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Invited Paper

Breakpoints and Unit Roots in Metro Manilans' Perceptions of the Senators' Fairness During the Impeachment Trials[1]

Ana Maria L. Tabunda[2]

ABSTRACT

This paper examines series on the perceived fairness of the senators during the impeachment trials for breakpoints and tests the unit root hypothesis for these series. Breakpoints in the series indicate when perceptions changed in response to new developments or information. A unit root finding would imply that shocks on the series have a permanent effect on the level or trend of the series. The unit root finding for the series on percentage of the respondents who perceived the senators as not fair suggests that shocks such as the 11 senators voting 'No' to the opening of the second envelope had a permanent effect on the series. The series will not revert to the lower levels it exhibited prior to the shock.

KEY WORDS: Unit root test, Chow breakpoint and forecast tests, structural break, stochastic trend, deterministic trend.

1. INTRODUCTION

On the eve of January 16, 2001, the 22nd day of the impeachment trial of former President Joseph Estrada, noise barrages spontaneously erupted throughout Metro Manila, and some of its residents rushed to the EDSA shrine to register their protest and indignation at 11 senators' having cast 'no' votes. These 'no' votes prevented the opening of the second envelope that would have linked former President Estrada to billions of pesos in an Equitable PCI Bank account under the name of one "Jose Velarde."

The response of these residents to the televised voting was immediate. Although there had been prior warnings from certain sectors and cause-oriented groups of a possible EDSA II in the event that the former president was acquitted of the charges, many had assumed that the nation would see the impeachment trial to its conclusion. There were few indications that the events would take the turn they did at that point in time.

It is clear that EDSA II was triggered by the perception that the 11 senators were no longer fair and were predisposed to judging the case in favor of former President Estrada. This paper seeks to characterize this perception variable, specifically the response as to whether one agrees or disagrees to the statement that "the senators will probably be fair and won't favor anyone in judging the impeachment case." In particular, the paper examines these series for breakpoints and performs unit root tests on the percentages of 'disagree,' 'can't say' and 'agree' responses.

A breakpoint, as the name suggests, is the point at which a series changes. A series that has undergone a structural change exhibits a particular behavior prior and up to the breakpoint and a different behavior thereafter. A series can contain more than one breakpoint. For

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[2] Professor, School of Statistics, University of the Philippines Diliman. Email: alt@stat.upd.edu.ph

example, the years 1973 and 1979 are breakpoints for many macroeconomic time series of several industrialized countries. Sharp increases in oil prices in these years helped cause the recessions of the U.S. economy in 1974-75 and 1981-82.

In this paper, we seek to identify the breakpoints for the series of interest and thereby deduce which event(s) or information might have led to a change in Metro Manilans' perception of the impartiality of the senators.

The interest in testing for the presence of unit roots in the perception series stems from the following. A finding that a series contains a unit root indicates that the series is not stationary. A stationary series is one which has a constant mean and a constant variance. It does not exhibit any trending behavior. Thus a nonstationary series may exhibit trending behavior and/or changing variance. A unit root finding indicates that a series is nonstationary and that it can be rendered stationary by differencing. The effects of shocks on such series are permanent (Nelson and Plosser, 1982 as cited in Perron, 1989). Moreover, such series do not exhibit mean-reverting tendencies. That is, they do not have a tendency to revert to their mean value prior to the shock.

The implication of a unit root finding for any of the perception series investigated is that the percentage of Metro Manila residents who hold a partcular view, say perceive that the senators will be fair, will not revert to the previous level after a breakpoint. Thus if such percentage declines in reaction to new information, it will not return to its previous higher levels.

The application of unit root tests to opinion poll data is not new. Using U.K. data, Byers (1991) (as cited in Byers, Davidson and Peel, 1997) rejected the null hypothesis that political popularity, as measured by voting intentions, has a unit root in favor of stationary ARMA models with AR coefficients close to 1. These results suggest that news on economic variables such as unemployment and inflation have a transitory effect on voting intentions of U.K. voters.

Postulating that voting intentions of committed individuals with strong party allegiances are less sensitive to news than that of uncommitted individuals who tend to award their votes on the basis of performance, Byers, Davidson and Peel (1997) show that support for the Conservative and Labour parties in the U.K. follow virtualy pure fractional noise processes. The series are thus nonstationary and have long memory but are eventually mean reverting.

