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# Collective Versus Individual Decisionmaking: A Case Study of the Bank of Israel Law*

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**Abstract**

The new Bank of Israel Law of 2010 changed monetary policy decisionmaking at the Bank of Israel from a setup where decisions are taken by the governor to one where decisions are taken by a committee of voting members. We use this institutional change as a natural experiment to compare individual versus collective decisionmaking. Empirical results show different dynamics for interest rate decisions across the two regimes and support the view that the status quo bias is larger when decisions are taken by a committee than when they are taken by a single individual.

*JEL classification*: D7, E5
*Key Words*: Committees, voting models, political economy of central banking

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# 1. Introduction

The new Bank of Israel Law of 2010 changed decisionmaking at the Bank of Israel in a fundamental way, from a setup where monetary policy decisions are taken by the governor to one where decisions are taken by a committee of voting members. The former setup dated from 1954, when the (old) Bank of Israel Law established the Bank and vested its governor with full authority over the conduct of monetary policy. Although the law provided for an advisory committee, the committee was appointed by the governor and the law did not compel the governor to follow its advice. Thus, in some sense, this setup is akin to the "single central banker" in the literature. In contrast, the new law creates a Monetary Committee and entrusts it with setting the key interest rate. The Committee includes the governor as its chair, along with two other Bank staff and three external members. Decisions are passed by a majority of voting members, with the governor casting an extra vote in case of a tie. Thus, the new setup is one where decisions are taken collectively by a group of policy makers.

In this paper, we use this institutional change at the Bank of Israel as a natural experiment to compare collective and individual decisionmaking. The issue is important because many economic decisions are taken by a group, rather than by a single individual. Examples include public spending and taxation decisions taken by legislatures, legal judgements made by appellate courts, and interest rate decisions taken by monetary policy committees in many central banks. The way a committee aggregates the different preferences of its members depends on the particular voting procedure that is adopted either implicitly or explicitly by the group. Except under the stringent assumptions of the median voter theorem, decisions taken by a group will be different from those taken by an individual (the median). In particular, the median preferred policy does not prevail in instances when only a subset of alternatives are put to a vote (see, for example, Romer and Rosenthal, 1978, and Krehbiel, 1998) or when the group makes decisions by supermajority rule, that is, by requiring a level of support that exceeds a simple majority.[1]

The empirical evaluation of the difference between collective and individual decisionmaking is complicated by the fact that it generally involves comparing institutions in different countries. Since countries may be different in ways other than in their institutions, it is difficult to know whether different policy decisions are the result of different institutions or of the different environments in which the institutions act. One strategy to address this identification problem is to study an institutional change, say from individual to collective decisionmaking, in the same country. This is precisely what happened in Israel with the introduction of the new Bank of Israel Law in 2010.

[1] Striving for consensus in groups has been pointed out by Janis (1982), and it appears especially relevant for monetary policy committees (see Fry et al., 2000).

Other countries have experienced a similar institutional change (e.g., the United Kingdom in 1997 and Sweden in 1999), but Israel is ideal for this study for several reasons. First, the Bank of Israel has always used fixed decision dates for policy announcements. This means that we observe all policy decisions regardless of whether the decision was to adjust the interest rate or to keep it fixed. In contrast, for central banks without fixed announcement dates, we observe interest rate adjustments (because they are announced), but without inside information, it is difficult to know when an adjustment was considered with the final decision being to keep the rate unchanged. Second, the introduction of the committee was not accompanied by a change in governor: Stanley Fischer was governor for five and a half years before the new law was enacted and three and a half years afterwards. This allows us to rule out the change in governorship as a potential source of variation in the data. Finally, although the law updated other aspects of the Bank's governance, we argue that they represent a less dramatic change than it may appear because, in some sense, the new law simply recognized the reality on the ground.

The main result from this project is that the status quo bias is larger when decisions are taken by a committee than when they are taken by a single individual. First, we document different dynamics for interest rate decisions before and after the new Bank of Israel Law. We argue that this difference is unlikely to be the result of other changes in the Bank's governance that were updated by the new law or of a change in governorship. We address the possibility that the difference in economic conditions across the two periods may account for the difference in decision dynamics by performing counterfactual experiments where we estimate the decisions that a committee would have taken if faced with the same inflation and unemployment as a governor prior to the new law, and vice versa. We conclude that economic conditions cannot completely account for the difference in policy decisions.

International evidence shows a clear trend towards more central banks making decisions by committee rather than by a single individual (see Blinder, 2004). The usual argument in favor of committee decisionmaking is that it draws and aggregates diverse viewpoints and thus ensures moderate and informed decisions. Our analysis points to the fact that monetary policy making by a committee features fewer interest rate changes and smaller adjustments than policymaking by a single individual. Put differently, we provide empirical evidence for the commonly held conjecture that committee decisionmaking is more inertial than individual decisionmaking.[2] Whether this larger inertia improves welfare is an issue that is beyond the scope of this paper and is left to future research.

[2] For example, Blinder (1998) writes,"Decisionmaking by committee, especially when there is a strong tradition of consensus, makes it very difficult for idiosyncratic views to prevail. So monetary policy decisions tend to regress towards the mean and to be inertial."

The paper is organized as follows. Section 2 describes decisionmaking at the Bank of Israel under its old and new organic laws. Section 3 describes the data on interest rate decisions and reports key empirical observations. Section 4 presents protocols that represent individual and collective decisionmaking, reports estimates of the parameters obtained using Israeli data, and reports the results of counterfactual experiments. Finally, section 5 summarizes the main results of our analysis.

## 2. Decisionmaking at the Bank of Israel

The Bank of Israel (BOI) was established under the Bank of Israel Law of 1954. According to the law, the governor was responsible for monetary policy decisions, with input from an advisory committee. The committee consisted of no more than 11 members, with at least seven of the members not in the employ of the Bank. However, the role of the committee was primarily consultative, and the governor had substantial power vis-à-vis the committee. First, all of its members were appointed by the governor. The chair of the committee was selected by the governor as well. Second, terms in the committee were relatively short (two years) and renewable. Thus, the governor had considerable short-term control over the composition of the committee. Third, the committee met only once a month, by written invitation from its chair, or whenever convened by the governor. Finally, the law required the governor to consult the committee (see § 21 in c. 5), but it did not compel the governor to follow its advice, and, in practice, there were instances when the governor took decisions without first consulting with the committee. Although institutional evidence suggests that the advisory committee played some role in the formulation of monetary policy, it is clear that this role was limited, especially when compared with similar structures in other central banks such as the Reserve Bank of New Zealand and the Bank of Canada. Hence, we can think of decisionmaking at the Bank of Israel during this period as resembling—as close as it is possible in the real world—the single central banker in the literature.

The new Bank of Israel Law was approved by the Knesset in March 2010 and took effect in June of the same year. The law defines the objectives of the Bank, states its autonomy, and establishes a monetary committee to be in charge of setting the interest rate and, more broadly, of deciding monetary policy (see c. 4). The committee is composed of six members. Three members are staff of the Bank of Israel: the governor, who serves as chair of the committee; the deputy governor; and an additional Bank employee appointed by the governor. The remaining three members are external to the Bank and are appointed by the government for a four-year term, renewable once. The law specifies that decisions will be passed by majority voting with the chair casting an additional vote in the case of a tie.

