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Do Markets Care Who Chairs the Central Bank?

Kenneth N. Kuttner and Adam S. Posen

Abstract

This paper assesses the effects of central bank governor appointments on financial-market expectations of monetary policy. To measure these effects, we assemble a new dataset of appointment announcements from 15 countries and conduct an event-study analysis on exchange rates, bond yields, and stock prices. Our main findings are threefold. First, exchange rates and bond yields display a statistically significant response to the announcement of a new governor, especially when the appointee's identity was not anticipated in advance. Second, the reactions are especially pronounced for central banks lacking either independence or a clear nominal anchor. Third, new governors are not generally perceived to lack credibility: there is no tendency for announcements to be associated with jumps in inflation expectations.

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Kenneth N. Kuttner is a professor of economics at Williams College, Williamstown, MA. **Adam S. Posen** is deputy director of the Peterson Institute for International Economics, where he has been a senior fellow since 1997.

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Contact: kenneth.n.kuttner@williams.edu or aposen@petersoninstitute.org.

Peterson Institute for International Economics

1750 Massachusetts Avenue, NW Washington, DC 20036-1903

Tel: (202) 328-9000 Fax: (202) 659-3225 www.petersoninstitute.org

1 INTRODUCTION

The appointment of a new central bank governor usually makes headlines in the financial press, and those reports often attribute to the appointment the subsequent movement in the financial markets.[1] Ben S. Bernanke's October 24, 2005 appointment to chair the US Federal Reserve, for example, generated hundreds of press reports and nearly as many analyses and commentaries speculating on his policy leanings.[2] Stocks climbed sharply immediately following the announcement, while bond prices fell.

That financial markets should react to the appointment of a new governor is hardly surprising. After all, central banks' policies can have significant macroeconomic effects, and it is taken as given that the governor exerts a disproportionate influence over those policies. This may have been especially true in the case of Alan Greenspan, to whom extraordinary powers of foresight were sometimes attributed and who was increasingly personally identified with US monetary policy over the course of his long tenure.[3] And decades earlier, a similar degree of prescience and personal influence was attributed to Benjamin Strong, the governor of the Federal Reserve Bank of New York (then the locus of US monetary policy decisionmaking), whose death in 1928 is thought by some to have contributed to the onset of the Great Depression.[4]

Governor-specific attributes also play a central role in much of the theoretical literature on monetary policy. The currently standard framework for modeling policymakers' incentives, which began with Kydland and Prescott (1977) and Barro and Gordon (1983), opened the door to characterizing differences in central bank behavior in terms of the objective function attributed to the central banker, as well as the institutional setting within which

[1] This paper uses the term "governor" generically to refer to the head of the central bank, even when the actual job title is "president" or "chair."

[2] Factiva alone reports 1322 such articles on the day of, and the day following, his appointment.

[3] This is nicely illustrated by Senator John McCain's unforgettable quip from a 1999 GOP presidential debate: "…if Mr. Greenspan should happen to die, God forbid, I would do like they did in the movie 'Weekend at Bernie's,' I would prop him up and put a pair of dark glasses on him and keep him as long as we could."

[4] Friedman and Schwartz (1963, p. 412-13) conjectured that "if [Benjamin] Strong had still been alive and head of the New York [Federal Reserve] Bank in the fall of 1930, he would very likely have recognized the oncoming liquidity crisis…" and taken "appropriate measures to head it off."

he or she served. This was made explicit in the influential Rogoff (1985) model of the "conservative" central banker. In a similar vein, the model of Cukierman and Meltzer (1986) distinguishes between different central banker types—"hawks" versus "doves". Financial market commentary often makes much of this distinction in central bankers' preferences when forecasting appointees' likely influence on monetary policy.[5]

The point of this paper is *not* to determine whether, and to what extent, central bank governors influence monetary policy and the economy—we assume that they do. Rather, it is to determine whether financial markets *perceive* that the central bank appointments contain new information relevant to policy expectations.[6] If so, then these appointments (or more precisely, the announcements) should move markets through their effects on expected inflation and interest rates.

Our objective is therefore to assess empirically the perceived information content, if any, of governor appointments in the eyes of financial market participants. The paper's specific goals are threefold. The first is to document the reaction of exchange rates, bond yields, and stock prices, and to determine those reactions' joint statistical significance. The second goal is to determine the extent to which the monetary policy framework in place at the time of the appointment affects the magnitude of the market response. Third, we are interested in whether the reactions indicate a generic concern about incoming governors' anti-inflation credibility: if this were the case, we would expect to see a tendency for announcements to be associated with rising bond yields and depreciating exchange rates.

So far as we know, this is the first effort to analyze the impact of new governor appointments on financial markets and monetary policy expectations. There is, of course, a large literature on how economic news affects financial markets, and a number of recent papers

[5]Bernasek (2005), for example, wrote following Bernanke's appointment: "Greenspan did, however, make one thing clear [at the time of his appointment]: the need to combat inflation. He realized that he needed to establish his credibility on this front. Soon after his appointment, the Fed raised interest rates by half a percentage point and sent a message about his determination to tame price increases. He understood that an unhappy bond market could undo a Fed chairman and that the economy would suffer the consequences.... The first test will be [Bernanke's] credibility on inflation ... the vote that ultimately matters more will be the one cast by the bond markets. Inflation will be their litmus test. Bond traders are already scouring Bernanke's record for evidence one way or the other.... The bond market reacted by inching rates higher."

[6]Note that the shifts in expectations created by these announcements need not be correct *ex post*.

have examined the effects of specific monetary policy actions (i.e., changes in the target federal funds rate for the United States) on financial markets. Examples include Kuttner (2001) for the bond market, Rigobon and Sack (2004) and Bernanke and Kuttner (2005) for the stock market, and Faust et al. (2003) for the foreign exchange market. Others, such as Lucca and Trebbi (2008), Bokus and Rosenberg (2006), and Reinhart and Sack (2005) focus on the information content of Federal Open Market Committee minutes and other forms of communication. Our study is in a spirit similar to that of Gürkaynak et al. (2005), who entertain the possibility that certain kinds of macroeconomic news can affect market participants' inferences about the central bank's policy objectives. It is also closely related to the case study of the 1987 Volcker-to-Greenspan transition in Meyer and Sack (2005).

Our approach is a systematic event-study analysis of 61 announcements of new governor appointments and departures of incumbent governors. Our results are based on a new dataset of central bank governor appointments spanning 15 countries and over three decades; precise announcement dates, and the circumstances surrounding the appointments, were gleaned from contemporary press reports.

Our results reveal a pronounced and statistically significant response of exchange rates and to a lesser extent of bond yields and stock prices. Just as importantly, the responses do not consistently point to an increase in inflation expectations. Some announcements appear to create expectations of tighter monetary policy (i.e., higher real interest rates or a lower inflation objective), while others are consistent with more expansionary policy. Overall, the results suggest that appointments contain (or at least are *thought* to contain) new information about future monetary policy. Moreover, the market appears to distinguish between appointments we term "newsworthy" and appointments whose announcement contains no new information regarding the new governor's likely preferences. In addition, the market responses are considerably more pronounced for central banks lacking independence or a firm domestic nominal anchor than they are for banks possessing those two features.

The paper is organized as follows. Section 2 discusses the nature of the information that might be contained in the announcement of a new governor and presents some descriptive analysis of the dispersion in inflation outcomes across central bankers. Section 3 describes

the construction of the announcement dataset and the selection of the sample. Section 4 lays out the statistical framework and presents the main results. Section 5 concludes.

2 ON THE INFORMATION CONTENT OF APPOINTMENTS

This paper's premise is that central bank governors' preferences can—or at least, are *perceived* to be able to—influence the conduct of monetary policy. To make that maintained assumption more concrete, it is worth taking a moment to review the ways in which the governor's preferences could affect the conduct of monetary policy, and how changes in those preferences would affect financial markets.

2.1 Characterizing central bankers' preferences

The standard way to characterize the central bank's preferences is in terms of a quadratic objective function involving the squared deviations of output and inflation from their targets,

$$L = \sum_{t=0}^{\infty} \delta^t [(\pi_t - \pi^T)^2 + \lambda (y_t - y_t^*)^2] \ , \tag{1}$$

where π is the inflation rate, π^T is the central bank's desired or "target" inflation rate, y is real output, and y^* is equilibrium or potential output. Future outcomes are discounted by the factor δ, and λ parameterizes the relative weight assigned to output fluctuations in assessing welfare costs, vis-à-vis deviations of π from π^T.

In the context of such an objective function, there are two dimensions along which central bankers might differ from one another. One is in the weight they attach to output relative to inflation stabilization—that is, they may have different values for λ. Much of the literature on central bankers' preferences has focused on this parameter, which is typically interpreted as summarizing the monetary authority's "conservatism," as defined in Rogoff (1985). A more conservative central banker will have a smaller value of λ, indicating a greater willingness to forgo output stabilization for the sake of inflation stabilization. This means that, faced with a higher-than-desired inflation rate, a "low-λ" central banker will pursue a relatively restrictive policy (i.e., high real interest rates) in order to achieve a rapid disinflation. Differences in λ seem to be implicit in business press reporting, which

often speaks of an appointee as being "pro-growth, relative to inflation" (Stanton, 2005), or "favoring faster interest rate reductions" as a means to restore full employment (Harverson and Corrigan, 1993). And in the academic literature, several efforts have been made to estimate the λ values associated with chairs of the Federal Reserve, such as Özlale (2003) and Favero and Rovelli (2003).

