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Perhaps surprisingly, we find that the probabilities of short-term deflation and of long-term high inflation are positively related.
In the era of independent central banks, are there any fiscal-monetary interactions to even talk about?
Background: Alarming Debt Projections

Let’s focus on the future rather than the current debt crisis in the EU. Below are projections of the public debt to GDP ratio in the U.S. using the Congressional Budget Office data (from Leeper, 2010)
‘We find that, under our baseline scenario, a full elimination of the fiscal and generational imbalances would require all taxes to go up and all transfers to be cut immediately and permanently by 35 percent. A delay in the adjustment makes it more costly.’
The net present value of the impact of aging-related spending on fiscal deficit (in percent of GDP): from IMF (2009).

<table>
<thead>
<tr>
<th>Country</th>
<th>Crisis</th>
<th>Aging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>30</td>
<td>482</td>
</tr>
<tr>
<td>Canada</td>
<td>21</td>
<td>726</td>
</tr>
<tr>
<td>France</td>
<td>31</td>
<td>276</td>
</tr>
<tr>
<td>Germany</td>
<td>29</td>
<td>280</td>
</tr>
<tr>
<td>Italy</td>
<td>35</td>
<td>169</td>
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<tr>
<td>Japan</td>
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<td>158</td>
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<tr>
<td>Korea</td>
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<td>683</td>
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<tr>
<td>Mexico</td>
<td>13</td>
<td>261</td>
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<tr>
<td>Spain</td>
<td>39</td>
<td>652</td>
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<tr>
<td>Turkey</td>
<td>22</td>
<td>204</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>48</td>
<td>335</td>
</tr>
<tr>
<td>United States</td>
<td>37</td>
<td>495</td>
</tr>
<tr>
<td>Advanced G-20 Countries</td>
<td>35</td>
<td>409</td>
</tr>
</tbody>
</table>
One of the Main Driving Forces: Aging Populations

Old-age dependency ratios (population 65+ to population 15-64, UN data, 2011-40 forecast)
Total Dependency Ratios (population 0-14 & 65+ to 15-64)

‘Interesting’ implications for capital and labour markets
Let’s Consider the Fiscal Implications: Expenditure on Pensions and Healthcare by Age

From the IMF (2011) for the United States

---

**Social Security**

**Medicare**

- **Male**
- **Female**

**Medicaid**

**Unemployment Compensation**
Let’s Consider the Fiscal Implications: Tax Revenues by Age

From the IMF (2011) for the United States
So What...?

Should Central Bankers Care About All This?
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- U.S. debt ceiling negotiations, ECB’s change of view on QE etc
- Due to the looming fiscal gap, the government and the central bank have different objectives
- Therefore, they prefer a different policy stance, both in the SR and LR
- Both policymakers act under **incomplete** information. With probability $p$ ‘Downturn’ scenario, with probability $(1 - p)$ ‘Normal times’ scenario (think of the U.S. in 2010-11).
Actions and Payoffs

- To focus on the strategic interactions we analyze the policy interactions as $2 \times 2$ games.
- Both policymakers’ decide about their policy stance: *Active* (tight $M$, easy $F$) or *Passive* (easy $M$, tight $F$).

<table>
<thead>
<tr>
<th>$F$</th>
<th>$M$</th>
<th>$M'$</th>
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<tbody>
<tr>
<td></td>
<td>Active</td>
<td>Passive</td>
</tr>
<tr>
<td>Active</td>
<td>$a, w$</td>
<td>$b, x$</td>
</tr>
<tr>
<td>Passive</td>
<td>$c, y$</td>
<td>$d, z$</td>
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Normal Times (probability $1 - p$)

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<tr>
<td></td>
<td>$A'$</td>
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Downturn (prob. $p$)

- Leeper’s policy regimes exogenous: we endogenize the active/passive policy choice.
Downturn: Battle of the Sexes

- The paper shows that such game can be derived from a simple model under realistic assumptions (reflecting the 2010-11 situation)

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<td><strong>Passive</strong></td>
</tr>
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<td></td>
<td>deflation</td>
<td>recovery</td>
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</tr>
<tr>
<td></td>
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Substitutability of M and F measures: between mid-November 2010 and end-March 2011 U.S. Treasury issued $589 billion in extra long-term debt (of which the Fed bought 87%) - undermining QE
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**Substitutability** of $M$ and $F$ measures: between mid-November 2010 and end-March 2011 U.S. Treasury issued $589 billion in extra long-term debt (of which the Fed bought 87%) - undermining QE

- Bernanke (2011): ‘it’s desirable that we take strong action to lower our budget deficits over the longer term.... [but] in light of the weakness of the recovery, it would be best not to have sudden and sharp fiscal consolidation in the near term.’

