EUROPEAN CENTRAL BANK

EUROSYSTEM

WORKING PAPER SERIES

NO 1731 / SEPTEMBER 2014

DO FEDERAL RESERVE BANK PRESIDENTS HAVE A REGIONAL BIAS?

Alexander Jung and Sophia Latsos

In 2014 all ECB publications feature a motif taken from the €20 banknote.

NOTE: This Working Paper should not be reported as representing the views of the European Central Bank (ECB). The views expressed are those of the authors and do not necessarily reflect those of the ECB.

Acknowledgements
The authors thank W. Poole, M. Rostagno, B. Hayo, E. Farvaque, P. Tillmann, M. Neuenkirch, H. Bennani, G. von Schweinitz, M. McMahon and J.F. Hammermann, A. Sirchenko, two anonymous referees and the participants of the European Public Choice Society meeting in Cambridge as well as participants from the Halle workshop on Central Bank Communication and Decision-making for discussion and useful comments. The views expressed by the authors are their own and do not necessarily reflect those of the ECB. The authors remain responsible for any errors or omissions.

Alexander Jung (corresponding author)
European Central Bank; e-mail: alexander.jung@ecb.europa.eu

Sophia Latsos
European Central Bank; e-mail: sophia_anastasia.latsos@ecb.europa.eu

© European Central Bank, 2014

Address	Kaiserstrasse 29, 60311 Frankfurt am Main, Germany
Postal address	Postfach 16 03 19, 60066 Frankfurt am Main, Germany
Telephone	+49 69 1344 0
Internet	http://www.ecb.europa.eu

All rights reserved. Any reproduction, publication and reprint in the form of a different publication, whether printed or produced electronically, in whole or in part, is permitted only with the explicit written authorisation of the ECB or the authors. This paper can be downloaded without charge from http://www.ecb.europa.eu or from the Social Science Research Network electronic library at http://ssrn.com/abstract_id=2491465. Information on all of the papers published in the ECB Working Paper Series can be found on the ECB's website, http://www.ecb.europa.eu/pub/scientific/wps/date/html/index.en.html

ISSN	1725-2806 (online)
ISBN	978-92-899-1139-9
EU Catalogue No	QB-AR-14-105-EN-N (online)

Abstract

This paper examines whether the interest rate preferences of Federal Reserve Bank Presidents are subject to a regional bias. In order to evaluate the regional bias hypothesis, we augment individual Taylor rules for the Federal Reserve Bank Presidents (sample 1989 to 2006) with regional variables and test for their influence on the Presidents' interest rate preferences. These preferences stem from FOMC (Federal Open Market Committee) transcripts. Estimates based on the augmented Taylor rules reveal that the preferences of some Federal Reserve Bank Presidents were not free of a regional bias. Augmented Taylor rules with inertia, however, show that this finding could also be due to the presence of an interest rate smoothing motive.

JEL Codes: C12, C30, D72, E58

Keywords: augmented Taylor rule, regional bias, real-time data, interest rate preferences, SUR model.

Non-technical summary

In a federal central banking system there is an undisputed need for a regional dimension to monetary policy decision-making. In fact, the literature suggests that monetary policy-makers, who are part of such a system, should use a wide range of indicators when assessing economic and financial conditions. Therefore, it appears warranted if these policy-makers choose to monitor regional data in order to enhance their understanding of national economic dynamics. At the same time, monetary theory cautions that policy-makers should avoid voting in a manner that would favour their region of origin. Such voting behaviour may reflect a regional bias in the interest rate preferences of policy-makers and could lead to suboptimal monetary policy outcomes. Motivated by this argument, several studies have examined whether regional bias is present in monetary policy. Using alternative econometric strategies, these studies mostly find evidence in favour of the existence of some form of regional *bias* in policy-makers' deliberations on interest rates. However, two important questions remain unresolved: do previous findings represent robust evidence that policy-makers' preferences are subject to a regional *bias*, and, if so, to what extent does the possible presence of a bias influence monetary policy decisions?

A regional bias is rarely observable in practice, unless the communication of policy-makers clearly indicates this kind of behaviour. The Federal Reserve System (Fed), for example, includes important institutional elements that minimise the risk of a regional bias in US monetary policy. Most importantly, its Federal Open Market Committee (FOMC) operates a rotation system which always provides the centre of the federal system with a structural majority in monetary policy decisions, thus limiting the potential for an influential regional bias. At the same time, the rotation system preserves two important elements of decision-making in a federal context, namely participation and regional representation. The regional dimension also facilitates the acquisition of regional information on the economy and enhances analytical diversity in the FOMC.

Nevertheless, there are several reasons to suspect that the Federal Reserve Bank Presidents of the US Federal Reserve System have a regional bias in their interest rate preferences. First, there are historical reasons relating to decentralised decision-making in the Federal Reserve System following its creation in 1913. Second, there are institutional reasons relating to different appointment procedures

between Governors and Federal Reserve Bank Presidents. Third, several lawsuits aimed at excluding the Federal Reserve Bank Presidents from voting on US monetary policy widely document concerns by politicians that a regional bias could be present in the monetary policy decision-making of the FOMC.

In order to detect a regional bias in policy-makers' interest rate preferences, it is necessary to apply specific empirical methods. In this sense, the evidence detecting such biased preferences has to be twofold. First, it has to show that a policy-maker's interest rate preference *responds* to regional data stemming from the respective home district. Second, the preference also has to be such that a policy-maker would *favour* the regional economy in his or her decision on the (national) interest rate. For example, a Federal Reserve Bank President with a regional bias would opt for lower (higher) interest rates when his or her region's unemployment rate was higher (lower) than the national average. The empirical approach to the hypothesis of a regional bias thus requires estimating policy-makers' reaction functions and augmenting them with a regional variable. The evidence obtained from this has to show that the regional variables of the policy-makers' respective home districts explain why their interest rate preference deviates from the FOMC's federal funds rate.

By estimating individual Taylor rules for FOMC members, we examine the interest rate preferences of the Federal Reserve Bank Presidents during the Greenspan era (sample 1989 to 2006). In order to evaluate the regional bias hypothesis, we augment individual Taylor rules for the Federal Reserve Bank Presidents with regional variables and test for their influence on the Presidents' preferences. Information on individual interest rate preferences stems from FOMC transcripts. Estimates based on these augmented Taylor rules reveal that the preferences of some Federal Reserve Bank Presidents were not free of a regional bias, a result that applies particularly to the smaller districts. However, Taylor rules with inertia show that this finding could also be due to the presence of an interest rate smoothing motive. Moreover, further tests confirm previous results by Chappell et al. (2008) who found that compared to the nationwide unemployment rate the district unemployment rate only has a small (negative) impact on FOMC members' interest rate preferences. Overall, our findings support the view that the presence of a regional bias in the interest rate preferences of some Federal Reserve Bank Presidents is unlikely to have impeded on the Fed's capacity to set interest rates with a nationwide focus.

1. INTRODUCTION

In a recent study on the Federal Reserve System (Fed) of the United States, Hayo and Neuenkirch (2013) analyse determinants of US monetary policy through speeches of Fed officials. The authors find evidence that Federal Reserve Bank Presidents systematically refer to regional information when explaining the Fed's monetary policy decisions. Using alternative econometric strategies, several other studies have examined whether a regional bias is present in monetary policy (see Tootell, 1991; Gildea, 1992; Meade and Sheets, 2002 and 2005; Chappell, McGregor and Vermilyea, 2008; Meade, 2009; Hayo and Méon, 2011). Most of these studies find evidence in favour of the existence of a regional bias in policy-makers' interest rate preferences. However, two important questions remain unresolved: do previous findings represent robust evidence that policy-makers' preferences are in fact subject to a regional bias, and, if so, to what extent does the possible presence of a bias influence monetary policy decisions?

A regional bias is rarely observable in practice, unless the communication of policy-makers clearly indicates this kind of behaviour. Therefore, it is necessary to apply specific empirical methods to sufficiently investigate whether there is a regional bias in their interest rate preferences. In order to be able to detect whether policy-makers have a regional bias, the evidence has to be twofold. First, it has to show that their interest rate preferences respond to regional data in their respective home districts. Second, it has to show that these preferences are such that the policy-makers would favour the regional economy. For example, Federal Reserve Bank Presidents whose preferences are regionally biased would opt for lower (higher) interest rates when their region's unemployment rate is higher (lower) than the national average (the same argument would apply for regional inflation and house prices, but with opposite sign). Consequently, this empirical approach not only requires estimating policy-makers' reaction functions, it also requires showing that a regional variable of the respective home district explains that a policy-maker's interest rate preference deviates from the majority view.

The aim of this paper is to examine whether the interest rate preferences of Federal Reserve Bank Presidents are subject to a regional bias. The empirical analysis focuses on the Greenspan era (sample 1989 to 2006), for which data availability is currently best. In order to evaluate the regional bias hypothesis, we generally follow the approach adopted in previous studies and test for the significance of regional variables in an interest rate reaction function. In contrast to previous studies on policy-makers` interest rate preferences (see Jung, 2013), we do not pool data across groups of members but estimate individual reaction functions for each Federal Reserve Bank President using real-time data. These individual Taylor rules allow identifying the driving factors of Federal Open Market Committee (FOMC) members' interest rate preferences, which were obtained from FOMC transcripts. Moreover, in this framework it is possible to test whether an interest rate smoothing motive might be present. Estimates based on the augmented Taylor rule indeed reveal that the preferences of some Federal Reserve Bank Presidents were not free of a regional bias. Augmented Taylor rules with inertia, however, show that this finding could also be due to the presence of an interest rate smoothing motive.

The remainder of the paper is organized as follows. Section 2 discusses the reasons why members of the FOMC could be subject to a regional bias. Section 3 provides new empirical evidence on the regional bias hypothesis in US monetary policy. Section 4 concludes.

