Additional simulation results for "Bayesian simultaneous determination of structural breaks and lag lengths"

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1 Simulation experiment

We use a small simulation experiment to asses the model selection properties of our procedure and compare the performance to the structural break tests of Bai and Perron(1998, 2003). As a base case we have a model without structural breaks,

$$y_t = 1 + 0.49y_{t-1} - 0.64y_{t-1} + \varepsilon_t,\ \sigma_\varepsilon^2 = 0.5,\ T = 270.\ \text{(DGP 1)} \tag{1}$$

This model has complex roots with a modulus of 1.25 and a period of 5 and the unconditional expectation of y_t is $E(y_t) = 0.87$. For the remaining DGPs we introduce structural breaks at $t = 75$ and $t = 190$. The first regime thus contains 75 observations (although some of these will be lost due to lags), the second regime contains 115 observations and the last regime 80 observations. In each case the outer regimes are the same as the base case and we modify the inner regime.

In the first set of structural break DGPs only the constant changes and the dynamics are unaffected by the break. We consider $\beta_0 = 1.5$, 1.75 and 2.0 corresponding to unconditional expectations for the inner regime of $E(y_t) = 1.31$, 1.56 and 1.75. We refer to these as DGPs 2a, 2b and 2c.

The second set of structural break DGPs consider changing dynamics. We first consider a relatively small change where the modulus of the inner regime is 5 (smaller amplitude) and the period is unchanged at 5. In addition we consider changes to dynamics where the roots are real in the inner regime with a dominant root of -1.25 and the second root set to roughly match the unconditional expectations in the first set of DGPs. We thus have four settings for the inner regime:

$$\begin{aligned}
&y_t = 1 + 0.12y_{t-1} - 0.04y_{t-2} + \varepsilon_t,\ \sigma_\varepsilon^2 = 0.5,\ 75 < t \leq 190,\ E(y_t) = 1.09\ \text{(DGP 3a)} \\
&y_t = 1 - 0.22y_{t-1} + 0.46y_{t-1} + \varepsilon_t,\ \sigma_\varepsilon^2 = 0.5,\ 75 < t \leq 190,\ E(y_t) = 1.32\ \text{(DGP 3b)} \\
&y_t = 1 - 0.16y_{t-1} + 0.52y_{t-1} + \varepsilon_t,\ \sigma_\varepsilon^2 = 0.5,\ 75 < t \leq 190,\ E(y_t) = 1.56\ \text{(DGP 3c)} \\
&y_t = 1 - 0.10y_{t-1} + 0.56y_{t-1} + \varepsilon_t,\ \sigma_\varepsilon^2 = 0.5,\ 75 < t \leq 190,\ E(y_t) = 1.85.\ \text{(DGP 3d)}
\end{aligned} \tag{2}$$

The third set of structural break DGPs changes both the constant and the dynamics but keep the unconditional expectation constant at $E(y_t) = 1$ across regimes. For the

outer regimes with the dynamics in (1) we thus set the constant to $\beta_0 = 1.15$. For the inner regime we use the same set of dynamics (2) as in the second set of DGPs and set the constant to $\beta_0 = 0.92$, 0.76, 0.64 and 0.54, respectively. We will refer to these as DGPs 4a, 4b, 4c and 4d.

For each DGP we generate 100 time series and calculate the exact model probabilities for all combinations of number of breaks $0 \leq r \leq 3$ and lag lengths $0 \leq p \leq 4$. Throughout we use the priors of section 2.1 with $\beta_0 = \mathbf{0}$, $\mathbf{M}_0 = \mathbf{I}$, $S_0 = 6$ and $v_0 = 8$. The choice of S_0 and v_0 corresponds to a prior mean and variance of 1.25 and 0.44 for the precision and 1 and 0.5 for the variance of ε. The minimum length of a regime is set to $d = 27$ for comparability with the Bai-Perron test. We use exact calculations rather than estimated model probabilities from algorithm 1 to reduce the influence of simulation noise. In addition to choosing the combination of number of breaks with the highest posterior probability out of the $4 \times 5 = 20$ specifications (the MaxP procedure) we also consider four sequential procedures. The first two are simple procedures similar to frequentist sequential testing, first selecting the number of breaks in a model with zero lags and then selecting lags conditional on the number of breaks (the PBL procedure) or first selecting lags in a model with no breaks and then selecting breaks conditional on the lags (the PLB procedure). The last two are more sophisticated and takes account of the joint posterior distribution of lags and breaks by choosing breaks based on the marginal posterior distribution over the number of breaks and then selecting lags conditional on the breaks (the mPBL procedure) or first selecting lags based on the marginal posterior and then selecting breaks conditional on the lags (the mPLB procedure). The first of these corresponds to our favoured procedure when the number of lags is allowed to differ between regimes.

For the Bai-Perron tests we follow the recommended testing procedure in Bai and Perron(2003, 2004) and first test the null of no structural breaks against the alternative of at least one structural break with the UD max test. If the null is rejected the number of breaks is determined using a sequence of $F(r+1|r)$ tests. A significance level of 5% is used throughout. In order to determine both the number of breaks and lag length we employ two sequential procedures. The first procedure first test for the number of breaks in a model with zero lags and then use BIC to choose lags given the number of breaks (the BP-BIC procedure). The second procedure first finds the number of lags with BIC in a model with no breaks and then tests for breaks given the number of lags (the BIC-BP procedure). In the BP-BIC procedure we use the version of the Bai-Perron test that allow for autocorrelation in the residuals and we allow for different error variances and data distributions (moment matrices) across regimes in both procedures. Finally we use a trimming constant $\varepsilon = 0.1$, corresponding to a minimum regime length of 27.

1.1 Results

When discussing the performance of the procedures we will not comment specifically on the mPBL and mPLB procedures as the performance is virtually identical to that of the MaxP procedure.

Results for the no break case (DGP 1) are given in Table 1. Overall the procedures perform very well. All procedures except the PBL and BIC-BP select zero breaks in 100% of the replicates and select the correct lag length, 2, between 94 and 95% of the time and

select higher lag lengths in the remaining replicates. The BP-BIC procedure never rejects the null hypothesis of zero breaks indicating that the UD max test is undersized when the nonparametric correction for autocorrelation is used. The BIC-BP test selects zero breaks in 94% of the replicates indicating that the UD max test has the right size when a sufficient number of lags are included in the model.

