

FTA REVENUE ESTIMATING – MODEL BLENDING TECHNIQUES

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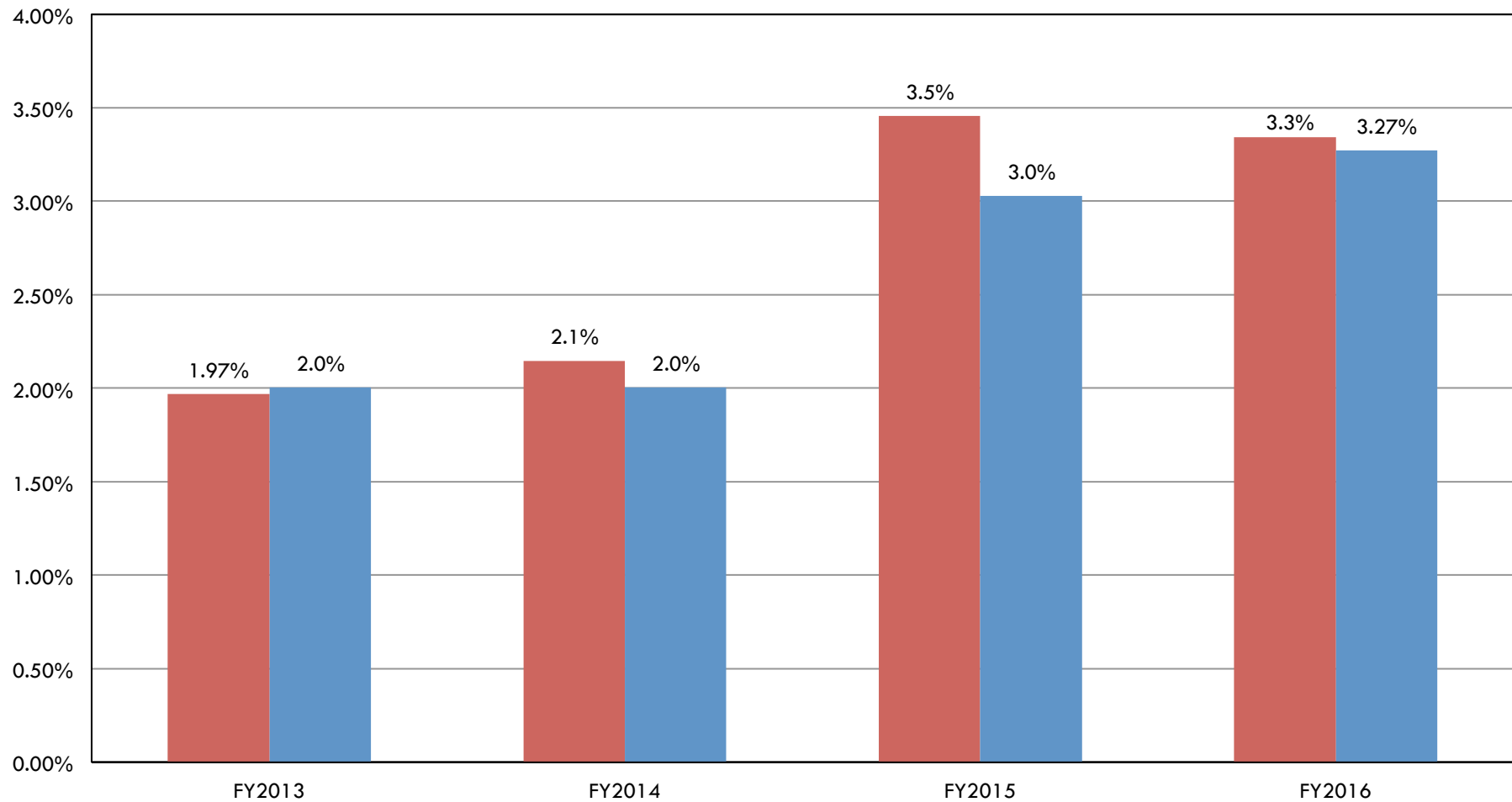
OCTOBER 8, 2013

Office of State Budget Director

Real GDP – Control Forecast

(Global Insight Forecast, Annual Growth Rates)

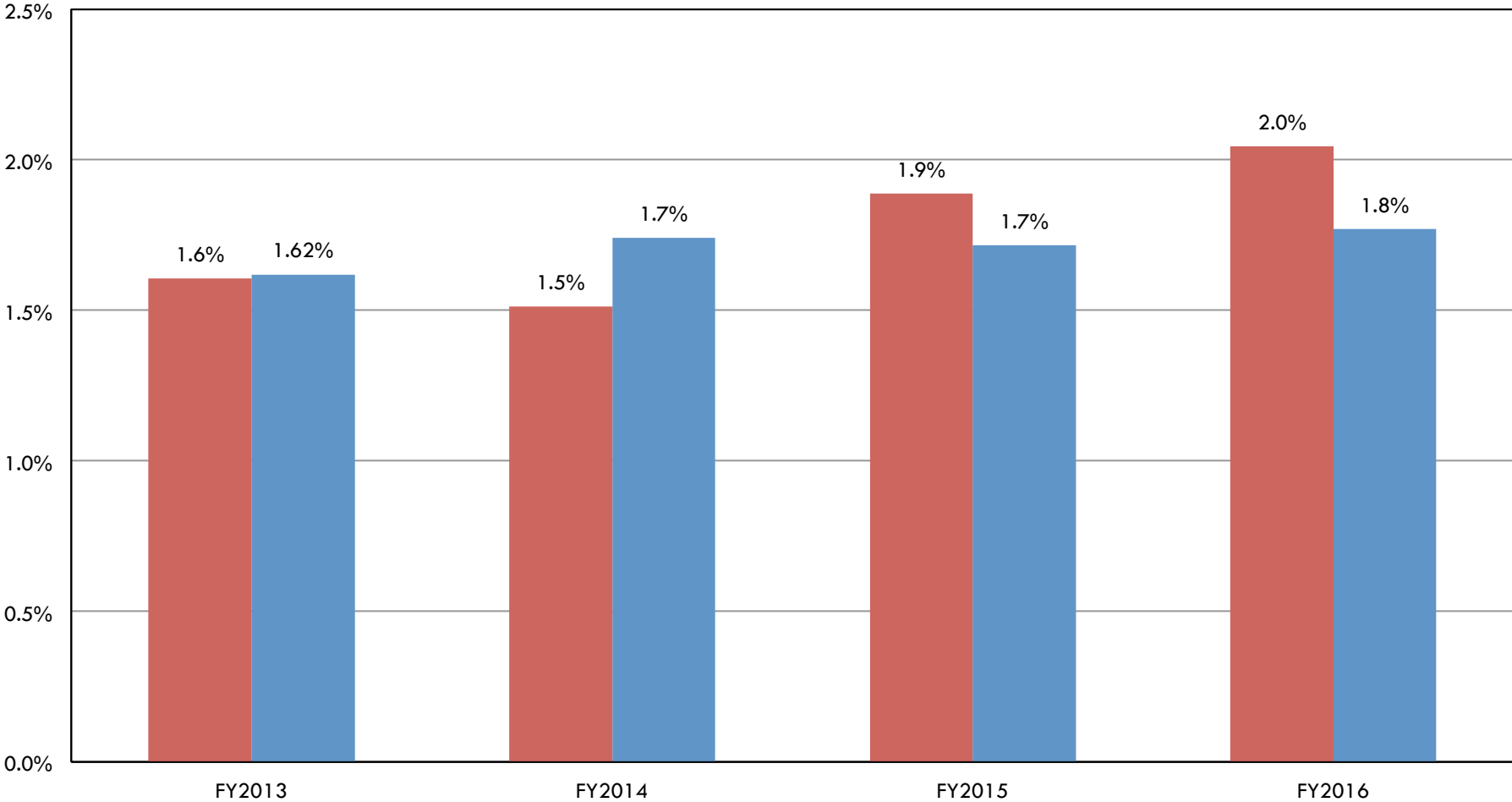
■ August ■ October



Nonfarm Employment— Control Forecast

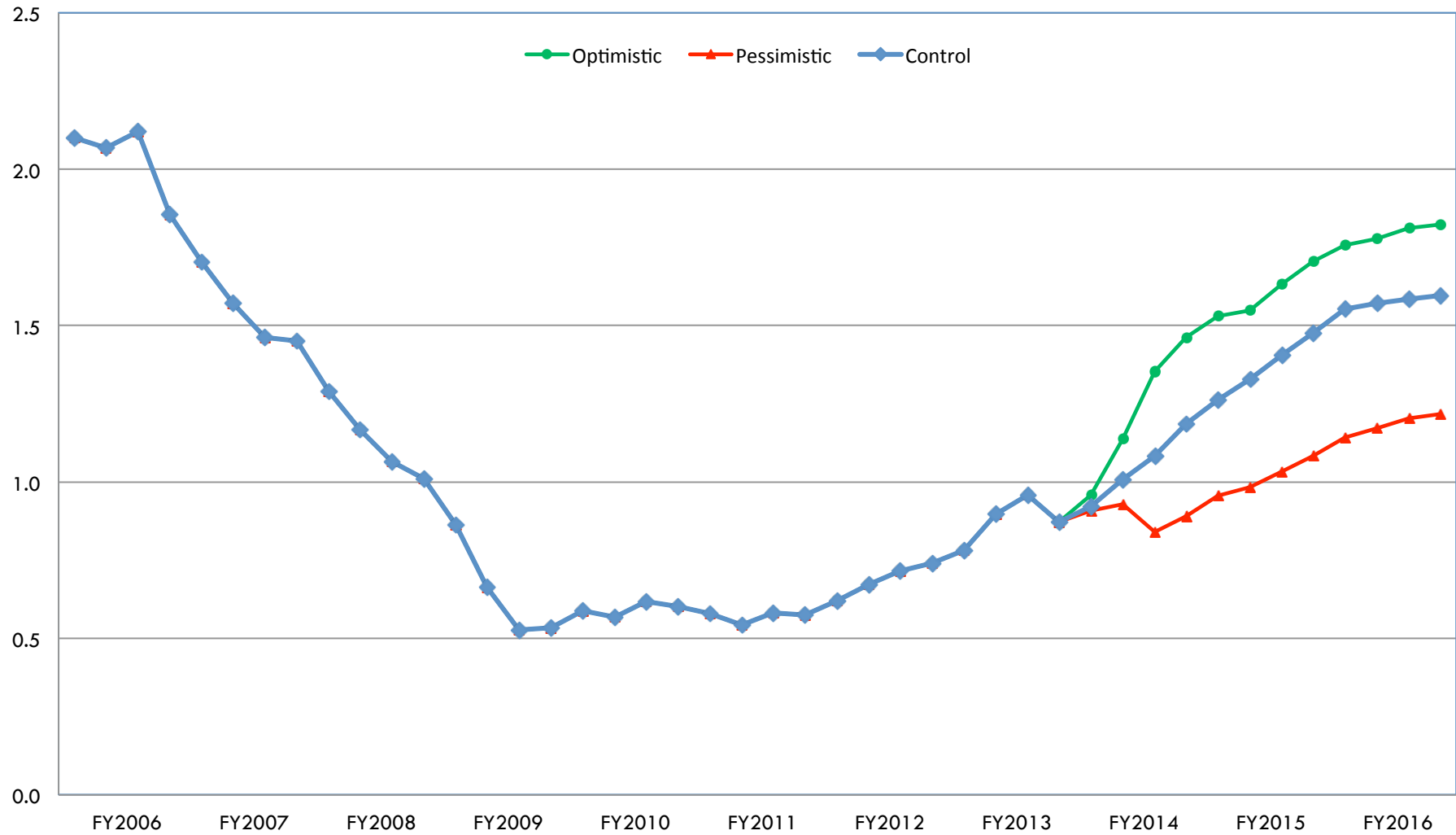
(Global Insight Forecast, Annual Growth Rates)