Central bank governors may also differ in terms of their desired inflation rate, π^T. This possibility has not received much attention in the theoretical literature, for the simple reason that, under the standard assumption of a vertical long-run Phillips curve, there are no gains to choosing a higher π^T.[7] Consistent with this assumption, most central banks have converged in recent years towards average inflation rates of roughly two percent. This has not always been the case, however: Favero and Rovelli (2003) estimated that the Federal Reserve's post-Volcker implicit inflation objective is three percentage points lower than it was in the 1960s and 1970s. In addition, Gürkaynak et al. (2005) found long-run inflation expectations (measured by the spread between nominal and inflation-indexed bonds) are not well anchored in the United States, implying some uncertainty about the Fed's ultimate inflation objective.

More subtly, central bank governors may also differ with respect to their perceived "credibility," defined as the extent to which they are trusted to follow through with their announced policies. In the extreme case of Barro and Gordon (1983), the absence of credibility (along with a preference for higher-than-equilibrium output) can lead central banks to choose higher inflation rates, in a futile effort to boost output.[8] To the extent that it creates an upward inflation bias, therefore, the lack of credibility has observable implications that are similar to a higher π^T.

In some models, the lack of credibility is a generic problem facing newly-appointed central bank governors. In Schaumburg and Tambalotti (2003) and Kara (2007), for ex-

[7] There may be practical reasons for choosing $\pi^T > 0$, such as to compensate for the upward bias in measured inflation rates or to create a buffer zone in order to avoid the zero lower bound on the nominal interest rate and the possibility of outright deflation.

[8] This should be seen not as a literal mistake or willful ignorance by central bank governors, but as a proxy for political and other pressures to expand output in an unsustainable way or for the lack of will to follow through with a difficult period of disinflation.

ample, the incumbent central bank governor can commit to policy during his or her own administration, but the commitment is not binding on his successor, who may have an incentive to exercise discretion immediately on taking office. Interestingly, based on the increase in the degree of inertia in the Fed's policy rule, Kara (2007) concluded that credibility increased under Volcker and Greenspan.

A similar, and more directly relevant, phenomenon arises in models in which the market participants are uncertain about the underlying preferences of the incoming governor, as in Cukierman and Meltzer (1986). In their model, a less conservative ("weak") governor initially has an incentive to mimic the behavior of a more conservative ("strong") policymaker, at least until some point at which it becomes optimal to behave opportunistically, thus revealing his true colors. Uncertainty about a governor's type is therefore likely to be highest at the start of a governor's tenure, before he or she has had an opportunity to demonstrate his anti-inflation credentials. In this "weak until proven strong" view, markets may have a tendency to react adversely (i.e., with an increase in inflation expectations) to the announcement of a new central bank governor, thus creating an "inflation scare" à la Goodfriend (1993).

2.2 Some indirect evidence on differences in desired inflation

In line with the attention focused on new governor appointments, we find it inherently plausible that governors' preferences can affect the conduct of monetary policy. And indeed, numerous studies have attempted to estimate governor-specific values of π^T and λ for individual countries. Instead, we offer a bit of circumstantial evidence that historically, there has been a considerable amount of dispersion in central bankers' implicit inflation objectives.

Our method is simply to calculate the inflation outcomes under each of the central bank governors in our sample and regress these inflation rates on a time trend and country-specific dummy variables. Country dummies are included to account for the observed tendency of certain countries to tolerate higher rates of inflation than others: Italy versus Germany, for example. The time trend is included to account for the tendency of infla-

tion rates to decline for virtually all of the countries in our sample, which begins in the mid-1970s. Since it is reasonable to assume that the central bank achieves its inflation objective over a horizon of one to three years, the regression residual can be interpreted as a rough gauge of (and surely an upper bound on) the size of the unobserved governor-specific inflation preferences.[9]

We use two regressions to characterize the dispersion in inflation outcomes, and both yield similar results. The first is linear in all the variables, with a quadratic time trend,

$$\pi_i = \pi_{77} + \beta_1(t-1977) + \beta_2(t-1977)^2 + \sum_{j=1}^{14} \gamma_j d_j + \varepsilon_i \ , \tag{2}$$

to allow for a change in the rate of inflation reduction. The d_j are country dummies, and the intercept π_{77} captures the average inflation rate prevailing in 1977 (the first year in the sample). Note that because the country-specific effects are additive, a country dummy for the 15th country (the United States) is omitted; consequently, the γ_j coefficients represent (time-invariant) inflation differentials relative to the United States The time term t is defined as the midpoint of the central bank governor's tenure.

The second regression builds in the observed tendency of inflation rates in the countries in our sample to converge toward a rate of roughly two percent. This involves a nonlinear specification of the form,

$$\pi_i = \pi_0 + \left(\sum_{j=1}^{15} \gamma_j d_j \right) e^{-\delta(t-1977)} + \varepsilon_i \ . \tag{3}$$

In this model, the country-specific effects shrink as t increases, and eventually every country converges to an inflation rate of π_0. The d_j are again country-specific dummies, but in this specification they capture the inflation differential prevailing in 1977. (Because the country-specific effects are not additive, a complete set of country dummies can be included.) Estimates for both specifications appear in Table 1. The linear-in-variables model

[9] This would not be true in cases of fiscal dominance, but this is not an issue in our sample of industrialized countries.

is estimated both with and without the quadratic trend, and the nonlinear model is estimated both with π_0 freely estimated and with π_0 set equal to 2.

We estimate equations 2 and 3 on a sample of 45 governors, over a period ranging from 1977 through 2006.[10] The parameter estimates are exactly what one would expect: the coefficient on the time trend is negative (implying lower inflation over time) and the country effects capture plausible differences in average inflation across countries (positive for countries such as Italy and Portugal, negative for Germany and Switzerland). Judging from the $\bar{R}^2$, the nonlinear model with convergent inflation rates fits much better than the linear model.

From our standpoint, the most interesting message conveyed by the results is that the regressions leave a great deal of inflation variance unexplained. In the nonlinear specification, for example, whose $\bar{R}^2$ is a respectable 0.784, the standard deviation of the error term is 1.5. In other words, even controlling for the secular decline in inflation and the tendency for inflation rates to differ systematically across countries, the standard deviation of the error term remains an economically significant 1.5 percentage points. Because the governor-specific attributes are surely not the only unobserved random variables contained in the error term, it would be an exaggeration to claim that the entire 1.5 percentage points was due to governors' preferences. Nonetheless, the results provide circumstantial evidence for differences in inflation preferences across central bank governors.

Finally, it is worth noting that average inflation is not the only potentially measurable outcome of differences in governors' preferences. For example, different degrees of conservatism will, *ceteris paribus*, generate differences in the relative volatilities of output and inflation. The problem is that these volatilities will also be affected by parameters other than λ: the slope of the aggregate supply curve and the variances of the various shocks affecting the economy. Estimating central bankers' preferences from the second moments would therefore require a structural approach like that of Favero and Rovelli (2003) or

[10] Since it is unrealistic to expect a central bank to reliably achieve its inflation objective over short periods of time, governors with tenures of less than 12 months are excluded from the sample. We obtain similar results when we limit the sample to governors serving three or more years.

Özlale (2003).

2.3 Policy expectations and asset prices

Together, the theory sketched in section 2.1 and the descriptive results from section 2.2 suggest central bank appointments could shift financial market expectations for future inflation and real interest rates. Empirically discerning such an effect is complicated by the lack of high-frequency direct expectations data, however. Surveys, such as those compiled by Consensus Economics, are too infrequent to be of any use in this context. Market-based measures derived from nominal and inflation-indexed bonds, such as those used by Gürkaynak et al. (2005) and Meyer and Sack (2005), are recent innovations and only available for a handful of countries. Lacking suitable expectations data, we rely on financial variables that are traded in deep and liquid markets, and are likely to be influenced by inflation and interest rate expectations: exchange rates, bond yields, and (to a lesser extent) stock prices.

The theory of uncovered interest rate parity, which relates the expected change in the (log) nominal exchange rate, $E_t \Delta e_{t+1}$, to the spread between domestic and foreign interest rates, $i_t - i_t^*$,

$$E_t \Delta e_{t+1} = i_t - i_t^* \tag{4}$$

establishes a link between policy expectations and the exchange rate. Solving equation 4 forward makes this linkage more explicit,

$$e_t = E_t \left(\sum_{s=0}^{T-1} (i_{t+s}^* - i_{t+s}) + e_T \right) \ , \tag{5}$$

where e_T, the nominal exchange rate at some future date T, is interpreted as the long-run equilibrium exchange rate, determined, for example, by the purchasing power parity (PPP) principle.

Expected changes in monetary policy can therefore affect the nominal exchange rate either via the path of future interest rate differentials or through an effect on the perceived equilibrium exchange rate. Expectations of a more restrictive monetary policy, which

would result from the appointment of a more conservative (smaller λ) central banker in an environment of higher-than-desired inflation, would tend to decrease e (appreciate) through two channels: first, by increasing i relative to i^*, and second, by reducing the expected future price level via the PPP effect.