Turning to the DGPs with a break in the constant term, the Bayesian procedures and the BP-BIC procedure perform poorly with a small break (DGP 2a, Table 2) selecting the correct combination of breaks and lags in 28% or less of the replicates. The poor performance is due to the procedures selecting zero breaks in the majority of the replicates. The BIC-BP procedure performs much better selecting the correct combination of breaks and lags in 59% of the replicates. The picture changes as the magnitude of the break increases. With the intermediate break (DGP 2b, Table 3) all procedures except PLB and BIC-BP selects the correct combination of breaks and lags in about 70% of the replicates with to few breaks and to long lag lengths in the remaining replicates. The PLB procedure selects the correct combination of lags and breaks in only 8% of the replicates and BIC-BP in 18% of the replicates. While the PLB procedure fails both in terms of lag and break selection the BIC-BP procedure selects two breaks in 92% of the replicates but selects to long lag lengths. In the case of a large break in the constant term (DGP 2c, Table 4) the MaxP and BP-BIC procedures do very well, selecting two breaks and two lags 97% and 100% of the replicates. The BIC-BP procedure again selects two breaks in 91% of the replicates, but selects to long lags (3 or 4) in 99% of the replicates. The PBL selects two breaks in 74% of the replicates, three breaks in 26% of the replicates and always selects two lags. The PLB procedure finally always selects to long lags, zero breaks in 45% of the replicates and two breaks in 55% of the replicates.

The results for the DGPs with breaks in the dynamics are reported in Tables 5, 6, 7 and 8. In DGP 3a with a break from complex dynamics to complex dynamics the signal is relatively week and the Bayesian procedures pick the correct combination of lags and number of breaks in between 40% and 50% of the replicates with the MaxP procedure doing best. The BIC-BP procedure does well, selecting the correct combination in 69% of the replicates. As can be expected the BP-BIC procedure does not pick up the change in dynamics and always selects zero breaks. The signal is stronger in the DGPs with a break to real dynamics (DGP 3b, 3c and 3d) and the MaxP procedure picks the correction lag lengths and number of breaks in 99% of the replicates. The PLB and BIC-BP procedures never selects the correct combination of breaks and lags. Both selects the maximum lag length in 97% or more of the replicates but selects the correct number of breaks in about 90% (BIC-BP) or 100% (PLB) of the replicates. The BP-BIC procedure does better for the DGPs with a stronger signal but there is still a tendency to select to few breaks and to many lags are selected to compensate for the missing breaks. The PBL on the other hand tend to select to many breaks, in particular with the larger breaks and selects the correct lag length in 98% of the replicates with DGP 3c and 3d.

The last set of DGPs (Tables 9, 10, 11 and 12) repeats the same breaks in the dynamics but combines with an offsetting break in the constant term to keep the unconditional expectation constant across regimes. The results are qualitatively similar the results for DGP 3a-3d. The MaxP, PLB and BIC-BP procedures perform well in selecting the number of breaks. With DGP 4a BIC-BP selects the correct number of breaks and lags in 56% of the replicas, MaxP in 30% and BIC-BP in 20% of the replicates. With DGP 3b-3d

MaxP selects the correct number of breaks and lags in all replicates whereas BIC-BP and PLB selects the correct number of breaks in over 90% of the replicates but always selects to long lags leading to zero correct combinations. The PBL and BP-BIC procedures, finally, tend to underestimate the number of breaks and overestimates the lag length.

Summing up the results we see that the MaxP procedure consistently performs well. It has the highest or second highest frequency of correct number of breaks and lag lengths for all DGPs. MaxP is beaten by the BP-BIC or BIC-BP procedure for the DGPs with small and difficult to detect breaks (DGP 2a, 3a and 4a). But the performance of these procedures vary substantially across DGPs and prior knowledge about the nature of the breaks is required in order to know which procedure to favour over the MaxP procedure. It is also noteworthy that the mPBL procedure performs on par with the MaxP procedure, it appears that nothing is lost by first selecting the number of breaks based on the marginal distribution and then selecting lags conditional on the breaks.

Table 1 Number of breaks and lag lenghts. Base case, no structural breaks, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**80**	**1**	**1**	**82**
1	0	0	**9**	1	1	11
2	0	0	**6**	0	0	6
3	0	0	**1**	0	0	1
Sum	0	0	**96**	2	2	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**95**	**4**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**95**	4	1	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**91**	**2**	**1**	**94**
1	0	0	**4**	2	0	6
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**95**	4	1	100

Bold entries indicate correct choice of number of breaks and or lags

Table 2 Number of breaks and lag lenghts. Small level shift, $\beta_{2,0} = 1.5$, DGP 2a

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**64**	15	8	87
1	0	0	**1**	0	0	1
2	**0**	**0**	**12**	**0**	**0**	**12**
3	0	0	**0**	0	0	0
Sum	0	0	**77**	15	8	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**43**	5	4	52
1	0	0	**7**	2	0	9
2	**0**	**0**	**28**	**0**	**0**	**28**
3	0	0	**11**	0	0	11
Sum	0	0	**89**	7	4	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**64**	19	9	92
1	0	0	**0**	0	0	0
2	**0**	**0**	**8**	**0**	**0**	**8**
3	0	0	**0**	0	0	0
Sum	0	0	**72**	19	9	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**64**	16	8	88
1	0	0	**0**	0	0	0
2	**0**	**0**	**12**	**0**	**0**	**12**
3	0	0	**0**	0	0	0
Sum	0	0	**76**	16	8	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**67**	12	8	87
1	0	0	**1**	0	0	1
2	**0**	**0**	**12**	**0**	**0**	**12**
3	0	0	**0**	0	0	0
Sum	0	0	**80**	12	8	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**77**	12	7	96
1	0	0	**2**	0	0	2
2	**0**	**0**	**2**	**0**	**0**	**2**
3	0	0	**0**	0	0	0
Sum	0	0	**81**	12	7	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**8**	2	4	14
1	0	0	**12**	3	1	16
2	**0**	**0**	**59**	**8**	**3**	**70**
3	0	0	**0**	0	0	0
Sum	0	0	**79**	13	8	100

Bold entries indicate correct choice of number of breaks and or lags

Table 3 Number of breaks and lag lenghts. Medium level shift, $\beta_{2,0} = 1.75$, DGP 2b