■ August ■ October



Housing Starts

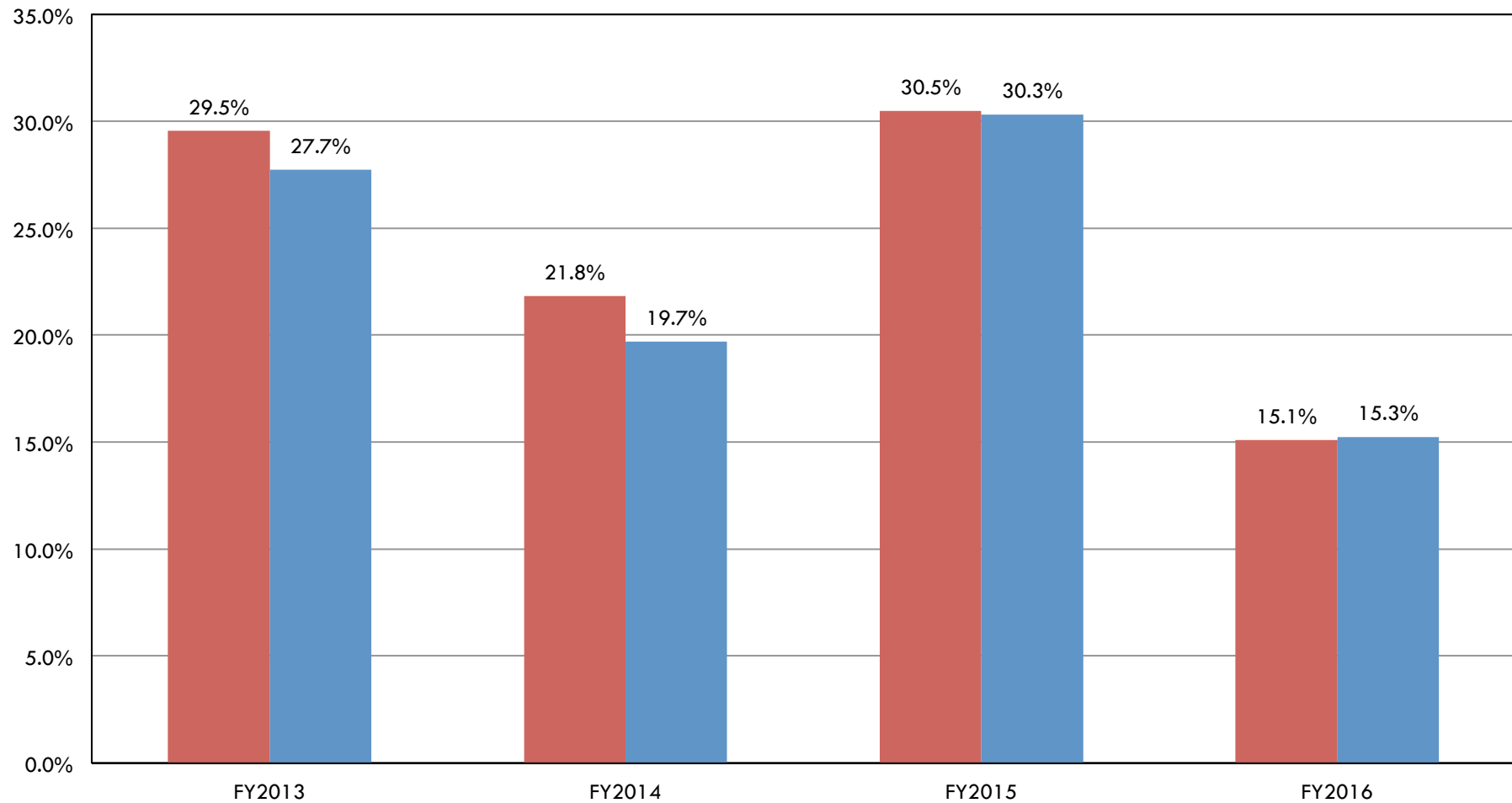
(Millions, Annual Rate, U.S. Bureau of the Census)



Housing Starts – Control Forecast

(Global Insight Forecast, Annual Growth Rates)

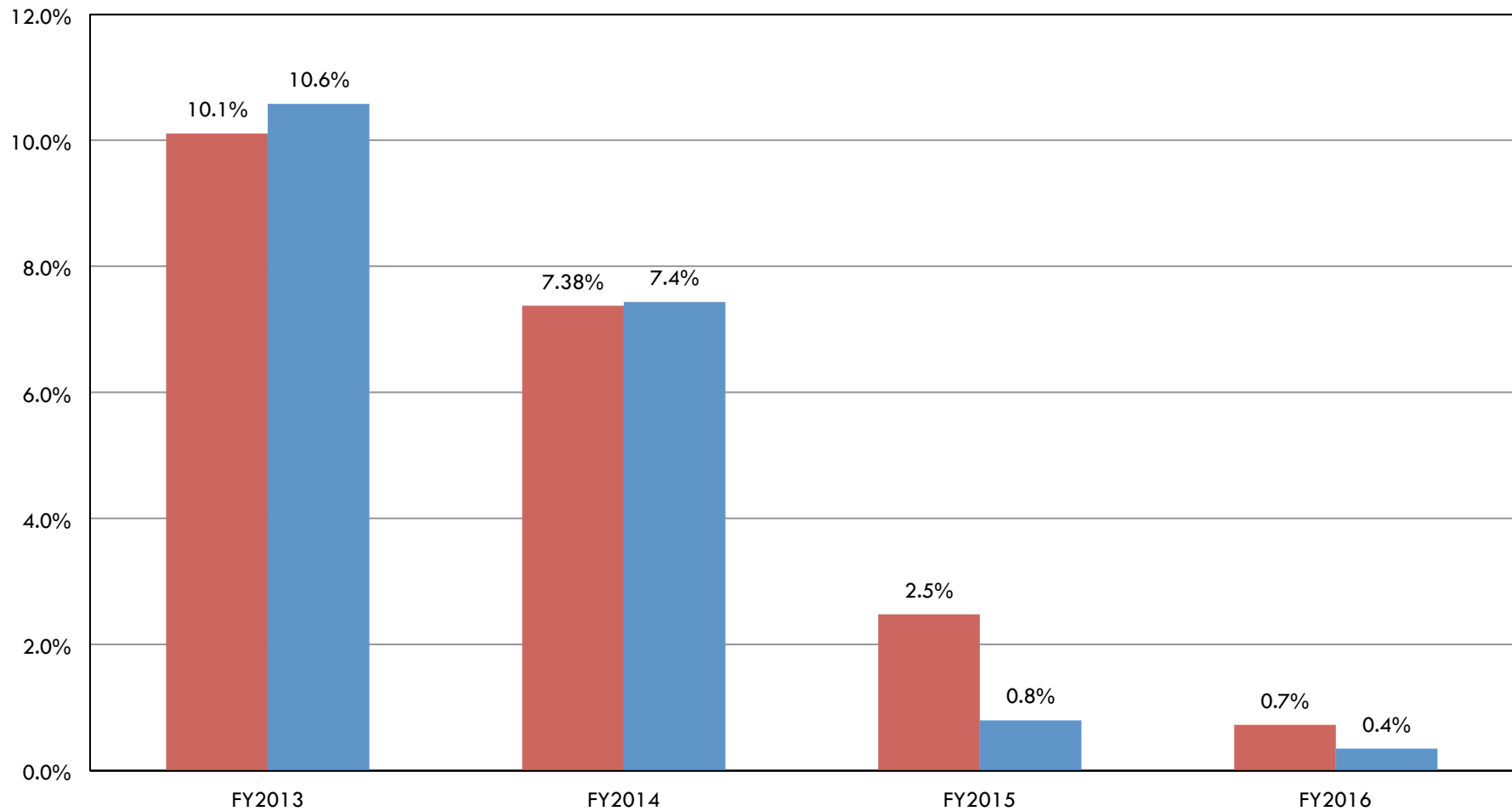
■ August ■ October



Median Sale Price of Single-Family Homes – Control Forecast

(Global Insight Forecast, Annual Growth Rates)

■ August ■ October

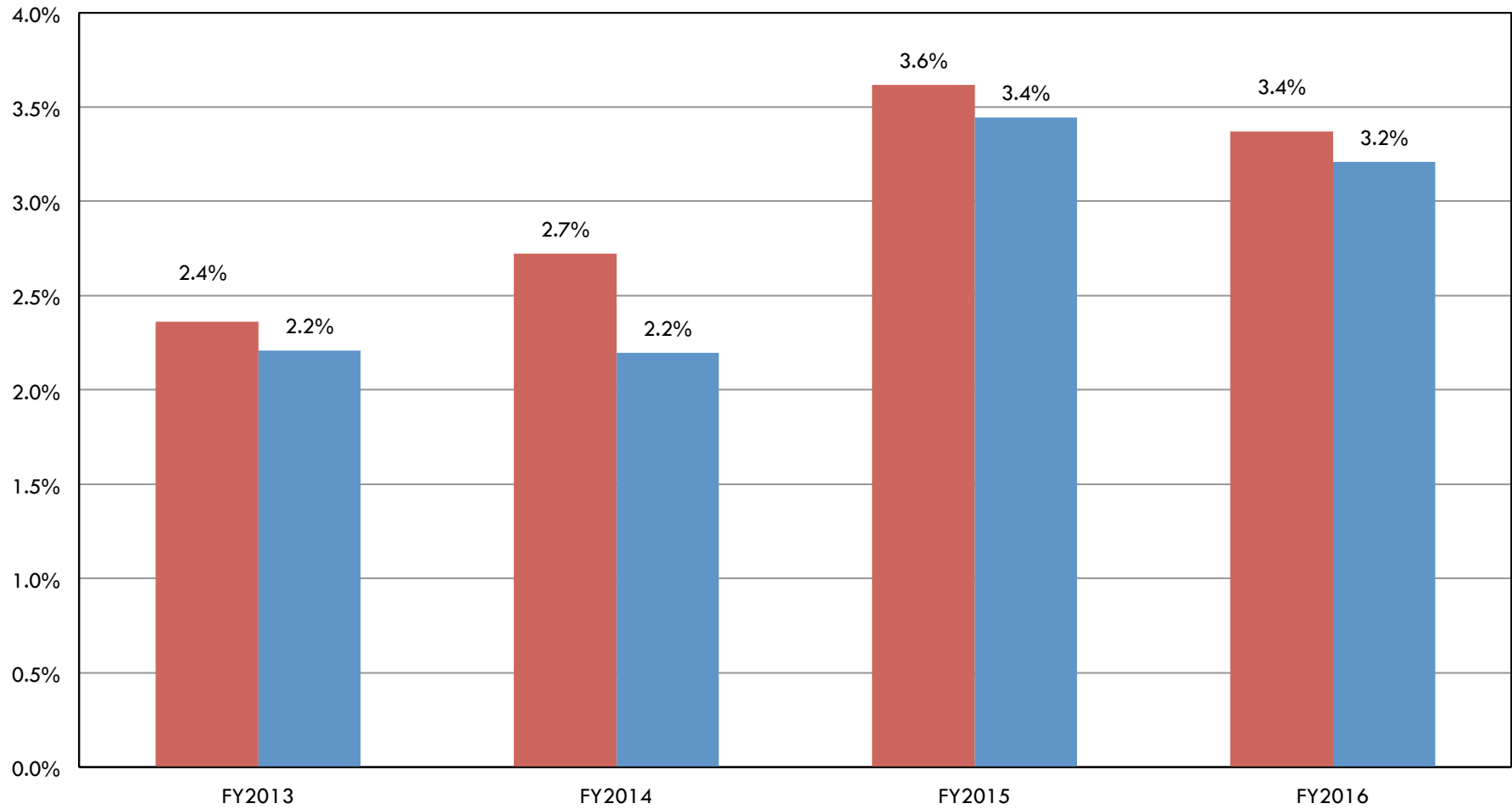


Real Personal Income – Control Forecast

(Global Insight Forecast, Annual Growth Rates)

