptions. In sum, a fairly clear result emerges: the scapegoat model generally yields the best performance, and both scapegoats and order flow information are important in driving this result, consistent with the scapegoat theory of BvW (2004, 2013).

4.2 When does a fundamental become a scapegoat?

The focus now turns to the second hypothesis of the scapegoat theory as formulated in Section 2. Specifically, the test investigates whether the scapegoat $\tau_{n,t}$ is related to the joint evolution of macro fundamentals and unobservable fundamentals. This is an important question as episodes of rational confusion can only arise, according to the theory, when there are large shocks to the unobservable fundamental. During these episodes it becomes rational for agents to blame factors they can actually observe *and* that fit the outcome. Furthermore, among those observable factors, investors will tend to blame those that are out of sync with their longer term equilibrium value. Fundamentals that can catch the investors’ attention by deviating from longer-term values, *and* are theoretically consistent with the change in the exchange rate, can create a scapegoat effect if the change due to unobservable factors is sufficiently surprising, i.e. large.

²⁰The HM test is asymptotically equivalent to a one-tailed test on the significance of the slope coefficient in the following regression: $I_{\{\Delta s_t > 0\}} = \varphi_0^{HM} + \varphi_1^{HM} I_{\{\widetilde{\Delta s}_t > 0\}} + \varepsilon_t$, where Δs_t , $\widetilde{\Delta s}_t$ denote the realized and fitted exchange rate returns, respectively; and $I_{\{\cdot\}}$ is the indicator function that takes the value of 1 when its argument is true and 0 otherwise. A positive and significant φ_1^{HM} provides evidence of market timing.

480 For instance, take output growth as example. Higher output growth should lead to an appreciation
481 of the exchange rate. Now imagine that as a result of large order flow there is a sharp appreciation of
482 the domestic currency. At the same time domestic output growth happens to be below its long-run level,
483 or even negative. In this case, output growth clearly cannot explain the appreciation. There would have
484 to be strong positive output growth to explain the appreciation. The theory implies that in this case
485 output growth cannot be the scapegoat of the exchange rate.

486 For this reason, it is first important to check whether on average large changes in a macro fundamental,
487 at times when order flow also displays large shocks, are theoretically consistent with directional changes
488 in the exchange rate. The test is based on the following panel regression of the exchange rate on order
489 flow interacted with a macro factor:

$$490 \Delta s_t = \alpha_0 + \alpha_1 (-x_t \times f_{n,t}) I_{\{f_{n,t}, x_t^q\}} + u_t, \quad (13)$$

491 where order flow is taken with the minus sign so that the expected sign of the parameter α_1 should be the
492 one expected from regressing the exchange rate on the fundamental.²¹ Order flow and the fundamental
493 are selected for different quantiles; precisely our focus is on the top 20, 30 and 40 percent of observations.
494 However, a particular observation is selected only if both the fundamental and order flow have experienced
495 a sufficiently large shock, i.e. they fall in their respective quantiles. Thus, $I_{\{f_{n,t}, x_t^q\}}$ takes the value of
496 1 if $f_{n,t}$ and x_t are respectively in their top q percent of observations.²² As mentioned above, this is
497 a necessary condition for the fundamental to become a scapegoat. Moreover, to some extent, the sign
498 of the regression is also important, as it informs us whether the movement of the exchange rate is on
499 average theoretically consistent with the movement in order flow and the fundamental.²³

500 Table 6 provides some support to the scapegoat theory, as the signs of the statistically significant
501 coefficients are theoretically consistent. Specifically, three of the scapegoats considered have statistically
502 significant coefficients. For example, output growth and the current account have the expected negative
503 sign so that positive output growth and a current account surplus are both associated with an appreciation
504 of the exchange rate, when there is also strong net buying pressure for the currency. Output growth
505 is statistically significant for particularly large values in the top 20 percent of observations, while the
506 current account is especially strongly significant for the top 30 and 40 percent of observations. Moreover,
507 the long-term interest rate differential enters with a negative coefficient, so that higher interest rates
508 are associated with an appreciation of the currency, and is strongly statistically significant for all of the
509 quantiles considered.

510 So far only the first leg of our second hypothesis has been tested. The focus now turns to the
511 second part of the test, where it emerges that the survey weight indeed rises (i.e. a variable becomes a
512 scapegoat) when large changes to the fundamental are associated with a large shock to the unobservable.
513 In particular, what follows relates the scapegoat weight of a macro variable to the absolute value of the
514 interaction between the macro factor itself and order flow. For simplicity, the analysis assumes that only
515 one macro factor is a scapegoat at any one point in time. Take again the example of output growth: only
516 those observations for which market participants attach a high weight to output growth relative to the
517 other macro fundamentals are selected. Therefore, the indicator function excludes those observations for
518 which output growth is not selected as a scapegoat by the investor, i.e. when the value of the survey on
519 output growth is relatively low. Thus, our empirical test is based on the panel regression:

$$520 \tau_{n,t} = \zeta_0 + \zeta_1 |x_t \times f_{n,t}| I_{\{\tau_{n,t} > \tau_{j,t}\}} I_{\{f_{n,t}, x_t^q\}} + \varepsilon_t, \quad (14)$$

521 where the indicator function $I_{\{f_{n,t}, x_t^q\}}$, consistent with Table 6, takes the value of 1 if at time t both $f_{n,t}$
522 and x_t are in the top q percent of observations, whereas $I_{\{\tau_{n,t} > \tau_{j,t}\}}$ takes the value of 1 if the survey on
523 the macro factor n exceeds the values of the remaining two macro factors $j \neq n$ at each time t . Equation
524 (14) closely follows the model of BvW (2009, 2013), where the expectation of the structural parameter
525 at time t is determined by the weighted average of time $t - 1$ expectation of the structural parameter
526 and the structural parameter itself, plus a term similar to our $(x_t \times f_{n,t})$. In the theory, this last term

²¹Assume that the fundamental has a positive average impact on the exchange rate. Order flow has a negative impact. In this case negative order flow combined with a positive fundamental (or positive order flow with a negative fundamental) should make the variable a scapegoat. So we simply regress the exchange rate on minus the product of order flow times the fundamental. Therefore, the sign of the regression should be the same as expected from regressing the exchange rate on the fundamental.

²²These regressions are performed in panel (across all currencies for one macro variable at a time) to increase estimation accuracy as the use of the quantiles, combined with the indicator function, substantially reduces the number of observations.

²³That said, different theories may sometimes conflict over the sign to attach to a particular variable.

527 reflects the scapegoat effect.²⁴

528 Table 7 presents the regression results. The parameter ζ_1 takes the expected positive sign for all
 529 fundamentals and quantiles, and is strongly statistically significant for five of the macro variables con-
 530 sidered at all quantiles (the exception being the long-term interest rate). This result suggests that $\tau_{n,t}$
 531 acts indeed as a scapegoat parameter as it consistently increases when both macro fundamentals and
 532 order flows become large in absolute value. Table 7 also shows that this statistical relation is strong for
 533 all fundamentals, with the R^2 reaching 79 percent for the regression using equity flows.

534 In sum, taken together, the two legs of the test give support to the scapegoat theory, indicating
 535 not only that scapegoat effects are powerful in enhancing the empirical performance of exchange rate
 536 models, but also that these effects arise when large unobservable shocks move the exchange rate and the
 537 scapegoat experiences a large value, consistent with the theory.