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**6**	5	17	28
1	0	0	**0**	0	0	0
2	**0**	**0**	**72**	**0**	**0**	**72**
3	0	0	**0**	0	0	0
Sum	0	0	**78**	5	17	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**1**	0	2	3
1	0	0	**0**	0	0	0
2	**0**	**0**	**71**	**0**	**0**	**71**
3	0	0	**26**	0	0	26
Sum	0	0	**98**	0	2	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**6**	17	45	68
1	0	0	**0**	0	0	0
2	**0**	**0**	**8**	**15**	**9**	**32**
3	0	0	**0**	0	0	0
Sum	0	0	**14**	32	54	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**7**	6	18	31
1	0	0	**0**	0	0	0
2	**0**	**0**	**69**	**0**	**0**	**69**
3	0	0	**0**	0	0	0
Sum	0	0	**76**	6	18	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**6**	5	15	26
1	0	0	**0**	1	0	1
2	**0**	**0**	**73**	**0**	**0**	**73**
3	0	0	**0**	0	0	0
Sum	0	0	**79**	6	15	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**12**	7	5	24
1	0	0	**4**	0	0	4
2	**0**	**0**	**72**	**0**	**0**	**72**
3	0	0	**0**	0	0	0
Sum	0	0	**88**	7	5	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	1	1
1	0	0	**0**	2	5	7
2	**0**	**0**	**18**	**36**	**38**	**92**
3	0	0	**0**	0	0	0
Sum	0	0	**18**	38	44	100

Bold entries indicate correct choice of number of breaks and or lags

Table 4 Number of breaks and lag lenghts. Large level shift, $\beta_{2,0} = 2.0$, DGP 2c

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	3	3
1	0	0	**0**	0	0	0
2	**0**	**0**	**97**	**0**	**0**	**97**
3	0	0	**0**	0	0	0
Sum	0	0	**97**	0	3	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**74**	**0**	**0**	**74**
3	0	0	**26**	0	0	26
Sum	0	0	**100**	0	0	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	45	45
1	0	0	**0**	0	0	0
2	**0**	**0**	**0**	**9**	**46**	**55**
3	0	0	**0**	0	0	0
Sum	0	0	**0**	9	91	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	3	3
1	0	0	**0**	0	0	0
2	**0**	**0**	**97**	**0**	**0**	**97**
3	0	0	**0**	0	0	0
Sum	0	0	**97**	0	3	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	3	3
1	0	0	**0**	0	0	0
2	**0**	**0**	**97**	**0**	**0**	**97**
3	0	0	**0**	0	0	0
Sum	0	0	**97**	0	3	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**100**	**0**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**100**	0	0	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	1	8	9
2	**0**	**0**	**1**	**12**	**78**	**91**
3	0	0	**0**	0	0	0
Sum	0	0	**1**	13	86	100

Bold entries indicate correct choice of number of breaks and or lags

Table 5 Number of breaks and lag lenghts. Change in complex dynamics, DGP 3a

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**33**	2	6	41
1	0	0	**6**	0	0	6
2	**0**	**0**	**51**	**2**	**0**	**53**
3	0	0	**0**	0	0	0
Sum	0	0	**90**	4	6	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**33**	2	3	38
1	0	0	**17**	0	1	18
2	**0**	**0**	**39**	**2**	**0**	**41**
3	0	0	**3**	0	0	3
Sum	0	0	**92**	4	4	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**34**	7	8	49
1	0	0	**2**	3	1	6
2	**0**	**0**	**40**	**2**	**3**	**45**
3	0	0	**0**	0	0	0
Sum	0	0	**76**	12	12	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**33**	2	6	41
1	0	0	**6**	0	0	6
2	**0**	**0**	**51**	**2**	**0**	**53**
3	0	0	**0**	0	0	0
Sum	0	0	**90**	4	6	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**34**	2	6	42
1	0	0	**6**	0	0	6
2	**0**	**0**	**51**	**1**	**0**	**52**
3	0	0	**0**	0	0	0
Sum	0	0	**91**	3	6	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**79**	14	7	100
1	0	0	**0**	0	0	0
2	**0**	**0**	**0**	**0**	**0**	**0**
3	0	0	**0**	0	0	0
Sum	0	0	**79**	14	7	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**3**	0	2	5
1	0	0	**7**	2	0	9
2	**0**	**0**	**69**	**12**	**5**	**86**
3	0	0	**0**	0	0	0
Sum	0	0	**79**	14	7	100

Bold entries indicate correct choice of number of breaks and or lags

Table 6 Number of breaks and lag lenghts. Real dynamics, small change, DGP 3b.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**99**	**0**	**0**	**99**
3	0	0	**1**	0	0	1
Sum	0	0	**100**	0	0	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	32	32
1	0	0	**2**	1	5	8
2	**0**	**0**	**44**	**0**	**0**	**44**
3	0	0	**16**	0	0	16
Sum	0	0	**62**	1	37	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**1**	**0**	**0**	**1**	**98**	**100**
3	0	0	**0**	0	0	0
Sum	1	0	**0**	1	98	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**99**	**1**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**99**	1	0	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**99**	**0**	**0**	**99**
3	0	0	**1**	0	0	1
Sum	0	0	**100**	0	0	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	1	31	32
1	0	0	**1**	5	16	22
2	**0**	**0**	**27**	**16**	**3**	**46**
3	0	0	**0**	0	0	0
Sum	0	0	**28**	22	50	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	7	7
2	**1**	**1**	**0**	**1**	**90**	**93**
3	0	0	**0**	0	0	0
Sum	1	1	**0**	1	97	100

Bold entries indicate correct choice of number of breaks and or lags

Table 7 Number of breaks and lag lenghts. Real dynamics, medium change, DGP 3c.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**99**	**0**	**0**	**99**
3	0	0	**1**	0	0	1
Sum	0	0	**100**	0	0	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	2	2
1	0	0	**0**	0	0	0
2	**0**	**0**	**78**	**0**	**0**	**78**
3	0	0	**20**	0	0	20
Sum	0	0	**98**	0	2	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**0**	**0**	**100**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**0**	0	100	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**99**	**1**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**99**	1	0	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**99**	**0**	**0**	**99**
3	0	0	**1**	0	0	1
Sum	0	0	**100**	0	0	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	3	3
1	0	0	**1**	0	14	15
2	**0**	**0**	**69**	**10**	**3**	**82**
3	0	0	**0**	0	0	0
Sum	0	0	**70**	10	20	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	9	9
2	**0**	**0**	**0**	**0**	**91**	**91**
3	0	0	**0**	0	0	0
Sum	0	0	**0**	0	100	100