Announcements affecting the central bank's perceived credibility (or alternatively, π^T), on the other hand, would tend to produce ambiguous exchange rate responses. While an increase in inflation expectations would tend to increase i relative to i^*, reducing e, it would at the same time *raise* the expected equilibrium e_T via the PPP channel. Consequently, the exchange rate is likely to be sensitive to perceived changes in the degree of conservatism (λ) attributed to the central bank.

For understanding the link between bond and policy expectations, the natural benchmark is the expectations hypothesis. The simplest version of the theory expresses the long-term nominal bond yield i^L as the average of expected future short-term (one-period) nominal interest rates, i^S, plus a (constant) term premium ϕ,

$$i_t^L = \frac{1}{T} E_t \sum_{s=0}^{T-1} i_{t+s}^S + \phi \quad . \tag{6}$$

Within the context of the expectations hypothesis, the effect of an increase in the desired inflation rate (or an increase in the inflation bias resulting from diminished credibility) is clear, as an increase in expected inflation would tend unambiguously to raise nominal interest rates and thus bond yields. The effect of an increase in central bank conservatism (i.e., a smaller λ) is somewhat less clear: while a tighter monetary policy will raise the nominal short-term interest rates over some horizon, it will also *reduce* those rates over a longer horizon, as inflation expectations decline. Nonetheless, as shown by Ellingsen and Söderström (2001), the latter effect will dominate the former for bonds of a sufficiently long maturity, thus leading to a decline on long-term nominal interest rates. Bond yields should therefore be highly sensitive to changes in the central bank's perceived inflation objective, but less so for changes in the perceived degree of conservatism.

Equity prices are even harder to interpret directly in terms of monetary policy expecta-

tions, even in the context of the simplest possible model in which the equity price represents the discounted sum of future earnings. Monetary policy clearly can affect equity prices through its effects on the discount rate applied to future earnings. What complicates interpretation is that policy expectations are also likely to affect those future earnings—both through the level of real economic activity and via its effects on inflation. Additionally, the possible effects of monetary policy on risk premia, which Bernanke and Kuttner (2005) found to account for a significant share of the variance of equity returns, are not necessarily consistent in sign with these other channels' effect on equity prices, further complicating the interpretation. Still, because higher inflation tends to be bad for stocks, examining the stock market's response to central bank appointments may contain useful information on shifts in long-run inflation expectations.[11]

2.4 A null hypothesis and two alternatives

The discussion in section 2.1 suggests two economically interesting hypotheses regarding the information content of central bank governor announcements. The first is simply that the appointments convey *some* sort of information relevant to the future conduct of monetary policy. According to this view, market participants use whatever information they have available to form an opinion of the new governor's characteristics (λ, π^T, or "credibility"). If these characteristics are thought to differ from those of the incumbent governor, then the appointment will alter inflation and interest rate expectations. Then, through the mechanisms discussed above in section 2.3, this shift in expectations will be reflected in exchange rates, bond yields, and stock prices. Under this first hypothesis, there is no presumption that the reaction will consistently tend in one direction or the other: the direction of movement will depend on the perceived governor-specific characteristics.

A second hypothesis is that credibility is a generic problem facing all new central bank governors: that is, they are perceived to be weak (in the sense of being willing to tolerate higher inflation) until they have had a chance to establish their strong anti-inflation credentials. As discussed above in section 2.1, this hypothesis is suggested by the models of

[11] See Fama (1981) for some evidence on the link between inflation and stock returns.

Cukierman and Meltzer (1986), Schaumburg and Tambalotti (2003) and Kara (2007) and implies that changes in central bank governors will tend to be associated with at least a transitory rise in inflation expectations. Thus, if this "weak until proven strong" hypothesis is correct, then we should observe a tendency for new governors to be associated with exchange rate depreciations and/or increases in bond yields.

The underlying null hypothesis in either case is that central bank appointments contain no discernible information and thus generate no market reaction. There are several reasons the appointment of a new central bank governor might be a non-event. One possibility is that macroeconomic outcomes are determined primarily by luck (i.e., exogenous shocks) or by policies outside of the central bank's control, rendering the central bank, and its governor, largely irrelevant. Another possibility is that financial market participants lack the information required to make meaningful inferences about the appointee's preferences. Alternatively, there may be little perceived variation among central bankers: if all governors were selected from a relatively homogeneous pool of candidates, then presumably any new appointee would be expected to pursue policies similar to those of his predecessor.

We would also expect a muted financial market response in cases where the ability of governors to reset policy objectives is constrained by the institutional environment. When the central bank is committed to a well-defined nominal anchor, such as inflation target, there will be little scope for an individual central bank governor to impose his or her preferences on the policy process. (Conversely, it is unlikely that someone favoring, say, a 4% rate of inflation would agree to serve as a governor of a central bank whose target was 2%.) A slightly more subtle argument applies for central bank independence: by insulating it from external pressure, independence allows a central bank to pursue its long-term policy objectives without political interference. Superficially, it might seem that a greater degree of independence would allow the central bank governor to exert greater discretion over monetary policy. In the case of independence, however, the appointment of a new governor would be unlikely to signal a politically-motivated policy shift. Furthermore, Posen (1995) argued that more independent central banks are associated with societies that are more conservative in Rogoff's (1985) sense (i.e., a smaller value of λ in equation 1), and

this would also tend to reduce the information conveyed by new appointments. For these reasons, central bank independence and a well-defined nominal anchor, separately but especially in combination, should attenuate the financial market's reactions to new governor appointments. We investigate this possibility below in section 4.4, splitting the sample according to criteria reflecting central bank autonomy and the existence of an operational domestic nominal anchor.

3 DATA AND SAMPLE SELECTION

We used two criteria to determine the set of countries to be included and the time period to be covered. First, we limit our analysis to industrialized countries. One reason to do so is that a great deal of turnover among central bank governors in emerging markets is related to—or in some cases, precipitated by—macroeconomic or financial crises. This connection makes it hard to distinguish the impact of the appointment from the contemporaneous financial turmoil. In addition, because reliable English-language press reports from these countries are scarce, it is often hard to pin down the precise announcement dates with any certainty.

The second criterion used in selecting the sample is that the currency in question must exhibit some degree of exchange rate flexibility. Because a credible hard peg effectively removes any scope for an independent monetary policy, central bank appointments in these cases would contain no information on the likely future path of inflation and interest rates.[12] Consistent with this criterion, the sample is limited to the post-Bretton Woods and (for euro adopters) the pre-euro periods.[13] European countries maintaining a hard Deutsche mark peg during the pre-euro period (e.g., Austria, Denmark, and Belgium) were also dropped

[12] For less than fully credible pegs, appointments could be seen as affecting the likelihood of exiting or adjusting the parity. Such a "peso-problem" phenomenon would, presumably, be reflected in interest rates and inflation expectations.

[13] Although many of the countries in the sample were members of the Exchange Rate Mechanism (ERM), during most of the period the bands were of sufficient width to allow for some degree of exchange rate variation and monetary autonomy, as reflected in the measurable and persistent inflation differentials between Exchange Rate Mechanism members outside of the hard-DM core. Matti Vanhala's June 1998 appointment to head the Bank of Finland was dropped, however, as the adoption of the euro was imminent, all but eliminating any variability in the markka-DM exchange rate.

from the sample.[14] The application of these two criteria yields a sample of 15 countries, covering the years from 1974 through 2006 (through 1999 for those countries adopting the euro).

The next step is to determine the dates of the governor appointments in the sample. It is important to note that, because the analysis focuses on the financial market impact, the relevant dates are those for the *announcements* of a new central bank governor's appointment (or his predecessor's departure), rather than the dates on which the new governor formally took office. Unfortunately, these announcement dates are not documented in any official sources, requiring us to turn to published news sources available electronically through LexisNexis, Factiva, and other online repositories. In the end, announcement dates for 50 central bank appointments were determined through this process.

3.1 Defining and classifying events

There is considerable variation in the circumstances surrounding the 50 appointments in the dataset, making for a fairly heterogeneous set of events. Some are orderly transitions to a widely-anticipated successor, while others are more abrupt or involve the appointment of a relative unknown. Because the information content of the announcements will depend to some extent on these circumstances, it will be important to make distinctions among them along two key dimensions.

One dimension has to do with whether the transition to the new governor was *scheduled* or *unscheduled*. Scheduled transitions are those involving the expiration of a term or a planned retirement; by contrast, unscheduled appointments would be those in which the incumbent retired unexpectedly or was replaced. This is also a potentially useful distinction because, in cases where there is a lag between the two, the incumbent's departure and the announcement of the successor can be treated as two separate events—at least for those cases in which the date of the departure announcement can be determined. In addition to

[14] When Klaus Liebscher left the presidency of the Austrian National Bank in 1998 to join the General Council of the European Central Bank, the *Financial Times* quipped that he would have a "proper" job for the first time since he took over as head of the Bank in 1995, noting that "some unkind critics have joked that his job could easily have been done by an incoming fax machine linked to the Bundesbank's Frankfurt headquarters" (Hall, 1998).

the 50 new governor announcements, there are 12 such "unscheduled exit" announcements, yielding a total of 62 distinct events.