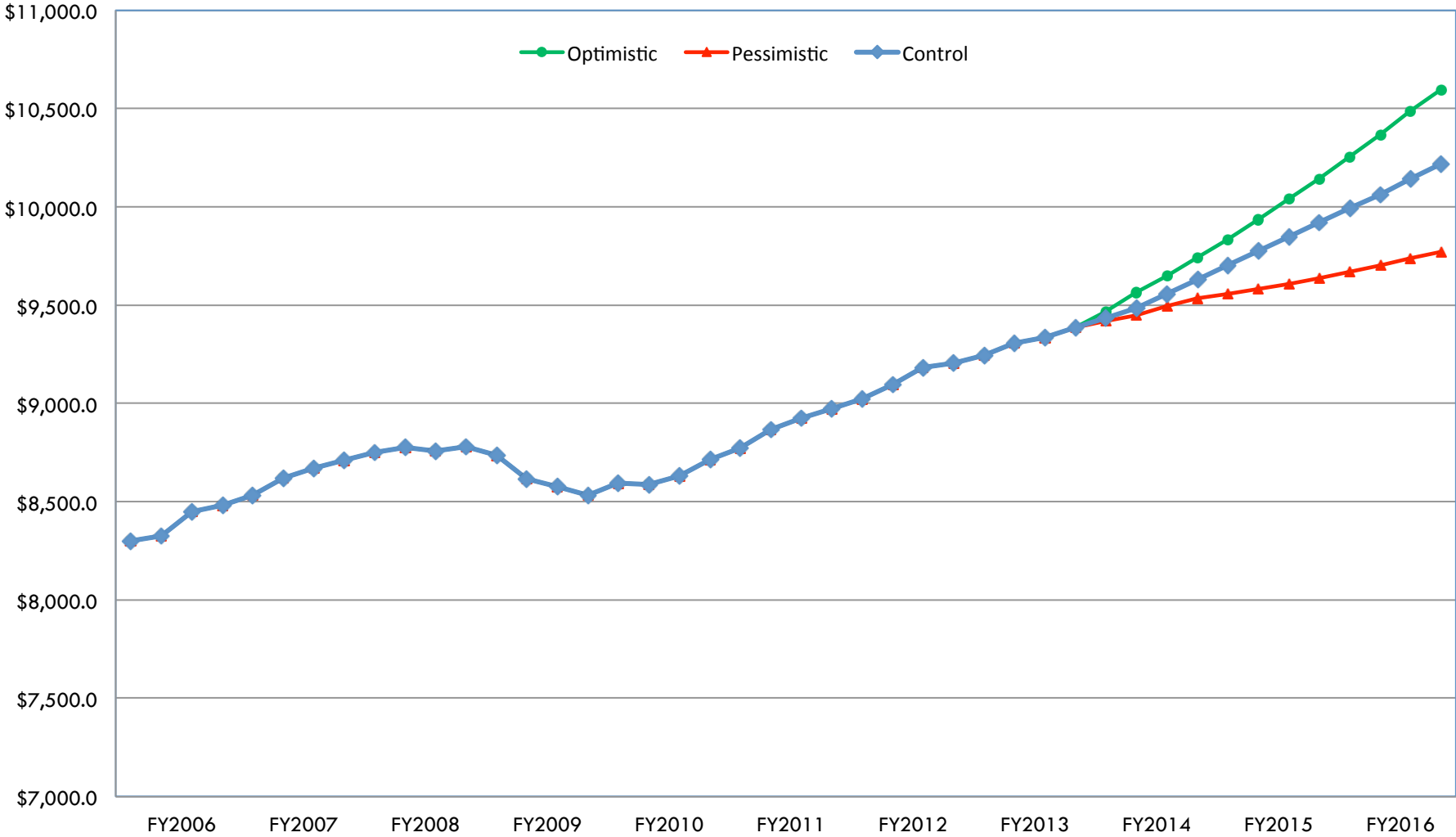


■ August ■ October



Real Consumer Spending (Excluding Food and Energy)

(Billions of 2009 Dollars, Annual Rate, BEA)

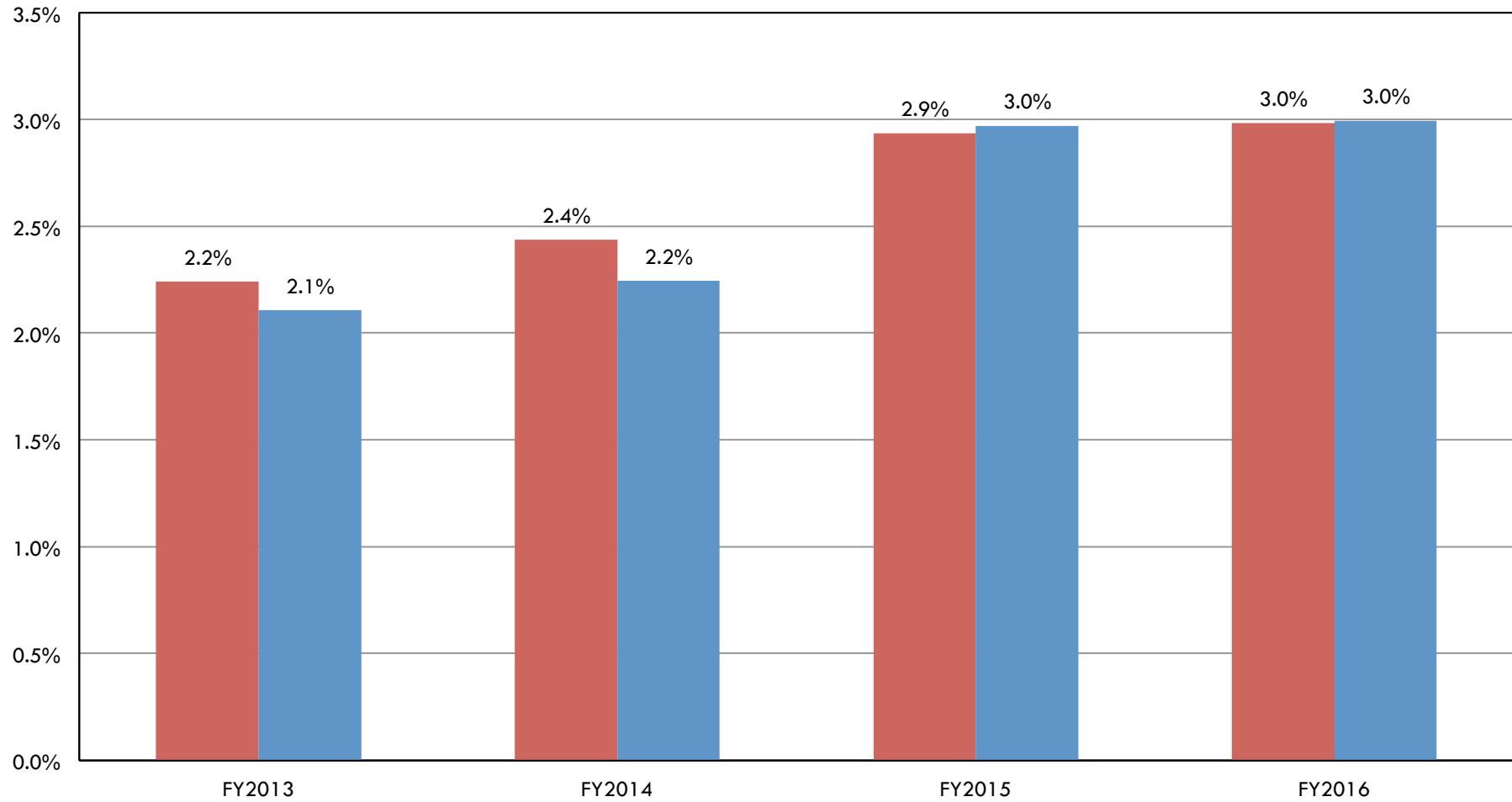


Real Consumer Spending (Ex. Food and Energy) – Control Forecast

(Global Insight Forecast, Annual Growth Rates)

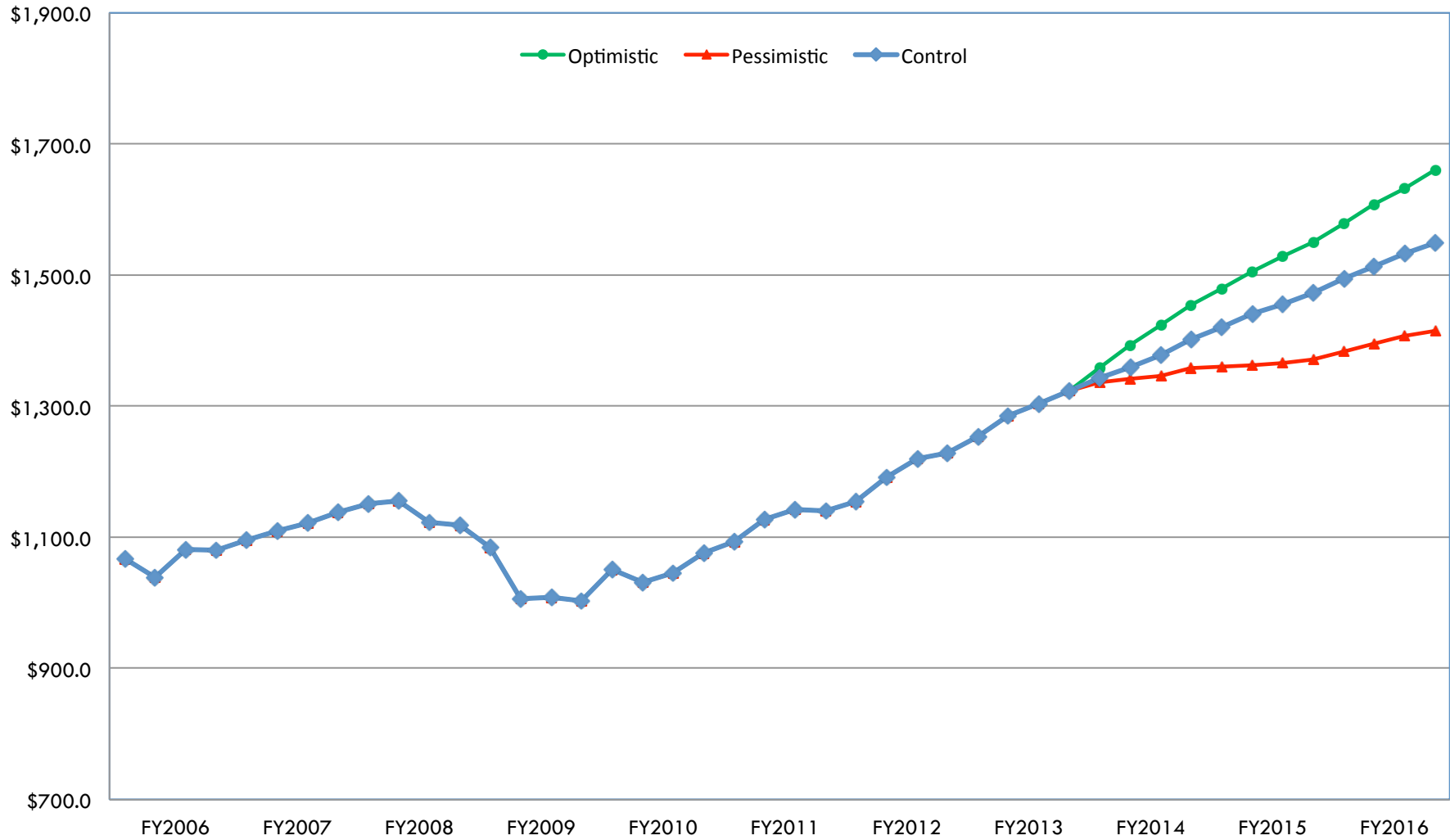


■ August ■ October



Real Consumer Spending on Durable Goods

(Billions of 2009 Dollars, Annual Rate, BEA)

