The Scapegoat Theory of Exchange Rates: The First Tests*

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Abstract

This paper provides an empirical test of the scapegoat theory of exchange rates (Bacchetta and van Wincoop 2004, 2011), which suggests that the poor performance of exchange rate models may be explained by the omission of scapegoat variables. This theory suggests that market participants may at times attach significantly more weight to individual fundamentals to rationalize the pricing of currencies, which are partly driven by unobservable shocks in the form of liquidity trades. Based on novel survey measures of foreign exchange scapegoats for 12 currencies and a decade of proprietary data on order flow, we find empirical evidence that strongly supports the empirical implications of the scapegoat theory of exchange rates. The findings have implications for exchange rate modelling, suggesting that a more accurate understanding of exchange rates requires taking into account the role of scapegoat factors and their time-varying nature.

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"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)

1 Introduction

A central conjecture of the work by Meese and Rogoff (1983, 1988) is that the presence of time-varying parameters is a key explanation for the failure of exchange rate models to predict future currency movements. However, 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, Rossi (2006) finds a high degree of parameter instability for a broad set of models and specifications. Sarno and Valente (2009) show that the relevance of information contained in fundamentals changes frequently over time, while Cheung and Chinn (2001) illustrate through US survey data the sharp shifts in the importance foreign exchange (FX) traders attach to different fundamentals over time.

In a series of papers, Bacchetta and van Wincoop (2004, 2011) propose a scapegoat theory to explain the 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, even when allowing for rationality of agents and Bayesian learning, but rather by *expectations* about these structural parameters.[1] The scapegoat theory starts from the premise that while agents may have a fairly accurate idea about the relationship between fundamentals and exchange rates in the long-run, there is significant 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 may be rational to assign additional weight to some fundamental, thus making it a scapegoat, for observed exchange rate changes.

In fact, there is ample anecdotal evidence – as illustrated in the quote above – for financial market participants to blame individual fundamentals for exchange rate movements, with such blame often shifting rapidly across different fundamentals over time. The scapegoat theory by Bacchetta and van Wincoop (2004, 2011) entails that a particular fundamental is more likely to become a scapegoat the larger the (unexplained) exchange rate movement *and* the more this particular fundamental seems

[1] In fact, in related work Bacchetta, van Wincoop and Beutler (2009) show that allowing for time-varying parameters has only a marginal effect on the predictive power of fundamentals for exchange rates.

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 exchange rate movements. As a final step, Bacchetta and van Wincoop (2011) calibrate their model for 5 currencies of industrialized countries, using a standard monetary model of exchange rates and matching the moments of the fundamentals and exchange rates.

The present paper constitutes an empirical test of the scapegoat theory of exchange rates. We do so by exploiting novel data on exchange rate scapegoats from surveys, as well as proxies of unobservable fundamentals based on FX order flow. 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, equity flows) as drivers of a country's exchange rate *vis-a-vis* a reference currency.[2] This survey data is available over a 9-year period (2001-2009) and a panel of currencies of advanced and emerging economies. Thus, the data allows us to extract quantitative scapegoat measures for each of these six fundamentals over time and across currencies. We match this survey data with a novel data set on FX order flow as a proxy of unobservable factors driving exchange rates. The data are proprietary customer transactions from one of the major players in the FX market in terms of market share, namely UBS. The empirical estimations are conducted for 12 currencies (6 of advanced and 6 of emerging economies) individually over this 9-year period, using monthly data frequency.

We present and test two main hypotheses of the scapegoat theory of exchange rates. The first hypothesis inherent in the theory is that the inclusion of scapegoats improves the power of fundamentals in explaining exchange rate movements. We employ two alternative benchmark exchange rate models, one based on constant parameters and one based on time-varying parameters with Bayesian updating for the macro variables. Moreover, we use three criteria for the comparison of in-sample model performance across models – one based on the goodness-of-fit, a second on an information criterion, and a third on market-timing tests. For all of the industrialized economies' currencies and several emerging markets in our sample, we show that the scapegoat model performs significantly better than both benchmark models, and does so across all three performance criteria. Moreover, the magnitude of the improvement in the performance of the scapegoat model over the benchmark models is substantial. For instance, the adjusted-R^2 increases from about 10% for the time-varying parameter model without scapegoats to, on average across currencies, 37% with scapegoats. The hit ratio of correctly explained directional FX changes rises from about 60% for the benchmark models to about 72% for the scapegoat model across the 12 currencies.

We then show that the improvement in the in-sample explanatory power of the scapegoat model

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

does not only stem from the inclusion of the order flow variable, but also from the inclusion of the scapegoat parameters themselves. This finding is relevant because it suggests that while order flow is important in accounting for currency movements, the scapegoat parameters have an additional, sizeable explanatory power. More fundamentally, the joint role of order flow and scapegoat parameters is a necessary condition for the scapegoat effect to arise. Again, these findings are robust across currencies as well as across macro fundamentals as scapegoats.

The second hypothesis of the scapegoat theory relates to the determinants of the scapegoat factors themselves, and the question of which macroeconomic fundamental becomes a scapegoat at which point in time. Bacchetta and van Wincoop's scapegoat theory states that a fundamental becomes a scapegoat if the size of the deviation from its equilibrium is large and there is a sizeable shock to unobservable fundamentals. We indeed find empirical support for this hypothesis as a macroeconomic fundamental is picked and identified by market participants as a scapegoat in periods when it shows large movements and tends to be out of sync with its own longer-term equilibrium, and at the same time the unobservable fundamental is large. Overall, this empirical evidence is remarkably robust, as it holds for all currency groups and for all macroeconomic variables in our sample.

Taken together, these two pieces of empirical evidence provide strong support in favour 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 is to a significant extent explained by the presence of scapegoats. In other words, in their attempt to gauge what factors may drive exchange rates market participants have a tendency to single out individual macro variables, which tend to be those that seem of out sync with their own longer term equilibrium, and in particular at times when exchange rate movements are large. Overall, these findings have implications for exchange rate modelling, suggesting that a more accurate understanding of exchange rates requires taking into account the role of scapegoat factors, and their time-varying nature.

The paper is organized as follows. Section 2 outlines the main elements of Bacchetta and van Wincoop's scapegoat theory of exchange rates, and describes its testable empirical implications. Section 3 presents the data used for the empirical analysis, focusing in particular on the measurement of exchange rate scapegoats, and also discusses the empirical methodology underlying our estimations. 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 some macroeconomic factors receive an unusually large weight and thus are made scapegoats of exchange rate movements. Such episodes can happen when investors do not know the true model of exchange rates or the true parameters of the model, and when some of the drivers of exchange rate fluctuations are unobservable.[3] In particular, the weight or scapegoat role of a macroeconomic variable is higher when both the role of the unobservable for currency movements is larger and the macroeconomic fundamental shows large variation. Such "rational confusion" arises because agents make inference on the true parameter only conditioning on observable fundamentals and exchange rate movements at times when the exchange rate is instead driven by unobservables (e.g. liquidity or hedging trades). Thus, when exchange rates move strongly in response to changes in the unobservables, it is rational for agents to blame factors they can actually observe, and more precisely those macro fundamentals that are out sync from their longer term equilibrium values.

In this section, we describe a simple scapegoat model of exchange rates, closely following Bacchetta and van Wincoop (2011). We then introduce our main hypotheses for the empirical test of the scapegoat model of exchange rates. Finally, we motivate and present two fundamental-based exchange rate models which benchmark the scapegoat model.

2.1 The scapegoat model of exchange rates

Bacchetta and van Wincoop describe the scapegoat effect in a series of papers (2004, 2006, 2011). These papers differ for a number of reasons. For example, Bacchetta and van Wincoop (2004, 2006) assume that agents have heterogeneous information, whereas Bacchetta and van Wincoop (2011) develop a dynamic model, whereby the exchange rate is forward looking and depends on expectations of future fundamentals. However, the models share similar empirical implications. So our empirical test can be seen more generally as a test of the scapegoat effect, which is central to all of the above papers, although we follow closely Bacchetta and van Wincoop (2011) in what follows. We start by presenting their key equation describing the scapegoat effect, which takes as the point of departure a standard formulation of the exchange rate reflecting the present value of future fundamentals, in the vein of Engel and West (2005). Using first differences, Bacchetta and van Wincoop (2011) derive this equation as:

$$\Delta s_t = f_t((1-\lambda)\beta_t + \lambda E_t\beta_t) + (1-\lambda)b_t + \lambda \sum_{i=1}^{T} f_t \left(E_t\beta_{t-i} - E_{t-1}\beta_{t-i} \right), \tag{1}$$

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

where s_t is the log nominal exchange rate (expressed as 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, $\boldsymbol{\beta}_t = (\beta_{1,t}, \beta_{2,t}, \ldots, \beta_{N,t})'$ is the vector of time-varying true structural parameters, $\mathbf{E}_t\boldsymbol{\beta}_t = (E_t\beta_{1,t}, E_t\beta_{2,t}, \ldots, E_t\beta_{N,t})'$ is the vector of expected parameters at time t, and λ is the discount factor. The true structural parameters $\boldsymbol{\beta}_t$ vary over time but are also unknown to investors. While investors may know the value of these structural parameters over the long-run, they may not know their value and time variation in the short- to medium-term. For this reason, some observable macro fundamental may at times be given an "excessive" weight by investors, in the sense that the fundamental is given more weight over the short-term than the longer-term structural relationship of the fundamental with the exchange rate entails. This fundamental then becomes a natural scapegoat and influences the trading strategies of investors. Therefore, in equation (1), the expectations of structural parameters directly determine changes in the exchange rate. In fact, the fundamentals f_t are multiplied by a weighted average of actual and expected parameters. However, higher weights are attached to the expected values of the parameters rather than the actual values, since the discount factor λ is smaller than but close to unity (see Engel and West, 2005; Sarno and Sojli, 2010).[4] The impact of macro fundamentals on the exchange rate in the scapegoat model can thus be formulated as:

$$\frac{\partial \Delta s_t}{\partial f_t} = (1-\lambda)\beta_t + \lambda E_t\beta_t + \lambda \sum_{i=0}^{T} \Delta f_{t-i} \frac{\partial E_t\beta_{t-i}}{\partial f_t}. \tag{2}$$