In practice, distinguishing between scheduled and unscheduled transitions is usually relatively straightforward: expirations of terms, planned retirements, and the like are generally matters of public record and thus easy to verify from press reports, central bank sources, and Pringle (2007). Cases in which the incumbent was eligible for reappointment, but did not receive it, are classified as unscheduled, on the grounds that the typical pattern is to serve out an additional term, if allowed.[15]

The second key dimension is whether the identity of the new governor is known in advance of the official announcement. This critical distinction determines the extent to which the announcement represents real "news," as opposed to the ratification of a *fait accompli* already anticipated by the markets. The distinction is an especially important one for the purposes of this paper, as efficient financial markets should, in theory, respond only to *new* information. Considering this factor jointly with the scheduled/unscheduled distinction, we can usefully partition the sample into two subsets: one consisting of 42 "newsworthy" events, defined as unscheduled departures and surprise new governor announcements, and a second consisting of 20 "non-newsworthy" events encompassing appointments in which the new appointee's identity was widely anticipated.

Discerning the extent to which the new governor's identity was known in advance is a challenge, as there is no direct means to divine the market's expectation of the next central bank governor.[16] In the absence of market data, we rely on press accounts during the period leading up to and including the announcement date. Often, the accounts are very clear as to whether the appointment was as expected; in others, some judgment is required.[17]

[15]Examples of events classified as unscheduled for this reason include the transitions from Arthur Burns to William Miller in the United States, and from John Crow to Gordon Thiessen in Canada.

[16]At least not until recently: in 2005, the betting site Intrade.com offered a futures contract allowing investors to take positions on Greenspan's successor. According to Intrade, Bernanke was the favored candidate, in the weeks leading up to the appointment, with a 40 percent probability of appointment; but Martin Feldstein and Glenn Hubbard were also thought to be serious possibilities, with probabilities of 27 and 20 percent, respectively (Pethokoukis, 2005). This is consistent with the view of Meyer and Sack (2005) who, writing at the end of August 2005, observed that "none of the candidates on the list has even emerged as a clear favorite."

[17]In the case of Mervyn King's initial appointment to head the Bank of England, for example, the press

Preventing sample selection bias naturally requires that this judgment be based exclusively on external sources, such as contemporary press accounts—and not on the financial market reaction itself.

This method of classification is admittedly somewhat subjective and based on limited information—some errors are inevitable.[18] Fortunately, the possibility of classification errors should not undermine the results: mis-classifying anticipated appointments as "surprises" should tend to attenuate the measured response to announcements, biasing the results *against* finding a significant reaction to central bank appointments. It is therefore unlikely that any such random misclassification would result in the spurious rejection of the "no reaction" null hypothesis. It could, however, mask a distinct reaction to newsworthy versus non-newsworthy events, and as discussed below, this is the likely source of one minor anomaly in our results.

Table 2 lists all 62 events, encompassing announcements of unscheduled departures and new appointments. The table also indicates whether the identity of the appointee was anticipated according to press reports.

3.2 Financial data

Having identified a set of events, as well as several interesting subsets, the next step is to assemble high-frequency exchange rate, bond yield, and stock price data. The daily exchange rate data are taken from the Federal Reserve's H.10 release. For the nine European countries in the sample (other than Germany), the exchange rate is the bilateral rate relative to the Deutsche mark. For Germany, and the other countries in the sample, the bilateral exchange rate with the United States is used; the US exchange rate is relative to the Deutsche mark (the euro, post 1999).[19]

Daily bond yields are obtained from a variety of sources. Some are reported by the

accounts suggest that, although King was the clear front-runner, Andrew Crockett was also a possibility. But because King was so heavily favored, his appointment is coded as "known in advance."

[18] In the absence of a large textual database, automated algorithms like those used by Lucca and Trebbi (2008) and Bokus and Rosenberg (2006) are obviously not feasible.

[19] It might seem at first that using the Federal Reserve exchange rate data, which are collected at noon Eastern time, would complicate the analysis—but the timing is such that announcements taking place during normal business hours in both Europe and Asia would be reflected in the Fed's data.

central banks themselves, while others were collected by the Federal Reserve Bank of New York. Most are the yields on benchmark government securities, typically of a 10-year maturity. The availability of high-frequency bond yield data is rather limited, however, as liquid long-term bond markets are a relatively recent development in many countries in our dataset. Consequently, bond yields are available for only 39 of the 62 events.

Daily values of the major equity market indexes in each country were obtained from Haver Analytics and other sources. These high-frequency data are even more limited, however, and the stock price is available for only 33 of the 62 events. Further details on the sources and availability of the financial data used in the analysis appear in the appendix.

4 MEASURING THE MARKET RESPONSE TO APPOINTMENTS

In gauging financial markets' response to central bank appointments, an important consideration is that the news may move the markets in *either* direction, depending on the nature of the information conveyed by the appointment. The unexpected appointment of a governor with a preference for very low inflation, for example, would tend to strengthen the exchange rate, while the appointment of one who was perceived to be soft on inflation would generate the opposite response. The challenge is to determine the extent to which markets perceive that the incoming governor will bring with him or her a shift in policy, while remaining agnostic on the direction of that shift. We therefore need a procedure for detecting higher-than-normal volatility on announcement days.[20]

4.1 The statistical framework

A simple statistical specification for modeling market reactions is as follows. On days *without* appointment announcements the change in the financial variable is modeled as a random shock, ε, embodying the impact of non-appointment related news on the financial markets. On appointment days, the financial markets receive the usual shock ε, plus a second shock, η, incorporating the information content of the appointment. Specifically,

[20] Conventional event-study methods, such as those outlined in MacKinlay (1997), are designed to measure excess returns around announcement dates, and so these techniques are not suitable for our application.

we assume z_i obeys:

$$z_i = \begin{cases} \varepsilon_i & \text{for } i \notin A \\ \varepsilon_i + \eta_i & \text{for } i \in A \end{cases} \tag{7}$$

where z_i is the suitably normalized change in the financial variable, and A represents the set of appointment days. The null hypothesis of interest is therefore that $\sigma_\eta^2 = 0$. To the extent that $\sigma_\eta^2 > 0$, the variance of z would be higher on announcement days, and this would be consistent with the hypothesis that announcements contain information of relevance to the financial markets.

The specification readily encompasses the scenario in which only some subset of the announcements is perceived to contain information. For whatever reason, some appointments—even among those classified as newsworthy—probably convey little or no new information. This could be the case for a variety of reasons: the new appointee's preferences might be perceived as similar to his or her predecessor's, for example; or, the announcement may have been misclassified or dated incorrectly. This can be captured with a minor generalization of equation 7, in which only some fraction α of appointment days is associated with the arrival of news in the form of an η shock; the remaining $1-\alpha$ fraction would receive only the ε shock. In this case, the variance of appointment days would still be higher than that of other days, but the difference would be smaller to the extent that $\alpha < 1$.

One complication is that the variance of ε may vary over time and across countries. Testing for a higher variance on announcement days therefore requires normalizing the change in each of the financial variables so that a consistent threshold can be applied. The natural way to do this is to de-mean each variable and divide by an estimate of its standard deviation,

$$z_i = (\Delta y_i - \overline{\Delta y})/\hat{s} \tag{8}$$

where Δy_i is the change in the relevant financial variable (the log of the exchange rate, the bond yield, or the log of the stock price) from the day prior to the announcement. The average change in the variable, $\overline{\Delta y}$, and the estimated standard deviation, $\hat{s}$, are obtained from

a 90-day window ending two days prior to the announcement, which makes it a reasonable estimate of σ_ε.[21] Calculated in this manner, the z will have a mean of zero and unit variance under the null hypothesis of $\sigma_\eta^2 = 0$.

The measured financial reactions (i.e., the zs and Δys) appear in table 2, along with the appointment data discussed above. The zs are generally centered on zero and typically less than one in absolute value. The sample nonetheless contains a number of relatively large reactions with many exceeding two in absolute value. In the case of the exchange rate, for example, 12 out of the 62 exceed this threshold. Casual inspection therefore suggests *something* unusual tends to happen on announcement days.

There is one conspicuous standout on this dimension: the exchange rate reaction to Finland's appointment of Sirkka Hamalainen in 1992. Following a period of relative stability, the 2.5 percent appreciation in the markka on April 3 (occurring immediately after an equally sharp depreciation) represents a 13 standard deviation change. Because including this single extreme observation could easily skew the results, we drop it from the analysis as an outlier, leaving 61 usable observations.[22]

4.2 Alternative statistical tests

We consider three methods to assess the statistical significance of the difference between the variance on announcement and non-announcement days. One to count the number of unusually large realizations of z, where "large" is defined as exceeding the critical value associated with a given tail probability. If the zs are distributed normally, for example, under the null hypothesis that $\sigma_\eta^2 = 0$ (or $\alpha = 0$), the expected value of the share exceeding 1.96 will be 0.05. The binomial distribution can be used to determine critical values for the

[21] In cases where the announcement was preceded by an unanticipated departure by the previous governor, a 90-day window prior to the departure announcement is used. In two cases, there was not enough pre-announcement bond yield data, and so a window beginning ten days following the announcement was used for calculating $\hat{s}$.