2. REASONS FOR A REGIONAL BIAS IN US MONETARY POLICY

What is a regional bias? A regional bias in policy-makers' interest rate preferences is present whenever (i) monetary policy-makers in a federal system take into account regional information of their home district and (ii) they attempt to favour their own region of origin by influencing the outcome of a monetary policy decision at monetary policy meetings. However, this is difficult to detect in practice. In general, policy-makers need to understand the impact of regional economic dispersion on the monetary policy transmission mechanism when discussing implications for monetary policy. In addition, different views across members of a monetary policy committee may emerge when there is high uncertainty in the economy, or when large shocks increase the dispersion across regions. Therefore, in a federal central banking system such different views may not always be a sign of a regional bias in policy-makers' interest rate preferences, but could have other explanations as well.

Does regional representation constitute a regional bias in the Federal Reserve System?

There is an undisputed need for a regional dimension to monetary policy decision-making in a federal central banking system. In this context, the US Federal Reserve System was designed to serve "*multiple interests across a variety of regions and financial institutions*" (Hoenig, 2006, p.3). On the one hand, its federal structure can be seen as a device to protect against the dangers of an autocratic, central government. On the other hand, it can be seen as a device to avoid an inefficient monetary policy process resulting from a predominant, regional representation.

Moreover, the literature suggests that monetary policy-makers should use a wide range of indicators when assessing economic and financial conditions. For example, members of the Fed's FOMC shall consult a wide range of information in their nationwide assessment that underlies their votes on interest rates.[2] Therefore, it appears unproblematic if policy-makers in a federal central banking system merely monitor regional data to enhance their understanding of economic dynamics. Conventional wisdom even asserts that regional indicators are not important for FOMC members' interest rate preferences and that they would place a large weight on national indicators. A survey by Fase and Vanthoor (2000) reveals that: *"Reserve Bank presidents base their policy recommendations to the FOMC primarily on national economic considerations. District developments are given attention when they appear to have nation-wide significance. [In addition,] the Board uses the regional information collected by the Reserve Banks in their Beige Books as background to his information on the general economic scene of the nation*" (Fase and Vanthoor 2000, p. 53).

Nevertheless, monetary theory cautions that policy-makers should avoid voting in a manner that would favour their region of origin. Such a regional bias in voting could lead to suboptimal results for monetary policy decisions. In fact, there are several reasons to suspect that Federal Reserve Bank Presidents have a regional bias in their interest rate preferences. First, there are historical reasons relating to the Federal Reserve System. The Federal Reserve Act of 1913 established a decentralised Federal Reserve System. It granted substantial autonomy to the Federal Reserve Banks and allowed them to set discount rates independently of each other. Meulendyke (1998, p. 24) argues that this feature enabled each Bank to respond to regional economic trends so that "*small differences among the regional Reserve Banks' discount rates often existed until World War II*". Later, the Banking Act of 1935 led to a reorganization of the System. Despite this institutional reform, as Reserve Bank President Hoenig (2006, p. 7) emphasises, "*this structure and these principles [of the initial Federal Reserve System] are as important today as they were in 1913, perhaps more so*." Second, there are reasons

[2] Federal Open Market Committee – Rules of Procedure; 12 CFR 272; as amended effective January 29, 2008: "In determining the policies to be followed in … [its] operations, the Committee considers information regarding business and credit conditions and domestic and international economic and financial developments, and other pertinent information gathered and submitted by its staff and the staffs of the Board of Governors of the Federal Reserve System (the "Board") and the Federal Reserve Banks."

relating to different appointment procedures. A regional Board of Directors (and not US Congress) appoints the Federal Reserve Bank Presidents.[3] This legal provision could constitute a conflict of interest between the Presidents' role as independent, social-welfare maximizing policy-makers and their own interest in seeking reappointment, for which they would need endorsement at the regional level. Third, there have been several lawsuits aimed at excluding the Federal Reserve Bank Presidents from voting on US monetary policy. These lawsuits criticized that the US Government did not endorse their appointments. Although not successful, these appeals document a broader concern that regional interest could impede US monetary policy (see Gildea, 1992).[4]

Against this background, the federal structure has evolved further. Today, it includes important institutional elements that minimise the risk of a regional bias in US monetary policy. Most importantly, the FOMC operates a rotation system which always provides the centre of the committee with a structural majority in monetary policy decisions.[6] This rotation system thus limits the potential for an influential regional bias coming from the Federal Reserve Bank Presidents. At the same time, the presence of regional banks in the System facilitates the acquisition of regional information on the economy and enhances analytical diversity in the FOMC (Goodfriend, 2000, p. 23).

Transcript evidence on the regional bias in the FOMC

A review of the FOMC transcript provides some anecdotal evidence about the possible presence of a regional bias in the interest rate preferences of Federal Reserve Bank Presidents. Two statements made by Fed Chicago President Keehn in June 1992 can illustrate this. On the first day of the FOMC meeting, during the assessment of regional economic conditions, he signalled his concerns about too high unemployment in his district: "*On the employment front, District employment has increased by about 100,000 since the low point in August of 1991, but despite that increase we still*

---

[3] These Directors are citizens who represent the public domain as well as the private sector of the respective District.

[4] A member of the Senate challenged the constituency of the FOMC's membership in the lawsuit *Melcher v. Federal Open Mkt. Comm., 644 F. Supp. 510 (D.D.C. 1986)*. Initiatives to eliminate Federal Banks from the monetary policy decisions were undertaken by Rep. Hamilton, Sen. Sarbanes, Sen. Sasser, and Rep. Dorgan.

[6] The FOMC consists of a total of 19 members, seven federally appointed members of the Board of Governors and twelve regionally appointed Bank Presidents. It has twelve voting members. Only the members of the Board of Governors and the President of the Fed New York have a permanent right to vote. The remaining four voting memberships are taken by the Bank Presidents, who serve one-year terms on a rotating basis. The rotating seats are filled from the following four groups of Banks, taking one Bank President from each group: Boston, Philadelphia, and Richmond; Cleveland and Chicago; Atlanta, St. Louis, and Dallas; Minneapolis, Kansas City, and San Francisco.

have recovered only about 25 percent of the losses that we sustained during the recession. Many manufacturers are continuing to implement staff reduction plans, and I just don't sense any fundamental improvement in the underlying employment conditions." The statement as such only confirms that the policy-maker monitors regional indicators, since it is clearly linked to the assessment of the overall economic situation in the United States. However, on the second day of the FOMC meeting, when members discussed policy rates, President Keehn revealed a regional bias in his interest rate preference. He clarified that his preference for easier monetary policy was linked to the subdued employment conditions in the Fed Chicago district: "*Mr. Chairman, given my comments yesterday, I'd favour alternative A and an easing move now, but I could accept alternative B with asymmetric language.*"

Do similar considerations apply to the members of the Board of Governors?[7] In contrast to these preceding examples, instances which would suggest that a Governor has a regional bias are rare. One case in point is Governor Martha Seger who is famous for her dissents to ease monetary policy during the early Greenspan years. Meade and Sheets (2002) quote several examples from the transcript, showing that she referred to economic developments in her home region of Chicago during the FOMC deliberations on monetary policy. In contrast, it appears to be difficult to find such evidence for Chairman Greenspan who used "*Greenspeak*" in his communications: "*since becoming a central banker, I have learned to mumble with great incoherence. If I seem unduly clear to you, you must have misunderstood what I said.*"[8] In this context, anecdotal evidence suggests that Chairman Greenspan used a number of unconventional indicators that were not prepared by Fed staff for his assessment of economic conditions in the United States. However, these indicators were not particularly linked to his home district New York.[9]

[7] In the FOMC, members of the Board of Governors must come from different Districts. Therefore, those members can also be considered regional representatives (see Chappell et al. 2008).
[8] This quote stems from a Senate Committee hearing in 1987 (source: *Guardian Weekly*, November 4, 2005).
[9] As is evident from the nomination hearing before the US Senate, Chairman Greenspan’s regional identity is the Fed District of New York.

3. INDIVIDUAL TAYLOR RULES FOR THE RESERVE BANK PRESIDENTS

To our knowledge, no other study so far has used the Taylor rule to test for the validity of the regional bias hypothesis in the individual interest rate preferences of FOMC members.[10] In contrast to other frameworks, which rely on pooled characteristics of these members (such as panel techniques or LOGIT models), the Taylor rule has several advantages. First, it provides a structural explanation of individual policy preferences based on its most important (real-time) determinants. Second, it provides a reaction function for each individual member that is included in the analysis. Third, it allows to incorporate an interest rate smoothing motive by member. Furthermore, the Taylor rule is widely considered to be a good approximation for the interest rate setting behaviour of the Fed. For example, Judd and Rudebusch (1998, p. 3) find that a Taylor-rule framework "*is a useful way to summarize key elements of monetary policy*" in the US during the Burns, Volcker, and Greenspan periods. Moreover, Blinder and Reis (2005, p. 5) point out that "*monetary policy decisions of the Greenspan era are well described by a Taylor rule.*"

Since the dual mandate of the Federal Reserve assigns prominence to the unemployment rate, labour market trends may matter for explaining individual interest rate preferences. While it is generally sufficient to either include an output gap or an unemployment gap in the reaction function for the US economy as a whole (see Orphanides and Wieland, 2008), a regional unemployment variable could be an important determinant of the individual interest rate preference of an FOMC member. Figure 1 shows that unemployment developments for the US regions were heterogeneous, even though they followed similar cycles. Alternatively, it is conceivable that FOMC members respond to the difference between regional and national unemployment rates when forming their interest rate preference. Figure 2 shows that for a large part of the sample some regions had unemployment rates systematically above the US level (for example the districts of New York, Dallas and San Francisco), whereas other regions had rates systematically below it (for example the districts of Boston, Richmond and Minneapolis).

In the following, Section 3.1 describes the data used for this analysis. Section 3.2 presents alternative specifications for the individual Taylor rules with regional information. Section 3.3 discusses the estimation results, while Section 3.4 provides checks for robustness.

[10] Besley, Meads, and Surico (2008) use Taylor-type rules for an analysis of the preferences of the members of the Monetary Policy Committee of the Bank of England, while Jung (2013) uses them to study members' preferences in three monetary policy committees including the FOMC.