Bold entries indicate correct choice of number of breaks and or lags

Table 8 Number of breaks and lag lenghts. Real dynamics, large change, DGP 3d.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**99**	**0**	**0**	**99**
3	0	0	**1**	0	0	1
Sum	0	0	**100**	0	0	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**72**	**0**	**0**	**72**
3	0	0	**28**	0	0	28
Sum	0	0	**100**	0	0	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**0**	**0**	**100**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**0**	0	100	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**99**	**1**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**99**	1	0	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**99**	**0**	**0**	**99**
3	0	0	**1**	0	0	1
Sum	0	0	**100**	0	0	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**1**	0	19	20
2	**0**	**0**	**73**	**4**	**3**	**80**
3	0	0	**0**	0	0	0
Sum	0	0	**74**	4	22	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	8	8
2	**0**	**0**	**0**	**0**	**92**	**92**
3	0	0	**0**	0	0	0
Sum	0	0	**0**	0	100	100

Bold entries indicate correct choice of number of breaks and or lags

Table 9 Number of breaks and lag lenghts. Change in complex dynamics, level unaffected, DGP 4a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**53**	8	4	65
1	0	0	**5**	0	0	5
2	**0**	**0**	**30**	**0**	**0**	**30**
3	0	0	**0**	0	0	0
Sum	0	0	**88**	8	4	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**43**	6	2	51
1	0	0	**21**	2	2	25
2	**0**	**0**	**20**	**1**	**0**	**21**
3	0	0	**3**	0	0	3
Sum	0	0	**87**	9	4	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**53**	15	4	72
1	0	0	**3**	2	0	5
2	**0**	**0**	**20**	**2**	**1**	**23**
3	0	0	**0**	0	0	0
Sum	0	0	**76**	19	5	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**55**	9	4	68
1	0	0	**5**	0	0	5
2	**0**	**0**	**27**	**0**	**0**	**27**
3	0	0	**0**	0	0	0
Sum	0	0	**87**	9	4	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**53**	8	4	65
1	0	0	**5**	0	0	5
2	**0**	**0**	**30**	**0**	**0**	**30**
3	0	0	**0**	0	0	0
Sum	0	0	**88**	8	4	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**75**	19	5	99
1	0	0	**1**	0	0	1
2	**0**	**0**	**0**	**0**	**0**	**0**
3	0	0	**0**	0	0	0
Sum	0	0	**76**	19	5	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**7**	1	2	10
1	0	0	**13**	4	1	18
2	**0**	**0**	**56**	**14**	**2**	**72**
3	0	0	**0**	0	0	0
Sum	0	0	**76**	19	5	100

Bold entries indicate correct choice of number of breaks and or lags

Table 10 Number of breaks and lag lenghts. Real dynamics, small change, level unaffected, DGP 4b.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**100**	**0**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**100**	0	0	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	13	61	74
1	0	0	**1**	14	2	17
2	**0**	**0**	**7**	**0**	**0**	**7**
3	0	0	**2**	0	0	2
Sum	0	0	**10**	27	63	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**0**	**19**	**80**	**99**
3	0	0	**0**	0	1	1
Sum	0	0	**0**	19	81	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**100**	**0**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**100**	0	0	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**100**	**0**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**100**	0	0	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	22	62	84
1	0	0	**0**	2	6	8
2	**0**	**0**	**0**	**6**	**2**	**8**
3	0	0	**0**	0	0	0
Sum	0	0	**0**	30	70	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	7	7
2	**0**	**0**	**0**	**23**	**70**	**93**
3	0	0	**0**	0	0	0
Sum	0	0	**0**	23	77	100

Bold entries indicate correct choice of number of breaks and or lags

Table 11 Number of breaks and lag lenghts. Real dynamics, medium change, level unaffected, DGP 4c.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**100**	**0**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**100**	0	0	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	4	69	73
1	0	0	**1**	13	2	16
2	**0**	**0**	**8**	**0**	**0**	**8**
3	0	0	**3**	0	0	3
Sum	0	0	**12**	17	71	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**0**	**6**	**93**	**99**
3	0	0	**0**	0	1	1
Sum	0	0	**0**	6	94	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**100**	**0**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**100**	0	0	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**100**	**0**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**100**	0	0	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	13	65	78
1	0	0	**0**	4	7	11
2	**0**	**0**	**0**	**8**	**3**	**11**
3	0	0	**0**	0	0	0
Sum	0	0	**0**	25	75	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	7	7
2	**0**	**0**	**0**	**14**	**79**	**93**
3	0	0	**0**	0	0	0
Sum	0	0	**0**	14	86	100

Bold entries indicate correct choice of number of breaks and or lags

Table 12 Number of breaks and lag lenghts. Real dynamics, large change, level unaffected, DGP 4d.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**100**	**0**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**100**	0	0	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	1	68	69
1	0	0	**3**	10	2	15
2	**0**	**0**	**10**	**0**	**0**	**10**
3	0	0	**6**	0	0	6
Sum	0	0	**19**	11	70	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**0**	**3**	**96**	**99**
3	0	0	**0**	0	1	1
Sum	0	0	**0**	3	97	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**100**	**0**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**100**	0	0	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	0	0
2	**0**	**0**	**100**	**0**	**0**	**100**
3	0	0	**0**	0	0	0
Sum	0	0	**100**	0	0	100

BP-BIC: B-P break test, then BIC lag

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	5	64	69
1	0	0	**1**	4	7	12
2	**2**	**0**	**3**	**9**	**5**	**19**
3	0	0	**0**	0	0	0
Sum	2	0	**4**	18	76	100

BIC-BP: BIC lag, then B-P break test

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**0**	0	0	0
1	0	0	**0**	0	9	9
2	**0**	**0**	**0**	**5**	**86**	**91**
3	0	0	**0**	0	0	0
Sum	0	0	**0**	5	95	100

