MN Income Tax Withholding Forecast Methodology

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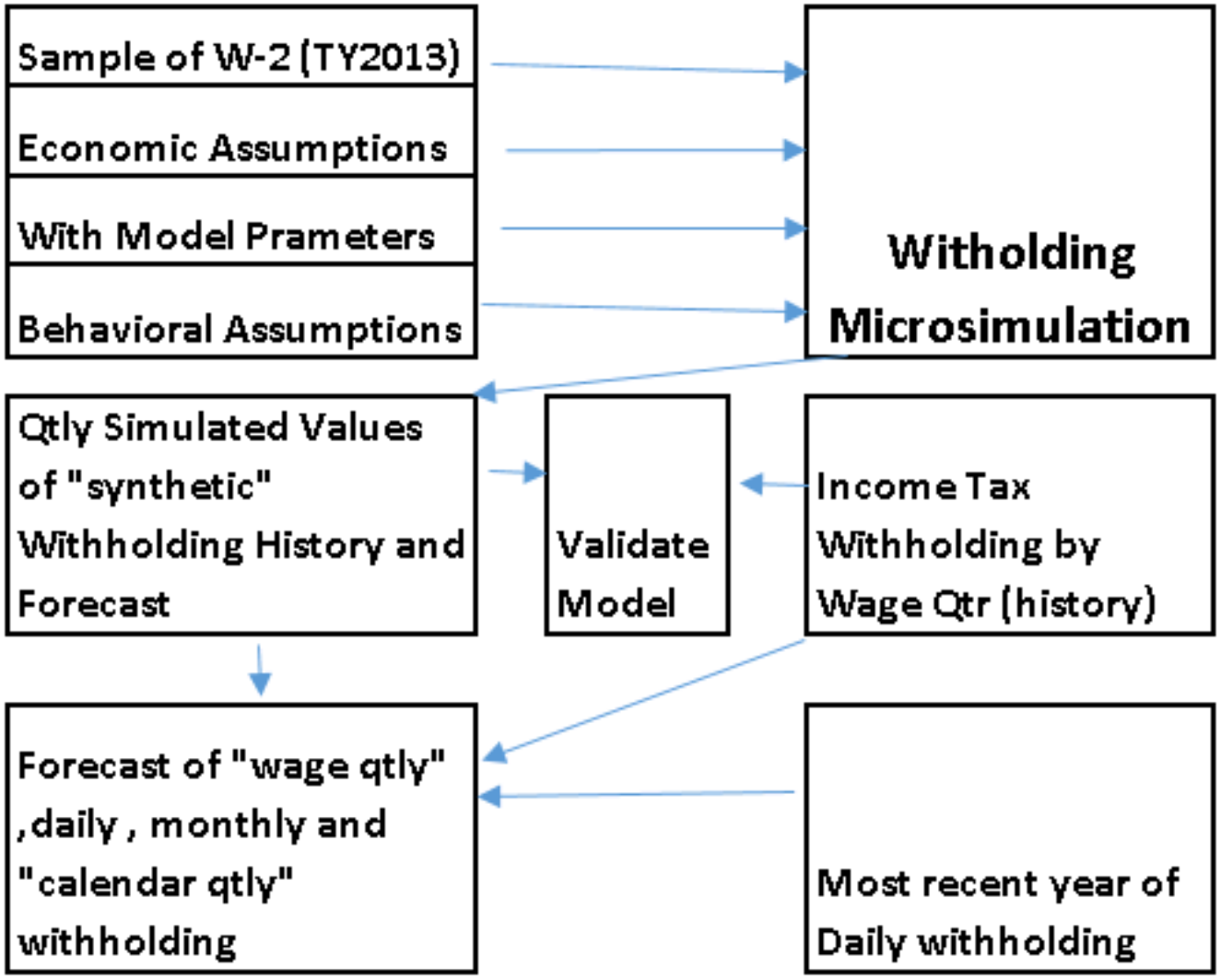
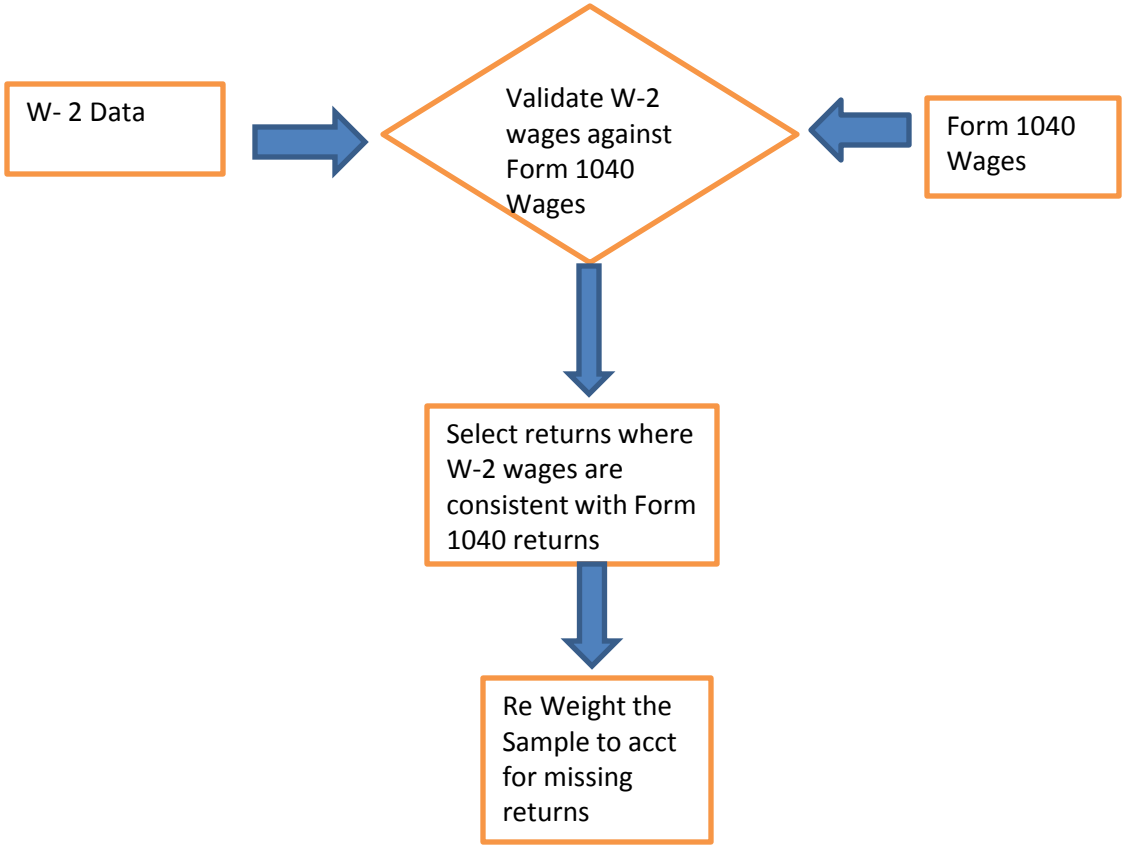
Benefits of the MMB Income Tax Withholding Model

- Income Tax Withholding is the state of MN's largest stream of revenue; obviously it is useful to have an explicit model of it.
- Wages are the largest part of the tax base – the model allows one to estimate Y/Y wage growth within two weeks of quarters end as opposed to waiting 3 to 4 months- this can be very useful in knowing the "starting point" for a wage forecast.
- Withholding model is useful in determining the timing of a law changes. This may impact the FY or Biennial allocation of a law change.
- It forces us to be cognizant of calendar "effects"; for example in CY 2015 there were effectively 53 Fridays (Dec 31 was Thursday so many who would normally be paid on Friday were paid on Thursday) which we believe had the effect of raising income tax liability idiosyncratically in TY2015.
- During the 2001 recession it helped us make the call that Q/Q nominal wages were declining long before BEA or major forecasters made the call. (Nominal wages had only declined once in '58 and in once in '70 prior to that.)

Withholding Model Overview



Select Returns with valid wages on W-2



Apply Econ Assumptions to “age” and Forecast the Withholding Sample

- The Sample is for a given year (current year is 2013).
- The W-2 wages for each taxpayer are “aged” back quarterly to 1995, “aged” forward to the current quarter and forecast for future quarters
- The QCEW wage data (NSA) and the CES (NSA) employment data are used to age the data.
- Wages for each quarter for each worker/taxpayer are assumed to grow at the Y/Y % ch in Average Wage.
- The number of wage earner/ taxpayers are assumed to grow at the rate of Y/Y% ch in employment.

Micro-Simulation Parameters

- MN Withholding tables for every quarter going back 1995Q3
- Option to raise or lower number of dependents claimed
- Option to treat those having multiples W-2's as having "effectively" held one Job or having 2 held 2 jobs in the year
- Option for taxpayers to use married table or single table regardless of filing status.
- Parameters are applied uniformly to all returns by filing status, in the case of married/single tables parameters weights are used so if half of two earner couples are assumed to use single tables and half use married tables their withholding will be computed as the average of the withholding generated from single and married tables.

Behavioral Assumptions to Generate Synthetic Withholding

- Synthetic Withholding is the quarterly estimate of withholding (1995q3 – Present) that results from applying the Withholding Microsimulation Parameters to the Aged Sample of W-2's
- The microsimulation assumptions used are:
- Taxpayers claim one less dependent than entitled to.
- Taxpayers with multiple W-2's held one job at a time during the year.
- 50% of married couples that have 2 earners elect to be withheld at a higher single rate and 50% at the lower married rate. Singles are assumed to all use single table.