3.1 Data

In order to estimate (forward-looking) Taylor rules, this paper combines data on voiced interest rate preferences of the Federal Reserve Bank Presidents (and Chairman Greenspan) with (real) economic indicators for the US economy (sample 1989 to 2006). These data are for the FOMC meeting frequency (for an overview of data sources see Table 1). With the exception of the regional unemployment rate, this analysis includes available real-time data for the estimation of Taylor rules.

There are two main sources that contain information about FOMC members' interest rate preferences: the voting records in the FOMC minutes and the FOMC transcripts. The voting records report individual preferences of the voting members at the end of the meeting (final vote). However, official voting records may not provide good proxies for the individual preferences of the FOMC members (see Meade, 2005; McCracken, 2010). In fact, dissenting votes may be distorted by strategic considerations and an implicit limit of a maximum of two dissents per FOMC meeting were applied during the Greenspan era (see Meyer, 2004).[11] Instead, FOMC transcripts may provide better information on the individual interest rate preferences. Most importantly, transcripts include information about individual preferences in the policy go-around by all FOMC participants, whereas voting records only include the voting members. Moreover, the transcript provides information on the preferences of all FOMC participants, regardless of whether they were voting or non-voting members. Like the voting records from FOMC minutes, FOMC meeting transcripts contain information about individual preferences in the form of agreement and dissent, or disagreement concerning the decision. Based on the final feds fund rate, this information can be transformed into an interest rate level assuming that dissents or disagreements are made in multiples of ±25 basis points (see Meade, 2005; El-Shagi and Jung, 2013).

Real-time measures on the inflation forecast (CPI, PCE), the output gap and unemployment rate forecast are obtained from the Greenbook for each FOMC meeting.[12] Staff forecasts are reported for

[11] For example, El-Shagi and Jung (2013) find that Chairman Greenspan systematically influenced the Bank Presidents in their voting behaviour towards a consensus. In addition, Johnson, Ellis and Kotenko (2012) find the presence of tenure effects in the FOMC's voting. Owing to strong consensus-building efforts of the Chairman, the voiced preferences of Bank Presidents would lean towards the Committee consensus. Only at the end of their tenure these members freely express their preferences for tighter monetary policy.

[12] The inflation index considered for the FOMC's inflation projections changed from the CPI to the PCE index in February 2000. Nevertheless, this change implies only small changes in the inflation process during the present

each meeting and at different horizons: the 6-quarter-ahead forecast is used for inflation, a contemporaneous measure and the 4-quarter-ahead forecast are used for the output gap. Greenbook data are published with a five-year lag. These Greenbook staff forecasts are used to compute forward-looking measures of the inflation gap.[13] This is the difference of the Greenbook staff forecast for inflation (6-quarter-ahead) and a notional numerical inflation goal, which is assumed to be the same for each member. The proxy used for the notional value of the inflation target is 2%. This is a value commonly used by other researchers (see Taylor, 1993) and which corresponds to the long-run inflation goal set by the FOMC (2012). It is not to suggest that FOMC members individually or collectively have shared this value for policy purposes. In fact, internal discussions in the FOMC during the year 1997 showed that members had dispersed views on the numerical value for price stability. However, the later announcement of a "*comfort zone*" (that is, a range of 1% to 2% inflation; see Bernanke, 2002) showed that there was no fundamental disagreement about this numerical value either.

We then compute a regional indicator that measures the unemployment wedge as perceived by an FOMC member in real time. This indicator is the difference between the regional unemployment rate in a member's home district and the national unemployment rate forecast (see Figure 2).[14] In order to detect the presence of a regional bias, we refer to the absolute deviation between the two series. This notional wedge is a proxy for the direction and extent to which a policy-maker with a regional bias in his or her preferences would like to deviate from the federal funds rate. Hence, for the purpose of our analysis it is not necessary to weigh the contribution from the regional variable on the nationwide unemployment in order to compute a measure of the effective deviation of the regional unemployment rate from the nationwide rate. Concerning the regional unemployment rates, we use data for each

sample (in 2002 and 2003, PCE inflation was slightly below CPI inflation) and can be ignored.

[13] It is sometimes argued that policy-makers base their interest rate decisions on their published individual forecasts. Some researchers (for example, Romer, 2010) suggest that such individual forecasts might provide additional insight into individual assessments of FOMC members. Nevertheless, there are several reasons why the individual Taylor-type rules of the present analysis use the nationwide forecasts provided by Fed staff for the FOMC meetings. First, individual forecasts are available only bi-annually, until 2003. Second, these individual forecasts could be biased in the presence of strategic motives (see Tillmann, 2011). Third, Romer and Romer (2008) find that the FOMC members' forecasts did not add any extra value to the staff forecasts. Moreover, a recent study by Apel, Claussen, Gerlach-Kristen, Lennartsdotter and Røisland (2013) provides survey evidence for other monetary policy committees of inflation-targeting central banks (in Sweden and Norway) that policy-makers rely heavily on staff input in their deliberations.

[14] Meade and Sheets (2005) employ a measure of the difference between national and district unemployment rates (prior to each FOMC meeting). In order to compute unemployment rates by district, they weigh state unemployment rates by population shares in the Districts, which were obtained from county-level data. Since the boundaries of some Federal Reserve Districts divide some states but not counties, Chappell et al. (2008) refined the measure by correctly aligning data with district boundaries. Their approach combines county unemployment data are from the Bureau of Labor Statistics with county population data are from the Census Bureau.

Federal Reserve District, which are available since 1990. The Federal Reserve St. Louis calculates a regional unemployment rate by district based on data from the Bureau of Labor Statistics. Such measures typically employ population shares to aggregate unemployment rates by county using data from the Census Bureau (see Meade and Sheets, 2005). In this context, it is important that the weighting scheme correctly aligns the resulting measure with district boundaries since the boundaries of some Federal Reserve Districts divide some states, but not counties (see Chappell et al., 2008).

Using regional unemployment variables as proxy for regional conditions has three advantages. First, they are in close relationship with the business cycle and have thus proved to be better indicators for the latter than other variables (such as regional house prices). Ghent and Owyang (2009) study the relationship between housing and employment over the business cycle for a set of 51 US cities. They find that regional house prices are not good leading indicators for the business cycle, whereas regional unemployment is. Second, research shows the potential importance of regional unemployment trends for US monetary policy. Coibion and Goldstein (2012) find that, contrary to the Fed's mandate, its interest rate policy appears to respond disproportionately to fluctuations in regions with low unemployment rates. Third, long series of unemployment data categorised by Federal Reserve Districts are readily available. In contrast, other variables entail severe data limitations, which would lead to incoherent estimation results. Most importantly, statistics on regional inflation and regional house prices typically do not refer to the districts themselves, but to different concepts (such as Cities or Metropolitan Areas).

3.2 Individual Taylor rules with regional information

Taylor (1993) popularized the idea that the trade-off between inflation and output in monetary policy can be analysed using a simple policy rule. The rule is an interest rate reaction function that captures the reaction of the federal funds rate to (nationwide) developments in inflation and the output gap. The present analysis incorporates Taylor's idea of a systematic trade-off between inflation and real income in monetary policy and applies it to the individual interest preferences of FOMC members. The estimated Taylor rules include national variables for inflation and real activity, thereby modelling FOMC members' trade-off between developments in inflation and economic activity. They also include regional variables to test whether these members have a regional bias in their interest rate preferences.

For the reasons explained in Section 3.1, we include alternative proxies for the regional unemployment rate. These augmented individual Taylor rules allow analysing whether policy-makers' preferences are responsive to changes in the regional conditions. The dependent variables in these Taylor rules are individual interest preferences in levels, which are continuous. We estimate the following equation for each FOMC meeting:

$$(1)\; i_{n,t} = \alpha_n + \beta_n(\pi_{t+h} - \pi^*) + \gamma_n(y_{t+h}) + \delta_n z_{n,t} + \varphi_n(ivote_{n,t}) + \omega_t$$

where $i_{n,t}$ is the interest rate preference of the policy-maker in district n at time t, π_{t+h} is the Greenbook staff inflation forecast for the US at horizon $h = 6$ for the 6-quarter ahead forecast, π^* is a notional inflation target set to 2%, y_{t+h} is the output gap for the US at horizon h ($h = 0$ for the contemporaneous gap and $h = 4$ for the 4-quarter-ahead forecast), $z_{n,t}$ represents a regional variable, and $ivote$ is a dummy which tracks whether a member had the right to vote at the FOMC meeting (*ivote*=0) or not (*ivote*=1). The voting dummy allows to distinguish between two states of a voter, namely voting and non-voting. It captures any effects from the rotation system on FOMC members' interest rate preferences. The rotation of voting rights implies that Federal Reserve Bank Presidents serve one-year terms on the FOMC with the right to vote, which rotates among the Presidents in four groups. However, both voting and non-voting members participate in the FOMC discussions. In this context, the voting dummy is not needed for all FOMC members who have a permanent voting right, namely the Federal Reserve Bank President of New York and the members of the Board of Governors.

Since members frequently meet in the same composition they could influence each other. There could be a learning process and there could even be groupthink (see Blinder, 2009). Therefore, cross-member correlation in the individual reaction functions of committee members is possible. Following Zellner (1962, 1963), the present analysis uses the Seemingly Unrelated Regression (SUR) model to estimate individual Taylor-type rules.[15] In this context, the SUR model treats the Chairman's preference as integral part of the system, when all equations are estimated jointly.

[15] Relative to other conceivable approaches, this method has two main advantages. First, it allows taking into account the correlation of the residuals of a set of unrestricted equations. That is, it accounts for cross-member correlation in the deliberations of the Federal Reserve Bank Presidents. Provided that the regressors are not identical across equations and the cross-equation covariance is not identical to zero (which is the case for the present analysis), this approach increases the efficiency of the estimation (see Dwivedi and Srivastava, 1978). Second, the SUR model allows for a structural interpretation of the estimated parameters since the Taylor rules link individual interest rate preferences of FOMC members to both national and regional indicators.