Bold entries indicate correct choice of number of breaks and or lags

1.2 Prior sensitivity

In order to investigate the sensitivity to changes in the prior specifications we consider variations on the priors for the number of breaks, r, the number of lags, p, and the regression parameters β_i. For the number of breaks and lags we consider priors of the form

$$\pi(r) \propto (r+1)^{-\delta_r}$$
$$\pi(p) \propto (p+1)^{-\delta_p}$$

with δ_r, $\delta_p = 0$, 1 or 2. $\delta = 0$ corresponds to our uniform priors in section 2.1 and $\delta > 0$ favours fewer breaks and shorter lag lengths. Results for the alternative priors with DGP 1 are in Tables 13 to 20, these should be compared with the results for the uniform prior in Table 1. There are no breaks in this DGP and increasing δ_r only affects the PBL procedure, which selects the number of breaks first, causing it to select to many breaks less frequently. Changing δ_r has also a very small effect on the selection of lags and breaks, the number of times the procedures select to long lags is reduced slightly and in no case do they select to short lags. The second set of results in Tables 21 to 28 is for DGP 3a with difficult to detect breaks with the results for the uniform prior in Table 5. The choice of δ_p has a relatively small effect on the already quite good selection of lags. Increasing δ_r, on the other hand, has a non-trivial effect on the selection of breaks. The frequency of selecting the correct number of breaks is reduced by 10% when δ_r is increased from 0 to 1 and again reduced by 10% when δ_r is increased from 1 to 2.

Turning to the prior for the regression parameters,

$$\beta_i|\sigma_i^2, p_i \sim N\left(\beta_0, \sigma_i^2 \mathbf{M}_0^{-1}\right),$$

we keep the prior mean of zero and study the effect of changes to the prior variance. In addition to our preferred setting $\mathbf{M}_0 = \mathbf{I}$, we set $\mathbf{M}_0 = c\mathbf{I}$ with $c = 0.1$ for a more uninformative prior, $c = 10$ for a tighter prior and $\mathbf{M}_0 = c\mathbf{L}$, with $c = 0.1$, 1, 10 and $\mathbf{L}$ the diagonal matrix

$$\mathbf{L} = \begin{pmatrix} 0.1 & & & \mathbf{0} \\ & 1 & & \\ & & 2 & \\ & & & \ddots \\ \mathbf{0} & & & p \end{pmatrix}$$

for a Litterman-type prior which is tighter around the prior mean of zero for higher lags. The results for DGP 1 are in Tables 29 to 33. Compared to the results for $\mathbf{M}_0 = \mathbf{I}$ in Table 1, the more disperse priors with $c = 0.1$ give similar results whereas the tighter prior with $c = 10$ leads to the selection of higher lag lengths while still selecting the number of breaks correctly. The Litterman type prior with $\mathbf{M}_0 = c\mathbf{L}$ also leads to the selection of higher lags lengths and thus to a lower frequency of correct break and lag selection. The effect of the prior specification is larger with DGP 3a (see Tables 34 to 38). Setting $c = 0.1$ leads to an increased selection of zero breaks instead of two breaks but has little effect on the choice of lag length compared to Table 5. Choosing $c = 10$ increases the selection of zero breaks even more and also increases the selection of larger lag lengths. Increasing the tightness of the prior (using $\mathbf{L}$ instead of $\mathbf{I}$) hardly affects the selection of

breaks and lags for $c = 0.1$ and 1. With $c = 10$ there is a trade off between high lags and a larger number of breaks and the maximum lag is selected less frequently coupled with more frequent selection of two breaks.

Table 13 Number of breaks and lag lenghts. $\delta_r = 0$, $\delta_p = 1$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**82**	**0**	**0**	**82**
1	0	0	**10**	0	1	11
2	0	0	**6**	0	0	6
3	0	0	**1**	0	0	1
Sum	0	0	**99**	0	1	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

Bold entries indicate correct choice of number of breaks and or lags

Table 14 Number of breaks and lag lenghts. $\delta_r = 0$, $\delta_p = 2$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**82**	**0**	**0**	**82**
1	0	0	**10**	0	1	11
2	0	0	**6**	0	0	6
3	0	0	**1**	0	0	1
Sum	0	0	**99**	0	1	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

Bold entries indicate correct choice of number of breaks and or lags

Table 15 Number of breaks and lag lenghts. $\delta_r = 1$, $\delta_p = 0$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**87**	**1**	**2**	**90**
1	0	0	**8**	1	0	9
2	0	0	**1**	0	0	1
3	0	0	**0**	0	0	0
Sum	0	0	**96**	2	2	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

Bold entries indicate correct choice of number of breaks and or lags

Table 16 Number of breaks and lag lenghts. $\delta_r = 1$, $\delta_p = 1$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**89**	**0**	**1**	**90**
1	0	0	**9**	0	0	9
2	0	0	**1**	0	0	1
3	0	0	**0**	0	0	0
Sum	0	0	**99**	0	1	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

Bold entries indicate correct choice of number of breaks and or lags

Table 17 Number of breaks and lag lenghts. $\delta_r = 1$, $\delta_p = 2$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**89**	**0**	**1**	**90**
1	0	0	**9**	0	0	9
2	0	0	**1**	0	0	1
3	0	0	**0**	0	0	0
Sum	0	0	**99**	0	1	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

Bold entries indicate correct choice of number of breaks and or lags

Table 18 Number of breaks and lag lenghts. $\delta_r = 2$, $\delta_p = 0$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**90**	**3**	**2**	**95**
1	0	0	**4**	0	0	4
2	0	0	**1**	0	0	1
3	0	0	**0**	0	0	0
Sum	0	0	**95**	3	2	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**94**	**4**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**94**	4	2	100

Bold entries indicate correct choice of number of breaks and or lags

Table 19 Number of breaks and lag lenghts. $\delta_r = 2$, $\delta_p = 1$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**92**	**2**	**1**	**95**
1	0	0	**4**	0	0	4
2	0	0	**1**	0	0	1
3	0	0	**0**	0	0	0
Sum	0	0	**97**	2	1	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

Bold entries indicate correct choice of number of breaks and or lags

Table 20 Number of breaks and lag lenghts. $\delta_r = 2$, $\delta_p = 2$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**93**	**1**	**1**	**95**
1	0	0	**4**	0	0	4
2	0	0	**1**	0	0	1
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**98**	**1**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**98**	1	1	100