The meetings of the committee usually take place over the course of two days and are in the form

of a "broad forum" followed by a "narrow forum." In the broad forum, the committee members, senior representatives from the Bank departments, and economists from the Research and Market Operations departments discuss current economic conditions. In the narrow forum, the directors of Research and Market Operations departments present their recommendations regarding the interest rate, and, after an open discussion, the committee members vote on the level of the interest rate. A report on the meetings is published with a two-week delay. The report contains a summary of the material presented in the broad forum, a summary of the discussion in the narrow forum, an explanation of the key considerations underlying the decision, and the decision itself, including the outcome of the vote. The report states whether the decision was unanimous or whether there were dissents. In the latter case, the report states the policy preference of the dissenter, but it does not reveal his or her identity.

It is interesting to note that the composition and workings of the Monetary Committee share similarities with those of the Monetary Policy Committee (MPC) of the Bank of England and of the Executive Board (EB) of the Riksbank. Like the MPC, it combines internal and external members. Like the EB, it has an even number of members, with the governor holding tie-breaking power. As with both of these committees, decisions are formally taken by simple majority and dissents are made public. One difference, however, is that in the MPC and the EB, the identity of the dissenter is revealed in the minutes, while it is not in the Monetary Committee.

It is important to keep in mind in interpreting the results of this study that the new Bank of Israel Law also updated two other key aspects of the Bank's governance. First, the law defines price stability as the Bank's main objective, with the secondary goals of supporting other government economic objectives (growth, employment, and reducing social gaps) and the stability of the financial system. However, the law states that this support should not prejudice the attainment of price stability over time, defined as the return of inflation to its target range within no more than two years (see § 3 in c. 3). The old law mentioned the dual objective of "promoting by monetary measures (1) the stabilization of the value of the currency in Israel and outside Israel; and (2) a high level of production, employment, national income and capital investments in Israel" (§ 3 in c. 3).

Under both laws, maintaining the purchasing power of the currency and promoting output growth are objectives, but under the new law the latter is clearly subordinated to the former except (possibly) in the short term. Cukierman (2007) argues that the de facto weight given to price stability in the pre-1985 period was less than the de jure weight, in part because of the use of BOI-directed credit to promote the development of certain sectors. After the inflation stabilization plan of 1985 and the introduction of inflation targets in 1992, there was a steady increase in the

emphasis on price stability in the decisionmaking process at the BOI and a corresponding decrease in the emphasis on output objectives (Cukierman, 2007, p. 12).

As part of the construction of his index of central bank independence, Cukierman summarizes quantitatively institutional information about the importance of price stability in policymaking. In particular, he specifies a code that ranges from 0 to 1, with 0 corresponding to the case where price stability is not one of goals in the charter of the central bank and 1 corresponding to the case where it is the only or a major goal.[3] For the Bank of Israel, the left panel of figure 1 reports both the de jure and de facto codes and their evolution over time from pre-1985 to 2003.[4] The de jure code is 0.4 based on the old law. The de facto code has an upward trend, reflecting the increasing importance of price stabilization among the BOI policy objectives over this period. The code reaches the value of 0.9 in the last year of the sample. Thus, we conclude that in defining the Bank's objectives, the new Bank of Israel Law simply formalizes the re-weighting of the two basic objectives (price stability versus output stabilization) that has been in place since the 1990s.

Second, the law states the Bank's independence by declaring it "autonomous in choosing its actions and exercising its powers" to attain its policy objectives (§ 5 in c. 2). The old law gave the government a role in monetary policymaking (see fn. 3), including the possibility of terminating the tenure of the governor in the case of "disagreement [...] on basic questions of policy" (§ 15 in c. 4). Also, although the old law forbade the Bank from making loans to the government to finance its expenditure (§ 45 in c. 8), it also created exceptions to this rule. Over time, these exceptions developed into a system of directed credit to specific economic sectors, with the BOI having limited influence over the terms, composition, and size of this credit (Cukierman, 2007, p. 8). The "No Printing Law" of 1985 severely limited the government's legal ability to obtain advances from the BOI and required such borrowing to be at market rates. Additional developments—the introduction of inflation targets in 1991, the lifting of the ceiling on treasury bill balances in 1994, the elimination of this ceiling in 2001, and the increased emphasis on price stability discussed above—steadily increased the de facto independence of the Bank of Israel.

Quantitative measures of de jure and de facto independence for the BOI are constructed by Cukierman (2007) and are reported here in the right panel of figure 1.[5] The de jure measure is 0.46 based on the old law, while the de facto measure increases over the sample period from 0.13 to 0.64, in line with the institutional evidence reported above. Thus, in terms of central bank

[3] The complete coding scheme can be found in table A1.1 of Cukierman (2007, p. 25).

[4] The values for this plot were taken from the second column of table A1.3 under the heading "Objectives" in Cukierman (2007, p. 31).

[5] The values for this plot were taken from the first column of table A1.3 under the heading AVAW in Cukierman (2007, p. 30). The table also reports a second measure of de facto independence (AVESX) that has the same upward trend.

independence, we conclude that the new law primarily bridges the gap between the de jure and the de facto independence of the Bank of Israel. This conclusion is in line with that of Fisher (2008), who argues that the new law provides "a proper legal basis for the reality that has been created."

In summary, we argue that while these two dimensions of the new law—the emphasis on price stability and the stated autonomy of the Bank of Israel—are important, they represent a less dramatic change than would at first appear because, in some sense, they simply acknowledge the reality on the ground.

Finally, we compute the number of dissents in each meeting of the Monetary Committee. From October 2011 to December 2015, out of a total of 51 meetings, there were 16 meetings with at least one dissent, four meetings with more than one dissent, and one meeting where the governor used his tie-breaking power (on 13 May 2013). Thus, the fraction of meetings where at least one member dissents is 0.31.[6] The dissenting data has two features. First, the occurrence of dissent is higher in the two years immediately after the Monetary Committee became operational. In this period, the fraction of meetings with one or more dissents is 0.52. Second, most dissents are from members who prefer an interest rate higher than the one agreed upon by the committee. We find, in fact, that in 11 (resp. five ) meetings, dissenters wanted a tighter (resp. looser) policy stance than desired by the committee as a whole. Overall, these statistics indicate that there exists a significant amount of disagreement at the meetings of the Monetary Committee of the Bank of Israel, comparable to that observed in committees in other central banks. These observations suggest that the new law of 2010 has implied a real, and not just a formal, change in the way in which monetary policy decisions are made.

# 3. The Data

## 3.1 Interest Rate Decisions

We collected data on 257 monetary policy decisions at the Bank of Israel for the 21 years from January 1995 to December 2015. Decisions concern the headline interest rate, which is the benchmark rate for commercial banks in Israel. Decisions are announced monthly, usually in the last 10 days of the month, and in the past, they took the form of a Monetary Program for the incoming

[6] This fraction is in line with that for other central banks. For example, Riboni and Ruge-Murcia (2014) report that the proportion of meetings where there is at least one dissent is 0.38 for the Riksbank, 0.34 for the US Federal Reserve, and 0.64 for the Bank of England. Dissent behavior at the Federal Open Market Committee has been studied by, among others, Havrilesky and Schweitzer (1990), Meade and Stasavage (2008), and Gerlach-Kristen and Meade, (2010). Dissent behavior at the Monetary Policy Committee of the Bank of England has been studied by Gerlach-Kristen (2009) and Harris et al. (2011).

month. In our sample, there is only one month (April 2001) when no decision was announced.[7] In extraordinary circumstances, additional interest rate decisions were made during the course of the month. For example, the headline rate was raised by 150 basis points on 9 June 2002, and it was cut by 50 basis points on 7 October 2008, during the financial crisis. However, this situation is rare and in our sample there are only seven of such instances. The raw data were taken from the Bank of Israel's website (www.bankisrael.gov.il). However, the available data concern only the "effective" headline rate during the month, and, so in order to construct a series on interest rate decisions, we completed these data using information from Bloomberg and official press releases.