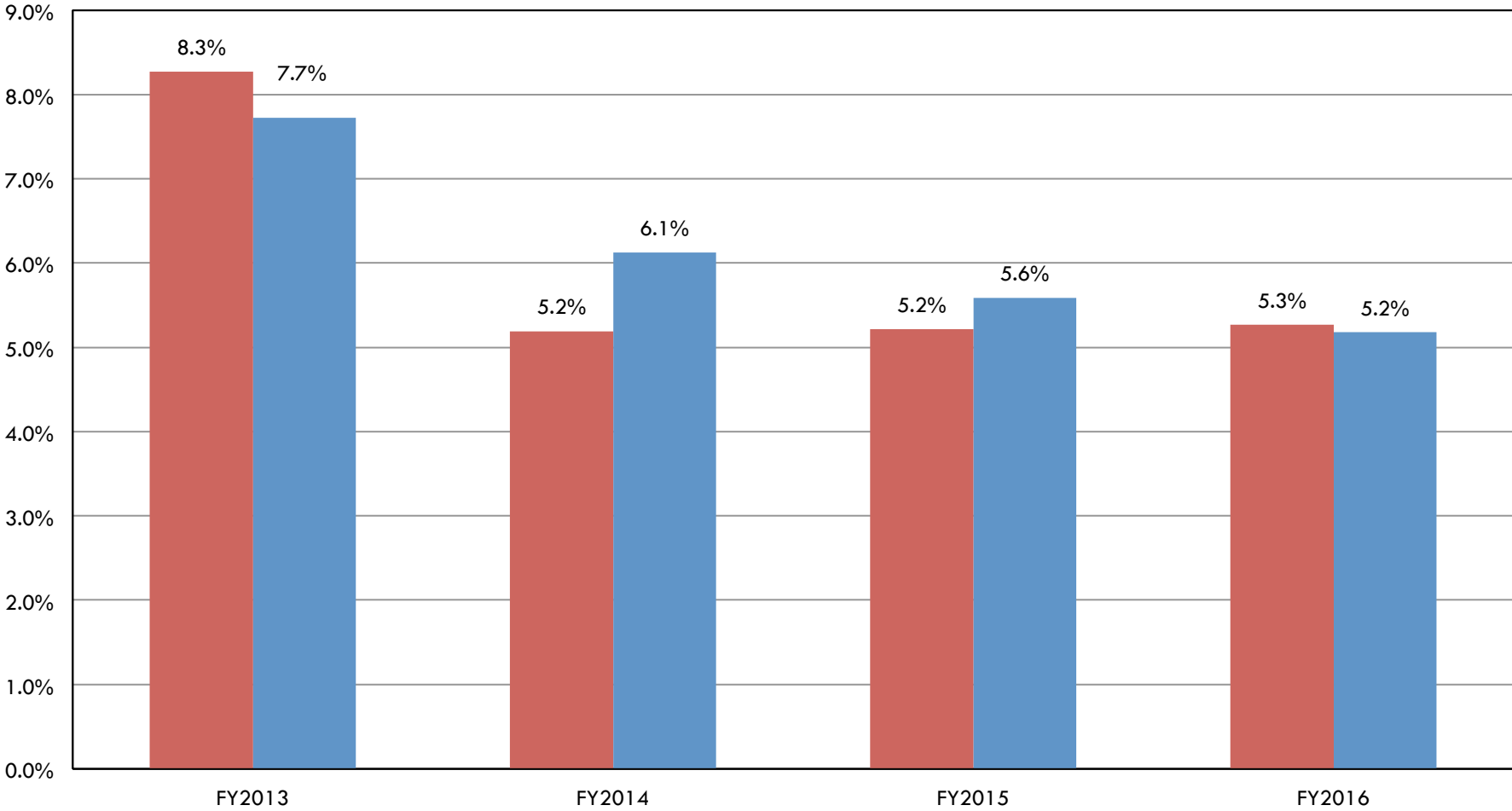


Real Durable Good Spending – Control Forecast

(Global Insight Forecast, Annual Growth Rates)

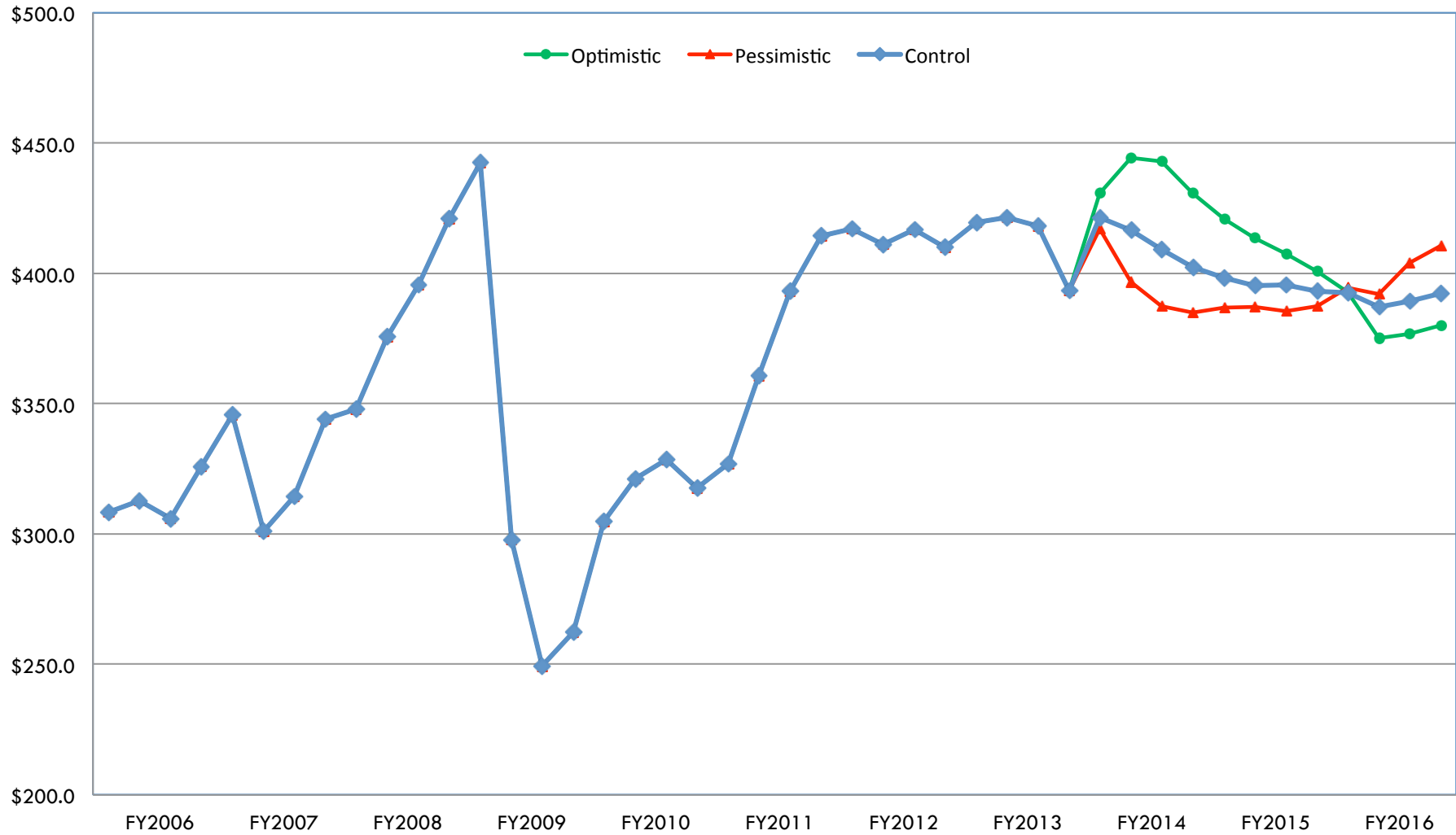


■ August ■ October



Nominal Consumption of Gasoline and Oil

(Billions of Dollars, Annual Rate, BEA)



A CLOSER LOOK AT THE KENTUCKY STATE ECONOMY

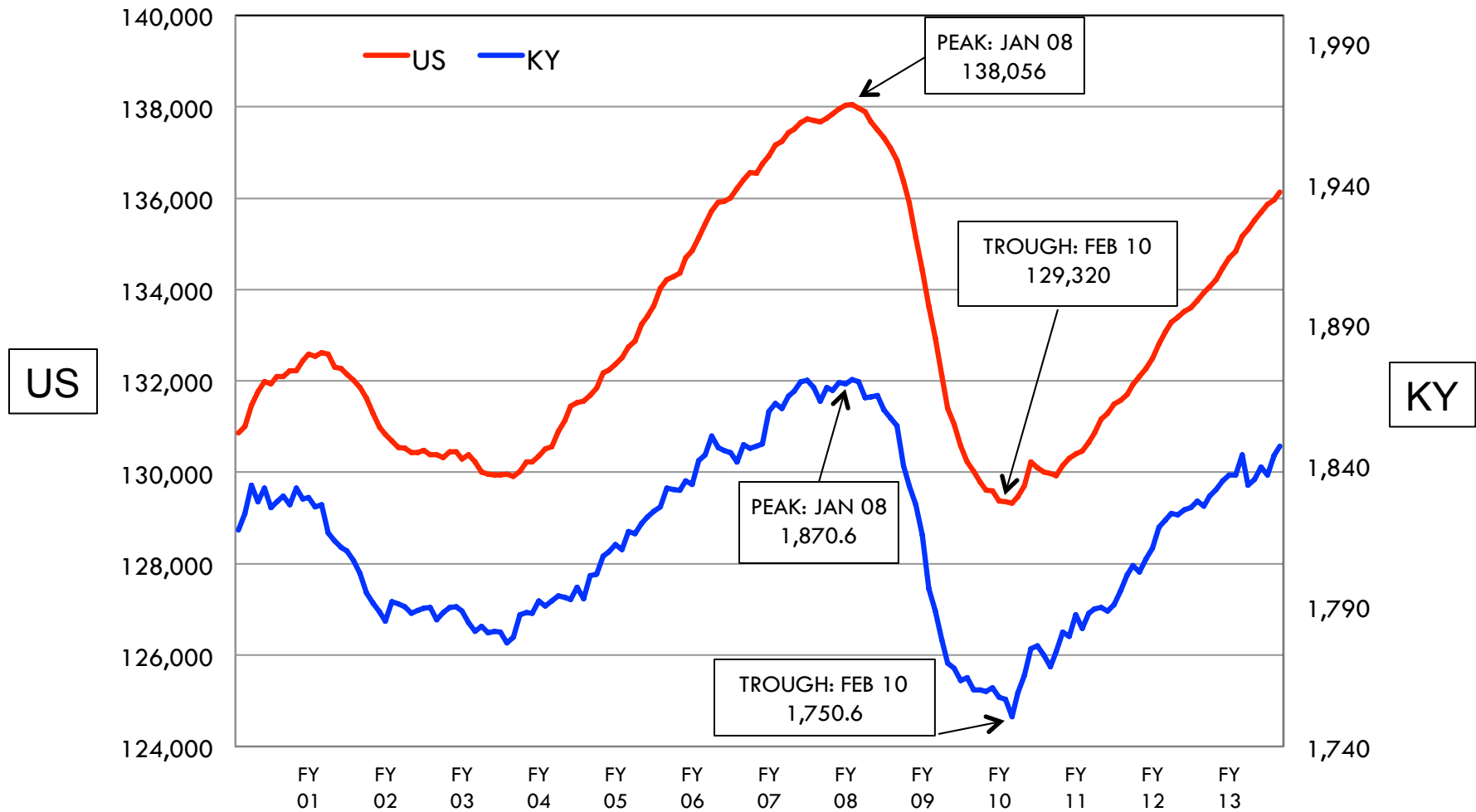
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Non-farm Employment