We now turn to deriving the empirical hypotheses to test this scapegoat theory. Our first hypothesis is that the scapegoat theory does a good job in explaining exchange rate movements Δs_t. In order to test this hypothesis, we estimate the following empirical scapegoat model of exchange rates, which is the empirical counterpart to equation (1):

$$SCA : \Delta s_t = f_t'\beta_t + (\tau_t f_t)'\gamma + \delta x_t + u_t, \tag{3}$$

where τ_t is the scapegoat parameter $E\beta_t$. We identify the latter by using survey data, and the unobserved fundamental is proxied by order flow x_t; the measurement of both is described in Section 3. It is apparent that the last term in equation (1), which captures the change in the expectations of past parameters interacted with past fundamentals, is missing from equation (3). This term is dropped as data on current and lagged expectations of past parameters are hard to measure empirically, and may also be of second-order importance relative to the current scapegoat parameter.[5]

[4] More precisely, just as a fundamental may at times receive a larger weight in investors' trading decisions over the short-term, it may at other times receive too little weight. The model by Bacchetta and van Wincoop (2011) entails that in the long-run investors know the true structural parameters β_t, which should imply that these long-run structural parameters should match the average scapegoat parameters.

[5] Hence the empirical model we take to the data is a simplified version of the scapegoat model, as we neglect the additional channel, whereby current fundamentals lead to changes in the expectation of both current and past parameters. Thus, if the hypothesis holds for our simplified empirical model it should hold even if we were to include

In order to gauge the effect of fundamentals on exchange rates, we need to determine the evolution over time of the underlying structural relationship between fundamentals and exchange rates. Investors may know the process that determines the evolution of β_t, even if the actual levels of the structural parameters are unknown to them. We consider the case where β_t evolves as a driftless random walk:

$$\beta_t = \beta_{t-1} + v_t. \tag{4}$$

This is a widely used process in the empirical literature (e.g. see Cogley and Sargent, 2001; Primiceri, 2005; Rossi, 2005), and is also formulated in this way in Bacchetta and van Wincoop (2011). We assume homoskedastic errors and uncorrelated factors, so that v_t is a vector of normally distributed error terms with zero mean and diagonal covariance matrix Q. Both these assumptions can be easily relaxed, and are not crucial to our analysis.

In Bacchetta and van Wincoop (2011) the expectations of structural parameter are more volatile than the actual underlying true parameters, and the two can diverge for reasonably long periods due to the scapegoat effects. However, in the long run, the two are equal so it needs to hold that they have equal unconditional mean ($E\overline{\beta} = E\overline{\tau}$). To be consistent with the scapegoat theory, this condition needs to hold also in the estimation. We do this by standardizing the surveys τ_t to have mean zero as it is already the case for β_t. This standardization is useful in making the estimated model theoretically consistent, but it is important to note that this implies the time-varying parameters are now defined in deviation from their long-run mean.

As to our null hypothesis, we expect γ to be significant but it is not possible to interpret either the magnitude or the sign in a meaningful way because of the standardization above. We also expect the order flow parameter δ to be negative, i.e. when the buying pressure for the foreign currency increases the domestic currency depreciates (Evans and Lyons, 2002; Bacchetta and van Wincoop, 2004, 2006, 2011). More fundamentally, the test of the scapegoat model of exchange rates rests on the comparison of the empirical estimation of equation (3) with some competing models. We expect the scapegoat model to outperform these models under a number of in-sample metrics.

A second main hypothesis of the scapegoat theory relates to the determinants of the scapegoat parameter τ_t itself. What determines the evolution of this parameter? When does a macro fundamental become a scapegoat? The papers by Bacchetta and van Wincoop (2004, 2006, 2011) shows 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. We will turn below to formulating the empirical test for this hypothesis.

the last term, given that scapegoat parameters may exhibit at least some persistence.

2.2 Exchange rate models to benchmark the scapegoat model

An important issue is how to benchmark the scapegoat model, i.e. with which alternative models to compare its explanatory power. One natural candidate is a basic macro model with constant and known parameters. Such fundamental-based exchange rate model is consistent with the notion that the exchange rate is given by the present value of current and expected future fundamentals (Mark, 1995; Engel and West, 2005; Engle, Mark and West, 2007). This model can be easily rewritten in first differences, so that changes in the exchange rate depend on changes in the fundamentals,

$$CP : \Delta s_t = f_t' \beta + u_t. \tag{5}$$

However, there is overwhelming evidence of parameter instability (Rossi, 2005). This instability may be rationalized on a number of grounds, including policy regime changes, instabilities in the money demand or purchasing-power-parity equations, or also agents' heterogeneity leading to different responses to macroeconomic developments over time (e.g. see Schinasi and Swamy, 1989; Rossi, 2005, 2006). An alternative explanation is that frequent shifts in the parameters can result when models, which optimally use the information in the fundamentals, experience large and frequent changes in structural parameters (Sarno and Valente, 2009). For these reasons a second potential benchmark is a model that accounts for parameter instability. We therefore use as a second benchmark specification that allows for time-varying parameters,

$$TVP : \Delta s_t = f_t' \beta_t + u_t. \tag{6}$$

Both benchmark models in equations (5) and (6) assume that parameters are known to the investors. However, the latter model also assumes that parameters can vary over time. And, the unstable relationship between exchange rates and fundamentals is generated by parameters being volatile. In contrast, the scapegoat model assumes that the investors cannot observe directly the (shock to the) structural parameter v_t. Agents observe the signal $f_t' v_t + x_t$ through the change in the exchange rate, but because the order flow is unknown to them the only extra piece of information they have is f_t. As a result, large changes in the unobservable combined with large changes in the observed fundamental can easily alter agents' expectations. Thus, agents can naturally change their expectations of the structural parameter even if v_t is actually zero. For example, assume that the $x_t > 0$ and $f_t > 0$, but v_t is 0 so that the true parameter did not change. It follows that agents naturally increase their expectation of v_t, since they are confused by f_t being greater than zero. The scapegoat effect arises from this rational confusion.

3 Data and econometric methodology

This section starts by outlining the data, and specifically how we measure scapegoats of exchange rates as well as order flow and macro fundamentals. We then proceed by discussing our empirical methodology.

3.1 Data on scapegoats and fundamentals

We employ a novel data set to measure when and which fundamentals are used as scapegoats for exchange rate movements by financial market participants. In short, the aim is to extract a quantitative measure of the importance that investors attach to different macroeconomic fundamentals for driving exchange rates at a particular point in time.

The data is based on surveys of 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 with the majority being located in the US and the UK as well as 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 broad set of currencies bilaterally *vis-a-vis* a reference currency, i.e. mostly the US dollar and *vis-a-vis* the euro for some European currencies. For the euro, yen and UK pound, the exchange rates considered are *vis-a-vis* the US dollar.

More precisely, participants are asked to rank six key macroeconomic factors on a scale from 0 (no influence) to 10 (very strong influence). The six key variables are short-term interest rates, 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 reference currency country.[6] Of course, these six macro fundamentals only comprise a subset of potentially relevant fundamentals. For example, the trade balance is suggested by both portfolio balance models (e.g. Branson, 1984; Kumhof and Van Nieuwerburgh, 2005) and elasticity models of the balance of trade (e.g. Krueger, 1983; Rose and Yellen,1989; Obstfeld and Rogoff, 2004). However, Andersen, Bollerslev, Diebold and Vega (2003) document that the set of macroeconomic news that affects the conditional mean of the exchange rate is quite broad so that additional fundamentals can include money, income, prices and other macroeconomic variables.

Consensus Economics conducts the surveys monthly with the same financial market participants, and the change in participants is relatively small. However, Consensus Economics conducts several

[6] Moreover, survey participants are invited at each survey round to add additional factors that they see as important as drivers of the exchange rate. We do no include these additional factors, both because few of these are mentioned sufficiently often for allowing us to generate a time series for a particular currency, and also because some are hard to measure. For instance, additional factors mentioned are political conflicts, fear of interventions by central banks, or house prices.

surveys on exchange rates with these market participants (such as about short-term forecasts, longer-term forecasts, expected trading ranges, and market uncertainty), and alternates across these surveys over the months. This means that the surveys about FX scapegoats is conducted only between every 3 to 6 months, though at regular intervals over the years. We linearly interpolate the data for missing months so as to arrive at a dataset with monthly observations.

Overall, the survey data on FX scapegoats are available over a 9-year period (2001-2009) and a panel of currencies of advanced and emerging economies. We reduce our country sample to those 12 currencies for which we have survey data for the full 9-year period, 6 being currencies of advanced countries (Australian dollar, Canadian dollar, euro, Japanese yen, Swiss franc, and UK pound) and 6 emerging market currencies (Czech koruna, Mexican peso, Polish zloty, South African rand, Singapore dollar, and Korean won). Another important criterion for the selection of emerging market currencies is that these six are among the most freely floating emerging market currencies, though all may have experienced periods of interventions by their monetary authorities.