The sample period covers the governorships of Jacob Frenkel, David Klein, Meir Sokoler (acting), Stanley Fischer, and Karnit Flug. Frenkel served two terms as governor starting in 1991 and announced his resignation in November 1999, to be effective on 2 January 2000. The Israeli cabinet voted Klein as his replacement on 17 January 2000, and he served one five-year term, ending on 16 January 2005. Fischer was appointed as his successor in the same month and took office on 1 May, with Sokoler serving as acting governor in the intervening time. Fischer was reappointed for a second five-year term starting in May 2010, but he announced his resignation in January 2013 to be effective at the end of June of the same year. During his tenure, the Knesset approved the new Bank of Israel Law (March 2010) and the members of the new Monetary Committee were appointed (April 2011) and confirmed (October 2011). The first interest rate decision by the Monetary Committee was taken in October 2011, with Fischer as chair. After Fischer's departure, Flug was acting governor until her appointment as governor in October 2013.

Since 1992 the Bank of Israel pursues an inflation target and uses the short-term (headline) interest rate as the policy instrument to attain the target. Thus, the monetary policy framework is stable during our sample and we can rule out a change in framework as a source of variation in the data.

### 3.2 Empirical Observations

Figure 2 plots the time series of the 257 interest rate changes decided by the Bank of Israel between January 1995 and December 2015. Thin lines indicate the beginning of each governorship (Frenkel, Klein, Sokoler, Fischer, and Flug) and the thick line indicates the date the new law took effect. The sample prior to the introduction of the new law consists of 190 decisions from January 1995 to May 2010, while the sample after the new law took effect consists of 67 decisions from June 2010 to December 2015.

[7] According to the press release of 24 April 2001, the reason was that sanctions imposed by the Workers' Committee of the BOI prevented the gathering of the necessary information and, as a result, the decision was postponed.

It is important to note that although the Monetary Committee became operational only in October 2011, a shift towards collective decisionmaking is apparent from the minutes of the narrow forum after June 2010. For example, the minutes report the individual recommendation of the members of the BOI management to the governor, even when it involves a dissent from the decision actually taken (see, for example, p. 7 of the minutes from the meeting held in April 2011). For this reason, in what follows, we treat the 16 decisions from June 2010 to September 2011 as part of the sample associated with committee decisionmaking.

Figure 2 strongly suggests different dynamics for interest rate decisions across the two sub-samples. In particular, the variance and autocorrelation of interest rate adjustments are larger in the first sub-sample than in the second. In addition, the first sub-sample features proportionally fewer decisions where the interest rate is kept unchanged and two instances of policy reversals where an interest rate adjustment in one direction was followed by an adjustment in the opposite direction in the next month (in January and July 1996).

In order to quantify these observations, we report in table 1 the key statistics for each sub-sample. The statistics are the autocorrelation and standard deviation of interest rate adjustments and the proportion of decisions where the rate was kept unchanged. The sample for Klein includes the four decisions by Sokoler from January to April 2005, and the sample for Fischer is divided in two sub-samples, that is, before and after the new law came into effect. Comparing the statistics for the full sample of committee decisions (All) with the those for the full sample of decisions under a single central banker (All) suggests the following. First, the autocorrelation of interest rate changes is much lower in the committee sample (0.22) than in the single banker sample (0.48). Second, the standard deviation of interest rate changes is substantially lower when decisions are made by a committee (14 basis points) than when they are made by a single banker (47 basis points).[8] This result is due partly to the fact that during the governorships of Frenkel and Klein, there were interest rate adjustments as large as 200 basis points. Finally, the proportion of decisions where the interest rate is left unchanged is 0.72 in the committee sample but only 0.40 in the single banker sample.

The hypothesis that the variance of interest rate changes is the same in both sub-samples can be tested using an $F$-test. The alternative is that the variance is larger in the first than in the second sub-sample. Denote the standard deviation and sample size of the first sub-sample by $S_1$ and $n_1$ and those of the second sub-sample by $S_2$ and $n_2$. Then, the statistic $S_1^2/S_2^2$ follows an $F$

[8] After the interest rate decision of March 2015, the key interest rate in Israel is effectively at the zero lower-bound, and it has been fixed to 0.1% since. Excluding these recent observations from the sample has basically no effect on the estimate of the standard deviation of interest rate adjustments: dropping these observations, the estimate becomes 11 basis points rather than the 14 points reported in table 1.

distribution with $(n_1 - 1)$ and $(n_2 - 1)$ degrees of freedom. Since the test statistic is 11.28 and is much larger than the 5% critical value of 1.67, the hypothesis can be safely rejected in favor of the alternative ($p$-value $< 0.001$). Thus, we conclude that the variance of interest rate changes under the old law is significantly larger than under the new law.

The hypothesis that the proportion of observations where the interest rate is left unchanged is the same in both sub-samples can be tested for as well. In this case, the alternative is that the proportion is larger in the second than in the first sub-sample. Under the null hypothesis, the statistic $(p_2 - p_1)/\sqrt{p(1-p)(1/n_1 + 1/n_2)}$ is normally distributed, with $p_1$, $p_2$, and $p$ standing for the proportion in, respectively, the first sub-sample, the second sub-sample, and the complete sample. Since the statistic is 4.46 and is larger than the 5% critical value of 1.64, we conclude that the proportion of decisions that involve keeping the interest rate unchanged is significantly larger under the new law than under the old law ($p$-value $< 0.001$).

It is interesting to note that the proportion of BOI decisions under the new law where the rate is left unchanged is quantitatively very similar to the proportion observed in the Bank of England (0.73) and the Riksbank (0.68),[9] whose committees have a structure similar to that of the BOI Monetary Committee. Table 1 also shows that there are some differences as well in the standard deviation and autocorrelation of interest rate changes across the samples for the three single bankers, but that the proportion of no-changes is relatively stable. The differences between these samples are qualitatively and quantitatively smaller than the differences between them as a whole and the sample after the new law took effect. Overall, these results support the view that the status quo bias is larger when decisions are taken by a committee than when they are taken by a single individual.

An important feature of the BOI data is that the institutional change towards committee decisionmaking took place without a concurrent change in governor. Instead, the same individual (Fischer) took decisions under a regime akin to that of a single central banker during the period of May 2005 to May 2010, as a member of a collective decision-making body from June 2010 to June 2013, and, more formally, as chair of the Monetary Committee from October 2011 onwards. Thus, we can rule out a change in governorship as a potential source of variation in the data. We also compute the statistics for decisions taken in both Fischer sub-samples and report them in table 1. Decisions by Fischer, as single central banker, have statistics that are quantitatively close to those of the other single central bankers: the standard deviation and autocorrelation are relatively high and the proportion of decisions with no interest rate change is relatively low (0.44). In contrast, decisions by Fischer, as chair of the Monetary Committee, resemble those of the subsequent chair

[9] See Riboni and Ruge-Murcia (2010), pp. 389 and 391.

