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THE SCAPEGOAT THEORY OF EXCHANGE RATES: THE FIRST TESTS

by Marcel Fratzscher[*] Dagfinn Rime[†] Lucio Sarno[‡] and Gabriele Zinna[**]

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.

JEL Classification: F34, G12, G15.
Keywords: scapegoat, exchange rates, economic fundamentals, survey data.

Contents

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1 Introduction[1]

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.[2] 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 fi-

[1]This paper was partly written while Marcel Fratzscher was at the European Central Bank, Dagfinn Rime was at Norges Bank, and Gabriele Zinna was at the Bank of England. The authors are indebted for their constructive comments to Philippe Bacchetta, Menzie Chinn, Nelson Mark, Adrien Verdelhan, Eric van Wincoop and other participants to the ASSA Annual Meetings, Denver 2011; the 2011 Bank of Canada-ECB conference on "Exchange Rates and Macroeconomic Adjustment"; the 2011 EEA Annual Meetings; and the Tsinghua-Columbia University conference on "Exchange Rates and the New International Monetary System". The authors would also like to thank Ella Getz Wold and Björn Kraaz for excellent research assistance. Sarno acknowledges financial support from the Economic and Social Research Council (No. RES-062-23-2340) and the gracious hospitality of the Cambridge Endowment for Research in Finance (CERF) of the University of Cambridge, where this research was completed. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of England, the Bank of Italy, DIW, the European Central Bank, or Norges Bank.

[2]In 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.

nancial 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.[3]

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.[4] 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 con-

[3]This 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.

[4]Specifically, 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.

structed from high-frequency data obtained from the Reuters electronic trading platform D2000-2 on special order.[5] The empirical estimations are conducted for 12 exchange rates over the period 2000-2011, using data at monthly frequency.

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

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

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

about 36 percent.

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

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

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

Finally, a key insight of BvW (2009) is that the derivative of the exchange rate with respect to the fundamentals is disconnected from the true underlying structural parameters in the short to medium term. In particular, this effect takes place when a macro fundamental receives an unusually large weight, and therefore is made the scapegoat for exchange rate changes. However, as a result of the investors' learning process, the expectation of the structural parameter should converge to the structural parameter in the long run. Our estimates support this prediction of the scapegoat theory: the expectation of the structural parameter converges toward the structural parameter as the scapegoat effect wears off.

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

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

2 Scapegoat theory and hypotheses

The essence of the scapegoat theory of exchange rates is that at times some macroeconomic factors receive an unusually large weight and thus are made scapegoats of exchange rate movements. This scapegoat effect arises because of agents' "rational confusion" as they make inference on the true parameters of the model only conditioning on observable fundamentals and exchange rate movements at times when the exchange rate is instead driven by unobservables (e.g. large order flows).[6] Thus, when exchange rates move strongly in response to unobservables, it is rational for agents to blame factors that they can actually observe, and more precisely those macro fundamentals that are out of sync from their longer term equilibrium values and move consistently with observed exchange rates. This scapegoat effect can generate an unstable relationship between exchange rates and macro fundamentals, driven mainly by the expectation of the structural parameters and not by the structural parameters themselves. The next section describes such effects, and then introduces the main hypotheses for the empirical test of the scapegoat theory of exchange rates.

[6] In this paper the words agents and investors are used interchangeably.

2.1 The scapegoat model of exchange rates

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

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

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

where s_t is the log nominal exchange rate (the foreign price of the domestic currency), $\mathbf{f}_t = (f_{1,t}, f_{2,t}, \ldots, f_{N,t})'$ is a vector of N observed macro fundamentals (in first differences), $\beta = (\beta_1, \beta_2, \ldots, \beta_N)'$ is the vector of true structural parameters, $E_t\beta$ is the vector of expected structural parameters, b_t is the unobserved fundamental, and λ is the discount factor $(0 < \lambda < 1)$.[7] Thus, the true structural parameters β are constant but are unknown to investors, who learn over time about β through observing the exchange rate and the macro fundamentals. Precisely, each period t they observe the signal $\mathbf{f}_t\beta + b_t$. However, both the parameters β and the fundamental b_t are unknown to them. As a result, although they can eventually learn about the structural parameters, this can only happen *slowly* over time.

Equation (1) also shows that the fundamentals $\mathbf{f}_t$ are multiplied by a weighted average of actual and expected parameters. However, since the discount factor λ is close to unity (see Engel and West, 2005; Sarno and Sojli, 2009), higher weights are attached to the expected values of the parameters rather than the actual values. Moreover, even though

[7] Note 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.

the parameters themselves are constant, the expectations of the parameters can change substantially over time. Precisely, the impact of macro fundamentals on the exchange rate in the scapegoat model can be formulated as:

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

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

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

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

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

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

2.2 Empirical scapegoat model with constant parameters

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

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

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

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

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

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:

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

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:

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

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):

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

where the structural parameters are now time-varying, and τ_t denotes the vector of scapegoat parameter $E_t \beta_t$.[8] A simplified version of equation (3) that excludes the unobservable fundamental from the conditioning information set is also considered:

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

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:

[8] Note 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.

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

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

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 model is solely due to the scapegoat variables. Note that all the benchmark models in equations (6), (7), (10) and (11) assume that parameters are known to the investors and therefore are not scapegoat models. However, the benchmark models (10) and (11) also allow parameters to vary over time. From an econometric point of view our empirical scapegoat models require estimation of both time-varying parameters (β_t) and time-invariant parameters (γ and δ). All empirical exchange rate models are estimated using Bayesian methods, following e.g. Kim and Nelson (1999) and Cogley and Sargent (2002, 2005).[9]

3 Data

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

3.1 Scapegoats and fundamentals

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

The data is based on the cross-sectional average, at every point in time, of surveys involving 40-60 FX market participants from major financial institutions (mostly asset managers) conducted monthly by Consensus Economics. These market participants reside in many different locations globally, though the majority is located in the US, the UK and other advanced economies. The participants are asked to "rank the current importance of a range of different factors in determining exchange rate movements" for each of a

[9]The 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.

broad set of currencies bilaterally *vis-a-vis* a reference currency, which mostly is the US dollar except for some European currencies for which the euro is the reference currency. More precisely, participants are asked to rank six macroeconomic factors on a scale from 0 (no influence) to 10 (very strong influence). The six variables are short- and long-term interest rates, growth, inflation, trade/current account, and equity flows. The survey explicitly stresses that the weights should be for the variables relative to those of the country of the reference currency.[10]

Consensus Economics conducts the surveys every month, with the same financial market participants wherever possible. However, Consensus Economics conducts several surveys on exchange rates with these market participants (e.g. on short-term forecasts, longer-term forecasts, expected trading ranges, and market uncertainty), and alternates across these surveys throughout the year. This means that the surveys about FX scapegoats are conducted only between every 3 to 6 months, though at regular intervals over the years. The data for missing months are interpolated so as to arrive at a dataset with monthly observations. This is done by assigning the last available survey values to the months for which the survey is not conducted. In this way only information available to the investor at any point in time is used.[11]

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

Tables I and II in the Internet Appendix show summary statistics about the scapegoat surveys (raw and interpolated, respectively) for the 12 currencies in our sample. A first interesting fact is that the six macro variables have mostly similar means and standard deviations across all 12 currencies and over time. A somewhat higher mean is recorded for short-term interest rates, and a somewhat lower mean for inflation as scapegoat. Also, interest rates (especially short-term) and inflation have been the dominant scapegoats, in the sense that they have been more frequently considered by investors as the main

[10]Of 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.

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

scapegoats. Figure 1 also shows the time variation of the scapegoat factors for some advanced and EM currencies, which is useful to illustrate how the weights investors attach to macro fundamentals can change substantially over time, and the main scapegoat changes fairly frequently.

The monthly scapegoat data are then matched with the real-time data on macroeconomic fundamentals for these six variables. To obtain monthly data, the trade balance is used instead of the current account, and industrial production is used as a measure of output to proxy GDP. The data source for the real-time macro series is the OECD's *Main Economic Indicators*, where it is possible to track both data for original release (i.e. in real time) and final release for all the countries examined.[12] Specifically, real time data are used for growth, inflation and trade balance. Then, interest rate and equity flow data are obtained from the IMF's *International Financial Statistics*. Note that, although equity flow data are not revised, they are published with a lag. To control for this, the final release equity flow data are lagged. Using data in real time implies that only information that was available historically at a particular point in time is used, allowing therefore both for measurement errors and release delays that affect macroeconomic data.[13] To be as consistent as possible with the surveys, actual macroeconomic fundamentals are calculated relative to those of the country of the reference currency.

A final point concerns the exchange rate data. Given the survey questions, it is preferable to use use nominal bilateral exchange rate changes *vis-a-vis* the reference currency, in the benchmark specification using changes over the past month. Exchange rates (expressed as the foreign price of the reference currency) are downloaded from *Datastream*.[14]

3.2 Order flow

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

[12]For Australia and New Zealand, however, only quarterly data are available for output and hence the data are interpolated 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.

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

[14]Table 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.

unobservable factors.

