Aggregate and Welfare Effects of Redistribution of Wealth Under Inflation and Price-Level Targeting

Césaire A. Meh    José-Víctor Ríos-Rull    Yaz Terajima

Bank of Canada    Minnesota, Penn, Mpls Fed, CAERP    Bank of Canada

2008 New Perspectives on Monetary Policy Design

Barcelona

October 9, 2008

The views expressed are those of the authors and not of the Bank of Canada or the Mpls Fed or Fed System or anybody else we can think of.
Introduction

- The main difference is that under inflation targeting (IT) past “mistakes” are ignored and under price-level targeting (PT) they are corrected.

- An unexpected surge in the price level has no effect on inflation expectations or in the subsequent inflation path for that matter under IT while it implies a reduction in inflation expectations under PT.
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Price Level Path under IT and PT

![Graph showing price level path under IT and PT](image)

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Aggr. and Welfare Effects of IT vs PT ... October 9, 2008

New Perspectives on Monetary Policy Design
Questions

1. What are the redistributinal effects of inflation that arise from the revaluation of nominal assets and liabilities under IT and PT?

2. What are the aggregate and welfare implications of these redistributive shocks under IT and PT?
Putting the question in context

- Many studies have examined important issues regarding IT and PT (e.g., Gaspar et al. (2007) and Svensson (1999)). But they have omitted many studies omit redistributional effects of inflation under IT and PT.

- We know from the work of Doepke and Schneider (2006) and that of Meh and Terajima (2007) that inflation has large redistributive consequences.

So we focus on: the redistributional effects and their aggregate consequences. We have little to say on other grounds.
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Redistribution Mechanism: \textbf{IT/PT} and \textit{Term-to-Maturity}

- Unexpected rise in price level lowers real value of nominal assets and liabilities, thereby redistributes wealth from lenders to borrowers.

- Consider a one-time transitory inflation shock that moves the price level up.

  \textbf{IT}: no effect on inflation expectations and thus price level remains on its new path.

  - Shorter and longer term nominal claims are equally affected by price level changes.

  \textbf{PT}: central bank brings the price level back to its initial path.

  - Longer term nominal claims are less affected by price level changes.
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Findings

- Redistributioonal effects of inflation are significant and larger under IT than PT.
  - Winner: young workers
  - Losers: middle-aged workers, rich and old

- The effects of inflation on output are positive and larger under IT than under PT.

- Despite the positive effect on output, inflation reduces the weighted welfare of domestic households.

- Aggregate and welfare effects of inflation depend on fiscal policy.
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A look at the World: How to sort and what to look

- We think of 6 age groups; 3 classes: rich, middle-class, poor.

- We classify assets and liabilities into Short-term nominal assets, Long-term nominal assets and Real assets.
  - Short-term: Cash, Deposits, Credit cards
  - Long-term: Bonds, Pensions and Mortgages
  - Real: Durable, Indexed assets and liabilities

- In addition, we follow Doepke and Schneider (2006) in adjusting Equity to reflect the business sector’s composition of assets.

- We we also deal with the government and foreign sectors. sector.

- Data: 2005 Survey of Financial Security (Statistics Canada)
Composition of Assets are Different: Households

SUMMARY

- Major nominal borrowers
  - Young poor and middle-class (mortgages)

- Major nominal lenders
  - Middle-aged rich (mortgages)
  - Old rich (long-term bonds)
  - Middle-aged/old middle-class (pensions)
### Composition of Assets are Different: Households