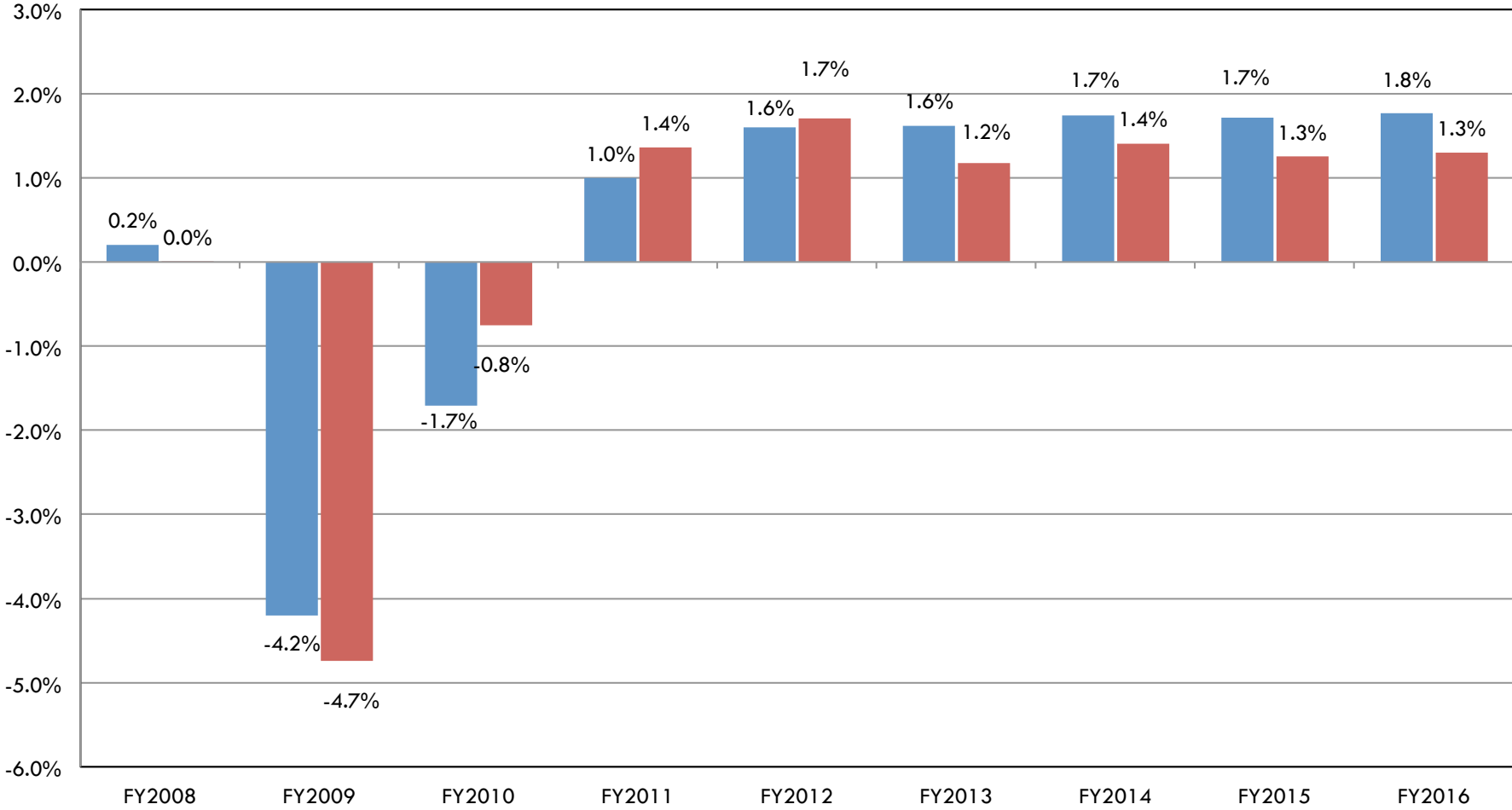
(Thousands, SA, BLS)



Non-Farm Employment – US and Kentucky

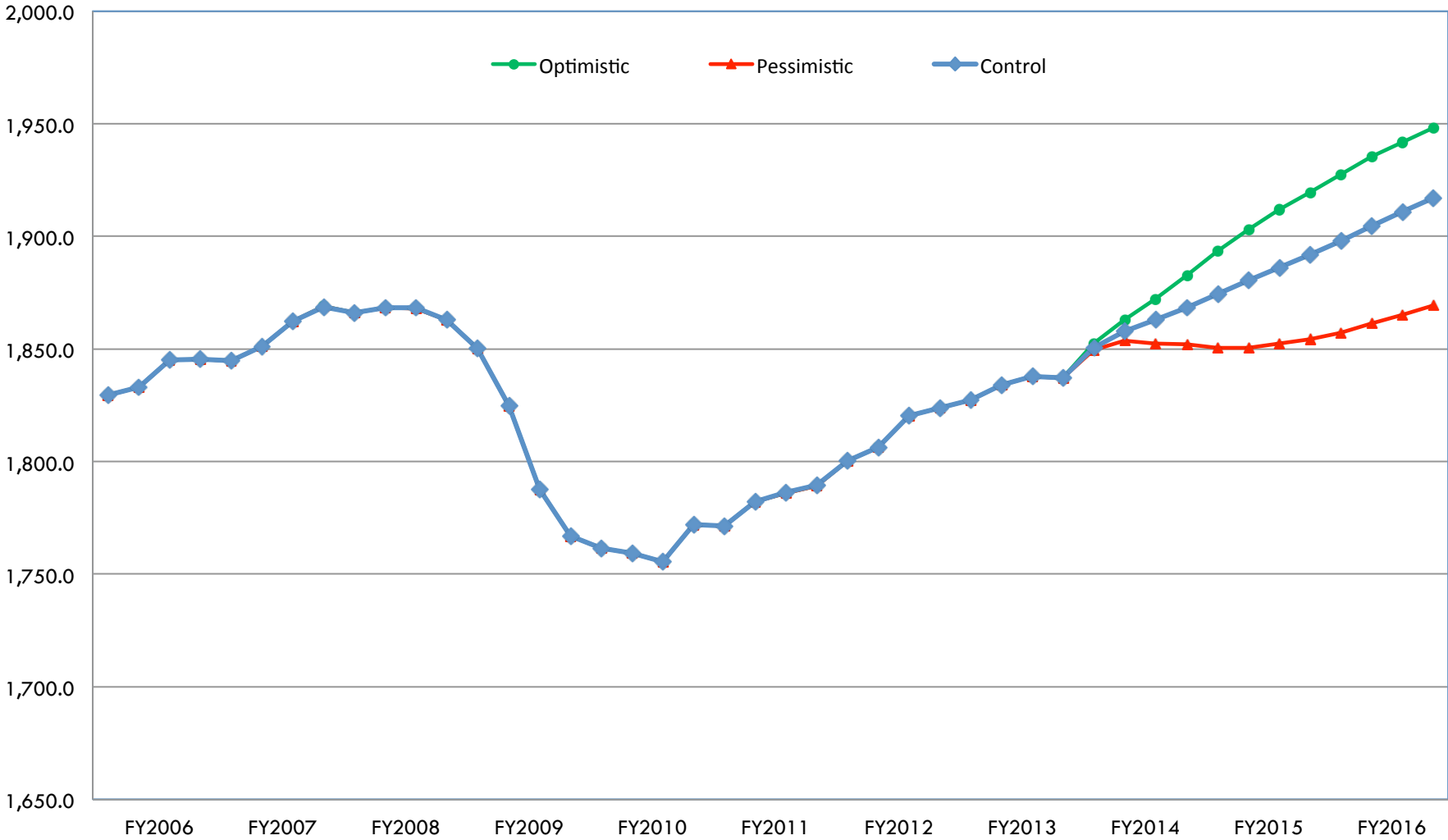
(Fiscal Year Growth Rates, BLS)

■ US - Control ■ KY - Control



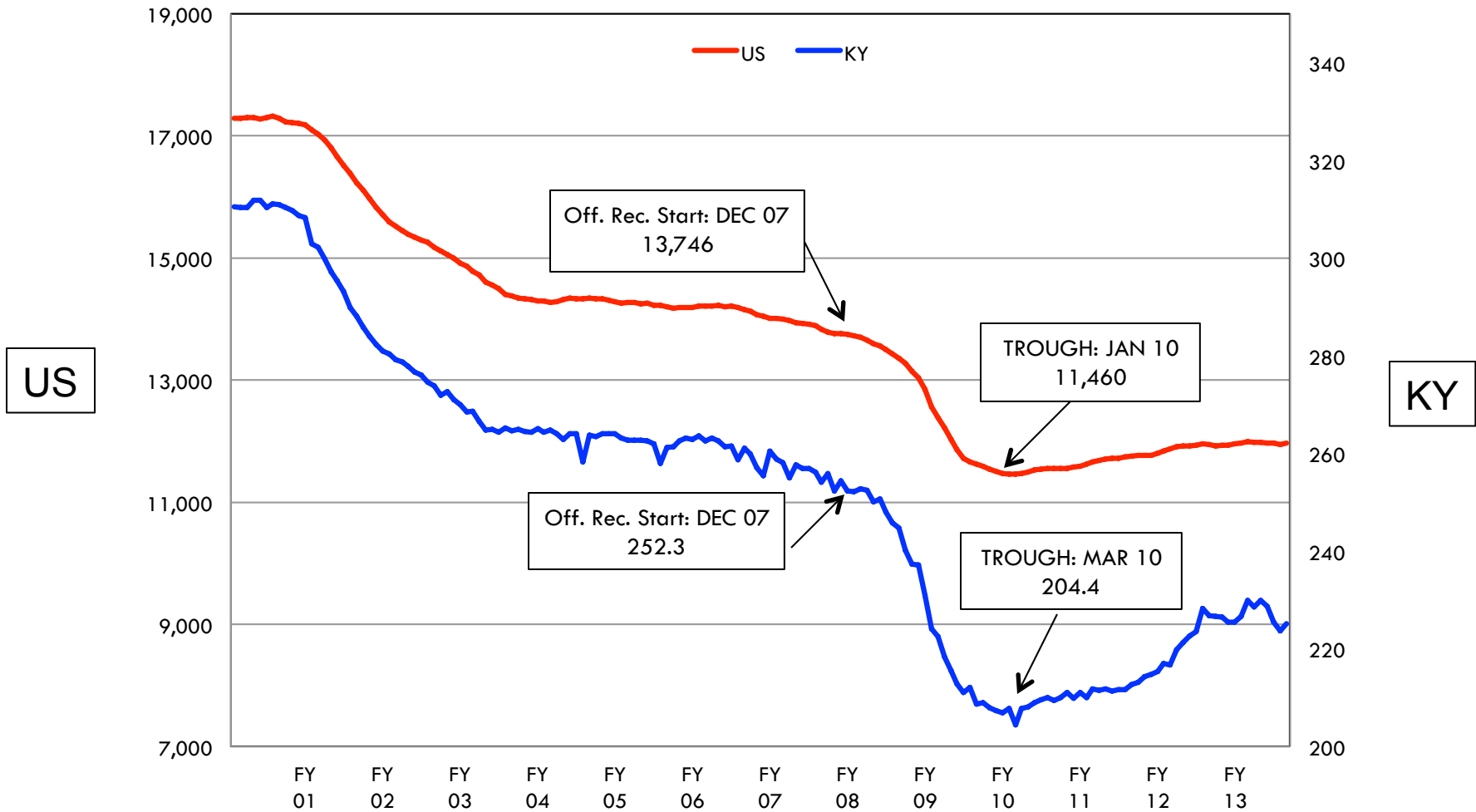
Kentucky Non-Farm Employment

(Thousands, KY MAK Model)