Table 1 shows summary statistics about the scapegoat surveys for the 12 currencies in our sample. A first interesting stylized fact is that the six macro variables have mostly similar means as well as 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. However, there are some revealing differences across currencies, in particular between advanced and EME currencies. For instance, inflation has never been the single most important scapegoat for advanced countries' currencies over the past decade. Short-term interest rates have been the dominant scapegoat for advanced currencies relatively more frequently, whereas for EME currencies growth differentials and the current account have been more frequently considered by investors as the main scapegoat. Moreover, Figure 1 illustrates the time variations of the scapegoat factors for some currencies, showing indeed that the variability of the weights investors attach to macro fundamentals often change substantially over time, and the main scapegoat changes fairly frequently.

We match the monthly scapegoat data with the actual macroeconomic fundamentals for these six variables. To obtain monthly data, we use the trade balance instead of the current account, and use interpolated monthly GDP growth figures. The data source for all macro series is the IMF's *International Financial Statistics*. To be as consistent as possible with the surveys, actual macroeconomic fundamentals are calculated relative to those of the reference country. As to the scaling of the scapegoat variables, we scale each scapegoat variable for each currency so that its mean and standard deviation are identical to those of the underlying actual macroeconomic variable. Table 2 offers summary statistics for the actual macro fundamentals with all, except the current account, being measured relative to the anchor currency.

A final point concerns the exchange rate data. Given the survey questions, we use nominal bilateral exchange rate changes *vis-a-vis* the reference currency, in the benchmark specification using changes over the past month. As we know the precise day when the surveys were conducted, these exchange rate changes are calculated relative to the market closing of the previous business day.

3.2 Data on order flow

The second important data for the empirical test of the scapegoat theory of exchange rates is on order flow. Our rationale is as follows. Bacchetta and van Wincoop stress the important role of unobservables, in particular such as unobservable liquidity trades, as drivers of exchange rates. It is hence important to try and capture such unobservables for two reasons. First, to test whether unobservables as captured and proxied by order flow exert a significant effect on monthly exchange rate changes; and second, it is important to control for unobservables in order to test whether scapegoats exert an additional effect on exchange rates.[7]

We use a comprehensive dataset of order flow for all 12 currencies in our sample over the entire 2001-2009 period. These order flow series are bilateral *vis-a-vis* the reference currency. The source of the data is UBS. To match the order flow data to the scapegoat data, we calculate the cumulative monthly order flow, based on daily order flow data, on the business day previous to the latest scapegoat survey and over the previous one month.

Moreover, we have available order flow from different types of investors for the advanced economies, but not for emerging market economies. Therefore we use total order flow for emerging currencies, whereas we use (the sum of) hedge funds and asset managers order flow for advanced countries. This is because the order flow of sophisticated investors is more likely to capture the unobservable shock in the theory of Bacchetta and van Wincoop. Moreover, we suspect that total order flow in emerging markets is vastly dominated by sophisticated investors, so that the use of total order flow is appropriate and largely consistent with our measure of order flow for advanced economies. Table 3 provides some summary statistics for the order flow series for each of the 12 currencies in our sample, indicating that order flow does fluctuate considerably over time.

The FX microstructure approach has surged since Evans and Lyons (2002) first documented that order flow explains a substantial proportion of the fluctuations in major exchange rates, a result that stands in stark contrast with decades of failure to find a robust empirical macroeconomic model of exchange rate behavior. Evans and Lyons (2005) subsequently show that order flow contains predictive power and outperforms a random walk in an out-of-sample forecasting exercise using conventional statistical criteria. Similarly, Rime, Sarno and Sojli (2010) find that order flow models generate substantial economic gains to an investor in a dynamic asset allocation setting. The

[7] Order flow, the net of buyer and seller-initiated transactions, is employed to capture price-relevant information that is revealed through trade.

explanatory and forecasting power of order flow has been mainly linked to macroeconomic news (e.g. Dominguez and Panthaki, 2006; Berger *et al.*, 2008; Love and Payne, 2008; Evans and Lyons, 2010), changes in expectations about the macroeconomy (Rime, Sarno and Sojli, 2010), and signals on the current state of the economy (Evans and Lyons 2005, 2006).

3.3 Econometric methodology

In Bacchetta and van Wincoop (2011), the scapegoat model (1) not only includes macro factors with loadings that vary over time, but also the expectation of future parameters and unobserved fundamentals. For convenience, we repeat equation (3) for our empirical version of the scapegoat model

$$\Delta s_t = f_t' \beta_t + (\tau_t f_t)' \gamma + \delta x_t + u_t, \tag{7}$$

where τ_t denotes the survey (scapegoat) parameters, 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 fundamentals. In the estimation all variables are separately standardized in such a way that they have zero mean and unit variance.

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). We perform a Bayesian estimation of the parameters of the empirical exchange rate models following Kim and Nelson (1999) and Cogley and Sargent (2001), among others. The use of Bayesian estimation methods in this context is particularly appropriate for at least two reasons. First, it allows to account for uncertainty surrounding parameter estimates in the model, which is important given our relatively small number of observations. Second, it allows us to make no assumption about the order of integration of the variables in the model. This is very relevant since, while exchange rate returns are clearly stationary, the fundamentals are very persistent, and this is known to complicate significantly statistical inference in empirical exchange rate regressions.

We use the Gibbs sampler to simulate draws from the posterior distribution. The Gibbs sampler, which belongs to the family of MCMC methods, decomposes the original estimation problem into (tractable) independent ones. In this way we can sample iteratively from the conditional densities of the parameters blocks. Precisely, all parameters are drawn sequentially from their full conditional posterior distribution.

For the constant-parameters linear model, we simply draw the hyperparameters conditional on the data. By contrast, in the models with time-varying parameters there are two main steps. First, we draw a history of states conditional on the data and the hyperparameters using the Carter and

Kohn (1994) simulation smoother. Then, we draw the hyperparameters, conditional on the data and the states. By repeatedly simulating from the known conditional distribution of each block in turn, we get samples of draws. These draws, beyond a burn-in period, are treated as variates from the target posterior distribution. More precisely, for the time-varying parameter models we perform 60,000 replications of which the first 40,000 are burned-in, and we save 1 every 10 draws of the last 20,000 replications of the chain so that the draws are independent.

The priors used in this paper are diffuse, and their distributions are chosen for convenience following a number of papers (Koop, 2003; Kim and Nelson, 1999; Cogley and Sargent, 2001; Primiceri, 2005). For example, it is convenient to assume that the initial states for the time-varying coefficients, and the hyperparameters are independent of each other. The priors for the covariances of the state innovations are assumed to be distributed as inverse-Wishart so that also the posterior has an inverse-Wishart distribution. Similarly, assuming an inverse-Gamma distribution for the measurement innovations implies that the posterior is distributed as an inverse-Gamma. In the scapegoat model, the constant mean parameters are drawn from a normal distribution given that the prior is also assumed to be normal. The priors for the initial states of the time-varying coefficients are assumed to be normally distributed. Finally, the Bayesian linear regression algorithm implements a simple MCMC assuming an independent inverse Gamma-Normal prior distribution (for details see Kim and Nelson, 1999). The MCMC algorithm for each of the three models is described in the Appendix A.

4 Empirical results

We now turn to the empirical results. Our 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, i.e. as for the short-term interest rate $f_t = i^*_{ST} - i_{ST}$, where (*) denotes the foreign country.

Before turning to the empirical results, it is important to explain how we choose the observed fundamentals, as we only use three fundamentals per regression. Ideally, we would like to use all the six macro fundamentals, so that each of the six observable variables has a chance of being chosen 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, we restrict the attention to only three fundamentals, that are allowed to be country specific. We use a general-to-specific method to select the fundamentals. Precisely, we regress Δs_t on the second term of equation (3),

$$\Delta s_t = \gamma_1 \tau_{1,t} f_{1,t} + \ldots + \gamma_6 \tau_{6,t} f_{6,t} + u_t, \tag{8}$$

where we exclude the variable with the lowest t-statistic. We repeat the same procedure until we end up with the three most relevant macro variables. In short, we use regression (8) to pre-screen the scapegoats and reduce the number of potential scapegoats from six to three to make estimation feasible and reduce estimation error.

Table 4 summarizes the estimates of the model with constant parameters. The table contains point estimates and one-standard deviation Bayesian confidence intervals (in squared brackets). However, from Table 4 we can also see the set of variables selected by our general-to-specific method for each country. Growth differentials are selected for all the industrialized countries (with the exception of Australia), whereas inflation is never chosen. By contrast, equity flows are important for all emerging market economies.

We proceed column-by-column, thus interpreting the coefficient of each macro fundamental in turn. We find that growth has the expected positive and significant coefficient for the euro and the pound, so that the currency of the faster growing country appreciates. We also find that the South Korean won rises when the inflation differential falls, as its purchasing power increases relative to the USD dollar. Moreover, we find the traditional forward bias since the loading on the short-term interest rate differential is statistically different from unity. Moreover, the sign of the loading on the long rates differential is mostly negative, though it is different from zero only in few cases (Australian dollar and Mexican peso), and positive for the Singaporean dollar. A current account deficit is associated with a weaker currency for the euro and the Canadian dollar. Finally, with only few exceptions, we find that as equity inflows in the domestic country rise relative to the inflows in the foreign country, the domestic currency appreciates. Equity flows appear particularly important for emerging market economies.