Adjust Accounting Data to Match Wage Withholding as close as possible

+ Quarterly Accounting Data On Withholding
- Entertainer Tax Withholding
- Non Resident “S” and P’ship withholding
- Lottery Withholding
- Unemployment Insurance Withholding
- Major S&L Public Pension Benefit Withholding

= Approximate Wage Related Withholding

Adjust Withholding Quarter to Match the “Wage Quarter”

- Quarterly Economic Wages are generally measured on the basis of when paid.
- Withholding remittances on Wages typically occur between 3 and 7 days after paid. This can cause a mismatch between withholding for wages paid in the Quarter and withholding paid in the calendar quarter.
- The mismatch can exceed 100 million $.
- By looking at daily withholding collections and paying attention to Fridays, and last weekday of month (typical paydays) one can estimate the amount of withholding in one quarter attributed to wages paid in a prior quarter.
- Sometimes withholding from two different wage quarters will be due on the same day. Allocate the withholding between the wage quarters on the basis of past patterns.
- The Result is: Adjusted Withholding per Accounting System (AWAS)

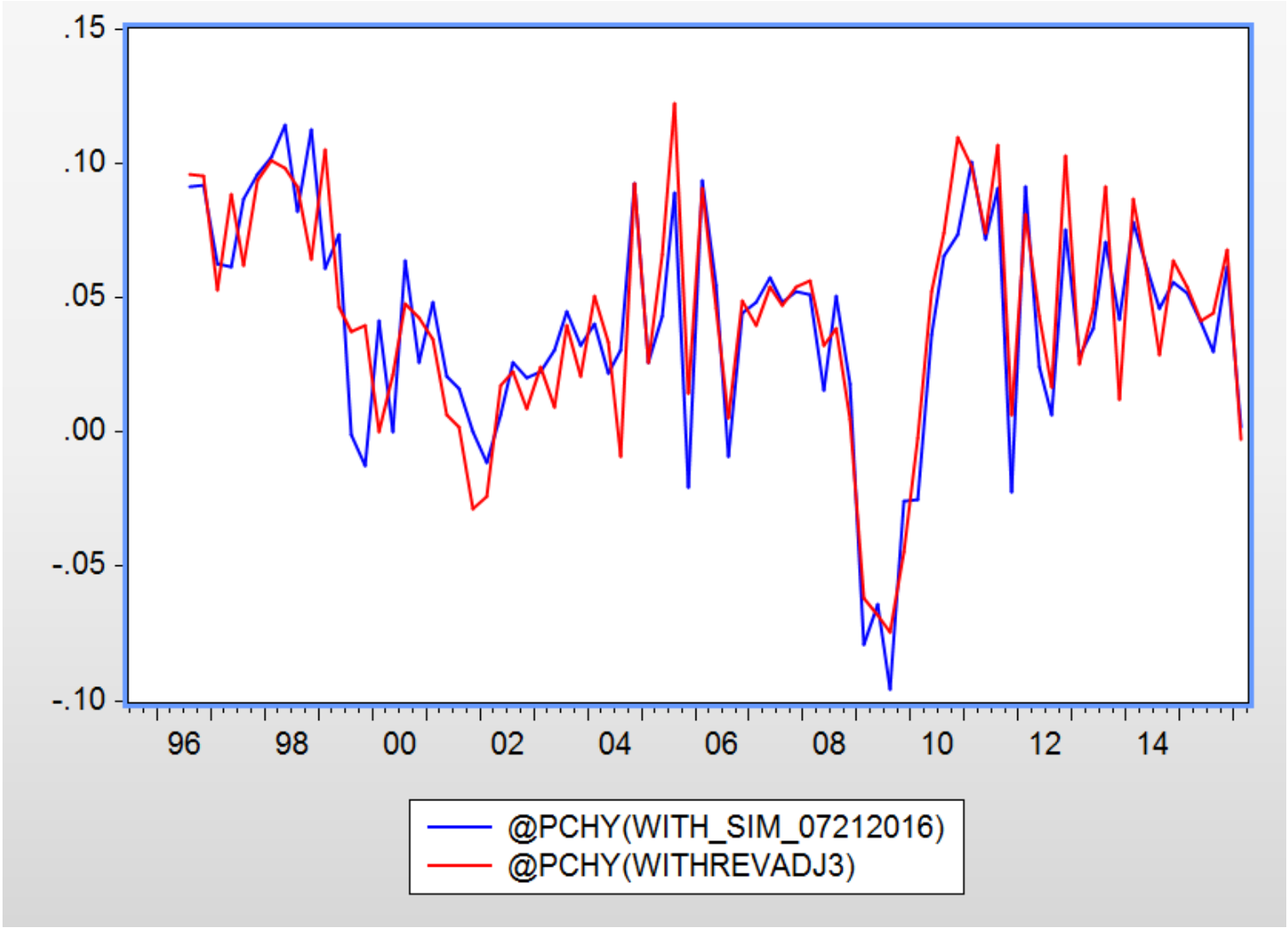
Adjusting Withholding Data for “Timing” and “Non Wage Withholding” Improves the Match against QCEW Wages

- A Simple log difference regression of “adjusted withholding” on the log difference of QCEW wages yields an RSQ of .825 in contrast the same regression of “not adjusted” withholding and QCEW wages yields and RSQ of .227

- A Simple log difference regression *4 quarters apart* of “adjusted withholding” on the log difference of QCEW wages yields and RSQ of .611 in contrast the same regression of “not adjusted” withholding and QCEW wages yields an RSQ of .471

Validate Model

Validate Synthetic Withholding - Graph of Y/Y Quarterly Synthetic Withholding vs Adjusted Withholding



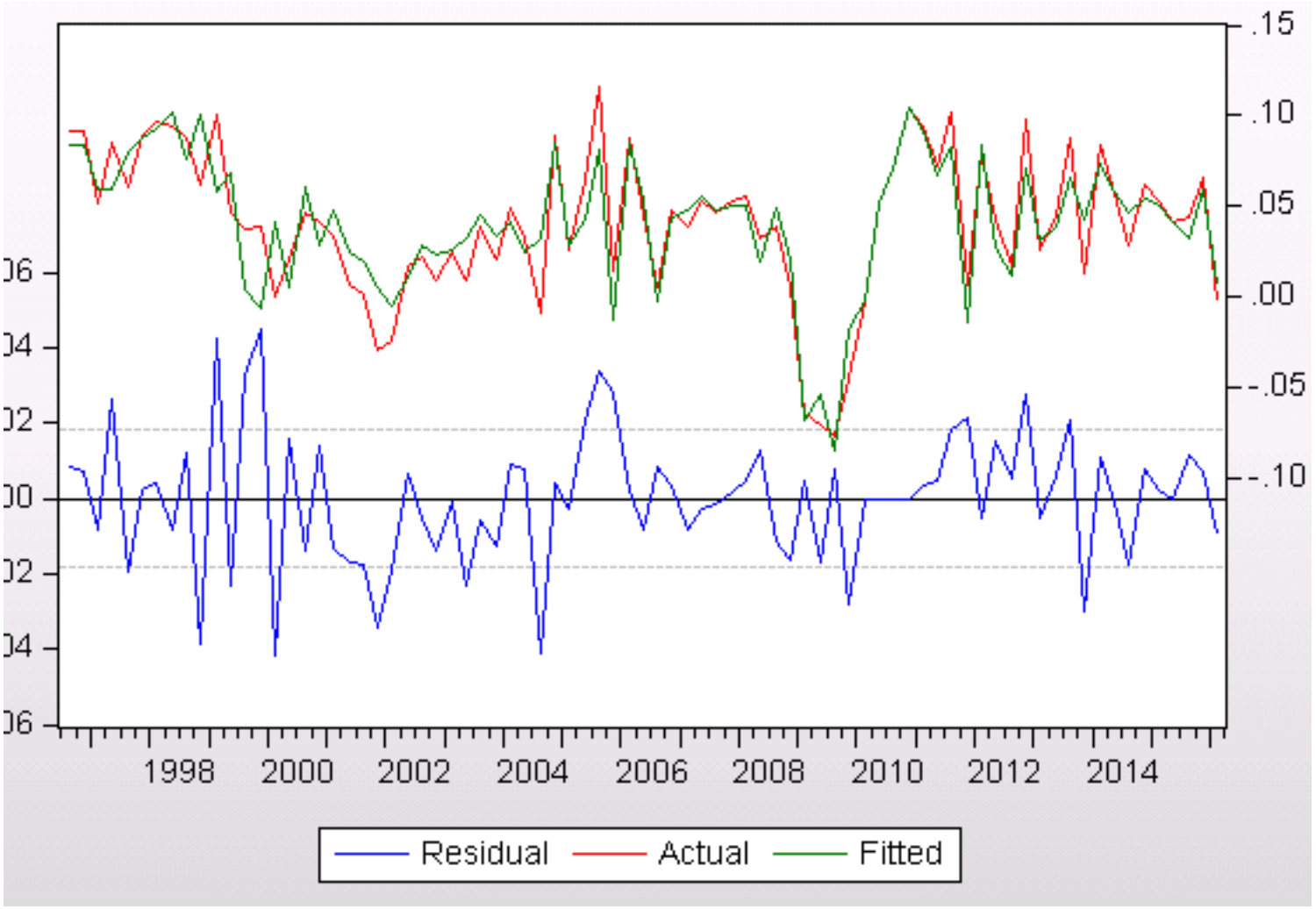
Reg (1) Adjusted Withholding on Synthetic Withholding and Dummy for Reciprocity Change (Qtly Y/Y log differences)

Dependent Variable: LOG(WITHREVADJ3)-LOG(WITHREVADJ3(-4))
Method: Least Squares
Date: 10/01/16 Time: 08:35
Sample (adjusted): 1996Q3 2016Q1
Included observations: 79 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(WITH_SIM_07212016)-LOG(WITH_S...	0.893867	0.051588	17.32690	0.0000
WRECIPD10Q1	0.014939	0.018643	0.801321	0.4255
WRECIPD10Q2	0.013777	0.018347	0.750946	0.4551
WRECIPD10Q3	0.009219	0.018390	0.501303	0.6177
WRECIPD10Q4	0.035440	0.018420	1.924023	0.0583
C	0.005325	0.002904	1.833602	0.0708

R-squared	0.814769	Mean dependent var	0.040806
Adjusted R-squared	0.802082	S.D. dependent var	0.040966
S.E. of regression	0.018225	Akaike info criterion	-5.099146
Sum squared resid	0.024247	Schwarz criterion	-4.919188
Log likelihood	207.4163	Hannan-Quinn criter.	-5.027049
F-statistic	64.22057	Durbin-Watson stat	2.342012
Prob(F-statistic)	0.000000		