2. THE DATA

Data for this paper were obtained from the daily opinion polls taken during the period November 17 to December 20, 2000 and January 2 to 20, 2001. The survey period covers 20 pre-trial days (the trial started on December 7, 2000) and 4 days after the fateful January 16, 2001. No poll was taken during the last two days of the impeachment trial before the Christmas recess (December 21 and 22), as funds had run out. The polls were resumed on January 2, 2001 and were halted the day after President Gloria Macapagal Arroyo took her oath of office.

The survey on the first day covered 300 respondents from Metro Manila. Subsequent surveys covered 30 new respondents per day.

We constructed several time series on the perception variable using 3-day, 5-day, 7-day, and 10-day moving averages based on the daily samples of new respondents. Taking moving averages is essentially equivalent to treating the data as rolling data. "Rolling data" is a commonly used procedure in poll and market research surveys. In the case where the data is rolled over a 10-day period, for example, the observations from the new respondents are added to that of the respondents from the previous 9 days. Thus in the situation where there are 30 new respondents daily, rolling the data over a 10-day period yields in effect a sample of 300 respondents. Use of the procedure thus reduces survey costs and the time needed for encoding and analyses.

An assumption in the use of rolling data, however, is that the respondents interviewed at the beginning of the roll-over period will not have changed their views by the end of the roll-over period. The use of roll-over periods that are too long may be reasonable in situations where the series changes slowly, but not when a series can change rapidly in response to developments. Inasmuch as the perception that the senators will be fair in judging the impeachment case could, at some point, have changed rapidly, we also considered short roll-over periods despite the small samples that these yield. The use of smaller sample sizes will lead to higher noise levels in the series. But the response to new information or shocks may also be reflected more quickly in the series based on the shorter roll-over periods.

3. METHODOLOGY

Because the unit root test is biased towards accepting the null hypothesis of a unit root in the presence of a structural break (Perron, 1989), Chow breakpoint and forecast tests are first performed to identify possible breakpoints.

The Chow breakpoint test fits a separate regression to each of the subsamples separated by a breakpoint or breakpoints and tests for significant differences in the fitted equations. A significant difference indicates a structural change in the relationship.

The Chow test uses an F statistic based on the sum of squared residuals resulting from a single equation fitted to the entire sample and the sum of the sums of squared residuals obtained from separate regressions fitted to each of the subsamples. In the case of a single breakpoint, the F statistic is given by

$$F = \frac{(\tilde{u}'\tilde{u} - u_1'u_1 - u_2'u_2)/k}{(u_1'u_1 - u_2'u_2)/(T-k)}$$

where $\tilde{u}'\tilde{u}$ is the restricted sum of squared residuals, $u_i'u_i$ is the sum of squared residuals from subsample i, T is the total number of observations, and k is the number of parameters in the equation. The formula is easily generalized to more than one breakpoint. The F-statistic has an exact finite sample F-distribution if the errors are independent and identically distributed normal random variables.

Another statistic computed by EViews software is the log likelihood ratio statistic which is the (Gaussian) log likelihood function. The LR test statistic has an asymptotic distribution with degrees of freedom equal to (m-1)k under the null hypothesis of no structural change, where m is the number of subsamples.

The Chow forecast test is useful when one of the subsamples is of short duration. It estimates the model for the longer subsample comprising the first T_1 observations. The estimated model is then used to predict the values of the dependent variable for the T_2 data points in the

second subsample. A large difference between the actual and predicted values is an indication of possible structural change. The Chow forecast F-statistic is computed as

$$F = \frac{(\tilde{u}'\tilde{u} - u'u)/T_2}{(u'u)/(T_1 - k)}$$

where $\tilde{u}'\tilde{u}$ is the residual sum of squares when the equation is fitted to all T sample observations, $u'u$ is the residual sum of squares when the equation is fitted to T_1 observations, and k is the number of estimated coefficients. This F-statistic has an exact finite sample F-distribution only if the errors are independent, and identically, normally distributed.

As in the Chow breakpoint test, another test statistic that may be used in lieu of the F-statistic is the log likelihood ratio test. The LR statistic is based on a comparison of the restricted and unrestricted maximum of the (Gaussian) log likelihood function computed from restricted and unrestricted regressions of the entire sample. The restricted regression is based on the original set of regressors; the unrestricted regression adds a dummy variable for each forecast point.