Table 5 presents the estimates of the time-invariant coefficients (γ and δ) of the scapegoat model.[8] If the expectation of the structural parameters matters for the exchange rate (scapegoat effects), γ should be statistically different from zero. In theory, γ should intensify the effect of the true parameter so that it should take the same sign of the structural parameter. However, we cannot interpret the sign of γ for a number of reasons. γ is constant while the structural parameter is time-varying and can switch sign from positive to negative values. Moreover, because τ is standardized to have mean zero, it also switches from positive to negative values. And this fact complicates the interpretation of the sign of γ even more. Overall, we find that γs are generally significant over both

[8]Estimations of the time-varying parameters benchmark model (TVP) are not reported, but it is worth noting that the parameters, though allowed to switch sign over the sample period, in general show little time-variation, displaying a persistent behavior.

the country and variable dimensions. Most importantly, for all currencies except the Polish Zloty, at least two out of the three γs are significant.

Another important finding is the existence of a close link between monthly exchange rate movements and order flow, so that when net buying pressure for the foreign currency increases the domestic currency depreciates. This result is important as it shows that unobservable fundamentals, proxied by order flow, exert a significant effect on exchange rates. This is a necessary condition for the scapegoat effect to exist, as outlined in Section 2.

4.1 In-sample fit of scapegoat model

The first hypothesis of the scapegoat theory, as formulated in Section 2, is that the scapegoat model does a good job in explaining exchange rate movements, and outperforms the two benchmark exchange rate models, i.e. the constant parameter model and the time-varying parameters model. In this sub-section, we present evidence on the goodness-of-fit, using three alternative criteria – R^2s, an information criterion, and market timing tests – of the scapegoat model compared to the two benchmark models.

Table 6 contains R^2s, both adjusted and non-adjusted, the Akaike information criterion (AIC), and two tests of market timing. In general, the adjusted-R^2 rises when we replace the specification for constants parameters with the specification for time-varying parameters. However, in general the improvement in terms of explained variance is much larger when we estimate the scapegoat model. For some currencies the order of improvement is remarkable. We move from not being able to explain the variance of the exchange rate changes to explaining a much larger proportion (e.g. for the euro, the Swiss franc and the South African rand). Even for those currencies for which we can explain part of the variance by means of the time-varying parameters model, the improvement is still remarkable when we use the scapegoat model.

As for the information criterion, Table 6 provides two pieces of information: the residual sum of squares and the AIC. The residual sum of squares is common to the AIC and the Bayes information criterion (not reported), whereas the two criteria differ for how they penalize for the use of extra variables. It holds that the lower the residual sum of squares or the AIC the better is the performance of the model. The AIC confirms the results of the R^2 for all industrialized countries' currencies except the UK pound, and for all emerging market currencies but the Mexican peso. In sum, the scapegoat model performs substantially better than the benchmark models also based on these information criteria.

To complete the model-fit analysis, we consider a set of tests for market timing ability of the competing models, including the 'hit' ratio (HR). The latter is calculated as the proportion of times the sign of the fitted value correctly matches the one of the realized change in the exchange rate. We also employ the test statistic proposed by Henriksson and Merton (1981). The HM test is asymptotically equivalent to a one-tailed test on the significance of the slope coefficient in the following regression:

$$I_{\{\Delta s_t>0\}} = \varphi_0^{HM} + \varphi_1^{HM} I_{\{\widetilde{\Delta s}_t>0\}} + \varepsilon_t \tag{9}$$

where Δs_t, $\widetilde{\Delta s}_t$ denote the realized and fitted exchange rate returns, respectively. $I_{\{.\}}$ 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. Overall, a fairly clear-cut result emerges from calculating the hit ratio and executing the HM test. The analysis of the hit ratio statistics shows that for most of the currencies the scapegoat model performs better than the other models - i.e. the hit ratios of the scapegoat model are the highest. These findings are largely corroborated by the results of the regression-based market timing test. For all industrialized countries' currencies, except the Canadian dollar, the φ_1^{HM} coefficient for the scapegoat model is statistically positive and higher than the φ_1^{HM} coefficients for the benchmark models. This result also holds for emerging market currencies, with the exceptions of the Mexican peso and the Polish zloty. We thus confirm that, in general, the market timing ability of the scapegoat model outperforms the one of the other benchmark models. More importantly, also according to the other metrics the scapegoat is the best model, and this is even more true for industrialized countries' currencies.

Figure 2 provides a visual comparison of the (unconditional) adjusted R^2s. However, differently from Table 6, we try to shed light on the causes of the higher performance of the scapegoat model. For this reason, we look at the two components that differentiate the scapegoat model from the time-varying parameters model, i.e. the order flow and the pure scapegoat term. So, in addition to the three models described above, we consider a variation of the scapegoat specification, where δ (see equation (3)) is set to zero. Therefore, by comparing the two specifications of the scapegoat model (with and without order flows) we are able to isolate the marginal contribution of order flows to the goodness of fit of the model. Figure 2 suggests that the relative contribution of order flow varies across countries. For example, order flow and the scapegoat terms are roughly equally important for the euro and the yen and the South African rand. By contrast, the contribution of the scapegoat term prevails for the Australian dollar, the Swiss frank and the South Korean won. Order flow is particularly important for the Canadian dollar. However, overall the findings indicate that the scapegoats themselves are an important or in some cases even dominant cause for the improved model fit for the majority of currencies.

We now turn to assessing how the relative contributions of macro factors (loadings on the time-varying parameters), order flow and scapegoat variables evolve over time. More precisely, Figure 3 presents the rolling adjusted-R^2 for the benchmark model with time-varying parameters, and two specifications of the scapegoat model: the restricted specification where δ is set to zero and the full specification where δ is estimated. Thus, in Figure 3 the top area (SCA) sheds light on the marginal contribution of order flow, whereas the middle area (SCA no order flow) sheds light on the marginal contribution of the scapegoat effect. We restrict the analysis to two industrialized and two emerging market currencies. It is apparent that the relative contribution of each component varies over time and across countries.

For instance, for the Canadian dollar order flow is particularly important around the last quarter of 2002. However, abstracting from this episode, the TVP benchmark model performs surprisingly well, in particular until the first quarter of 2004. Then, order flow becomes increasingly important, and it becomes predominant during the recent crisis. Moreover, the scapegoat effect experiences a sharp and short-lived increase towards the end of the sample when order flow, becoming increasingly important, may generate a rational confusion. By contrast, as far as the euro is concerned, the contribution of macro factors is negligible if compared to order flow and scapegoat variables. The contribution of the scapegoat effect is high over all the sample, but even higher during the first and last two years. By contrast, order flow is increasingly important during the central years of the sample.

For the South African rand, the scapegoat effect is important throughout the sample, whereas macro factors become less important over time. Moreover, there is a clear structural break around the beginning of 2005, when the contribution of order flow takes off. Similarly, for the Korean won the scapegoat effect is important for all the sample. However, the scapegoat effect takes its highest values over the second part of the sample when the role of the order flow also increases. During this period, when unobservables are particularly important, investors may find it rational to blame observable macro fundamentals. In this regard, what is remarkable is that the scapegoat effect is associated with episodes when order flow is also important. In sum, also the conditional analysis provides evidence in favour of the importance of scapegoat effects, while these effects vary over time and across countries.

4.2 When does a fundamental become a scapegoat?

We now turn to the second hypothesis of the scapegoat theory as formulated in Section 2. Our test investigates whether or not the scapegoat parameter τ_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. During these episodes it becomes rational for agents to blame factors they can actually observe. However, among those observable factors, investors will only blame those macroeconomic fundamentals that are out of sync with their longer term equilibrium value. So, there is a scapegoat effect only if both the macro fundamental and the unobservable are large.

Our empirical test 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 reasons, we assume that only one macro factor is a scapegoat at any one point in time. This is a reasonable assumption consistent with the original work of Bacchetta and van Wincoop (2004) and with the anecdotal evidence that the FX market concentrates on one issue at a time. Thus, our empirical test is based on the following panel regression:

$$\tau_{t,i} = \varphi_0 + \varphi_1 \left| of_t \times f_{t,i} \right| I_{\{\tau_{t,i} > \tau_{t,-i}\}} + \varepsilon_t, \tag{10}$$

where the indicator function ($I_{\{\tau_i > \tau_{-i}\}}$) takes the value of 1 if the survey on the macro factor i exceeds the values of the remaining two macro factors $-i$ at each time t. We repeat the regression separately for each of the six macro fundamentals.

Table 7 presents the regression results. We find that the parameters (φ_1) take the expected positive sign for all fundamentals. This result suggests that the $\tau_{t,i}$ is indeed the 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 particularly strong for growth, inflation and short-term interest rate differentials, with R^2s ranging from 20 to 38 per cent (when we compute the R^2s only when the indicator function is active).

We repeat the analysis for the two sub-samples of industrialized and emerging market countries to get a better understanding of the robustness of the results. What emerges is that the short rate differential is particularly important for the industrialized economies. Similarly, the current account and the long rate differential are more important for industrialized than emerging market currencies. By contrast, inflation and growth differentials are more likely to become scapegoats in emerging markets. Although equity flows is frequently selected and important for emerging markets, it shows a rather low R^2, indicating that only a limited share of the selection of this variable as a scapegoat is captured by the model.

5 Conclusions

Investors have a tendency at times to pick individual economic fundamentals as scapegoats for exchange rate movements. There is indeed ample anecdotal evidence for financial market participants to blame individual fundamentals for exchange rate movements, with such blame often shifting rapidly across different fundamentals over time. This fact has been conceptualized in a series of seminal papers by Bacchetta and van Wincoop (2004, 2006, 2011). The main insight from the scapegoat theory of exchange rates is that investors face uncertainties in the form of unobservables driving exchange rates as well as through uncertainty about the actual effect of observable fundamentals on exchange rates. When exchange rates move strongly in response to changes in unobservables, it is rational for investors to blame factors they can actually observe, and more precisely those macro fundamentals that are out sync from their longer term equilibrium values.

