

# Will Inequality Continue to Rise? Forecasting Income Inequality in the United States

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# Starting in 1980....

- 1980 represents a turning point in inequality after which it “exploded” (Piketty 2014, Goldin and Katz 2008)
- Trends are different afterwards such that beginning in a previous period leads to worse forecasts
- Change in labor market conditions starting in 1980 due to skill-biased technological change (SBTC)
- Analysts do not expect future trends to resemble the prior period
- Swaps crosswalk only to 1975 too many changes in CPS survey methods



# Motivation and Aim

- Efforts to explain trends in inequality-hot topic for policy
  - Recent work by Piketty (2014) to predict future trends
  - Role of skill-biased technological change—role in inequality trends
  - Best model to predict trends?
- “This paper [attempts to] answers question by choosing models to forecast several inequality measures and providing short-term forecast.”



# Motivation

- Research Questions:
  - ▶ Will income inequality continue to rise in the short-run?
  - ▶ Does this depend on other macro, human capital and labor market variables?
- Strong growth in income inequality in the United States since 1980. This growth has differed by group and by income share
- Contribution: Forecasting short-run inequality for the United States using microdata from Current Population Survey and potential determinants

# To predict inequality, need answers to questions

- Most appropriate measure?
- Determinates?



# Measure

- What to measure? Income
  - ▶ Individual earnings-wages, self-employment, and farm income
  - ▶ Household income-labor (70% of hh Y), capital income, capital income, government transfers
- How to measure? Dependent variable in regression model
  - ▶ Gini index
  - ▶ 90/10 income ratios
  - ▶ Income shares
- Where to measure using Gini?
  - ▶ Overall distribution
  - ▶ Top 1% income share
  - ▶ Top 0.1% income share

# Determinants on Inequality Forecast

- Human capital attainment
- Labor Force structure
- Macroeconomic variables



# Predictive Factors I: Human Capital Attainment Indicators

- % Population 25+ Years Who have Completed College
- % Female Population 25+ Years Who have Completed College
- % of Population 25+ Years Who have Completed High School
- % of Female Population 25+ Years Who have Completed High
- Skill Premium (College Wage/High School Wage)





# Predictive Factors II: Labor Force Structure Indicators

- High-Skill Employment (Non-routine Cognitive)
- Middle-Skill Employment I (Routine Cognitive)
- Middle-Skill Employment II (Routine Manual)
- Low-Skill Employment (Non-routine Manual)
- Share of Services in GDP
- Labor Force Participation
- Female Labor Force Participation

❖ *“Skill” vars. defined as log number employed in group*

# Predictive Factors III: Macroeconomic Indicators

- Real GDP (*gdp*)
- Government Expenditure as a Share of GDP (*gov/gdp*)
- Inflation (*infl*)
- Unemployment (*unemp*)
- Male Unemployment (*m\_unemp*)