Prior to implementing the breakpoint tests, timeplots of the series were examined to help identify possible breakpoints. The time points corresponding to December 21, 2000, when polling was temporarily halted, and January 17, 2001 were also tested as possible breakpoints for all series. We also followed Tsay's idea of first fitting an ARMA model and examining the residuals for potential outliers (Tsay, 1988 as discussed jn Vaage, 2000) to help identify possible breakpoints. While this step already presumes that, barring the effects of outliers, the process is difference stationary, it is the best available option for identifying possible breakpoints. Possible breakpoints were then inputted in the Chow testing procedures.

Although nothing in the nature of the data would suggest that it should have a deterministic trend, we nevertheless tested the unit root hypothesis, (equivalently, the hypothesis that the series is stochastic stationary) against the alternative that the process is trend stationary. A deterministic trend would imply that the percentages of 'agree', 'disagree' and 'can't say' to the statement on perceived fairness of the senators should decrease or increase with time. Shocks have no permanent effects on series with deterministic trends.

Perron (1989) shows that even if the data generating process has a deterministic trend, the Dickey Fuller unit root testing procedure would have difficulty rejecting the null unit root hypothesis when the series contains structural breaks and the magnitude of the shift in trend is significant. This would suggest that shocks have a permanent effect on the series, when "only the one-time shift in the trend function is permanent."

Perron thus proposed the following procedure for testing for a unit root in the presence of a one-time change in the level or slope of the trend function. The null hypotheses of interest are

Model (A) $y_t = a_0 + a_1 y_{t-1} + \mu_1 DP_t + \varepsilon_t$

Model (B) $y_t = a_0 + a_1 y_{t-1} + \mu_2 DL_t + \varepsilon_t$

Model (C) $y_t = a_0 + a_1 y_{t-1} + \mu_1 DP_t + \mu_2 DL_t + \varepsilon_t$,

where y_t is the original series, y_{t-1} is the series lagged one period, t is the time trend variable, DP_t is a *pulse* dummy variable that takes the value 1 at time point $\tau + 1$, where τ is the breakpoint, and 0 elsewhere, and DL_t is a *level* dummy variable that takes the value 1 for all $t \geq \tau + 1$ and 0 elsewhere. The alternative hypotheses Perron (1989) considered are,

Model (A) $y_t = a_0 + a_2 t + \mu_2 DL_t + \varepsilon_t$

Model (B) $y_t = a_0 + a_2 t + \mu_3 DT^*_t + \varepsilon_t$

Model (C) $y_t = a_0 + a_2 t + \mu_2 DL_t + \mu_4 DT_t + \varepsilon_t$,

where DT^*_t = t - τ and DT_t = t if t > τ and zero elsewhere. The alternative hypothesis under Model A allows for a one-time change in the intercept of the trend function. That under Model B allows a change in the slope of the trend function. The alternative hypothesis under Model C allows for both changes in level and in the growth path.

The model equations in the alternative hypotheses are fitted as the case requires. The detrended values are then calculated by obtaining the residuals from the above fitted regressions denoted by, say, $\tilde{y}_t$, and then perform the regression

$$\tilde{y}_t = a_1 \tilde{y}_{t-1} + \varepsilon_t$$

If the resulting residuals are not yet white noise, the equation is estimated in the form of an augmented Dickey Fuller test. That is to say, the model

$$\tilde{y}_t = a_1 \tilde{y}_{t-1} + \sum_{i=1}^{k} \beta_i \Delta \tilde{y}_{t-i} + \varepsilon_t \qquad (*)$$

is fitted, where the $\Delta \tilde{y}_{t-i}$ are lagged differences. The t-value for Ho: $a_1 = 1$ is then compared to the appropriate critical values given in Perron (1989).

Perron (1989) shows that when the residuals are i.i.d., the asymptotic distribution of α_1 depends on the proportion occurring before the break, $\lambda = \tau / T$, where T is the total number of observations. The paper also remarks that, for model A, the asymptotic distribution for the t-statistic for $\hat{a}_1$ obtained from the following estimated regression

$$y_t = \hat{a}_0 + \hat{a}_2 t + \hat{\mu}_1 DP_t + \hat{\mu}_2 DL_t + \hat{a}_1 y_{t-1} + \sum_{i=1}^{k} \hat{\beta}_i \Delta y_{t-i,t}$$

is the same as the asymptotic distribution of the OLS estimator of a_1 in (*).