**Net Positions as % of Average Wealth in Each Household Group**

<table>
<thead>
<tr>
<th></th>
<th>≤35</th>
<th>36-45</th>
<th>46-55</th>
<th>56-65</th>
<th>66-75</th>
<th>≥76</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rich</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-term</td>
<td>3.86</td>
<td>-3.73</td>
<td>-1.97</td>
<td>-2.36</td>
<td>8.48</td>
<td>8.56</td>
</tr>
<tr>
<td>Long-term</td>
<td>-6.52</td>
<td>5.89</td>
<td>18.40</td>
<td>19.89</td>
<td>19.03</td>
<td>21.26</td>
</tr>
<tr>
<td>Real</td>
<td>102.66</td>
<td>97.84</td>
<td>83.57</td>
<td>82.47</td>
<td>72.49</td>
<td>70.18</td>
</tr>
<tr>
<td><strong>Middle Class</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-term</td>
<td>5.83</td>
<td>2.24</td>
<td>4.39</td>
<td>5.49</td>
<td>9.07</td>
<td>14.91</td>
</tr>
<tr>
<td>Long-term</td>
<td>-95.27</td>
<td>-28.71</td>
<td>7.01</td>
<td>20.55</td>
<td>20.29</td>
<td>18.97</td>
</tr>
<tr>
<td>Real</td>
<td>189.44</td>
<td>126.47</td>
<td>88.60</td>
<td>73.96</td>
<td>70.64</td>
<td>66.12</td>
</tr>
<tr>
<td><strong>Poor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-term</td>
<td>18.90</td>
<td>-0.06</td>
<td>5.04</td>
<td>13.84</td>
<td>12.58</td>
<td>10.96</td>
</tr>
<tr>
<td>Long-term</td>
<td>-71.01</td>
<td>-27.07</td>
<td>-8.30</td>
<td>6.89</td>
<td>1.57</td>
<td>12.79</td>
</tr>
<tr>
<td>Real</td>
<td>152.11</td>
<td>127.13</td>
<td>103.26</td>
<td>79.27</td>
<td>85.85</td>
<td>76.25</td>
</tr>
</tbody>
</table>
## Composition of Assets are Different: Sectors

Data: 2005 National Balance Sheet Account (Statistics Canada)

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Households</th>
<th>Government</th>
<th>Foreigners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term</td>
<td>12.25</td>
<td>-7.60</td>
<td>-4.65</td>
</tr>
<tr>
<td>Long-term</td>
<td>27.89</td>
<td>-35.39</td>
<td>7.49</td>
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</table>
A Simple Model (Needed to Assess Policies)

- Overlapping generations model of a small open economy.

- Agents live for $I$ periods (retire at $I^*$) and can be one of $j \in \{1, \cdots, J\}$ skill types with type specific endowment of efficient units of labour.

- Probability of surviving from age $i$ to age $i + 1$ (trick to have shorter periods than length of life over 6)

- Preferences: $E \left\{ \sum_{i=1}^{I} \beta_{j}^{i-1} u_{j}(c_{i,j,t}, 1 - n_{i,j,t}) + \psi_{j}(a_{i,j,t}) \right\}$. Agents derive utility from consumption, leisure and bequests ("warm-glow"). and choose them optimally.
The BIG Caveat

- We assume, however, that the composition of assets is exogenously determined and depends on age and skill:

  - $\alpha_{ij}^s$: share of assets held in short-term nominal form for type $ij$
    with nominal rate of return $= (1 + \bar{\pi})$

  - $\alpha_{ij}^\ell$: share held in long-term nominal form for type $ij$
    with nominal rate of return $= (1 + \bar{\pi})(1 + \bar{r})$

  - $\alpha_{ij}^r$: share held in real assets for type $ij$
    with real rate of return $= (1 + \bar{r})$
So the Policies Matter

- With an inflation shock of \( z \), rates of return will be discounted by:
  - \( \left( \frac{1}{1+z} \right) \) under both IT and PT for short-term nominal assets
  - \( \left( \frac{1}{1+z} \right) \) only under IT for long-term nominal assets
Closing the Model

- Aggregate Cobb-Douglas production: \( F(N_t, K_t) = K_t^\alpha N_t^{1-\alpha} \)

- Foreigners borrow and lend in the domestic market.

- Government taxes labour income and issues government debt to finance government expenditure, interest payments and transfers to old. There is a need to specify the fiscal policy associated to the inflation shock.

**Commercial Break**
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  **Commercial Break**
Unlike many papers on monetary policy that HIDE the implied fiscal adjustments by assuming a lump sum tax that deems it inexistent, we explore the set of typical adjustments. This is important because of redistribution.
Calibrate the model to Canadian economy

Households differ in patience, ability and laziness:
- Discount factors ($\beta'$s): average wealth by class
- Relative weight on leisure: average work hours of 40% for each type
- Labour productivity: estimation from the panel data
- Survival rates: fraction of retirees to be 17%

Government:
- Labour income tax rate: tax revenue of 32% of GDP
- Retirement transfer: average transfer of 12.51% of GDP per HH
- Government debt: debt to GDP ratio of 56.45%
Experiment: Redistribution Under IT and PT

- We use the 2005 composition of assets and liabilities of Canadian households, government and foreign sector.