538 While the above results are clear-cut, it is worth recalling that they depend on the validity of the
 539 assumption that order flow is a suitable proxy for the unobservable fundamental. As discussed earlier,
 540 the microstructure literature provides different interpretations of the information in order flow, which can
 541 reflect information both at the micro and macro level as well as variation in risk aversion and liquidity in
 542 financial markets. Irrespective of its underlying drivers, order flow generates a change in exchange rates
 543 that is not understandable for investors since order flow is not publicly observed, hence being a logical
 544 proxy for the unobserved fundamental in the scapegoat theory. However, future research is warranted to
 545 test the theory using alternative proxies for the unobserved fundamental or using latent factors.

546 4.3 Learning in the long run

547 A key insight of the BvW (2009) theory is that the derivative of the exchange rate with respect to the
 548 fundamentals – recall equation (2) – can be disconnected from the true underlying structural parameters
 549 in the short to medium term. In particular, this effect takes place when a macro fundamental receives
 550 an unusually large weight, and therefore is made the scapegoat for exchange rate changes. However, as
 551 a result of the investors’ learning process, the expectation of the structural parameter should converge
 552 to the structural parameter in the long run. This implies that the evolution of $E_t\beta_{n,t}$ and the evolution
 553 of $\beta_{n,t}$ should be linked in the limit. Specifically, $E_t\beta_{n,t}$ should tend to $\beta_{n,t}$ when the scapegoat effect
 554 wears off.

555 This hypothesis can be analyzed by using our estimates from TVP-SCA. Specifically, this is done by
 556 estimating the following model:

$$557 \Delta \widehat{E}_t \widehat{\beta}_{n,t} = b_0 + b_1 (\widehat{E}_{t-1} \widehat{\beta}_{n,t-1} - \widehat{\beta}_{n,t-1}) + b_2 (\widehat{E}_{t-1} \widehat{\beta}_{n,t-1} - \widehat{\beta}_{n,t-1}) I_{\{\Delta \tau_{n,t} < 0\}} + \varepsilon_{n,t}. \quad (15)$$

558 where n refers to a macro variable (e.g. growth); $\widehat{\beta}_{n,t-1}$ is the estimated time-varying structural pa-
 559 rameter; $\widehat{E}_t \widehat{\beta}_{n,t} = \widehat{\gamma}_n \tau_{n,t}$, where $\widehat{\gamma}_n$ is the estimated scapegoat parameter presented in Table 8 and $\tau_{n,t}$
 560 is the survey; and $I_{\{\Delta \tau_{n,t} < 0\}}$ is an indicator function which takes the value of 1 for negative changes
 561 in the survey ($\Delta \tau_{n,t} < 0$), and 0 otherwise. The scapegoat theory suggests that $E_t \beta_{n,t}$ tends to $\beta_{n,t}$
 562 only when the scapegoat effect wears off, i.e. investors attach less weight to the fundamental. Hence,
 563 one would expect that $b_1 + b_2 < 0$, so that the model is stable and $E_t \beta_{n,t}$ corrects towards its long-run
 564 equilibrium, which is determined by $\beta_{n,t}$. In contrast, no correction should take place otherwise, so that
 565 $b_1 \geq 0$. A positive value of b_1 tells us that $E_t \beta_{n,t}$ does not converge to $\beta_{n,t}$ or may even diverge from
 566 $\beta_{n,t}$, consistent with a scapegoat effect taking place.

567 Table 8 presents the estimation results. There is strong evidence supporting the hypothesis that as the
 568 scapegoat effect wears off the expectation of the structural parameter converges towards the structural
 569 parameter. In fact, for all fundamentals $b_1 + b_2$ is negative and statistically significant, generally at the
 570 1 percent significance level. Of interest is also that b_1 is positive, with the only exception of growth,
 571 indicating that when the survey increases, or is stable, no learning is taking place and the expectation
 572 of the structural parameter may diverge from the true parameter.

573 4.4 Out-of-sample forecasting and the random walk

574 Much empirical research has tested the usefulness of exchange rate theories by evaluating models in out-
 575 of-sample forecasting. Therefore, an out-of-sample forecasting exercise is carried out as an additional

²⁴The weighted average instead reflects the rather slow speed of learning, as agents attach higher weight to the past expectation of the structural parameter than the structural parameter itself.

576 and final piece of empirical evidence on the performance of the scapegoat model, although the theory is
577 silent on the role of scapegoats for forecasting.

578 Among the many lessons from the line of research on forecasting exchange rates, it is worth noting two:
579 i) the driftless random walk model is a logical and hard benchmark to beat in out-of-sample forecasting;
580 ii) the results are mixed in that forecasting ability varies depending on the macro variables used and
581 the metric of evaluation adopted when comparing exchange rate models to the random walk (e.g. Rossi,
582 2013). Therefore, the analysis below considers the driftless random walk as an additional model and
583 uses it as benchmark for the tests of forecast accuracy, while relying on different metrics of evaluation –
584 statistical and economic – to check the sensitivity of the results to the metric chosen.

585 The forecasting setup is the following. All models are estimated using data up to December 2006,
586 and then out-of-sample recursive forecasts are produced for the period from January 2007 to November
587 2011.²⁵ The variable selection is repeated each month, as described in Section 4. One-month-ahead
588 forecasts are then generated based on the predictive specifications of the following models: the constant
589 parameter macro model (CP-M), the survey model (CP-MS), the order flow augmented macro model
590 (CP-MO), and the scapegoat model (CP-SCA).²⁶ These models are assessed against the driftless random
591 walk model (RW). Then, model comparison is based on the following statistics: the ratio of the root
592 mean squared forecast error (RMSFER) from a model over that of the RW; the hit ratio (HR); the
593 Henriksson-Merton test (HM); and measures of economic values that are summarized in the Sharpe
594 ratio.²⁷ The Sharpe ratio is simply the outcome of a trading strategy that goes long in the currency
595 that the model predicts will appreciate, and short in the currency predicted to depreciate by the model,
596 for each exchange rate considered. Hence, the Sharpe ratio provides a direct measure of the economic
597 value of the scapegoat model, and can be compared and tested against the Sharpe ratio generated by
598 the benchmark RW model to check whether any difference in economic value relative to the RW is
599 statistically different from zero.

600 The forecasting results are reported in Table VIII of the Internet Appendix for each exchange rate,
601 while Table 9 provides a summary of the results by reporting average statistics across the 12 exchange
602 rates considered. Starting from the ratio of the RMSFER of a model relative to the RW benchmark,
603 one can see that such ratio is generally bigger than unity, meaning that the RW produces lower forecast
604 errors.

605 Turning to the hit ratios, it is apparent that the scapegoat model generally produces the most accurate
606 forecasts in terms of directional accuracy, being above the 50 percent accuracy that would be implied by
607 a random directional forecast. On average across exchange rates, the directional accuracy of CP-SCA
608 is 54.82 percent (specifically, 54.09 and 55.56 percent for industrialized and EM countries, respectively).
609 This is confirmed by the inspection of the HM tests as the largest coefficients in the HM regressions are
610 recorded for CP-SCA. However, there is no evidence of statistical significance, possibly (presumably)
611 because of low test power due to our small sample of out-of-sample observations (59). Nevertheless, the
612 directional accuracy tests suggest that currency trading strategies based on the scapegoat model might
613 generate economic value higher than RW forecasts.