(Flug) in that the standard deviation and autocorrelation are low and the proportion of decisions with no interest rate change is high (0.62).

The test of the hypothesis that the variance of interest changes is the same in both Fisher sub-samples can be rejected against the alternative that the variance in the first sub-sample is larger than in the second sub-sample ($p$-value = 0.002). Also, the test of the hypothesis that the proportion of no interest rate changes is the same in both sub-samples can be rejected against the alternative that it is larger in the second than in the first sub-sample ($p$-value = 0.044). Although these results should be interpreted with caution because the sample sizes are small and because the financial crisis took place during Fisher's first term as governor, they are consistent with the view that the dynamics of interest rate decisions are different under the new than under the old law, even when the governor was the same.

# 4. Counterfactual Experiments

A possible explanation for the results in the previous section is that the difference in decision dynamics is simply the result of different economic conditions across the two sub-periods. In order to examine this possibility, we perform counterfactual experiments where we estimate the decisions that a single central banker would have taken if faced with the same inflation and unemployment rates as the committee after the new law and vice versa. First, we present and estimate models of individual and collective decisionmaking for Israel. The models are a single central banker model and the consensus model due to Riboni and Ruge-Murcia (2010). Then, we simulate individual and committee decisionmaking in counterfactual experiments.

## 4.1 Protocols

Assume that preferences are single-peaked and that the interest rate preferred by policy maker $n$ at time $t$ is

$$i^*_{n,t} = a_n + b\pi_t + cy_t + \zeta_t, \tag{1}$$

where $i_t$ is the nominal interest rate, $\pi_t$ is inflation, $y_t$ is an output measure, $a_n$ is an individual-specific intercept, $b$ and $c$ are constant coefficients, and $\zeta_t$ is a disturbance term assumed to be normally distributed with mean zero and variance $\sigma^2$.[10] A model that delivers (1) as the solution to an optimization problem by member $n$ in a new Keynesian environment was developed in our previous work (Riboni and Ruge-Murcia, 2010), where the difference in intercepts across policy

[10] Previous research that studies preference heterogeneity in committees and estimates interest rate rules for individual members include Chappell et al. (2005), Riboni and Ruge-Murcia (2008), Besley et al. (2008), and Jung (2013).

makes arises from different degrees of relative prudence with respect to a common inflation target.[11] Because individual reaction functions differ in their intercepts only, it is easy to see that economic shocks or changes in output/inflation shift the preferred interest rates of all committee members, without affecting the ordering.

First, consider the case where the interest rate is selected by one policy maker alone. In the absence of frictions, this single central banker will select her preferred interest rate, $i^*_{n,t}$, in every period. Thus, under this protocol, the policy outcome is

$$i_t = i^*_{n,t}. \tag{2}$$

The assumptions in this protocol—that is, one policy maker and no frictions—are implicit in most of the literature that derives Taylor-type rules as the optimal solution to a linear-quadratic problem (for example, Woodford, 2001).

Now, assume that the interest rate is selected by a committee composed of $N$ members and that the committee makes decisions by consensus. We model consensus using the protocol in Riboni and Ruge-Murcia (2010), where it is shown that this consensus model fits actual policy decisions better than alternative models of committee decisionmaking (e.g., the agenda-setting model of Romer and Rosenthal, 1978). In particular, the better fit is also obtained for committees that operate formally under a simple majority rule, such as those at the Bank of England, the Swedish Riksbank, and the US Federal Reserve. The consensus model is a two-part protocol where members first decide by simple majority the direction of the interest rate change and then vote sequentially on the size of the increment with a super majority of votes required for a proposal to pass.[12]

More formally, we order committee members according to their preferred interest rate so that individual 1 is the member with the lowest preferred rate, $N$ is the member with the highest preferred rate, and the median member is the one with index $m = (N+1)/2$. For convenience, we assume that $N$ is odd. Denote by $q_t$ the status quo policy in the current meeting, which corresponds to the interest rate selected in the previous meeting. In the first part of the meeting, members decide by simple majority whether the interest rate will be increased or decreased. Suppose, for example, that the committee decides to increase the interest rate. Then, all policy alternatives strictly smaller than $q_t$ are discarded, and in the second part of the meeting members vote on successive $\epsilon$-size increases of the interest rate, where $\epsilon$ is infinitesimally small. This vote is subject to a super majority rule that requires that for a proposal to pass, the number of favorable votes,

[11] For convenience, this model is reproduced in the appendix.

[12] Throughout, we assume that economic shocks and changes in inflation and output are observed by all committee members. For a model with disperse private information, see Hansen et al. (2014). The conditions under which committees aggregate private information is the subject of an enormous literature, starting from Condorcet (1785).

$(N+1)/2+k$, needs to be strictly larger than simple majority, $(N+1)/2$, where $k \geq 1$ is the size of the super majority. Voting proceeds as follows. Members first vote on the proposal $q_t + \epsilon$ against the alternative $q_t$. If the proposal does not receive the support of a super majority of members, then the proposal is defeated and the interest rate adopted by the committee is $i_t = q_t$. Alternatively, if the proposal passes, members vote on a new proposal, $q_t + 2\epsilon$, against the alternative $q_t + \epsilon$. This procedure continues until a proposal fails to have the support of a super majority of members. As explained in Riboni and Ruge-Murcia (2010), the focus is on a pure-strategy, sub-game perfect equilibrium with the property that members vote as if they were pivotal. Members are assumed to be forward-looking within each meeting, but they abstract from the effects of their voting decision on future meetings via the status quo. The policy outcome in the consensus protocol is[13]

$$i_t = \begin{cases} i^*_{m+k,t}, & \text{if} \quad q_t > i^*_{m+k,t}, \\ q_t, & \text{if} \quad i^*_{m-k,t} \leqslant q_t \leqslant i^*_{m+k,t}, \\ i^*_{m-k,t}, & \text{if} \quad q_t < i^*_{m-k,t}. \end{cases}$$

Note that this protocol induces an inaction interval, that is, a set of status quo policies where interest rate changes are not possible. For an initial status quo in the inaction interval, regardless of the result in the first part of the meeting, no proposal will pass in the second stage and the interest rate will remain unchanged. The width of the inaction interval is equal to the distance between the policies preferred by members with indices $m+k$ and $m-k$ and is increasing in the size of the supermajority. When instead status quo policies are sufficiently extreme, compared with the values preferred by most members, the committee adopts a new policy that is closer, but not equal, to the median outcome.

### 4.2 Estimation

For the estimation of the model, we use the interest rate decisions described above and measures of inflation and output. The measure of inflation is the 12-month percent change of the seasonally unadjusted Consumer Price Index (CPI) taken from the website of the Bank of Israel (www.bankisrael.gov.il/en). The measure of output is the deviation of the seasonally adjusted unemployment rate from a quadratic trend. These data were taken from the website of the Organization for Economic Cooperation and Development (www.oecd.org) for observations until the last quarter of 2011 and from the website of the Central Bureau of Statistics for observations from January 2012 onwards.[14]

[13] See Riboni and Ruge-Murcia (2010) for a formal proof.