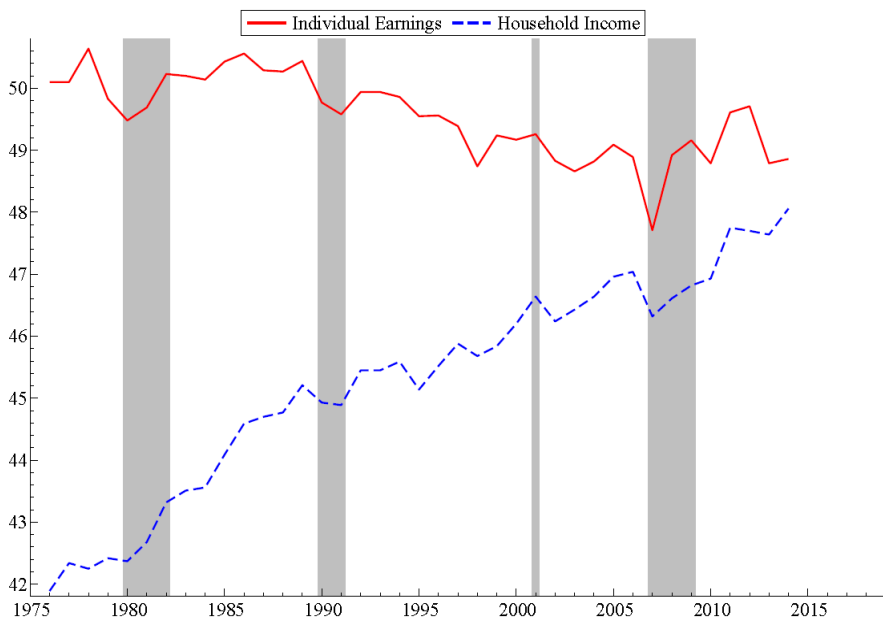


# Data: Current Population Survey

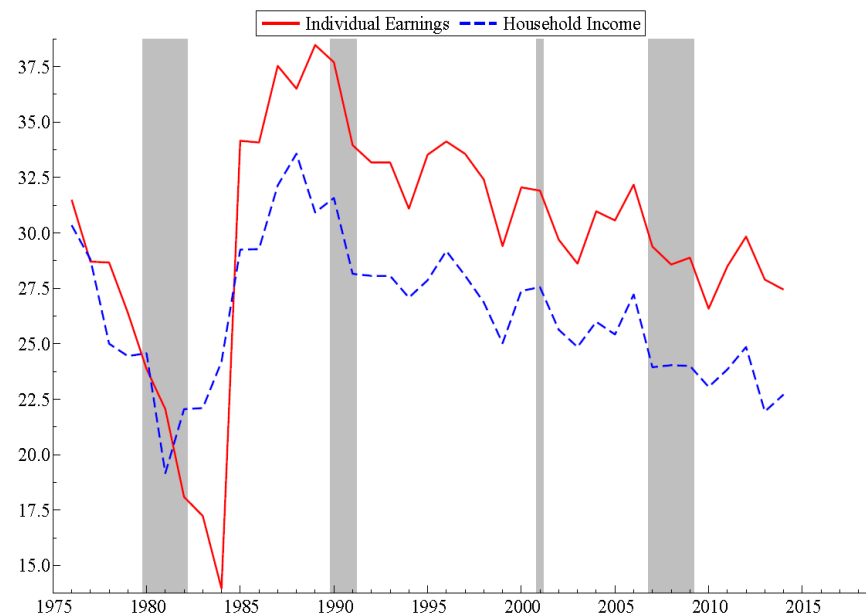
- Annual microdata in CPS 1975-2014 (public use)
- Structural breaks
  - ▶ 1993: Structural break due to survey instrument change
    - Asked specifically about other sources of income
    - Allowed higher values for income reporting (internal topcode)
    - Weighting and imputation changes
    - Change in interview mode
  - ▶ Most of increase is not increase in income inequality but to structural break from 1992 to 1993
  - ▶ Others: 1985, 1987, 2007
- Top-coding - existence and consistency: used rank proximity swapping technique (all value greater  $\geq$  topcode swapped with other values within a bounded interval to better represent internal data and allow for more accurate inequality calculations)