Manufacturing Employment

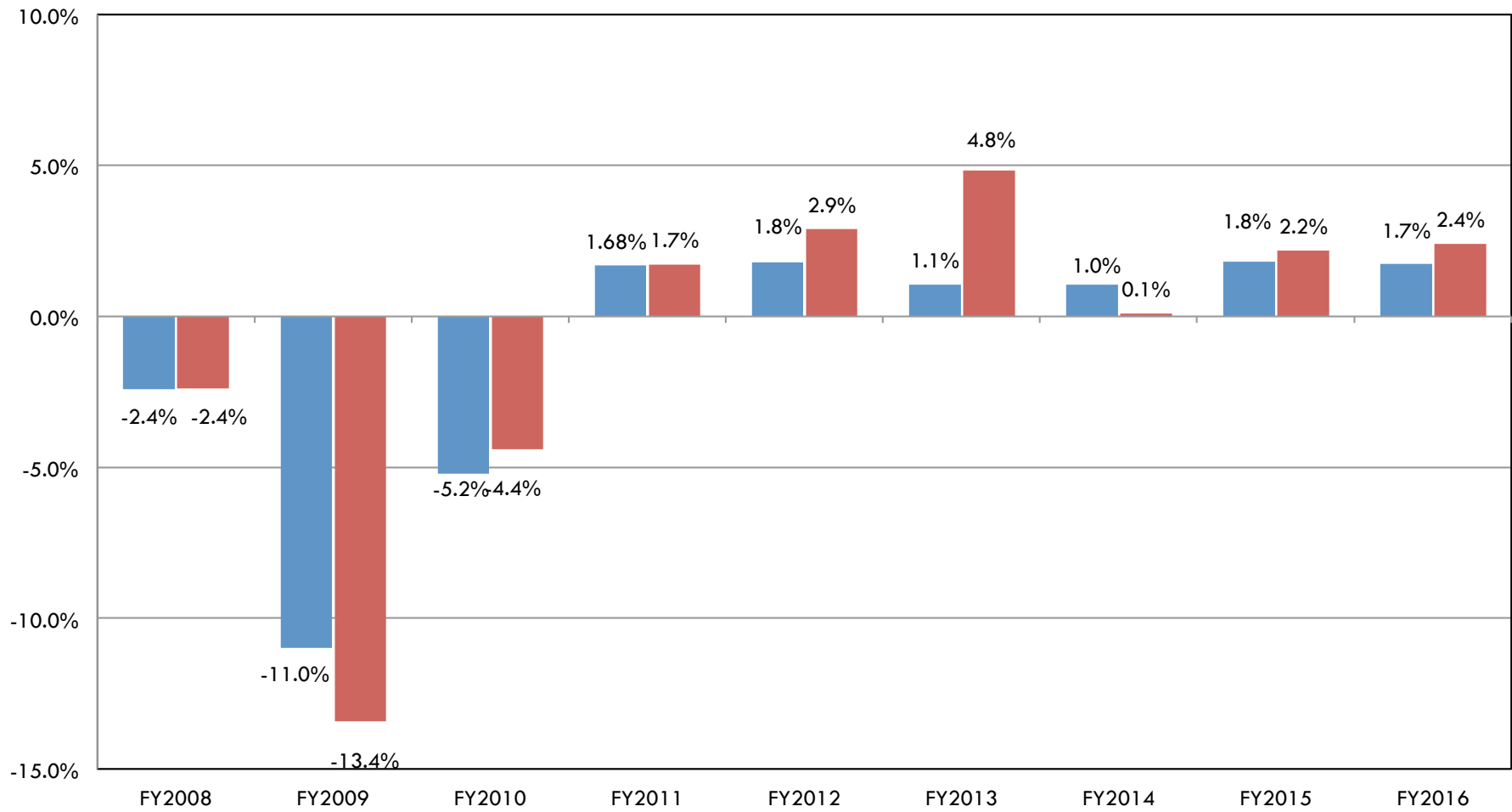
(Thousands, SA, BLS)



Manufacturing Employment – US and Kentucky

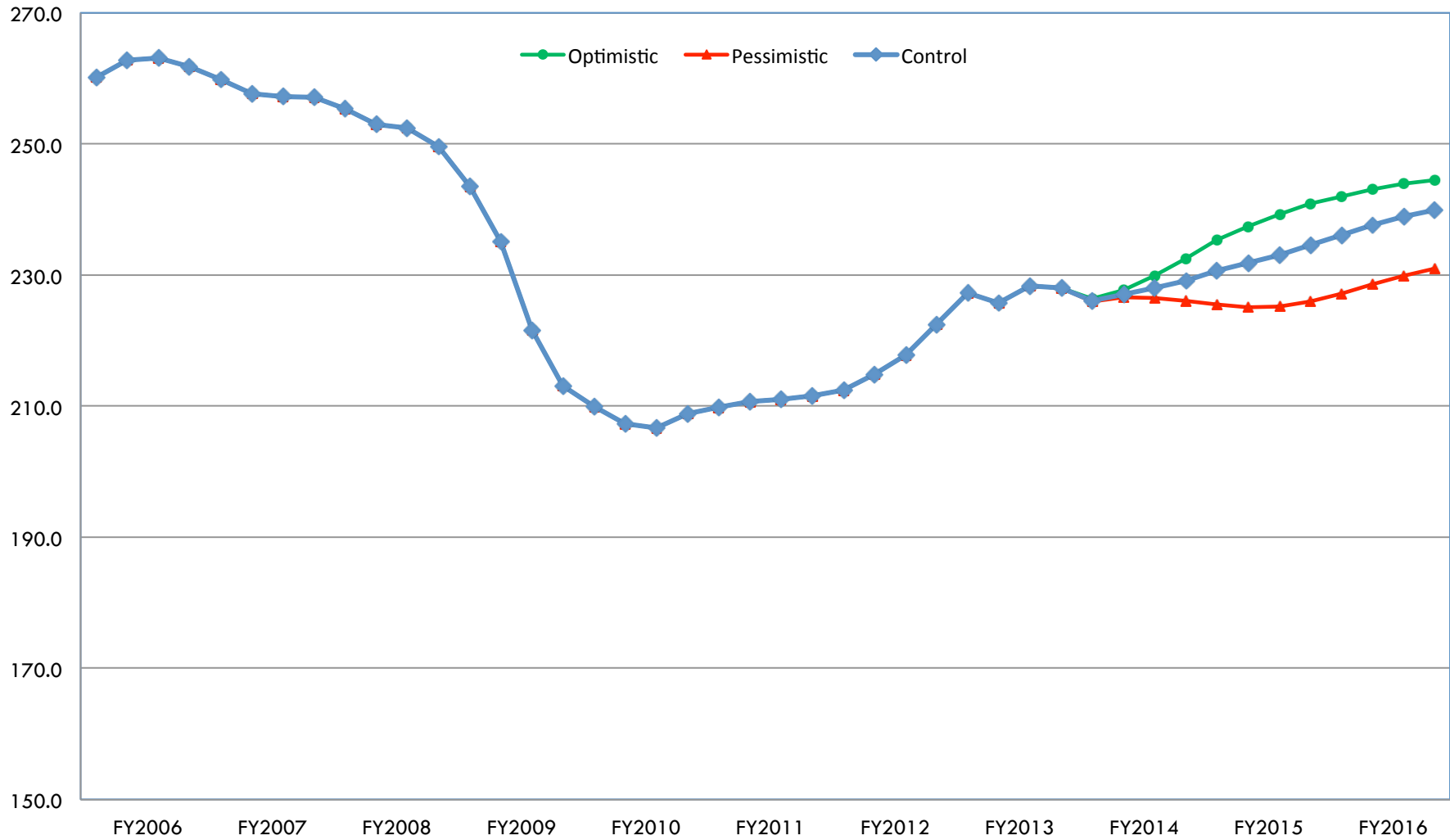
(Fiscal Year Growth Rates, BLS)

■ US - Control ■ KY - Control



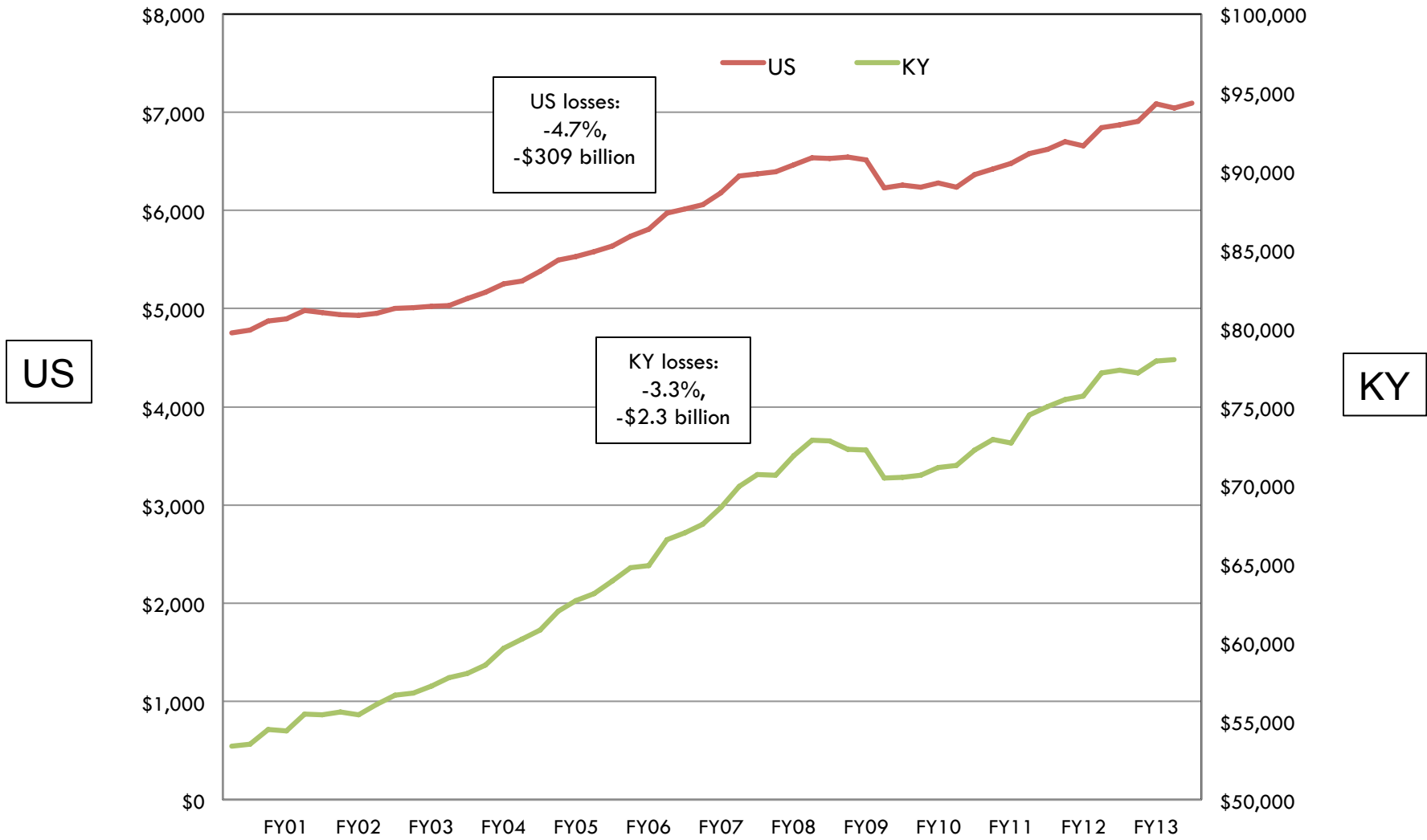
Kentucky Manufacturing Employment

(Thousands, KY MAK Model)