The present paper constitutes the first empirical test of the scapegoat theory of exchange rates. We do so by exploiting novel data on exchange rate scapegoats from surveys, as well as proxies of unobservable fundamentals based on FX order flow. 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 a number of macro factors as drivers of a country's exchange rate *vis-a-vis* a reference currency. We match this survey data with a novel data set on FX order flow as a proxy of unobservable factors driving exchange rates. Overall, we test the scapegoat theory over a sample of 12 currencies, equally split between industrialized and emerging countries, over the 2001-2009 period at monthly frequency.

We find strong empirical support for both empirical hypotheses derived from the scapegoat theory of exchange rates. First, the scapegoat model does a good job in explaining exchange rate movements, showing a significantly improved performance relative to alternative exchange rate models. This finding is robust across three different performance criteria, as well as across currencies and over time. The results are particularly strong for industrialized economies' currencies and for several emerging markets. Importantly, the improvement in the explanatory power of the scapegoat model does not only stem from the inclusion of the order flow variable, but from the inclusion of the scapegoat parameters themselves. This finding is relevant because it suggests that while order flow is important in accounting for currency movements, the scapegoat parameters have an additional, sizeable explanatory power.

The empirical analysis also yields support for our second hypothesis. We find that a macroeconomic fundamental is picked and identified by market participants as a scapegoat in periods when it is strongly out of sync with its own longer-term equilibrium and at the same time the unobservable fundamental is large. This empirical evidence is remarkably robust, as it holds for all currency groups and for all macroeconomic variables in our sample. Taken together, our results provide strong support in favour of the scapegoat theory of exchange rates. They stress that expectations of structural parameters, and their interaction with unobservables, are important for improving our understanding of the drivers of exchange rates.

A Appendix: Bayesian MCMC estimation

This appendix describes the estimation of the constant parameter model, time-varying parameters model, and scapegoat model. We perform a Bayesian estimation of the parameters of the empirical exchange rate models, following Kim and Nelson (1999) and Cogley and Sargent (2001), among others.

A.1 The linear regression algorithm (CP)

This subsection deals with the estimation of the following linear regression model

$$\Delta s_t = f_t' \beta + u_t, \tag{A.1}$$

where s_t is the log of the nominal exchange rate (defined as the foreign price of domestic currency), β is a K×1 vector of coefficients, X_t is a K×1 vector of macro variables, and u_t is a disturbance term normally distributed with 0 mean and constant variance σ^2. We need to estimate the set of the conditional mean hyperparameters (β) and the constant variance hyperparameter (σ^2). We define the following priors: for β we assume a Normal prior N(b_0, V_0), where $b_0 = \beta_K^{OLS}$ and V_0 =20^{-1}(I$_{KK}$); for σ^2 we assume an inverse Gamma prior 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 (for more details see Kim and Nelson, 1999)

1. Initialize σ^2.
2. Sample β from $p\left(\beta|\sigma^2, \Delta s^T, f^T\right) = N(b_1, V_1)$, where $V_1 = \left(V_0^{-1} + \sigma^{-2} f' f\right)^{-1}$ and $b_1 = V_1\left(V_0^{-1} b_0 + \sigma^{-2} f' \Delta s\right)$.
3. Sample σ^2 from $p\left(\sigma^2|\beta, \Delta s^T, f^T\right) = IG\left(\frac{d_1^2}{2}, \frac{v_1}{2}\right)$,where $v_1 = v_0 + T$ and $d_1^2 = d_0^2 + \sum_{t=1}^{T}\left(\Delta s_t - f_t'\beta\right)^2$.
4. Go to step 2 and iterate 40,000 beyond a burn-in of 20,000 iterations.

A.2 Time-varying parameters algorithm (TVP)

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

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

where the conditional β's parameters are now time-varying. To close the model we need to specify the transition equation which describes the law of motion of the parameters. We treat the parameters has a hidden state vector which evolves as a multivariate driftless random walk

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

where v_t is an i.i.d. Gaussian process with mean 0 and covariance Q. We assume that the innovations, (u_t, v_t), are identically and independently distributed normal random variables with mean 0 and covariance matrix

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

where σ^2 is the variance for the measurement innovation and Q is the covariance matrix for the state innovations. We assume that the innovations are not correlated. In particular, not only the cross-covariance matrix is equal to 0, but also the 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 we use to simulate a sample from the joint posterior $p\left(\sigma^2, Q, \beta^T \mid y_T\right)$, where the vectors

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

and

$$\beta^T = \left[\beta_1', \ldots, \beta_T'\right] \tag{A.6}$$

represent the histories of the data, $y^T = [\Delta s^T, \ f^T]$, and states, β^T, up to time T. Thus, the Gibbs sampler consists of sampling conditionally from three blocks, of which two for the hyperparameters (σ^2, Q), and the remaining one for the latent parameters (β^T). Next we describes each of the steps in turn similarly to Cogley and Sargent (2001).

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

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

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 Carter and Kohn (1994), or Chib and Greenberg (1995) among others. Given $\beta_{0|0}$ and $R_{0|0}$ the Kalman Filter forward recursion are

$$
\begin{aligned}
K_t &= R_{t|t-1} f_t (f_t' R_{t|t-1} f_t + \sigma^2)^{-1} \\
\beta_{t|t} &= \beta_{t-1|t-1} + K_t (y_t - f_t' \beta_{t-1|t-1}) \\
R_{t|t-1} &= R_{t-1|t-1} + Q \\
R_{t|t} &= R_{t|t-1} - K_t f_t' R_{t|t-1}
\end{aligned} \tag{A.8}
$$

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

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

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

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

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

To obtain an entire sample of β^T, the simulation smoother works as follows. First, draw β^d_T from $N(\beta_{T|T}, R_{T|T})$, then compute $R_{T-1|T}$ and $\beta_{T-1|T}$, using β^d_T. Second, draw β^d_{T-1} from $N(\beta_{T-1|T}, R_{T-1|T})$ and so forth. Finally, draw β^d_1 from $N(\beta_{1|2}, R_{1|2})$.

Gibbs Step 2: Hyperparameter σ^2 given states:

Conditional on β^T and y^T, the innovations of the measurement equation are observable so that the conditional density of σ^2 is independent from Q. When an inverse Gamma prior is combined with a Gaussian likelihood, the posterior has also an inverse Gamma density,

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

with scale and shape parameters

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

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

Gibbs Step 3: Hyperparameter Q given states:

We now focus on drawing the variance-covariance matrix Q of the coefficients' innovations v_t. Conditional on a realization of the β^T, the v_t are observable. Moreover, because v_t are independent of the other shocks of the model u_t, then σ is redundant to draw Q. Given an inverse Wishart prior for Q and a normal likelihood, the posterior of Q has itself an inverse-Wishard distribution,

$$p\left(Q|\beta^T, y^T\right) = IW\left(Q_1^{-1}, z_1\right) \tag{A.12}$$

with scale and degree-of-freedom parameters

$$\begin{aligned} Q_1 &= Q_0 + \sum_{t=1}^{T} \left(\beta_t - \beta_{t-1}\right)\left(\beta_t - \beta_{t-1}\right)' \\ z_1 &= z_0 + T \end{aligned}$$

Under the assumption of uncorrelated states we set the off-diagonal elements of Q^d to 0. 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 a inverse Gamma density. The the two methods are equivalent.

We iterate over the three steps above for a number of iterations sufficient to insure convergence of the chain to the ergodic distribution. Precisely, we perform 60,000 replications of which the first 40,000 are burned-in, and we save 1 every 10 draws of the last 20,000 replications of the chain.

A.3 The scapegoat model (SCA)

In Bacchetta and van Wincoop (2011), the scapegoat model (1) not only includes macro factors with loadings that vary over time (as in our benchmark TVP), but also the expectation of future parameters and unobserved fundamentals. Our empirical version of the scapegoat model of Bacchetta and van Wincoop (2011) is the following

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

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 are the order flows data, which proxy for the unobservable fundamentals. If we compare the empirical equation (1) to equation (3), we can see that we drop their last term, which captures the change in the expectations of past parameters interacted with changes in past fundamentals.

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 we need 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 $S_1 = S_0 + \sum_{t=1}^{T}(\Delta s_t - f_t'\beta_t - \gamma\tau_t f_t' - \delta x_t)^2$. Similarly, the joint posterior density of the states will also depend on γ and δ. Thus, in the forward Kalman recursion we modify the filtered value of the state at time t such that $\beta_{t|t} = \beta_{t-1|t-1} + K_t(y_t - f_t'\beta_{t-1|t-1} - \gamma\tau_t f_t' - \delta x_t)$.

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

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

where $z_t = [\tau_t f_t, x_t]$ and $A = [\gamma, \delta]$ are vectors of independent variables and parameters, respectively, each of dimension $(K+1) \times 1$. Now, drawing As is equivalent to the problem of drawing the conditional mean parameters in a linear regression model (see above). We assume a Normal prior distribution, with $a_0 = A^{ols}$ and $V_{A,0} = 20(I_{K+1,K+1})$, so that the posterior is also Normal,

$$p\left(A|\sigma^2, y^T, \beta^T\right) = N\left(a_1, V_{A,1}\right) \tag{A.15}$$

where $V_{A,1} = \left(V_{A,0}^{-1} + \sigma^{-2}z'z\right)^{-1}$ and $a_1 = V_{A,1}\left(V_{A,0}^{-1}a_0 + \sigma^{-2}z'\Delta\widetilde{s}\right)$.