# Individual and Household: All and Top 1%: Gini

Ginis compared: Individuals & Households

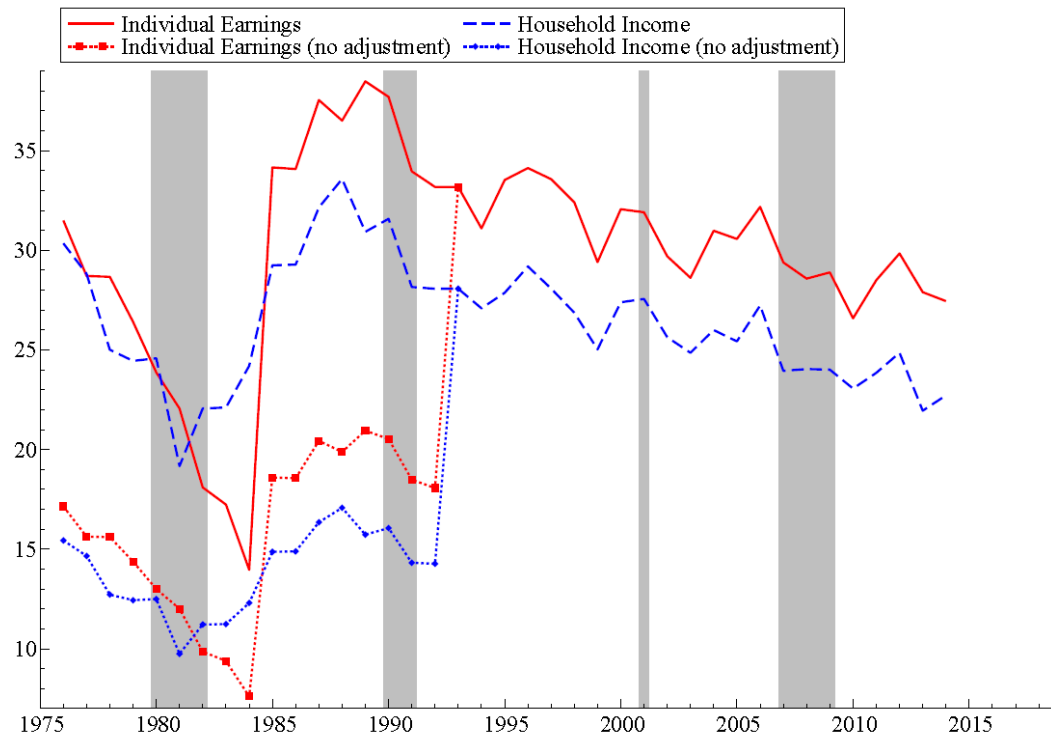


Top 1 Gini compared: Individuals & Households



# Income Data Adjusted for Break

Top 1 Ginis compared: 1992-1993 Structural Break



# Model Selection

- Dickey-Fuller test: all series stationary after first differencing, except labor force participation and female labor force participation which were second differenced
  - Model in differences, converted back into levels
  - Max 4 lags
  - Standard autoregressive models were chosen
  - General-to-Specific modeling approach<sup>1</sup>, with Impulse Indicator
  - Saturation (Impulse Indicator Saturation) at 1% level
  - Forecast comparison in pseudo-out-of-sample periods with Diebold-Mariano tests and White Reality Check
  - Cautions: Correlation of indicators and overfitting
- ❖ <sup>1</sup>*Autometrics (OxMetrics) used to select best model*



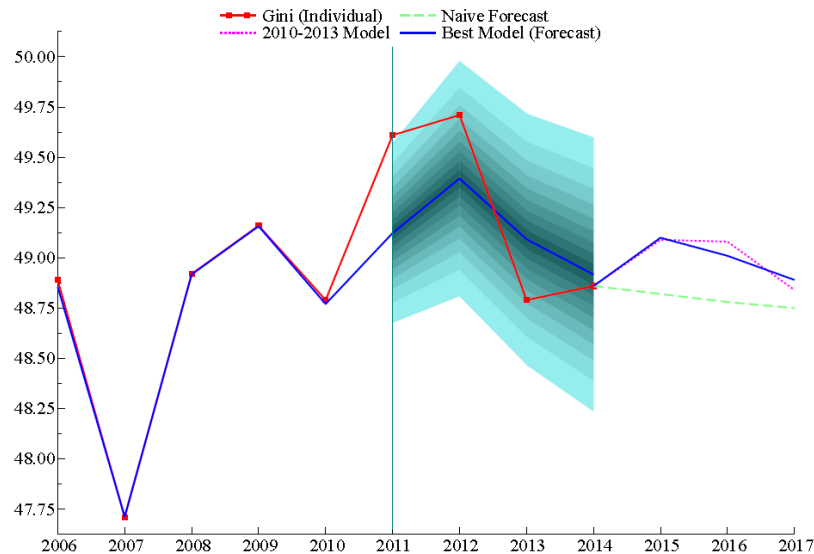
# Results

- Best predictors
  - ▶ Human capital attainment
  - ▶ Labor force structure
- Model selection not robust but yields robust forecasts
- Out of sample forecasts differ between models by <6% for all variables and <2% for 4/8 measures
- Top 1% is projected to rise, while share of top 0.1% predicted to fall - consistent with inequality within top 1% falling
- Overall (Gini) individual inequality constant while household inequality rises

# Gini: Individual Earnings

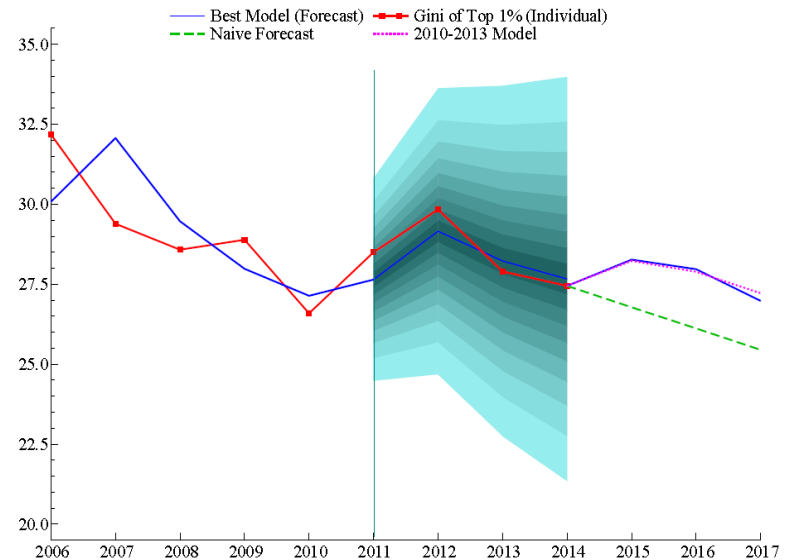
## Gini: Individual Earnings

$$\Delta \widehat{Gini}_t = -0.04 - 1.97d_{2007} + 1.05d_{2008} - 0.15 \Delta Gini_{t-1} - 0.37 \Delta Gini_{t-2} - 0.09 \Delta mskill_{2,t-1} - 3.55 \Delta mskill_{2,t-2} + \epsilon_t$$