Reg (1) Residual, Actual, Fitted



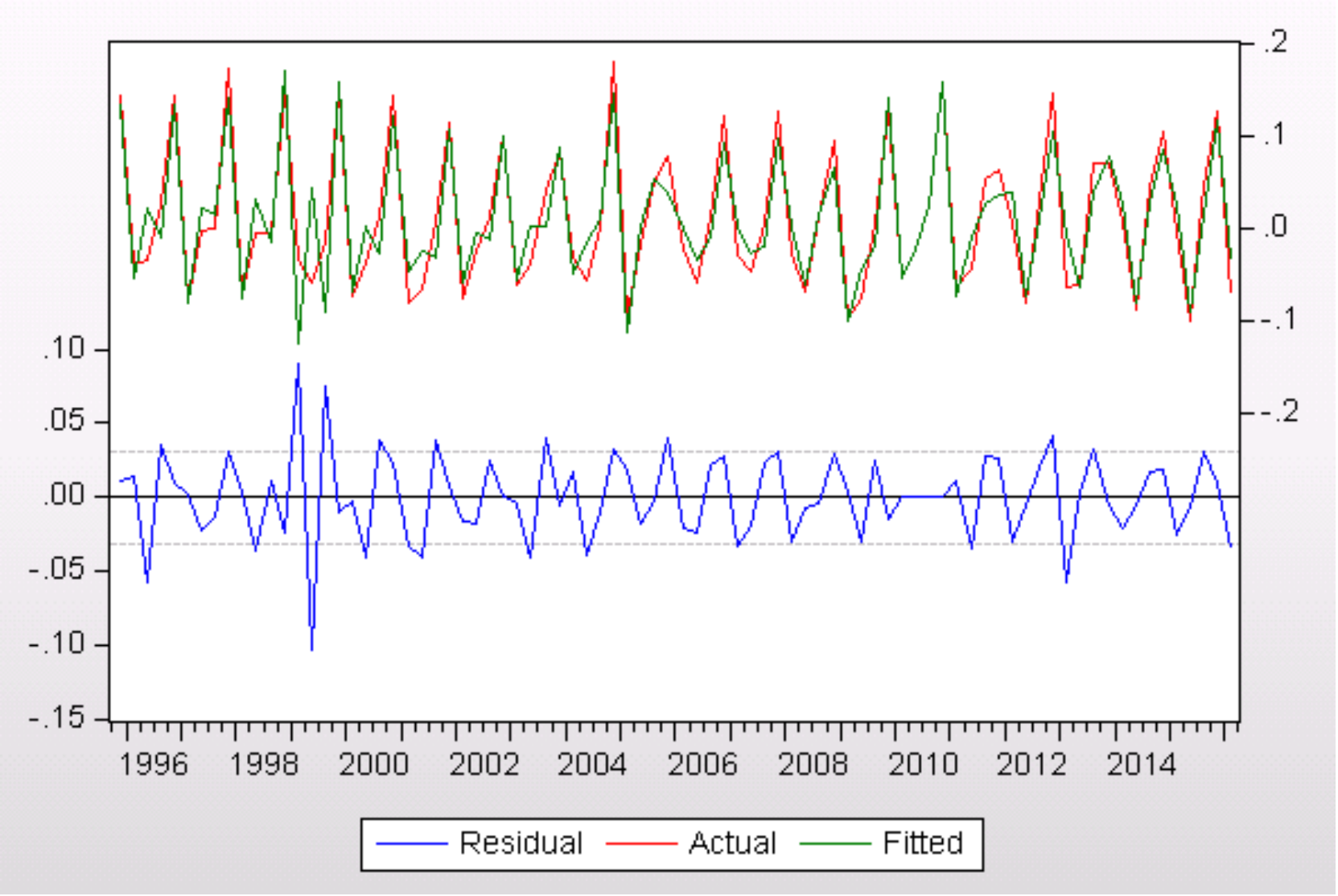
Reg (2) Adjusted Withholding on Synthetic Withholding , Dummy for Reciprocity Change (log diff Q/Q)

Dependent Variable: DLOG(WITHREVADJ3)
Method: Least Squares
Date: 10/01/16 Time: 08:35
Sample (adjusted): 1995Q4 2016Q1
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(WITH_SIM_07212016)	1.018251	0.051374	19.82039	0.0000
WRECIPD10Q1	0.045814	0.031909	1.435788	0.1552
WRECIPD10Q2	-0.039550	0.031419	-1.258814	0.2120
WRECIPD10Q3	0.016509	0.031418	0.525468	0.6008
WRECIPD10Q4	0.010084	0.032172	0.313447	0.7548
C	-0.000221	0.003574	-0.061913	0.9508

R-squared	0.847000	Mean dependent var	0.011026
Adjusted R-squared	0.836935	S.D. dependent var	0.077307
S.E. of regression	0.031218	Akaike info criterion	-4.025304
Sum squared resid	0.074066	Schwarz criterion	-3.849203
Log likelihood	171.0375	Hannan-Quinn criter.	-3.954602
F-statistic	84.14661	Durbin-Watson stat	2.851689
Prob(F-statistic)	0.000000		

Reg (2) Residual, Actual, Fitted



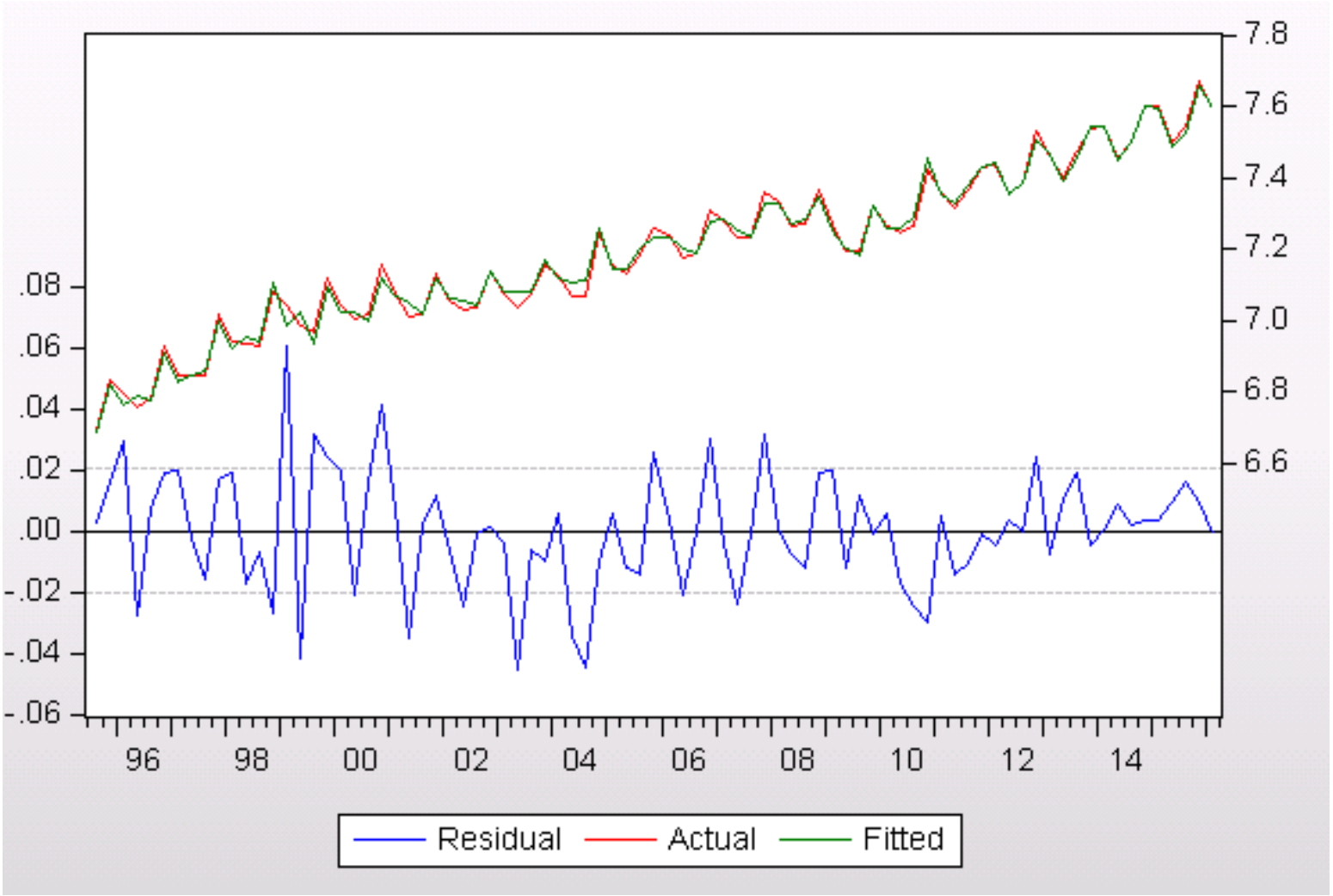
Reg (3) Adjusted Withholding on Synthetic Withholding Dummy for Reciprocity Change (Qtly Log Levles)

Dependent Variable: LOG(WITHREVADJ3)
Method: Least Squares
Date: 10/01/16 Time: 08:35
Sample: 1995Q3 2016Q1
Included observations: 83

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(WITH_SIM_07212016)	0.997825	0.015447	64.59699	0.0000
WRECIP10Q1	0.036528	0.009674	3.775933	0.0003
WRECIP10Q2	0.020087	0.009617	2.088649	0.0400
WRECIP10Q3	0.044387	0.009753	4.551136	0.0000
WRECIP10Q4	0.062441	0.010497	5.948578	0.0000
C	-1.399933	0.131343	-10.65857	0.0000

R-squared	0.992487	Mean dependent var	7.193219
Adjusted R-squared	0.992000	S.D. dependent var	0.224931
S.E. of regression	0.020119	Akaike info criterion	-4.904770
Sum squared resid	0.031167	Schwarz criterion	-4.729914
Log likelihood	209.5480	Hannan-Quinn criter.	-4.834523
F-statistic	2034.502	Durbin-Watson stat	2.077920
Prob(F-statistic)	0.000000		

