Did Quantitative Easing Increase Income Inequality?

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QE & Inequality

Research Question:
What were the distributional impacts of unconventional monetary policy?

This Paper:
▶ Econometric decomposition of changes in U.S. income inequality
▶ Examine contribution of QE channels pre and post-QE
▶ Simple counterfactual exercise to frame likely causal magnitudes

Results:
▶ Employment generation is highly egalitarian
▶ But outweighed by large disequalizing equity return effects
▶ Net effect: QE modestly increased income inequality
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Economic Expansions Since 1960

Employment Rate

Stock Prices

Current Expansion

Historical
Overview

Income Growth by Quantile – 2010-2016

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Overview

Preview of Results

Distributional Decomposition

- QE Channels explain most distributional changes for 2010-2016
- \( \approx \frac{2}{3} \) of the increase in the 95/10 ratio
- More than half of the increased Gini coefficient
- Main culprit are higher stock returns via \textit{realized} k-gains

Counterfactual Analysis

- \textit{Causal} effect was likely disequalizing
- Increase in the ratio of 95/10th percentiles of \( \approx 1 \) percentage point
- Only implausibly large employment effects would yield a reduction in inequality
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## Theoretical Channels

<table>
<thead>
<tr>
<th>Channel</th>
<th>Income component</th>
<th>Expected direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>employment wages</td>
<td>equalizing</td>
<td></td>
</tr>
<tr>
<td>inflation real debt burden, inflation “tax”</td>
<td>ambiguous</td>
<td></td>
</tr>
<tr>
<td>asset prices capital gains</td>
<td>disequalizing</td>
<td></td>
</tr>
<tr>
<td>refinancing interest burden</td>
<td>ambiguous</td>
<td></td>
</tr>
</tbody>
</table>

- Net effect is ambiguous a priori → Empirical question!
Existing Empirical Studies

United States

- Bivens (2015) – QE was equalizing
- Coibion et al. (2017) – Studies conventional m-policy

Europe

- Adam and Tzamourani (2016) – wealth inequality in the Eurozone
- Lenza and Slacalek (forthcoming) – employment effect dominates

Japan

- Inui et al. (2017) – distributionally neutral, time-varying
Distributional Effects: an example

Suppose, e.g. $Y = \text{income} \text{ & } X = \text{stock ownership}$
Effect of \( X \) on 90th percentile is:

\[
\Delta_{90} = Q_{X=1}^{90} - Q_{X=0}^{90}
\]
Distributional Effects: an example

Effect of $X$ on $90/20$ ratio:

$$\Delta_{90/20} = \Delta_{90} - \Delta_{20}$$
Empirical Methodology

1 Distributional Decomposition
   - Firpo et al. (2008): RIF regression & Oaxaca-Blinder decomposition
   - Contribution of returns and endowments on distributional statistics

2 RIF Regressions
   - Firpo et al. (2007) – Regression models going “beyond the mean”
   - Estimate direct effect of $X$ on a distributional statistic
   - e.g. what factors explain median income?

3 Oaxaca-Blinder Decomposition
   - Decompose changes in $y$ into “endowment” and “returns” components
   - e.g. How much of income growth is due to changes in the composition of workers?
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RIF Regressions

- Simple framework to estimate effect of a covariate on a distributional statistic (e.g. quantiles, gini coefficient, etc.)
- For a statistic $\nu$, replace dependent variable $y_i$ with its “recentered influence function” (RIF)
- The RIF of $y_i$ for a statistic $\nu$ has the nice property that:

  $$\mathbb{E}\{RIF(y, \nu)\} = \nu$$

- Assume conditional mean is linear:

  $$\mathbb{E}\{RIF(y, \nu)|X_i\} = \beta X + u$$

- Calculate the RIF and run OLS!
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**Empirical Methodology**

**Oaxaca-Blinder Decomposition**

- Consider the linear regression model:

\[
y_{it} = \gamma_t X_{it} + u_{it}
\]

- The change \( \Delta = y_{i1} - y_{i0} \) can be decomposed as:

\[
\Delta = (\bar{X}_1 - \bar{X}_0) \hat{\gamma}_0 + (\hat{\gamma}_1 - \hat{\gamma}_0) \bar{X}_0 + (\bar{X}_1 - \bar{X}_0)(\hat{\gamma}_1 - \hat{\gamma}_0)
\]