Wages and Salaries Income

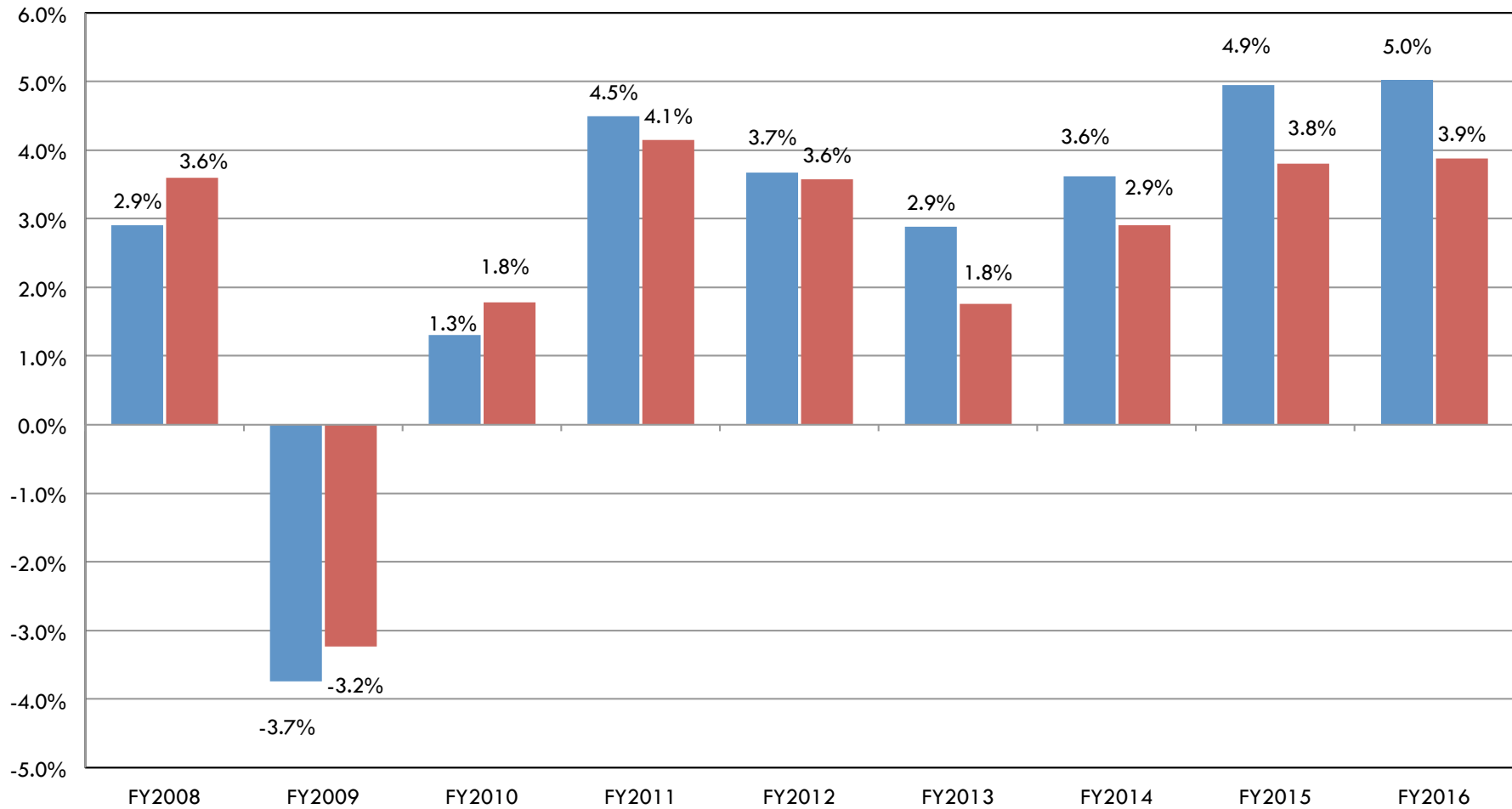
(US – Billions of Dollars, Kentucky - Millions of Dollars, SA, BEA)



Wages and Salaries – US and Kentucky

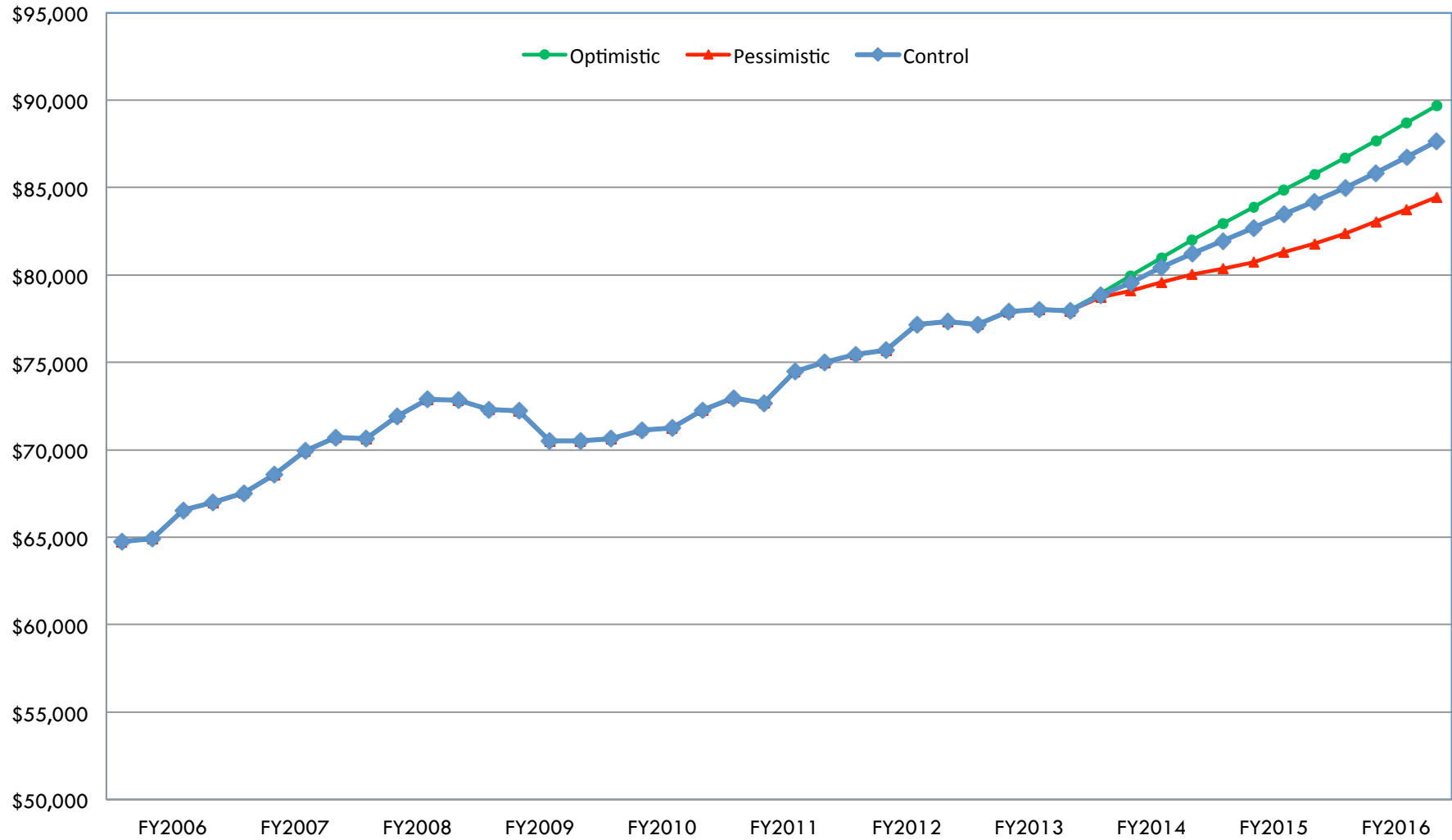
(Fiscal Year Growth Rates, BLS)

■ US - Control ■ KY - Control



Kentucky Wages and Salaries

(Millions of Dollars, KY MAK Model)



Wages in the Aftermath of the Recession

(Growth since the end of the recession)

- U.S. wages have grown more sharply than Kentucky wages since the end of the recession.
 - ▣ U.S. wage and salary income are expected to rise 21.4% between FY09Q2 (the most recent trough) and the end of FY14.
 - ▣ Kentucky wage and salary incomes are expected to rise 13.2% between FY09Q1 (the most recent trough) and the end to FY14.
 - ▣ Kentucky wages and salaries are highly correlated with the largest two General Fund revenue source, the Individual Income Tax and the Sales tax.