- We assume 6-year horizon to correct the price level under PT.
Redistribution of Wealth Across Sectors under IT and PT After a 1% Inflation Shock as a % of GDP

- Winners: Government (net borrowers)
- Losers: Households (net lenders)
- Gains and losses are larger under IT than under PT.

<table>
<thead>
<tr>
<th></th>
<th>Household</th>
<th>Government</th>
<th>Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT</td>
<td>-0.40</td>
<td>0.43</td>
<td>-0.03</td>
</tr>
<tr>
<td>PT</td>
<td>-0.15</td>
<td>0.14</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Redistribution of Wealth Across Households After 1% Inflation Shock under IT as % of Group Net Worth

- Young poor/middle-class are major winners due to large mortgage.
- Old and rich are losing because of bonds and pensions.
- Middle-aged is also losing significantly.

<table>
<thead>
<tr>
<th>Age cohort</th>
<th>≤ 35</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Rich</td>
<td>0.03</td>
<td>-0.02</td>
<td>-0.16</td>
<td>-0.17</td>
<td>-0.27</td>
<td>-0.30</td>
</tr>
<tr>
<td>Middle</td>
<td>0.89</td>
<td>0.26</td>
<td>-0.11</td>
<td>-0.26</td>
<td>-0.29</td>
<td>-0.34</td>
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<tr>
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<td>0.27</td>
<td>0.03</td>
<td>-0.21</td>
<td>-0.14</td>
<td>-0.24</td>
</tr>
</tbody>
</table>
Redistribution of Wealth Across Households After 1% Inflation Shock under $\textbf{PT}$ as % of Group Net Worth

- The gains and losses from inflation are smaller under $\textbf{PT}$ than $\textbf{IT}$.

<table>
<thead>
<tr>
<th>Age cohort</th>
<th>≤ 35</th>
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<td>-0.11</td>
<td>-0.13</td>
</tr>
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</table>
Experiment: Aggregate and Welfare Implications

- We model inflation as an unanticipated zero-sum redistribution of real wealth that displaces the economy from its initial steady state.

- In the baseline, the government uses its windfall gain from the price level increase to cut labour taxes.

- We also consider other fiscal policy scenarios such as transfer to old and lump sum transfer to all households.
Output Changes under **IT** and **PT** After a 1% Shock

- Positive initial effects on output (4 times larger under **IT**)

![Graphs showing output and asset changes under IT and PT](image-url)
Initial Output and Welfare Effects Under IT and PT for Different Fiscal Policy Scenarios

- The effects on output are larger for tax cut under both regimes
- With transfer to old, inflation is welfare improving (more so under IT)

<table>
<thead>
<tr>
<th>Policies</th>
<th>Output IT</th>
<th>Output PT</th>
<th>Welfare IT</th>
<th>Welfare PT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax Cut</td>
<td>0.330</td>
<td>0.082</td>
<td>-0.032</td>
<td>-0.035</td>
</tr>
<tr>
<td>Transfer to Old</td>
<td>0.099</td>
<td>0.038</td>
<td><strong>0.185</strong></td>
<td><strong>0.043</strong></td>
</tr>
<tr>
<td>Lump Sum Transfer</td>
<td>0.014</td>
<td>0.010</td>
<td>-0.033</td>
<td>-0.022</td>
</tr>
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</table>
Conclusion

- We assess quantitatively the redistributional effects of inflation that arise from the revaluation of nominal assets and liabilities under IT and PT in Canada.

- Using a heterogeneous agents model we quantify the aggregate and welfare implications of redistributive effects of inflation under IT and PT.
Conclusion

- Larger redistributions under **IT** than **PT**
  - Winners: Young workers
  - Losers: Middle-aged workers, rich and old

- Positive effects on output and larger under **IT** than under **PT**

- Negative average welfare effect with tax cut fiscal policy

- Aggregate and welfare effects of inflation depend on fiscal policy.
Real Real Conclusions

- We desperately need

  A theory of portfolio choice: Why some long, some short, some nominal some real.

- Of course a theory about the hardships of shifting savings into investment. What is so hard.
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