[22] As it happens, Hamalainen's appointment followed the resignation of her predecessor, Rolf Kullberg, in a public dispute over policy that sent a "shock wave through the Finnish money markets" and also resulted in a spike in the Helibor rate of nearly four percentage points (Webb, 1992). With by far the largest market reaction in the sample, omitting this particular newsworthy event can only weaken the evidence for a significant aggregate financial market response. Moreover, since the markka appreciated sharply, the omission of this observation makes it more difficult to dismiss the view that new governors are perceived as weak.

number of observations exceeding the threshold.

A second test procedure is based on the sum of the squared z_i: assuming normality, $\sum_{i=1}^{N} z_i^2$ will follow a χ_N^2 distribution under the null hypothesis. A third procedure involves calculating the average $|z_i|$ and comparing this statistic to the relevant critical value. Assuming the z_i are distributed normally, the mean and variance of $|z_i|$ would be those of the truncated normal distribution. In addition, since z_i has a zero mean and a unit variance under the null, the hypothesis to be tested is that $N^{-1}\sum_{i=1}^{N}|z_i| = f(0)/F(0) = 0.798$, where $f(\cdot)$ is the normal density function and $F(\cdot)$ is the tail probability.

These procedures are all based on the assumption that the z_i are statistically independent of one another. This condition is quite likely to hold in practice, as the events are separated by both space and time; that is, there is no reason to believe that a change in the Finnish exchange rate in May 1983, for example, would be correlated with a change in the Swiss exchange rate in October 1984.

One important question regarding the alternative tests concerns their relative power against the null of $\sigma_\eta^2 = 0$ (or $\alpha = 0$). To address this question, we used monte-carlo methods to calculate the three tests' rejection probabilities for α values ranging from 0 to 1, assuming $\sigma_\eta^2 = 2\sigma_\varepsilon^2$. The sample size is 60, corresponding approximately to the number of observations in our full sample of central bank appointments.[23]

The results, plotted in Figure 1, indicate that the χ^2 sum-of-squares test is the most powerful of the three for most values of α, although the tail-based test is not far behind. The power of the test based on the absolute value of z is considerably lower than that of the other two, however. For $\alpha = 0.3$, for example, the rejection probability is only 0.2, compared with roughly 0.5 for the other two tests. In light of this finding, we used only the χ^2 and tail-based tests in the results reported below.

Not surprisingly, even these tests' power falls off markedly as the sample size shrinks.

[23]The calculations used 10,000 draws from a normal distribution, For the sum-of-squares and absolute-value tests, the exact critical values were determined from the theoretical χ^2 and truncated normal distributions. To avoid discontinuities created by the discrete nature of the binomial distribution, a normal distribution was used for the tail-based test. In small samples, the normal approximation tends to overstate the power of the tail-based test.

As shown in Figure 2, the χ^2 test is able to reject the null reliably in large samples even when α is relatively small: for $\alpha = 0.3$, for example, the rejection rate is roughly 0.8 when $N = 200$. The rate falls to 0.5 for $N = 60$, and for $N = 20$, the rate is only 0.25. The lack of financial data for many of the appointments in the sample will therefore limit our ability to discern a significant market impact.

A potential problem with the proposed statistical tests is that the theoretical critical values are based on the assumption that the normalized changes in the financial variables (the z) obey a normal distribution. This may be a bad assumption for financial data, which often contain more large observations than one would expect in a normally-distributed population.

To account for this possibility, we also report tests based on bootstrapped critical values. To obtain these values, we sampled with replacement zs from a population consisting of the data from the 90-day window prior to the announcements, pooled across events. The critical values of the sum-of-squares and tail-based tests correspond to the fractiles of the empirical distribution of the test statistics, based on 10,000 replications. We repeated the procedure for each of the three financial variables and for all of the relevant sample sizes. It turns out that in the case of exchange rates, the bootstrapped critical values are markedly larger than those based on the χ^2 distribution: with $N = 60$, for example, the 5 percent threshold is 91, versus 79 for the χ^2. For the tail-based test, the differences between the bootstrapped and theoretical critical values are relatively small.

4.3 Responses distinguished by announcement type

The first row of Table 3 contains our baseline results. In the case of exchange rates, we see strong evidence of reaction in the full 61-event sample. The sum-of-squares test statistic is 93.8, which is significant at the 1 percent level using the χ^2 critical values, and at the 5 percent level using the bootstrapped critical values.[24] Eleven of the 61 events (18 percent) are associated with an exchange rate movement in excess of 1.96 standard deviations, which differs from the predicted 5 percent at the 1 percent level regardless of

[24]Here, and in all the results reported below, the Hamalainen appointment is dropped.

whether the binomial or bootstrapped critical values are used.

The remaining rows of the table contain results in which the sample has been partitioned according to the circumstances surrounding the appointment: resignations versus new appointments, and whether the appointee's identity was known in advance. We also consider the set of "newsworthy" appointments, defined as the set of unscheduled departures plus those appointments for which the new governor's likely identity was not known in advance.

Partitioning the sample in this way reveals a number of interesting patterns. First, we find a much stronger exchange rate reaction for 49 appointments than we do for the 12 unscheduled departures. The same is true when we compare the response to all newsworthy events and to newsworthy appointments (i.e., dropping the unscheduled departures). In these subsamples, the sum of squares statistics are significant at the 1 or 5 percent level, depending on whether the χ^2 or the bootstrapped critical values are used. Interestingly, there is *no* significant reaction when the sample is restricted to the 20 non-newsworthy events (i.e., anticipated appointments), as would be expected according to the principle of efficient markets.[25]

The results in Table 3 also show a tendency for bond yields to react to central bank appointments, at least in the case of new appointments. The relative paucity of usable bond yield data somewhat diminishes the statistical significance, however. Judging from the sum-of-squares statistics, the reaction is significant at either the 1 or 5 percent level (again, depending on how the critical values are calculated) in the full sample and new governor announcement subsamples; as with exchange rates, there is no significant reaction to unscheduled exits. Restricting the sample to the 20 newsworthy appointments also yields a rejection of the null at the 10 percent level. With only three appointments associated with a two-standard-deviation change in the bond yield (a share of 0.08 for the full sample and 0.09 for the new governor subset), the tail-based statistics are mostly insignificant.[26]

[25]This is consistent with the finding in Kuttner (2001) that bond yields do not react to anticipated changes in the federal funds rate target.

[26]The fact that two of the three unusually large reactions observed in the sample are quantitatively very large (three and four standard deviations) explains the strength of the results based on the sum-of-squares

One puzzling result involving the bond yield is that it exhibits a significant reaction for the non-newsworthy subsample but not in the case of newsworthy events, contradicting the efficient markets principle. An inspection of the individual responses in Table 2 suggests that this anomalous response can be traced to two observations: Australia's 1989 appointment of Bernie Fraser and Norway's 1996 appointment of Kjell Storvik. Both of these were classified as anticipated appointments, based on press reports, and yet, both were associated with pronounced bond market responses. Yields rose 15 basis points (two standard deviations) on Fraser's announcement and *fell* 19 basis points (over four standard deviations) on Storvik's.

In Fraser's case, the reason for the unusual reaction is clear. The likely choice of Fraser, the sitting Secretary of the Treasury, had been criticized in the weeks prior to the announcement as an appointment that would predispose the Reserve Bank of Australia (RBA) to yield to political pressure for more accommodative monetary policy.[27] And, while Fraser was widely viewed as the clear front-runner for the job, there was some speculation that Bob Hawke's government would back away from its preferred candidate and appoint instead one of several viable candidates from within the RBA.[28] Thus, the adverse market reaction provoked by the announcement suggests Fraser's appointment was not thought to be entirely certain. Reclassifying Fraser's appointment along these lines would render the bond market's reaction significant at the 10 percent level in the newsworthy subsample.

The pronounced reaction to Storvik's appointment is more puzzling. Deputy governor of the Norges Bank, Storvik was appointed acting governor after his predecessor, Torstein Moland, resigned in 1995 to fight tax evasion charges. With Storvik's confirmation for the permanent position widely anticipated, it is unclear why the market would respond enthusiastically to his official appointment, unless it was a "relief rally" or a response to some unrelated event occurring on the same day. Unfortunately, the English-language business

statistic, compared with those that use the tail-based test.

[27] Ironically, Fraser went on to establish inflation targeting at the Reserve Bank of Australia. This underscores the point made previously, that the financial market's reaction to an appointment need not correctly anticipate the policy changes occurring under a new governor.

[28] See Walsh (1989) and Lloyd (1989).

press contains no clues as to the cause of the bond market reaction.

Like the bond market, the stock market's reaction to central bank appointments is somewhat weaker than it is for the foreign exchange markets. Again, with roughly half the observations of the exchange rate dataset, this is likely due to the low power of these tests in small samples. Nonetheless, there is evidence of a significant reaction in the case of newsworthy appointments, which is exactly where one would expect to see the strongest reaction. (The market's 2.8 percent rally following Bernanke's 2005 appointment is one such example.) That there should be any significant response in the equity market is a little surprising given the small number of observations, and the less clear-cut theoretical relationship between central bank preferences and equity values.