614 Therefore, it is worth examining the results from the Sharpe ratios produced by long-short strategies
615 that invest in the currency predicted to appreciate and short the currency predicted to depreciate accord-
616 ing to the model. These results are clear-cut. First, several models outperform the RW benchmark, often
617 displaying a statistically significantly different (i.e. higher) Sharpe ratio. Second, in general, CP-MS gen-
618 erates a higher Sharpe ratio than CP-M, and CP-SCA produces a higher Sharpe ratio than CP-MO.
619 Third, on average across all exchange rates (and on average across each subset of industrialized and EM
620 countries), CP-SCA produces the highest economic value on the basis of the Sharpe ratio measure –
621 being 0.95 on average across all 12 exchange rates, against 0.20 obtained with a random walk.^{28,29}

622 Overall, the results in this sub-section confirm the difficulty to outperform the random walk in out-of-

²⁵The results are qualitatively identical if using one year more or one year less for the out-of-sample period.

²⁶The out-of-sample forecasts are constructed according to a recursive procedure where they are conditional only upon information up to the date of the forecast and with successive re-estimation as the date on which forecasts are conditioned moves through the data set. Given the largely illustrative nature of this exercise, the analysis is confined to models with constant parameters, also because recursive Bayesian estimation of the time-varying parameter models would be computationally very intensive.

²⁷The table also reports the mean of the excess returns in percent (Mean), and the standard deviation of the returns in percent (Std. Dev.), from which the Sharpe ratios are calculated.

²⁸Note that in calculating the Sharpe ratios we deliberately do not take into account transactions costs.

²⁹It is also interesting that the simplest macro model, *CP-M* does quite well in terms of Sharpe ratios while *CP-MO* does not, given that typically the literature finds that macro information is less useful than order flow in FX forecasting. This result is possibly due to the fact that the sample period for the out-of-sample analysis is dominated by the crisis period, when anecdotally macro variables have performed particularly well.

623 sample exchange rate forecasting using conventional statistical metrics such as the RMSFER. However,
624 there is evidence that the scapegoat models produce significantly larger economic value than the random
625 walk for an investor who follows the forecasts in a conventional long-short currency strategy. The pecking
626 order of the models is the same as reported for the in-sample results, indicating that both surveys
627 (scapegoats) and order flow have forecasting power, especially when used jointly as in the scapegoat
628 model CP-SCA.

629 5 Conclusions

630 There is ample anecdotal evidence that financial market participants tend to blame individual macro
631 fundamentals to rationalize observed exchange rate movements, with such blame often shifting across
632 different fundamentals over time. This fact has been conceptualized in the scapegoat theory of exchange
633 rates by BvW (2004, 2013). The main insight is that when exchange rates move in response to changes in
634 an unobservable fundamental, it is rational for investors to blame factors that they can actually observe,
635 and more precisely those macro fundamentals that are out of sync with their long-term equilibrium values
636 and move consistently with the observed exchange rate change.

637 This paper provides the first empirical test of the scapegoat theory of exchange rates, exploiting novel
638 data on exchange rate scapegoats from surveys as well as proxies of unobservable fundamentals based
639 on FX order flow for a sample of 12 exchange rates over the 2000-2011 period. The empirical analysis
640 provides strong support for two key hypotheses derived from the scapegoat theory. First, the scapegoat
641 model, especially in its time-varying formulation, does very well in explaining exchange rate movements,
642 outperforming benchmark macro and order flow models that do not allow for scapegoat effects. Second, a
643 macroeconomic fundamental is picked by market participants as a scapegoat in periods when it strongly
644 deviates from its long-term equilibrium and at the same time the unobservable fundamental is large,
645 consistent with the theory.

646 Of interest is also that, consistent with the predictions of the scapegoat theory, the analysis shows
647 that the expectation of the structural parameter tends to the structural parameter as the scapegoat effect
648 wears off. However, in terms of out-of-sample exchange rate, the evidence is mixed: while the scapegoat
649 models produce out-of-sample forecasts that generate significantly higher economic value than a random
650 walk, they cannot outperform a random benchmark on the basis of standard statistical criteria.

651 Overall, the first tests of the scapegoat theory of exchange rates provide empirical support to the
652 theory, suggesting that expectations of structural parameters, and their interaction with unobservables,
653 are important for improving our understanding of exchange rate fluctuations. The results in this paper
654 have been obtained using a relatively short sample and assuming that order flow is a suitable proxy for
655 unobserved fundamentals. Future research is warranted to examine their validity in longer samples of
656 data and with alternative proxies for the unobserved fundamental.

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Table 1: Constant Parameter Macro Model (CP-M)

Panel A: Industrialized Economies						
	Δ Growth	Δ Inflation	Δ Rate ST	Δ Rate LT	CA	Δ Equity
AUD/USD	-	-0.22**	0.27**	-0.31**	-	-
		[-0.30;-0.13]	[0.14;0.40]	[-0.44;-0.18]	-	-
CAD/USD	-	-0.30**	0.17**	-	-	-0.05*
		[-0.39;-0.22]	[0.09;0.25]	-	-	[-0.14;0.03]
EUR/USD	-	-0.31**	0.13**	-	-0.16**	-
		[-0.40;-0.22]	[0.05;0.21]	-	[-0.25;-0.08]	-
JPY/USD	-0.09**	-	0.06**	-0.13**	-	-
	[-0.16;-0.03]	-	[0.01;0.12]	[-0.22;-0.04]	-	-
CHF/EUR	-	-0.05*	-0.15**	-	-	0.09**
		[-0.14;0.04]	[-0.23;-0.06]	-	-	[0.00;0.17]
GBP/USD	-	-0.34**	-	-0.07**	-0.30**	-
		[-0.43;-0.24]	-	[-0.13;-0.02]	[-0.40;-0.20]	-
Panel B: Emerging Market Economies						
	Δ Growth	Δ Inflation	Δ Rate ST	Δ Rate LT	CA	Δ Equity
CZK/EUR	-	-0.10**	-	-0.16**	-	0.06**
		[-0.17;-0.03]	-	[-0.25;-0.07]	-	[0.01;0.10]
MXD/USD	-0.05**	0.01	-	-	-0.10**	-
	[-0.09;-0.01]	[-0.08;0.10]	-	-	[-0.17;-0.03]	-
PLN/EUR	-	0.07**	-0.10**	-0.09	-	-
		[0.01;0.13]	[-0.19;-0.02]	[-0.32;0.15]	-	-
ZAR/USD	-0.18**	-	-0.12**	-	-	0.18**
	[-0.28;-0.08]	-	[-0.19;-0.04]	-	-	[0.09;0.26]
SGD/USD	-0.16**	-	-0.11**	0.16**	-	-
	[-0.25;-0.08]	-	[-0.22;-0.00]	[0.05;0.28]	-	-
NZD/USD	-	-0.26**	0.18**	0.05**	-	-
		[-0.36;-0.18]	[0.09;0.28]	[0.01;0.08]	-	-

738 The table presents the estimated loadings of the exchange rate empirical model with constant parameters (CP-M)

$$\Delta s_t = \beta_1 f_{1,t} + \beta_2 f_{2,t} + \beta_3 f_{3,t} + u_t,$$

739 where Δs_t is the monthly exchange rate return; if s_t increases the domestic exchange rate (either the USD or the EUR) appreciates.
740 The sample period spans from January 2000 to November 2011. The analysis uses three macro factors per country, selected using
741 the general-to-specific procedure described in Section 4. Note that all variables, except the surveys, are standardized by subtracting
742 the mean and dividing by their standard deviation. τ s are standardized so that they have unit variance. One-standard deviation
743 confidence intervals are reported in brackets. (*) and (**) indicate that the (27-68) and (16-84) intervals, respectively, do not
contain 0.