Data on bilateral order flow is *vis-a-vis* the reference currency over the period from January 2000 to November 2011. The order flow data are created based on tick-by-tick data from the Reuters electronic trading platform D2000-2. To match the order flow data to the scapegoat data, the order flow is aggregated over the previous month. Table IV provides some summary statistics of the order flow series for each of the 12 currencies in our sample, indicating that order flow fluctuates considerably over time.[15]

The FX market is an opaque market with little regulations, like e.g. disclosure requirements seen in other asset markets. Trading is organized in two main segments: (i) the customer-bank segment where end-user customers trade with banks, and (ii) the interdealer segment where banks trade with each other. Trades in the customer-bank segment are only observed by the two parties involved. Since dealers typically do not accumulate large inventory of currency, the trading in the interdealer market is then a derivative of the trading with customers. This interdealer order flow is not easily available to end-user customers like investors. Moreover, dealers typically only observe this order flow at very high frequency. Further analysis of this order flow requires both expensive subscriptions and calculations based on large amounts of data, since Reuters does not provide data on aggregate order flow. In practice this amounts to aggregate order flow being unobservable.[16]

Evans and Lyons (2002) first documented that order flow explains a substantial proportion of the fluctuations in two major exchange rates. In their setting, order flow is derived from a customer portfolio shift independent of the current state of the economy, and as such closely resembles the unobservable fundamental suggested in BvW (2004, 2006, 2009, 2013). Such a portfolio shift can in principle also be linked to shifts in preferences and risk premia.

Subsequent papers have further investigated the possible drivers of order flow. Evans (2010) and Evans and Lyons (2013) study how order flow reflects and aggregates information at the micro level (e.g. from firms and households), hence capturing information on macroeconomic fundamentals not yet observable in real time. Consistent with such a view, Rime, Sarno and Sojli (2010) find that order flow is linked to updates in expec-

[15]Specifically, 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.

[16]In 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.

tations about the macroeconomy. Similarly, Dominguez and Panthaki (2006), Berger, Chaboud, Chernenko, Howorka and Wright (2008), Love and Payne (2008) and Evans and Lyons (2008) have linked the information content of order flow to macroeconomic news.[17] Finally, it seems reasonable that order flow also captures information about (shocks to) liquidity and risk-aversion which are not observable in real time; for example, one would expect that demand for riskier, high-interest rate currencies drops at times of lower market liquidity and higher risk-aversion. Indeed in Kyle's (1985) model, which has inspired much of the subsequent theory in equity and FX microstructure, the impact of order flow on asset returns also depends on liquidity.

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

4 Empirical results

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

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

$$\Delta s_t = \gamma_1 \tau_{1,t} f_{1,t} + \ldots + \gamma_6 \tau_{6,t} f_{6,t} + u_t, \tag{12}$$

whereby changes in the exchange rate (Δs_t) are related to the second term of equation (8). By applying this general-to-specific model selection in order to produce an operational

[17] As 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."

model, regression (12) is implicitly used to pre-screen the scapegoats, reducing the number of potential scapegoats from six to three.[18]

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

We proceed column-by-column, thus interpreting the coefficient of each macro fundamental in turn. Growth has the expected negative (and statistically significant) coefficient for all four exchange rates where it is selected as a scapegoat, so that the currency of the faster growing country appreciates. In general, the foreign currency appreciates when inflation rises, with a couple of exceptions – the Polish zloty and the Mexican peso, although in the latter case the coefficient is tiny and statistically insignificant. The majority of the loadings on interest rate differentials are negative, implying that higher interest rates are generally associated with an appreciation of the currency. Moreover, a current account deficit is associated with a weaker currency in each case. Finally, with the only exception of the Canadian dollar, as equity inflows in the domestic country rise relative to the inflows in the foreign country, the domestic currency depreciates.[19]

Table 2 presents the estimates of the coefficients (β, γ and δ) of the scapegoat model with constant parameters (CP-SCA in equation (4)). If the expectation of the structural parameters matters for the exchange rate due to scapegoat effects, γ must be statistically different from zero. Also, defining n as a generic macro variable, γ_n should intensify the effect of the true parameter β_n so that it should take the same sign as the structural

[18] General-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.

[19] This 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.

parameter. Overall, γ and β are strongly significant over both the country and variable dimensions (with only one exception), and that the γ coefficients intensify the effect of the β coefficients (i.e. they have the same sign). These results are consistent with the benchmark macro model with constant parameters. Another comforting finding is the existence of a close link between monthly exchange rate movements and order flow, so that net buying pressure for a currency is associated with its appreciation. This result confirms that unobservable fundamentals, proxied by order flow, exert a strong effect on exchange rates. This is a necessary condition for the scapegoat effect to exist, as outlined in Section 2.

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

Table 3 presents the estimates of γ and δ for the scapegoat model with time-varying parameters (TVP-SCA in equation (8)). For scapegoat effects to exist, also in this case γ and δ should be statistically different from zero. Consistently, the results show that the γ coefficients are generally significant over both the country and variable dimensions. The existence of a close link between exchange rate movements and order flow is also confirmed as δ is statistically significantly different from zero. Table VII in the Internet Appendix reports results for TVP-MS. Similar to the constant parameter case, there are no substantial differences with TVP-SCA. Thus, we can conclude that also for the time-varying parameter models there is evidence in support of the basic predictions of the scapegoat model in terms of statistical significance of γ and δ.[20]

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

4.1 In-sample fit of scapegoat models

The first hypothesis of the scapegoat theory, as formulated in Section 2, is that scapegoat effects are empirically powerful in explaining exchange rate movements. This requires that the scapegoat models (with constant and time-varying parameters) perform satisfactorily in fitting exchange rate fluctuations, and outperform the respective benchmark models, i.e. CP-MS and TVP-MS outperform CP-M and TVP-M respectively, and CP-SCA and TVP-SCA outperform CP-MO and TVP-MO respectively. These model comparisons should inform us about both the explanatory power of the scapegoat model for exchange rate changes and the relative importance of scapegoat information (surveys) versus order flow. In this sub-section, we present evidence on the statistical performance of the scapegoat models relative to the benchmark models, using several conventional criteria of model evaluation – the (adjusted) R^2, root 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^2s 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.[21] 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

[21]The 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 $I_{\{.\}}$ 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.

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.

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

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

$$\Delta s_t = \alpha_0 + \alpha_1 \left(-x_t \times f_{n,t}\right) I_{\left\{f^q_{n,t}, x^q_t\right\}} + u_t, \tag{13}$$

where order flow is taken with the minus sign so that the expected sign of the parameter α_1 should be the one expected from regressing the exchange rate on the fundamental.[22] Order flow and the fundamental are selected for different quantiles; precisely our focus is on the top 20, 30 and 40 percent of observations. However, a particular observation is selected only if both the fundamental and order flow have experienced a sufficiently large shock, i.e. they fall in their respective quantiles. Thus, $I_{\left\{f^q_{n,t}, x^q_t\right\}}$ takes the value of 1 if $f_{n,t}$ and x_t are respectively in their top q percent of observations.[23] As mentioned above, this is a necessary condition for the fundamental to become a scapegoat. Moreover, to some extent, the sign of the regression is also important, as it informs us whether the movement of the exchange rate is on average theoretically consistent with the movement in order flow and the fundamental.[24]

[22] Assume 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.

[23] These 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.

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

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

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

$$\tau_{n,t} = \zeta_0 + \zeta_1 \left| x_t \times f_{n,t} \right| I_{\{\tau_{n,t} > \tau_{j,t}\}} I_{\left\{f_{n,t}^q, x_t^q\right\}} + \varepsilon_t, \tag{14}$$

where the indicator function $I_{\left\{f_{n,t}^q, x_t^q\right\}}$, consistent with Table 6, takes the value of 1 if at time t both $f_{n,t}$ 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 the macro factor n exceeds the values of the remaining two macro factors $j \neq n$ at each time t. Equation (14) closely follows the model of BvW (2009, 2013), where the expectation of the structural parameter at time t is determined by the weighted average of time $t-1$ expectation of the structural parameter and the structural parameter itself, plus a term similar to our $(x_t \times f_{n,t})$. In the theory, this last term reflects the scapegoat effect.[25]

[25] The 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.

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

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

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

4.3 Learning in the long run

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

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

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

where n refers to a macro variable (e.g. growth); $\widehat{\beta}_{n,t-1}$ is the estimated time-varying structural parameter; $\widehat{E_t\beta}_{n,t} = \widehat{\gamma}_n\tau_{n,t}$, where $\widehat{\gamma}_n$ is the estimated scapegoat parameter presented in Table 8 and $\tau_{n,t}$ is the survey; and $I_{\{\Delta\tau_{n,t}<0\}}$ is an indicator function which takes the value of 1 for negative changes in the survey ($\Delta\tau_{n,t} < 0$), and 0 otherwise. The scapegoat theory suggests that $E_t\beta_{n,t}$ tends to $\beta_{n,t}$ only when the scapegoat effect wears off, i.e. investors attach less weight to the fundamental. Hence, 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 equilibrium, which is determined by $\beta_{n,t}$. In contrast, no correction should take place otherwise, so that $b_1 \geq 0$. 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 $\beta_{n,t}$, consistent with a scapegoat effect taking place.

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

4.4 Out-of-sample forecasting and the random walk

Much empirical research has tested the usefulness of exchange rate theories by evaluating models in out-of-sample forecasting. Therefore, an out-of-sample forecasting exercise is carried out as an additional and final piece of empirical evidence on the performance of the scapegoat model, although the theory is silent on the role of scapegoats for forecasting.