4.4 The relevance of the monetary policy framework

We turn now to the question of whether the monetary policy framework affects the strength of the markets' response to new appointments. As discussed above in section 2.4, there is good reason to suspect that it does: the policy pursued by an independent central bank with a well-defined nominal anchor is less likely to be influenced by the governor's preferences than one lacking those two features.

One could make a number of distinctions along these lines, and in the ideal world it would be interesting to distinguish between inflation targeters and non-targeters, for example, or between those with money targets and those without. The relatively small number of observations precludes such fine-grained distinctions, unfortunately; instead, we make a cruder distinction between "strong" and "weak" policy frameworks. Strong frameworks satisfy two criteria: First, the central bank must enjoy at least partial autonomy, as defined in Kuttner and Posen (2001).[29] And second, the framework must include an explicit nominal anchor, such as an inflation target or an operational intermediate money target. The United Kingdom, post-1997, and New Zealand, post-1989, are well-known examples of the former; pre-European Monetary Union Germany and Switzerland are examples of the

[29] Specifically, to be classified as fully autonomous, a central bank must be under no obligation to finance government spending, and the governor cannot be dismissed without cause. Banks meeting one of these two conditions are classified as partially autonomous.

latter. Central banks not satisfying both criteria are classified as having weak policy frameworks.[30] In Table 2, the column labeled "W/S" gives the framework in effect at the time of the event (W for weak, S for strong).

Table 4 shows the results when the sample is partitioned along this dimension. As hypothesized, there is strong evidence of a pronounced reaction for those with weak policy frameworks: all three financial variables display statistically significant responses. For exchange rates and bond yields, the sum-of-squares statistic rejects the null of no reaction at the 1 percent level, or at the 5 percent level when the bootstrapped critical values are used. The proportion of events associated with a 1.96 standard deviation change is also quite large: 0.22 for the exchange rate, 0.19 for the stock price, and 0.14 for bond yields. Just as important, there is no evidence of a reaction for those central banks with a strong policy framework. In these cases, neither statistic rejects the null hypothesis at even the 10 percent level. In fact, for bonds and stocks, *no* announcement generates a 1.96 standard deviation change; for exchange rates, the proportion is a statistically insignificant 0.11.

One possible objection is that these results concerning the policy framework are heavily influenced by U.S. appointments. All four Federal Reserve observations are associated with a strong reaction in one or more of the markets and, because of its lack of a clear nominal anchor, the Federal Reserve is classified as having a weak policy framework. The appointments of Miller, Volcker, and Greenspan all generated exchange rate changes in excess of two standard deviations. Greenspan's appointment also led to a 27 basis point (three standard deviation) *increase* in the bond yield, apparently on fears that he would be too soft on inflation.[31]

To ensure that the results are not unduly influenced by U.S. data, we recalculated the test statistics for those central banks classified as having a weak framework, excluding the observations corresponding to the four Fed appointments. The results, shown in the last

[30] Although the U.S. Federal Reserve published monetary aggregate targets throughout much of the 1970s and 1980s, Friedman and Kuttner (1996) show that these targets had no measurable impact on the conduct of monetary policy. Consequently, despite the Fed's high level of independence, the United States is defined as having a weak framework.

[31] Meyer and Sack (2005) characterized the episode as an "inflation scare."

row of Table 4, show that the U.S. experience is not anomalous. Even with these four observations deleted, the null of no reaction is rejected, albeit at a diminished level of statistical significance due, at least in part, to the reduction in sample size.

4.5 Quantitative and economic interpretations

As in any such exercise, it is fair to ask whether the results are economically, as well as statistically, significant. One gauge of economic significance is simply the share of appointments associated with large reactions, which is substantial: over 20 percent exceed 1.96 standard deviations for the exchange rate in the cases of newsworthy appointments and weak monetary policy frameworks. Translating these numbers into percentage changes is not straightforward, since we allow the standard deviation to vary across countries and over time. For the United States, the standard deviation of daily exchange rate changes was 0.57 percent during the period just prior to Bernanke's appointment, and this is representative of most of the episodes in our sample. That means a two standard deviation change in the exchange rate would be something on the order of 1.1 percent. The magnitudes are similar in the case of bond yield and stock price movements. For bonds, the 4.5 basis point standard deviation prior to Bernanke's appointment is typical, so a two standard deviation change would be 9 basis points.

Another way to assess the results' quantitative significance uses the sum-of-squares statistic. Under the "no news" null hypothesis, the standard deviation of the normalized event-day changes should be equal to unity. Thus, the event-day standard deviation, calculated directly from the sum-of-squares statistic, will give a sense of the increase in volatility associated with new governor announcements. Specifically, according to equation 7, $\sigma_z^2 = 1 + \sigma_\eta^2$, so an estimate of the standard deviation of the news associated with the announcement would be

$$\hat{\sigma}_\eta = \sqrt{\hat{\sigma}_z^2 - 1} \ .$$

Things are slightly more complicated if it is assumed that only some share α of the an-

nouncements convey new information, in which case

$$\hat{\sigma}_\eta = \sqrt{\alpha^{-1}(\hat{\sigma}_z^2 - 1)} \ .$$

Using the results in Tables 3 and 4, we find that, in cases where there is a statistically significant reaction, the standard deviation of the η shock is on roughly the same order of magnitude as that of the ε shock. For the full sample in the case of the exchange rate, for example, $\hat{\sigma}_\eta = 0.73$, assuming $\alpha = 1$. At the other end of the spectrum, $\hat{\sigma}_\eta = 1.32$ for bond yields in the weak policy framework subsample, assuming $\alpha = 0.5$. For the pre-Bernanke period in the United States, these figures would imply η shocks in the neighborhood of 0.57 percent for the exchange rate and 4.5 basis points for bond yields.

Having established that central bank appointments contain (or are at least *perceived* to contain) statistically and economically significant news, the remaining question is whether the observed reactions tend to go systematically in one direction or the other. Specifically, we would like to determine whether there is any evidence to support the "weak until proven strong" hypothesis discussed above in section 2.4: if true, then the responses should be consistent with a jump in expected inflation (a depreciation of the currency and higher bond yields). Calculating the average reaction and the associated t test statistics should reveal whether this is actually observed in the data.

Table 5 reports the average change in the (normalized) financial variables, and t tests for the null of a zero mean. The table includes the statistics for the full sample of events, plus several subsets in which the null of no reaction was soundly rejected in Tables 3 and 4. The main finding here is a negative one. The table shows that announcements fail to generate a consistent, statistically significant change on average in either direction for any of the financial variables. Regardless of the sample chosen, the average change is neither statistically nor economically significant. The average change in the exchange rate for the full sample, for example, is -0.110, an appreciation of 0.1 standard deviations. The average changes in the bond yield and the stock price are -0.14 and 0.01 standard deviations, respectively. Restricting the sample to newsworthy events, or those central banks with

weak policy frameworks, makes no difference: every average change is statistically and economically insignificant. Thus, there is no empirical support for the "weak until proven strong" hypothesis.

Overall, the findings reported in Tables 3 and 4 show that financial markets, especially the foreign exchange and bond markets, *do* respond to news about the new central bank governor. The reactions, however, are not unidirectional: in particular, the results reported in Table 5 provide no support for the "weak until proven strong" hypothesis. That reactions are observed in both directions suggests they are based on perceived characteristics of specific appointees, rather than a generic concern that all new governors are susceptible to inflation bias. This is also consistent with the failure to find a significant reaction to the unexpected departure of an incumbent: financial markets apparently render a snap judgment on the preferences of the new appointee but do not exhibit a generalized panic over news of a change in governor.

5 CONCLUSIONS

This paper has investigated the question of whether the appointment of a new central bank governor, or the departure of the incumbent, affects financial markets—and if so, why. To address this question, we assembled a unique dataset consisting of the announcement dates of appointments and unscheduled departures and merged it with high-frequency data on exchange rates, bond yields, and stock prices.

In general, the results show that markets *do* seem to care who chairs the central bank. Our primary finding is that financial markets tend to react to the appointment of a new central bank governor with larger-than-normal price changes, especially when a distinction is made between "newsworthy" announcements (i.e., those plausibly incorporating new information) and those merely confirming an anticipated appointment. Given the limitations of our dataset, however, it is hard to determine whether the observed market reactions result from differences in the governors' perceived inflation objectives or their relative weight on output and inflation.

Second, the reaction of asset prices tends to be considerably stronger for central banks

with weak monetary policy frameworks compared with those with strong frameworks, defined as some degree of independence plus an operational domestic nominal anchor. This confirms that strong policy frameworks effectively stabilize inflation expectations, thus corroborating the analysis of Gürkaynak et al. (2005) and Levin et al. (2004) for inflation-targeting central banks. It would, of course, be interesting to further partition the sample on other criteria, such as the size and structure of the policymaking committee. The relatively small number of observations in our sample precludes a more fine-grained analysis, however.

Third, we find no systematic tendency for bond yields to rise, or the exchange rate to depreciate, in response to the announcement of a new governor; nor is there a significant negative response to the unscheduled departure of the incumbent. These findings contradict the "weak until proven strong" view sometimes expressed in the academic literature and in the business press. The lack of support for this hypothesis suggests that financial market participants tend to sift through the available information on the new governor in an effort to form an unprejudiced (but not necessarily correct *ex post*) inference regarding the appointee's likely policy preferences. This conclusion supports and generalizes that of Meyer and Sack (2005), who infer, based on their case study of the Greenspan appointment, that the Fed's credibility is largely tied to the credentials of the Fed chairman.