We considered model A for this paper. Since the Perron testing procedure allows for unit root testing in the presence of only one structural break at a time, we performed the tests for each of the possible breakpoints identified by the Chow breakpoint testing procedure. We chose the fitted model with the lowest value for the Schwarz Bayesian criterion (SBC).

For series that appear to have no breakpoints, we used the augmented Dickey Fuller (ADF). The ADF unit testing procedure due to Dickey and Fuller (1979) consists of testing the null hypothesis that a_1 is zero using the model equation given by

$$\Delta y_t = a_0 + a_1 y_{t-1} + a_2 t + \sum_{i=1}^{k} \beta_i \Delta y_{t-i} + \varepsilon_t \ .$$

Here Δy_t is the first difference and the error term ε_t is assumed to be generated from a white noise process. The t-statistic corresponding to a_1 has its own asymptotic distrbution and corresponding critical values.

The assumption that the error term follows a white noise process was validated for all relevant models. Except for the models fitted using the Phillips-Perron testing procedure, only models with residuals that appear to be white noise were considered among the final models.

4. RESULTS AND FINDINGS

The opinion polls reveal this interesting aspect of the impact of the impeachment trials on formation of public opinion in Metro Manila: The impeachment trials apparently affected people's perception of the impartiality of the senators more than it affected their opinion on whether the former President should resign or not. The greatest change in agreement/disagreement to the statement 'Erap should resign now' is 13.5 percentage points (Table 1), or approximately 1.4 standard errors, given the noise levels in the January 20, 2001 series. That for agreement/disagreement to the statement 'The senators will probably be fair and won't favor anyone in judging the impeachment case' is 28.6 percentage points, also approximately 2.9 standard errors.

Table 1. Distribution of Response to 'Erap should resign now' (in percent)

Response		Jan. 20, 2001		
	Nov. 17, 2000 (n=300)	7-day MA (n=210)	5-day MA (n=150)	3-day MA (n= 90)
Disagree	45.0	45.3	42.7	35.6
Can't Say	17.3	12.4	11.3	13.3
Agree	37.7	42.4	46.0	51.2

Table 2 . Distribution of Response to 'The senators will probably be fair . . . . ' (in percent)

Response		Jan. 20, 2001		
	Nov. 17, 2000 (n=300)	7-day MA (n=210)	5-day MA (n=150)	3-day MA (n= 90)
Disagree	17.0	38.6	45.4	45.6
Can't Say	28.7	15.7	14.0	12.2
Agree	53.3	45.7	40.7	42.3

It may be noted also that a greater percentage of the respondents were undecided or did not wish to give their opinion as to whether the senators will be fair in the beginning of the polling period. Fewer respondents were undecided as to whether the former president should resign at once during the start of the polling period. It may be that many Metro Manila residents had already formed their opinions on whether the former president should resign on the basis of the information they obtained from the coverage of the hearings conducted by the Senate Blue Ribbon Committee in October and November, 2000. In addition, as events in May 2001 would later show, it appears that there was a sizeable group of Metro Manila residents who were loyal to the former president and who would support him through good times and bad.

4.1 The Breakpoints

We used the series which were not "rolled over", i.e., were not averaged, to identify the possible breakpoints. Breakpoints that can be identified as such despite the high noise levels in these series will also serve as breakpoints or determine the breakpoints in the rolling data series.

The 'Very Much Disagree' and the 'Just Disagree' series were combined into one series, since the percentages for the first series were rather low. The plots of the unsmoothed series for 'Disagree' and 'Can't Say' (Figure 1) indicate breakpoints close to the points identified by the formal tests (Table 3). These breakpoints are more easily seen in the plots of the 10-day moving average series (Figure 2).

For the series on percentages 'Disagree' and 'Can't Say', the tests identified the following breakpoints:

Multiple breakpoints for 'Disagree'	: Dec 11 & Dec. 20, 2000; Jan. 15, 2001
Single breakpoint for 'Can't Say'	: Jan. 16, 2001

No breakpoint was found for the series on percentages 'Just Agree' and 'Very Much Agree'. The models considered and the attained significance values for the Chow breakpoint and forecast tests are shown in Table 3.