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

The forecasting setup is the following. All models are estimated using data up to December 2006, and then out-of-sample recursive forecasts are produced for the period from January 2007 to November 2011.[26] The variable selection is repeated each month, as described in Section 4. One-month-ahead forecasts are then generated based on the predictive specifications of the following models: the constant parameter macro model (CP-M), the survey model (CP-MS), the order flow augmented macro model (CP-MO), and the scapegoat model (CP-SCA).[27] These models are assessed against the driftless random walk model (RW). Then, model comparison is based on the following statistics: the ratio of the root mean squared forecast error (RMSFER) from a model over that of the RW; the hit ratio (HR); the Henriksson-Merton test (HM); and measures of economic values that are summarized in the Sharpe ratio.[28] The Sharpe ratio is simply the outcome of a trading strategy that goes long in the currency that the model predicts will appreciate, and short in the currency predicted to depreciate by the model, for each exchange rate considered. Hence, the Sharpe ratio provides a direct measure of the economic value of the scapegoat model, and can be compared and tested against the Sharpe ratio generated by the benchmark RW model to check whether any difference in economic value relative to the RW is statistically different from zero.

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

Turning to the hit ratios, it is apparent that the scapegoat model generally produces the most accurate forecasts in terms of directional accuracy, being above the 50 percent accuracy that would be implied by a random directional forecast. On average across exchange rates, the directional accuracy of CP-SCA is 54.82 percent (specifically, 54.09 and 55.56 percent for industrialized and EM countries, respectively). This is confirmed by the inspection of the HM tests as the largest coefficients in the HM regressions are recorded for CP-SCA. However, there is no evidence of statistical significance, possibly

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

[27]The 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.

[28]The 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.

(presumably) because of low test power due to our small sample of out-of-sample observations (59). Nevertheless, the directional accuracy tests suggest that currency trading strategies based on the scapegoat model might generate economic value higher than RW forecasts.

Therefore, it is worth examining the results from the Sharpe ratios produced by long-short strategies that invest in the currency predicted to appreciate and short the currency predicted to depreciate according to the model. These results are clear-cut. First, several models outperform the RW benchmark, often displaying a statistically significantly different (i.e. higher) Sharpe ratio. Second, in general, CP-MS generates a higher Sharpe ratio than CP-M, and CP-SCA produces a higher Sharpe ratio than CP-MO. Third, on average across all exchange rates (and on average across each subset of industrialized and EM countries), CP-SCA produces the highest economic value on the basis of the Sharpe ratio measure – being 0.95 on average across all 12 exchange rates, against 0.20 obtained with a random walk.[29,30]

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

5 Conclusions

There is ample anecdotal evidence that financial market participants tend to blame individual macro fundamentals to rationalize observed exchange rate movements, with such blame often shifting across different fundamentals over time. This fact has been conceptualized in the scapegoat theory of exchange rates by BvW (2004, 2013). The main insight is that when exchange rates move in response to changes in an unobservable fundamental, it is rational for investors to blame factors that they can actually observe,

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

[30]It 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.

and more precisely those macro fundamentals that are out of sync with their long-term equilibrium values and move consistently with the observed exchange rate change.

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

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

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

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
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

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
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]	-	-

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

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

where Δs_t is the monthly exchange rate return; if s_t increases the domestic exchange rate (either the USD or the EUR) appreciates. The sample period spans from January 2000 to November 2011. The analysis uses three macro factors per country, selected using the general-to-specific procedure described in Section 4. Note that all variables, except the surveys, are standardized by subtracting the mean and dividing by their standard deviation. τs are standardized so that they have unit variance. One-standard deviation 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							
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity	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							
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity	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]

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

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

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

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

Panel A: Industrialized Economies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity	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

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity	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]

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

$$\Delta s_t = \mathbf{f}_t'\beta_t + (\tau_t \mathbf{f}_t)'\gamma + \delta x_t + u_t$$
$$\beta_t = \beta_{t-1} + \mathbf{v}_t.$$

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

Table 4: **In-sample Model Performance: CP Models**

	R^2(%)	RMSE	BIC	AIC	HR(%)	HM	R^2(%)	RMSE	BIC	AIC	HR(%)	HM
Panel A: Industrialized Economies												
			AUD/USD						*JPY/USD*			
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
			CAD/USD						*CHF/EUR*			
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
			EUR/USD						*GBP/USD*			
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
			CZK/EUR						*ZAR/USD*			
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
			MXD/USD						*SGD/USD*			
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
			PLN/EUR						*NZD/USD*			
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

The table provides several measures of model fit for the constant parameter models: CP-M, CP-MS, CP-MO and CP-SCA. There are measures of explained variance, in-sample predictive performance, information criteria and market timing: the adjusted R-squared in percent (R^2); the root mean squared error (RMSE); the Bayesian (BIC) and Akaike (AIC) information 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 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 and $\widetilde{\Delta s}_t$ denote the realized and fitted exchange rate returns, and I is the indicator function equal to unity when its argument is true and 0 otherwise. A positive and significant φ_1^{HM} provides evidence of market timing. Precisely, we report under HM $\widehat{\varphi_1}$ a, b, and c, denote the 1-, 5-, and 10-percent confidence levels, respectively. Standard error are calculated using Newey-West (1987).

Table 5: **In-sample Model Performance: TVP Models**

	R^2(%)	RMSE	BIC	AIC	HR(%)	HM	R^2(%)	RMSE	BIC	AIC	HR(%)	HM
Panel A: Industrialized Economies												
			AUD/USD						*JPY/USD*			
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]
			CAD/USD						*CHF/EUR*			
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]
			EUR/USD						*GBP/USD*			
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
			CZK/EUR						*ZAR/USD*			
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]
			MXD/USD						*SGD/USD*			
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]
			PLN/EUR						*NZD/USD*			
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]

The table provides several measures of model fit for the time-varying parameter models: TVP-M, TVP-MS, TVP-MO and TVP-SCA. There are measures of explained variance, in-sample predictive performance, information criteria and market timing: the adjusted R-squared in percent (R^2); the root mean squared error (RMSE); the Bayesian (BIC) and Akaike (AIC) information 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 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 and $\widetilde{\Delta s}_t$ denote the realized and fitted exchange rate returns, and I is the indicator function equal to unity when its argument is true and 0 otherwise. A positive and significant φ_1^{HM} provides evidence of market timing. Precisely, we report under HM $\widehat{\varphi_1}$ a, b, and c, denote the 1-, 5-, and 10-percent confidence levels, respectively. Standard error are calculated using Newey-West (1987).

Table 6: **Exchange Rates, Order Flow and Macro Factors**

	ΔGrowth			ΔInflation			ΔRate ST		
q	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]
$R^2_N(\%)$	26	11	10	-2	-1	0	-1	3	3
N	18	50	99	31	83	154	59	139	227
	ΔRate LT			CA			ΔEquity		
q	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]
$R^2_N(\%)$	9	9	5	11	6	5	13	4	2
N	33	79	137	7	9	14	27	62	100

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

$$\Delta s_t = \alpha_0 + \alpha_1 \left(-x_t \times f_{n,t}\right) I_{\left\{f^q_{n,t}, x^q_t\right\}} + u_t.$$

The order flow is taken with the minus sign so that the expected sign should be the one expected from regressing the exchange rate return on the fundamental. The order flow and the fundamental are selected for different quantiles ranging from 20 to 40 percent. Precisely, each variable is sorted in absolute value and we take the largest 20, 30 and 40 percent of the observations, and the observation is selected only if in that period both the fundamental and order flow are included in their respective quantiles. N denotes the number of times the fundamental times order flow is selected for each quantile. Thus, $I_{\left\{f^q_{n,t}, x^q_t\right\}}$ takes the value of 1 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 experienced a sufficiently large shock. Note that the macro fundamentals are selected only if the scapegoat effect $\widehat{\gamma}_n$ is significant in Table 3. R^2_N is the adjusted R^2s computed over the N observations. The regression is estimated using robust estimation; by 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 20%	ΔGrowth 30%	ΔGrowth 40%	ΔInflation 20%	ΔInflation 30%	ΔInflation 40%	ΔRate ST 20%	ΔRate ST 30%	ΔRate ST 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 20%	ΔRate LT 30%	ΔRate LT 40%	CA 20%	CA 30%	CA 40%	ΔEquity 20%	ΔEquity 30%	ΔEquity 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

The table displays the results for the six panel regressions of the survey ($\tau_{n,t}$) on the absolute value of the correspondent macro factor ($f_{n,t}$) times the order flow (x_t) times the indicator functions $\left(I_{\{\tau_{n,t}>\tau_{j,t}\}}\right)$ and $\left(I_{\{f^q_{n,t},x^q_t\}}\right)$. The latter takes the value 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 survey $\tau_{n,t}$ we estimate:

$$\tau_{n,t} = \zeta_0 + \zeta_1 \left| x_t \times f_{n,t} \right| I_{\{f^q_{n,t},x^q_t\}} I_{\{\tau_{n,t}>\tau_{j,t}\}} + \varepsilon_t,$$

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

Table 8: **Learning in the long run**

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

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

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

where n is an index of the macro variable (e.g. growth). The dependent variable and the regressors are denoted with an $\widehat{(\cdot)}$ 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 parameter, and $\widehat{E_t\beta}_{n,t} = \widehat{\gamma}_n\tau_{n,t}$, where $\widehat{\gamma}_n$ is the estimated scapegoat parameter, as presented in Table 3, and $\tau_{n,t}$ is the survey. $I_{\{\Delta\tau_{n,t}<0\}}$ is an indicator function which takes the value of 1 for negative changes in the survey ($\Delta\tau_{n,t} < 0$), and 0 otherwise. 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 only if in that month the survey is available. Newey-West (1987) standard errors are reported in parenthesis. a, b, and c, denote the 1-, 5-, and 10-percent confidence levels, respectively.