Bold entries indicate correct choice of number of breaks and or lags

Table 21 Number of breaks and lag lenghts. $\delta_r = 0$, $\delta_p = 1$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**34**	2	6	42
1	0	0	**6**	0	0	6
2	**0**	**0**	**52**	**0**	**0**	**52**
3	0	0	**0**	0	0	0
Sum	0	0	**92**	2	6	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**34**	2	2	38
1	0	0	**17**	0	1	18
2	**0**	**0**	**40**	**1**	**0**	**41**
3	0	0	**3**	0	0	3
Sum	0	0	**94**	3	3	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**34**	7	7	48
1	0	0	**4**	2	0	6
2	**0**	**0**	**41**	**2**	**3**	**46**
3	0	0	**0**	0	0	0
Sum	0	0	**79**	11	10	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**33**	2	6	41
1	0	0	**6**	0	0	6
2	**0**	**0**	**52**	**1**	**0**	**53**
3	0	0	**0**	0	0	0
Sum	0	0	**91**	3	6	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**36**	0	3	39
1	0	0	**6**	0	0	6
2	**0**	**0**	**55**	**0**	**0**	**55**
3	0	0	**0**	0	0	0
Sum	0	0	**97**	0	3	100

Bold entries indicate correct choice of number of breaks and or lags

Table 22 Number of breaks and lag lenghts. $\delta_r = 0$, $\delta_p = 2$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**36**	1	3	40
1	0	0	**6**	0	0	6
2	**0**	**0**	**54**	**0**	**0**	**54**
3	0	0	**0**	0	0	0
Sum	0	0	**96**	1	3	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**35**	1	2	38
1	0	0	**17**	0	1	18
2	**0**	**0**	**40**	**1**	**0**	**41**
3	0	0	**3**	0	0	3
Sum	0	0	**95**	2	3	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**36**	4	6	46
1	0	0	**4**	2	0	6
2	**0**	**0**	**44**	**4**	**0**	**48**
3	0	0	**0**	0	0	0
Sum	0	0	**84**	10	6	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**35**	1	5	41
1	0	0	**6**	0	0	6
2	**0**	**0**	**52**	**1**	**0**	**53**
3	0	0	**0**	0	0	0
Sum	0	0	**93**	2	5	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**36**	0	3	39
1	0	0	**6**	0	0	6
2	**0**	**0**	**55**	**0**	**0**	**55**
3	0	0	**0**	0	0	0
Sum	0	0	**97**	0	3	100

Bold entries indicate correct choice of number of breaks and or lags

Table 23 Number of breaks and lag lenghts. $\delta_r = 1$, $\delta_p = 0$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**42**	3	6	51
1	0	0	**6**	0	0	6
2	**0**	**0**	**42**	**1**	**0**	**43**
3	0	0	**0**	0	0	0
Sum	0	0	**90**	4	6	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**39**	5	5	49
1	0	0	**16**	0	1	17
2	**0**	**0**	**30**	**2**	**0**	**32**
3	0	0	**2**	0	0	2
Sum	0	0	**87**	7	6	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**42**	7	9	58
1	0	0	**2**	3	1	6
2	**0**	**0**	**32**	**2**	**2**	**36**
3	0	0	**0**	0	0	0
Sum	0	0	**76**	12	12	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**42**	4	7	53
1	0	0	**5**	0	0	5
2	**0**	**0**	**41**	**1**	**0**	**42**
3	0	0	**0**	0	0	0
Sum	0	0	**88**	5	7	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**42**	2	6	50
1	0	0	**6**	0	0	6
2	**0**	**0**	**43**	**1**	**0**	**44**
3	0	0	**0**	0	0	0
Sum	0	0	**91**	3	6	100

Bold entries indicate correct choice of number of breaks and or lags

Table 24 Number of breaks and lag lenghts. $\delta_r = 1$, $\delta_p = 1$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**42**	2	6	50
1	0	0	**6**	0	0	6
2	**0**	**0**	**44**	**0**	**0**	**44**
3	0	0	**0**	0	0	0
Sum	0	0	**92**	2	6	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**40**	5	4	49
1	0	0	**16**	0	1	17
2	**0**	**0**	**31**	**1**	**0**	**32**
3	0	0	**2**	0	0	2
Sum	0	0	**89**	6	5	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**42**	7	8	57
1	0	0	**4**	2	0	6
2	**0**	**0**	**33**	**2**	**2**	**37**
3	0	0	**0**	0	0	0
Sum	0	0	**79**	11	10	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**43**	4	6	53
1	0	0	**5**	0	0	5
2	**0**	**0**	**42**	**0**	**0**	**42**
3	0	0	**0**	0	0	0
Sum	0	0	**90**	4	6	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**43**	2	5	50
1	0	0	**6**	0	0	6
2	**0**	**0**	**43**	**1**	**0**	**44**
3	0	0	**0**	0	0	0
Sum	0	0	**92**	3	5	100

Bold entries indicate correct choice of number of breaks and or lags

Table 25 Number of breaks and lag lenghts. $\delta_r = 1$, $\delta_p = 2$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**44**	1	5	50
1	0	0	**6**	0	0	6
2	**0**	**0**	**44**	**0**	**0**	**44**
3	0	0	**0**	0	0	0
Sum	0	0	**94**	1	5	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**44**	2	3	49
1	0	0	**16**	0	1	17
2	**0**	**0**	**31**	**1**	**0**	**32**
3	0	0	**2**	0	0	2
Sum	0	0	**93**	3	4	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**44**	4	6	54
1	0	0	**4**	2	0	6
2	**0**	**0**	**36**	**4**	**0**	**40**
3	0	0	**0**	0	0	0
Sum	0	0	**84**	10	6	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**46**	1	5	52
1	0	0	**6**	0	0	6
2	**0**	**0**	**42**	**0**	**0**	**42**
3	0	0	**0**	0	0	0
Sum	0	0	**94**	1	5	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**45**	1	4	50
1	0	0	**6**	0	0	6
2	**0**	**0**	**44**	**0**	**0**	**44**
3	0	0	**0**	0	0	0
Sum	0	0	**95**	1	4	100