Table 2: Constant Parameter Scapegoat Model (CP-SCA)

Panel A: Industrialized Economies							
	Δ Growth	Δ Inflation	Δ Rate ST	Δ Rate LT	CA	Δ Equity	Order Flow
AUD/USD							
β	-	-0.25**	0.31**	-0.65**	-	-	-
		[-0.32;-0.17]	[0.17;0.44]	[-0.80;-0.50]	-	-	-
γ	-	-0.03**	0.04**	-0.03**	-	-	-0.49**
		[-0.05;-0.01]	[0.02;0.05]	[-0.04;-0.01]	-	-	[-0.58;-0.40]
CAD/USD							
β	-	-0.23**	0.07**	-	-	-0.13**	-
		[-0.30;-0.17]	[0.02;0.13]	-	-	[-0.20;-0.06]	-
γ	-	-0.02**	0.02**	-	-	-0.05**	-0.54**
		[-0.03;-0.00]	[0.01;0.03]	-	-	[-0.06;-0.03]	[-0.61;-0.47]
EUR/USD							
β	-	-0.22**	0.04**	-	-0.06**	-	-
		[-0.30;-0.13]	[0.01;0.07]	-	[-0.10;-0.01]	-	-
γ	-	-0.02**	0.03**	-	-0.01**	-	-0.48**
		[-0.04;-0.01]	[0.02;0.04]	-	[-0.02;-0.00]	-	[-0.56;-0.40]
JPY/USD							
β	-0.09**	-	0.07**	-0.21**	-	-	-
	[-0.16;-0.03]	-	[0.02;0.13]	[-0.31;-0.10]	-	-	-
γ	-0.01**	-	0.01**	-0.02**	-	-	-0.56**
	[-0.02;-0.00]	-	[0.00;0.02]	[-0.03;-0.01]	-	-	[-0.63;-0.49]
CHF/EUR							
β	-	-0.03	-0.23**	-	-	0.12**	-
		[-0.11;0.05]	[-0.32;-0.13]	-	-	[0.02;0.22]	-
γ	-	-0.01	-0.01**	-	-	0.02**	-0.26**
		[-0.03;0.01]	[-0.02;-0.00]	-	-	[0.00;0.04]	[-0.35;-0.17]
GBP/USD							
β	-	-0.33**	-	-0.12**	-0.13**	-	-
		[-0.42;-0.23]	-	[-0.19;-0.04]	[-0.22;-0.04]	-	-
γ	-	-0.04**	-	-0.03**	-0.06**	-	-0.36**
		[-0.06;-0.02]	-	[-0.04;-0.01]	[-0.09;-0.04]	-	[-0.45;-0.28]

Panel B: Emerging Market Economies							
	Δ Growth	Δ Inflation	Δ Rate ST	Δ Rate LT	CA	Δ Equity	Order Flow
CZK/EUR							
β	-	-0.14**	-	-0.07**	-	0.08**	-
		[-0.22;-0.06]		[-0.13;-0.01]		[0.02;0.14]	
γ	-	-0.05**	-	-0.03**	-	0.08**	-0.47**
		[-0.07;-0.03]		[-0.06;-0.01]		[0.06;0.11]	[-0.55;-0.40]
MXD/USD							
β	-0.06**	0.00	-	-	-0.13**	-	-
	[-0.11;-0.01]	[-0.09;0.07]			[-0.22;-0.05]		
γ	-0.02**	0.01	-	-	-0.04**	-	-0.12**
	[-0.04;-0.01]	[-0.01;0.03]			[-0.06;-0.03]		[-0.20;-0.05]
PLN/EUR							
β	-	0.07**	-0.08**	-0.27**	-	-	-
		[0.01;0.13]	[-0.15;-0.02]	[-0.51;-0.05]			
γ	-	0.04**	-0.01**	-0.02**	-	-	-0.48**
		[0.01;0.07]	[-0.02;-0.00]	[-0.05;-0.00]			[-0.55;-0.39]
ZAR/USD							
β	-0.09**	-	-0.16**	-	-	0.10**	-
	[-0.16;-0.02]		[-0.24;-0.08]			[0.03;0.16]	
γ	-0.04**	-	-0.03**	-	-	0.03**	-0.59**
	[-0.06;-0.01]		[-0.04;-0.01]			[0.02;0.05]	[-0.66;-0.52]
SGD/USD							
β	-0.13**	-	-0.11**	0.17**	-	-	-
	[-0.20;-0.05]		[-0.19;-0.03]	[0.07;0.26]			
γ	-0.02**	-	-0.02**	0.02**	-	-	-0.44**
	[-0.03;-0.01]		[-0.04;-0.01]	[0.01;0.03]			[-0.52;-0.36]
NZD/USD							
β	-	-0.09	0.26**	0.05**	-	-	-
		[-0.22;0.03]	[0.17;0.35]	[0.01;0.08]			
γ	-	0.01	0.02**	0.02**	-	-	-0.51**
		[-0.01;0.04]	[0.01;0.04]	[0.00;0.03]			[-0.58;-0.43]

744 The table presents the estimates for the coefficients (β , γ and δ) of the constant parameter scapegoat model (CP-SCA):

$$\Delta s_t = \mathbf{f}_t' \beta + (\tau_t \mathbf{f}_t)' \gamma + \delta x_t + u_t.$$

745 Note that all variables, except the surveys, are standardized by subtracting the mean and dividing by their standard deviation. τ s
746 are standardized so that they have unit variance. The sample period spans from January 2000 to November 2011. One-standard
747 deviation confidence intervals are reported in brackets. (*) and (**) indicate that the (27-68) and (16-84) intervals, respectively,
748 do not contain 0.

Table 3: Time-varying Parameter Scapegoat Model (TVP-SCA)