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

	RW	CP-M	CP-MS	CP-MO	CP-SCA
Panel A: All Currencies					
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

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

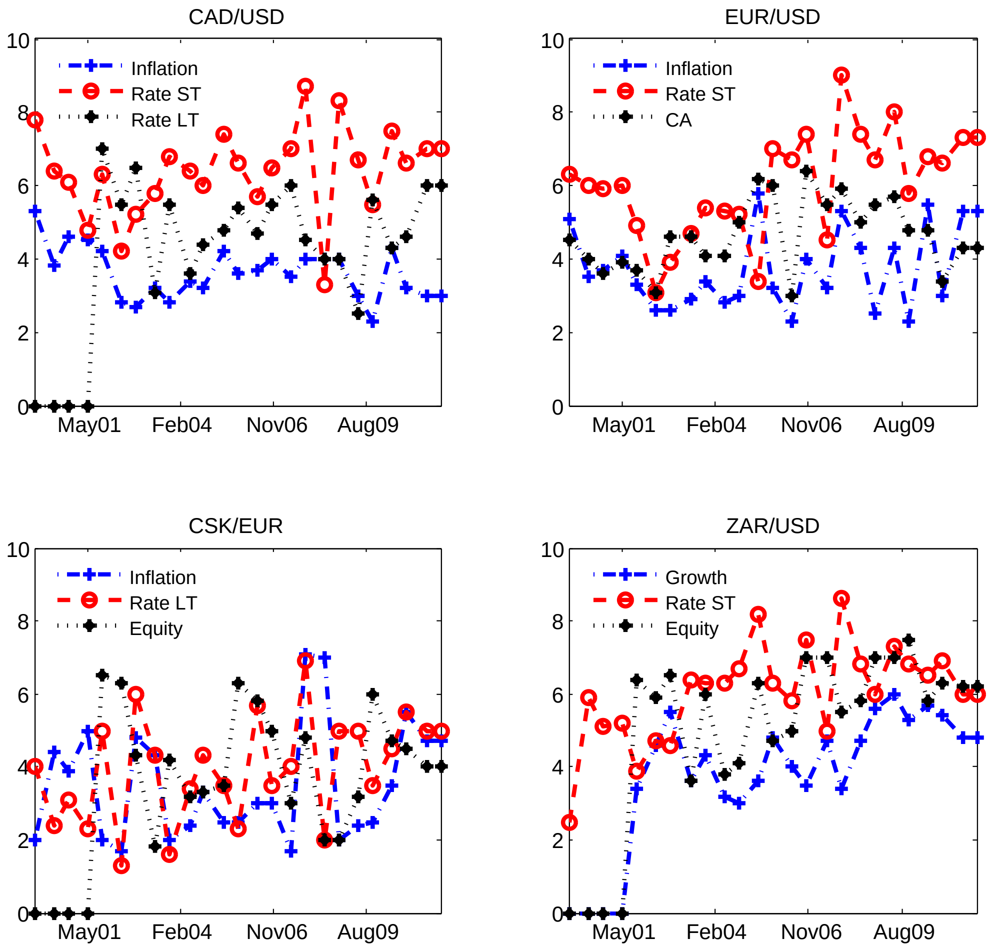

Figure 1: **Selected scapegoat variables.** The figures show the exchange rate consensus surveys selected by our methodology for four currencies: Canadian dollar, euro, Czech koruna and South African rand. The sample spans the period from January 2000 to November 2011.

Internet Appendix

The Scapegoat Theory of Exchange Rates: The First Tests

by
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A Appendix: Bayesian MCMC estimation

The appendix describes the estimation of the benchmark macro models and the scapegoat models, including the scapegoat model with no order flow. A Bayesian estimation of the parameters of the empirical exchange rate models is performed, following Kim and Nelson (1999), Cogley and Sargent (2002, 2005), and Primiceri (2005), among others. See Koop (2003) for a more general introduction to Bayesian methods. We first present the algorithm for the constant parameter models, and then move on to describing the algorithm of the time-varying parameter models.

A.1 The linear regression algorithm (CP-M, CP-MS, CP-MO, and CP-SCA)

This subsection deals with the estimation of the constant parameter models CP-M, CP-MS, CP-MO, and CP-SCA. Let us consider the following linear regression model

$$\Delta s_t = \mathbf{X}_t'\theta + u_t, \tag{A.1}$$

where s_t is the log of the nominal exchange rate (defined as the foreign price of domestic currency), $\theta = (\theta_1, \theta_2, , \ldots, \theta_K)'$ is a K vector coefficients, $\mathbf{X}_t = (X_{1,t}, X_{2,t}, , \ldots, X_{K,t})'$ is a K vector of regressors a time t, and u_t is a disturbance term normally distributed with 0 mean and constant variance σ^2. One needs to estimate the set of the conditional mean hyperparameters (θ) and the constant variance hyperparameter (σ^2). Define the following priors: for θ the algorithm assumes a Normal prior $\mathrm{N}(\theta_0, V_0)$, where $\theta_0 = \mathbf{0}_K$ and $\mathbf{V}_0 = \mathbf{I}_{KK}$; for σ^2 an inverse Gamma prior $\mathrm{IG}(\frac{d_0^2}{2}, \frac{v0}{2})$ with shape and scale parameters $v_0 = 1$ and $d_0^2 = 1$, respectively. The Gibbs algorithm consists of the following simple steps:

1. Initialize σ^2.
2. Sample θ from $p\left(\theta|\sigma^2, \mathbf{\Delta s}^T, \mathbf{X}^T\right) = N(\theta_1, \mathbf{V}_1)$, where $\mathbf{V}_1 = \left(\mathbf{V}_0^{-1} + \sigma^{-2}\mathbf{X}\mathbf{X}'\right)^{-1}$ and $\theta_1 = \mathbf{V}_1\left(\mathbf{V}_0^{-1}\theta_0 + \sigma^{-2}\mathbf{X}\Delta s'\right)$.
3. Sample σ^2 from $p\left(\sigma^2|\theta, \mathbf{\Delta s}^T, \mathbf{X}^T\right) = IG\left(\frac{d_1^2}{2}, \frac{v_1}{2}\right)$, where $v_1 = v_0 + T$ and $d_1^2 = d_0^2 + \sum_{t=1}^{T}\left(\Delta s_t - \mathbf{X}_t'\theta\right)^2$.
4. Go to step 2 and iterate 40,000 times beyond a burn-in of 20,000 iterations.

In the CP-M model $\mathbf{X}_t = [\mathbf{f}_t]$ and $\theta = [\beta]$, where $\mathbf{f}_t$ denotes a 3×1 vector of macro fundamentals. By contrast, in the CP-SCA model $\mathbf{X}_t = [\mathbf{f}_t; \tau\mathbf{f}_t; x_t]$ and $\theta = [\beta; \gamma; \delta]$, where $\mathbf{f}_t$ is a 3×1 vector of macro fundamentals, $\tau_t\mathbf{f}_t$ is a 3×1 vector of scapegoat parameters τ_t (surveys) times their respective macro fundamentals $\mathbf{f}_t$, x_t is the unobservable fundamental (order flow) and θ is the K vector of coefficients. Therefore, in the CP-SCA model $K = 7$. Finally the CP-MS model does not include order flow so that $\mathbf{X}_t = [\mathbf{f}_t; \tau\mathbf{f}_t]$ and $\theta = [\beta; \gamma]$, whereas the CP-MO model does not include the surveys so that $\mathbf{X}_t = [\mathbf{f}_t; x_t]$ and $\theta = [\beta; \delta]$.

A.2 Time-varying parameters algorithm (TVP-M)

A model with time-varying parameters displays a non-linear state space representation. The measurement equation is

$$\Delta s_t = \mathbf{f}_t' \beta_t + u_t, \tag{A.2}$$

where the conditional β_t parameters are now time-varying. To close the model it is necessary to specify the transition equation which describes the law of motion of the parameters. The parameters are treated as a hidden state vector which evolves as a multivariate driftless random walk

$$\beta_t = \beta_{t-1} + \mathbf{v}_t, \tag{A.3}$$

where $\mathbf{v}_t$ is an i.i.d. Gaussian process with mean $\mathbf{0}$ and covariance $\mathbf{Q}$. The estimation assumes that the innovations, $(u_t, \mathbf{v}_t)$, are identically and independently distributed normal random variables with mean 0 and covariance matrix

$$E_t \begin{bmatrix} u_t \\ \mathbf{v}_t \end{bmatrix} [u_t \; \mathbf{v}_t] = \mathbf{V} = \begin{pmatrix} \sigma^2 & 0 \\ 0 & \mathbf{Q} \end{pmatrix}, \tag{A.4}$$

where σ^2 is the variance for the measurement innovation and $\mathbf{Q}$ is the covariance matrix for the state innovations. It is also assumed that the innovations are not correlated. In particular, not only the cross-covariance matrix is equal to 0, but also the $\mathbf{Q}$ matrix takes a diagonal form. These assumptions can easily be relaxed but are not crucial to our analysis.