Bold entries indicate correct choice of number of breaks and or lags

Table 26 Number of breaks and lag lenghts. $\delta_r = 2$, $\delta_p = 0$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**49**	6	7	62
1	0	0	**4**	0	0	4
2	**0**	**0**	**34**	**0**	**0**	**34**
3	0	0	**0**	0	0	0
Sum	0	0	**87**	6	7	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**47**	7	8	62
1	0	0	**16**	0	1	17
2	**0**	**0**	**21**	**0**	**0**	**21**
3	0	0	**0**	0	0	0
Sum	0	0	**84**	7	9	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**49**	8	9	66
1	0	0	**1**	3	1	5
2	**0**	**0**	**26**	**1**	**2**	**29**
3	0	0	**0**	0	0	0
Sum	0	0	**76**	12	12	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**49**	7	7	63
1	0	0	**4**	0	0	4
2	**0**	**0**	**33**	**0**	**0**	**33**
3	0	0	**0**	0	0	0
Sum	0	0	**86**	7	7	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**51**	4	6	61
1	0	0	**5**	0	0	5
2	**0**	**0**	**34**	**0**	**0**	**34**
3	0	0	**0**	0	0	0
Sum	0	0	**90**	4	6	100

Bold entries indicate correct choice of number of breaks and or lags

Table 27 Number of breaks and lag lenghts. $\delta_r = 2$, $\delta_p = 1$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**50**	6	6	62
1	0	0	**4**	0	0	4
2	**0**	**0**	**34**	**0**	**0**	**34**
3	0	0	**0**	0	0	0
Sum	0	0	**88**	6	6	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**48**	7	7	62
1	0	0	**16**	0	1	17
2	**0**	**0**	**21**	**0**	**0**	**21**
3	0	0	**0**	0	0	0
Sum	0	0	**85**	7	8	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**50**	8	8	66
1	0	0	**3**	2	0	5
2	**0**	**0**	**26**	**1**	**2**	**29**
3	0	0	**0**	0	0	0
Sum	0	0	**79**	11	10	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**50**	6	6	62
1	0	0	**4**	0	0	4
2	**0**	**0**	**34**	**0**	**0**	**34**
3	0	0	**0**	0	0	0
Sum	0	0	**88**	6	6	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**51**	4	6	61
1	0	0	**5**	0	0	5
2	**0**	**0**	**34**	**0**	**0**	**34**
3	0	0	**0**	0	0	0
Sum	0	0	**90**	4	6	100

Bold entries indicate correct choice of number of breaks and or lags

Table 28 Number of breaks and lag lenghts. $\delta_r = 2$, $\delta_p = 2$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**53**	3	5	61
1	0	0	**5**	0	0	5
2	**0**	**0**	**34**	**0**	**0**	**34**
3	0	0	**0**	0	0	0
Sum	0	0	**92**	3	5	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**53**	4	5	62
1	0	0	**16**	0	1	17
2	**0**	**0**	**21**	**0**	**0**	**21**
3	0	0	**0**	0	0	0
Sum	0	0	**90**	4	6	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**53**	5	6	64
1	0	0	**3**	2	0	5
2	**0**	**0**	**28**	**3**	**0**	**31**
3	0	0	**0**	0	0	0
Sum	0	0	**84**	10	6	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**53**	4	5	62
1	0	0	**4**	0	0	4
2	**0**	**0**	**34**	**0**	**0**	**34**
3	0	0	**0**	0	0	0
Sum	0	0	**91**	4	5	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**54**	2	5	61
1	0	0	**5**	0	0	5
2	**0**	**0**	**34**	**0**	**0**	**34**
3	0	0	**0**	0	0	0
Sum	0	0	**93**	2	5	100

Bold entries indicate correct choice of number of breaks and or lags

Table 29 Number of breaks and lag lenghts. $\mathbf{M}_0 = 0.1\mathbf{I}$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**99**	**0**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**99**	0	1	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**90**	**0**	**1**	**91**
1	0	0	**8**	0	0	8
2	0	0	**1**	0	0	1
3	0	0	**0**	0	0	0
Sum	0	0	**99**	0	1	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**99**	**0**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**99**	0	1	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**99**	**0**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**99**	0	1	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**99**	**0**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**99**	0	1	100

Bold entries indicate correct choice of number of breaks and or lags

Table 30 Number of breaks and lag lenghts. $\mathbf{M}_0 = 10\mathbf{I}$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**82**	**3**	**15**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**82**	3	15	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**79**	**3**	**14**	**96**
1	0	0	**3**	0	1	4
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**82**	3	15	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**82**	**3**	**15**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**82**	3	15	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**82**	**3**	**15**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**82**	3	15	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**82**	**3**	**15**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**82**	3	15	100

Bold entries indicate correct choice of number of breaks and or lags

Table 31 Number of breaks and lag lenghts. $\mathbf{M}_0 = 0.1\mathbf{L}$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**93**	**2**	**1**	**96**
1	0	0	**4**	0	0	4
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**97**	2	1	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**96**	**3**	**1**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**96**	3	1	100

Bold entries indicate correct choice of number of breaks and or lags

Table 32 Number of breaks and lag lenghts. $\mathbf{M}_0 = \mathbf{L}$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**92**	**6**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**92**	6	2	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**86**	**3**	**2**	**91**
1	0	0	**7**	0	1	8
2	0	0	**1**	0	0	1
3	0	0	**0**	0	0	0
Sum	0	0	**94**	3	3	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**92**	**6**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**92**	6	2	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**92**	**6**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**92**	6	2	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**92**	**6**	**2**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**92**	6	2	100

Bold entries indicate correct choice of number of breaks and or lags

Table 33 Number of breaks and lag lenghts. $\mathbf{M}_0 = 10\mathbf{L}$, DGP 1.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**56**	**30**	**14**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**56**	30	14	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**47**	**24**	**11**	**82**
1	0	0	**4**	3	4	11
2	0	0	**0**	5	1	6
3	0	0	**1**	0	0	1
Sum	0	0	**52**	32	16	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**56**	**30**	**14**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**56**	30	14	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**56**	**30**	**14**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**56**	30	14	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	**0**	**0**	**56**	**30**	**14**	**100**
1	0	0	**0**	0	0	0
2	0	0	**0**	0	0	0
3	0	0	**0**	0	0	0
Sum	0	0	**56**	30	14	100

