Open Policy Analysis: Concepts and Applications

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1. Why we need Open Policy Analysis (Hoces de la Guardia, Grant & Miguel, 2018)

2. Application to policy estimates of the minimum wage.

Policy Analysis And The Evidence-Based Policy Movement

Evidence-Based movement is growing.

- "The golden age of evidence-based policy" (Haskins 2017).
- Credible causal evidence (Angrist & Pischke, 2010)
- Transparency and reproducibility of research (Miguel et al. 2014).

Policy Analysis is a fundamental link.

- As many definitions as textbooks (Dunn, 2015; Weimer & Vining, 2017; Williams, 1971)
- Common denominator: client-oriented empirical analysis meant to inform a specific policy debate
- Aspires at scientific rigor. (Wildavsky 1979),

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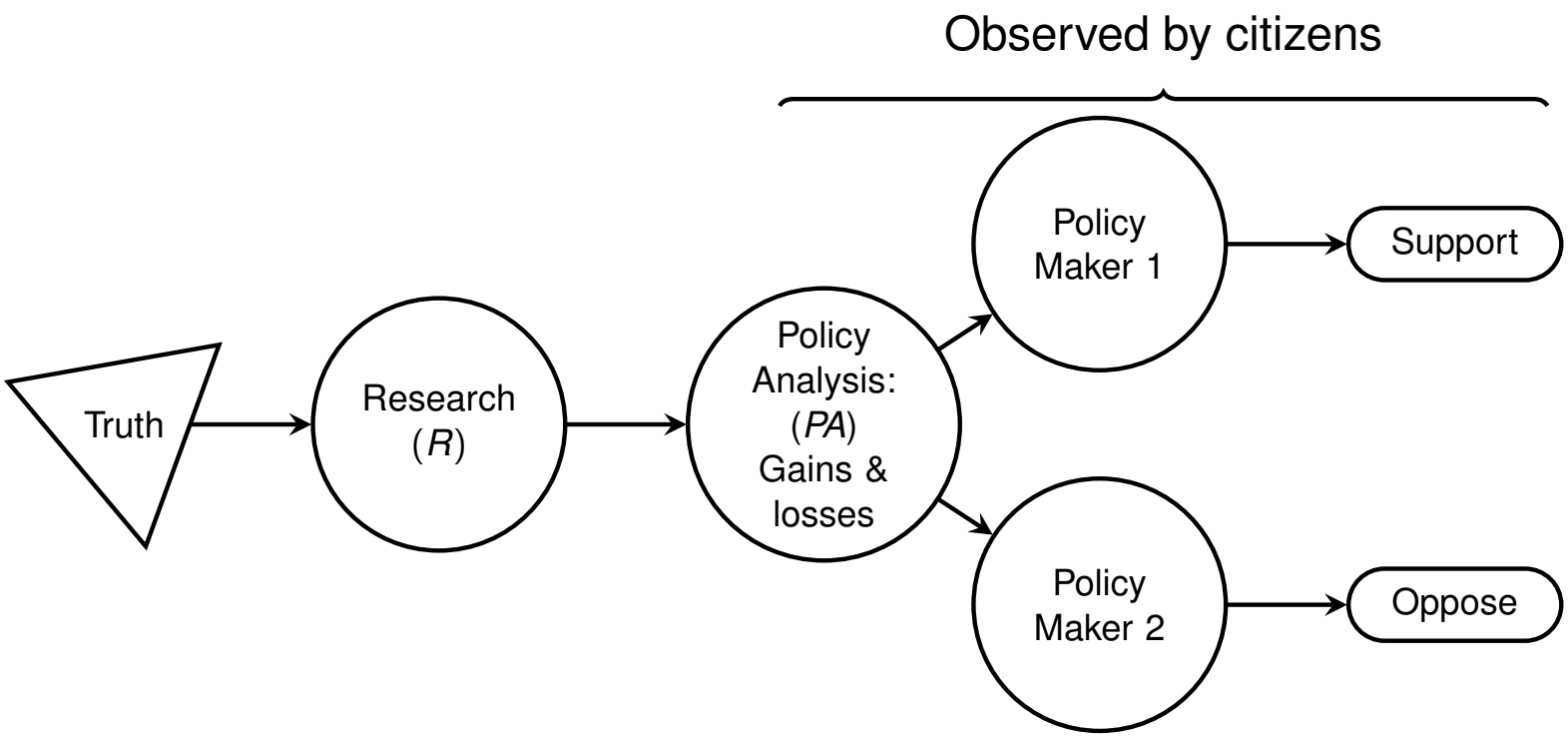
Examples of Policy Analysts

One Ideal Evidence-Based Policy Link



Reproducibility Crisis In Empirical Research

- Large magnitude of publication bias (Franco et al 2014).
- Evidence of extensive p-hacking across social science disciplines (Gerber et al 2008, Brodeur et al 2016).
- Replication rates are low (Collaboration et al, 2015 , Camerer et al, 2016, 2018).
- Computational reproducibility is also low (Stodden et al 2016, Chang and Li 2015, Gertler et al 2018).

The Open Science Movement

- Definition of principles of Open Science/Research Transparency (Miguel et al 2014)
- Development of guidelines to operationalize principles of Open Science (Nosek et al 2015)
- Journals and funders: Journals (Science + 5k other journals), Registries (AEA), Funders (NIH, NSF and multiple donors)

Credibility Crisis Of Policy Analysis

- Incredible Certitudes (Manski, 2013)
- Report wars (Wesselink et al, 2013)
- Alternative facts ("The Death of Expertise" Nichols, 2017; "The Death of Truth", Kakutani 2018; "Truth Decay", Rich & Kavanagh 2018)

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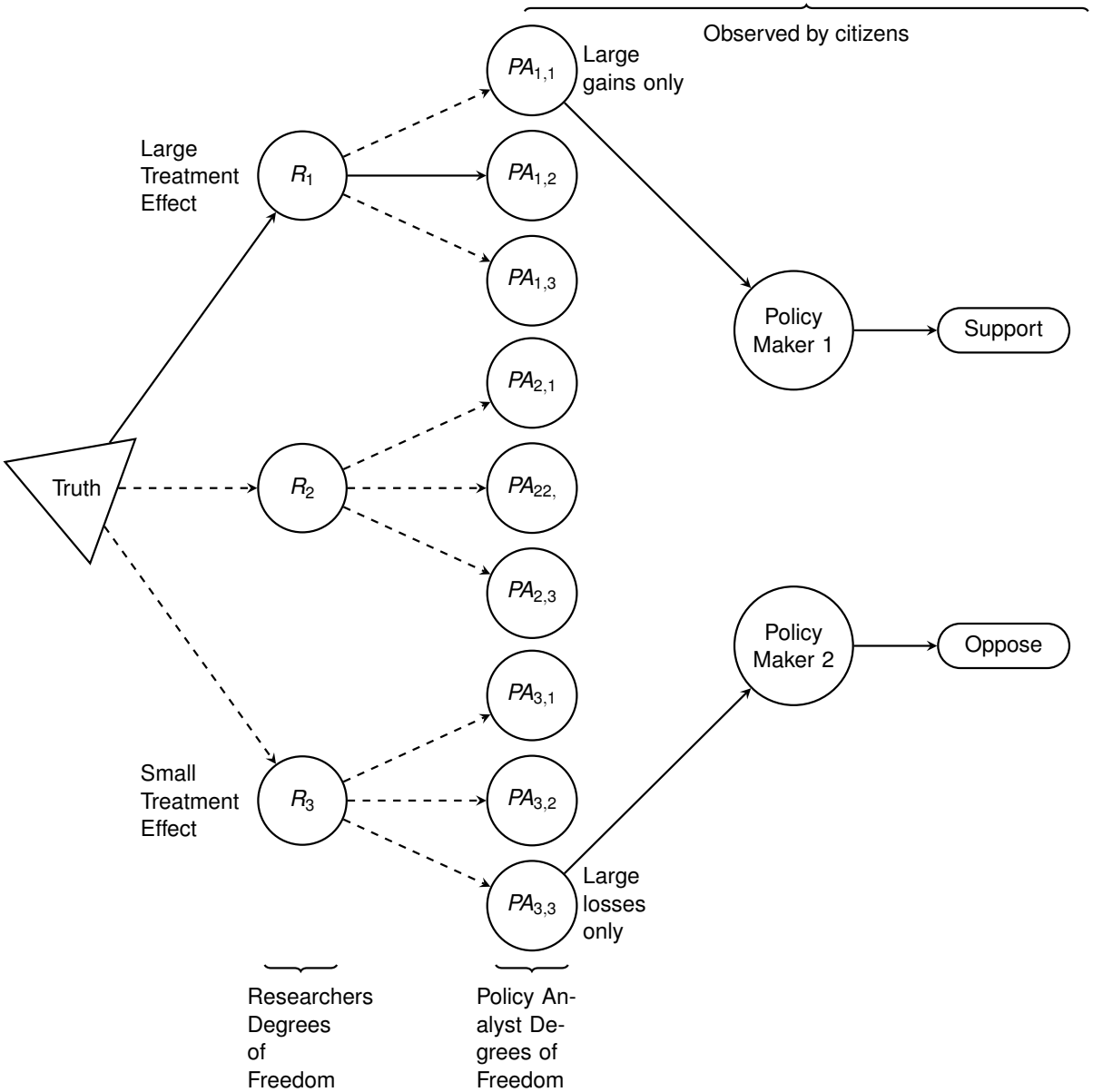

Relevance

Main consequences of policy analysis that lacks openness:

1. Cherry picking evidence.
2. Challenging to automate and improve systematically recurring reports.
3. Difficulty understanding how research informs policy analysis.