Panel A: Industrialized Economies							
	Δ Growth	Δ Inflation	Δ Rate ST	Δ Rate LT	CA	Δ Equity	Order Flow
AUD/USD							
γ	-	-0.03**	0.04**	-0.03**	-	-	-0.73**
		[-0.05;-0.01]	[0.01;0.07]	[-0.05;-0.01]			[-0.83;-0.62]
CAD/USD							
γ	-	-0.01	0.02**	-	-	-0.04**	-0.66**
		[-0.04;0.03]	[0.01;0.03]			[-0.06;-0.01]	[-0.74;-0.58]
EUR/USD							
γ	-	-0.03**	0.02**	-	-0.02**	-	-0.69**
		[-0.05;-0.01]	[0.01;0.04]		[-0.04;-0.01]		[-0.78;-0.60]
JPY/USD							
γ	-0.01**	-	0.03**	-0.02**	-	-	-0.59**
	[-0.02;-0.00]		[0.01;0.05]	[-0.03;-0.00]			[-0.67;-0.52]
CHF/EUR							
γ	-	0.00	-0.02**	-	-	0.02**	-0.28**
		[-0.03;0.03]	[-0.03;-0.00]			[0.01;0.05]	[-0.38;-0.19]
GBP/USD							
γ	-	-0.07**	-	-0.03**	-0.10**	-	-0.53**
		[-0.11;-0.04]		[-0.05;-0.01]	[-0.14;-0.06]		[-0.62;-0.43]
Panel B: Emerging Market Economies							
	Δ Growth	Δ Inflation	Δ Rate ST	Δ Rate LT	CA	Δ Equity	Order Flow
CZK/EUR							
γ	-	-0.03**	0.04**	-0.03**	-	-	-0.73**
		[-0.05;-0.01]	[0.01;0.07]	[-0.05;-0.01]			[-0.83;-0.62]
MXD/USD							
γ	-	-0.01	0.02**	-	-	-0.04**	-0.66**
		[-0.04;0.03]	[0.01;0.03]			[-0.06;-0.01]	[-0.74;-0.58]
PLN/EUR							
γ	-	-0.03**	0.02**	-	-0.02**	-	-0.69**
		[-0.05;-0.01]	[0.01;0.04]		[-0.04;-0.01]		[-0.78;-0.60]
ZAR/USD							
γ	-0.01**	-	0.03**	-0.02**	-	-	-0.59**
	[-0.02;-0.00]		[0.01;0.05]	[-0.03;-0.00]			[-0.67;-0.52]
SGD/USD							
γ	-	0.00	-0.02**	-	-	0.02**	-0.28**
		[-0.03;0.03]	[-0.03;-0.00]			[0.01;0.05]	[-0.38;-0.19]
NZD/USD							
γ	-	-0.07**	-	-0.03**	-0.10**	-	-0.53**
		[-0.11;-0.04]		[-0.05;-0.01]	[-0.14;-0.06]		[-0.62;-0.43]

749 The table presents the estimates for the time-invariant coefficients (γ and δ) of the time-varying parameter scapegoat model
750 (TVP-SCA):

$$\Delta s_t = \mathbf{f}_t' \beta_t + (\tau_t \mathbf{f}_t)' \gamma + \delta x_t + u_t$$

$$\beta_t = \beta_{t-1} + \mathbf{v}_t.$$

751 Note that all variables, except the surveys, are standardized by subtracting the mean and dividing by their standard deviation. τ s
752 are standardized so that they have unit variance. The sample period spans from January 2000 to November 2011. One-standard
753 deviation confidence intervals are reported in brackets. (*) and (**) indicate that the (27-68) and (16-84) intervals, respectively,
754 do not contain 0.

Table 4: In-sample Model Performance: CP Models

Panel A: Industrialized Economies												
	R ² (%)	RMSE	BIC	AIC	HR(%)	HM	R ² (%)	RMSE	BIC	AIC	HR(%)	HM
			<i>AUD/USD</i>						<i>JPY/USD</i>			
CP-M	5.79	0.957	0.02	-0.05	58.74	0.18 ^b	-0.84	0.995	0.09	0.03	53.15	0.06
CP-MS	11.39	0.931	-0.04	-0.10	58.04	0.18 ^b	0.57	0.999	0.10	0.04	54.55	0.09
CP-MO	22.31	0.865	-0.15	-0.23	74.13	0.48 ^a	27.48	0.834	-0.22	-0.31	72.73	0.46 ^a
CP-SCA	26.71	0.842	-0.21	-0.29	72.03	0.44 ^a	29.28	0.840	-0.21	-0.29	71.33	0.43 ^a
			<i>CAD/USD</i>						<i>CHF/EUR</i>			
CP-M	7.47	0.949	0.00	-0.06	53.85	0.07	0.54	0.984	0.07	0.01	58.04	0.14 ^c
CP-MS	12.16	0.938	-0.02	-0.09	57.34	0.16 ^c	0.89	0.986	0.08	0.01	55.24	0.10
CP-MO	33.09	0.805	-0.29	-0.38	64.34	0.29 ^a	5.53	0.955	0.05	-0.04	63.64	0.27 ^a
CP-SCA	37.47	0.784	-0.35	-0.43	66.43	0.34 ^a	6.21	0.958	0.05	-0.03	64.34	0.29 ^a
			<i>EUR/USD</i>						<i>GBP/USD</i>			
CP-M	6.16	0.956	0.01	-0.05	62.24	0.25 ^a	6.97	0.952	0.01	-0.06	56.64	0.13 ^c
CP-MS	8.30	0.951	0.00	-0.06	61.54	0.24 ^b	11.76	0.931	-0.04	-0.10	58.04	0.17 ^b
CP-MO	26.25	0.840	-0.21	-0.29	73.43	0.47 ^a	16.68	0.901	-0.07	-0.15	62.24	0.25 ^a
CP-SCA	28.61	0.829	-0.24	-0.32	75.52	0.52 ^a	21.66	0.870	-0.14	-0.22	63.64	0.28 ^a
Panel B: Emerging Economies												
	R ² (%)	RMSE	BIC	AIC	HR(%)	HM	R ² (%)	RMSE	BIC	AIC	HR(%)	HM
			<i>CZK/EUR</i>						<i>ZAR/USD</i>			
CP-M	3.91	0.997	0.10	0.04	55.24	0.12	4.88	0.970	0.04	-0.02	50.35	0.02
CP-MS	9.55	0.965	0.03	-0.03	57.34	0.17 ^b	7.21	0.969	0.04	-0.02	51.75	0.04
CP-MO	21.87	0.889	-0.10	-0.18	65.04	0.30 ^a	32.08	0.816	-0.27	-0.35	75.52	0.51 ^a
CP-SCA	28.82	0.848	-0.19	-0.27	65.73	0.32 ^a	36.65	0.791	-0.33	-0.41	76.22	0.52 ^a
			<i>MXD/USD</i>						<i>SGD/USD</i>			
CP-M	-0.86	1.000	0.10	0.04	52.45	0.05	1.42	0.979	0.07	0.00	53.38	0.07
CP-MS	7.92	0.976	0.06	-0.01	51.75	0.08	3.03	0.977	0.06	0.00	50.38	0.01
CP-MO	-0.45	0.997	0.13	0.05	56.64	0.13	20.19	0.876	-0.12	-0.20	70.68	0.41 ^a
CP-SCA	8.00	0.970	0.08	0.00	54.55	0.14 ^c	21.66	0.874	-0.12	-0.21	66.92	0.33 ^a
			<i>PLN/EUR</i>						<i>NZD/USD</i>			
CP-M	-0.25	1.005	0.11	0.05	45.45	-0.08	7.59	0.985	0.07	0.01	47.55	-0.06
CP-MS	4.99	1.004	0.11	0.05	51.05	0.04	11.49	0.941	-0.02	-0.08	58.74	0.18 ^b
CP-MO	22.85	0.882	-0.11	-0.20	68.53	0.37 ^a	31.85	0.855	-0.18	-0.26	65.73	0.32 ^a
CP-SCA	26.67	0.894	-0.09	-0.17	67.83	0.36 ^a	34.80	0.829	-0.24	-0.32	69.23	0.39 ^a

755 The table provides several measures of model fit for the constant parameter models: CP-M, CP-MS, CP-MO and CP-SCA. There
756 are measures of explained variance, in-sample predictive performance, information criteria and market timing: the adjusted R-
757 squared in percent (R²); the root mean squared error (RMSE); the Bayesian (BIC) and Akaike (AIC) information criteria; the
758 hit ratios in percent (HR) and the HM test. The HM test is a one-tailed test on the significance of the slope coefficient in the
759 following regression:

$$I_{\{\Delta s_t > 0\}} = \varphi_0^{HM} + \varphi_1^{HM} I_{\{\widetilde{\Delta s}_t > 0\}} + \varepsilon_t,$$

760 where Δs_t and $\widetilde{\Delta s}_t$ denote the realized and fitted exchange rate returns, and I is the indicator function equal to unity when
761 its argument is true and 0 otherwise. A positive and significant φ_1^{HM} provides evidence of market timing. Precisely, we report
762 under HM $\widehat{\varphi}_1^a$, $\widehat{\varphi}_1^b$, and $\widehat{\varphi}_1^c$, denote the 1-, 5-, and 10-percent confidence levels, respectively. Standard error are calculated using
763 Newey-West (1987).