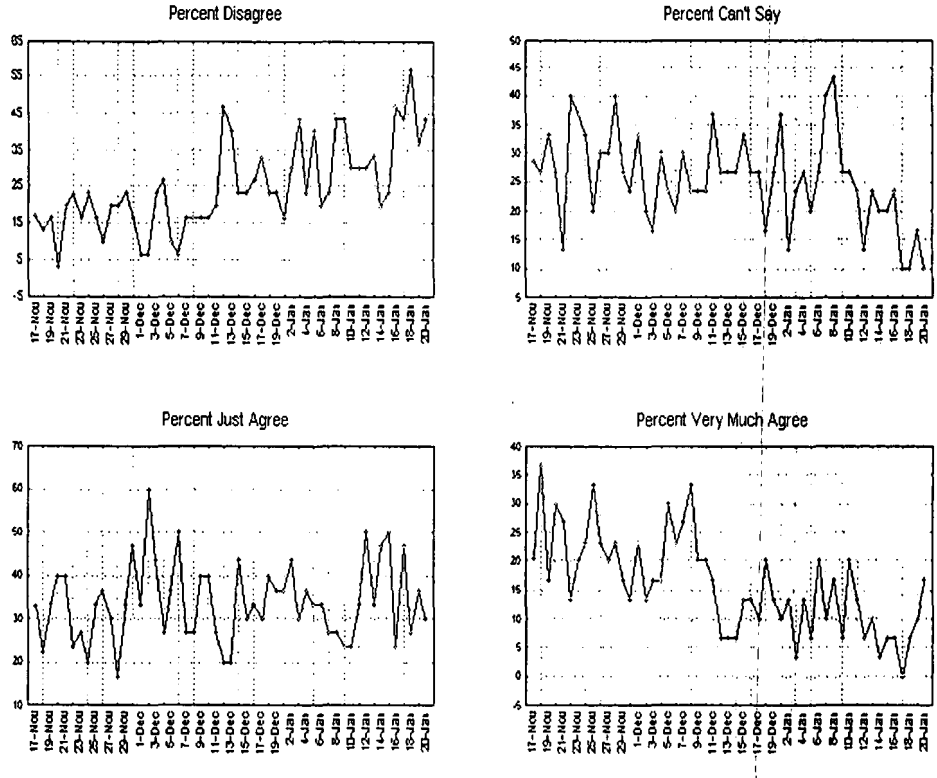

Figure 1. Plots of the unsmoothed series.

Table 3. P-values for Chow Breakpoint and Forecast Tests

Series/Breakpoints	Chow F	LR
Breakpoint Tests		
'Disagree'		
$y_t = a_0 + a_1 y_{t-1} + \epsilon_t$		
12/11, 12/20, 1/15	.0001	.00003
Forecast Tests		
'Disagree'		
$y_t = a_0 + a_1 y_{t-1} + \epsilon_t$		
1/15	.020	.011
'Can't Say'		
$y_t = a_0 + a_1 y_{t-1} + \epsilon_t$		
1/16	.014	.008