In order to examine whether individual interest rate preferences are subject to a regional bias, we test two alternative hypotheses by means of a standard t-test. First, our hypothesis of "*regional monitoring*" states that policy-makers take into account regional unemployment rates when forming their interest rate preferences. In this case ($z_{n,t} = ur_{n,t}$), we can use the unemployment rate in the Federal Reserve District n as a proxy for the regional variable. The null of "no regional monitoring" ($H_0: \delta_n = 0$) is tested against the alternative that the coefficient is negative ($H_1: \delta_n < 0$). This hypothesis implies that policy-makers value information on the dynamics of the regional labour market in their home district for their own understanding of labour market dynamics in the US. However, it does not yet clarify whether policy-makers also favour their region of origin, when forming their interest rate preferences. Therefore, our "*regional bias*" hypothesis states that FOMC members from a region with higher (lower) unemployment rates than the US average would opt for lower (higher) interest rates relative to what nation-wide conditions require. The null of "no regional bias" ($H_0: \delta_n = 0$) is tested against the alternative that the coefficient for the difference in regional and national unemployment is negative ($H_1: \delta_n < 0$). In order to test this hypothesis, we include a notional wedge, namely the difference between the regional and the national unemployment rate, where $z_{n,t} = ur_{n,t} - u_{t+h}$, that is, the difference between the unemployment rate in the Federal Reserve District n and the unemployment rate forecast for the US at horizon $h = 4$ quarters, with the remaining notations as above. Compared to other conceivable measures, this gap has the advantage that it comprises of information corresponding to the information set which policy-makers may have monitored in real-time.

We caution that an approach based on Taylor-type rules has known limitations, which some researchers may find critical for the assessment of the results. First, FOMC members consider various factors for their assessments of inflationary risks, which are not modelled by a rule. Moreover, they may exert judgement in their policy decisions. Although a Taylor rule captures important determinants of the members' preferences, it cannot capture all of these determinants. Consequently, the present study considers Taylor rules as benchmarks in its investigation of the regional bias hypothesis. Second, our approach can only detect a regional bias for the FOMC as a whole if the chairman of the FOMC is subject to a regional bias. In the case of the FOMC, however, this should not distort the results. As has been documented in Meyer (2004), Chairman Greenspan influenced the other members of the Board of

Governors prior to the FOMC meeting. In addition, members of the Board of Governors were always voting in support of Chairman Greenspan's interest rate proposal (with the exception of Governor Seger in the early Greenspan years; see Meade, 2005). Moreover, the Board of Governors has a structural majority in voting and can therefore outvote the Bank Presidents. Hence, demonstrating that there is a regional bias in the US monetary policy decisions thus requires detecting a regional bias in the Chairman's interest rate preference. Third, the forecasting assumption of the projections used in this study could give rise to an endogeneity problem. We argue that this is not the case, since we use Greenbook forecasts which were available to policy-makers in real time. On the one hand, these data fully preserve genuine data uncertainties that were present during the FOMC meetings. On the other hand, these forecasts are not based on an own interest rate path (which could in turn pose an endogeneity problem). Instead, projections were made conditional on the vague technical assumption that monetary policy should be appropriate (and the interpretation of this assumption was different across members).

Lastly, we provide further controls and checks for the robustness of the results. First, an important point relates to the existence of differences between members of the Board of Governors and the Federal Reserve Bank Presidents, since they have different roles and voting rights in the policy process. Meade and Sheets (2005), who use final votes in their study, find that the regional influence is stronger for Governors than for Presidents. In this context, Meade (2009) finds that in particular smaller (as opposed to larger) Federal Reserve Districts are more likely to voice disagreement with an interest rate proposal. By contrast, Chappell et al. (2008), who use voiced interest rate preferences, find that regional unemployment is a more important determinant for interest rate decisions of Bank Presidents than for Board members. Therefore, in order to control for the different roles of FOMC members, we estimate an individual reaction function for the Chairman of the Board of Governors and include a voting dummy to capture whether a member was a voting or a non-voting member.

Second, a previous study by Chappell et al. (2008) finds that regional conditions in the labour market have a smaller influence on interest rate preferences than economic conditions in the federal state. In our framework, this proposition can be tested by estimating a variant of equation (1), which provides a robustness test of the regional bias hypothesis by decomposing the notional unemployment wedge in its underlying regional and national component:

$$(2)\ i_{n,t} = \alpha_n + \beta_n(\pi_{t+h} - \pi^*) + \gamma_n(y_{t+h}) + \delta_n ur_{n,t} + \varepsilon_n u_{t+h} + \varphi_n(ivote_{n,t}) + \eta_t$$

with the notations as above. The "no regional bias" hypothesis requires that $H_0: \delta_n = 0$. In this unrestricted specification, it is implicitly assumed that policy-makers would form their interest rate preference in a separate way; on the one hand, based on the regional unemployment rate, on the other hand, based on the federal unemployment rate forecast. This could be rationalised by a behaviour in which policy-makers have two different but independent mind sets: one that reflects only regional factors and one that mirrors the federal perspective.

Third, in the presence of inertia, it has been observed that the classic Taylor rule could be improved by including an interest rate smoothing motive (see Coibion and Gorodnichenko, 2012). The presence of interest rate smoothing means that policy-makers adjust the fed funds rate more gradually in order to dampen volatility. It implies that policy-makers need several meetings to align the fed funds rate with their interest rate preferences. Inertia in setting interest rates is typically modelled by specifying a Taylor rule with the lagged policy rate on the right hand side (see Orphanides, 2001; Fendel and Rülke, 2012; El-Shagi and Jung, 2013). Sack and Wieland (2000) suggest that interest rate smoothing would be consistent with optimal monetary policy if it reflects forward-looking behaviour by market participants, a measurement error concerning key indicators and uncertainty regarding structural parameters. Rudebusch (2006) explains that the strong persistence of the short-term policy interest rate most likely reflects factors typically not included in Taylor rules (for example credit conditions). He also shows that a classic Taylor rule augmented to include persistent shocks as a proxy for omitted factors cannot be distinguished from a reaction function with interest rate smoothing.[16] Therefore, it may no longer be possible to check for the influence of an omitted variable once the Taylor rule is augmented to include the lagged policy rate. In order to provide a check for the robustness of our results, we specify a Taylor-type rule (see El-Shagi and Jung, 2013) which includes the lagged policy rate, augment this reaction function with a regional variable z_n, and test the two hypotheses again:

$$(3)\ i_{n,t} = (1-\rho_n)(\alpha_n + \beta_n(\pi_{t+h} - \pi^*) + \gamma_n(y_{t+h}) + \delta_n z_{n,t}) + \rho_n i_{t-1} + \varphi_n(ivote_{n,t}) + v_t$$

[16] Judd and Rudebusch (1998) also find that the coefficient estimates with and without interest rate smoothing are robust.

where i_t denotes the policy rate and the remaining notations are as above.

3.3 Results

Table 2 shows the estimation results of the individual reaction functions (equation 1) for each Federal Reserve District (and for Chairman Greenspan) with two different proxies for regional unemployment. Overall, it appears that the individual regressions have high explanatory power and the estimated parameters for the (forward-looking) inflation gap and the (forward-looking) output gap are significant and have the correct sign. As expected, the estimates of β show that all members have followed the Taylor principle. This is evident from the estimated inflation gap coefficients β_n, which exceed unity ($\beta_n > 1$) in a statistically significant manner for all individual reaction functions of all members. In line with other studies (see Jung, 2013; El-Shagi and Jung, 2013), FOMC members' parameter estimates for the response to inflation and output are fairly similar. Nevertheless, the constant α, which measures the individual natural rate of interest, differs across members. This finding may be attributable to different notions of members regarding the long-run inflation target of the Fed and to their different degrees of hawkishness. Moreover, in all regressions (see Table 2 to 4) the voting dummy is significant for at most four districts and the coefficients are quite small. This result suggests that the rotation of voting rights per se did not impact on the formation of interest rate preferences of Federal Reserve Bank Presidents, as measured from FOMC transcripts.

The Durbin-Watson test statistic is indicative of first-order autocorrelation in the residuals of all individual reaction functions. It is well known that the classic Taylor rule suffers from autocorrelation and that this problem can be addressed by including an interest rate smoothing term (see Judd and Rudebusch, 1998; Blinder and Reis, 2005). Autocorrelation may lead to biased coefficient estimates, which could pose a problem for the hypothesis testing. However, since the present analysis estimates the reaction functions as part of a SUR model, which uses a GLS estimator, it could still be the case that the parameter estimates as such are unbiased and efficient (BLUE) so that standard inference can be applied. Nevertheless, we provide a robustness check for interest rate smoothing at the end of this subsection.

Moreover, the coefficient for the unemployment variable in these reaction functions is negative for all FOMC members and significant for some Federal Reserve Bank Presidents. With regard to the question whether members' interest rate preferences are influenced by regional developments (see Table 2, upper half), the regional monitoring hypothesis can be rejected for two districts at the 1% level (namely Boston and St. Louis). The reaction functions also show that the interest rate preferences of the other Federal Reserve Bank Presidents were *responsive* to unemployment trends in the home district. However, the coefficient estimates for δ_n show that the impact coming from the regional unemployment rate is relatively small compared to the other driving forces (inflation and output gap). In this context, the regional monitoring hypothesis cannot be rejected for our control variable Chairman Greenspan. This is broadly in line with anecdotal evidence suggesting that Chairman Greenspan regularly monitored a wide range of indicators measuring the state of the US economy from various perspectives, even though narrative evidence would not suggest that economic developments in the New York district had any kind of prominence in his assessments.

Table 2 (lower half) shows that the regional bias hypothesis can be rejected for half of the districts at the 1% level. For five districts (New York, Cleveland, Kansas City, Dallas, San Francisco) the regional bias hypothesis cannot be rejected at the 1% level, whereas for Philadelphia it cannot be rejected at the 5% level. Since our results detect a response for New York and San Francisco, these results differ somewhat from Meade (2009) who suggests that disagreement with Chairman Greenspan's interest rate proposals was mainly related to smaller districts. According to her analysis, the smaller districts are Atlanta, Dallas, Kansas City, Minneapolis, Philadelphia, and St. Louis, which each account for less than 5% of the total Reserve Bank assets.