Table 5: In-sample Model Performance: TVP Models

Panel A: Industrialized Economies												
	R ² (%)	RMSE	BIC	AIC	HR(%)	HM	R ² (%)	RMSE	BIC	AIC	HR(%)	HM
	<i>AUD/USD</i>				<i>JPY/USD</i>							
TVP-M	13.55	0.907	-0.09	-0.15	58.74	0.20 ^b	4.09	0.945	-0.01	-0.07	64.34	0.29 ^a
TVP-MS	18.64	0.867	-0.18	-0.24	62.94	0.27 ^a	17.83	0.843	-0.24	-0.30	71.33	0.43 ^a
TVP-MO	33.12	0.766	-0.40	-0.48	74.83	0.49 ^a	35.78	0.757	-0.42	-0.50	81.12	0.63 ^a
TVP-SCA	47.55	0.644	-0.74	-0.83	79.72	0.59 ^a	38.10	0.743	-0.46	-0.54	79.72	0.60 ^a
	<i>CAD/USD</i>				<i>CHF/EUR</i>							
TVP-M	7.49	0.925	-0.05	-0.11	60.14	0.20 ^a	1.14	0.965	0.03	-0.03	62.24	0.22 ^a
TVP-MS	11.68	0.910	-0.09	-0.15	59.44	0.20 ^a	8.47	0.967	0.04	-0.03	62.94	0.25 ^a
TVP-MO	41.80	0.715	-0.53	-0.62	72.73	0.47 ^a	6.72	0.921	-0.02	-0.11	69.93	0.40 ^a
TVP-SCA	48.80	0.663	-0.68	-0.77	77.62	0.56 ^a	9.29	0.908	-0.05	-0.14	71.33	0.42 ^a
	<i>EUR/USD</i>				<i>GBP/USD</i>							
TVP-M	9.32	0.932	-0.04	-0.10	63.64	0.29 ^a	9.36	0.894	-0.12	-0.18	66.43	0.33 ^a
TVP-MS	13.66	0.930	-0.04	-0.10	66.43	0.33 ^a	20.28	0.852	-0.22	-0.28	67.83	0.36 ^a
TVP-MO	41.23	0.726	-0.50	-0.58	81.12	0.62 ^a	27.59	0.776	-0.37	-0.45	67.83	0.36 ^a
TVP-SCA	43.04	0.701	-0.57	-0.65	80.42	0.61 ^a	41.98	0.673	-0.65	-0.74	72.03	0.44 ^a
Panel B: Emerging Economies												
	R ² (%)	RMSE	BIC	AIC	HR(%)	HM	R ² (%)	RMSE	BIC	AIC	HR(%)	HM
	<i>CZK/EUR</i>				<i>ZAR/USD</i>							
TVP-M	5.00	0.921	-0.06	-0.12	62.24	0.25 ^a	4.26	0.950	0.00	-0.06	53.85	0.08
TVP-MS	10.84	0.904	-0.10	-0.16	60.14	0.21 ^a	6.39	0.931	-0.04	-0.10	53.85	0.08
TVP-MO	24.82	0.817	-0.26	-0.35	65.04	0.30 ^a	34.21	0.777	-0.36	-0.45	77.62	0.55 ^a
TVP-SCA	31.20	0.795	-0.32	-0.40	67.13	0.34 ^a	39.15	0.743	-0.46	-0.54	75.52	0.51 ^a
	<i>MXD/USD</i>				<i>SGD/USD</i>							
TVP-M	0.86	0.949	0.00	-0.06	62.94	0.32 ^a	3.69	0.931	-0.03	-0.10	58.65	0.17 ^b
TVP-MS	15.41	0.863	-0.19	-0.25	65.73	0.30 ^a	12.57	0.888	-0.13	-0.19	63.16	0.26 ^a
TVP-MO	1.95	0.935	0.00	-0.08	65.73	0.33 ^a	28.51	0.781	-0.35	-0.43	72.93	0.46 ^a
TVP-SCA	14.12	0.851	-0.18	-0.27	69.23	0.38 ^a	35.82	0.720	-0.51	-0.60	69.92	0.40 ^a
	<i>PLN/EUR</i>				<i>NZD/USD</i>							
TVP-M	5.70	0.912	-0.08	-0.14	65.73	0.32 ^a	19.18	0.860	-0.20	-0.26	66.43	0.32 ^a
TVP-MS	12.48	0.853	-0.21	-0.28	67.13	0.35 ^a	30.74	0.774	-0.41	-0.47	75.52	0.51 ^a
TVP-MO	29.23	0.789	-0.34	-0.42	78.32	0.57 ^a	41.37	0.742	-0.46	-0.54	74.83	0.49 ^a
TVP-SCA	37.72	0.712	-0.54	-0.62	82.52	0.65 ^a	42.09	0.734	-0.48	-0.56	76.92	0.54 ^a

764 The table provides several measures of model fit for the time-varying parameter models: TVP-M, TVP-MS, TVP-MO and TVP-
765 SCA. There are measures of explained variance, in-sample predictive performance, information criteria and market timing: the
766 adjusted R-squared in percent (R²); the root mean squared error (RMSE); the Bayesian (BIC) and Akaike (AIC) information
767 criteria; the hit ratios in percent (HR) and the HM test. The HM test is a one-tailed test on the significance of the slope coefficient
768 in the following regression:

$$I_{\{\Delta s_t > 0\}} = \varphi_0^{HM} + \varphi_1^{HM} I_{\{\widehat{\Delta s}_t > 0\}} + \varepsilon_t,$$

769 where Δs_t and $\widehat{\Delta s}_t$ denote the realized and fitted exchange rate returns, and I is the indicator function equal to unity when
770 its argument is true and 0 otherwise. A positive and significant φ_1^{HM} provides evidence of market timing. Precisely, we report
771 under HM $\widehat{\varphi}_1^a$, $\widehat{\varphi}_1^b$, and $\widehat{\varphi}_1^c$, denote the 1-, 5-, and 10-percent confidence levels, respectively. Standard error are calculated using
772 Newey-West (1987).