Cherry Picking Evidence

"When I was director of the CBO, I was very frustrated when we would write a policy report [saying] a certain policy would have these two advantages and these two disadvantages, and the advocates would quote only the part about the advantages, and the opponents would quote only the part about the disadvantages. That encourages the view that there are simple answers. There aren't generally simple answers. There are trade-offs."

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Harvard Magazine, 2016

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Open Science

	Empirical Research	Policy Analysis
Problems	Reproducibility Crisis	Credibility Crisis
Solutions	*Open Science* Principles, Guidelines, Applications	

Open Policy Analysis

	Empirical Research	Policy Analysis
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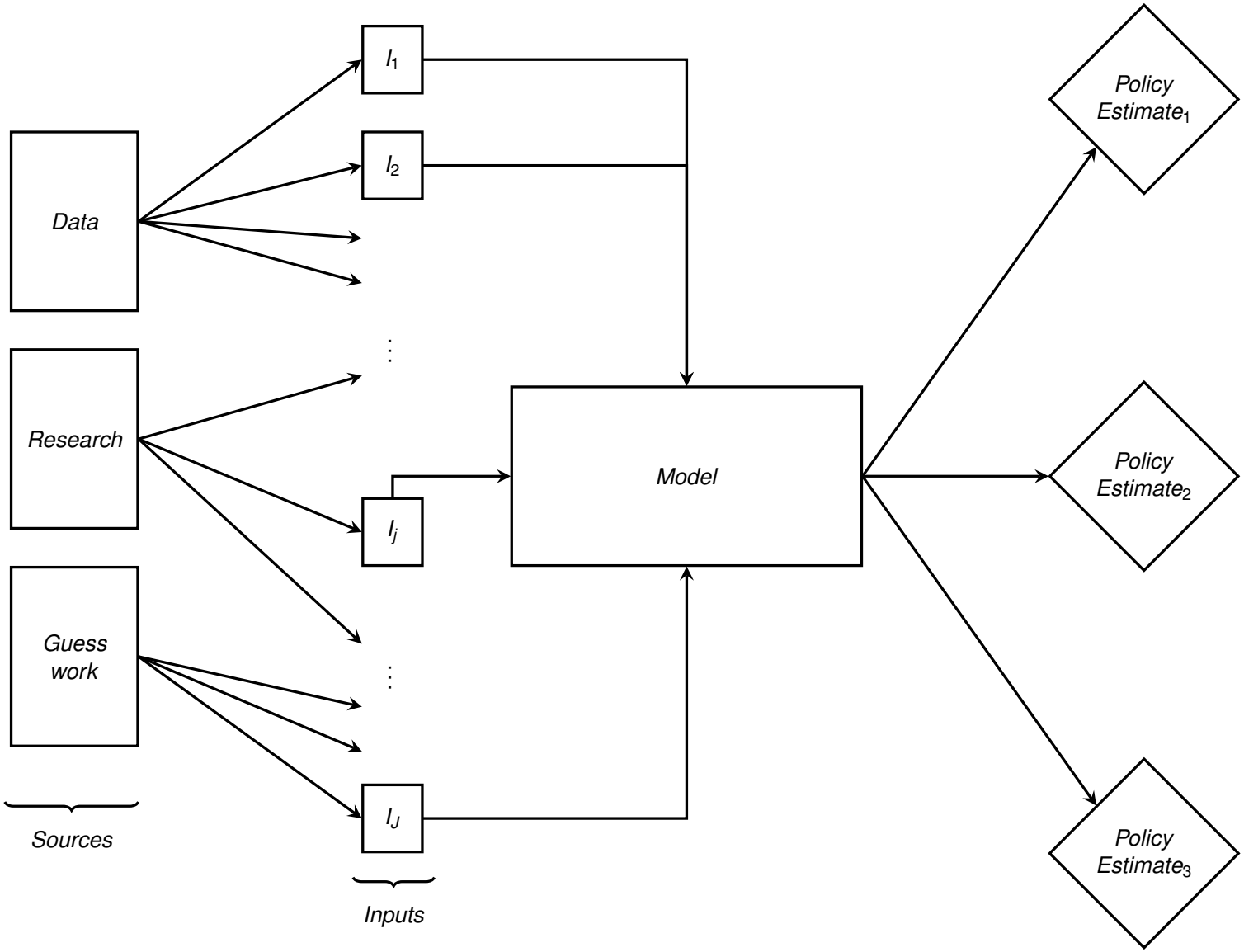
The Process of Policy Analysis



Principles for Open Policy Analysis

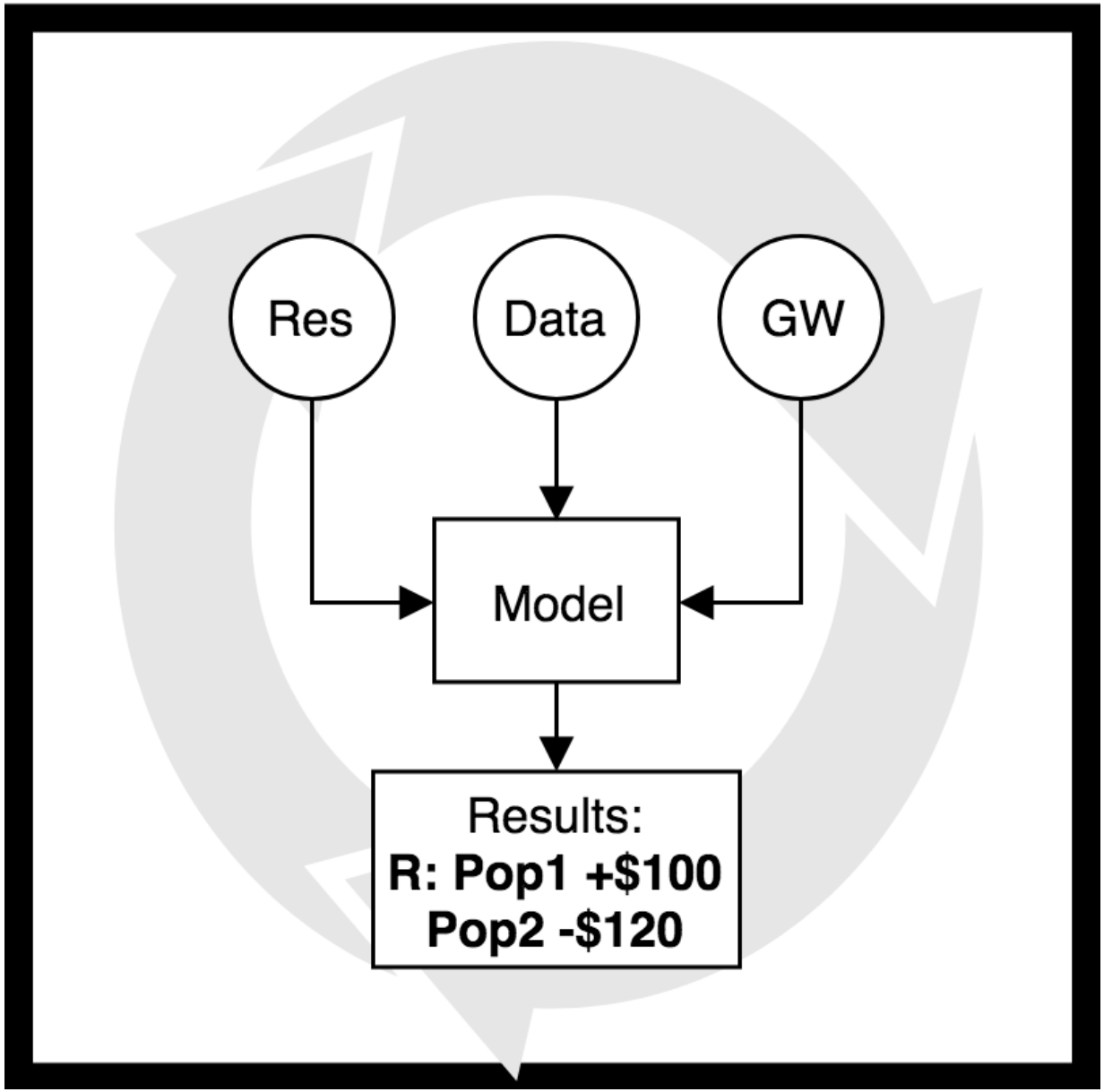
Proposed principles:

1. Computational Reproducibility
2. Analytic Transparency
3. Output Transparency

Principle 1: Stop re-inventing the wheel

Computational Reproducibility

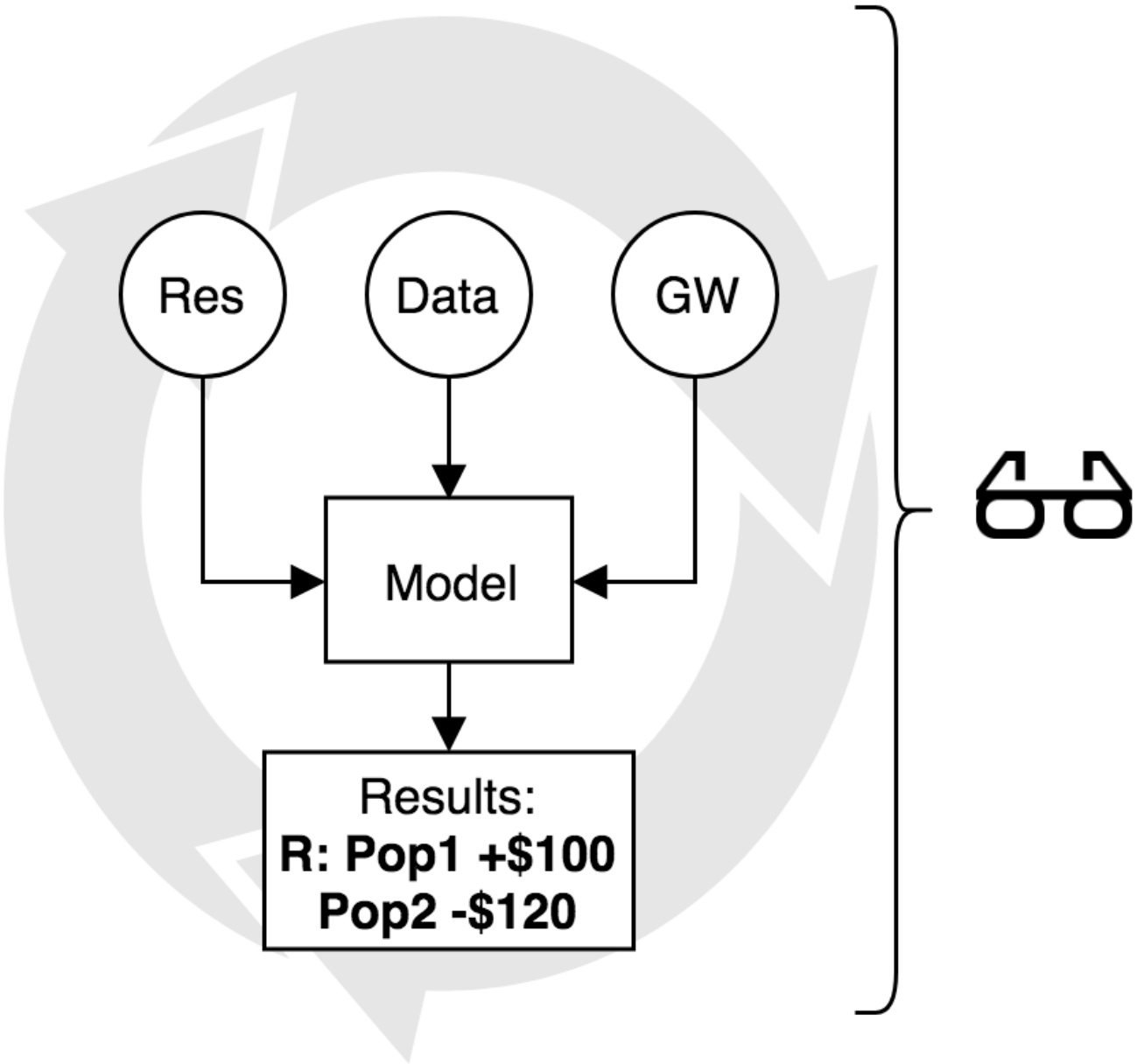
- Literate Programming
- Version control
- File structure
- **Label sources**



Principle 2: Show your work (readable)

Analytic Transparency

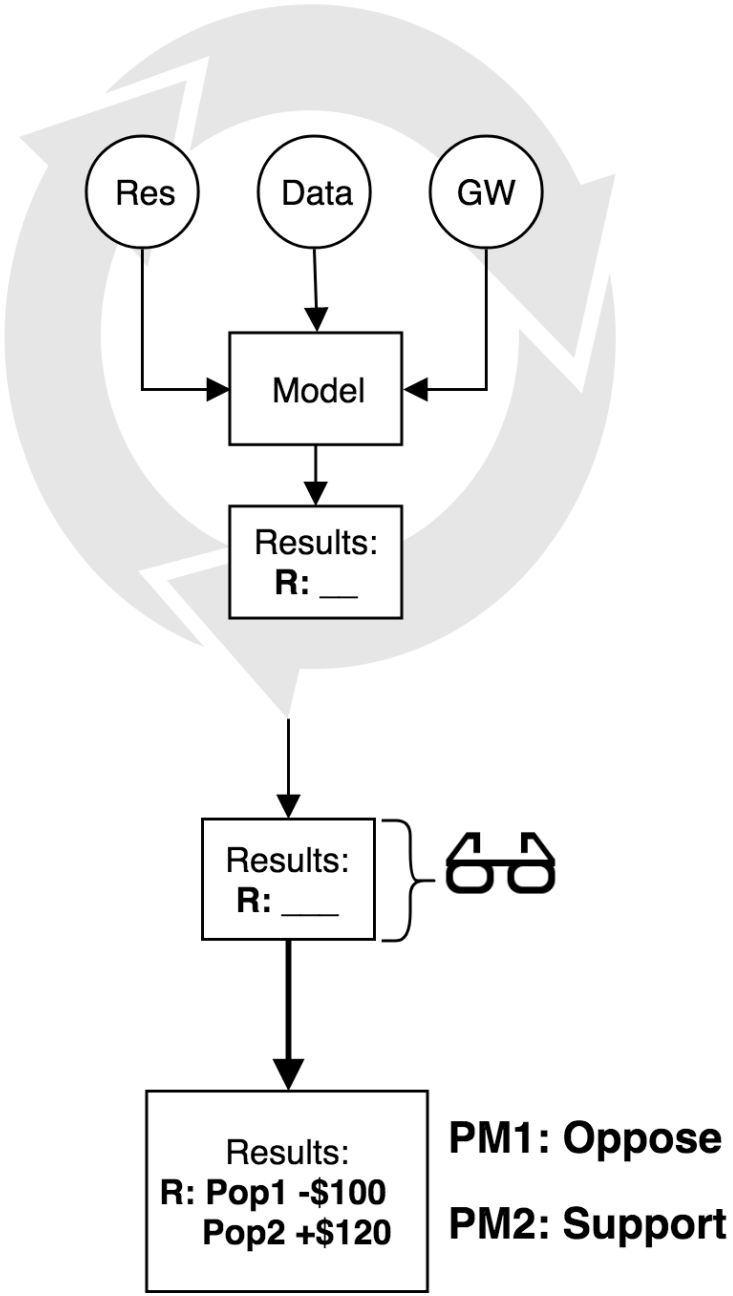
- Open code
- Open data
- Report as Dynamic Document



Principle 3: Let's all agree on one table/viz

Output Transparency

- Pre-committed output display
- Assumptions-output link



Suggestions

Suggestions:

1. **Policy Analysts: Just Post It**.
   Things are moving in this direction. Play a leading role in a credibility revolution for policy analysis.
2. **Policy Analysis Organizations: Open by Default**
   Boost in credibility, lower costs in the long run. Examples: GiveWell, and AEI.
3. **Government Agencies and Funders: Support Open Policy Analysis** Examples: Require contracted policy analysis to be fully open. Support training and adoption of new tools (VC and DD). Inject resources for the transition.