- **Endowments:** \( \Delta_X = (\bar{X}_1 - \bar{X}_0) \hat{\gamma}_0 \)
- **Coefficients:** \( \Delta_\gamma = (\hat{\gamma}_1 - \hat{\gamma}_0) \bar{X}_0 \)
- **Interaction:** \( \Delta_X\gamma = (\bar{X}_1 - \bar{X}_0)(\hat{\gamma}_1 - \hat{\gamma}_0) \)
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Data

**Survey of Consumer Finances (SCF)**
- Triennial household survey sponsored by the Federal Reserve
- Best coverage of financial assets and liabilities for U.S.
- Covers upper tails of the income distribution
- Will use survey years 2010, 2013, 2016

Some difficulties for inference . . .
- Multiple imputations
- Population weights
- Confidential survey design details
- *Approach*: repeated imputation inference with bootstrapping
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- Approach: repeated imputation inference with bootstrapping
Definition of Income

- Will use “net income”:

\[ \text{Net Income} = \text{Total Income} - \text{Debt Service} \]

- Makes it possible to study impact of refinancing & debt

<table>
<thead>
<tr>
<th>Total vs. Net Income, 2016 U.S. dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Median</td>
</tr>
</tbody>
</table>
Distributional Decomposition

Functional Forms

\[ Wages_{it} = \alpha_t EMP_{it} + X_{it} \tau + \epsilon_{it} \]

\[ Financial\ Income_{it} = A_{it} \beta_t + \epsilon_{it} \]

\[ Debt\ Service_{it} = \gamma_t RF_{it} + \mu_t B_{it} + \nu_{it} \]

- EMP is an employment dummy and X are HH characteristics
- A are financial asset ownership dummies
- RF is a dummy for mortgage refinancing

Combine to obtain Net income:

\[ Net_{it} = b_{1t} EMP_{it} + \tau X_{it} + b_{2t} A_{it} + b_{3t} RF_{it} + b_{5t} B_{it} + e_{it} \]
Decomposition Results

Mean Endowments: $\bar{X}_t$

(a) Employment

(b) Equities

(c) Mortgage Refinancing

\[
\Delta = (\bar{X}_1 - \bar{X}_0) \hat{\gamma}_0 + (\hat{\gamma}_1 - \hat{\gamma}_0) \bar{X}_0 + (\bar{X}_1 - \bar{X}_0) (\hat{\gamma}_1 - \hat{\gamma}_0)
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Decomposition Results

RIF Coefficients: \( \hat{\gamma}_t \)

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Decomposition Results: Employment

Employment – Endowments Component ($\Delta_X$)
Decomposition Results: Stock Returns

Stock Returns – Coefficients Component ($\Delta \gamma$)

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Decomposition Results: Bond Returns

Bonds – Coefficients Component ($\Delta \gamma$)

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Decomposition Results: Refinancing

Mortgage Refinancing – 2010-2013

Coefficients

Endowments
Decomposition Results: Refinancing

Mortgage Refinancing – 2010-2016

Coefﬁcients

Δ Percentage Point Contribution vs Quantile

Endowments

Δ Percentage Point Contribution vs Quantile

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## Decomposition Results: Inequality Measures

**Percentage Point Change in Inequality**

<table>
<thead>
<tr>
<th></th>
<th>95/10</th>
<th>90/10</th>
<th>Gini</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Change</strong></td>
<td>0.071</td>
<td>0.058</td>
<td>0.028</td>
</tr>
<tr>
<td><strong>QE Channels</strong></td>
<td>0.045</td>
<td>0.045</td>
<td>0.016</td>
</tr>
<tr>
<td><em>Employment Channel</em></td>
<td>-0.008</td>
<td>-0.008</td>
<td>-0.001</td>
</tr>
<tr>
<td><em>Financial Returns</em></td>
<td>0.062</td>
<td>0.048</td>
<td>0.019</td>
</tr>
<tr>
<td><em>Mortgage Refinancing</em></td>
<td>-0.009</td>
<td>0.005</td>
<td>-0.002</td>
</tr>
</tbody>
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Robustness Checks: Reweighting, Additional Covariates

(a) Employment ($\Delta x$)

(b) Equities ($\Delta y$)

Additional Checks:

- “Over Smoothing”
- Alternative asset categories / definitions
- Data from PSID
Robustness Checks

Stock returns including 99th percentile

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House Prices?