[14] Because the Israeli Labor Force Survey (LFS) was carried out quarterly until 2011, the rate of unemployment is available only at the quarterly frequency prior to 2012, and we use linear interpolation to construct a monthly measure of unemployment. The LFS is carried out monthly starting in 2012.

Maximum likelihood (ML) estimates of the single banker model for the period from January 1995 to May 2010 are reported in the first column of table 2. Under the model, intercepts for the three bankers (Frenkel, Klein, and Fischer) are different, but the inflation and unemployment coefficients are the same. As expected, the inflation coefficient is positive and statistically significant and that of unemployment is negative and statistically significant. Thus, either a decrease in inflation or an increase in unemployment induce a cut in the interest rate. ML estimates of the consensus model for the period June 2010 to January 2015 are reported in the second column of table 2. As before, the inflation coefficient is positive and the unemployment coefficient is negative, with both coefficients being statistically different from zero. This model involves two threshold points associated with the preferred policies of the members with indices $m + k$ and $m - k$. These thresholds are globally identified from interest rate decreases and increases, respectively, and locally identified from the decisions with no change in the interest rate.

### 4.3 Experiments

First, we assume that a single central banker with the same inflation and unemployment preferences as the one prior to June 2010 makes policy decisions in the second sub-sample. The inflation and unemployment that the central banker faces are the actual historical values from June 2010 onwards. Results from these experiments are reported in table 3 and show that interest rate adjustments in this period would have been characterized by a higher standard deviation and more interest rate adjustments than observed in the actual data, where decisions were made by a committee. An interesting observation is that the autocorrelation would have been similar to that in the data. The reason is that the single banker model features relatively low endogenous persistence and its persistence derives directly from that of inflation and unemployment. Figure 3 plots the histograms of decisions that would have been made by the fictional single banker (left panel) compared with those of decisions actually made by the committee (right panel). This figure shows that a central banker faced with the same inflation and unemployment rates would have made larger and more frequent interest rate changes than the Monetary Committee actually did.

We also perform counterfactual experiments where a committee working under consensus is in charge of monetary policy prior to June 2010. Preference parameters are those reported in table 2; the inflation and unemployment the committee faces are the actual historical values from January 1995 to May 2010. In this case, the standard deviation is lower, and proportion of no interest rate changes is higher, than in the data, while the autocorrelation is only somewhat higher. The former result is consistent with the observation that the status quo bias is larger when decisions are taken by a committee than when they are taken by a single individual.

Figure 4 plots the histograms of the interest rate changes that the fictional committee would have made (left panel) compared with those actually made by the single central banker (right panel). We observe a lower standard deviation; it is also clear that a committee would not have made the large changes of 200 basis points observed in the actual data. However, there would still have been substantial interest rate adjustments driven by the fact that inflation was extremely volatile in this period. The reason is that in the consensus model, the interest rate is usually unchanged for small shocks or small changes in inflation/unemployment because the interest rate likely remains in the inaction interval in this case. However, for large shocks or large changes in inflation/unemployment, the model generally predicts an interest rate adjustment, although usually of a magnitude smaller than that implied by the single banker model.

In summary, results from these counterfactual experiments indicate that economic conditions—inflation and unemployment—do not completely account for the difference in decision dynamics in the periods before and after the new Bank of Israel Law. In particular, decisions taken by a fictional committee in the period prior to June 2010 feature a lower standard deviation and higher proportion of no changes than decisions taken by actual single central bankers, while the converse is true for the period after 2010.

## 5. Conclusions

This paper uses the institutional change in the Bank of Israel in 2010 as a natural experiment to compare individual and collective decisionmaking. We document that the status quo bias is larger when decisions are taken by a committee than when they are taken by a single individual. We argue that this observation is unlikely to be the result of other changes in the Bank of Israel governance updated in the new law or of a change in governorship (since there was not one). Counterfactual experiments suggest that the different dynamics of inflation and unemployment across the two sub-periods do not completely account for the difference in dynamics in interest rate adjustments across sub-samples. In particular, counterfactual experiments suggest that if a committee had been in charge of formulating policy in the period prior to June 2010 and faced the same inflation and unemployment as the actual single central bankers did, interest rate changes would have featured lower standard deviation and a larger proportion of no changes and that changes as large as the 200 basis observed in the data are unlikely to have taken place. It is very important to keep in mind when interpreting the conclusions from this research that our methodology and results do not allow us to make statements about social welfare, and hence we cannot conclude whether the inertia associated with committee decisionmaking is welfare improving. This is an important issue that we leave for future research.

## Appendix A Model of Individually Preferred Interest Rates

The utility function of a generic member $n$ is

$$E_\tau \left( \sum_{t=\tau}^{\infty} \delta^{\tau-t} U_n(\pi_t) \right),$$

where $E_\tau$ denotes the expectation conditional on information available at time $\tau$, $\delta \in (0,1)$ is the discount factor, and $U_n(\pi_t)$ is the instantaneous utility function. Assume that

$$U_n(\pi_t) = \frac{-\exp\left(\mu_n(\pi_t - \pi^*)\right) + \mu_n(\pi_t - \pi^*) + 1}{\mu_n^2}, \tag{A1}$$

where $\pi^*$ is an inflation target and $\mu_n$ is a member-specific preference parameter. The functional form (A1) is based on Varian (1974).

As in Svensson (1997), the behavior of the private sector is summarized by a Phillips curve,

$$\pi_{t+1} = \pi_t + \alpha_1 y_t + \varepsilon_{t+1}, \tag{A2}$$

and an aggregate demand curve,

$$y_{t+1} = \beta_1 y_t - \beta_2(i_t - \pi_t - \iota) + \eta_{t+1}, \tag{A3}$$

where $\pi_t$ is inflation, $y_t$ is an output measure, $i_t$ is the nominal interest rate, $\iota$ is the real interest rate, $\alpha_1, \beta_2 > 0$ and $0 < \beta_1 < 1$ are constant parameters, and $\eta_t$ and $\varepsilon_t$ are disturbances. The disturbances follow the moving average processes

$$\varepsilon_t = (1 - \kappa_1 L)\, u_t,$$
$$\eta_t = (1 - \varsigma_1 L)\, v_t,$$

where $L$ is the lag operator, the roots of $(1 - \kappa_1 x)$ and $(1 - \varsigma_1 x)$ lie outside the unit circle, and $u_t$ and $v_t$ are mutually independent innovations. The innovations are normally distributed white noises with zero mean and constant conditional variances $\sigma_u^2$ and $\sigma_v^2$, respectively. Before proceeding, note from (A2) and (A3) that in the model the interest rate at time $t$ affects inflation only after two periods.