What follows outlines the Gibbs sampler algorithm used to simulate a sample from the joint posterior $p\left(\sigma^2, \mathbf{Q}, \beta^T \mid \mathbf{y}^T\right)$, where the vectors

$$\mathbf{y}^T = [y_1, \ldots, y_T] \tag{A.5}$$

and

$$\beta^T = [\beta_1, \ldots, \beta_T] \tag{A.6}$$

represent the history of the data $\mathbf{y}^T = [\Delta s^T, \mathbf{f}^T]$, and states β^T, up to time T. Thus, the Gibbs sampler consists of sampling conditionally from three blocks, of which two relate to the hyperparameters $(\sigma^2, \mathbf{Q})$, and the remaining one to the latent parameters β^T. Next each of the steps is described in turn.

Gibbs Step 1: States given hyperparameters The model is linear with a conditional Gaussian state space representation, so that the joint posterior density of β^T is simply

$$p\left(\beta^T | \sigma^2, \mathbf{Q}, \mathbf{y}^T\right) = p\left(\beta_T | \sigma^2, \mathbf{Q}, \mathbf{y}^T\right) \prod_{t=1}^{T-1} p\left(\beta_t | \beta_{t+1}, \sigma^2, \mathbf{Q}, \mathbf{y}^t\right). \tag{A.7}$$

The conditional posterior of β^T can be obtained through a forward run of the Kalman filter followed by the one of the simulation smoother as in e.g. Carter and Kohn (1994) or Chib and Greenberg (1995). Given $\beta_{0|0}$ and $\mathbf{R}_{0|0}$, the Kalman Filter forward recursion are

$$
\begin{aligned}
\mathbf{K}_t &= \mathbf{R}_{t|t-1}\mathbf{f}_t'(\mathbf{f}_t\mathbf{R}_{t|t-1}\mathbf{f}_t' + \sigma^2)^{-1} \\
\beta_{t|t} &= \beta_{t-1|t-1} + \mathbf{K}_t(\Delta s_t - \mathbf{f}_t'\beta_{t-1|t-1}) \\
\mathbf{R}_{t|t-1} &= \mathbf{R}_{t-1|t-1} + \mathbf{Q} \\
\mathbf{R}_{t|t} &= \mathbf{R}_{t|t-1} - \mathbf{K}_t\mathbf{f}_t\mathbf{R}_{t|t-1}
\end{aligned} \tag{A.8}
$$

where $\beta_{t|t} \equiv E(\beta_t|\sigma^2, \mathbf{Q}, \mathbf{y}^t)$, $\mathbf{R}_{t|t-1} \equiv Var(\beta_t|\sigma^2, \mathbf{Q}, \mathbf{y}^{t-1})$ and $R_{t|t} \equiv Var(\beta_t|\sigma^2, \mathbf{Q}, \mathbf{y}^{t-1})$ are the mean and, respectively, the predicted and smoothed variance-covariance matrices.

The last forward recursion delivers $p\left(\beta_T|\sigma^2, \mathbf{Q}, \mathbf{y}^T\right) = N(\beta_{T|T}, \mathbf{R}_{T|T})$, the first term of the joint posterior (A.7). The simulation smoother instead provides the updated estimates of the conditional means and variances, $\beta_{t|t+1} \equiv E(\beta_t|\beta_{t+1}, \sigma^2, \mathbf{Q}, \mathbf{y}^t)$ and $R_{t|t} \equiv Var(\beta_t|\beta_{t+1,}\sigma^2, \mathbf{Q}, \mathbf{y}^t)$, respectively. Specifically:

$$
\begin{aligned}
\beta_{t|t+1} &= \beta_{t|t} + \mathbf{R}_{t|t}\mathbf{R}_{t+1|t}^{-1}(\beta_{t+1}^d - \beta_{t|t}) \\
\mathbf{R}_{t|t+1} &= \mathbf{R}_{t|t} - \mathbf{R}_{t|t}\mathbf{R}_{t+1|t}^{-1}\mathbf{R}_{t|t}
\end{aligned} \tag{A.9}
$$

fully determine the remaining densities of equation (A.7),

$$
p\left(\beta_t|\beta_{t+1}, \sigma^2, \mathbf{Q}, \mathbf{y}^t\right) = N(\beta_{t|t+1}, \mathbf{R}_{t|t+1}) \tag{A.10}
$$

To obtain an entire sample of the latent parameters β^T, the simulation smoother works as follows. First, draw β_T^d from $N(\beta_{T|T}, \mathbf{R}_{T|T})$, then compute $\mathbf{R}_{T-1|T}$ and $\beta_{T-1|T}$ using β_T^d. Second, draw β_{T-1}^d from $N(\beta_{T-1|T}, \mathbf{R}_{T-1|T})$, and so forth. Finally, draw β_1^d from $N(\beta_{1|2}, \mathbf{R}_{1|2})$.

Gibbs Step 2: Hyperparameter σ^2 given states Conditional on β^T and $\mathbf{y}^T$, the innovations of the measurement equation are observable so that the conditional density of σ^2 is independent from $\mathbf{Q}$. When an inverse Gamma prior is combined with a Gaussian likelihood, the posterior has also an inverse Gamma density

$$
p\left(\sigma^2|\beta^T, \mathbf{y}^T\right) = IG(\frac{S_1}{2}, \frac{\nu_1}{2}) \tag{A.11}
$$

with scale and shape parameters

$$
\begin{aligned}
S_1 &= S_0 + \sum_{t=1}^{T}(\Delta s_t - \mathbf{f}_t'\beta_t)^2 \\
\nu_1 &= \nu_0 + T
\end{aligned}
$$

where the priors are $S_0 = 1$ and $\nu_0 = 1$.

Gibbs Step 3: Hyperparameter Q given states The focus now shifts on drawing the variance-covariance matrix of the coefficients' innovations $\mathbf{v}_t$, $\mathbf{Q}$. Conditional on a realization of β^T, the innovations $\mathbf{v}_t$ are observable. Moreover, because $\mathbf{v}_t$ is independent of the other shocks of the model u_t, then σ is redundant to draw $\mathbf{Q}$. Given an inverse-Wishart prior for $\mathbf{Q}$ and a normal likelihood, the posterior of $\mathbf{Q}$ has itself an inverse-Wishart distribution

$$p\left(\mathbf{Q}|\beta^T,\mathbf{y}^T\right) = IW\left(\mathbf{Q}_1^{-1}, z_1\right) \tag{A.12}$$

with scale and degrees-of-freedom parameters

$$\mathbf{Q}_1 = \mathbf{Q}_0 + \sum_{t=1}^{T}(\beta_t - \beta_{t-1})(\beta_t - \beta_{t-1})'$$
$$z_1 = z_0 + T.$$

Under the assumption of uncorrelated states the off-diagonal elements of $\mathbf{Q}^d$ are set to 0.[31]

The algorithm iterates over the three steps above for a number of iterations sufficient to ensure convergence of the chain to the ergodic distribution. Precisely, 80,000 replications are performed of which the first 40,000 are burned-in, saving 1 every 10 draws of the last 40,000 replications of the chain.

A.3 The scapegoat models (TVP-MS and TVP-SCA)

In Bacchetta and van Wincoop (2009), the scapegoat model not only includes macro factors with loadings that vary over time (as in our benchmark TVP-M), but also the expectation of future parameters and unobserved fundamentals. Our empirical version of the scapegoat model of Bacchetta and van Wincoop (2009) (TVP-SCA) is:

$$\Delta s_t = \mathbf{f}_t'\beta_t + (\tau_t\mathbf{f}_t)'\gamma + \delta x_t + u_t, \tag{A.13}$$

where τ_t denotes the surveys which capture the expectation of future parameters and weights the information in the macro factors. In addition, x_t is the order flow, which proxies for the unobservable fundamental.

From an econometric point of view, our empirical scapegoat model consists of estimating a model with both time-varying parameters (β_t) and time-invariant parameters (γ and δ). This means that it is necessary to modify the time-varying parameters algorithm described above. In particular, the conditional distribution of the variance of the measurement error also depends on γ and δ so that the scale matrix now becomes $S_1 = S_0 + \sum_{t=1}^{T}(\Delta s_t - \mathbf{f}_t'\beta_t - (\tau_t\mathbf{f}_t)'\gamma - \delta x_t)^2$. Similarly, the joint posterior density of the states will also depend on γ and δ. Thus, in the forward Kalman recursion the filtered value of the state at time t is modified such that $\beta_{t|t} = \beta_{t-1|t-1} + \mathbf{K}_t(\Delta s_t - \mathbf{f}_t'\beta_{t-1|t-1} - (\tau_t\mathbf{f}_t)'\gamma - \delta x_t)$.

More importantly, an additional step in the Gibbs sampler is required to draw γ and δ. Conditional on the previous draw of the states, one can rewrite the original scapegoat model as

$$\Delta\widetilde{s}_t = \Delta s_t - \mathbf{f}_t'\beta_t = \mathbf{z}_t'\mathbf{A} + u_t, \tag{A.14}$$

where $\mathbf{z}_t = [\tau_t\mathbf{f}_t; x_t]$ and $\mathbf{A} = [\gamma; \delta]$ are vectors of independent variables and parameters, respectively, each of dimension (4×1). Now, drawing $\mathbf{A}$ is equivalent to the problem of drawing the conditional mean parameters in a linear regression model (see above). A

[31] An alternative would be to work with the full conditional density equation by equation assuming an inverse Gamma for each element of the diagonal of Q, so that also the posterior has an inverse Gamma density. The two methods are equivalent.