Preliminary Conclusions

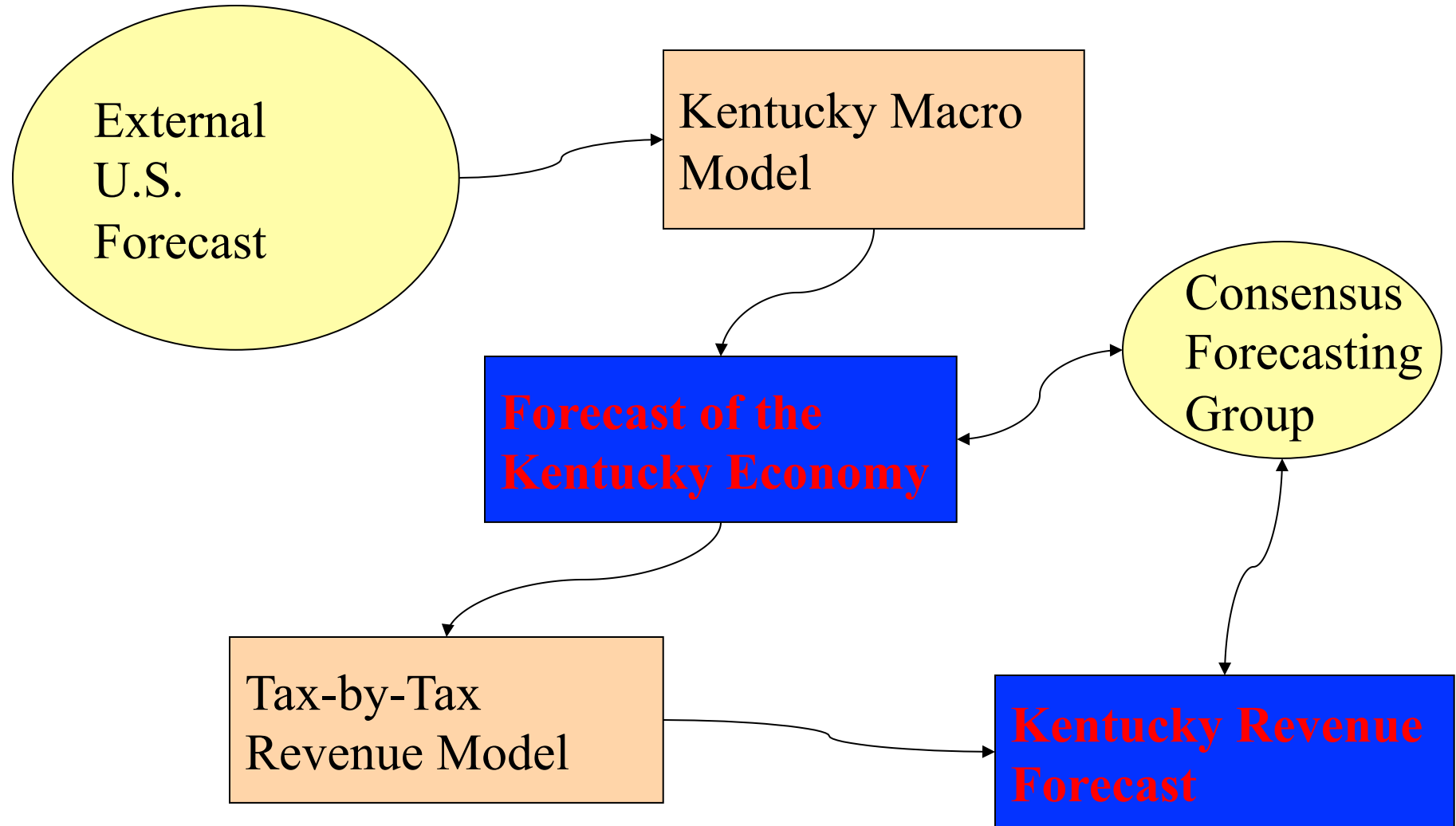
(Key KY variables vis-à-vis U.S. counterparts)

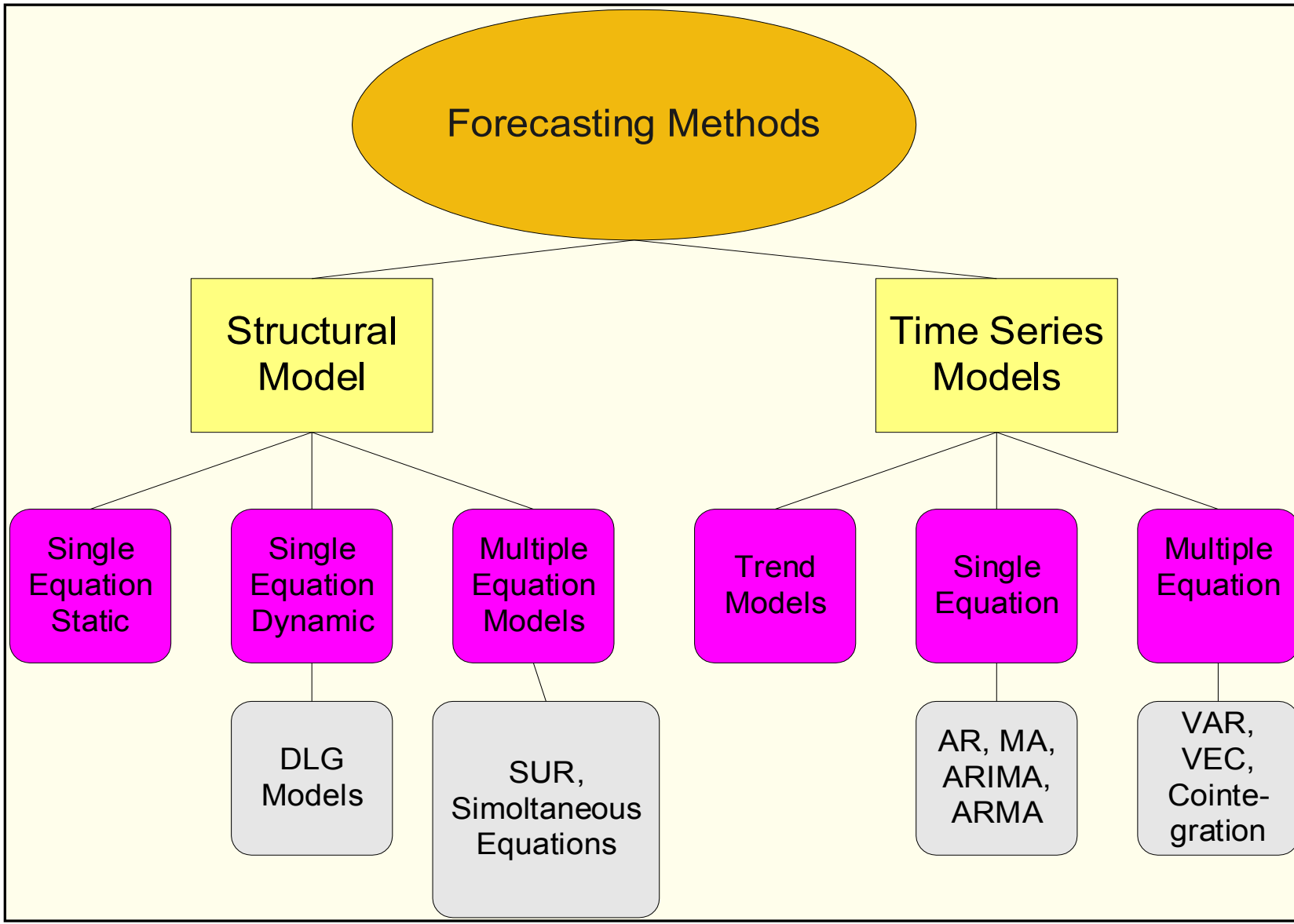
- Kentucky wage and salary incomes fared better during the recessionary years FY08 through FY10, but the rebound from the trough has been more muted.
- Kentucky wages and salaries peaked in FY08Q1 but regained recessionary losses by FY10Q4
- U.S. wages peaked in FY08Q2 and regained recessionary losses by FY11Q2.
- Peak to trough declines:
 - ▣ U.S. – 5.1%
 - ▣ KY – 3.3%

Kentucky Consensus Forecasting

(State Budget Office, CFG, LRC Staffing)

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Historical Sales Tax Growth

(Falling elasticity, slower nominal growth)

Fiscal Year	Sales Tax Growth
2004	3.5%
2005	6.0%
2006	6.0%
2007	2.5%
2008	8.6%
2009	-0.7%
2010	-2.2%
2011**	3.7%
2012	5.4%
2013	-1.0%

** Includes addition of package alcohol into sales tax base

Historical Sales Tax Growth

(Falling elasticity, slower nominal growth)

	<u>Sales Tax Receipts</u>	<u>Annual Growth</u>		<u>Sales Tax Receipts</u>	<u>Annual Growth</u>
FY88	951,755,124		FY00	2,171,397,969	4.1%
FY89	1,045,200,114	9.8%	FY01	2,248,471,100	3.5%
FY90	1,085,822,176	3.9%	FY02	2,299,990,621	2.3%
FY91	1,296,310,445	19.4%	FY03	2,364,182,478	2.8%
FY92	1,363,690,026	5.2%	FY04	2,447,584,698	3.5%
FY93	1,462,251,261	7.2%	FY05	2,594,966,373	6.0%
FY94	1,560,085,519	6.7%	FY06	2,749,765,011	6.0%
FY95	1,680,520,815	7.7%	FY07	2,817,652,253	2.5%
FY96	1,783,881,316	6.2%	FY08	2,877,814,014	2.1%
FY97	1,882,681,995	5.5%	FY09	2,857,665,168	-0.7%
FY98	1,981,297,580	5.2%	FY10	2,794,057,329	-2.2%
FY99	2,085,899,677	5.3%			

Compound Growth 1988-2007

5.9%

Analysis of Recent Trends

- The decline in sales tax receipts for FY13 represents the third decline in the previous five fiscal years
- Before the past recession, sales taxes fell only one time since 1979
- The decade of the 1990's witnessed profound growth in the sales tax on a regular basis
- Growth has stalled in recent years
 - ▣ Multiple hypothetical explanations
 - ▣ Global Insight has emphasized
 - Consumer deleveraging
 - Cost-cutting in absence of pricing power
 - Uncertainty regarding employment and earnings

Sales Tax – A Blended Approach

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Sales Tax – A Blended Approach

- ARIMA model ({2,3,4}; 1; {2,4,6})
 - ▣ Very sensitive to sample used in estimation
 - ▣ Contraindicated for planning horizon
 - ▣ Performed well in-sample
- VEC model using co-integration equation
 - ▣ In LEVELS
 - ▣ Endogenous: Sales Tax, KY Wages and Salaries, Construction Starts

OSBD ARIMA Models

- ARIMA models are generally contraindicated for long-range forecasting, -- but –
- They are useful tools for short forecasting if properly specified
- ARIMA (Autoregressive, Integrated, Moving Avg)
 - ▣ Integration from Stationarity (DF Test)
 - ▣ Autoregressive from Partial Autocorrelation functions
 - ▣ Moving Average from Autocorrelation Functions
- Need to check your residuals to ensure expected value is zero.

OSBD Vector Autoregression Protocol

- VAR is a modeling methodology, not an estimation technique. EViews estimates all VAR equations in OLS.
- Test all endogenous variables for stationarity (Augmented Dickey-Fuller)
- Estimate the VAR using predetermined lag-length
- The remaining steps are enhancements pursuant to prolonged consultations with Dr. Oral Capps (Texas A&M University, NABE)
 - ▣ Check the Lag Length Criteria Test
 - ▣ Re-Estimate the VAR with the appropriate lag structure
 - ▣ Review the diagnostics and eliminate coefficients that do not have a coefficient statistically different from 0 at the 90% confidence level
 - ▣ Create a new system of equations
 - ▣ Estimate the new system of equations using SUR, 3SLS, or GLS
 - ▣ Check the diagnostic on each equation for acceptable R^2 and significance of all coefficients
 - ▣ Once the estimation phase is complete, the system is turned into a model which is solved for the appropriate forecasting horizon.

OSBD Cointegration Protocol

- Why to Use Cointegration Models?
 - ▣ Marginal Efficiency Gains
 - ▣ Use of Levels of Endogenous Variables are Cointegrated of the Same Order
 - ▣ Specify Cointegrated Relationship
 - ▣ Hypothesis Testing
- Similar to VAR Models
 - ▣ Both systems of equations
 - ▣ Both have flexible estimation technique options

August Forecast

(October Forecast Due on Friday)

Fiscal Year	Control (\$ mil)	Optimistic (\$ mil)	Pessimistic (\$ mil)
2014	\$3,065.2 (1.4%)	\$3,099.7 (2.6%)	\$3,027.3 (0.2%)
2015	\$3,102.3 (1.2%)	\$3,153.3 (1.7%)	\$3,074.3 (1.6%)
2016	\$3,166.3 (2.1%)	\$3,199.0 (1.5%)	\$3,121.0 (1.5%)
2017	\$3,242.0 (2.4%)	\$3,274.0 (2.3%)	\$3,187.3 (2.1%)
2018	\$3,323.3 (2.8%)	\$3,375.3 (3.1%)	\$3,269.3 (2.6%)

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