Consider the member-specific interest rate $i_{n,t}^*$ chosen at time $t$ to maximize the expected utility of member $n$ at time $t+2$. That is,

$$i_{n,t}^* = \underset{i_t \geq 0}{\arg\max}\ \delta^2 E_t U_n(\pi_{t+2}),$$

subject to equations (A2) and (A3). Because of the shocks that occur during the control lag period, ex-post inflation will typically differ from $\pi^*$. This induces a prudence motive in the conduct of monetary policy which varies with $\mu_n$. The first-order necessary condition is

$$E_t \exp\left(\mu_n(\pi_{t+2} - \pi^*)\right) = 1. \tag{A4}$$

Under the assumption that innovations are normally distributed, the inflation rate at time $t+2$ (conditional on the information available at time $t$) is also normally distributed. Thus, $\exp\left(\mu_n(\pi_{t+2} - \pi^*)\right)$ is distributed log-normal with mean $\exp\left(\mu_n(E_t\pi_{t+2} - \pi^*) + \mu_n^2\sigma_\pi^2/2\right)$ where $\sigma_\pi^2$ stands for the conditional variance of $\pi_t$. Substituting into (A4) and taking logs,

$$E_t\pi_{t+2} = \pi^* - \mu_n\sigma_\pi^2/2.$$

Finally, using equations (A2) and (A3), write the interest rate preferred by member $n$ as

$$i^*_{n,t} = a_n + b\pi_t + cy_t + \zeta_t, \tag{A5}$$

where

$$a_n = \iota - (1/\alpha_1\beta_2)\pi^* + (\mu_n/2\alpha_1\beta_2)\,\sigma_\pi^2, \tag{A6}$$

$b = 1 + (1/\alpha_1\beta_2)$, $c = (1 + \beta_1)/\beta_2$, and $\zeta_t$ is a white-noise disturbance formed from the linear combination of the innovations $u_t$ and $v_t$.

**Table 1. Summary Statistics**

| | Old Law | | | | New Law | | |
|---|---|---|---|---|---|---|---|
| | Frenkel | Klein | Fischer | All | Fischer | Flug | All |
| Standard deviation | 0.617 | 0.473 | 0.268 | 0.472 | 0.171 | 0.089 | 0.141 |
| Autocorrelation | 0.408 | 0.527 | 0.648 | 0.478 | 0.234 | 0.074 | 0.217 |
| Proportion no changes | 0.403 | 0.353 | 0.444 | 0.400 | 0.622 | 0.833 | 0.717 |
| Number of decisions | 62 | 65 | 63 | 190 | 37 | 30 | 67 |

*Note:* The sample periods are the following: Frenkel from January 1995 to December 1999, Klein from January 2000 to December 2004 and includes the four decisions by Sokoler from January to April 2005, Fischer (as single banker) from May 2005 to May 2010, Fischer (as committee member) from June 2010 to June 2013, and Flug from July 2013 to December 2015.

**Table 2. Estimates**

| | Old Law | New Law |
|---|---|---|
| | Single Banker | Monetary Committee |
| Intercept | | |
| Frenkel | 10.799* | |
| | (0.421) | |
| Klein | 6.642* | |
| | (0.267) | |
| Fischer | 1.916* | |
| | (0.262) | |
| Member $m-k$ | | −0.537 |
| | | (0.389) |
| Member $m+k$ | | 1.294* |
| | | (0.317) |
| Inflation | 0.300* | 0.702* |
| | (0.049) | (0.154) |
| Unemployment | −0.640* | −0.340† |
| | (0.177) | (0.194) |
| Standard deviation | 1.567* | 0.487* |
| | (0.0804) | (0.079) |

*Notes:* The sample period for the old law is from January 1995 to May 2010 and for the new law is from June 2010 to January 2015. The numbers in parenthesis are asymptotic standard errors. The superscripts $*$ and † denote significance at the 5% and 10% significance levels, respectively.

**Table 3. Counter-Factual Experiments**

| | Old Law | | New Law | |
|---|---|---|---|---|
| | Monetary Committee | Data | Single Banker | Data |
| Standard deviation | 0.337 | 0.472 | 0.215 | 0.141 |
| Autocorrelation | 0.543 | 0.478 | 0.199 | 0.217 |
| Proportion no changes | 0.571 | 0.400 | 0.018 | 0.717 |

*Note:* The sample period for the old law is from January 1995 to May 2010 and for the new law is from June 2010 to January 2015.

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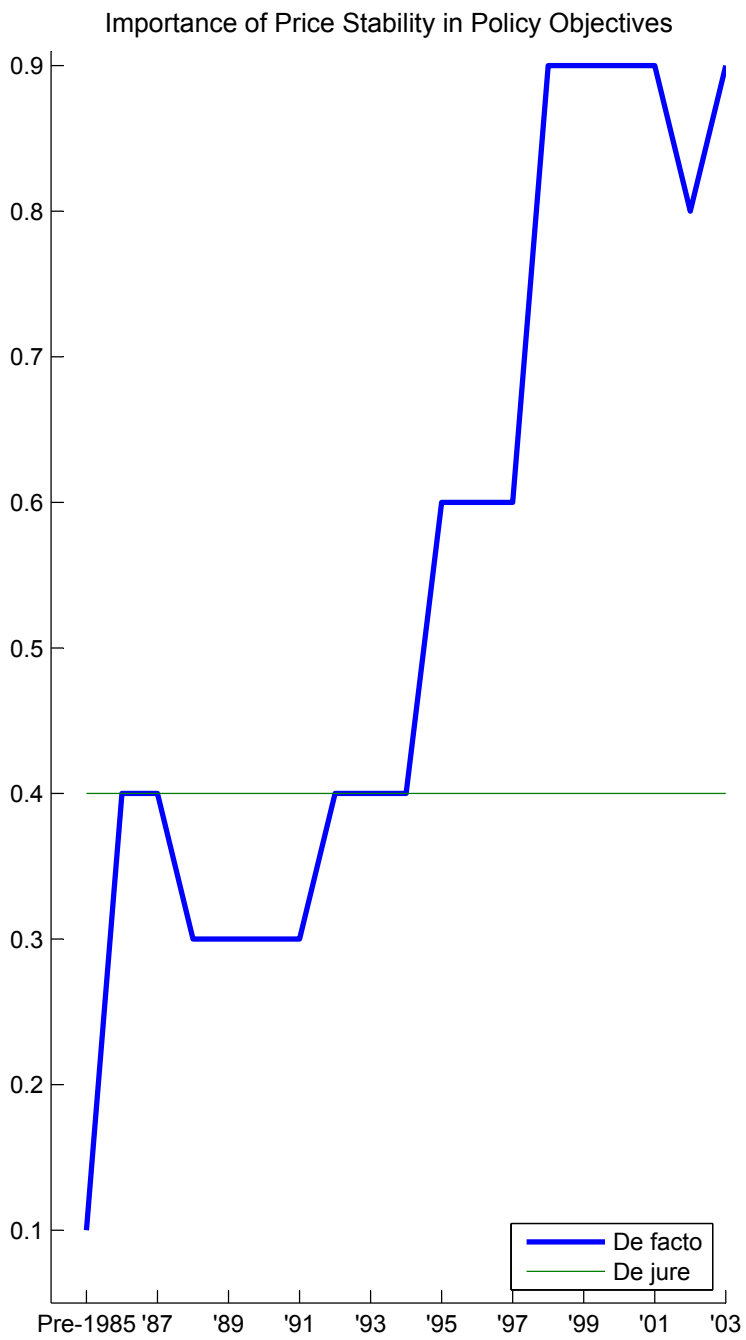
# Figure 1: The Bank of Israel