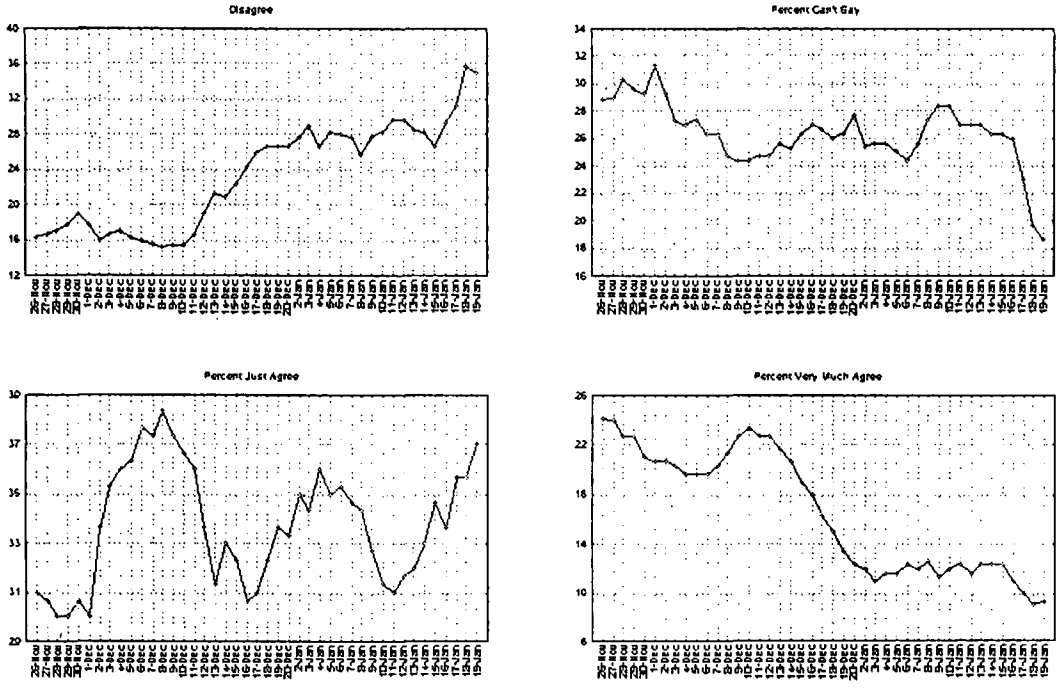

Figure 2. Plots of the 10-day moving average series.

It can be seen from Table 4 that the first breakpoint for the 'Disagree' series followed the testimony of Ms. Emma Lim, an employee of former Ilocos Sur Gov. Singson and the cross-examination of former Philippine National Police Chief Lastimoso by former Senators Coseteng and Santiago. The tests detected the change in pattern, as an increasing percentage of the respondents started to perceive the senators as not being fair.

Although Dec. 20 was identified by the Chow tests as the second breakpoint for the 'Disagree' series, the actual break may have occurred on Dec. 22, when Ms. Clarissa Ocampo testified to witnessing the former president sign "Jose Velarde' on the forms for opening a trust account. But since the polls stopped after Dec. 20, and the impact of Ms Ocampo's testimony on all parties (senators, defense and prosecution panels, the public) was captured by the polls at the earliest only upon resuming in January 2, 2001, the statistical procedure pinpoints Dec. 20 as the breakpoint.

A third breakpoint identified by the Chow tests for the 'Disagree' series is January 15, 2001. The testimonies of former Finance Secretary Edgardo Espiritu and former Securities and Exchange Commissioner Perfecto Yasay preceded this breakpoint.

As for the percentages for 'Can't Say', the breakpoint occurred on January 16, 2001, when 11 senators voted 'No' to the opening of the second envelope that would have shown that the 'Jose Velarde' account had P 3.3 billion. The percentage of respondents who were undecided declined after January 16.

Table 4. Selected Events and Reports Preceding Breakpoints

Trial Day	Day of the Week	Date	Event/Report
1	Th	Dec. 7	Start of Impeachment Trial Prosecution presented a facsimile of a P142M check issued by "Jose Velarde" to a corporation that acquired an P86M Quezon City. property. The signature bore a striking similarity to the "Joseph E. Estrada" signature on P500 bills. Former Phil. National Police Chief Roberto Lastimoso testified that sometime in 1998 Pres. Estrada gave him implicit instructions to "go easy" on jueteng and to coordinate with Ilocos Sur Gov. Chavit Singson.
2	Fr	Dec. 8	Emma Lim, employer of Ilocos Sur Gov. Luis Chavit Singson, testified she collected a total of P3M in jueteng money from San Juan Mayor Jinggoy Estrada. She said that the collection included a personalized check for P1M bearing the mayor's picture. Former PNP chief Lastimoso was cross-examined by Senators Miriam Defensor Santiago and Anna Dominique Coseteng.
3	Mo	Dec. 11	Cross-examination of Emma Lim by former Solicitor General Estelito Mendoza.