Jan Libich, Dat T. Nguyen, and Petr Stehlík (Supported by the Australian Research Council (DP0879638))

Monetary Exit and Fiscal Spillovers

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Normal Times: Game of Chicken

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</tr>
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Estimated Regimes: USA (Leeper and Davig, 2010)

- AM,PF − Ricardian
- AM,AF − Explosive
- PM,PF − Indeterminacy
- PM,AF − Fiscal Theory

Figure:

劳务派遣，Dat T. Nguyen，and Petr Stehlík (Supported by the Australian Research Council (DP0879638))

Monetary Exit and Fiscal Spillovers

This Version: April 2012 17 / 42
To incorporate institutional features our game theoretic framework allows for **stochastic revisions of the policy stance**
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- let’s plot this timing in a diagram

Inability to change the policy stance is interpreted as **long-term monetary commitment** and **fiscal rigidity**.
Timing of Moves

- Nature makes a move about (current and near future) economic conditions given probability $p$.
- Observing the draw, the players move simultaneously at time $t = 0$.
- One of the players, called **reviser**, can move again in time $t \in [0, 1]$ with some ex-ante known positive probability, observing the initial play of the opponent (unlike the **leader**).
- Payoffs accrue continuously over $t \in [0, 1]$.
- A **dynamic** version of the **Stackelberg leadership** concept.
- In Basov, Libich and Stehlík (2011) both players are revisers.
Timing of the Revision Opportunity: Examples

- In contrast to the standard simultaneous move game
Timing of the Revision Opportunity: Examples

- In contrast to the standard simultaneous move game
- 3rd (Calvo) case: annual budget vs FOMC’s meetings (absence of $M$ commitment, otherwise reversed)
The revision function

\[ F(t) : [0, 1] \rightarrow [0, 1], \text{ where } F(0) = 0, \quad (1) \]

is an arbitrary non-decreasing function summarizing the timing of the revision. It is the cumulative distribution function (CDF) of the underlying probability distribution, i.e. it expresses the probability that the reviser has had the opportunity to revise no later than time \( t \).
The integral $\int_0^1 F(t) \, dt$ describes the reaction speed of the revisers. The complementary CDF

$$\int_0^1 (1 - F(t)) \, dt = 1 - \int_0^1 F(t) \, dt,$$

(2)

expresses the degree of rigidity of the reviser. Therefore,

$$\frac{1}{\int_0^1 (1 - F(t)) \, dt} \in [1, \infty)$$

(3)

is the degree of the leader’s relative rigidity.
Results under Responsible M and Ambitious F

- Three equilibrium regions separated by thresholds $T_F$ and $T_M$:
  - **F-dominance**: no double-dip, but $M$ exit unsuccessful
  - **M-dominance**: no double-dip, and $M$ exit successful
  - **regime-switching**: double-dip possible, $M$ exit uncertain (so we may get deflation now and high inflation later)

- the strength of leadership: $F$ rigidity relative to $M$ commitment (expands the standard cases: $F$-leadership, simultaneous move, $M$-leadership)

![Diagram showing regions]

**Figure**: Which region is the most likely one?
Intuition (under p=0)

- Focus on the case $F$ rigidity $> M$ commitment
- Solving backwards, $F$ knows that through her own inaction she can force the bank to act.
- But the initial waiting game can be a costly tug-of-war
- For $F$ to surely-win the game $AF$ must be the unique best response not only to $PM$, but also to $AM$.

$$x \int_0^1 (1 - R_M(t)) \, dt + z \int_0^1 R_M(t) \, dt > w.$$  

The ‘victory’ area below the CDF must be sufficiently large relative to the ‘conflict’ area above the CDF.
The regime-switching Case