Normal prior distribution is assumed, with $\mathbf{a}_0 = \mathbf{0}_4$ and $\mathbf{V}_{A,0} = \mathbf{I}_{4,4}$, so that the posterior is also Normal

$$p\left(\mathbf{A}|\sigma^2, \mathbf{y}^T, \beta^T\right) = N\left(\mathbf{a}_1, \mathbf{V}_{A,1}\right), \tag{A.15}$$

where $\mathbf{V}_{A,1} = \left(\mathbf{V}_{A,0}^{-1} + \sigma^{-2}\mathbf{z}\mathbf{z}'\right)^{-1}$ and $\mathbf{a}_1 = \mathbf{V}_{A,1}\left(\mathbf{V}_{A,0}^{-1}\mathbf{a}_0 + \sigma^{-2}\mathbf{z}\Delta\widetilde{s}\right)$.

The TVP-MS model, which is a simpler version of the scapegoat model (TVP-SCA) without order flow, takes the form:

$$\Delta s_t = \mathbf{f}_t'\beta_t + (\tau_t\mathbf{f}_t)'\gamma + u_t. \tag{A.16}$$

And its estimation therefore closely follows TVP-SCA. The key difference though is that $\mathbf{z}_t = [\tau_t\mathbf{f}_t]$ and $\mathbf{A} = [\gamma]$, so that i) $\mathbf{a}_0 = \mathbf{0}_3$ and $\mathbf{V}_{A,0} = \mathbf{I}_{3,3}$; and ii) $S_1 = S_0 + \sum_{t=1}^{T}(\Delta s_t - \mathbf{f}_t'\beta_t - (\tau_t\mathbf{f}_t)'\gamma)^2$ and $\beta_{t|t} = \beta_{t-1|t-1} + \mathbf{K}_t(\Delta s_t - \mathbf{f}_t'\beta_{t-1|t-1} - (\tau_t\mathbf{f}_t)'\gamma)$.

A.4 The order flow model (TVP-MO)

The TVP-MO model is also a simplified version of the scapegoat model (TVP-SCA) where surveys are excluded. Specifically, it takes the form:

$$\Delta s_t = \mathbf{f}_t'\beta_t + \delta x_t + u_t. \tag{A.17}$$

so that its estimation closely follows the estimation of the TVP-MS and TVP-SCA models. The key difference though is that $\mathbf{z}_t = [x_t]$ and $\mathbf{A} = [\delta]$, so that i) $\mathrm{a}_0 = 0$ and $V_{A,0} = 1$; and ii) $S_1 = S_0 + \sum_{t=1}^{T}(\Delta s_t - \mathbf{f}_t'\beta_t - \delta x_t)^2$ and $\beta_{t|t} = \beta_{t-1|t-1} + \mathbf{K}_t(\Delta s_t - \mathbf{f}_t'\beta_{t-1|t-1} - \delta x_t)$.

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B Appendix: Tables

This appendix reports a number of additional empirical results and robustness checks.

Table I: **Survey Data: Summary Statistics**

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Panel A: All currencies						
Obs	263	300	300	300	300	257
Obs: scape	89	225	225	175	75	85
Obs: (%) scape	33.8	75.0	75.0	58.3	25.0	33.1
Mean	5.3	4.1	6.2	5.0	5.0	4.9
Std. Dev.	1.2	1.1	1.4	1.0	1.1	1.2
Min	2.9	2.3	3.2	3.0	2.9	2.6
Max	7.3	6.4	8.5	7.0	7.1	7.1
AC(1)	0.29	0.28	0.37	0.08	0.24	0.14
Panel B: Industrialized Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	135	150	150	150	150	131
Obs: scape	25	125	125	75	50	43
Obs: (%) scape	18.5	83.3	83.3	50.0	33.3	32.8
Mean	5.2	3.7	6.3	5.1	4.6	4.9
Std. Dev.	1.2	1.0	1.4	0.9	1.0	1.2
Min	2.8	2.2	3.3	3.3	2.9	2.7
Max	7.3	5.8	8.9	7.0	6.5	7.2
AC(1)	0.26	0.21	0.46	0.14	0.30	0.18
Panel C: Emerging Market Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	128	150	150	150	150	126
Obs: scape	64	100	100	100	25	42
Obs: (%) scape	50.0	66.7	66.7	66.7	16.7	33.3
Mean	5.3	4.5	6.1	4.9	5.3	5.0
Std. Dev.	1.2	1.2	1.3	1.1	1.2	1.2
Min	3.0	2.4	3.1	2.7	2.8	2.4
Max	7.2	6.9	8.2	7.0	7.8	7.0
AC(1)	0.33	0.34	0.27	0.03	0.17	0.11

The table presents descriptive statistics for the survey data. Obs denotes the number of surveys available in the period from October 1999 to October 2011. “Obs: scape” and “Obs: scape (%)” indicate how many times a variable was the main scapegoat out of the six variables considered, and the percentage share of all observations for which it was the main scapegoat, respectively.

Table II: **Interpolated Survey Data: Summary Statistics**

Panel A: All currencies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	1536	1716	1716	1716	1716	1515
Obs: scape	520	1287	1287	1001	429	501
Obs: (%) scape	33.9	75.0	75.0	58.3	25.0	33.1
Mean	5.2	4.1	6.2	5.1	5.0	5.0
Std. Dev.	1.1	1.1	1.3	1.0	1.1	1.2
Min	2.9	2.3	3.2	3.0	2.9	2.6
Max	7.3	6.4	8.5	7.0	7.1	7.1
AC(1)	0.87	0.87	0.88	0.83	0.86	0.86
Panel B: Industrialized Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	782	858	858	858	858	771
Obs: scape	143	715	715	429	286	253
Obs: (%) scape	18.3	83.3	83.3	50.0	33.3	32.8
Mean	5.2	3.7	6.3	5.2	4.6	4.9
Std. Dev.	1.1	0.9	1.4	0.9	0.9	1.1
Min	2.8	2.2	3.3	3.3	2.9	2.7
Max	7.3	5.8	8.9	7.0	6.5	7.2
AC(1)	0.86	0.85	0.90	0.84	0.88	0.86
Panel C: Emerging Market Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	754	858	858	858	858	744
Obs: scape	377	572	572	572	143	248
Obs: (%) scape	50.0	66.7	66.7	66.7	16.7	33.3
Mean	5.3	4.4	6.2	5.0	5.3	5.0
Std. Dev.	1.2	1.2	1.3	1.1	1.2	1.2
Min	3.0	2.4	3.1	2.7	2.8	2.4
Max	7.2	6.9	8.2	7.0	7.8	7.0
AC(1)	0.88	0.88	0.86	0.82	0.85	0.85

The table presents descriptive statistics for the interpolated survey data. Obs denotes the number of interpolated surveys available in the period from January 2000 to November 2011. "Obs: scape" and "Obs: scape (%)" indicate how many times a variable was the main scapegoat out of the six variables considered, and the percentage share of all observations for which it was the main scapegoat, respectively.

Table III: **Macro Fundamentals: Summary Statistics**

Panel A: All currencies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	1706	1706	1706	1701	1706	1702
Mean	0.13	0.03	1.46	0.80	-1.08	0.36
Std. Dev.	2.52	0.49	1.91	0.87	4.08	0.58
Min	-7.53	-1.11	-1.90	-0.80	-12.03	-1.10
Max	7.96	1.92	6.12	3.12	10.81	1.55
AC(1)	-0.08	0.17	0.96	0.92	0.68	0.76
Panel B: Industrialized Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	858	858	858	858	858	858
Mean	-0.05	-0.05	-0.40	-0.73	-0.07	0.50
Std. Dev.	1.21	0.42	1.47	0.60	3.56	0.57
Min	-5.16	-1.09	-3.32	-2.13	-9.47	-1.02
Max	3.99	1.55	2.58	0.69	8.41	1.57
AC(1)	0.02	0.09	0.96	0.92	0.76	0.75
Panel C: Emerging Market Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	848	848	848	843	848	844
Mean	1.81	0.62	19.97	14.00	-12.58	1.26
Std. Dev.	23.00	3.36	14.12	6.87	27.60	3.53
Min	-59.46	-6.83	-2.88	3.13	-87.54	-7.12
Max	71.63	13.73	57.91	33.30	79.26	9.17
AC(1)	-1.14	1.52	5.72	5.53	3.54	4.66

The table presents descriptive statistics for the following macro fundamentals: growth, inflation, short-term interest rates, long-term interest rates, current account, and equity flows. All these variables, except the current account, are computed as differential with respect to the domestic variable, e.g. as for the short term interest rate ΔRate ST= $i^{\dagger}_{ST} - i_{ST}$, where (†) denotes the foreign country. The dataset covers the period from January 2000 to November 2011.