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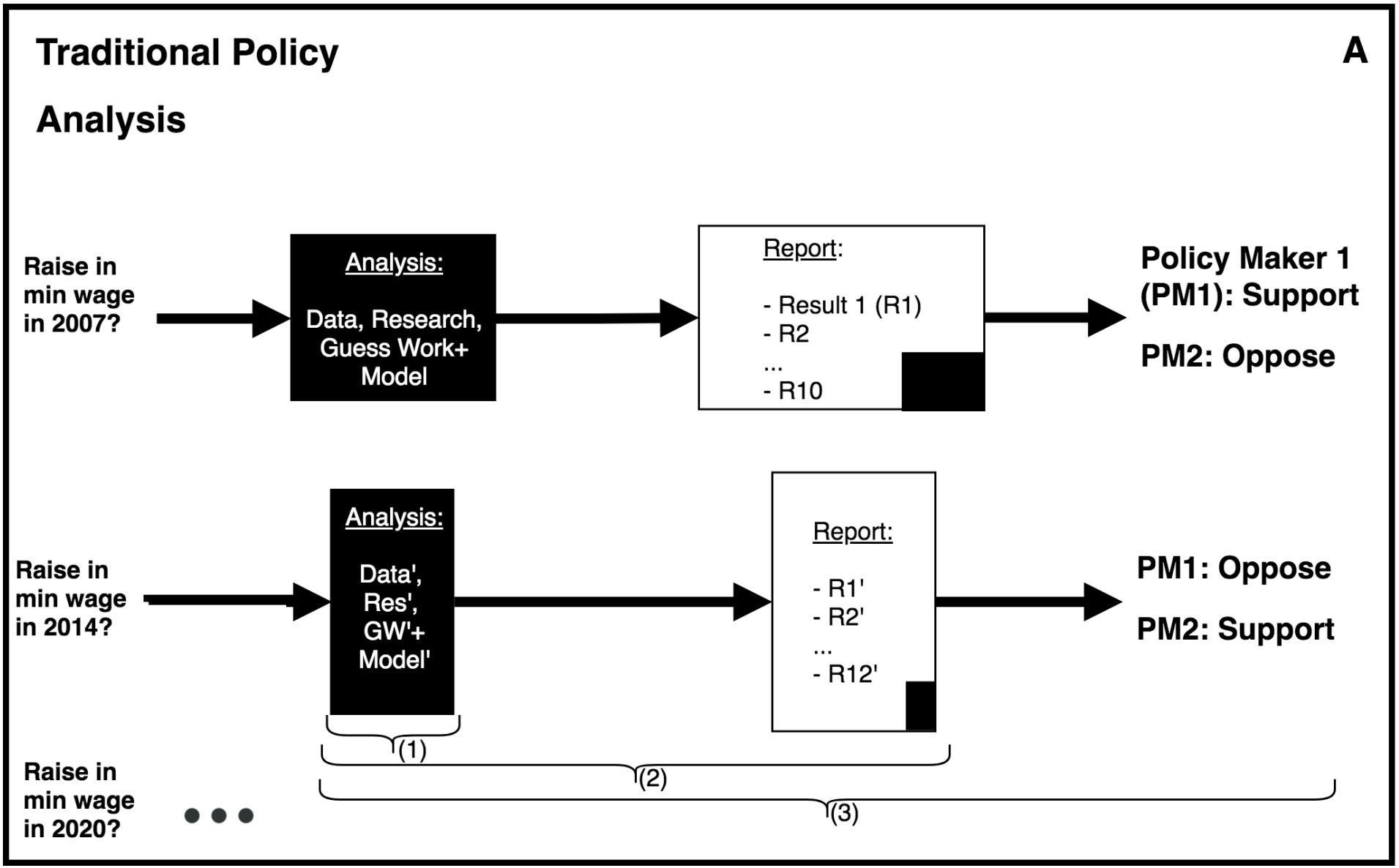
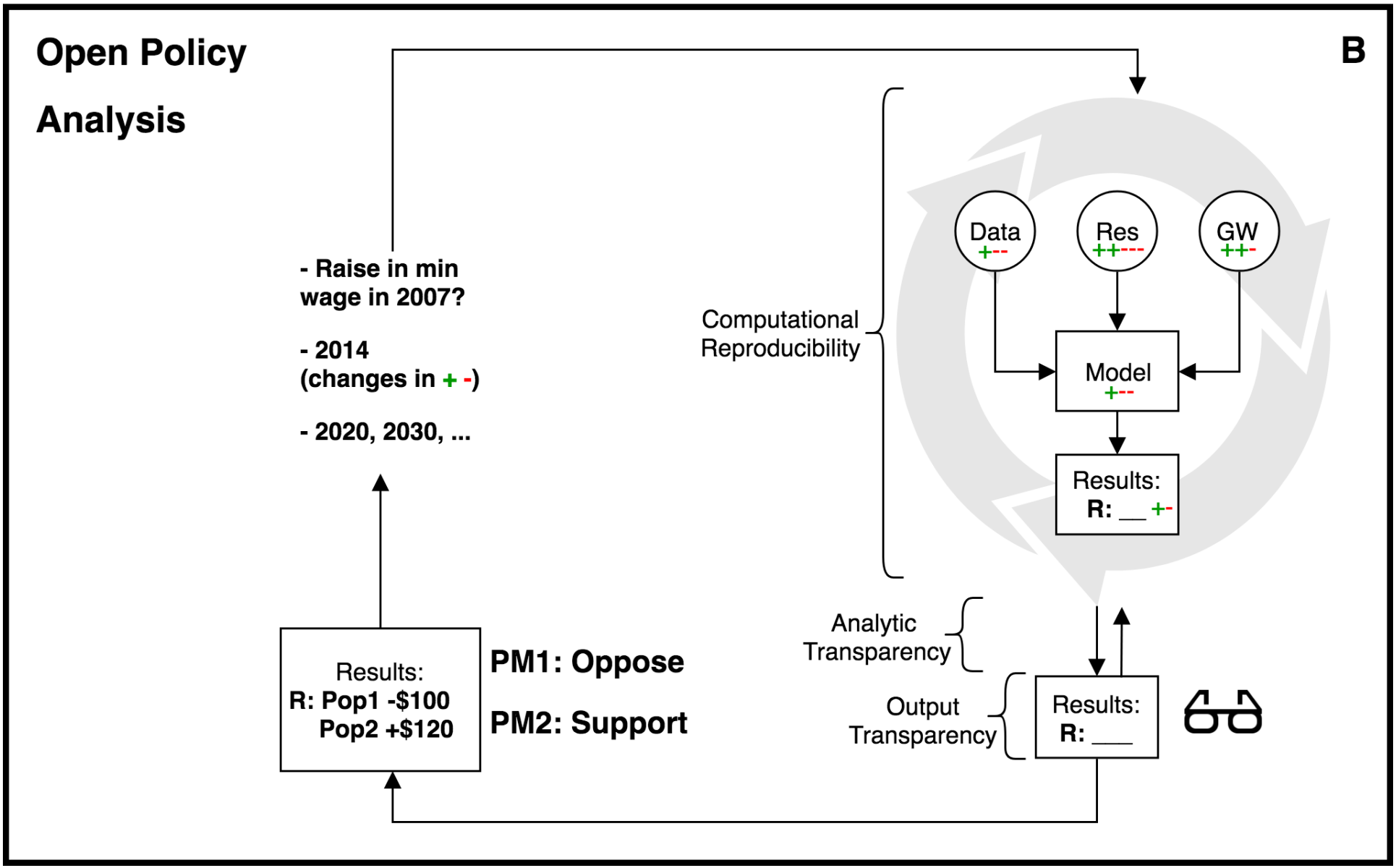
Summing Up: Where We Are



Summing Up: Where Should We Go



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	Empirical Research	Policy Analysis
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Description of Case Study

"The Effects of a Minimum-Wage Increase on Employment and Family Income" Congressional Budget Office (2014)

Description: CBO estimated the effects of a raise in the federal minimum wage from $7.25/hr to $10.10/hr.

Main policy estimates:

- 500,000 jobs would be lost.
- 16.5 million workers would receive a salary increase.
- Distributional effects: below poverty line (PL) +$5billion; between one and three PL +$12billion; between three and six PL +$2billion; above six PL -$17billion

Key research estimate: Elasticity of labor demand for teenagers in the labor force.

Reasons for Selecting the Case Study

- Relatable
- Recurrent
- Feasible
- Relevant:

Figure: Google Search Intensity of “Minimum Wage”

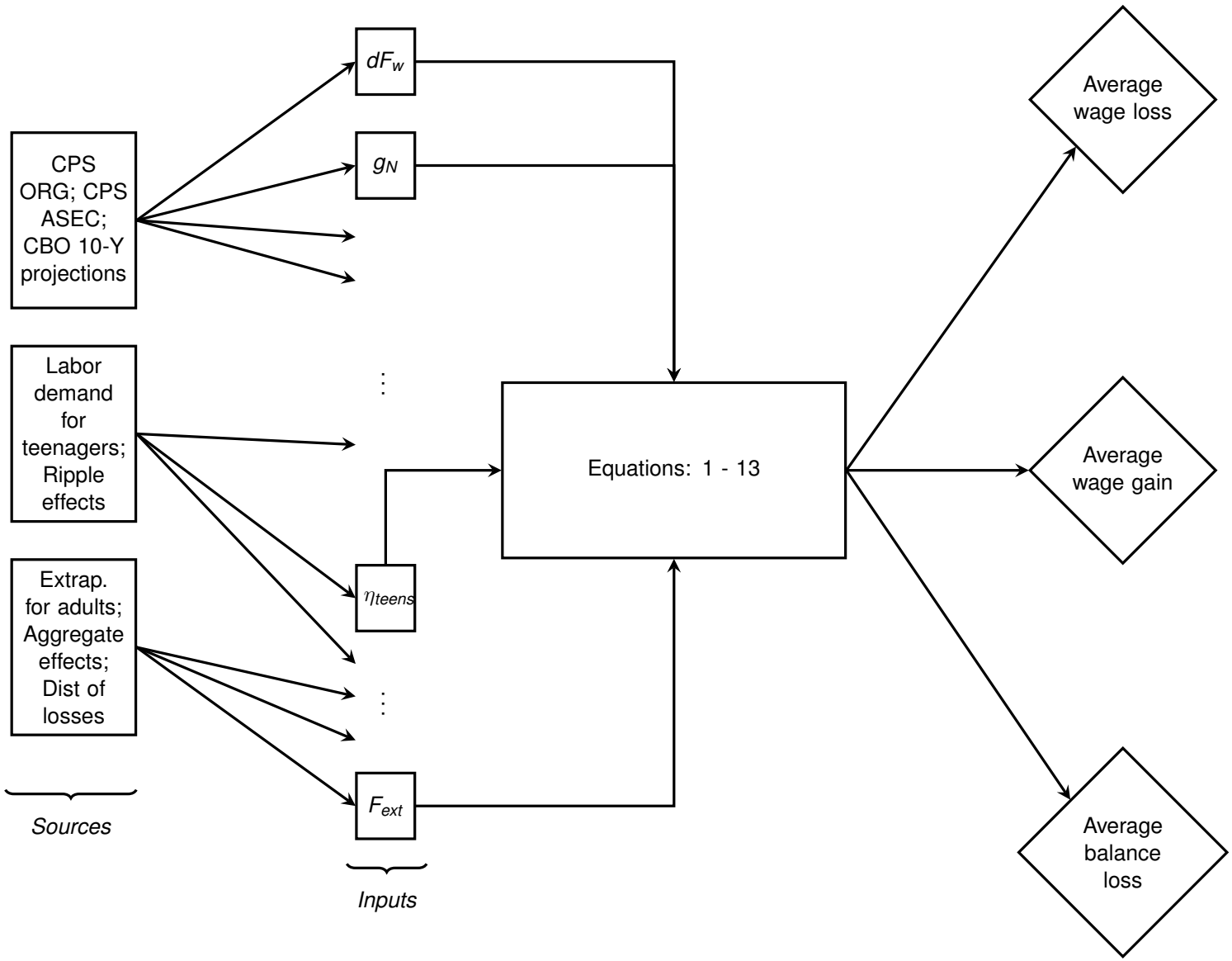
Adapting TOP Guidelines to Policy Analysis