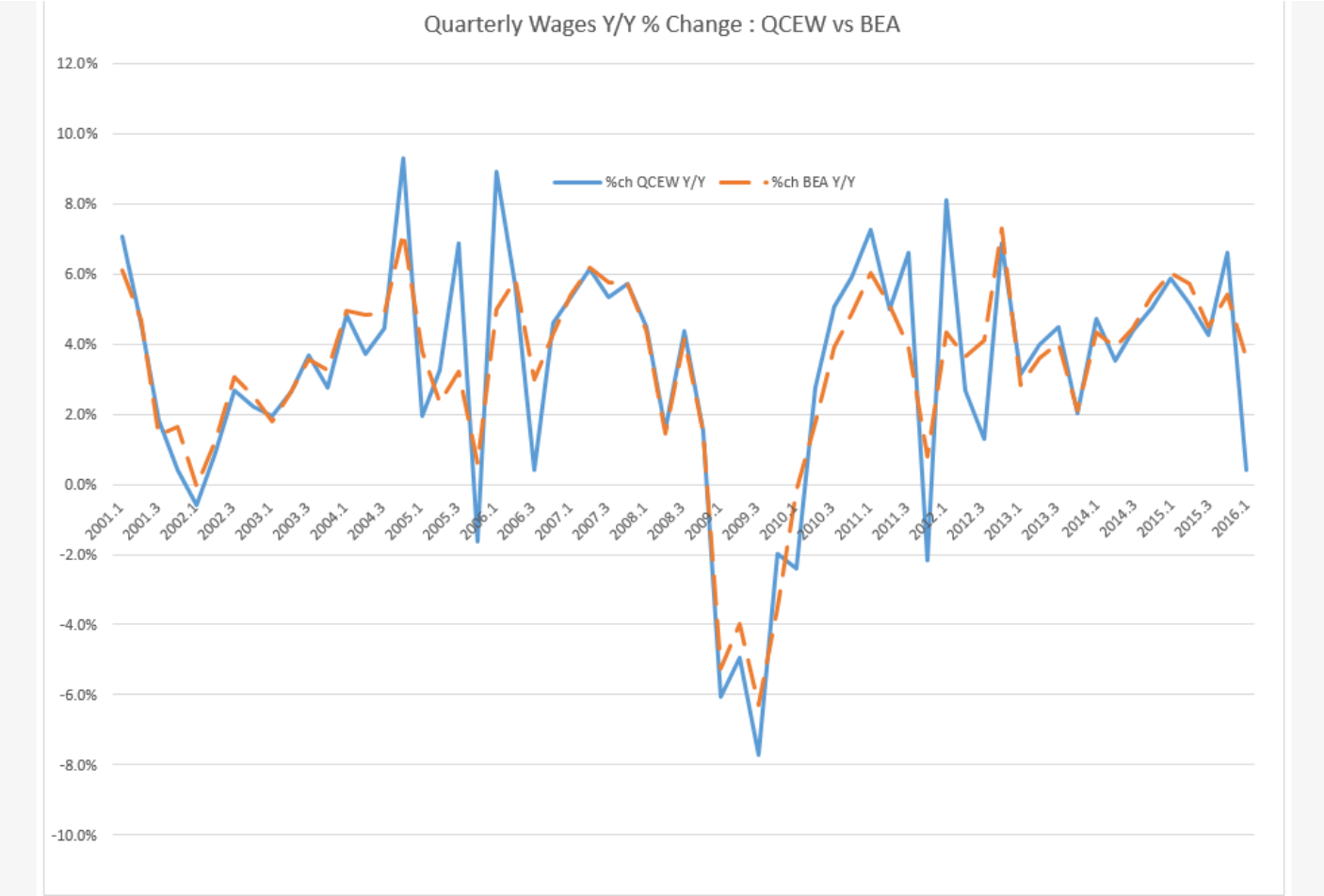
Reg (3) Residual, Actual, Fitted



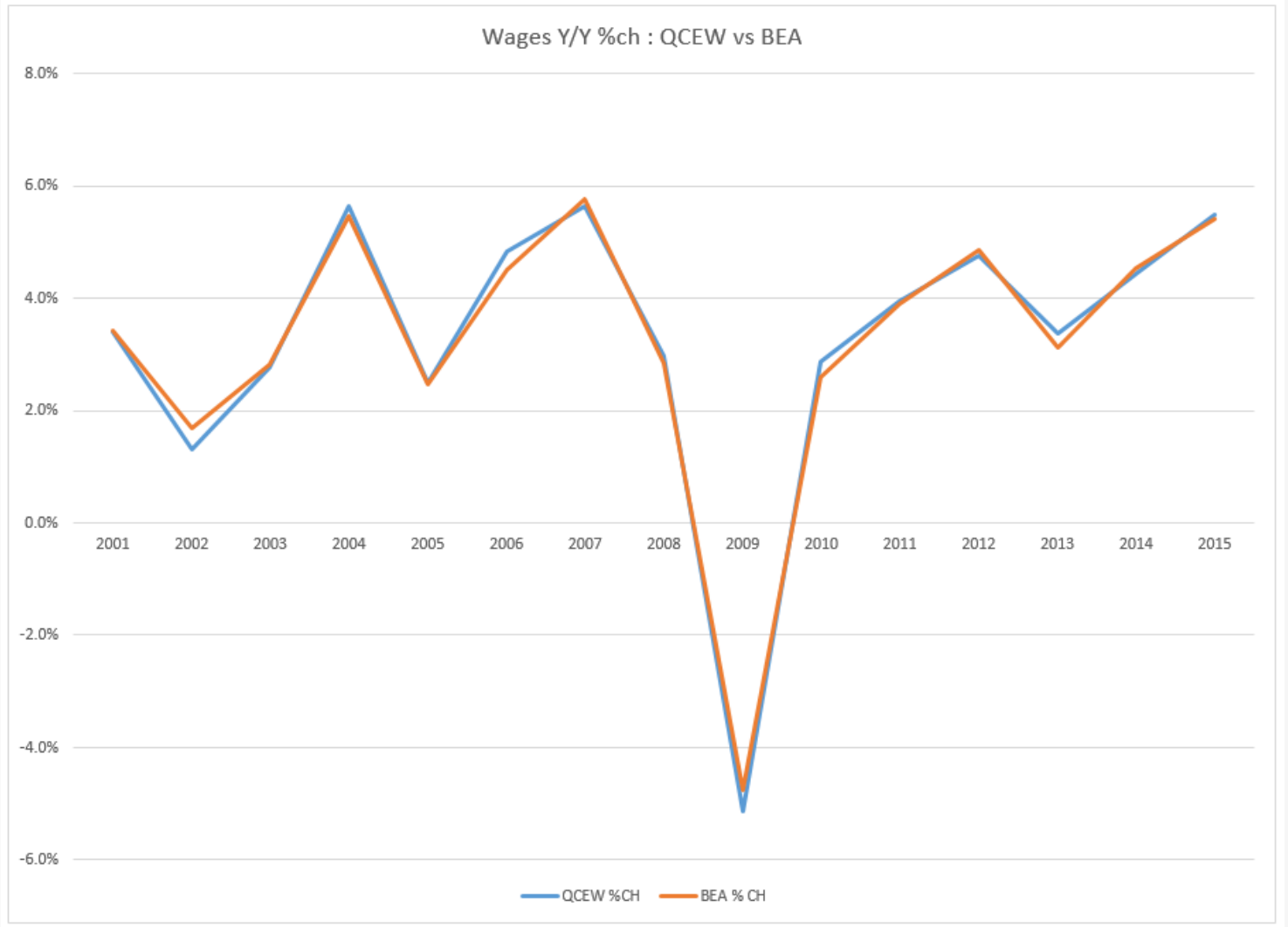
Forecasting Synthetic Withholding

- Forecasts of the following are entered into the withholding Microsimulation to produce a forecast of synthetic withholding:
- Minnesota Wage growth from MN economic model :BEA wages drive QCEW wages
- Minnesota Employment growth from MN economic model
- Future Minnesota Withholding tables; largely a function of CPI
- Legislated discretionary changes to future withholding tables that are not a function of current law (for example an increase in the standard deduction)

Relationship Between BEA and QCEW Wages



MN: Annual QCEW Wages vs BEA Wages in Personal Income (%ch)



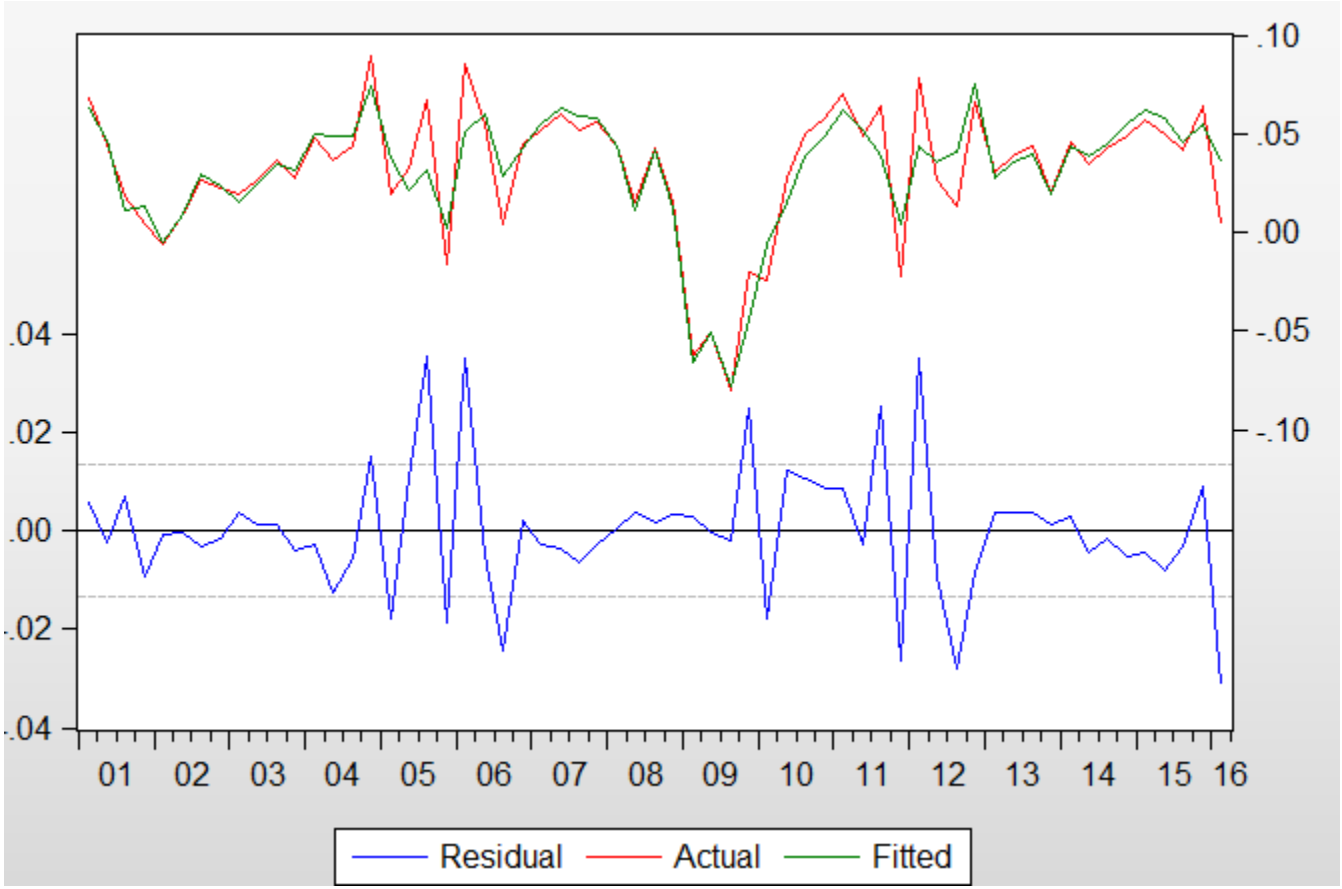
Reg(4) Wages: MN QCEW on MN BEA (Log Diff Qtly Y/Y)

Dependent Variable: LOG(QCEW)-LOG(QCEW(-4))
Method: Least Squares
Date: 10/13/16 Time: 09:43
Sample (adjusted): 2001Q1 2016Q1
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(YPWAGEMN)-LOG(YPWAGEMN(-...	1.128965	0.063735	17.71343	0.0000
C	-0.004568	0.002657	-1.719179	0.0908