Table 4 (cont). Selected Events and Reports Preceding Breakpoints

			Francisco Yap, Jr., president of Phil. Clearing House Corp., a private clearing house owned and operated by 50 commercial banks in the country, testified that 6 checks totaling P200M were processed and cleared at his company beginning April 13, 2000. Sen. Juan Ponce Enrile apparently asked who issued and who receiv ed the checks.
4	Tu	Dec. 12	Equitable-PCI Bank delivered bank records to Senate impeachment court. Ilocos Sur Gov. Chavit Singson took the witness stand and said that Pres. Estrada received jueteng money. He submitted a ledger showing jueteng protection money for Pres. Estrada. Senators Raul Roco and Renato Cayatano publicly declare Gov. Singson's testimonies to be clear and in order.
12	Fr	Dec. 22	Clarissa Ocampo, Equitable-PCI Bank Senior Vice President and Trust Officer, testified that she saw Pres. Estrada sign the name "Jose Velarde" when he opened a trust account under that name.
13	Tu	Jan. 2	Manuel Curato, Equitable-PCI Bank First Vice President and head of the legal department, corroborated Clarissa Ocampo's testimony.
20	Th	Jan. 11	Former Finance Secretary Edgardo Espiritu testified that, at the behest of Pres. Estrada, BW resources obtained a P600M loan from PNB although it had neither collateral nor the capacity to pay. He also said that Estrada told him of having earned huge sums of money through Dante Tan who had been accused of insider trading in the BW Resources stock manipulation scandal.
21	Fr	Jan. 12	Former SEC Chairman Perfecto Yasay testified that Pres. Estrada instructed him to clear Dante Tan in the multibillion peso BW Resources scandal.
23	Tu	Jan. 16	11 senators voted against opening the second envelope submitted by Equitable-PCI Bank, the contents of which, prosecutors said, would have linked Estrada to billions of pesos in ill-gotten wealth.

4.2 The Unit Root Tests

Unit root tests were performed on the 'Disagree', 'Can't Say', 'Just Agree', and 'Very Much Agree' series. Interestingly, the unsmoothed or un-averaged 'Just Agree' series was found to follow a white noise process. It would appear that the sample size of 30 new respondents daily was too small to capture the trend for this series, there being much shifting into as well as out of this category. It appears that many respondents changed their opinion from the other categories (principally 'very much agree') to 'agree' just as there were many that changed their opinion from 'agree' to the other categories. The effect was to produce random fluctuations in the 'Just Agree' series unlike in the 'Disagree' and 'Very Much Agree' series, where the shifts in opinion resulted in clearly discernible rising and falling trends even for the unsmoothed series (Figure 1). However, the smoothed 'Just Agree' series (3-day MA to 10-day MA) exhibited nonrandom patterns.

Results indicate that none of the series has a deterministic trend (Table 5). The unit root hypothesis is not rejected for all models except for the unsmoothed 'Disagree' and 'Can't Say series. These results suggest that the series are not stationary and that shocks have a permanent effect on them.

The results also indicate that the pulse and level dummy variables for the December 11 and January 15 breakpoints for the 'Disagree' series are significant. This indicates that the shocks (developments) that preceded these breaks had a permanent effect on the mean percentage of respondents that perceive the senators to be unfair. The shocks served to increase the mean of the series.

The level dummy variable for the January 16 breakpoint for the series 'Can't Say' is also significant, indicating a change in magnitude in the drift term of this series. The percentage that are undecided would have continued to decline after this point. The results thus indicate that the January 16 voting helped those who were initially undecided to make up their minds regarding the senators' impartiality.

5. CONCLUSION

The results clearly indicate that the survey respondents' perceptions that the senators will be fair in handling the impeachment trial were affected by the events during the impeachment trials and the information obtained from the news and broadcast media coverage. This is not surprising, as the level of the nation's interest in the trials was unusually high. Bautista (2001) cites a January 6-9, 2001 nationwide survey of the Social Weather Stations and ABS-CBN which showed that 91% of the voting-age Filipinos interviewed obtained information about the trial from television. Because of the nature of the medium, viewers were able to obtain information not only on facts pertinent to the case, but also information on the attitudes, opinions, behavior, biases if you will, and work habits of all actors in the trial, principally the presiding judge, members of the defense and prosecution panels, and the senators.

What is interesting is that the statistical analyses reveal that the exogenous shocks (in the form of new information either about facts of the case or the behavior of the senators) had a permanent effect. The study further shows that the developments that greatly affected those who perceived

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Table 5. Unit Root Tests

Fitted Regression Model: $y_t = \hat{a}_0 + \hat{a}_2 t + \hat{\mu}_1 DP_t + \hat{\mu}_2 DL_t + \hat{a}_1 y_{t-1} + \sum_{i=1}^{k} \hat{\beta}_i \Delta y_{t-i} + \hat{\varepsilon}_t$