☑	Dimensions	0	1	2	3
	Computational Reproducibility				
☐	1. Follow a common template for file structure		Some FS	Standard FS	SFS + sources dir
☐	2. Label and document each input sources (data, research, guesswork)		List	+ sources	+detailed links/ref.
☐	3. Make code readable.		Scripts in repo/ xls with SOPs	High readability + QA report	One-Click (DD)
☐	4. Use a version control strategy.		Some naming	Clear naming	Git
	Analytic Transparency				
☐	5. Open Code		Final	Final + prep	Human read (DD)
☐	6. Open Data (raw & analytic files).		Final	Final+raw	+ repository `+ inst 4 S.I.
☐	7. Open Report		Final	Final + VC	+ DD
☐	8. Open notes		List	Final	Final+VC
	Output Transparency.				
☐	9. Define results format before publishing/justify changes format output		General	Specific	Specific +

Applying Guidelines to Build an Open Report

DEMO

Map the complete policy analysis



Easier Methodological Appraisal. Example: dis-employment effects

Steps taken to verify the analysis & employment variation ($\widehat{\Delta E} \times 1000$) at each line[1]

1. Find an elasticity: -0.1 (page 25): $\widehat{\Delta E} \approx 300$
2. What about adults? $\eta^{adults} = \frac{1}{3}\eta^{teens}$ (page 28): $\widehat{\Delta E} \approx 100$
3. What about the adjustment? $\widehat{\eta^{g}_{w \leq MW}} = \frac{\eta^{g}_{llt}}{p^{g}_{w \leq MW}} \times \frac{\%\Delta MW}{\%\Delta w^{g}}$ (page 26-28 + 2 papers): $\widehat{\Delta E} \approx 1,100$
4. The adjustment factors $\frac{1}{p^{g}_{w \leq MW}} \times \frac{\%\Delta MW}{\%\Delta w^{g}} = F^{g}_{adj}$ are not computed from the data (3.2 teens, 19.5 adults). Instead: $F^{teen}_{adj} = F^{adult}_{adj} = 4.5$ (page 28) $\widehat{\Delta E} \approx 500$

Steps 2-4 took several days of work!

[1] Assuming target population $\approx$ 22 million, $\overline{\Delta w_{w \leq MW'}} \approx 14\%$, and non-compliance $\approx 15\%$