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Table 1
Surveys Summary Statistics

Panel A: All currencies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	1224	1224	1224	1224	1224	1224
Obs: scape	246	22	660	59	157	246
Obs: (%) scape	12.3	1.8	53.9	4.8	12.8	20.1
Mean	5	3.9	6.0	4.9	5.0	5.0
Std. Dev.	1.2	1.1	1.4	1.0	1.2	1.2
Min	1.5	1.1	1.7	1.3	1.3	1
Max	8.2	8.0	9.0	8.0	8.8	8.3

Panel B: Industrialized Economies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	612	612	612	612	612	612
Obs: scape	40	0	387	32	58	121
Obs: (%) scape	6.5	0.0	63.2	5.2	9.5	19.8
Mean	4.9	3.6	6.1	5.1	4.6	4.9
Std. Dev.	1.1	0.8	1.5	1.0	1.2	1.1
Min	2.0	1.1	1.7	1.9	1.3	2.0
Max	8.2	6.3	9.0	8.0	7.4	8.0

Panel C: Emerging Market Economies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	612	612	612	612	612	612
Obs: scape	111	22	273	27	99	125
Obs: (%) scape	18.1	3.6	44.6	4.4	16.2	20.4
Mean	5.1	4.3	5.9	4.8	5.3	5.1
Std. Dev.	1.3	1.3	1.2	1.0	1.1	1.3
Min	1.5	1.5	2.3	1.3	2.0	1.0
Max	8.1	8.0	8.7	7.8	8.8	8.3

The table presents descriptive statistics for the survey data on exchange rates. Obs: scape and Obs: scape (%) indicate how many times a variable was the main scapegoat out of the six or the percentage share of all observations it was the main scapegoat, respectively. The data set covers the interpolated monthly surveys from March 2001 to August 2009.

Table 2
Macro Fundamentals Summary Statistics

Panel A: All currencies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	1224	1224	1224	1224	1224	1224
Mean	0.75	0.20	1.42	0.82	5.51	-1.80
Std. Dev.	2.52	2.31	3.24	2.47	7.34	6.57
Min	-10.22	-5.14	-5.20	-4.15	-10.83	-38.23
Max	11.01	10.98	14.39	10.40	35.22	33.24

Panel B: Industrialized Economies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	612	612	612	612	612	612
Mean	-0.13	-0.67	0.10	-0.39	5.53	-1.19
Std. Dev.	1.58	1.44	2.17	1.49	4.19	8.01
Min	-8.71	-5.14	-5.20	-4.15	-2.22	-38.23
Max	3.24	3.59	5.27	2.65	16.66	33.24

Panel C: Emerging Market Economies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
Obs	612	612	612	612	612	612
Mean	1.64	1.06	2.74	2.04	5.50	-2.42
Std. Dev.	2.94	2.67	5.59	2.65	9.51	4.62
Min	-10.22	-4.09	-2.93	-3.54	-10.83	-19.80
Max	11.01	10.98	14.39	10.40	35.22	8.64

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, i.e. as for the short term interest rate ΔRate ST= $i^*_{ST} - i_{ST}$, where $(*)$ denotes the foreign country. The data set covers the period from March 2001 to August 2009.

Table 3
Exchange Rates and Order Flows Summary Statistics

Panel A: Industrialized Economies

	Mean	St. Dev	Min	Max	Mean	St. Dev	Min	Max
	AUD/USD				CAD/USD			
Δs	-0.39	4.22	-11.25	23.48	-0.25	2.82	-6.34	10.80
of	-0.11	0.91	-4.40	1.54	0.02	0.90	-3.08	4.76
	EUR/USD				JPY/USD			
Δs	-0.43	2.90	-6.93	6.39	-0.16	3.20	-7.60	7.39
of	-0.21	3.06	-8.39	13.39	0.44	2.17	-6.26	7.09
	CHF/EUR				GPB/USD			
Δs	0.01	1.26	-4.50	3.92	-0.05	2.92	-7.41	8.70
of	0.26	1.63	-4.79	11.77	-0.13	3.10	-21.45	17.66

Panel B: Emerging Market Economies

	Mean	St. Dev	Min	Max	Mean	StDev	Min	Max
	CZK/EUR				MXN/USD			
Δs	-0.27	1.77	-4.042	6.44	0.39	3.44	-13.33	22.19
of	0.00	0.11	-0.65	0.43	-0.06	0.21	-0.98	0.50
	PLN/EUR				ZAR/USD			
Δs	-0.22	3.49	-7.32	13.06	0.14	5.22	-13.97	14.68
of	-0.03	0.18	-0.86	0.67	0.00	0.40	-1.46	1.35
	SGD/USD				SKO/USD			
Δs	-0.21	1.57	-4.37	4.61	0.06	3.82	-13.11	19.01
of	-0.01	0.45	-2.74	2.10	-0.08	0.34	-1.34	0.94

The table presents descriptive statistics for monthly exchange rate returns (Δs) and order flow (of) for each of the 12 currencies. The order flow data is the cumulative monthly order flow, based on daily order flow data, on the business day previous to the latest scapegoat survey and over the previous month. Order flow is measured in billion of dollars. The data set covers the period from March 2001 to August 2009.

Table 4
Constant Parameters Macro Model

Panel A: Industrialized Economies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
AUD/USD	-	-	0.2484	-0.2106	-	-0.1818
			[0.14;0.36]	[-0.31;-0.10]		[-0.27;-0.09]
CAD/USD	-0.2226	-	0.12	-	0.2102	-
	[-0.33;-0.12]		[0.02;0.21]		[0.10;0.32]	
EUR/USD	0.1279	-	0.0447	-	-0.20	-
	[0.03;0.23]		[-0.06;0.15]		[-0.30;-0.11]	
JPY/USD	-0.0887	-	-	-0.0654	-	0.1013
	[-0.18;-0.01]			[-0.17;0.03]		[0.01;0.20]
CHF/EUR	0.0604	-	-	-0.0356	0.2776	-
	[-0.03;0.16]			[-0.13;0.06]	[0.18;0.38]	
GPB/USD	0.1800	-	0.0253	-	0.0015	-
	[0.07;0.29]		[-0.09;0.14]		[-0.10;0.10]	

Panel B: Emerging Market Economies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
CZK/EUR	-	-0.0466	0.0624	-	-	-0.3281
		[-0.14;0.04]	[-0.03;0.15]			[-0.42;-0.24]
MXN/USD	-	-	0.2978	-0.1984	-	-0.1447
			[0.17;0.42]	[-0.32;-0.08]		[-0.23;-0.05]
PLN/EUR	-	-0.0053	-	0.0288	-	-0.1392
		[-0.11;0.10]		[-0.08;0.14]		[-0.23;-0.05]
ZAR/USD	-0.0292	-	-	-0.0928	-	-0.1573
	[-0.13;0.07]			[-0.19;0.01]		[-0.25;-0.07]
SGD/USD	-	-	-	0.1363	-0.0989	0.0451
				[0.05;0.23]	[-0.22;0.02]	[-0.07;0.17]
KRW/USD	-	0.3024	-	-	-0.3080	-0.1405
		[0.20;0.40]			[-0.41;-0.20]	[-0.26;-0.02]

The table presents the estimated loadings of the exchange rate empirical model with constant parameters

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

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 Mar-2001 through Aug-2009. We use three macro factors per country. The selection criterion for the macro factors consists of a general-to-specific method, whereby we regress Δs_t on the survey ($\tau_{i,t}$) times the respective macro factor ($f_{i,t}$)

$$\Delta s_t = \alpha_1 \tau_{1,t} f_{1,t} + \alpha_2 \tau_{2,t} f_{2,t} + \alpha_3 \tau_{3,t} f_{3,t} + u_t$$

and we select the three macro factors corresponding to the α_i that display the highest t-statistic. The choice of three macro factor is due to the limited sample size and the otherwise excessive number of parameters. Note all variables are standardized by subtracting the mean and dividing by their standard deviation. τ and f are standardized separately so that both β_t and $\gamma\tau$ have the same unconditional mean of 0. One-standard deviation confidence intervals are reported in brackets.

Table 5

Scapegoat Model: Loadings on Expected Structural Parameters, and Order Flow

Panel A: Industrialized Economies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity	Order Flow
AUD/USD	-	-	2.5294**	-0.6406**	-	-0.9626**	-0.0891**
			[2.04;3.00]	[-0.92;-0.36]		[-1.28;-0.64]	[-0.15;-0.02]
CAD/USD	0.1970**	-	0.1655**	-	-0.0560*	-	-0.3812**
	[0.01;0.39]		[0.01;0.32]		[-0.18;0.07]		[-0.47;-0.29]
EUR/USD	-0.4489**	-	-0.1659*	-	-0.2942*	-	-0.1743**
	[-0.60;-0.29]		[-0.41;0.08]		[-0.53;-0.05]		[-0.54;-0.36]
JPY/USD	-0.2919**	-	-	-0.3951**	-	0.1109*	-0.3902**
	[-0.46;-0.12]			[-0.64;-0.15]		[-0.04;0.27]	[-0.49;-0.29]
CHF/EUR	-0.3547**	-	-	-0.1475*	-0.5189**	-	-0.1212**
	[-0.49;-0.22]			[-0.30;0.01]	[-0.95;-0.09]		[-0.20;-0.04]
GPB/USD	-0.0902*	-	0.1142	-	-0.1048*	-	-0.1393**
	[-0.24;-0.06]		[-0.09;0.31]		[-0.27;0.06]		[-0.22;-0.05]