The regression results suggest that the magnitude of a regional bias in the interest rate preferences of the Federal Reserve Bank Presidents could be rather small. For the purpose of illustration, we provide a rough back of the envelope quantification of the (average and maximum) impact the regional variable has on individual interest rate preferences of the Federal Reserve Bank Presidents during the whole Greenspan era. We use the coefficient estimates from equation (1) and compute the (excess) contribution from the regional unemployment variable as the product of the parameter δ_{n} and the (average and maximum) size of the notional wedge between the regional unemployment rate of district n and the national unemployment rate. Figure 3a shows the implied average contribution of the unemployment rate gap to the interest rate preference by district. In fact, the average contribution turns out to be very small and has likely been offset across districts. Since the effect is small and only significant in six districts, while for the other six districts the effect is insignificant, it can be expected that a regional bias in the interest rate preferences of some Federal Reserve Bank Presidents is unlikely to have impeded on the Fed's capacity to set interest rates with a nationwide focus. This holds even for single meetings for which the impact of the regional bias on their interest rate preferences was higher, as shown in Figure 3a ("High levels"). However, a regional bias may still be a valid explanation for dissents of these Federal Reserve Bank Presidents, particularly at times when the unemployment rate in their region exceeded the nationwide rate. Moreover, we cannot reject the regional bias at the 1% level for the Chairman of the Board of Governors. However, given that the FOMC changed interest rates in steps of 25, 50 or 75 basis points per meeting, the estimates show that the likely magnitude of such a bias is small. In the next section, we will provide an alternative explanation of this observed behaviour.

3.4 Checks for robustness

In this subsection, we conduct three robustness checks of the results. First, we estimate specifications of the individual Taylor rules where the output gap is replaced with an unemployment gap (similar to Blinder and Reis, 2005; Orphanides and Wieland, 2008). Although some researchers favour this specification for the investigation of US monetary policy during the 1990s, it turns out that this modification does not change the results of this study.[17]

Second, we decompose the notional unemployment wedge and include the regional unemployment rate for district n and the national unemployment rate (forecast) separately in individual Taylor rules. We then estimate the functions without imposing a constraint on the parameters (see Table 3). Overall, we confirm previous results by Chappell et al. (2008) that compared to the nationwide unemployment rate the district unemployment rate has only a small (negative) impact on members' interest rate preferences. In six (larger) districts, the regional unemployment rate is found to be insignificant, implying that members from these districts mainly look into national unemployment rates. This specification is more in line with Meade (2009) since it demonstrates that the regional bias is mainly related to smaller districts. In addition, when comparing the results from Table 3 with those

[17] For brevity of the analysis we do not report this fairly standard finding; however, the results are available from the authors upon request.

from Table 2 (lower half), we can confirm the finding that some FOMC members are subject to a regional bias (see also the illustration in Figure 3b). However, it turns out that this finding appears to be robust only for four Federal Reserve Bank Districts (Philadelphia, Cleveland, Kansas City and Dallas), whereas both specifications disagree on the presence of a regional bias in the case of four other Districts (New York, Chicago, Minneapolis and San Francisco) and the Chairman.

Third, we test for the influence of inertia in policy-makers' preferences on the results (see Table 4). As expected, these reaction functions show significant improvements in terms of statistical properties, such as the absence of (first-order) autocorrelation, as indicated by the Portmanteau test, and an increased explanatory power. In this context, reaction functions used to test for the regional bias (see Table 4, lower half) show somewhat better characteristics than those regressions that only include the regional unemployment rate. In line with other studies for the Greenspan era (see El-Shagi and Jung, 2013), the impact of inertia on the policy rate is found to be significant, and varies only little across FOMC policy-makers.[18] The estimates for the (long-run) coefficients for the inflation and output gap are in a similar range as for the other equations. However, it is no longer possible to detect a (significant) negative influence of the regional variable either in terms of the regional unemployment rate or the unemployment rate gap for the Federal Reserve Bank Presidents and Chairman Greenspan. Following this analysis, we conduct an additional check for robustness by decomposing the unemployment wedge in its regional and federal unemployment component (similar to equation 2), while adding the lagged interest rate preference. In this specification, however, it turns out that the national unemployment rate is insignificant and the regional unemployment variable is either insignificant, has the wrong sign, or both, so that we can reject the regional bias hypothesis.[19] Overall, these regressions indicate that no systematic link exists between the degree of smoothing by district and a possible regional bias. Hence, assuming the presence of interest rate smoothing behaviour, it is no longer possible to confirm the regional bias hypothesis.

There are two conceivable implications of this finding. First, what has been interpreted as a regional bias can likewise be explained as the presence of an interest rate smoothing motive in policy-makers' preferences. Coibion and Gorodnichenko (2012), for example, find strong evidence for the

[18] A notable exception is the reaction function for the Richmond district which shows a smaller smoothing parameter than for the other districts.
[19] The results are available from the authors.

presence of such a motive during the Greenspan era. This may also imply that previous studies, which find a regional bias of FOMC members (see Meade and Sheets, 2002 and 2005; Chappell et al., 2008), have overlooked an alternative explanation of the results. Second, applying the argument by Rudebusch (2006), it is only possible to address one of two possible phenomena. Hence, with the inclusion of interest rate smoothing in the Taylor rule, it is no longer possible to check for the presence of an omitted variable, since the serial correlation is no longer present. In sum, this paper suggests that the presence of an interest rate smoothing motive may be an alternative explanation for unexplained distortions in the interest rate preferences of Federal Reserve Bank President, which researchers so far have only attributed to the presence of a regional bias.

4. CONCLUSIONS

Although there is an undisputed need for a regional dimension to monetary policy decision-making in a federal central banking system, the presence of a regional bias in the interest rate preferences of policy-makers can lead to suboptimal monetary policy outcomes. In this context, the present paper examines the interest rate preferences of the Federal Reserve Bank Presidents for the Greenspan era (sample 1989 to 2006), which stem from FOMC transcripts. By estimating policy-makers' reaction functions, we enhance the understanding of the extent to which regional information has an impact on FOMC members' views and, ultimately, on the Fed's monetary policy decisions. Estimates based on the augmented Taylor rule reveal that the preferences of some Federal Reserve Bank Presidents were not free of a regional bias. However, augmented Taylor rules with inertia show that this finding could also be due to the presence of an interest rate smoothing motive. Further analysis confirms previous results by Chappell et al. (2008) that compared to the nationwide unemployment rate the district unemployment rate has only a small (negative) impact on members' interest rate preferences. Overall, our findings support the view that the presence of a regional bias in the interest rate preferences of some Federal Reserve Bank Presidents is unlikely to have impeded on the Fed's capacity to set interest rates with a nationwide focus.

Given the present evidence for the FOMC, it might be interesting to investigate the regional bias hypothesis for other federal central banking systems. In view of data limitations, however, only few researchers have done so. Moreover, over the last two decades, these central banks have taken their monetary policy decisions in a fairly consensual manner. This could also suggest that they are capable of controlling the adverse impact of a regional bias in the interest rate preferences on the policy outcome. Finally, the Fed's example shows that its rotation system, which includes a structural majority for the centre of the FOMC, has effectively limited the regional influence on policy-making while strengthening participation of regional representatives.

REFERENCES

Apel, M., C. Claussen, P. Gerlach-Kristen, P. Lennartsdotter and Ø. Røisland. "Monetary policy decisions – comparing theory and 'inside' information from MPC members." Norges Bank Working Paper No. 2013/03, 2013.

Besley, T., N. Meads, and P. Surico. "Insiders versus Outsiders in monetary policymaking." *American Economic Review: Papers and Proceedings*, 98, 2008, 218-223.

Bernanke, B. "Deflation: making sure 'it' doesn't happen here." Speech delivered at the National Economists Club, Washington on 21. November 2002, http://www.federalreserve.gov/boarddocs/speeches/2002/20021121/ .

Blinder, A. "Making monetary policy by committee." *International Finance*, 12(2), 2009, 171-194.

Blinder, A. and R. Reis. "Understanding the Greenspan standard." *Proceedings*, Federal Reserve Bank of Kansas City, August, 2005, 11-96.

Chappell, H. W. Jr., R. R. McGregor and T. A. Vermilyea. "Regional economic conditions and monetary policy." *European Journal of Political Economy,* 24, 2008, 283-293.

Coibion, O. and D. Goldstein. "One for some or one for all? Taylor rules and interregional heterogeneity." *Journal of Money, Credit and Banking*, 44, 2012, 401-431.

Coibion, O. and Y. Gorodnichenko. "Why are Target Interest Rate Changes so Persistent? " *American Economic Journal: Macroeconomics*, 4(4), 2012, 126-162.

Dwiwedi,T. and V. K Srivastava. "Optimality of Least Squares in the seemingly unrelated regressions model." *Journal of Econometrics*, 7, 1978, 391-395.

El-Shagi, M. and A. Jung. "Does the Greenspan era provide evidence on leadership in the FOMC." ECB Working Paper No. 1579, 2013.

Fase, M. and W. Vanthoor. "The Federal Reserve System Discussed: A Comparative Analysis." DNB

Staff Reports, No. 56, 2000.

Fendel, R. and J.-C. Rülke. "Are heterogeneous FOMC forecasts consistent with the Fed's monetary policy? " Economics Letters, 116, 2012, 5-7.

Ghent, A. C. and M. T. Owyang. "Is housing the business cycle? Evidence from US cities." *Journal of Urban Economics*, 67(3), 2010, 336-351.

Gildea, J. A. "The regional representation of Federal Reserve Bank Presidents." *Journal of Money, Credit and Banking*, 24(2), 1992, 215-225.

Goodfriend, M. "The role of a regional bank in a system of central banks." *Economic Quarterly*, Federal Reserve Bank of Richmond, issue Winter, 2000, 7-25.

Hayo, B. and P.-G. Méon. "Behind closed doors: Revealing the ECB's Decision Rule." MAGKS Joint Discussion Paper Series in Economics No. 35-2011, Marburg, 2011.

Hayo, B. and M. Neuenkirch. "Do Federal Reserve Presidents Communicate with a Regional Bias?" *Journal of Macroeconomics*, 35, 2013, 62-72.

Hoenig, T. M. "Twelve Banks: the strength of the Federal Reserve." TEN, Federal Reserve Bank of Kansas City, issue Fall, 2006, 1-5.