Home ownership – coefficients component ($\Delta \gamma$)
Household Debt

(a) Coefficients component – \((\Delta X)\)

(b) Endowments component – \((\Delta \gamma)\)

- Falling interest rates have helped bottom half
- Deleveraging in the middle of the distribution
Until now...
QE Counterfactuals

Counterfactual Analysis

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QE Counterfactuals

- Decompositions do not say anything about causality!
- Focus on causal estimates of QE on *intermediate channels*
- Empirical literature:
  - Effect on employment: 1 - 1.5 percentage points
  - Stock prices: 2 - 8 percent growth
- Use components from decomposition results to carry out counterfactual scenarios
QE Counterfactuals

Equity Returns

What would the contribution of stock returns to inequality look like if we assume QE was responsible for a $\theta$ percent growth in stock returns?

Counterfactual stock contribution is:

$$\Delta_S = \theta \hat{\gamma}_0, s \bar{X}_0, s$$

Employment Effect

What would the contribution to inequality of higher employment look like if we assume QE increased employment by $\Delta X_E$?

Counterfactual employment contribution is:

$$\Delta_E = \Delta X_E \hat{\gamma}_1, E$$
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Counterfactual Scenarios

Contribution to 95/10 Ratio – Various Counterfactuals

Engen et al. (2015)

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Stock Return and Employment Effect Tradeoffs

- Stock return effect (θ)
- Employment effect (ΔX)

Zero locus, 2% locus, -2% locus

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Counterfactual Contributions to the 95/10 Ratio

<table>
<thead>
<tr>
<th>Equity Return Scenarios (θ)</th>
<th>Employment effect (ΔX)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 pp</td>
</tr>
<tr>
<td>0% scenario</td>
<td>-0.3</td>
</tr>
<tr>
<td>5% scenario</td>
<td>0.6</td>
</tr>
<tr>
<td>10% scenario</td>
<td>1.5</td>
</tr>
<tr>
<td>20% scenario</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Note: This table reports the combined contribution of returns to equities and changes in the employment rate to the 95/10 ratio under various counterfactual scenarios. The contributions are presented as percentage changes. Each counterfactual contribution is calculated according to equation (3.11) in the text. A one pp employment effect refers to a one percentage point causal change in the employment rate. QE to inequality through employment and stock returns is positive for a substantial range of effects on employment. For example, let’s consider the net contribution to inequality assuming that the causal effect of QE on employment was 1.2 percentage points. This change in employment is consistent with the baseline estimates reported by Engen et al. [37]. As can be seen in panel (a), this corresponds to a 0.5 percentage point increase to the 95/10 ratio under the 5 percent stock returns scenario, a 1.5 percentage point contribution under the 10 percent scenario, and as high as 3.4 percentage points under the 20 percent scenario. Indeed, under the 5 percent stock returns scenario, the contribution to the 95/10 ratio only becomes negative for assumed employment effects exceeding 3 percentage points, which is more than double the baseline effect reported by Engen et al. [37]. Making the less conservative assumption that 10 percent of the change in stock returns was due to QE, the employment effects necessary to yield a neutral or negative
Conclusions

Summary of Results

- QE channels associated with large increases in inequality
- Precise causal framing is more nuanced
- Counterfactual analysis suggests modest but positive impact

Outstanding Questions

- Causal magnitudes for other QE channels?
- Impact of QE on wealth inequality?
- Generality of the results?
- QE paradox?
Thank You : )
Stable Relationship between realized and unrealized capital gains

(a) Pre-QE

(b) Post-QE
Alternative asset indicators

Stock returns – coefficients component ($\Delta \gamma$)

\[ A = \mathbb{1}\{\text{Stocks} > p(75)\} \]
Over smoothing

(a) Employment ($\Delta X$)

(b) Equities ($\Delta \gamma$)
Decomposition using the PSID (2009-2013)

Employment

Stock Returns

Δ Percentage Point Contribution

Quantile