Panel B: Emerging Market Economies

	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity	Order Flow
CZK/EUR	-	-0.0867*	-0.1987**	-	-	0.6039**	-0.1866**
		[-0.23;0.05]	[-0.38;-0.02]			[0.60;0.94]	[-0.29;-0.09]
MXN/USD	-	-	0.0807	-0.0633*	-	-0.1223*	-0.1399**
			[-0.08;0.24]	[-0.14;0.02]		[-0.26;0.02]	[-0.19;-0.01]
PLN/EUR	-	-0.0660	-	-0.0297	-	-0.1341*	-0.2207**
		[-0.27;-0.14]		[-0.22 -0.16]		[-0.30;0.03]	[-1.53;-1.03]
ZAR/USD	-0.1445*	-	-	0.1665**	-	0.3672**	-0.3099**
	[-0.36;0.07]			[0.05;0.28]		[0.05;0.68]	[-0.45;-0.26]
SGD/USD	-	-	-	-0.3706**	0.4419**	-0.3447**	-0.3043**
				[-0.53;-0.22]	[0.22;0.30]	[-0.55;-0.14]	[-0.42;-0.19]
KRW/USD	-	0.0682	-	-	-0.2834**	0.3547**	-0.1901**
		[-0.17;0.30]			[-0.50;-0.07]	[0.19;0.52]	[-0.28; -0.10]

The table presents the estimates for the time-invariant coefficients (γ and δ) of the scapegoat model

$$\begin{aligned} \Delta s_t &= f_t'\beta_t + (\tau_t f_t)'\gamma + \delta of_t + u_t \\ \beta_t &= \beta_{t-1} + v_t \end{aligned}$$

This model is also defined as SCA, whereas TVP (not reported) is the benchmark model where γ and δ are set to 0. Note all variables are standardized by subtracting the mean and dividing by their standard deviation. τ and f are standardized separately so that both β_t and $\gamma\tau_t$ have the same unconditional mean of 0. 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 6
In-sample Model Performance

Panel A: Industrialized Economies

		Expl. Variance		Information Criteria		Market-Timing Tests	
		R^2	R^2adj	log(SSR/T)	AIC	HR(%)	HM
AUD/USD	CP	7	5	-0.09	-0.03	56	0.12(0.10)
	TVP	19	16	-0.35	-0.29	66	0.32***(0.08)
	SCA	79	77	-1.90	-1.75	87	0.74***(0.06)
CAD/USD	CP	4	1	-0.05	0.01	59	0.18*(0.10)
	TVP	13	10	-0.30	-0.25	65	0.32***(0.09)
	SCA	35	30	-0.59	-0.45	69	0.37***(0.10)
EUR/USD	CP	4	1	-0.05	0.01	52	0.04(0.09)
	TVP	9	6	-0.22	-0.16	66	0.32***(0.07)
	SCA	49	46	-0.90	-0.76	77	0.55***(0.08)
JPY/USD	CP	2	0	-0.03	0.03	50	0(-)
	TVP	3	0	-0.12	-0.06	66	0.32***(0.09)
	SCA	28	23	-0.44	-0.30	73	0.45***(0.08)
CHF/EUR	CP	6	4	-0.08	-0.02	64	0.28***(0.08)
	TVP	9	7	-0.21	-0.15	65	0.30***(0.08)
	SCA	42	38	-0.89	-0.76	74	0.46***(0.07)
GBP/USD	CP	4	1	-0.05	0.01	50	0.00(0.09)
	TVP	20	17	-0.35	-0.29	61	0.25***(0.08)
	SCA	25	19	-0.43	-0.11	68	0.36***(0.08)

The table provides several measure of model fit such as measures of explained variance, information criteria and market-timing. As for the information criteria, ln(RSS/T) is common to both the AIC and BIC (not reported) criteria, whereas the two differ in the way penalize for the extra parameters. The Henriksson-Merton (HM) test is one-tailed test on the significance of the slope coefficient in the following regression:

$$I_{\left\{\Delta s_t>0\right\}} = \varphi_0^{HM} + \varphi_1^{HM} I_{\left\{\widetilde{\Delta s_t}>0\right\}} + \varepsilon_t$$

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 provides evidence of market timing. Precisely, we report under HM $\widehat{\varphi_1}$ and in parentheses its standard error using the Newey-West (1987) autocorrelation and heteroskedasticity consistent covariance matrix.

		Expl. Variance		Information Criterion		Market-Timing Tests	
Panel B: Emerging Market Economies							
		R^2	R^2adj	log(SSR/T)	AIC	HR(%)	HM
	CP	11	9	-0.13	-0.07	56	0.12(0.10)
CZK/EUR	TVP	16	13	-0.23	-0.17	58	0.16*(0.10)
	SCA	33	28	-0.40	-0.26	68	0.35***(0.10)
	CP	4	1	-0.05	0.01	50	0.01(0.08)
MXN/USD	TVP	8	5	-0.15	-0.09	55	0.08(0.10)
	SCA	11	4	-0.17	-0.03	59	0.16*(0.10)
	CP	2	0	-0.03	0.03	52	0.04(0.09)
PLN/EUR	TVP	16	14	-0.29	-0.23	63	0.29***(0.09)
	SCA	26	20	-0.39	-0.25	63	0.27***(0.09)
	CP	2	0	-0.03	0.03	56	0.13(0.11)
ZAR/USD	TVP	8	6	-0.19	-0.13	62	0.24***(0.10)
	SCA	35	30	-0.54	-0.40	74	0.48***(0.08)
	CP	3	0	-0.04	0.02	59	0.17(0.11)
SGD/USD	TVP	10	7	-0.19	-0.13	70	0.41***(0.08)
	SCA	26	20	-0.30	-0.15	74	0.48***(0.08)
	CP	11	8	-0.13	-0.07	63	0.25***(0.08)
KRW/USD	TVP	30	27	-0.64	-0.58	66	0.32***(0.10)
	SCA	52	49	-1.10	-0.96	77	0.55***(0.08)

Table 7
Surveys, Order flows and Macro Factors

Panel A: All Countries						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
φ_1	0.44	1.12	0.47	0.40	0.28	0.42
(SE)	(0.07)	(0.16)	(0.07)	(0.14)	(0.10)	(0.14)
R^2adj (%)	10.2	24.9	11.5	5.0	4.3	2.3
R^2_Nadj (%)	19.8	37.9	28.2	8.7	8.3	5.1
N	199	73	199	264	191	298

Panel B: Industrialised Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
φ_1	0.40	-	0.55	0.48	0.38	0.76
(SE)	(0.06)	-	(0.09)	(0.15)	(0.10)	(0.30)
R^2adj (%)	9.6	-	14.5	7.6	8.2	2.1
R^2_Nadj (%)	19.8	-	32.2	10.9	16.2	2.2
N	161	-	134	112	131	74

Panel C: Emerging Market Economies						
	ΔGrowth	ΔInflation	ΔRate ST	ΔRate LT	CA	ΔEquity
φ_1	0.96	1.12	0.34	0.33	0.07	0.39
(SE)	(0.18)	(0.16)	(0.08)	(0.20)	(0.12)	(0.15)
R^2adj (%)	18.1	24.9	6.7	3.1	0.0	2.5
R^2_Nadj (%)	23.7	37.8	19.6	5.6	0.0	5.7
N	38	73	65	152	60	224

The table displays the results for the 6 panel regressions of the survey ($\tau_{t,i}$) on the absolute value of the correspondent macro factor ($f_{t,i}$) times the order flow (x_t) times the indicator function ($I_{\{\tau_i>\tau_{-i}\}}$). The latter takes the value of 1 if the survey on the macro factor i exceeds the values of the other two macro factors $-i$ at each time t. For a generic survey $\tau_{t,i}$ we estimate

$$\tau_{t,i} = \varphi_0 + \varphi_1 \left| x_t \times f_{t,i} \right| I_{\{\tau_{t,i}>\tau_{t,-i}\}} + \varepsilon_t,$$

where i is an index of macro variable and t is an index of time. For each of the 6 regressions, a country macro variable is included or not according to whether it was previously selected in Table 5 using the general-to-specific criterion. For example, for $i = \Delta$Growth we only use CAD, EUR, JPY, CHF, GBP, and ZAR. Panel A presents the regression for all countries, whereas panel B and C only include industrialized and emerging market economies, respectively. N denotes the number of times the macro factor i exceeds the values of the other two macro factors $-i$. And R^2_Nadj is the adjusted R^2 computed over the N observations. Standard errors reported in brackets, follow Newey-West (1987), allowing up to 6 lags in the adjustment.