Johnson, E., M. Ellis and D. Kotenko. "Consensus building on the FOMC: an analysis of end of tenure policy preferences." *Economics Letters*, 117, 2012, 368-371.

Judd, J. and G. Rudebusch. "Taylor's rule and the Fed: 1970 – 1992." *Federal Reserve Bank of San Francisco Economic Review*, 3, 1998, 1-16.

Jung, A. "Policy-makers interest rate preferences: recent evidence for three monetary policy committees." *International Journal of Central Banking*, 9(3), 2013, 145 - 192.

McCracken, M. "Disagreement at the FOMC: the dissenting votes are just part of the story." *The Regional Economist*, October, 2010, 11-16.

Meade, E. E. "The FOMC: preferences, voting, and consensus." *Federal Bank of St. Louis Review*, 87(1), 2005, 93-101

Meade, Ellen E. "Federal Reserve Transcript publication and regional representation." *Contemporary Economic Policy*, 28(2), 2009, 162-170

Meade, E. E., and N. Sheets. "Regional Influences on U.S. Monetary Policy: Some Implications for Europe." International Finance Discussion Paper (Federal Reserve Board) No. 720, 2002.

Meade, E. E. and N. Sheets. "Regional influences on FOMC voting patterns." *Journal of Money, Credit, and Banking*, 37, 2005, 661-677.

Meulendyke, A.-M. *U.S. Monetary Policy and Financial Markets.* New York: Federal Reserve Bank of New York, 1998.

Meyer, L. H. *A Term at the Fed – An Insider's View.* New York: Harper Collins Publishers, 2004.

Orphanides, A. and V. Wieland. "Economic projections and rules of thumb for monetary policy." *Federal Reserve Bank of St. Louis Review*, 90, 2008, 307-324.

Orphanides, A. "Monetary Policy Rules based on Real-Time Data. " *American Economic Review*, 91, 2001, 964-985.

Rudebusch, G. "Monetary Policy Inertia: Fact or Fiction? " *International Journal of Central Banking*, 2(4), 2006, 85-135.

Romer, D. H. "A new data set on monetary policy: the economic forecasts of individual members of the FOMC." *Journal of Money, Credit, and Banking*, 42, 2010, 951-957.

Romer, C. D. and D. H. Romer. "The FOMC versus the Staff: where can monetary policymakers add value?" *American Economic Review*, 98(2), 2008, 230-235.

Sack, B., and V. Wieland. "Interest Rate Smoothing and Optimal Monetary Policy: A Review of Recent Empirical Evidence. " *Journal of Economics and Business*, 52, 2000, 205-228

Taylor, J. B. "Discretion versus policy rules in practice." *Carnegie-Rochester Conference Series on Public Policy*, 39, 1993, 195-214.

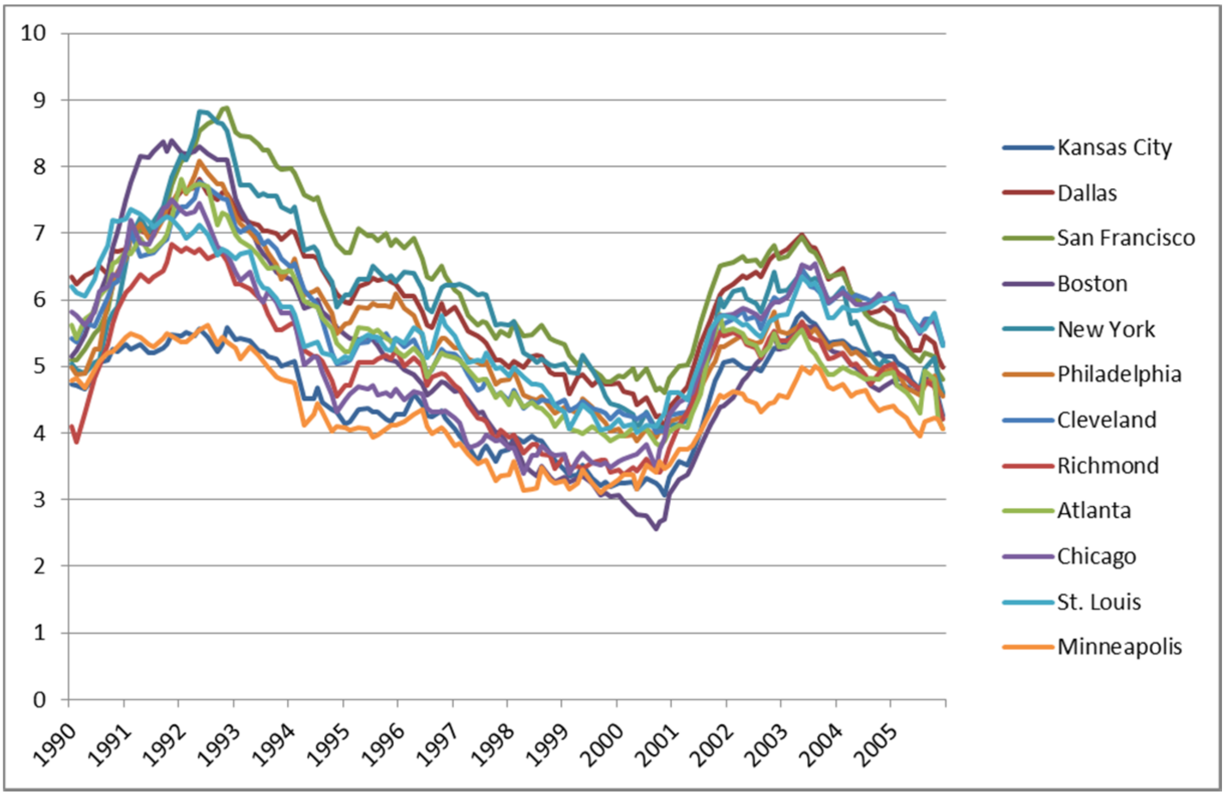
Tillmann, P. "Strategic forecasting on the FOMC." *European Journal of Political Economy*, 27, 2011, 547-553.

Tootell, G. M. B. "Regional economic conditions and the FOMC votes of district presidents." *New England Economic Review*, Federal Reserve Bank of Boston, issue March, 1991, 3-16.

Zellner, A. "An efficient method of estimating seemingly unrelated regressions and tests of aggregation bias." *Journal of the American Statistical Association*, 57, 1962, 348-368.

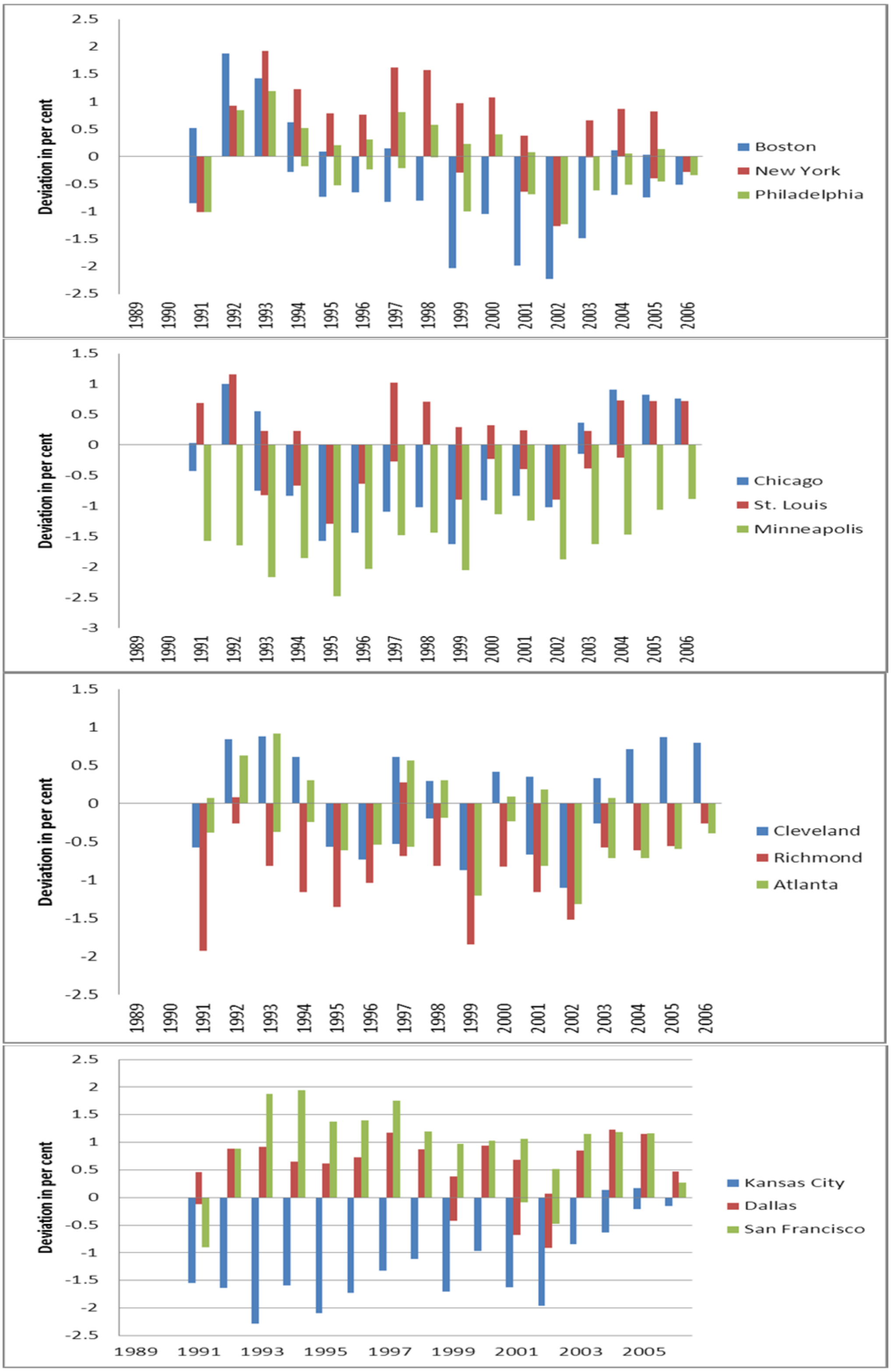
Zellner, Arnold. "Estimators for seemingly unrelated regression equations: some exact finite sample results." *Journal of the American Statistical Association*, 58, 1963, 977-992.