Bold entries indicate correct choice of number of breaks and or lags

Table 34 Number of breaks and lag lenghts. $\mathbf{M}_0 = 0.1\mathbf{I}$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**64**	3	2	69
1	0	0	**7**	0	0	7
2	**0**	**0**	**24**	**0**	**0**	**24**
3	0	0	**0**	0	0	0
Sum	0	0	**95**	3	2	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**46**	2	1	49
1	0	0	**16**	0	1	17
2	**0**	**0**	**32**	**0**	**0**	**32**
3	0	0	**2**	0	0	2
Sum	0	0	**96**	2	2	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**64**	6	2	72
1	0	0	**6**	0	0	6
2	**0**	**0**	**21**	**1**	**0**	**22**
3	0	0	**0**	0	0	0
Sum	0	0	**91**	7	2	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**64**	3	2	69
1	0	0	**7**	0	0	7
2	**0**	**0**	**24**	**0**	**0**	**24**
3	0	0	**0**	0	0	0
Sum	0	0	**95**	3	2	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**64**	2	2	68
1	0	0	**7**	0	0	7
2	**0**	**0**	**25**	**0**	**0**	**25**
3	0	0	**0**	0	0	0
Sum	0	0	**96**	2	2	100

Bold entries indicate correct choice of number of breaks and or lags

Table 35 Number of breaks and lag lenghts. $\mathbf{M}_0 = 10\mathbf{I}$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**42**	3	49	94
1	0	0	**2**	0	1	3
2	**0**	**0**	**2**	**1**	**0**	**3**
3	0	0	**0**	0	0	0
Sum	0	0	**46**	4	50	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**33**	2	42	77
1	0	0	**12**	0	9	21
2	**0**	**0**	**1**	**0**	**1**	**2**
3	0	0	**0**	0	0	0
Sum	0	0	**46**	2	52	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**42**	3	50	95
1	0	0	**1**	0	2	3
2	**0**	**0**	**2**	**0**	**0**	**2**
3	0	0	**0**	0	0	0
Sum	0	0	**45**	3	52	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**42**	3	49	94
1	0	0	**2**	0	1	3
2	**0**	**0**	**2**	**1**	**0**	**3**
3	0	0	**0**	0	0	0
Sum	0	0	**46**	4	50	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**41**	3	50	94
1	0	0	**2**	0	1	3
2	**0**	**0**	**1**	**1**	**1**	**3**
3	0	0	**0**	0	0	0
Sum	0	0	**44**	4	52	100

Bold entries indicate correct choice of number of breaks and or lags

Table 36 Number of breaks and lag lenghts. $\mathbf{M}_0 = 0.1\mathbf{L}$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**59**	7	5	71
1	0	0	**7**	0	0	7
2	**0**	**0**	**22**	**0**	**0**	**22**
3	0	0	**0**	0	0	0
Sum	0	0	**88**	7	5	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**56**	8	5	69
1	0	0	**17**	0	1	18
2	**0**	**0**	**13**	**0**	**0**	**13**
3	0	0	**0**	0	0	0
Sum	0	0	**86**	8	6	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**59**	12	6	77
1	0	0	**5**	0	0	5
2	**0**	**0**	**17**	**1**	**0**	**18**
3	0	0	**0**	0	0	0
Sum	0	0	**81**	13	6	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**61**	8	5	74
1	0	0	**6**	0	0	6
2	**0**	**0**	**20**	**0**	**0**	**20**
3	0	0	**0**	0	0	0
Sum	0	0	**87**	8	5	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**59**	7	5	71
1	0	0	**7**	0	0	7
2	**0**	**0**	**22**	**0**	**0**	**22**
3	0	0	**0**	0	0	0
Sum	0	0	**88**	7	5	100

Bold entries indicate correct choice of number of breaks and or lags

Table 37 Number of breaks and lag lenghts. $\mathbf{M}_0 = \mathbf{L}$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**32**	4	7	43
1	0	0	**5**	1	0	6
2	**0**	**0**	**49**	**2**	**0**	**51**
3	0	0	**0**	0	0	0
Sum	0	0	**86**	7	7	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**33**	8	8	49
1	0	0	**15**	1	1	17
2	**0**	**0**	**30**	**2**	**0**	**32**
3	0	0	**2**	0	0	2
Sum	0	0	**80**	11	9	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**33**	5	11	49
1	0	0	**2**	3	2	7
2	**0**	**0**	**32**	**8**	**4**	**44**
3	0	0	**0**	0	0	0
Sum	0	0	**67**	16	17	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**34**	5	8	47
1	0	0	**5**	0	0	5
2	**0**	**0**	**45**	**2**	**0**	**47**
3	0	0	**1**	0	0	1
Sum	0	0	**85**	7	8	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**32**	5	7	44
1	0	0	**5**	1	0	6
2	**0**	**0**	**48**	**2**	**0**	**50**
3	0	0	**0**	0	0	0
Sum	0	0	**85**	8	7	100

Bold entries indicate correct choice of number of breaks and or lags

Table 38 Number of breaks and lag lenghts. $\mathbf{M}_0 = 10\mathbf{L}$, DGP 3a.

MaxP: Max posterior probability

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**24**	19	34	77
1	0	0	**0**	0	2	2
2	**0**	**0**	**6**	**10**	**4**	**20**
3	0	0	**1**	0	0	1
Sum	0	0	**31**	29	40	100

PBL: Breaks by cond. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**13**	8	17	38
1	0	0	**6**	3	9	18
2	**0**	**0**	**10**	**19**	**12**	**41**
3	0	0	**1**	1	1	3
Sum	0	0	**30**	31	39	100

PLB: Lags by cond. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**25**	19	35	79
1	0	0	**0**	1	1	2
2	**0**	**0**	**4**	**3**	**12**	**19**
3	0	0	**0**	0	0	0
Sum	0	0	**29**	23	48	100

mPBL: Breaks by marg. posterior, then lags

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**24**	19	35	78
1	0	0	**0**	0	2	2
2	**0**	**0**	**6**	**10**	**3**	**19**
3	0	0	**1**	0	0	1
Sum	0	0	**31**	29	40	100

mPLB: Lags by marg. posterior, then breaks

$r\backslash p$	0	1	2	3	4	Sum
0	0	0	**26**	19	33	78
1	0	0	**0**	0	2	2
2	**0**	**0**	**6**	**9**	**4**	**19**
3	0	0	**0**	1	0	1
Sum	0	0	**32**	29	39	100

Bold entries indicate correct choice of number of breaks and or lags

References

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