Table 6: Exchange Rates, Order Flow and Macro Factors

q	ΔGrowth			ΔInflation			ΔRate ST		
	20%	30%	40%	20%	30%	40%	20%	30%	40%
α_0	0.31	-0.39	-0.36	0.17	0.13	0.09	0.10	-0.04	-0.19
t-stat	[0.90]	[-2.29]	[-3.42]	[0.75]	[0.89]	[0.90]	[0.58]	[-0.43]	[-2.55]
α_1	-0.28	-0.08	-0.03	0.02	0.00	-0.02	0.04	0.01	0.00
t-stat	[-2.41]	[-1.02]	[-0.58]	[0.28]	[0.07]	[-0.44]	[0.70]	[0.14]	[0.13]
R_N^2 (%)	26	11	10	-2	-1	0	-1	3	3
N	18	50	99	31	83	154	59	139	227
q	ΔRate LT			CA			ΔEquity		
	20%	30%	40%	20%	30%	40%	20%	30%	40%
α_0	-0.07	0.05	0.03	0.09	0.03	0.04	-0.53	-0.32	-0.19
t-stat	[-0.32]	[0.40]	[0.36]	[0.27]	[0.18]	[0.38]	[-1.97]	[-2.06]	[-1.76]
α_1	-0.14	-0.15	-0.13	-0.19	-0.14	-0.12	-0.08	-0.05	0.01
t-stat	[-2.01]	[-2.89]	[-2.84]	[-1.67]	[-2.10]	[-2.41]	[-0.93]	[-0.82]	[0.19]
R_N^2 (%)	9	9	5	11	6	5	13	4	2
N	33	79	137	7	9	14	27	62	100

773 The table presents the regression of the exchange rate return on the order flow times the macro factor:

$$\Delta s_t = \alpha_0 + \alpha_1 (-x_t \times f_{n,t}) I_{\{f_{n,t}, x_t^q\}} + u_t.$$

774 The order flow is taken with the minus sign so that the expected sign should be the one expected from regressing the exchange
775 rate return on the fundamental. The order flow and the fundamental are selected for different quantiles ranging from 20 to 40
776 percent. Precisely, each variable is sorted in absolute value and we take the largest 20, 30 and 40 percent of the observations, and
777 the observation is selected only if in that period both the fundamental and order flow are included in their respective quantiles. N
778 denotes the number of times the fundamental times order flow is selected for each quantile. Thus, $I_{\{f_{n,t}, x_t^q\}}$ takes the value of 1
779 if at time t both $f_{n,t}$ and x_t are in the top q percent of observations. This means that both the fundamental and order flow have
780 experienced a sufficiently large shock. Note that the macro fundamentals are selected only if the scapegoat effect $\hat{\gamma}_n$ is significant
781 in Table 3. R_N^2 is the adjusted R²s computed over the N observations. The regression is estimated using robust estimation; by
782 default, the Matlab algorithm uses iteratively re-weighted least squares with a bisquare weighting function.

Table 7: Surveys, Order Flow and Macro Factors

q	ΔGrowth			ΔInflation			ΔRate ST		
	20%	30%	40%	20%	30%	40%	20%	30%	40%
ζ ₀	-0.28	0.04	0.07	0.30	0.03	0.02	0.02	0.02	0.11
t-stat	[-1.37]	[0.31]	[0.77]	[1.69]	[0.24]	[0.28]	[0.13]	[0.20]	[1.30]
ζ ₁	0.31	0.27	0.25	0.47	0.59	0.59	0.26	0.25	0.26
t-stat	[3.70]	[3.50]	[3.30]	[2.45]	[3.60]	[4.05]	[4.23]	[4.46]	[5.43]
R ² _{N_I} (%)	48	31	15	22	12	9	55	35	36
R ² _{N_{II}} (%)	49	46	35	48	51	41	57	40	42
N _I	18	50	99	44	110	203	59	139	227
N _{II}	9	20	37	4	10	19	46	112	181
	ΔRate LT			CA			ΔEquity		
	20%	30%	40%	20%	30%	40%	20%	30%	40%
ζ ₀	0.35	0.16	0.11	-0.82	-0.73	-0.58	-0.06	-0.04	0.02
t-stat	[2.10]	[1.26]	[1.19]	[-5.07]	[-7.54]	[-5.84]	[-0.75]	[-0.53]	[0.30]
ζ ₁	0.07	0.09	0.16	0.69	0.65	0.63	0.22	0.28	0.32
t-stat	[0.51]	[0.78]	[1.59]	[6.83]	[7.49]	[5.66]	[2.87]	[3.19]	[4.08]
R ² _{N_I} (%)	15	4	4	50	53	34	21	16	13
R ² _{N_{II}} (%)	24	11	17	68	55	49	79	69	69
N _I	39	89	152	21	45	79	27	62	100
N _{II}	9	24	37	7	9	14	3	12	24

783 The table displays the results for the six panel regressions of the survey ($\tau_{n,t}$) on the absolute value of the correspondent macro
784 factor ($f_{n,t}$) times the order flow (x_t) times the indicator functions ($I_{\{\tau_{n,t} > \tau_{j,t}\}}$) and ($I_{\{f_{n,t}^q, x_t^q\}}$). The latter takes the value
785 of 1 if the survey on the macro factor n exceeds the values of the other two macro factors $j \neq n$ at each time t . For a generic
786 survey $\tau_{n,t}$ we estimate:

$$\tau_{n,t} = \zeta_0 + \zeta_1 |x_t \times f_{n,t}| I_{\{f_{n,t}^q, x_t^q\}} I_{\{\tau_{n,t} > \tau_{j,t}\}} + \varepsilon_t,$$

787 where n is an index of macro variable and t is an index of time. For each of the six regressions, a country macro variable is included
788 or not according to whether it was previously selected in Table 3 using our selection procedure. For example, for $n = \Delta\text{Growth}$
789 only JPY, MXD, ZAR and SGD are used. Similarly to Table 6, N_I denotes the number of times the fundamental times order
790 flow is selected for each quantile. In addition, within these N_I observations, N_{II} denotes the number of times the fundamental
791 n exceeds the values of the other two macro factors $j \neq n$. Then, $R_{N_I}^2$ and $R_{N_{II}}^2$ are the adjusted R^2 s computed over the N_I
792 and N_{II} observations, respectively. The regression is estimated using robust estimation; by default, the Matlab algorithm uses
793 iteratively re-weighted least squares with a bisquare weighting function.

Table 8: Learning in the long run

Δ Growth				Δ Inflation			
b_1	b_2	$b_1 + b_2$	$R^2(\%)$	b_1	b_2	$b_1 + b_2$	$R^2(\%)$
-0.05 [0.056]	-0.236 ^a [0.057]	-0.282 ^a [0.098]	22.64	0.225 ^a [0.017]	-0.376 ^a [0.022]	-0.151 ^a [0.037]	58.24
Δ Rate ST				Δ Rate LT			
b_1	b_2	$b_1 + b_2$	$R^2(\%)$	b_1	b_2	$b_1 + b_2$	$R^2(\%)$
0.097 ^a [0.007]	-0.163 ^a [0.010]	-0.066 ^a [0.016]	58.15	0.149 ^a [0.020]	-0.335 ^a [0.026]	-0.187 ^a [0.042]	50.64
CA				Δ Equity			
b_1	b_2	$b_1 + b_2$	$R^2(\%)$	b_1	b_2	$b_1 + b_2$	$R^2(\%)$
0.067 ^c [0.040]	-0.257 ^a [0.031]	-0.191 ^a [0.063]	54.19	0.134 ^c [0.071]	-0.432 ^a [0.084]	-0.298 ^b [0.145]	26.83