FIGURE 1
Unemployment rates in the twelve Federal Reserve Districts (annual percentage changes)



Source: Bureau of Labor Statistics.

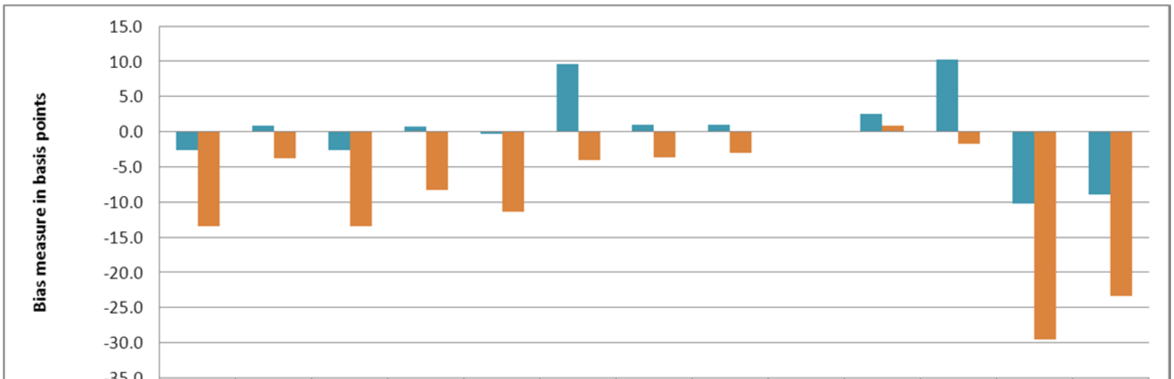
FIGURE 2
Notional unemployment wedge by Federal Reserve District (annual percentage changes)



Source: Bureau of Labor Statistics and Board of Governors.
Notes: The unemployment wedge is the difference between the regional and the national unemployment rate, where $z_{n,t} = ur_{n,t} - u_{t+h}$, that is, the difference between the unemployment rate in the Federal Reserve District n and the unemployment rate forecast for the US at horizon h=4 quarters.

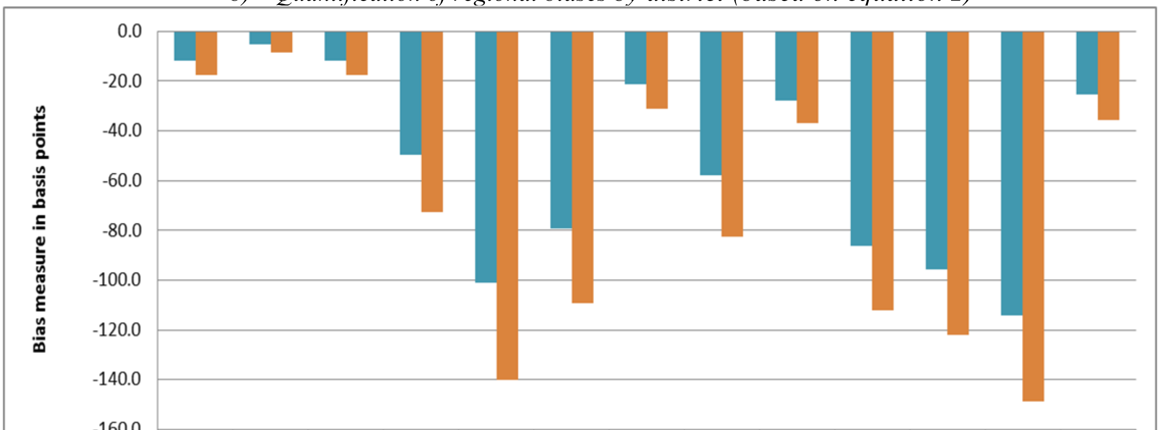
FIGURE 3

a) Quantification of regional biases by district (based on equation 1)



	Chairman Green-span	Boston	New York	Phila-delphia	Cleveland	Rich-mond	Atlanta	Chicago	St. Louis	Minne-apolis	Kansas City	Dallas	San Francisco
Average levels	-2.6	0.8	-2.6	0.7	-0.2	9.6	1.0	1.0	0.0	2.6	10.3	-10.2	-9.0
High levels	-13.4	-3.8	-13.4	-8.3	-11.4	-4.1	-3.7	-3.0	0.0	0.9	-1.7	-29.5	-23.3

b) Quantification of regional biases by district (based on equation 2)



	Chairman Green-span	Boston	New York	Phila-delphia	Cleveland	Rich-mond	Atlanta	Chicago	St. Louis	Minne-apolis	Kansas City	Dallas	San Francisco
Average levels	-11.9	-5.2	-11.9	-49.5	-101.0	-79.2	-21.4	-57.9	-28.1	-86.2	-95.8	-114.4	-25.4
High levels	-17.6	-8.4	-17.6	-72.8	-140.0	-109.3	-31.2	-82.6	-36.8	-112.2	-122.0	-148.6	-35.5

Notes: This sample runs from 1990 to 2006. In Figure 3a, the bias measure has been calculated using the expression $bias_n = \delta_n (ur_n - u)$ for each district n and the Chairman. The parameter estimate for δ is taken from equation Table 2 (lower panel). In Figure 3b, the bias measure has been calculated using the expression $bias_n = \delta_n ur_n$ for each district n and the chairman. The parameter estimate for δ is taken from Table 3. “average” refers to the sample average of the unemployment rate gap, “high” refers to the highest observed value of the unemployment rate gap at a FOMC meeting during the sample. The notional unemployment wedge is the difference between the regional and the national unemployment rate, that is, the difference between the unemployment rate in the Federal Reserve District n and the unemployment rate forecast for the US at horizon *h=4* quarters. Members of the Board of Governors and the President of the Fed New York have permanent voting rights. The remaining four rotating seats are filled from the following four groups of Banks, one Bank President from each group: Boston, Philadelphia, and Richmond; Cleveland and Chicago; Atlanta, St. Louis, and Dallas; and Minneapolis, Kansas City, and San Francisco.

TABLE 1
Data sources

Indicators	Sources
FOMC policy-makers' interest rate preferences and votes	FOMC minutes; database by Meade (2005) and updates based on FOMC transcripts for each Federal Reserve Bank and the Chairman by El-Shagi and Jung (2013)
Greenbook staff forecasts for inflation (CPI), unemployment rate, output gap	ALFRED database Federal Reserve St. Louis (real-time) and Real-time database of the Federal Reserve Philadelphia
Regional unemployment rates (by Federal District)	ALFRED database Federal Reserve St. Louis (final and seasonally adjusted data)

TABLE 2

Tests for significance of regional variables in individual Taylor-type rules (equation 1)

Coefficients / Districts	α	β	γ	δ	φ	Adj. R^2	DW	Obs.
Regional monitoring hypothesis (with z=ur)								
Alan Greenspan	3.97** (0.17)	1.90** (0.08)	0.56** (0.04)	-0.07** (0.03)	-	0.79	0.35	129
Boston	3.83** (0.15)	1.92** (0.08)	0.59** (0.05)	-0.04 (0.03)	-0.06 (0.05)	0.79	0.36	129
New York	3.95** (0.17)	1.89** (0.08)	0.56** (0.04)	-0.07** (0.03)	-	0.79	0.35	129
Philadelphia	4.29** (0.22)	1.94** (0.08)	0.52** (0.04)	-0.16** (0.04)	0.13* (0.05)	0.81	0.35	129
Cleveland	4.89** (0.30)	1.93** (0.08)	0.48** (0.05)	-0.24** (0.05)	-0.03 (0.05)	0.81	0.37	129
Richmond	4.66** (0.52)	1.88** (0.08)	0.57** (0.07)	-0.21* (0.11)	0.00 (0.10)	0.80	0.58	129
Atlanta	4.09** (0.27)	1.91** (0.08)	0.56** (0.05)	-0.10* (0.05)	-0.02 (0.04)	0.79	0.37	129
Chicago	4.05** (0.25)	1.87** (0.08)	0.54** (0.05)	-0.10* (0.05)	-0.00 (0.04)	0.79	0.34	129
St. Louis	4.06** (0.27)	1.94** (0.08)	0.58** (0.04)	-0.08 (0.05)	-0.04 (0.05)	0.81	0.37	129
Minneapolis	4.54** (0.33)	1.94** (0.08)	0.51** (0.05)	-0.26** (0.08)	0.13 (0.05)	0.82	0.37	129
Kansas City	5.05** (0.24)	1.87** (0.07)	0.48** (0.04)	-0.32** (0.05)	-0.10* (0.05)	0.83	0.41	129
Dallas	4.92** (0.28)	1.98** (0.06)	0.48** (0.04)	-0.27** (0.05)	0.20** (0.05)	0.84	0.43	129
San Francisco	4.02** (0.23)	1.92** (0.08)	0.57** (0.04)	-0.07* (0.03)	-0.03 (0.04)	0.81	0.36	129
Regional bias hypothesis (with z= ur-u)								
Alan Greenspan	3.58** (0.09)	1.88** (0.09)	0.59** (0.04)	-0.07** (0.03)	-	0.79	0.35	129
Boston	3.65** (0.09)	1.90** (0.09)	0.62** (0.04)	-0.02 (0.02)	-0.10* (0.05)	0.79	0.36	129
New York	3.58** (0.09)	1.88** (0.09)	0.59** (0.04)	-0.07** (0.03)	-	0.79	0.35	129
Philadelphia	3.47** (0.09)	1.89** (0.09)	0.60** (0.04)	-0.07* (0.03)	0.11* (0.04)	0.79	0.34	129
Cleveland	3.60** (0.09)	1.89** (0.09)	0.59** (0.04)	-0.13** (0.04)	-0.03 (0.04)	0.79	0.35	129
Richmond	3.56** (0.12)	1.84** (0.09)	0.67** (0.05)	-0.15 (0.11)	0.03 (0.09)	0.79	0.56	129
Atlanta	3.57** (0.09)	1.87** (0.09)	0.60** (0.05)	-0.04 (0.04)	-0.02 (0.03)	0.78	0.36	129
Chicago	3.55** (0.09)	1.86** (0.09)	0.60** (0.05)	-0.03 (0.03)	0.00 (0.03)	0.78	0.34	129
St. Louis	3.65** (0.09)	1.92** (0.09)	0.62** (0.04)	-0.00 (0.03)	-0.07 (0.05)	0.80	0.37	129
Minneapolis	3.47** (0.10)	1.90** (0.09)	0.60** (0.04)	-0.02 (0.04)	0.11 (0.04)	0.79	0.37	129
Kansas City	3.56** (0.09)	1.87** (0.09)	0.61** (0.04)	-0.10** (0.03)	-0.10** (0.04)	0.80	0.39	129
Dallas	3.51** (0.08)	1.91** (0.07)	0.60** (0.04)	-0.24** (0.06)	0.19** (0.05)	0.82	0.40	129
San Francisco	3.68** (0.09)	1.90** (0.08)	0.61** (0.04)	-0.12** (0.04)	-0.04 (0.04)	0.81	0.36	129