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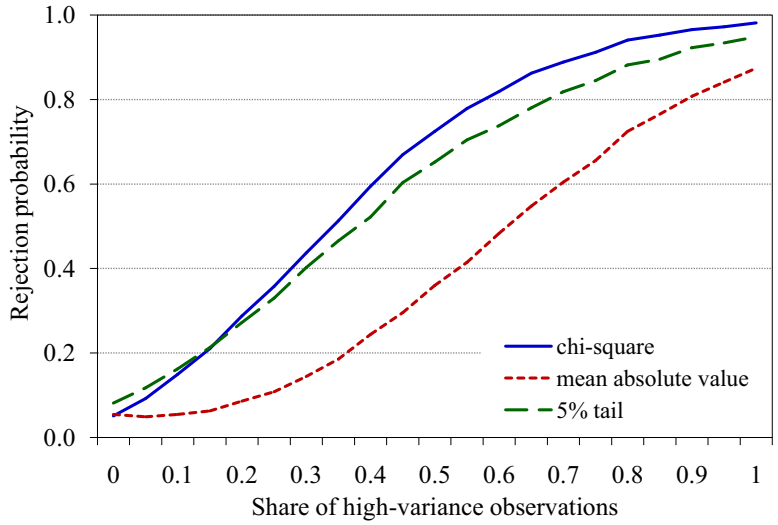
Figure 1

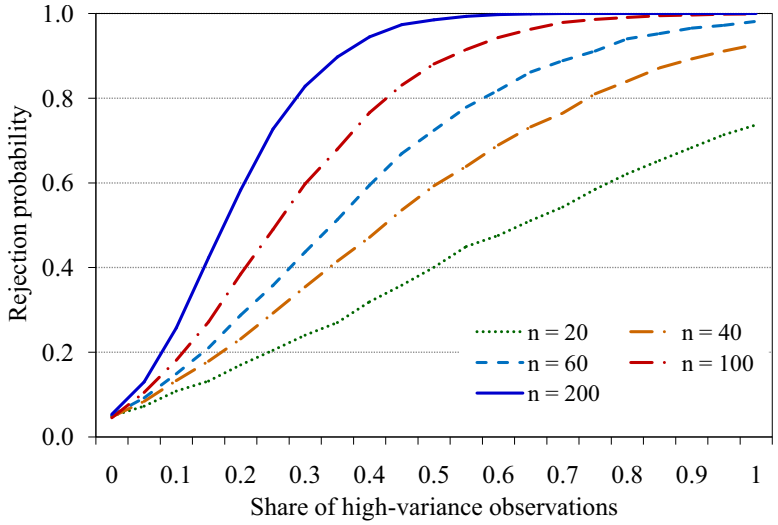
Statistical Power of Alternative Test Statistics



Note: The figure depicts the probability of rejection, as a function of the share of high-variance ("news") observations, for three test statistics: the χ^2 statistic based on the sum of squared normalized changes in the financial variable; the share of observations in the 5% tail; and the mean of the absolute values of the change in the financial variable. The "news" variance is twice the "normal" variance, the sample size is 60, and 10,000 trials were used in the calculation.

Figure 2

Statistical Power as a Function of Sample Size



Note: The figure depicts the probability of rejection from the χ^2 test, as a function of the share of high-variance observations, for a variety of sample sizes. The "news" variance is twice the "normal" variance, and 10,000 trials were used in the calculation.

Table 1
Central bank governors' inflation performance

	Linear model		Nonlinear model	
Regressor	(a)	(b)	(c)	(d)
1977 inflation (π_{77})	8.96***	10.34***	...	...
(Year – 1977) (β_1)	−0.28***	−0.64***	...	...
(Year – 1977)^2 (β_2)	...	0.013**	...	...
Terminal inflation (π_0)	...	...	2†	1.16
Decay rate (δ)	...	...	0.16***	0.13***
Australia dummy	−0.59	−0.19	9.8	13.4
Canada dummy	−0.79	−0.49	11.5	12.5
Finland dummy	−0.25	0.36	18.7***	16.7***
France dummy	−1.33	−1.10	8.5***	9.3***
Germany dummy	−3.02*	−2.66	2.1	3.3*
Italy dummy	2.04	2.09	12.4***	13.4***
Japan dummy	−2.51	−2.42	−17.3	−3.3
New Zealand dummy	−0.12	−0.24	5.8	13.3
Norway dummy	−0.44	−0.38	5.4	14.9
Portugal dummy	1.68	2.62	51.9**	36.6***
Spain dummy	−0.17	0.75	24.1**	19.9**
Sweden dummy	−0.88	0.77	20.5*	17.0**
Switzerland dummy	−3.01*	−2.85*	1.3	2.6
UK dummy	0.11	0.24	16.3*	15.1**
US dummy	...	...	11.0***	11.3***
$\bar{R}^2$	0.551	0.623	0.774	0.784
Standard error	2.22	2.03	1.58	1.54

Note: The table reports the results from regressions of central bank governors' average inflation rates as a function of a time trend and country-specific dummy variables. The inflation rate is at an annual rate, and expressed in percentage terms. The sample consists of 45 of the 49 central bank governors' tenures whose length exceeded 12 months. Estimation is by ordinary least squares for the linear model, nonlinear least squares for the nonlinear mode. Parentheses indicate statistical significance: *** for the 0.01 level, ** for 0.05, and * for 0.10. A † indicates that the value of the parameter is imposed, not estimated.

Table 2
Announcements of governor departures and appointments

Event	Date	ID?	W/S	Exchange rate		Bond yield		Stock price	
				% Δ	*t*	bp Δ	*t*	% Δ	*t*
Australia									
Fraser	7/5/1989	Y	W	-0.53	-0.76	15	1.99	0.58	0.70
MacFarlane	8/14/1996	Y	S	0.03	-0.01	5	1.00	-0.35	-0.53
Stevens	8/1/2006	Y	S	0.42	0.79	1	-0.01	-0.06	0.00
Canada									
Crow	12/17/1986	N	W	-0.02	-0.16	-4	-0.63	-0.07	-0.15
Thiessen	12/22/1993	N	S	-0.60	-1.82	-10	-1.61	0.29	0.50
Dodge	12/20/2000	N	S	-0.03	-0.20	-5	-1.43	-2.78	-1.54
Finland									
Koivisto departure	6/14/1979		W	0.01	0.14				
Karjalainen	2/5/1982	Y	W	-0.56	-2.27				
Karjalainen departure	5/13/1983		W	0.16	0.37				
Kullberg	5/27/1983	Y	W	-0.38	-0.75				
Hamalainen	4/3/1992	N	W	-2.55	-13.01	-19	-1.53		
France									
Clappier	6/12/1974	N	W	-0.81	-1.59				
De la Geniere	11/14/1979	N	W	0.28	0.77				
Camdessus	11/14/1984	N	W	0.00	-0.05				
Camdessus departure	12/17/1986		W	0.03	0.15				
De Larosiere	1/16/1987	Y	W	0.19	1.82	1	0.18		
De Larosiere departure	8/17/1993		S	-0.77	-2.50	6	1.47	-0.55	-0.68
Trichet	9/13/1993	Y	S	-0.73	-2.38	-3	-0.38	0.51	0.49
Germany									
Emminger	3/9/1977	N	S	0.17	0.54				
Poehl	9/19/1979	Y	S	-0.33	-0.90				
Poehl departure	5/16/1991		S	0.41	0.30	-4	-0.71	0.48	0.23
Schlesinger	5/29/1991	Y	S	0.91	0.85	-3	-0.51	-0.04	-0.12
Tietmeyer	6/23/1993	Y	S	-0.21	-0.35	2	0.58	0.08	0.07
Italy									
Baffi	7/30/1975	N	W	-0.61	-1.57				
Ciampi	9/21/1979	N	W	0.46	2.05				
Ciampi departure	4/26/1993		W	-1.22	-1.87	-3	-0.27		
Fazio	5/4/1993	N	W	-0.12	-0.24	-3	-0.27		
Japan									
Mieno	11/22/1989	Y	W	0.07	0.06	-1	-0.25	0.63	1.13
Matsushita	11/10/1994	Y	W	0.14	0.29	0	-0.12	-0.82	-1.15
Matsushita departure	3/12/1998		W	-0.04	-0.07	2	0.60	-1.09	-0.53
Hayami	3/16/1998	N	W	0.91	1.13	-4	-1.16	-1.17	-0.55
Fukui	2/24/2003	N	W	-0.85	-1.41	-2	-0.97	0.60	0.52