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All in One Output

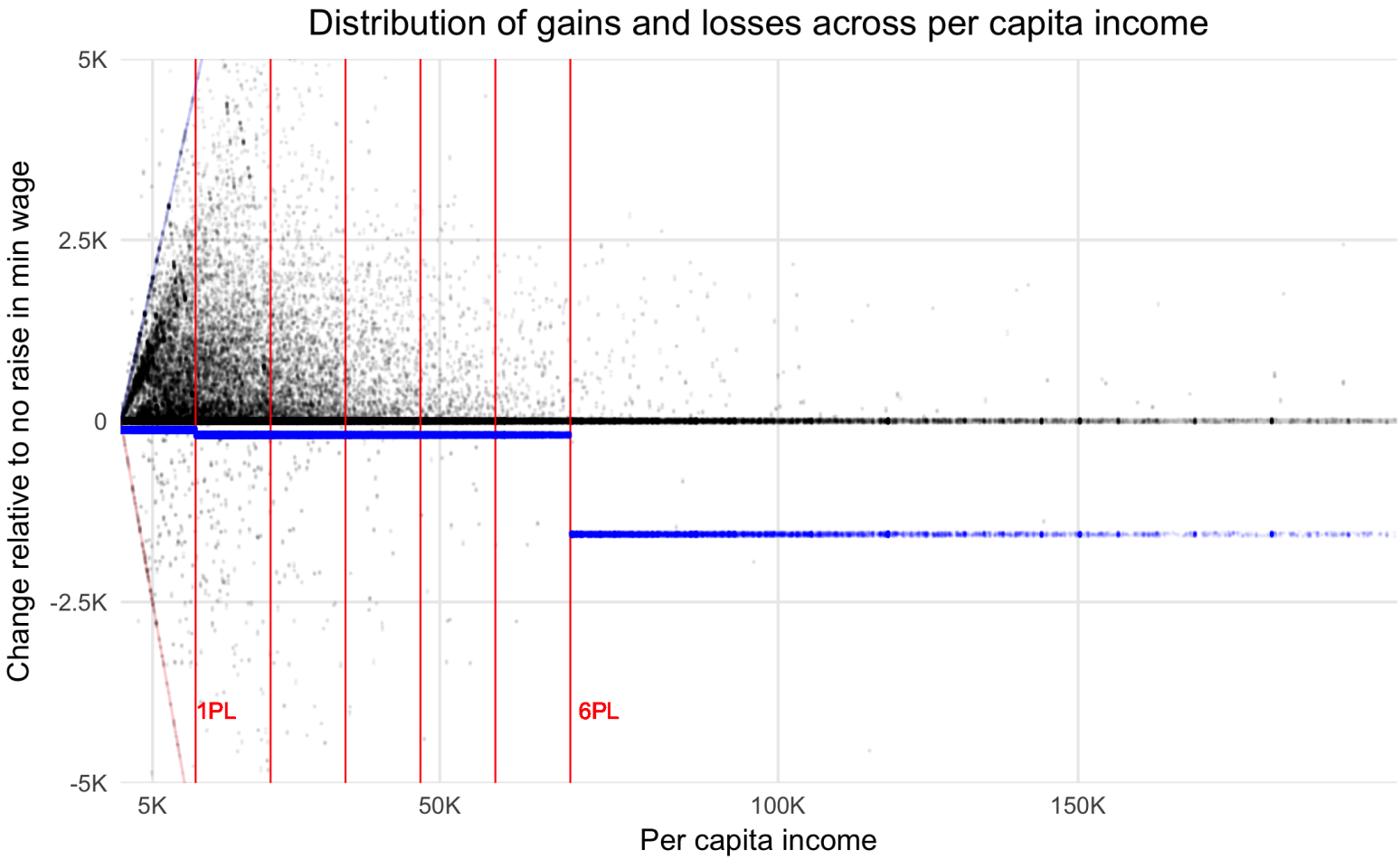


Figure: Gains and losses. Different Units

Sensitivity Analysis: Status Quo

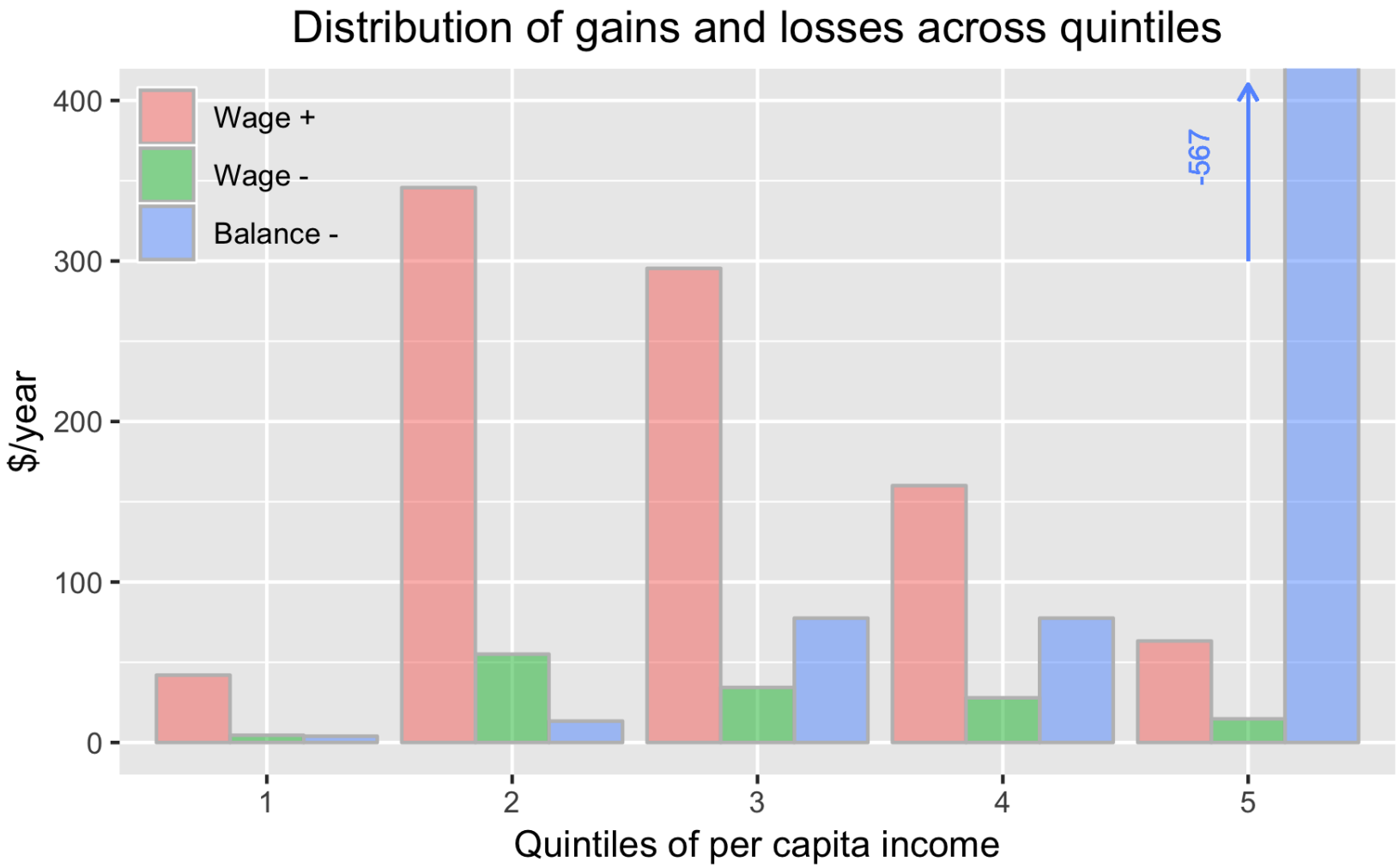


Figure: Default settings

SA: Change in Elasticity of Labor Demand

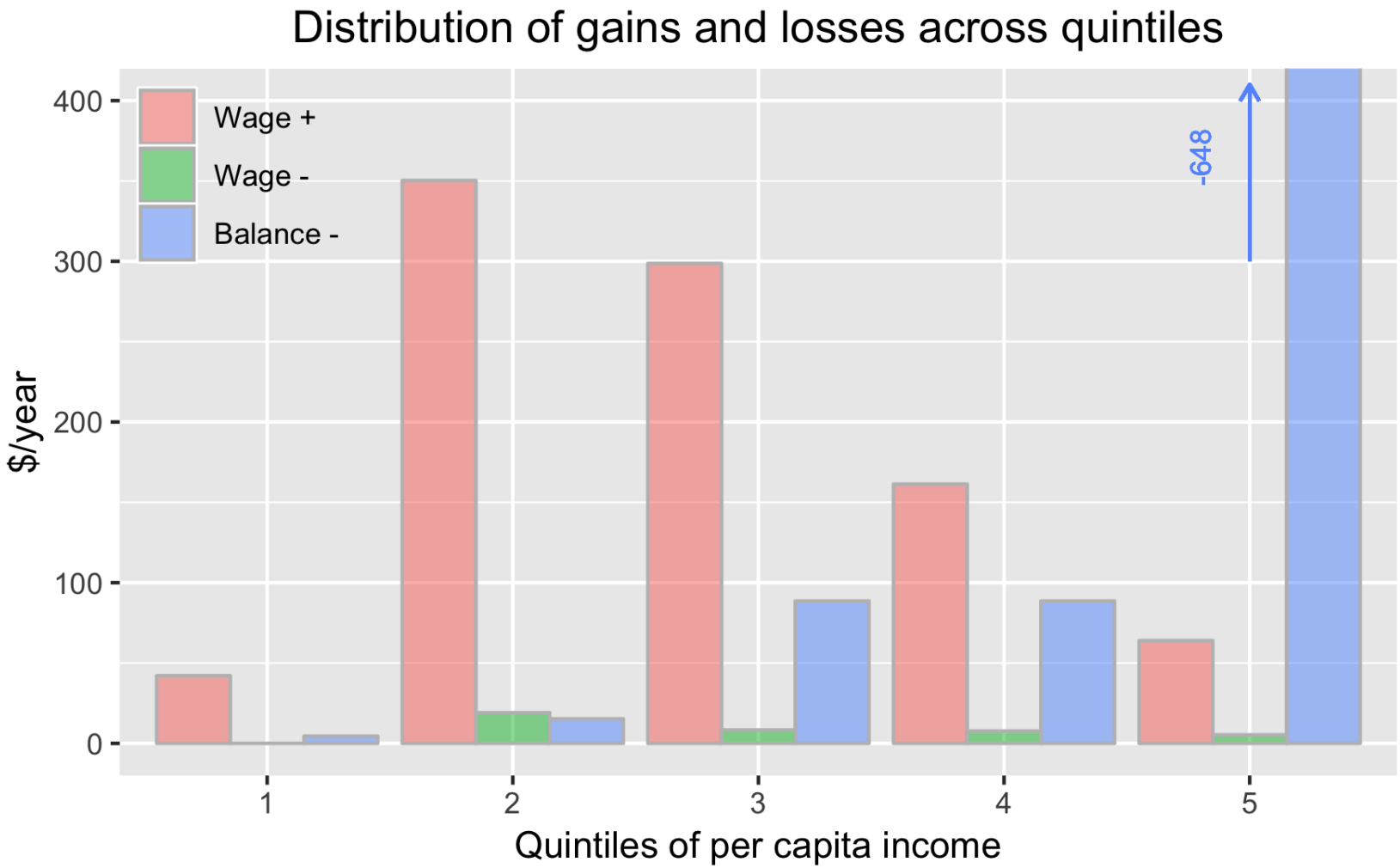


Figure: From $\eta_{lit}^{teens} = -0.1$ to $\eta_{lit}^{teens} = -0.01 (\Delta^{-} 90\%)$