Notes: This sample runs from 1990 to 2006; * indicates significance at 5%; ** at 1%; standard errors in brackets; total pooled observations: 1677. The regional variable $z_{n,t} = ur_{n,t}$ refers to the unemployment rate in the Federal Reserve District n; $z_{n,t} = ur_{n,t} - u_{t+h}$ refers to the unemployment wedge, i.e. the difference between the unemployment rate in the Federal Reserve District n and the unemployment rate forecast for the US at horizon h=4 quarters.

TABLE 3

Impact of national and regional unemployment rates in individual Taylor-type rules (equation 2)

Coefficients Districts	α	β	γ	δ	ε	φ	Adj. R^2	DW	Obs.
Alan Greenspan	9.89** (1.16)	2.16** (0.10)	0.04 (0.11)	-0.02 (0.02)	-1.18** (0.22)	-	0.82	0.47	129
Boston	9.78** (1.09)	2.17** (0.09)	0.08 (0.10)	-0.01 (0.03)	-1.15** (0.21)	-0.09 (0.05)	0.83	0.50	129
New York	9.90** (1.16)	2.16** (0.10)	0.04 (0.11)	-0.02 (0.22)	-1.19** (0.22)	-	0.82	0.47	129
Philadelphia	9.85** (1.03)	2.19** (0.09)	0.04 (0.10)	-0.09* (0.04)	-1.13** (0.20)	0.16** (0.05)	0.84	0.50	129
Cleveland	10.47** (1.03)	2.19** (0.09)	-0.01 (0.10)	-0.18** (0.05)	-1.12** (0.20)	-0.03 (0.04)	0.84	0.50	129
Richmond	9.10** (1.18)	2.08** (0.10)	0.18 (0.11)	-0.16 (0.12)	-0.89** (0.23)	0.01 (0.10)	0.81	0.66	129
Atlanta	10.01** (1.13)	2.16** (0.10)	0.04 (0.11)	-0.04 (0.05)	-1.18** (0.22)	-0.03 (0.03)	0.82	0.49	129
Chicago	10.35** (1.06)	2.15** (0.09)	-0.01 (0.10)	-0.11* (0.04)	-1.19** (0.20)	0.01 (0.04)	0.83	0.49	129
St. Louis	9.67** (1.05)	2.19** (0.09)	0.10 (0.10)	-0.05 (0.04)	-1.09** (0.20)	-0.06 (0.05)	0.84	0.50	129
Minneapolis	10.31** (0.95)	2.21** (0.08)	0.00 (0.09)	-0.20** (0.07)	-1.15** (0.18)	0.17** (0.05)	0.85	0.53	129
Kansas City	10.34** (0.94)	2.14** (0.08)	0.02 (0.09)	-0.21** (0.05)	-1.10** (0.18)	-0.11* (0.05)	0.85	0.55	129
Dallas	9.68** (0.89)	2.19** (0.07)	0.06 (0.08)	-0.19** (0.05)	-0.99** (0.18)	0.19** (0.05)	0.85	0.55	129
San Francisco	9.50** (1.15)	2.17** (0.10)	0.09 (0.11)	-0.04 (0.04)	-1.08** (0.23)	-0.04 (0.03)	0.83	0.49	129

Notes: This sample runs from 1990 to 2006; * indicates significance at 5%; ** at 1%; standard errors in brackets; total pooled observations: 1677. In the above, the "no regional bias" hypothesis requires $\mathbf{H_0}: \boldsymbol{\delta_n} = \mathbf{0}$.

TABLE 4

Impact of interest rate smoothing on the results using individual Taylor-type rules (equation 3)

Coefficients / Districts	α	β	γ	δ	ρ	φ	Adj. R^2	P-Val.	Obs.
Regional monitoring hypothesis (with z=ur)									
Alan Greenspan	3.26** (0.35)	1.71** (0.18)	1.02** (0.12)	0.06 (0.05)	0.86** (0.02)	-	0.99	0.01	129
Boston	3.25** (0.45)	1.66** (0.18)	1.33** (0.16)	0.19 (0.10)	0.86** (0.02)	-0.04* (0.02)	0.99		
New York	3.09** (0.35)	1.66** (0.18)	1.04** (0.12)	0.10 (0.05)	0.87** (0.02)	-	0.99		
Philadelphia	3.21** (0.45)	1.63** (0.17)	1.04** (0.12)	0.09 (0.09)	0.86** (0.02)	0.00 (0.01)	0.99		
Cleveland	3.85** (1.34)	1.94** (0.20)	1.07** (0.22)	0.01 (0.25)	0.87** (0.02)	-0.03 (0.02)	0.98		
Richmond	5.93** (1.60)	1.81** (0.20)	0.75** (0.23)	-0.45 (0.33)	0.68** (0.06)	0.04 (0.09)	0.91		
Atlanta	3.32** (0.64)	1.56** (0.19)	1.11** (0.14)	0.11 (0.13)	0.86** (0.02)	-0.02 (0.01)	0.99		
Chicago	3.69** (0.57)	1.67** (0.17)	1.07** (0.14)	-0.01 (0.11)	0.86** (0.02)	0.00 (0.01)	0.99		
St. Louis	3.68** (0.78)	1.97** (0.14)	1.05** (0.12)	0.05 (0.15)	0.83** (0.02)	-0.01 (0.03)	0.99		
Minneapolis	3.89** (0.62)	1.82** (0.15)	0.95** (0.11)	-0.08 (0.15)	0.84** (0.02)	0.04** (0.01)	0.99		
Kansas City	3.87** (0.62)	1.78** (0.16)	1.01** (0.12)	0.00 (0.14)	0.85** (0.02)	-0.03 (0.02)	0.99		
Dallas	3.01** (0.82)	1.85** (0.16)	0.96** (0.13)	0.07 (0.14)	0.84** (0.02)	0.02 (0.02)	0.99		
San Francisco	3.27** (0.56)	1.95** (0.16)	1.07** (0.12)	0.09 (0.09)	0.85** (0.02)	-0.03 (0.02)	0.99		
Regional bias hypothesis (with z= ur-u)									
Alan Greenspan	3.57** (0.18)	1.73** (0.18)	1.00** (0.11)	0.13* (0.06)	0.87** (0.02)	-	0.99	0.01	129
Boston	4.22** (0.21)	1.73** (0.17)	1.20** (0.13)	0.14 (0.09)	0.86** (0.02)	-0.05* (0.02)	0.99		
New York	3.57** (0.18)	1.68** (0.18)	1.00** (0.12)	0.16** (0.06)	0.87** (0.02)	-	0.99		
Philadelphia	3.63** (0.16)	1.66** (0.16)	0.99** (0.10)	0.06 (0.09)	0.86** (0.02)	0.01 (0.01)	0.99		
Cleveland	3.89** (0.22)	1.96** (0.20)	1.08** (0.14)	0.11 (0.22)	0.87** (0.02)	-0.03 (0.02)	0.98		
Richmond	3.67** (0.34)	1.71** (0.21)	1.00** (0.14)	-0.30 (0.34)	0.70** (0.05)	0.06 (0.09)	0.91		
Atlanta	3.94** (0.19)	1.56** (0.18)	1.06** (0.11)	0.24 (0.14)	0.86** (0.02)	-0.02 (0.01)	0.99		
Chicago	3.62** (0.17)	1.67** (0.18)	1.07** (0.12)	-0.03 (0.08)	0.86** (0.02)	-0.00 (0.01)	0.99		
St. Louis	3.94** (0.16)	1.98** (0.14)	1.03** (0.09)	-0.13 (0.12)	0.83** (0.02)	-0.01 (0.03)	0.99		
Minneapolis	3.40** (0.19)	1.79** (0.15)	1.00** (0.10)	-0.16 (0.10)	0.85** (0.02)	0.03* (0.01)	0.99		
Kansas City	3.84** (0.20)	1.77** (0.16)	1.01** (0.10)	-0.05 (0.11)	0.85** (0.02)	-0.03 (0.02)	0.99		
Dallas	3.41** (0.18)	1.87** (0.15)	0.92** (0.09)	-0.01 (0.14)	0.84** (0.02)	0.02 (0.02)	0.99		
San Francisco	3.75** (0.20)	1.98** (0.16)	1.02** (0.10)	0.10 (0.11)	0.84** (0.02)	-0.03 (0.02)	0.99		

Notes: This sample runs from 1990 to 2006; * indicates significance at 5%; ** at 1%; standard errors in brackets; P-Val is the p-value of the Portmanteau test for serial correlation at lag 1 (null hypothesis of no serial correlation in the SUR system); total pooled observations: 1677; $z_{n,t} = ur_{n,t}$ refers to the unemployment rate in the Federal Reserve District n; $z_{n,t} = ur_{n,t} - u_{t+h}$ refers to the unemployment wedge, i.e. the difference between the unemployment rate in the Federal Reserve District n and the unemployment rate forecast for the US at horizon h=4 quarters.