Continued…

Table 2, continued

Event	Date	ID?	W/S	Exchange rate		Bond yield		Stock price	
				% Δ	*t*	bp Δ	*t*	% Δ	*t*
New Zealand									
Brash	6/14/1988	N	W	0.53	0.91			-0.68	-0.43
Brash departure	4/26/2002		S	0.20	0.42	-8	-1.39	0.13	0.21
Bollard	8/22/2002	N	S	0.22	0.44	3	0.52	0.87	1.60
Norway									
Moland departure	11/17/1995		W	0.09	0.36				
Storvik	2/23/1996	Y	W	-0.05	-0.17	-19	-4.15		
Gjedrem	10/2/1998	N	W	1.74	2.46	-1	-0.10	-1.58	-0.74
Portugal									
Constancio departure	3/24/1986		W	-0.69	-1.50				
Moreira	5/16/1986	N	W	0.28	0.43				
Beleza	4/9/1992	Y	W	-0.26	-1.04				
De Sousa	6/23/1994	N	W	-0.15	-0.66	-14	-1.38	3.09	2.58
Spain									
Rubio	7/20/1984	Y	W	-0.59	-1.01				
Luis Rojo	6/29/1992	N	W	0.45	1.96	8	1.26	-1.73	-2.53
Sweden									
Dennis	10/1/1982	N	W	0.10	0.34				
Baeckstroem	11/3/1993	N	S	0.00	-0.12	-13	-1.62		
Heikensten	6/13/2002	Y	S	-0.19	-1.30	-7	-1.78	0.02	-0.01
Heikensten departure	9/29/2005		S	-0.53	-2.02	3	0.77	0.00	-0.30
Ingves	10/11/2005	N	S	-0.02	-0.19	2	0.50	0.16	0.22
Switzerland									
Leutwiler	3/15/1974	Y	S	0.15	0.43				
Leutwiler departure	6/13/1984		S	0.01	-0.08				
Languetin	10/31/1984	Y	S	-0.04	-0.24				
Lusser	9/10/1987	Y	S	0.08	0.36				
Meyer	10/26/1995	N	S	-0.31	-1.10			0.03	0.10
Roth	9/18/2000	N	S	-0.21	-0.69	4	1.29	-0.98	-1.58
United Kingdom									
Leigh-Pemberton	12/23/1982	N	W	1.15	2.30	-1	0.04		
George	1/22/1993	N	W	0.64	0.49	3	0.42	0.28	0.13
King	11/27/2002	Y	S	-0.36	-0.87	0	-0.03	0.99	0.44
United States									
Miller	12/28/1977	N	W	1.17	2.59	1	0.25	0.06	-0.05
Volcker	7/25/1979	N	W	-0.80	-2.51	-2	-0.44	0.02	0.01
Greenspan	6/2/1987	N	W	1.65	2.35	27	3.19	-0.47	-0.46
Bernanke	10/24/2005	N	W	0.33	0.56	6	1.28	1.66	2.81

Note: The table lists the events (announcements of new governors plus unscheduled departures) used in the analysis. For new appointments, the column labeled "ID?" indicates whether the identity of the appointee was anticipated in advance of the announcement. Weak and strong monetary policy frameworks are distinguished in the column labeled "W/S." For the exchange rate, positive numbers correspond to depreciations.

Table 3

Tests for the presence of market reactions, distinguished by type of event

	Exchange rate		Bond yield		Stock price	
	N (k)		N (k)		N (k)	
Sample	χ^2 stat	5% tail	χ^2 stat	5% tail	χ^2 stat	5% tail
Full sample	61 (11)		38 (3)		33 (3)	
	93.8^{***}_{**}	0.18^{***}_{***}	62.1^{***}_{**}	0.08	35.0	0.09
New governor announcements	49 (9)		32 (3)		28 (3)	
	77.1^{***}_{**}	0.18^{***}_{***}	56.5^{***}_{**}	0.09	34.1	0.11
Unscheduled exits	12 (2)		6 (0)		5 (0)	
	16.7	0.17	5.6	0.00	0.9	0.00
Newsworthy events	41 (9)		26 (1)		23 (3)	
	71.3^{***}_{**}	0.22^{***}_{***}	35.8	0.04	31.2	0.13_{*}
Newsworthy events, appointments only	29 (7)		20 (1)		18 (3)	
	54.6^{***}_{**}	0.24^{***}_{***}	30.3^{*}_{*}	0.05	30.3^{**}_{*}	0.17^{*}_{**}
Non-newsworthy events	20 (2)		12 (2)		10 (0)	
	22.6	0.10	26.2^{***}_{**}	0.17_{*}	3.8	0.00

Note: The table reports tests for the joint significance of the reactions of the exchange rate, bond yield, and stock price. N is the number of observations, and k is the number of observations for which the normalized change exceeds 1.96 standard deviations. The χ^2 test statistic is the sum of the squared normalized change in the financial market variable. Asterisks denote statistical significance: *** for 1%, ** for 5%, and * for 10%. Superscripted asterisks are based on the critical values from the χ^2 and binomial distributions. Subscripted asterisks are based on bootstrapped critical values.

Table 4

Tests for the presence of market reactions, distinguished by policy framework

	Exchange rate		Bond yield		Stock price	
	N (k)		N (k)		N (k)	
Sample	χ^2 stat	5% tail	χ^2 stat	5% tail	χ^2 stat	5% tail
Full sample	61 (11)		38 (3)		33 (3)	
	93.8^{***}_{**}	0.18^{***}_{***}	62.1^{***}_{**}	0.08	35.0	0.09
Weak policy frameworks	37 (8)		21 (3)		16 (3)	
	66.9^{***}_{**}	0.22^{***}_{***}	42.6^{***}_{**}	0.14^{*}_{**}	25.9^{*}_{*}	0.19^{**}_{**}
Strong policy frameworks	24 (3)		17 (0)		17 (0)	
	29.6	0.13	19.5	0.00	10.0	0.00
Weak frameworks, excluding U.S.	33 (5)		17 (2)		12 (2)	
	48.0^{**}_{*}	0.15^{**}_{***}	27.9^{*}_{**}	0.12_{*}	17.8	0.17_{*}

Note: The table reports tests for the joint significance of the reactions of the exchange rate, bond yield, and stock price. N is the number of observations, and k is the number of observations for which the normalized change exceeds 1.96 standard deviations. The χ^2 test statistic is the sum of the squared normalized change in the financial market variable. Asterisks denote statistical significance: *** for 1%, ** for 5%, and * for 10%. Superscripted asterisks are based on the critical values from the χ^2 and binomial distributions. Subscripted asterisks are based on bootstrapped critical values.

Table 5
Average market reaction to governor announcements

Sample		Exchange rate	Bond yield	Stock price
Full sample	Avg. change	−0.110	−0.142	0.011
	N	61	38	33
	p-value	0.492	0.500	0.951
New governor announcements	Avg. change	−0.009	−0.184	0.051
	N	49	32	28
	p-value	0.962	0.443	0.810
Newsworthy events	Avg. change	0.018	−0.074	−0.028
	N	41	26	23
	p-value	0.933	0.753	0.912
Newsworthy events, appointments only	Avg. change	0.242	−0.120	0.024
	N	29	20	18
	p-value	0.351	0.674	0.940
Weak policy frameworks	Avg. change	0.105	−0.098	0.080
	N	37	21	16
	p-value	0.640	0.760	0.811

Note: The table reports the average change in the normalized exchange rate, bond yield, and stock price on event days. The changes are expressed in terms of standard deviations of the relevant variable. Exchange rates are bilateral with respect to the United States; for the United States, it is the bilateral exchange rate with respect to the Deutsche mark (euro, post 1999). The change is defined so that positive numbers correspond to depreciations. The reported *p*-values are for the null hypothesis that the mean change is zero.

Appendix: Data sources

The table below summarizes the sources and availability of daily bond yield and stock price data. Unless otherwise noted, the yield is that of a 10-year government bond. FRBNY data were compiled by the Research Department of the Federal Reserve Bank of New York (FRBNY), and Haver refers to Haver Analytics (www.haver.com). All daily exchange rate data were obtained from the Federal Reserve's H.10 release. The inflation series used in section 2.2 were calculated from consumer price index data obtained from the International Monetary Fund, International Financial Statistics.

Country	Bond yield	Stock price
Australia	RBA Occasional Paper No. 10, 1/1989-9/1993 & update, 10/1993-	All Ordinaries, Haver, 1/1985-
Canada	FRBNY, 6/1985-	Toronto 300 Composite, 1/1984-
Finland	Bank of Finland, 8/1991-	OMX Helsinki, Haver, 1/1995-
France	FRBNY, 1/1987-	CAC40, Haver, 1/1988-
Germany	FRBNY, 1/1983-	DAX30, www.econstats.com, 1/1981-
Italy	FRBNY, 1/1989-	MIB30, Haver, 1/1996-
Japan	FRBNY, 2/1982-	Nikkei 225, Haver, 1/1984-
New Zealand	10-year swap rate, RBNZ, 12/1997-	Barclay's Capital Price Index, 1988; NZSE Top 50, 2002; RBNZ.
Norway	Norges Bank, 1/1996-	Oslo OBX, Haver, 4/1996-
Portugal	Bank of Portugal, 7/1993-	PSI20, Haver, 1/1993-
Spain	Bank of Spain, 4/1991-	Madrid General Index, Haver, 1/1990-
Sweden	Riksbank (Reuters), 2/1987-	Stockholm Affarsvarlden, Haver, 1/1996-
Switzerland	Swiss National Bank, 1/1998-	Zurich Swiss Market, Haver, 7/1998-
United Kingdom	Bank of England, 1/1979-	FTSE100, Haver, 1/1984-
United States	Federal Reserve H.15, 1/1974-	S&P500, Haver, 1/1974-