R-squared	0.841724	Mean dependent var	0.031229
Adjusted R-squared	0.839041	S.D. dependent var	0.033587
S.E. of regression	0.013475	Akaike info criterion	-5.743721
Sum squared resid	0.010713	Schwarz criterion	-5.674512
Log likelihood	177.1835	Hannan-Quinn criter.	-5.716597
F-statistic	313.7654	Durbin-Watson stat	2.585067
Prob(F-statistic)	0.000000		

Reg (4) Residual, Actual, Fitted



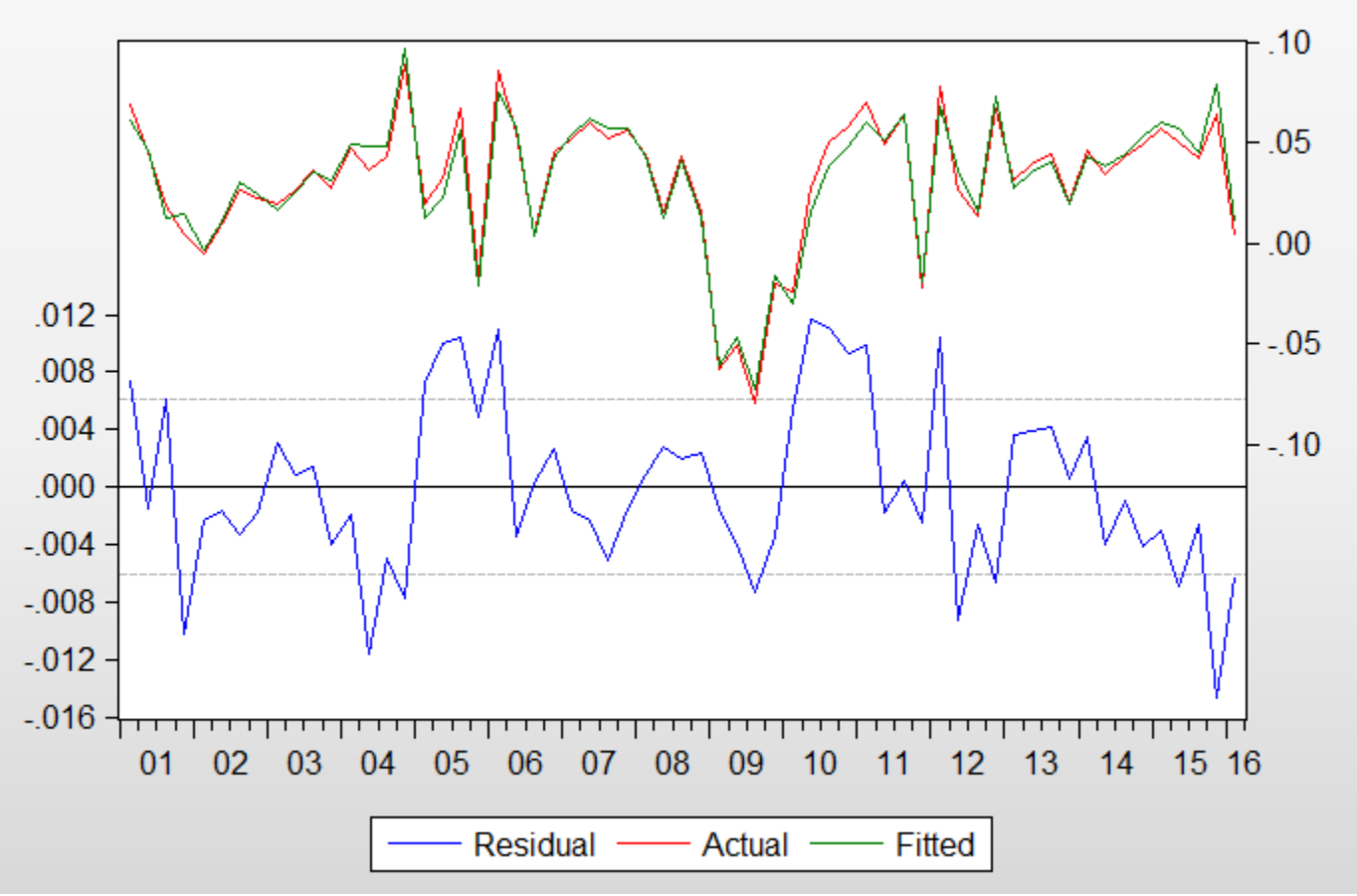
Reg (5) Wages: MN QCEW on MN BEA; Dummy for differing numbers of Fridays (takes values +1, 0,-1) (log Diff Qtly Y/Y)

Dependent Variable: LOG(QCEW)-LOG(QCEW(-4))
Method: Least Squares
Date: 10/13/16 Time: 14:28
Sample (adjusted): 2001Q1 2016Q1
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(YPWAGEMN)-LOG(YPWAGEMN(-...	1.076683	0.029146	36.94059	0.0000
FDUM	0.024914	0.001647	15.12777	0.0000
C	-0.002923	0.001212	-2.412193	0.0190

R-squared	0.967922	Mean dependent var	0.031217
Adjusted R-squared	0.966816	S.D. dependent var	0.033590
S.E. of regression	0.006119	Akaike info criterion	-7.306922
Sum squared resid	0.002172	Schwarz criterion	-7.203108
Log likelihood	225.8611	Hannan-Quinn criter.	-7.266236
F-statistic	875.0525	Durbin-Watson stat	1.219528
Prob(F-statistic)	0.000000		

Reg. (5) Residual, Actual, Fitted



Forecasting Accounting System Withholding related to wages from Synthetic Withholding

- Observation: The elasticity of withholding adjusted for timing and non wage withholding per the accounting system with respect to Synthetic Withholding is very close to 1.0.

- Given that the elasticity is close to 1.0; for simplicity we assume adjusted accounting system collections will grow a the same rate as Synthetic withholding.

- We forecast accounting system collections related to wages by applying the quarterly Y/Y percent change in synthetic withholding to accounting system collections.

- We now have a forecast of quarterly accounting system withholding collections related to wages by “wage quarter”.

Forecasting Quarterly Accounting System Withholding not related to Wages

- S & L Pension withholding forecast - judgment informed by a forecast of pensions per JP
- UI withholding forecast – judgment informed by forecast of UI benefits per Employment Agency
- Lottery – judgment based on past trends
- Non- Resident Partnership/S Corp withholding – judgment informed by P’ship and S-Corp model.
- Non Resident Entertainer Tax – judgment informed by past trends

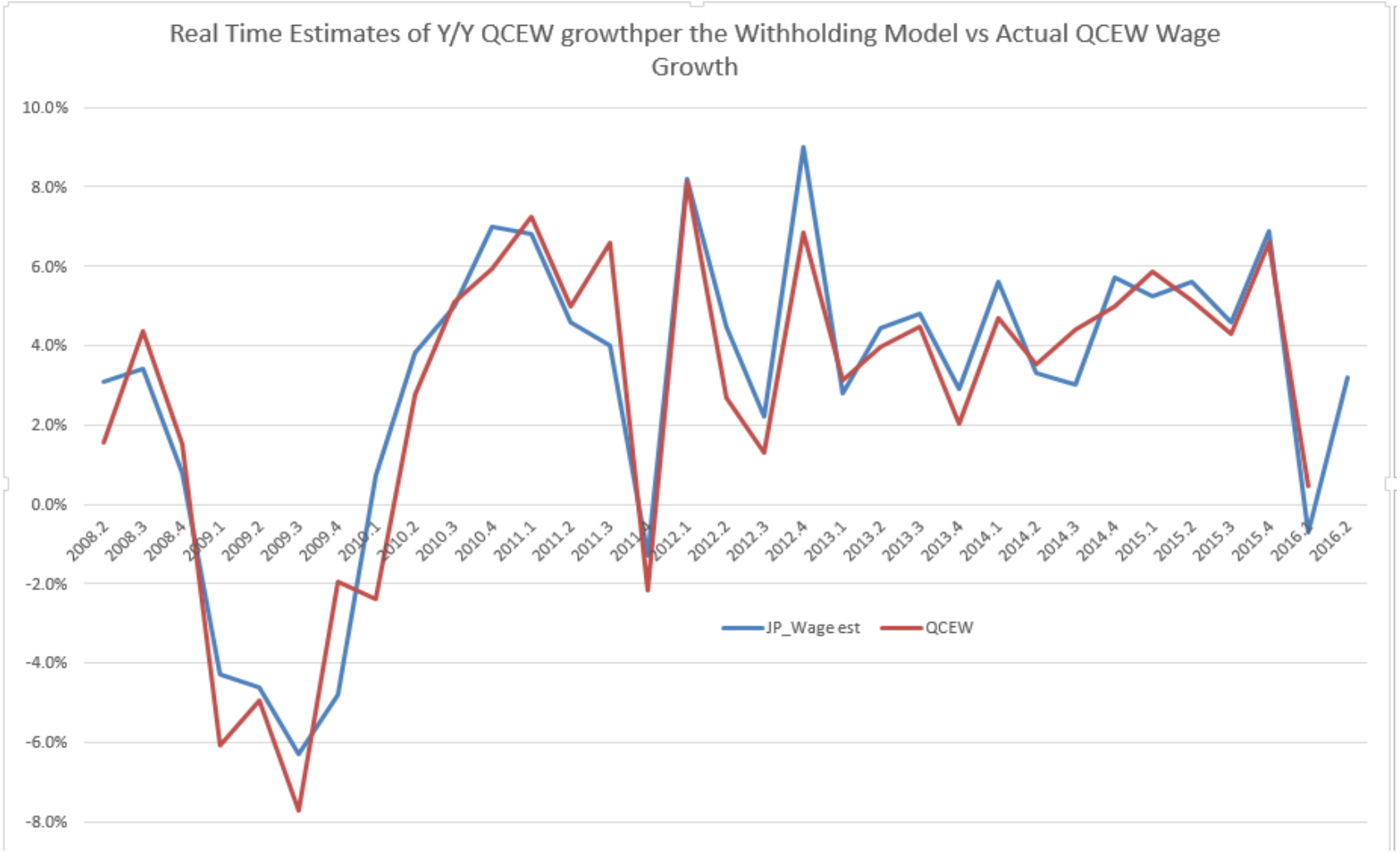
Convert Quarterly Withholding from Wage Quarter to Calendar Quarter and Month

- Add the quarterly withholding due to wages and to due to non wage income (this is in wage quarters)
- Identify the days of the year that constitute the wage quarter and allocate the wage quarter withholding over those days on the basis of last years daily collections.
- The result will be a daily forecast of withholding that by simple addition yields the calendar month and the calendar quarter.