Sensitivity Analysis: Status Quo

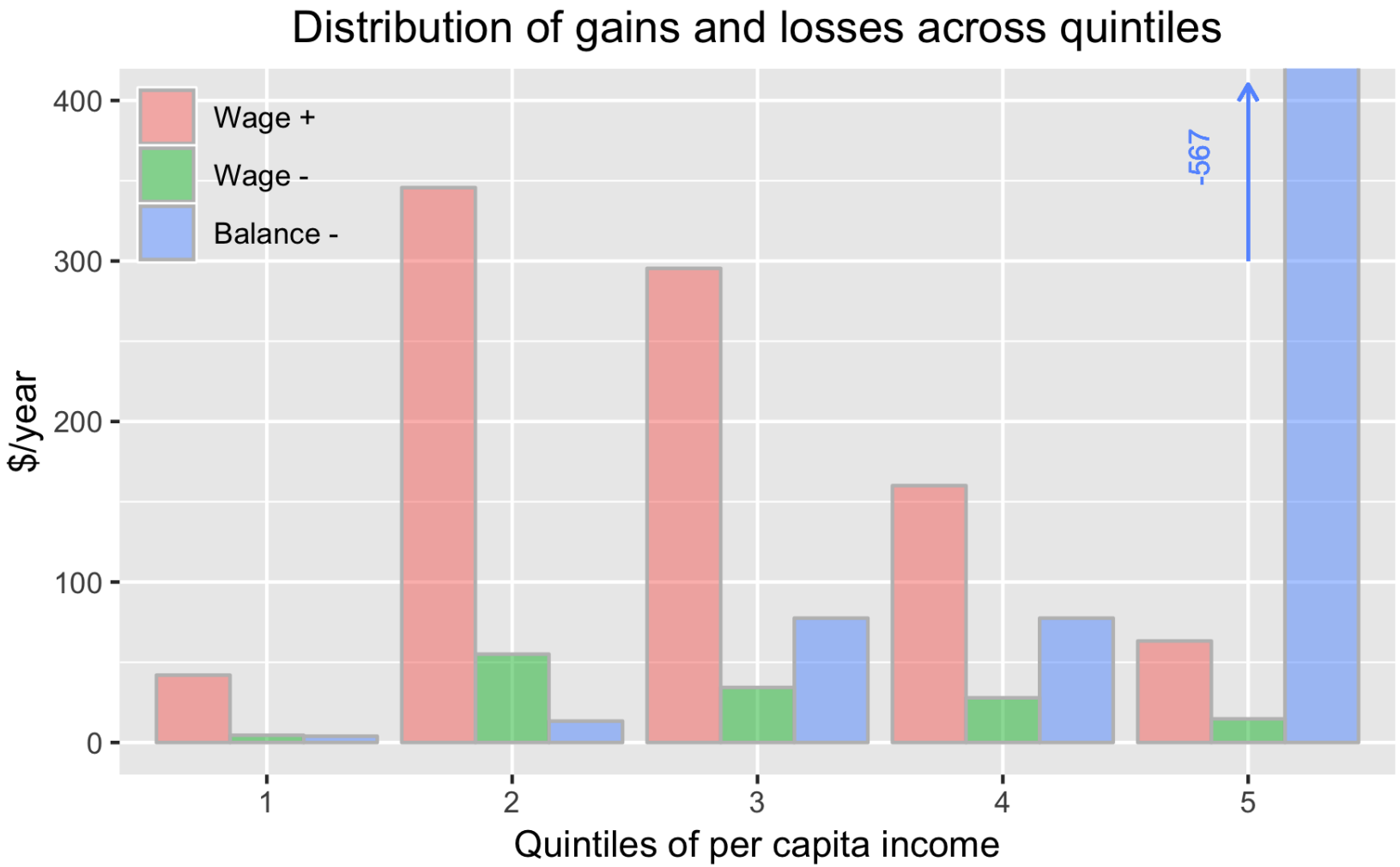


Figure: Default settings

SA: Change in Distribution of Balance Loses

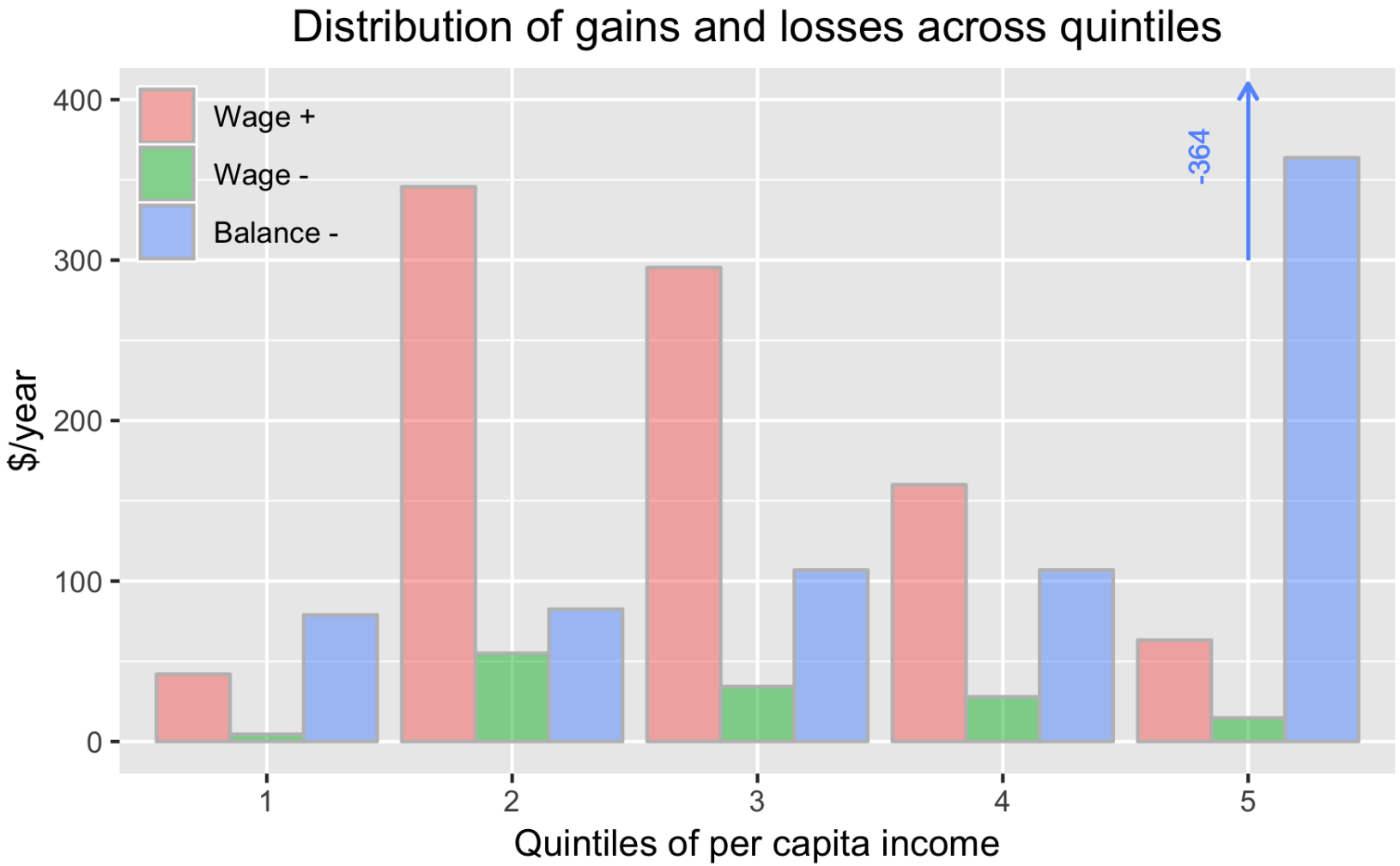


Figure: From $(1PL, 6PL) \sim (1\%, 29\%, 70\%)$ to $(20\%, 40\%, 40\%)$

Comparing the Trade-offs: A Toy Example

Model for the normative comparison made by a policy maker (welfare function):

$$W(\rho) = \sum_{i \in N} \left(\omega_{wg} wg_i + \omega_{wl} wl_i + \omega_{bl} bl_i\right) \omega_i^d(Q_i, \rho)$$

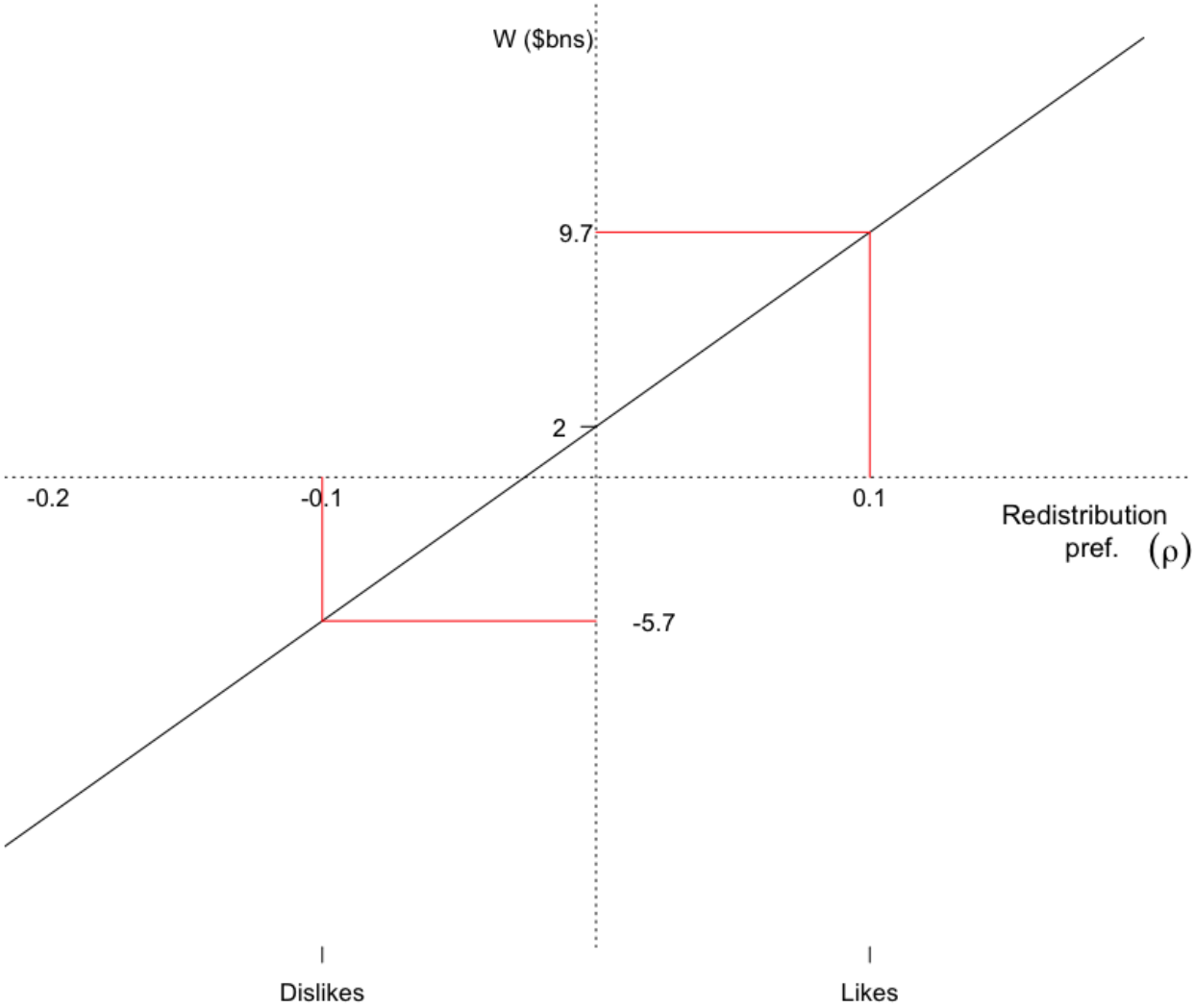
with:

$$\omega_i^d(Q_i, \rho) = \frac{(1 - \rho(Q_i - Q_{median}))}{\sum_i \omega_i^d(Q_i)} Q_{max} \quad \text{for } \rho \in \left(-\frac{1}{2}, \frac{1}{2}\right)$$

$\rho > 0$ represents positive valuation of progressive redistribution. $\rho < 0$ represents positive valuation of regressive redistribution.

Redistribiutional Preferences

Toy Example ($\omega_{WG} = \omega_{WL} = \omega_{BL} = 1$)



Sensitivity Analysis For Multiple Parameters

Table: $\%\Delta W$ for a $\%\Delta$ in inputs. Two sample policy makers.