- Analogously, for the $M$-dominance case the central bank must be willing to fight $F$.
- The intermediate regime-switching case does not exist under static commitment, and therefore has not been discussed in the Sargent and Wallace (1981) and Leeper (1991) literature.
- One policy is still the leader, but insufficiently so to fully dominate the game.
- This may be a possible advantage in the long-term, but a disadvantage in the short-term.
- Policies are more likely to engage in a costly tug-of-war (a ‘waiting game’, trying to induce the other to respond, leading to deflation).
Additional Insights (Relative to Static Stackelberg Leadership)

- The thresholds $T_F$ and $T_M$ are increasing in the leader’s **conflict costs** relative to his **victory gain** - in downturn and normal times weighted by the **probability** $p$

$$\frac{1}{\int_0^1 (1 - R_M(t)) \, dt} > T_M = \frac{p (y' - w') + (1 - p) (z - x)}{p (y' - x') + (1 - p) (z - w)} > 1.$$

- The magnitudes of the variables differ across countries

- implying an explanation for the observed differences in institutional design of both policies (e.g. not all countries legislated a numerical inflation target).
Additional Insights

- If the cost/gain in downturn exceeds that in normal times then \( T_F \) and \( T_M \) are increasing in \( p \).
- This implies that certain degree of \( M \) commitment sufficient in normal times may be insufficient in a post-crisis situation.
- The future will show whether the FED and others fall in this category.
- A legislated \( M \) commitment may therefore serve as a credibility insurance over the course of the business cycle.
- Good monetary policy design may induce fiscal policy to behave optimally, both in the short responses and long-term stance.
Our Institutional Indices

- To (approximately) assign countries to the three equilibrium regions we need to quantify the \( \frac{M_{\text{commitment}}}{F_{\text{rigidity}}} \) ratio.
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- \( F \) rigidity: average of eight components based on: (i) the \( F \) space concept of Aizenman and Jinjarak (2011), (ii) the estimated probabilities of a given \( F \) space by Ostry et al. (2010), (iii) the \( F \) space, \( F \) path, and \( F \) governance of Augustine et al. (2011), and (iv) average \( F \) balances over 2000-11.
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\( M \) commitment: average of four components based on: (i) the political transparency measure of Eijffinger and Geraats (2006) as calculated by Dincer and Eichengreen (2011), and (ii) the final responsibility measure of the central bank accountability index of Haan et al. (1998) as updated by Sousa (2002), and (iii) the inflation focus and central bank accountability measures of Fry et al. (2000).
Fiscal Rigidity Country Ranking

Figure: Relative fiscal rigidity scores.
The Monetary Commitment vs Fiscal Rigidity Space
Equilibrium Regions

Figure: Relative monetary commitment to fiscal rigidity scores ratios.

- While countries such as Australia and New Zealand seem safely in the $M$ dominance region, countries such as the United States and Japan are likely in the $F$ dominance or Regime switching regions.
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a (much) higher probability of both short-term deflation and long-term high inflation in the latter pair of countries.

Figure: Relative monetary commitment to fiscal rigidity scores ratios.
**Figure:** Impulse responses of the interest rate (vertical axis) to a debt-financed government spending shock in Australia (left) and the U.S. (right), for details see Franta, Libich and Stehlík (2012).
Figure: Evolution of the government debt to GDP ratio (in %, demeaned) in EIT countries (top) and non-EIT countries (bottom). The start of the shaded area indicates the regime’s adoption. For details see Franta, Libich, and Stehlik (2012).
Government Debt in Non-targeters

Debt/GDP
(in %, demeaned)

Japan
Switzerland
USA

Extension: Monetary Union with Three Types of Governments

- The common (responsible) central bank’s payoff is a weighted average of the payoffs obtained from interactions with each government type $i \in \{A, R, U\}$ using the weights $f^i$.
- Showing how responsible governments potentially improve the outcomes, and ultra-ambitious governments make them worse.
- Coalition of the common CB and responsible governments against the coalition of the (ultra-)ambitious ones. If $f^R < \overline{f^R}$, where

$$
\overline{f^R} = \frac{f^U[p(b' - a') + (1 - p)(a - b)] - [p(b' - c') + (1 - p)(a - d)]}{[p(c' - d') + (1 - p)(d - c)]}.
$$

then the former coalition never ‘surely-wins’, i.e. we may have $F$-spillovers even if the common CB is **infinitely strongly committed** (so only two equilibrium regions).
Summary and Conclusions

- Understanding **strategic** monetary-fiscal interactions is important in the current situation of $F$ stress.