794 The table presents the results of the six panel regressions of the change in the scapegoat on a constant, the lagged value of the
795 scapegoat and the lagged value of the respective structural parameter. The following regression is estimated:

$$\Delta \widehat{E}_t \widehat{\beta}_{n,t} = b_0 + b_1 (\widehat{E}_{t-1} \widehat{\beta}_{n,t-1} - \widehat{\beta}_{n,t-1}) + b_2 (\widehat{E}_{t-1} \widehat{\beta}_{n,t-1} - \widehat{\beta}_{n,t-1}) I_{\{\Delta \tau_{n,t} < 0\}} + \varepsilon_{n,t}.$$

796 where n is an index of the macro variable (e.g. growth). The dependent variable and the regressors are denoted with an $\widehat{\cdot}$
797 indicating the fact that they are the estimates of model TVP-SCA. More specifically, $\widehat{\beta}_{n,t-1}$ is the estimated time-varying structural
798 parameter, and $\widehat{E}_t \widehat{\beta}_{n,t} = \widehat{\gamma}_n \tau_{n,t}$, where $\widehat{\gamma}_n$ is the estimated scapegoat parameter, as presented in Table 3, and $\tau_{n,t}$ is the survey.
799 $I_{\{\Delta \tau_{n,t} < 0\}}$ is an indicator function which takes the value of 1 for negative changes in the survey ($\Delta \tau_{n,t} < 0$), and 0 otherwise.
800 Note that the macro fundamentals are selected only if the scapegoat effect $\widehat{\gamma}_n$ is significant in Table 3. Moreover, $\widehat{\beta}_{n,t-1}$ is selected
801 only if in that month the survey is available. Newey-West (1987) standard errors are reported in parenthesis. a, b, and c, denote
802 the 1-, 5-, and 10-percent confidence levels, respectively.

Table 9: **Out-of-sample Model Performance by Groups**

Panel A: All Currencies					
	RW	CP-M	CP-MS	CP-MO	CP-SCA
RMSFER	1.00	1.02	1.05	1.03	1.06
HR(%)	-	52.92	54.39	52.19	54.82
HM	-	0.02	0.07	0.00	0.07
Mean	1.48	5.63	6.96	6.63	7.92
Std. Dev.	10.38	9.16	8.32	8.88	8.36
Sharpe Ratio	0.20	0.63	0.86	0.74	0.95
Panel B: Industrialized Economies					
	RW	CP-M	CP-MS	CP-MO	CP-SCA
RMSFER	1.00	1.02	1.08	1.03	1.09
HR(%)	-	52.34	52.92	51.75	54.09
HM	-	-0.02	0.05	-0.04	0.06
Mean	1.26	6.51	7.50	7.29	8.56
Std. Dev.	8.88	8.72	7.76	9.18	8.30
Sharpe Ratio	0.26	0.69	0.96	0.72	0.98
Panel C: Emerging Economies					
	RW	CP-M	CP-MS	CP-MO	CP-SCA
RMSFER	-	1.02	1.02	1.03	1.03
HR(%)	-	53.51	55.85	52.63	55.56
HM	-	0.05	0.10	0.03	0.09
Mean	1.71	4.75	6.43	5.96	7.27
Std. Dev.	11.87	9.61	8.88	8.58	8.42
Sharpe Ratio	0.13	0.56	0.76	0.75	0.92

803 The table presents the averages by groups of the out-of-sample model performance statistics presented in Table VIII in the Internet
804 Appendix. Specifically, this table reports: the ratio of the root mean squared forecast error of the indicated model over the that
805 of the random walk (RMSFER); the hit ratio (HR); the Henriksson-Merton test (HM); the mean of the excess returns in percent
806 (Mean), the standard deviation of the returns in percent (Std. Dev.) and the Sharpe Ratios. The model is estimated recursively
807 for each currency the sample starts in January 2000 and out-of-sample forecasts are evaluated over the period from January 2007
808 to November 2011.

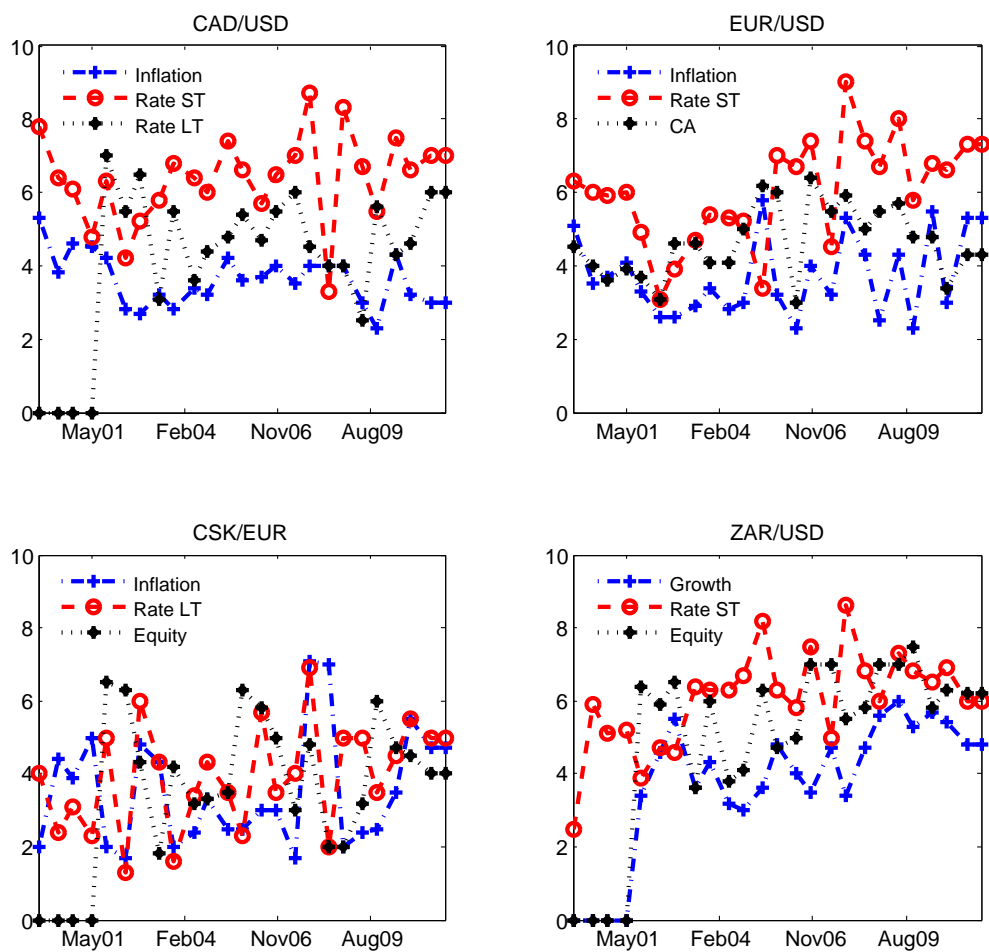


Figure 1: **Selected scapegoat variables.** The figures show the exchange rate consensus surveys selected by our methodology for four currencies: Canadian dollar, euro, Czech koruna and South African rand. The sample spans the period from January 2000 to November 2011.