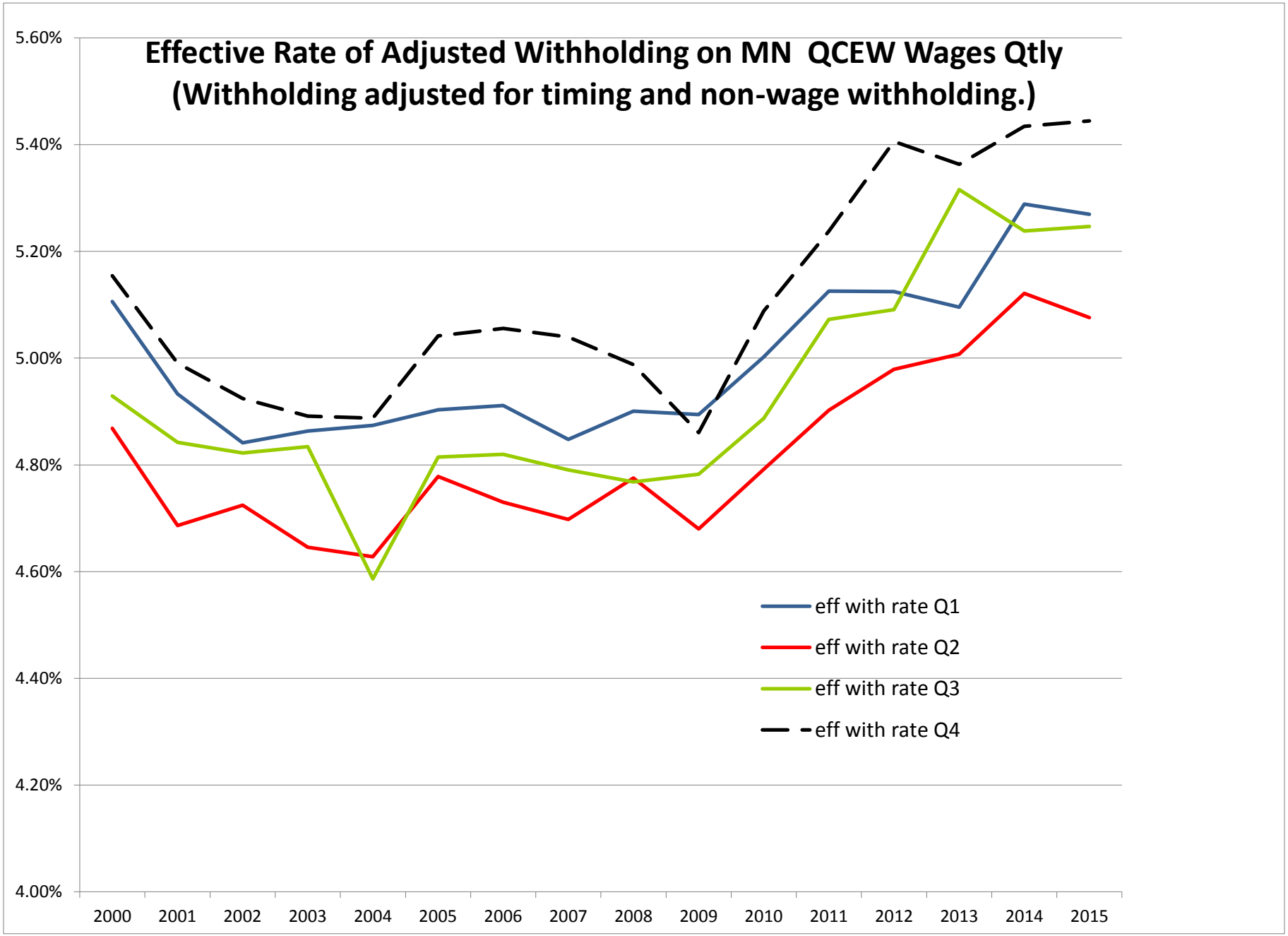
Inferring QCEW wage growth in “Real Time”

- Typically within 10 days of the end of calendar quarter the “wage quarter” will have ended.
- Using Y/Y % ch in Withholding for the “wage quarter” through an iterative process one can use the withholding model to estimate Y/Y QCEW wage growth for the quarter.
- It would typically take two or three iterations to estimate wage growth.

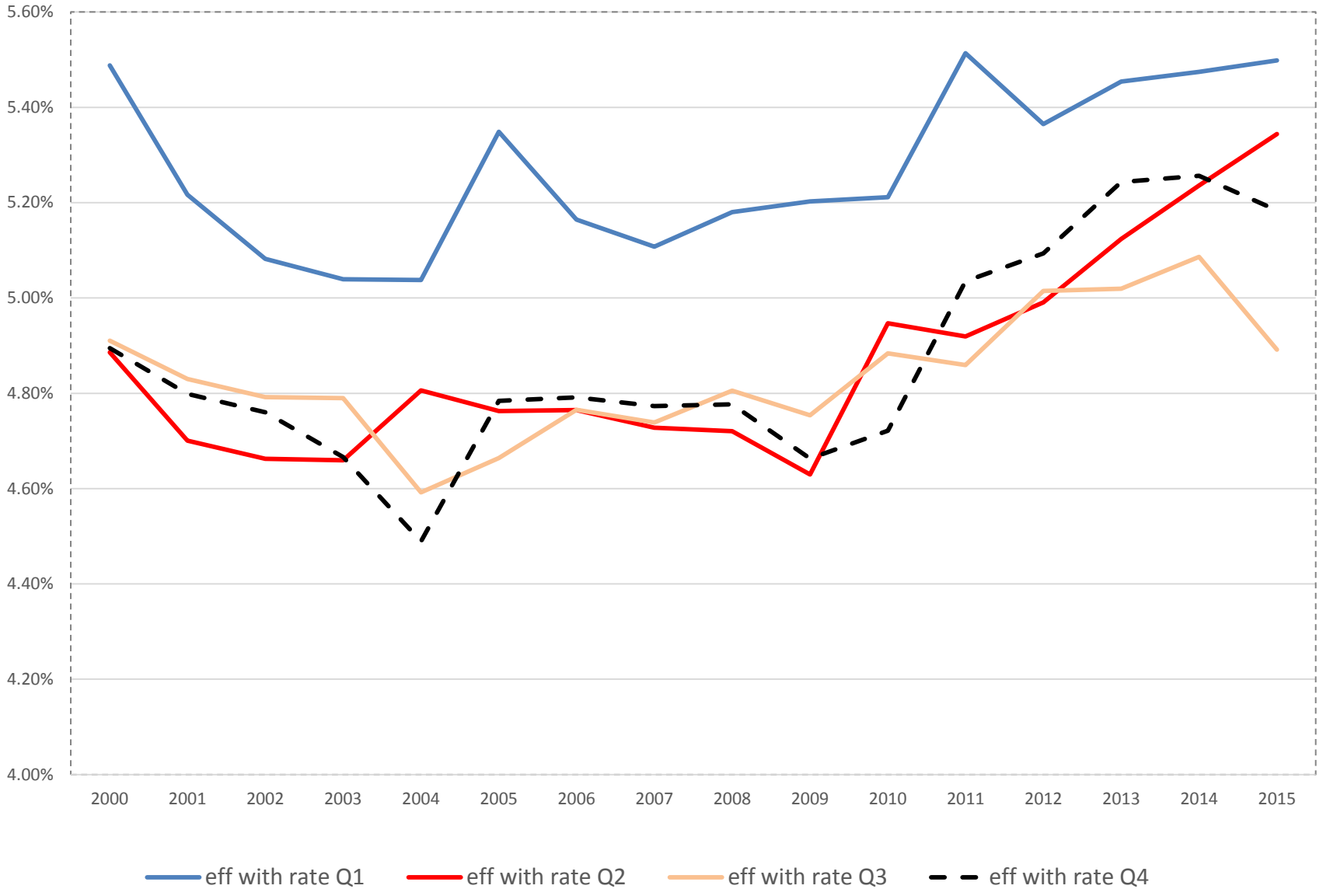
Estimates of QCEW Wage Growth in Real Time at Quarters end vs Actual QCEW Wage Growth



Problems in Forecasting 4th Quarter Withholding


Effective Rate of Adjusted Withholding on MN QCEW Wages Qtly
(Withholding adjusted for timing and non-wage withholding.)
5.60%
5.40%
5.20%
5.00%
4.80%
4.60%
4.40%
4.20%
4.00%
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
eff with rate Q1
eff with rate Q2
eff with rate Q3
eff with rate Q4

Effective Rate of Withholding on MN QCEW Wage (Qtly)
(Withholding adjusted for non Wage With but not for timing.)



Observations on 4th Quarter Withholding and Wages

- The absolute size of the residuals for the 4th quarter is the largest compared to the other three quarters (residuals from "Reg. 1" shown earlier)
- The effective tax rate for the fourth quarter is the highest when one adjusts for the timing of withholding; W/O adjustment the first quarter is highest.
- The model assumes that all taxpayers make use of the Withholding tables.
- We think it likely that the owners of S Corporations make significant "discretionary" withholding payments in the 4th quarter to cover wages and other income (they are required to impute a reasonable wage).
- Work done with 2011 "high income Schedule E returns" indicates they paid about 73 million more in withholding than could be explained by claiming zero dependents and using the single tables. This is out of 225.8 million. Had all this occurred in the 4th quarter it would have been 4.3% of the withholding in the quarter.
- We hypothesize that "S corporation " discretionary withholding explain larger 4th Quarter residuals and the difficulty of forecasting 4th quarter withholding.

Potential Further Research

- Compare actual withholding reported on the each taxpayer's W-2 to the withholding simulated.
- Develop an algorithm to infer for each taxpayer/worker the likely table used, the number of exemptions claimed, and whether those with multiple W-2's held multiple jobs simultaneously.
- Assign to each taxpayer the withholding table, the number exemptions claimed and assumption about jobs that results in a simulated amount that most closely matches actual withholding. (There are numerous possible combinations for each tax return – easier said than done.)

Cautions

- The model does not look at the actual withholding reported on W-2's and compare it to simulated.
- It simply makes assumptions that are considered to be "on average" reasonable and produce reasonable results when one compares percent change in simulated withholding to actual.
- One should not conclude from this presentation that my behavioral assumptions with regard to claiming exemptions or the use of single married table are verified or conclusive. (Recent work I have done indicates that variations in these assumptions make only a small difference if there are no significant law changes on the forecast horizon).
- The model forces the same behavioral assumptions on all taxpayers. In the case of the withholding table assumptions it allows a weighted average of the married and single tables – but is not taxpayer specific.

Thank You

APPENDIX (contains miscellaneous information for answering questions.)

Deposit Due Dates

How often you need to deposit Withholding Tax varies. It depends on your federal deposit schedule and how much Minnesota tax you withheld.