	T	λ	k	$\hat{a}_0$	$t_{\hat{a}_0}$	$\hat{a}_2$	$t_{\hat{a}_2}$	$\hat{\mu}_1$	$t_{\hat{\mu}_1}$	$\hat{\mu}_2$	$t_{\hat{\mu}_2}$	$\hat{a}_1$	$t_{\hat{a}_1}$*
Disagree													
No Averaging Dec. 11, 2000	53	0.47	0	8.98	2.77	0.30	1.93	21.16	2.43	4.77	0.97	0.19	-5.88[a]
3-day MA Jan. 15, 2001	51	0.90	3	3.60	1.97	0.08	1.27	-3.06	-0.75	6.61	2.99	0.77	-2.10
5-day MA Jan. 15, 2001	49	0.90	0	2.77	2.08	0.07	1.45	-1.82	-0.71	4.32	3.15	0.80	-2.03
7-day MA Dec. 11, 2000	47	0.40	7	2.48	1.65	0.08	1.43	-0.80	-0.41	2.77	2.34	0.73	-2.11
10-day MA Dec. 11, 2000	44	0.89	10	1.49	1.40	-0.03	-0.49	0.63	0.46	1.59	2.05	1.01	0.08

* corresponds to the null hypothesis that a_1=1.
[a] significant at the 1% level

Table 5 (cont). Unit Root Tests

Fitted Regression Model: $y_t = \hat{a}_0 + \hat{a}_2 t + \hat{\mu}_1 DP_t + \hat{\mu}_2 DL_t + \hat{a}_1 y_{t-1} + \sum_{i=1}^{k} \hat{\beta}_i \Delta y_{t-i_t}$

	T	λ	k	$\hat{a}_0$	$t_{\hat{a}_0}$	$\hat{a}_2$	$t_{\hat{a}_2}$	$\hat{\mu}_1$	$t_{\hat{\mu}_1}$	$\hat{\mu}_2$	$t_{\hat{\mu}_2}$	$\hat{a}_1$	$t_{\hat{a}_1}$*
Can't say													
No Averaging	53	0.92	0	27.97	5.76	-0.10	-1.31	-3.11	-0.37	-10.87	-2.91	0.06	-6.47[a]
3-day MA	51	0.92	3	5.48	1.48	-0.04	-1.10	-0.78	-0.23	-2.52	-1.27	0.83	-1.42
5-day MA	49	0.92	0	9.11	2.83	-0.03	-1.06	2.13	0.91	-3.62	-2.25	0.68	-2.93
7-day MA	47	0.91	8	5.40	1.81	0.001	0.05	0.23	0.14	-2.80	-2.06	0.78	-1.92
10-day MA	44	0.91	0	6.11	2.27	-0.001	-0.55	0.21	0.17	-3.16	-3.95	0.78	-2.39

Series without Breakpoints

Fitted Regression Model: $\Delta y_t = \hat{a}_0 + \hat{a}_2 t + \hat{a}_1 y_{t-1} + \sum_{i=1}^{k} \hat{\beta}_i \Delta y_{t-i_t}$

Just agree				
3-day MA	51	6	0.008	0.45
5-day MA	49	10	0.008	0.85
7-day MA	47	8	0.003	0.38
10-day MA	44	7	0.002	0.35

* corresponds to the null hypothesis that a_1=1.
[a] significant at the 1% level

Table 5 (cont). Unit Root Tests

	T	λ	k	$\hat{a}_0$	$t_{\hat{a}_0}$	$\hat{a}_2$	$t_{\hat{a}_2}$	$\hat{\mu}_1$	$t_{\hat{\mu}_1}$	$\hat{\mu}_2$	$t_{\hat{\mu}_2}$	$\hat{a}_1$	$t_{\hat{a}_1}$*
Very much agree													
3-day MA	51		1									-0.08	-1.57
5-day MA	49		5									-0.03	-2.13
7-day MA	47		7									-0.02	-2.05
10-day MA	44		10									-0.03	-2.99

* corresponds to the null hypothesis that a_1=1.

the senators as unfair started early in the trial, at about the time that Emma Lim delivered her testimony. The shock that affected those who were initially undecided was the vote of the 11 senators against the opening of the second envelope.

6. DIRECTIONS FOR FUTURE RESEARCH

One direction that may be pursued is the application of Tsay's procedure for detecting outliers, level shifts and variance changes on the series as a means of validating the results in this paper. The modification proposed by Balke, 1993 (as discussed in Vaage, 2000) could also be tried.

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