Table IV: **Exchange Rates and Order Flow: Summary Statistics**

	Panel A: Industrialized Economies											
	Mean	St.D.	Min	Max	AC(1)	Obs	Mean	St.D.	Min	Max	AC(1)	Obs
			AUD/USD						*JPY/USD*			
Δs	-0.24	4.01	-8.54	18.71	0.08	143	-0.15	2.84	-6.86	8.95	-0.03	143
x	1.07	2.38	-6.35	6.19	0.38	143	0.02	0.22	-0.65	0.94	0.19	143
			CAD/USD						*CHF/EUR*			
Δs	-0.21	2.75	-8.59	13.26	-0.05	143	-0.17	1.81	-7.24	4.90	-0.17	143
x	-0.89	1.80	-7.16	2.62	0.20	143	0.01	0.05	-0.14	0.16	0.25	143
			EUR/USD						*GBP/USD*			
Δs	-0.15	3.16	-8.93	10.58	0.02	143	0.05	2.64	-8.39	9.87	0.12	143
x	0.24	1.04	-2.47	3.36	0.46	143	1.11	1.87	-3.93	6.47	0.25	143

	Panel B: Emerging Market Economies											
	Mean	St.D.	Min	Max	AC(1)	Obs	Mean	St.D.	Min	Max	AC(1)	Obs
			CSK/USD						*ZAR/USD*			
Δs	-0.23	1.72	-4.76	6.82	0.06	143	0.32	5.12	-11.22	17.63	0.05	143
x	-0.15	0.26	-1.33	0.63	0.21	143	-0.78	0.84	-3.67	0.85	0.46	143
			MXD/USD						*SGD/USD*			
Δs	0.29	2.82	-6.49	15.36	0.20	143	-0.22	1.71	-4.94	8.20	-0.08	133
x	-0.62	0.87	-4.05	3.23	0.44	143	-0.41	0.63	-2.32	1.57	0.36	133
			PLN/EUR						*NZD/USD*			
Δs	0.10	2.93	-7.21	9.51	0.27	143	-0.19	4.15	-11.54	14.90	0.03	143
x	-0.17	0.62	-2.26	2.30	0.41	143	0.37	0.72	-1.62	3.20	0.18	143

The table presents descriptive statistics for monthly exchange rate returns (Δs) and order flow data (x) for each of the 12 currencies. The order flow data is the cumulative monthly order flow, based on daily order flow data. Order flow is defined as the number of buyer-initiated trades minus the number of seller-initiated trades, in thousands. The dataset covers the period from January 2000 to November 2011. Note that SGD/USD order flow are available only from October 2000, therefore the summary statistics, and as a result the estimation period, for the Singaporean dollar refer to the period from November 2000 to November 2011.

Table V: **Constant Parameter Survey Model (CP-MS)**

Panel A: Industrialized Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
AUD/USD						
β	-	-0.20^{**}	0.15^{**}	-0.24^{**}	-	-
	-	[-0.27;-0.12]	[0.04;0.26]	[-0.37;-0.11]	-	-
γ	-	-0.02^{**}	0.04^{**}	-0.03^{**}	-	-
	-	[-0.04;-0.01]	[0.03;0.06]	[-0.04;-0.01]	-	-
CAD/USD						
β	-	-0.34^{**}	0.16^{**}	-	-	-0.06^{**}
	-	[-0.42;-0.25]	[0.08;0.25]	-	-	[-0.11;-0.01]
γ	-	-0.02^{**}	0.02^{**}	-	-	-0.03^{**}
	-	[-0.03;-0.00]	[0.01;0.04]	-	-	[-0.05;-0.01]
EUR/USD						
β	-	-0.32^{**}	0.11^{**}	-	-0.14^{**}	-
	-	[-0.42;-0.22]	[0.03;0.18]	-	[-0.21;-0.06]	-
γ	-	-0.03^{**}	0.02^{**}	-	-0.02^{**}	-
	-	[-0.06;-0.01]	[0.01;0.03]	-	[-0.03;-0.00]	-
JPY/USD						
β	-0.09^{**}	-	0.06^{**}	-0.14^{**}	-	-
	[-0.15;-0.03]	-	[0.01;0.12]	[-0.24;-0.04]	-	-
γ	-0.01^{**}	-	0.02^{**}	-0.02^{**}	-	-
	[-0.02;-0.00]	-	[0.01;0.04]	[-0.03;-0.00]	-	-
CHF/EUR						
β	-	-0.04^{*}	-0.13^{**}	-	-	0.08^{*}
	-	[-0.12;0.04]	[-0.23;-0.04]	-	-	[-0.01;0.17]
γ	-	-0.01^{*}	-0.01^{**}	-	-	0.02^{*}
	-	[-0.03;0.01]	[-0.02;-0.00]	-	-	[-0.01;0.05]
GBP/USD						
β	-	-0.36^{**}	-	-0.14^{**}	-0.31^{**}	-
	-	[-0.46;-0.27]	-	[-0.22;-0.06]	[-0.43;-0.20]	-
γ	-	-0.03^{**}	-	-0.03^{**}	-0.06^{**}	-
	-	[-0.05;-0.01]	-	[-0.05;-0.01]	[-0.08;-0.03]	-

Panel B: Emerging Market Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
CZK/EUR						
β	-	-0.10^{**}	-	-0.11^{**}	-	0.08^{**}
	-	[-0.17;-0.03]	-	[-0.19;-0.03]	-	[0.02;0.14]
γ	-	-0.04^{**}	-	-0.06^{**}	-	0.06^{**}
	-	[-0.07;-0.02]	-	[-0.08;-0.03]	-	[0.03;0.09]
MXD/USD						
β	-0.05^{**}	0.01	-	-	-0.15^{**}	-
	[-0.10;-0.01]	[-0.07;0.07]	-	-	[-0.23;-0.06]	-
γ	-0.02^{**}	0.01	-	-	-0.04^{**}	-
	[-0.04;-0.01]	[-0.00;0.03]	-	-	[-0.06;-0.03]	-
PLN/EUR						
β	-	0.07^{**}	-0.09^{**}	-0.27^{*}	-	-
	-	[0.01;0.13]	[-0.18;-0.02]	[-0.52;0.00]	-	-
γ	-	0.05^{**}	-0.02^{**}	-0.02^{*}	-	-
	-	[0.02;0.08]	[-0.04;-0.01]	[-0.05;0.00]	-	-
ZAR/USD						
β	-0.18^{**}	-	-0.11^{**}	-	-	0.18^{**}
	[-0.28;-0.08]	-	[-0.19;-0.04]	-	-	[0.09;0.26]
γ	-0.05^{**}	-	-0.02^{**}	-	-	0.02^{**}
	[-0.08;-0.02]	-	[-0.04;-0.01]	-	-	[0.00;0.03]
SGD/USD						
β	-0.13^{**}	-	-0.10^{**}	0.14^{**}	-	-
	[-0.21;-0.05]	-	[-0.20;-0.01]	[0.02;0.27]	-	-
γ	-0.02^{**}	-	-0.02^{**}	0.01^{**}	-	-
	[-0.04;-0.01]	-	[-0.04;-0.00]	[0.00;0.03]	-	-
NZD/USD						
β	-	-0.02	0.17^{**}	0.07^{**}	-	-
	-	[-0.14;0.06]	[0.07;0.27]	[0.01;0.13]	-	-
γ	-	0.02	0.02^{**}	0.04^{**}	-	-
	-	[-0.01;0.05]	[0.01;0.04]	[0.02;0.06]	-	-

The table presents the estimates for the coefficients (β and γ) of the constant parameter scapegoat model which excludes order flow (CP-MS):

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

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

Table VI: **Constant Parameter Order Flow Model (CP-MO)**

Panel A: Industrialized Economies							
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity	Order Flow
AUD/USD	-	-0.27^{**}	0.44^{**}	-0.71^{**}	-	-	-0.50^{**}
	-	[-0.34;-0.20]	[0.32;0.56]	[-0.85;-0.57]	-	-	[-0.59;-0.55]
CAD/USD	-	-0.20^{**}	0.08^{**}	-	-	-0.18^{**}	-0.53^{**}
	-	[-0.27;-0.13]	[0.02;0.13]	-	-	[-0.25;-0.10]	[-0.60;-0.57]
EUR/USD	-	-0.24^{**}	0.05^{**}	-	-0.08^{**}	-	-0.47^{**}
	-	[-0.32;-0.16]	[0.01;0.09]	-	[-0.14;-0.03]	-	[-0.54;-0.51]
JPY/USD	-0.09^{**}	-	0.07^{**}	-0.19^{**}	-	-	-0.54^{**}
	[-0.15;-0.03]	-	[0.02;0.13]	[-0.30;-0.09]	-	-	[-0.61;-0.58]
CHF/EUR	-	-0.04	-0.23^{**}	-	-	0.13^{**}	-0.26^{**}
	-	[-0.12;0.04]	[-0.32;-0.14]	-	-	[0.05;0.22]	[-0.35;-0.31]
GBP/USD	-	-0.31^{**}	-	-0.06^{**}	-0.13^{**}	-	-0.35^{**}
	-	[-0.40;-0.22]	-	[-0.10;-0.01]	[-0.22;-0.04]	-	[-0.44;-0.41]

Panel B: Emerging Economies							
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity	Order Flow
CZK/EUR	-	-0.13^{**}	-	-0.13^{**}	-	0.04^{**}	-0.45^{**}
	-	[-0.21;-0.05]	-	[-0.21;-0.05]	-	[0.01;0.08]	[-0.53;-0.50]
MXD/USD	-0.05^{**}	0.00	-	-	-0.09^{**}	-	-0.11^{**}
	[-0.10;-0.01]	[-0.09;0.09]	-	-	[-0.16;-0.03]	-	[-0.18;-0.15]
PLN/EUR	-	0.07^{**}	-0.08^{**}	-0.10^{*}	-	-	-0.48^{**}
	-	[0.02;0.13]	[-0.15;-0.02]	[-0.31;0.11]	-	-	[-0.56;-0.53]
ZAR/USD	-0.09^{**}	-	-0.15^{**}	-	-	0.12^{**}	-0.53^{**}
	[-0.15;-0.03]	-	[-0.23;-0.08]	-	-	[0.05;0.18]	[-0.60;-0.57]
SGD/USD	-0.16^{**}	-	-0.10^{**}	0.16^{**}	-	-	-0.44^{**}
	[-0.24;-0.09]	-	[-0.21;-0.00]	[0.06;0.26]	-	-	[-0.52;-0.48]
NZD/USD	-	-0.28^{**}	0.30^{**}	0.04^{**}	-	-	-0.53^{**}
	-	[-0.35;-0.21]	[0.20;0.40]	[0.01;0.06]	-	-	[-0.61;-0.58]