Frequency	If you withheld:	Your deposit is due by:
Semiweekly	More than $1,500 in the previous quarter **and** the IRS requires you to deposit semiweekly	Wednesday after payday (if your payday is Wed., Thur. or Fri.) **or** Friday after payday (if your payday is Sat., Sun., Mon. or Tue.)
Monthly	More than $1,500 in the previous quarter **and** the IRS requires you to deposit monthly	15th day of the next month
Annual	Less than $500 prior to Dec. 1 *(See annual deposit exception)*	Feb. 28
Exception/ Quarterly	$1,500 or less in the previous quarter **and** you filed that quarter's return on time	April 30, July 31, Oct. 31 and Jan. 31

Annual deposit exception

If your total tax withheld for the year exceeds $500 prior to December 1, you must deposit the total amount by the last day of the month after you exceed $500.

Seasonal option

If you consistently withhold tax in the same quarters each calendar year (up to three, but not all four), you can deposit tax and file returns for only the quarters you pay wages. If you meet this condition, call us to update your account. You will use the above due date schedules when filing returns and depositing tax for active quarters.

For more information, see Withholding Tax for Seasonal Businesses.

Remittance Days Mapped to Month Ending Days by Type of Payroll and “Payday”

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Month ending date													
2	Friday payroll remittance date													
3	Bimonthly & Monthy payrolls pay on last day of month remittance date													
4	Bimonthly and Friday Payroll remittance date are the same													
5														
6	Commingles Bimonthly last day with The first Friday payroll of the new month													
7														
8	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday
9														
10	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday
11														
12	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday
13														
14	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday
15														
16	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday
17														
18	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday
19														
20	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday
21														
22														
23														
24														

These day will contain remittances from the Friday that ended in the current month and remittances from bimonthly payrolls from the last day of the prior month. Commingles wage quarter remittances.

Regression of Calendar Quarterly Withholding on QCEW Wages

Dependent Variable: DLOG(WRAW)
Method: Least Squares
Date: 09/19/16 Time: 10:32
Sample (adjusted): 1995Q4 2016Q1
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(QCEW)	0.576567	0.120755	4.774673	0.0000
C	0.005844	0.006770	0.863261	0.3906

R-squared	0.221771	Mean dependent var	0.012210
Adjusted R-squared	0.212043	S.D. dependent var	0.067710
S.E. of regression	0.060104	Akaike info criterion	-2.761384
Sum squared resid	0.289002	Schwarz criterion	-2.702683
Log likelihood	115.2167	Hannan-Quinn criter.	-2.737816
F-statistic	22.79751	Durbin-Watson stat	2.391053
Prob(F-statistic)	0.000008		

Regression of "Wage Quarter" Withholding on QCEW Wages

Dependent Variable: DLOG(WADJTNONW)
Method: Least Squares
Date: 09/19/16 Time: 10:37
Sample (adjusted): 1995Q4 2016Q1
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(QCEW)	1.272416	0.065419	19.45039	0.0000
C	-0.003023	0.003668	-0.824299	0.4122

R-squared	0.825449	Mean dependent var	0.011025
Adjusted R-squared	0.823267	S.D. dependent var	0.077454
S.E. of regression	0.032561	Akaike info criterion	-3.987303
Sum squared resid	0.084819	Schwarz criterion	-3.928602
Log likelihood	165.4794	Hannan-Quinn criter.	-3.963736
F-statistic	378.3176	Durbin-Watson stat	2.579169
Prob(F-statistic)	0.000000		

Regression of Calendar Quarterly Withholding on QCEW Wages (Qtly Y/Y)

Dependent Variable: LOG(WRAW)-LOG(WRAW(-4))
Method: Least Squares
Date: 09/19/16 Time: 10:35
Sample (adjusted): 1996Q3 2016Q1
Included observations: 79 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(QCEW)-LOG(QCEW(-4))	0.743974	0.089857	8.279557	0.0000
C	0.011458	0.004903	2.337067	0.0220

R-squared	0.470976	Mean dependent var	0.042266
Adjusted R-squared	0.464106	S.D. dependent var	0.038765
S.E. of regression	0.028378	Akaike info criterion	-4.261424
Sum squared resid	0.062008	Schwarz criterion	-4.201438
Log likelihood	170.3263	Hannan-Quinn criter.	-4.237392
F-statistic	68.55106	Durbin-Watson stat	1.447192
Prob(F-statistic)	0.000000		

Regression of "Wage Quarter" Withholding on QCEW Wages (Qtly Y/Y)

Dependent Variable: LOG(WADJTNONW)-LOG(WADJTNONW(-4))
Method: Least Squares
Date: 09/19/16 Time: 10:41
Sample (adjusted): 1996Q3 2016Q1
Included observations: 79 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(QCEW)-LOG(QCEW(-4))	0.898681	0.081712	10.99813	0.0000
C	0.003592	0.004459	0.805700	0.4229

R-squared	0.611030	Mean dependent var	0.040806
Adjusted R-squared	0.605979	S.D. dependent var	0.041111
S.E. of regression	0.025806	Akaike info criterion	-4.451451
Sum squared resid	0.051277	Schwarz criterion	-4.391465
Log likelihood	177.8323	Hannan-Quinn criter.	-4.427419
F-statistic	120.9589	Durbin-Watson stat	1.111243
Prob(F-statistic)	0.000000		

Regression of Calendar Quarterly Withholding on QCEW Wages (time span with few law changes)

Dependent Variable: DLOG(WRAW)
Method: Least Squares
Date: 09/29/16 Time: 10:07
Sample: 2001Q1 2013Q2
Included observations: 50

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(QCEW)	0.560970	0.160062	3.504701	0.0010
C	0.004118	0.008082	0.509537	0.6127

R-squared	0.203755	Mean dependent var	0.007178
Adjusted R-squared	0.187166	S.D. dependent var	0.063016
S.E. of regression	0.056813	Akaike info criterion	-2.858908
Sum squared resid	0.154933	Schwarz criterion	-2.782427
Log likelihood	73.47269	Hannan-Quinn criter.	-2.829783
F-statistic	12.28293	Durbin-Watson stat	2.401310
Prob(F-statistic)	0.001001		

Regression of "Wage Quarter" Withholding on QCEW Wages (time span with few law changes)

Dependent Variable: DLOG(WADJTNONW)
Method: Least Squares
Date: 09/29/16 Time: 09:44
Sample: 2001Q1 2013Q2
Included observations: 50

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(QCEW)	1.334755	0.084876	15.72586	0.0000
C	-0.002404	0.004286	-0.560953	0.5774

R-squared	0.837455	Mean dependent var	0.004877
Adjusted R-squared	0.834068	S.D. dependent var	0.073958
S.E. of regression	0.030127	Akaike info criterion	-4.127637
Sum squared resid	0.043565	Schwarz criterion	-4.051156
Log likelihood	105.1909	Hannan-Quinn criter.	-4.098512
F-statistic	247.3026	Durbin-Watson stat	2.639388
Prob(F-statistic)	0.000000		

Regression of Calendar Quarterly Withholding on QCEW Wages (time span with few law changes) (Qtly Y/Y)

Dependent Variable: LOG(WRAW)-LOG(WRAW(-4))
Method: Least Squares
Date: 09/29/16 Time: 09:47
Sample: 2001Q1 2013Q2
Included observations: 50

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(QCEW)-LOG(QCEW(-4))	0.820451	0.101094	8.115707	0.0000
C	0.008219	0.004646	1.769169	0.0832

R-squared	0.578447	Mean dependent var	0.032021
Adjusted R-squared	0.569665	S.D. dependent var	0.038839
S.E. of regression	0.025478	Akaike info criterion	-4.462795
Sum squared resid	0.031159	Schwarz criterion	-4.386314
Log likelihood	113.5699	Hannan-Quinn criter.	-4.433671
F-statistic	65.86470	Durbin-Watson stat	1.578980
Prob(F-statistic)	0.000000		

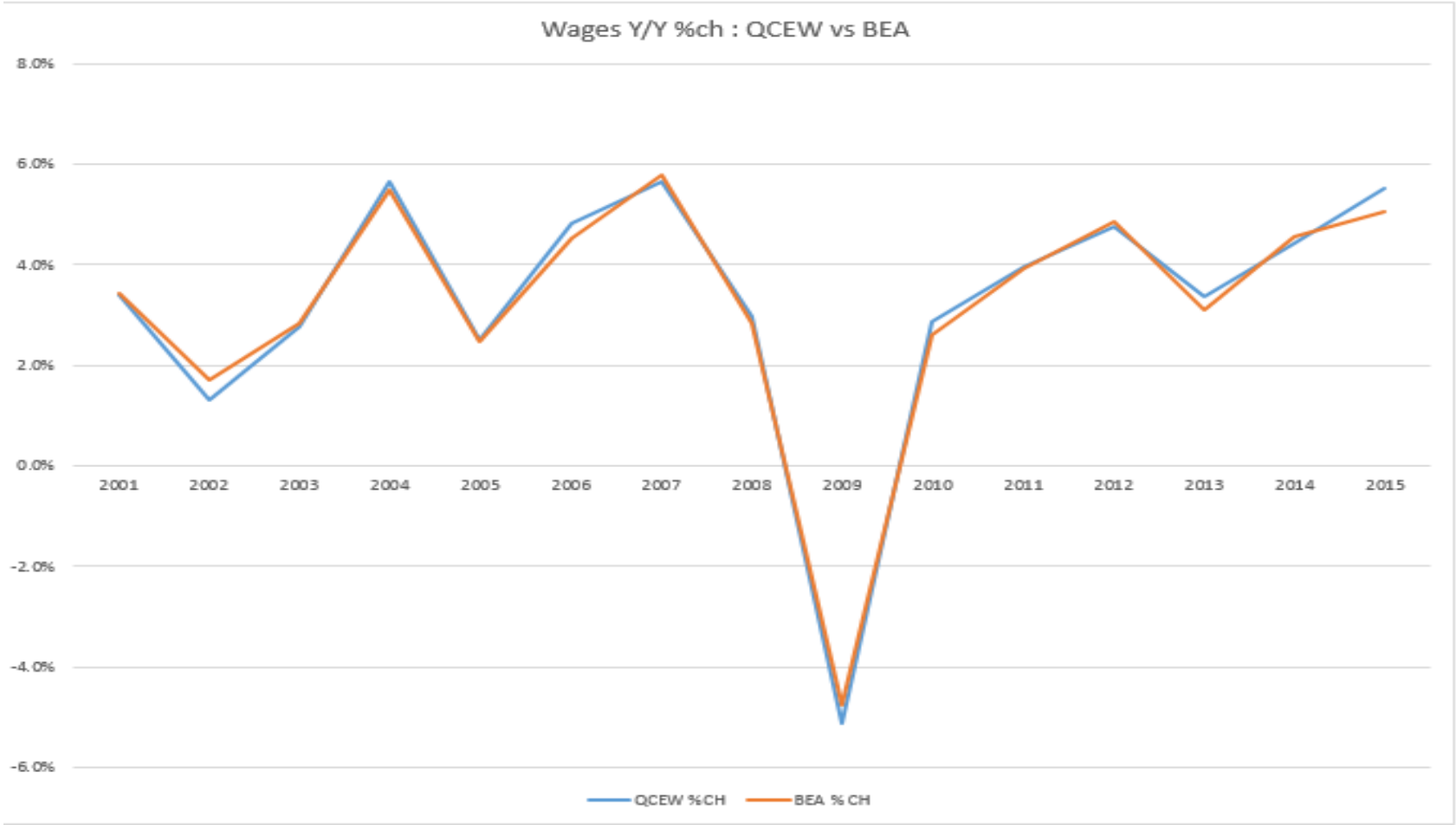
Regression of "Wage Quarter" Withholding on QCEW Wages (time span with few law changes) (Qtly Y/Y)