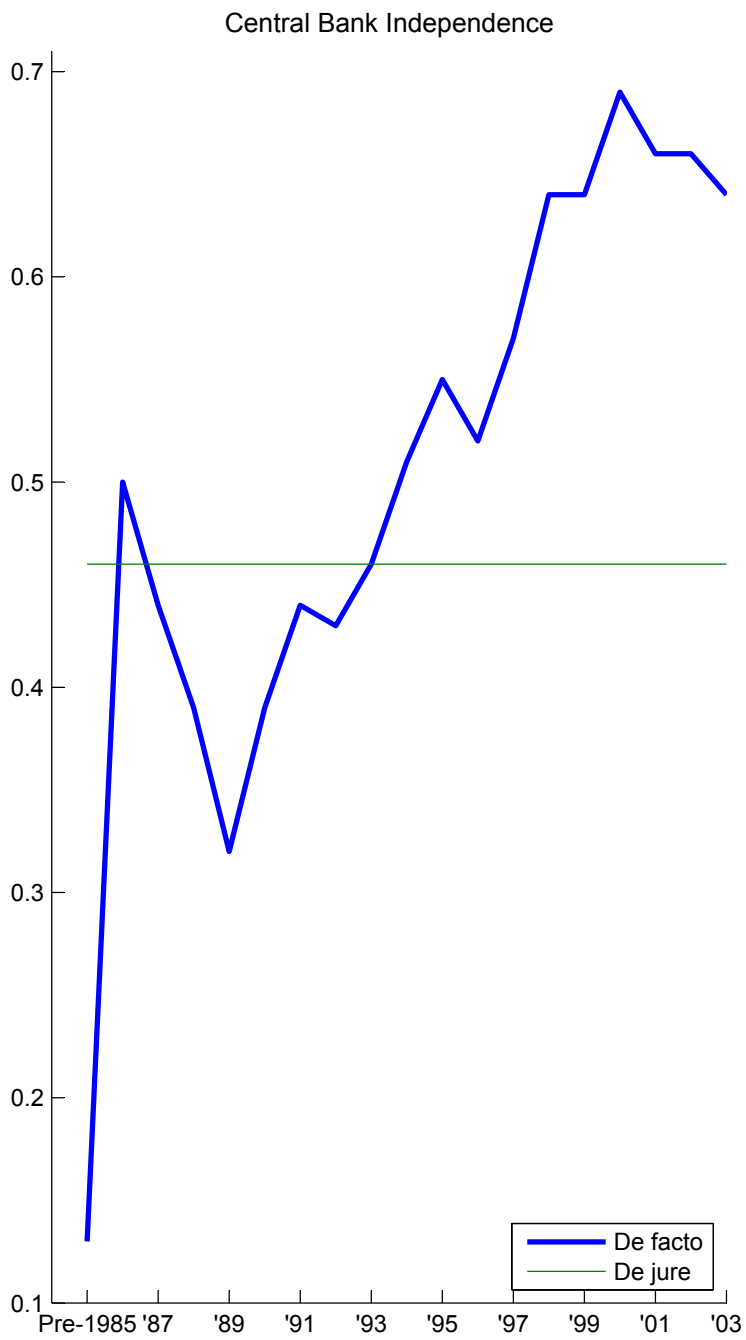
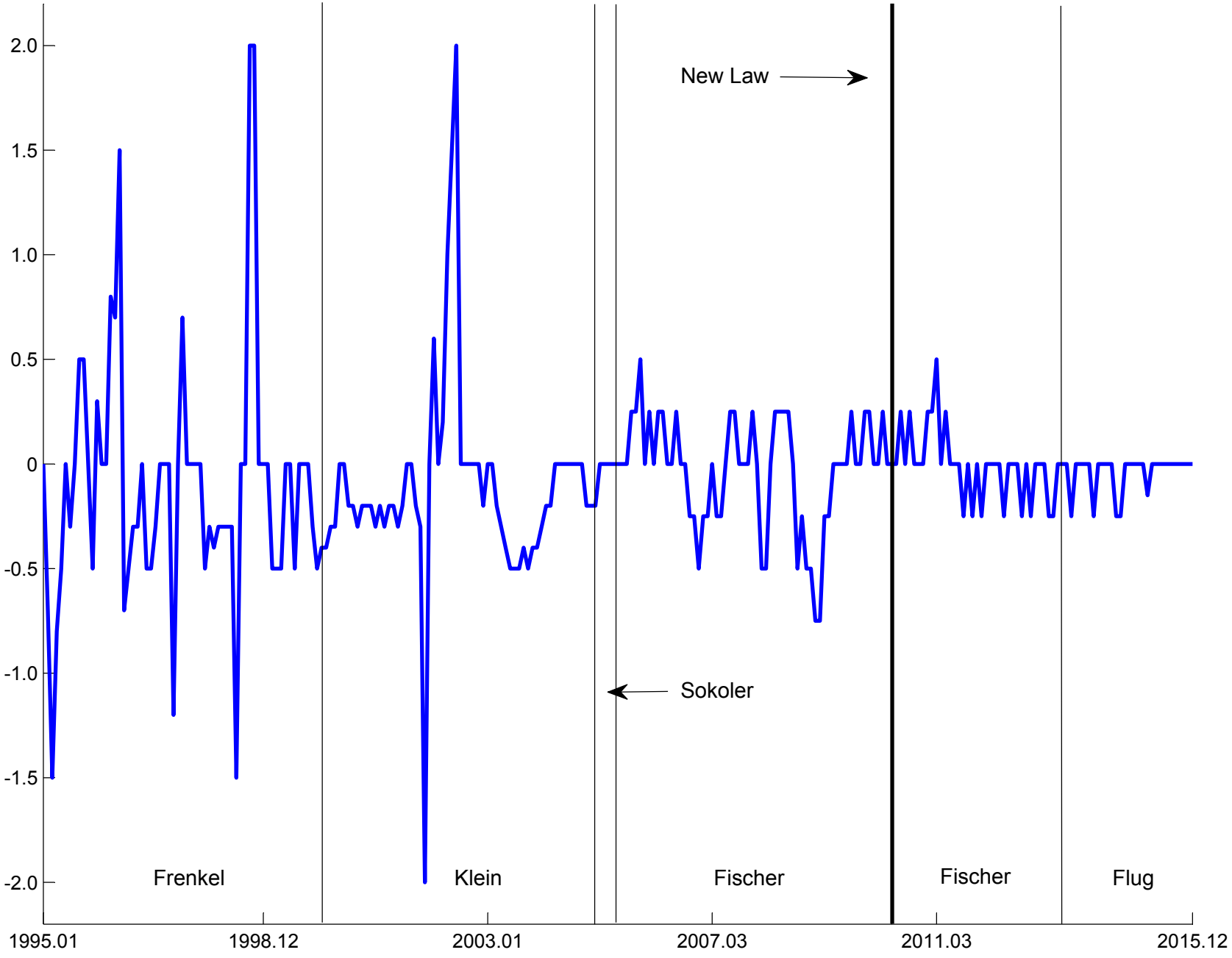
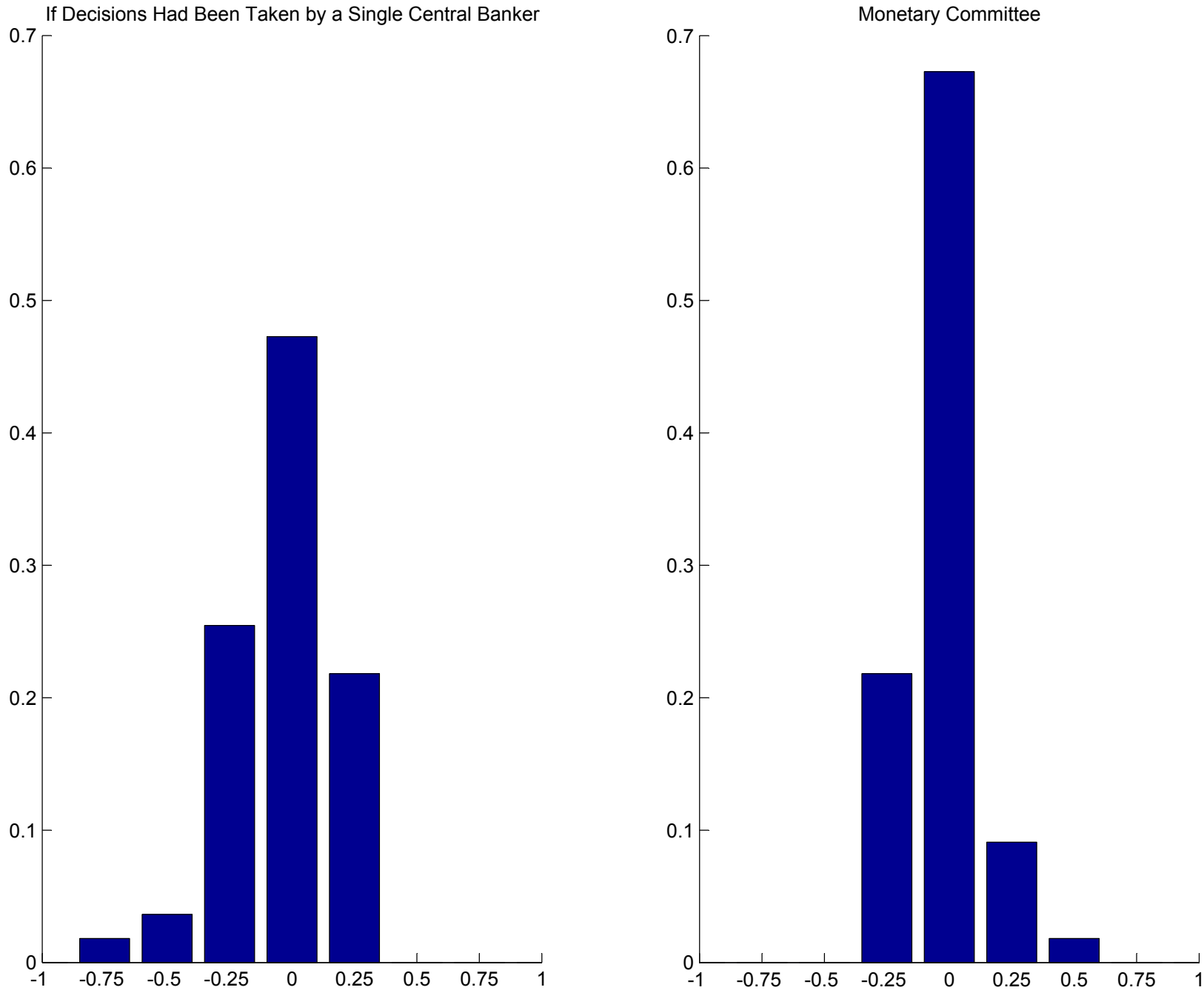