The table presents the estimates for the coefficients (β and γ) of the constant parameter scapegoat model which excludes surveys (CP-MO):

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

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

Table VII: **Time-varying Parameter SUR Model (TVP-MS)**

Panel A: Industrialized Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
AUD/USD						
γ	-	-0.04^{**}	0.04^{**}	-0.04^{**}	-	-
	-	[-0.06;-0.01]	[0.02;0.07]	[-0.06;-0.01]	-	-
CAD/USD						
γ	-	0.01	0.03^{**}	-	-	0.00
	-	[-0.02;0.05]	[0.01;0.04]	-	-	[-0.03;0.03]
EUR/USD						
γ	-	-0.04^{**}	0.02^{**}	-	-0.03^{**}	-
	-	[-0.06;-0.01]	[0.00;0.03]	-	[-0.05;-0.01]	-
JPY/USD						
γ	-0.02^{**}	-	0.07^{**}	-0.03^{**}	-	-
	[-0.04;-0.01]	-	[0.03;0.11]	[-0.05;-0.01]	-	-
CHF/EUR						
γ	-	-0.01	-0.02^{**}	-	-	0.03^{**}
	-	[-0.04;0.03]	[-0.04;-0.01]	-	-	[0.01;0.06]
GBP/USD						
γ	-	-0.04^{**}	-	-0.05^{**}	-0.07^{**}	-
	-	[-0.07;-0.02]	-	[-0.08;-0.03]	[-0.10;-0.04]	-

Panel B: Emerging Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
CZK/EUR						
γ	-	-0.04^{**}	0.04^{**}	-0.04^{**}	-	-
	-	[-0.06;-0.01]	[0.02;0.07]	[-0.06;-0.01]	-	-
MXD/USD						
γ	-	0.01	0.03^{**}	-	-	0.00
	-	[-0.02;0.05]	[0.01;0.04]	-	-	[-0.03;0.03]
PLN/EUR						
γ	-	-0.04^{**}	0.02^{**}	-	-0.03^{**}	-
	-	[-0.06;-0.01]	[0.00;0.03]	-	[-0.05;-0.01]	-
ZAR/USD						
γ	-0.02^{**}	-	0.07^{**}	-0.03^{**}	-	-
	[-0.04;-0.01]	-	[0.03;0.11]	[-0.05;-0.01]	-	-
SGD/USD						
γ	-	-0.01	-0.02^{**}	-	-	0.03^{**}
	-	[-0.04;0.03]	[-0.04;-0.01]	-	-	[0.01;0.06]
NZD/USD						
γ	-	-0.04^{**}	-	-0.05^{**}	-0.07^{**}	-
	-	[-0.07;-0.02]	-	[-0.08;-0.03]	[-0.10;-0.04]	-

The table presents the estimates for the time-invariant coefficients (γ) of the time-varying parameter scapegoat model which excludes order flow (TVP-MS):

$$\Delta s_t = \mathbf{f}_t'\beta_t + (\tau_t \mathbf{f}_t)'\gamma + u_t$$
$$\beta_t = \beta_{t-1} + \mathbf{v}_t.$$

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

Table VIII: **Out-of-sample Model Performance by Currency**

	Panel A: Industrialized Economies									
	RW	CP-M	CP-MS	CP-MO	CP-SCA	RW	CP-M	CP-MS	CP-MO	CP-SCA
			AUD/USD					*JPY/USD*		
RMSFER	-	1.03	1.05	1.03	1.04	-	1.03	1.10	1.03	1.10
HR(%)	-	54.39	56.14	56.14	59.65	-	54.39	50.88	57.89	50.88
HM	-	-0.04	0.16	-0.11	0.15	-	-0.02	-0.04	0.10	-0.04
Mean	10.13	13.62	13.62	13.71	14.59	0.22	5.88	8.16	6.42	8.37
Std. Dev.	17.58	15.46	10.32	15.53	11.51	0.71	9.19	9	9.12	9
Sharpe Ratio	0.58	0.88	1.32[a]	0.88	1.27[a]	0.30	0.64[c]	0.91[a]	0.70[b]	0.93[a]
			CAD/USD					*CHF/EUR*		
RMSFER	-	0.98	1.14	0.98	1.15	-	1.03	1.07	1.04	1.07
HR(%)	-	50.88	52.63	49.12	56.14	-	49.12	50.88	49.12	49.12
HM	-	0.00	0.05	-0.03	0.12	-	-0.06	-0.01	-0.06	-0.06
Mean	0.58	7.07	7.33	8.15	9.49	0.48	6.96	6.33	5.72	6.16
Std. Dev.	11.28	9.16	8.87	8.8	8.49	0.47	8.87	8.87	8.95	8.91
Sharpe Ratio	0.05	0.77[a]	0.83[a]	0.93[a]	1.12[a]	1.01	0.78	0.71	0.64	0.69
			EUR/USD					*GBP/USD*		
RMSFER	-	1.05	1.10	1.08	1.11	-	1.01	1.04	1.01	1.03
HR(%)	-	54.39	50.88	47.37	52.63	-	50.88	56.14	50.88	56.14
HM	-	0.09	0.04	-0.06	0.07	-	-0.07	0.09	-0.07	0.10
Mean	-0.65	4.3	6.16	9.72	10.98	-3.2	1.19	3.37	0.01	1.74
Std. Dev.	12.65	5.84	5.68	8.36	7.41	10.58	3.77	3.81	4.31	4.46
Sharpe Ratio	-0.05	0.74[a]	1.08[a]	1.16[a]	1.48[a]	-0.30	0.32[a]	0.89[a]	0.00	0.39[a]

	RW	CP-M	CP-MS	CP-MO	CP-SCA	RW	CP-M	CP-MS	CP-MO	CP-SCA
Panel B: Emerging Economies										
			CZK/EUR					*ZAR/USD*		
RMSFER	-	1.03	1.03	1.04	1.04	-	1.02	1.04	1.02	1.05
HR(%)	-	61.40	59.65	54.39	56.14	-	40.35	47.37	42.11	45.61
HM	-	0.22^b	0.18^c	0.08	0.11	-	-0.19^b	-0.07	-0.16	-0.10
Mean	0.52	6.44	4.99	5.76	5.01	3.85	5.11	6.96	8.59	7.86
Std. Dev.	6.18	5.42	5.5	5.53	5.32	18.06	15.56	12.97	13.28	12.79
Sharpe Ratio	0.08	1.19^a	0.91^a	1.04^a	0.94^a	0.21	0.33	0.54^c	0.65^b	0.61^b
			MXD/USD					*SGD/USD*		
RMSFER	-	1.02	1.00	1.04	1.01	-	1.01	1.05	1.02	1.06
HR(%)	-	64.91	59.65	61.40	59.65	-	66.67	64.91	56.14	63.16
HM	-	0.29^c	0.18	0.22	0.19	-	0.26^b	0.21^c	0.03	0.17
Mean	-0.32	3.71	6.06	7.14	8.91	2.06	3.45	5.65	3.91	5.80
Std. Dev.	12.25	8.28	8.58	5.85	6.21	6.74	5.29	5.65	5.43	5.64
Sharpe Ratio	-0.03	0.45^b	0.71^a	1.22^a	1.44^a	0.31	0.65^c	1.00^a	0.72^b	1.03^a
			PLN/EUR					*NZD/USD*		
RMSFER	-	1.02	1.02	1.03	1.03	-	1.01	1.01	1.01	0.99
HR(%)	-	45.61	54.39	56.14	56.14	-	42.11	49.12	45.61	52.63
HM	-	-0.12	0.08	0.12	0.12	-	-0.16	0.00	-0.10	0.05
Mean	-0.87	0.35	4.49	1.35	4.82	5.02	9.47	10.41	9.01	11.26
Std. Dev.	10.51	10.27	7.98	9.37	7.93	17.50	12.87	12.58	11.99	12.60
Sharpe Ratio	-0.08	0.03	0.56^a	0.14	0.61^a	0.29	0.74^b	0.83^a	0.75^b	0.89^a

This table presents the model performance of out-of-sample recursive forecasts for the period from January 2007 to November 2011. The variable selection is repeated each month, as described in Section 4. Then one-month-ahead forecasts are generated based on the predictive specifications of the following models: the constant parameter macro model (CP-M), the survey model (CP-MS), the order flow augmented macro model (CP-MO) and the scapegoat model (CP-SCA). These models are benchmarked with the driftless random walk model (RW), using the following statistics: the ratio of the root mean squared forecast error of the indicated model over that of the random walk; the hit ratios (HR); the Henriksson-Merton test (HM), whereby a, b, and c, denote the 1-, 5-, and 10-percent confidence levels based on Newey-West standard errors, respectively. The table then reports the mean of the excess returns in percent (Mean), the standard deviation of the returns in percent (Std. Dev.) and the Sharpe Ratios. The Mean, Std. Dev. and the Sharpe ratios are annualized and assume no transaction costs. The a, b, and c Sharpe ratio subscripts denote the 1-, 5-, and 10-percent significance levels for a test of whether the Sharpe ratio of the selected model is different from the Sharpe ratio of the benchmark RW model.

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