Dependent Variable: LOG(WADJTNONW)-LOG(WADJTNONW(-4))
Method: Least Squares
Date: 09/29/16 Time: 09:46
Sample: 2001Q1 2013Q2
Included observations: 50

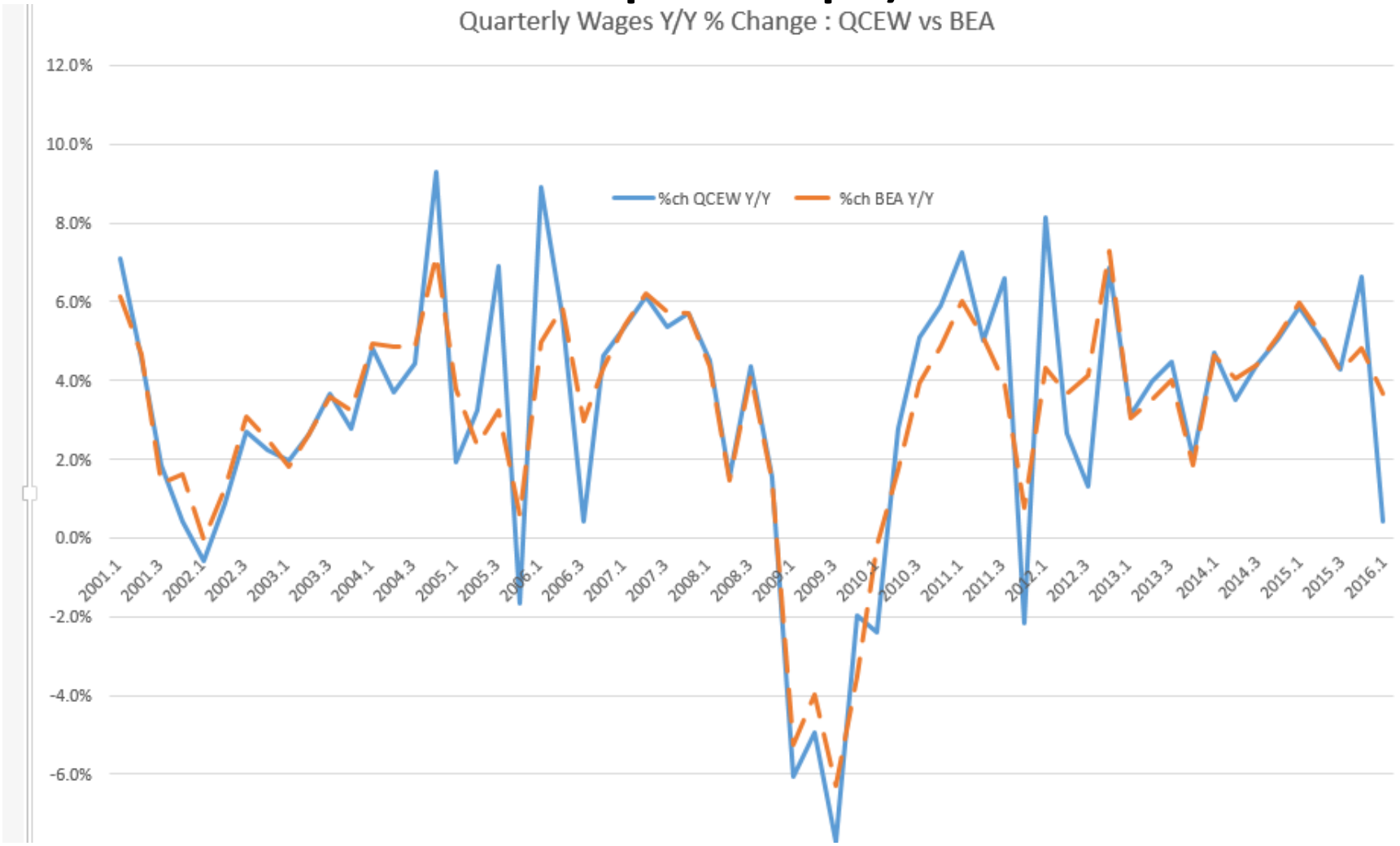
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(QCEW)-LOG(QCEW(-4))	1.063974	0.084716	12.55930	0.0000
C	0.000266	0.003893	0.068205	0.9459

R-squared	0.766691	Mean dependent var	0.031132
Adjusted R-squared	0.761831	S.D. dependent var	0.043749
S.E. of regression	0.021351	Akaike info criterion	-4.816292
Sum squared resid	0.021881	Schwarz criterion	-4.739811
Log likelihood	122.4073	Hannan-Quinn criter.	-4.787167
F-statistic	157.7359	Durbin-Watson stat	0.972584
Prob(F-statistic)	0.000000		

Before Data Revsion on Sept 28



Before Sept 28 Revision (note gap 15q4 16q1)



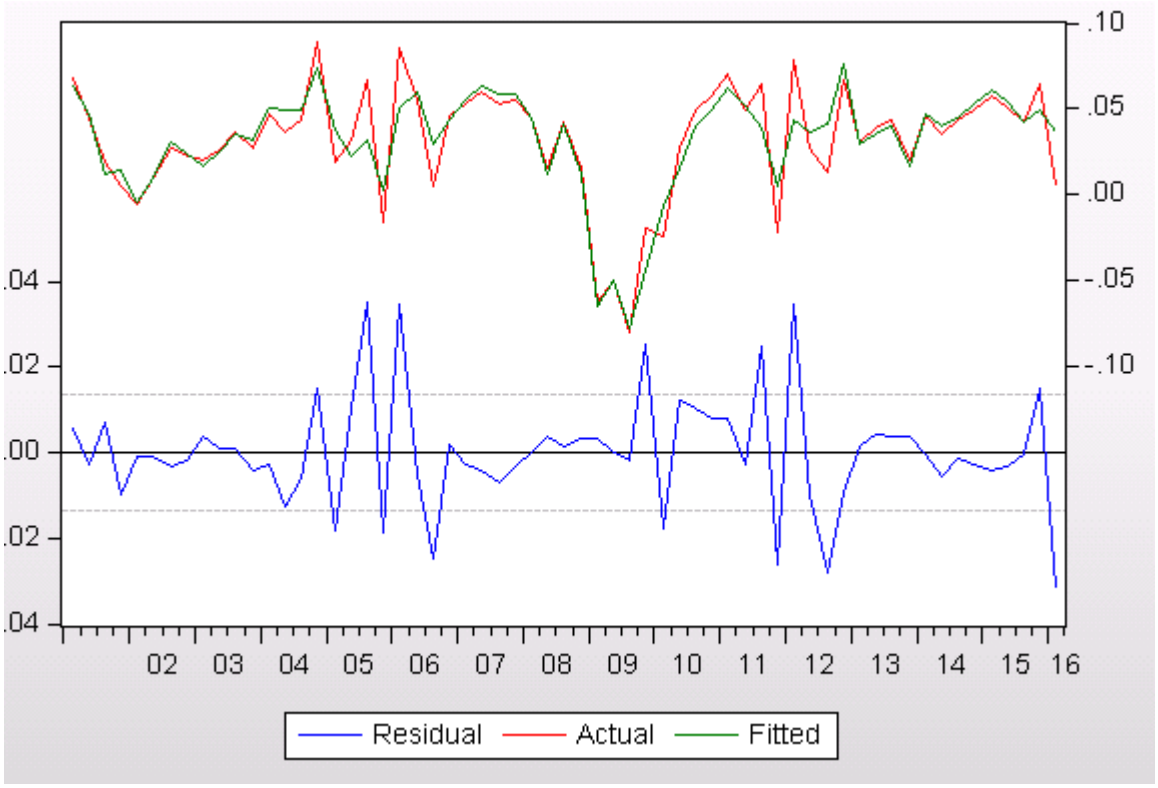
Reg 4 prior to data revision

Dependent Variable: LOG(QCEW)-LOG(QCEW(-4))
Method: Least Squares
Date: 09/28/16 Time: 18:15
Sample (adjusted): 2001Q1 2016Q1
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(YPWAGEMN)-LOG(YPWAGEMN(-4))	1.133279	0.064396	17.59868	0.0000
C	-0.004467	0.002669	-1.673546	0.0995

R-squared	0.839984	Mean dependent var	0.031229
Adjusted R-squared	0.837272	S.D. dependent var	0.033587
S.E. of regression	0.013549	Akaike info criterion	-5.732791
Sum squared resid	0.010831	Schwarz criterion	-5.663582
Log likelihood	176.8501	Hannan-Quinn criter.	-5.705668
F-statistic	309.7135	Durbin-Watson stat	2.604669
Prob(F-statistic)	0.000000		

Reg 4 Prior to Data Revison



Reg 5 Prior to Data Revision

Dependent Variable: LOG(QCEW)-LOG(QCEW(-4))
Method: Least Squares
Date: 09/28/16 Time: 18:24
Sample (adjusted): 2001Q1 2016Q1
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(YPWAGEMN)-LOG(YPWAGEMN(-4))	1.083278	0.027835	38.91753	0.0000
FDUM	0.025322	0.001565	16.17764	0.0000
C	-0.002892	0.001151	-2.513086	0.0148

R-squared	0.970971	Mean dependent var	0.031229
Adjusted R-squared	0.969970	S.D. dependent var	0.033587
S.E. of regression	0.005820	Akaike info criterion	-7.406995
Sum squared resid	0.001965	Schwarz criterion	-7.303182
Log likelihood	228.9134	Hannan-Quinn criter.	-7.366310
F-statistic	970.0141	Durbin-Watson stat	1.227837
Prob(F-statistic)	0.000000		

Reg 5 Prior to Data Revison