## Gini of Top 1%: Individual Earnings

$$\Delta \widehat{Top1Gini}_t = -0.69 + 19d_{1985} + 208 \Delta \frac{mskill1}{lskill}_{t-1} - 258 \Delta \frac{mskill1}{lskill}_{t-2} - 185 \Delta \frac{mskill1}{lskill}_{t-3}$$



Pseudo out-of-sample forecast (2011-14) vs True out-of-sample forecast (2015-2017)

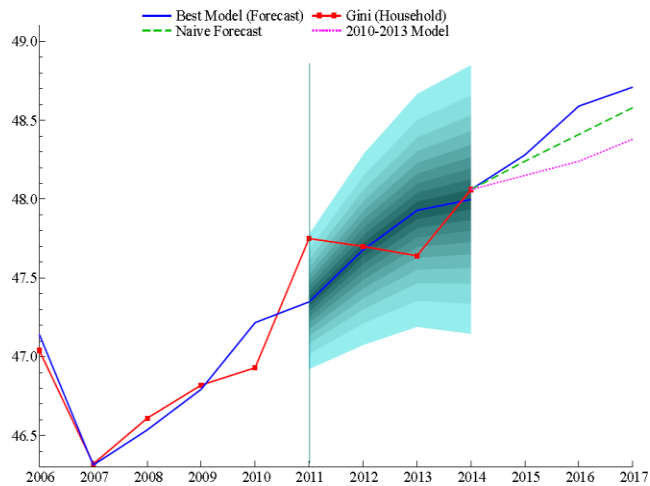




# Gini: Household Income

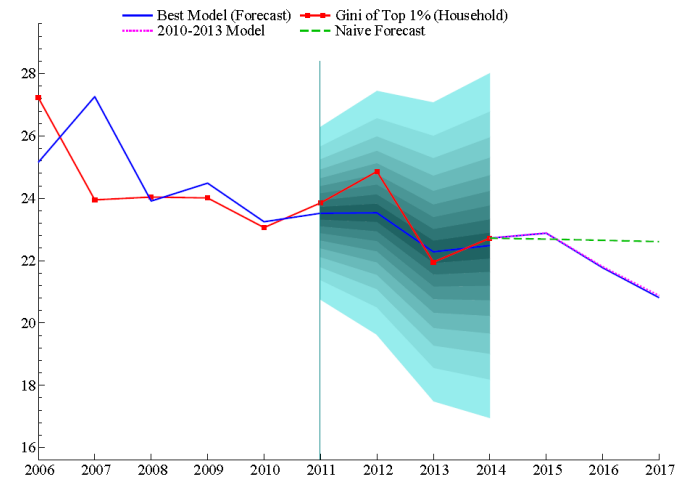
## Gini: Household Income

$$\widehat{\Delta Gini}_t = 0.01 - 0.91d_{2007} + 6.10 \Delta serv/gdp_{t-2} - 38.90 \Delta \frac{mskill}{skill}_{t-3} + 0.28 \Delta col\_fem_{t-3} + \epsilon_t$$



## Gini of Top 1%: Household Income

$$\widehat{\Delta Top1Gini}_t = -0.73 - 5.78d_{1981} + 3.83d_{1985} + 36.89 \Delta lskill_{t-2} - 1.23 \Delta \Delta fem\_lfpr_{t-2} - 0.27 \Delta \Delta fem\_lfpr_{t-3} + 0.63 \Delta \Delta fem\_lfpr_{t-4} + \epsilon_t$$



Also results plotted for change in shares

# Results: Model Selection

- Best predictors
  - ▶ Indicators of human capital attainment
  - ▶ Labor force structure - no one variable is super predictive
- Model selection in a General-to-Specific modeling approach is not robust but yields robust forecasts
- Sensitive to lag length and variable inclusion

# Results: Forecasts

- 2010-2013 models forecast in the same direction as 2011-2014 models
- Out of sample forecasts differ between models by <6% for all variables and <2% for 4/8 measures
- Best models not not statistically different from naive models
- Overall Gini individual earnings inequality constant while household inequality increases steady-Inequality among individual and households continues to show different patterns
- Share of top 1% rising but inequality within top 1% falling



# Comments-1

- Concern with forecast since income used appears to subject to topcodes (Burkhuser et al. 2011)—concern swapping adequate
  - ▶ Try analysis with internal data
  - ▶ Try analysis with imputes from SCF at top or tax data
- Are these data appropriate/adequate for measuring top 1% much less 0.1%?
- Issue of taxes, realized capital gains, definitions of transfers (especially at top given different compensation packages for executives)
- Farm income versus income from rental properties (one individual, one household)
- Use of equivalence scales? Major changes in households composition over this time period



# Comments-2

- Determinants are macro—what about micro? You have the data...
  - ▶ Different determinants for individuals and households over the income distribution
- Macroeconomic econometrics— what about micro?



# Contact Information

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