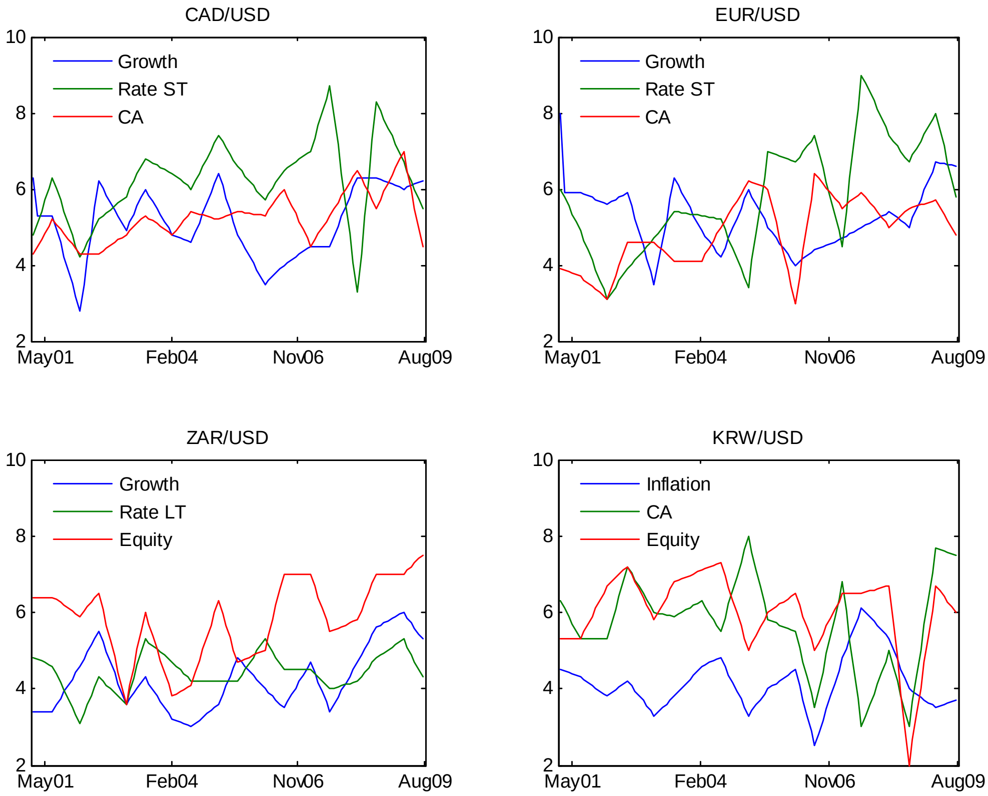

Figure 1
Selected scapegoat variables

The figures show the exchange rate interpolated surveys selected by our general-to-specific criterion for four currencies: Canadian dollar, euro, South African rand and Korean won. The sample is monthly and spans the period from March 2001 to August 2009.

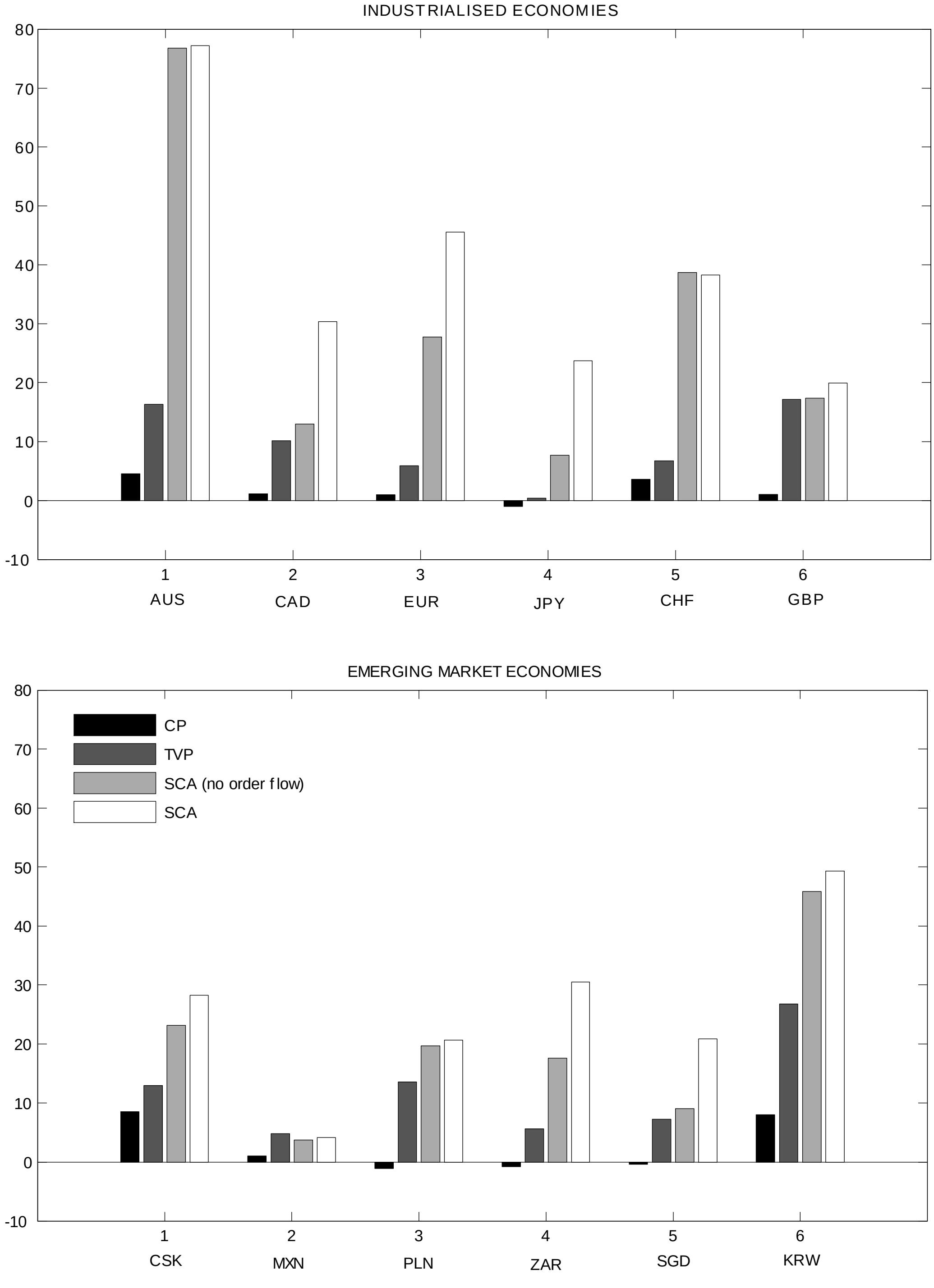

Figure 2
Unconditional adjusted-R^2

The figures show the percentage adjusted-R^2 for the benchmark models with constant parameters (CP) and time-varying parameters (TVP), and two specifications of the scapegoat model: the full specification where γ is estimated (SCA) and the restricted specification where γ is set to zero (SCA no order flow). The first panel refers to the industrialised countries, whereas the second to emerging market economies.

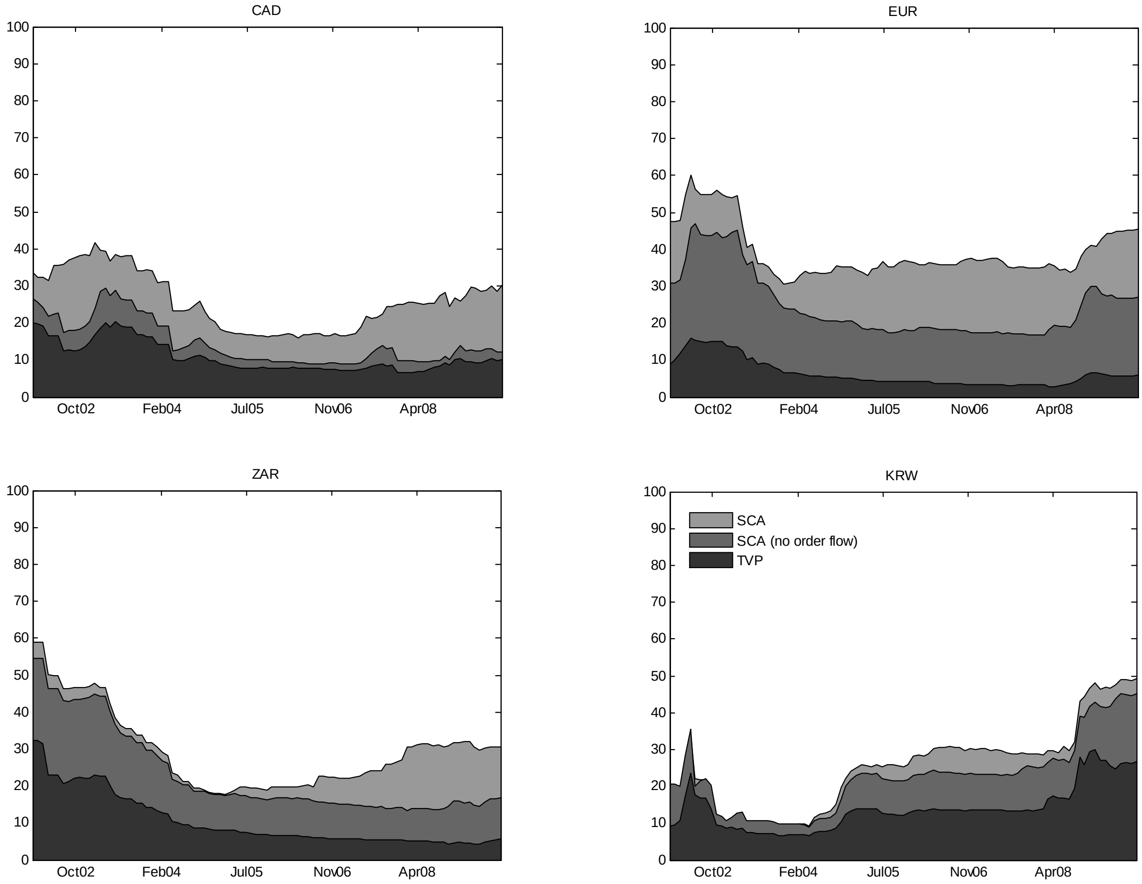

Figure 3
Rolling adjusted-R^2

The figure shows the rolling percentage adjusted R^2 for the benchmark model with time-varying parameters (TVP), and two specifications of the scapegoat model: the full specification where γ is estimated (SCA) and the restricted specification where γ is set to zero (SCA no order flow). The sample goes from Feb-2002 to Aug-2009 and covers the Canadian dollar (CAD), euro (EUR), South African zar (ZAR) and Korean won (KRW).