		Re-distributional Preferences			
		Dislikes ($\rho = -0.1$)		Likes ($\rho = 0.1$)	
Source	Input	$10\%\Delta^+$	$10\%\Delta^-$	$10\%\Delta^+$	$10\%\Delta^-$
Data					
	Annual wage growth (g_w)	-3%	2%	-2%	1%
	Annual growth in N	0.8%	-0.9%	0.5%	-0.5%
Research					
	η_{teen}	-4%	4%	-2%	2%
	Ripple Scope $(8.7, 11.5)$	37%	-24%	21%	-14%
	Ripple Intensity $(50\%\Delta w)$	5%	-5%	3%	-3%
Guess Work					
	Extrapolation factor (F_{ex})	-3%	2%	-1%	1%
	Non compliance (α_1)	-7%	7%	-4%	4%
	Substitution factor (F_{sub})		20%		-8%
	Net benefits	-5%	5%	2%	-2%
	Distribution of balance losses				
	Current: $(1\%, 29\%, 70\%)$				
	$(1\%, 4\%, 95\%)$	22%		13%	
	$(5\%, 35\%, 60\%)$	-17%		-9%	
	$1/N$	-129%		-73%	

Limitations

- There is additional scope for reproducibility.
- Complete case study requires extensive institutional knowledge.
- Guidelines need to be build based on consensus of practitioners.

What lies ahead

Let's assume this becomes the new status quo.

- Costs of producing the next report on effects of minimum wage will be very small.
- Every additional effort will imply improvements on the "state of the art" report (e. g. *dBL*; $\eta(MW), \alpha_1(MW)$)
- Learning about one parameter (QALYs, DWL) will update estimates *across* reports.
- Much easier to have a substantive and normative policy debate. Pilot example: `Shiny App!`.

Your next steps to push OPA forward

- Collaborate with BITSS to open up your PA.
- Fund OPA: directly or conditionally.
- Train students/analysts in OPA.
- Present/showcase your OPA. Pioneers: GiveWell, AEI, CBO.
- Nominate a PA to be open here.

An Aspiration

"Democracy Thrives In Sunlight"

The Wonk Times

Washington DC

VOL.III. . . No.14 | *MARCH 29, 2020* | THREE DOLLARS

CBO Publishes Open Report on Minimum Wage

Results Will Be Published Separately in Two Weeks

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Bipartisan Support for CBO Methodology

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Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Quisque ullamcorper placerat ipsum.

Thank you.

Pre-prints:
Why OPA
OPA Case Study

Slides at
tinyurl.com/yacz2z78

fhoces@berkeley.edu

Equations from Model in DD

$$\widehat{\Delta E} = N \times \eta \times \%\Delta w + \text{Other factors} \tag{1}$$

$$\widehat{N^s_{final}} = g_N(\hat{t'}|t) \times \hat{N}^s_t \times P(\hat{w'} \leq MW^{new}|s) \times (1 - \hat{\alpha}^s_1 - \hat{\alpha}^s_2) \qquad s = \{teens \tag{2}$$

The elasticity for adults from the literature is define as the one for teenagers with an extrapolation factor.

$$\eta^{adults}_{lit} = \eta^{teens}_{lit} \times F_{extrapolation} \tag{3}$$

Adjustments to the elasticity of labor demand

Following Neumark and Wascher (2008), Brown (1999). First:

$$\eta^s_{lit} = p^s_{w \leq MW} \eta^s_{w \leq MW} + (1 - p^s_{w \leq MW}) \eta^s_{w > MW} \qquad s = \{teens, adults\}$$

Second, assume $\eta^s_{w \leq MW} = 0$:

$$\eta^s_{w \leq MW} = \frac{\eta^s_{lit}}{p^s_{w \leq MW}} \qquad s = \{teens, adults\}$$

And third, adjust for the effective average wage variation for each group ($\overline{\%\Delta w^s}$):

$$\widetilde{\eta^s_{w \leq MW}} = \frac{\eta^s_{lit}}{p^s_{w \leq MW}} \times \frac{\%\Delta MW}{\overline{\%\Delta w^s}} = \eta^s_{lit} \times F^s_{adjs} \qquad s = \{teens, adults\} \tag{4}$$

Final Effect on Employment

$$\widehat{\Delta E} = \sum_{g \in \{A,T\}} \left(\widehat{N_g^{final}} \times \widetilde{\eta_{w \leq MW}^{g}} \times \overline{\%\Delta w^g} \right) - \widehat{OF} \tag{5}$$

Effect on Wages

w' : wages in 2016 under the status quo.

$$w'' = \begin{cases} w' & if \quad U[0,1] < \alpha_1 \\ w^{new} & o/w \end{cases} \tag{6}$$

$$w^{new} = \begin{cases} w'/2 & if \quad w \in U[0,1] < \frac{2\Delta E}{N_{w<MW'}} \\ \widetilde{w^{new}} & o/w \end{cases} \tag{7}$$

Ripple Effects

$$\widetilde{w^{new}} = \begin{cases} MW' & if \quad w' < R_{lb} \\ MW' + R^l(w' - R^s_{lb}) & if \quad w' \in [R_{lb}, MW') \\ w' + R^l(R^s_{ub} - w') & if \quad w' \in [MW', R_{ub}) \\ w' & o/w \end{cases} \tag{8}$$

Computing Income

$$y'_{i,h} = \sum_{i \in N_h} \left(g_{nw}(t'|t) nw_i + w'_i \right) / N_h$$

$$y''_{i,h} = \sum_{i \in N_h} \left(g_{nw}(t'|t) nw_i + w''_i \right) / N_h \tag{9}$$

Final Policy Estimates

$$WG_i = \left(y''_i - y'_i \right) \mathbf{I} \left(y''_i > y'_i \right) \tag{10}$$

$$WL_i = \left(y'_i - y''_i \right) \mathbf{I} \left(y''_i < y'_i \right) \tag{11}$$

$$BL = \sum_i WG_i - F_{sub} \sum_i WL_i; \quad BL_i = BL \times dBL \tag{12}$$

$$\overline{WG_Q} = \frac{\sum_{i \in Q} WG_i}{N_{pop}/5} \quad \overline{WL_Q} = \frac{\sum_{i \in Q} WL_i}{N_{pop}/5}$$

$$\overline{BL_Q} = \frac{\sum_{i \in Q} BL_i}{N_{pop}/5} \tag{13}$$

Clear connection between sources and inputs

Source	Input
Data	
CPS ORG 2013 (CEPR version)	Number of salary workers in 2013 ($\widehat{N^g_{final}}$ $g \in \{teen, adult\}$); Fraction of workers below the new minimum wage ($P_{\hat{w} \leq MW^1 \mid g}$); Average wage variation for those below the new min wage ($\overline{\%\Delta w^g}$); Non-compliance rate (α_1^g)
CPS ASEC 2012 (CEPR version)	Wages and Non-Wage Income distribution (dF_w, dF_{nw}); Household size (N_h); Hours/weeks worked ($\hat{w}, \hat{h}$)
State level Min. Wage (DOL)	Trends in state min. wage (MW_t^s)
10-year economic forecast (CBO)	Predicted worker growth by 2016 (in 2013) ($\hat{g_N}$); Wage growth in by 2016 ($\hat{g_w}$); Non-wage growth by 2016 ($\hat{g_{nw}}$)
Research	
Elasticity of labor demand for teenagers	$\eta^{lit}_{teen} = -0.1$
Ripple effects	From $R_{lb} = \$8.7$ to $R_{ub} = \$11.5$ with a "ripple" intensity of $R_I = 50\%$
Guess Work	
Extrapolation factor from teenagers to adults	$F_{ex} = 1/3$
Net benefits	$\hat{NB} = \$2 billion$
Adjustment to account for effective wage variation and affected population	$F_{adj} = 4.5$
Aggregate consumption effects on employment	$\hat{OF} = 40,000$ *new jobs*
Distribution of balance loses	$dBL = (1\%, 29\%, 70\%)$ if income $\in [0, 1PL, 6PL, +)$
Fract. of wage loses used to pay wage gains	$F_{subs} = 1$
Job killing process: fraction of jobs	Cut wages in half for twice the number of jobs destroyed

Fully specified model

Model	Policy estimate (per quintile)
Predicted household income with and without min wage increase. **Depends on**: $\widehat{N^g_{final}}$, $P_{\hat{w} \leq MW^1 \mid g}$, $\overline{\%\Delta w^g}$, α^g_1, dF_w, dF_{nw}, N_h, $\hat{w}$, $\hat{h}$, MW^s_t, $\hat{g_N}$, $\hat{g_w}$, $\hat{g_{nw}}$, η^{lit}_{teen}, R_{lb}, R_{ub}, R_l, F_{ex}, F_{adj}, $\hat{OF}$	Average gain in per capita income due to net wage increase. ($\overline{WG_q}$)
Predicted household income with and without min wage increase. **Depends on**: $\widehat{N^g_{final}}$, $P_{\hat{w} \leq MW^1 \mid g}$, $\overline{\%\Delta w^g}$, α^g_1, dF_w, dF_{nw}, N_h, $\hat{w}$, $\hat{h}$, MW^s_t, $\hat{g_N}$, $\hat{g_w}$, $\hat{g_{nw}}$, η^{lit}_{teen}, F_{ex}, F_{adj}, $\hat{OF}$	Average loss in per capita income due to net wage decrease. ($\overline{WL_q}$)
Distribution of balance loses **Depends on**: $\overline{WG_q}(\cdot)$, $\overline{WL_q}(\cdot)$, $\hat{NB}$, F_{subs}, dBL	Average loss in per capita income to balance wage gains. ($\overline{BL_q}$)
Equations; Back	