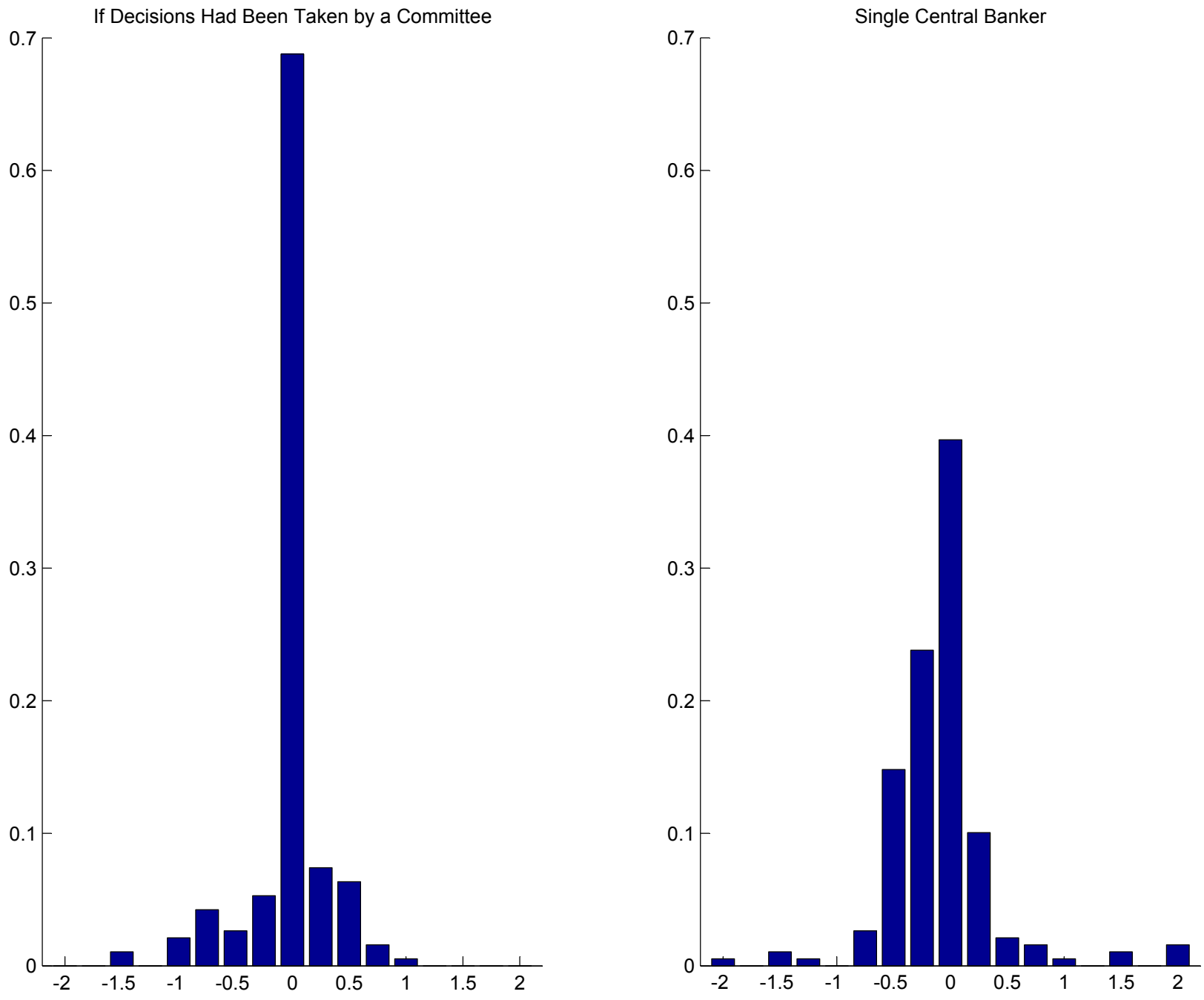
Figure 2: Interest Rate Changes



# Figure 3: Interest Rate Decisions after May 2010



# Figure 4: Interest Rate Changes before June 2010



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