- Our analysis can roughly be interpreted as examining the following question: ‘Which policy, if any, will (be forced to) deal with the short-term threat of a double-dip recession, and which with the long-term fiscal imbalance?’

- Need to ‘**institutionalize**’ good policy - legislate commitment devices that ensure the right incentives of the policymakers (a mixture of **independence, transparency** and **accountability** - in both policies)

- In many countries direct fiscal reform seems politically difficult, so discipline can sometimes be achieved **indirectly** through (**legislated**) **long-term monetary commitment**, which may both:
  - reduce the risk of a double-dip recession and deflation in the short-term, and
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- reduce the risk of a double-dip recession and deflation in the short-term, and
- facilitate the exit strategy of $M$ policy, ie prevent $F$ spillovers
A legislated numerical target = monetary ‘credibility insurance’ over all phases of the business cycle.
Summary and Conclusions

- A legislated numerical target = monetary ‘credibility insurance’ over all phases of the business cycle.

- In line with Mishkin (2010): ‘Providing a firm anchor for long-run inflation expectations would make the threat of deflation less likely. But a firm anchor would also give the Fed flexibility to respond to the weakness of the economy – because it would help ensure that any new moves to quantitative easing would not be misinterpreted as signalling a shift in the central bank’s long-run inflation goal, making an upward surge in inflation expectations less likely too.’
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- Brash (2011): ‘I have not the slightest doubt that having legislation which requires government and central bank to formally agree, and disclose to the public, the inflation rate which the central bank must target has a most useful role in creating strong incentives for good fiscal policy.’
More Views on Monetary-Fiscal Interactions, the Euro etc

Hour-long video interviews with academics and policymakers (Dr Don Brash, Prof Eric Leeper, Prof Andrew Hughes Hallett, Dr Stefan Auer...)

Figure: Evolution of the government debt to GDP ratio (in %, demeaned) in EIT countries (top) and non-EIT countries (bottom). The start of the shaded area indicates the regime's adoption.
A Sketch of Fiscal Stress

What can be done about it (other than default)?

\[ B_1 - \lambda \frac{Z_1 - T_1}{P_1} = R_0 B_0. \]

- (only temporary) **Borrowing**: growing debt \( B_1 - B_0 > 0 \).
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- **Reneging on promises**: \( \lambda = 0 \) - passive \( F \) policy
A Sketch of Fiscal Stress

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\[ B_1 - \lambda \frac{Z_1 - T_1}{P_1} = R_0 B_0. \]

- (only temporary) **Borrowing**: growing debt \( B_1 - B_0 > 0 \).
- **Structural fiscal reform**: reducing \( Z \) and/or increasing \( T \) to ensure the required level of \( Z_1 - T_1 \leq 0 \) - **passive F policy**
- **Reneging on promises**: \( \lambda = 0 \) - **passive F policy**
- **Monetization** [ala Sargent and Wallace (1981)]/**Fiscal Theory of the Price Level** [ala Leeper (1991)]: increase in \( P_1 \) - **passive M policy**
Policymakers’ preferences:

\[ U_i = -\phi_i (P_1 - P_T)^2 - \left( \frac{B_1}{P_1} - b^T \right)^2 - \delta_i (1 - \lambda)^2, \tag{4} \]

where \( i \in \{M, F\} \) and \( \phi_M > \delta_M \geq 0 \) and \( \delta_F > \phi_F \geq 0 \).
Active/Passive Policies

- Policymakers’ preferences:

\[ U_i = -\phi_i (P_1 - P^T)^2 - \left( \frac{B_1}{P_1} - b^T \right)^2 - \delta_i (1 - \lambda)^2, \]  

where \( i \in \{M, F\} \) and \( \phi_M > \delta_M \geq 0 \) and \( \delta_F > \phi_F \geq 0 \).

Definition

An **active policy** is such that it provides *no adjustment at all* to balance the budget constraint (4). That is \( P_1 = P^T \) and \( \lambda = 1 \). In contrast, a **passive policy** is such that it provides the *full adjustment* necessary to balance the budget constraint and keep stable real debt - independently of the other policy (ie assuming the other policy is active). Specifically, it is \( P_1^*(Z, T) > P^T \) and \( \lambda^* = 0 \).
Mapping and Outcomes

- For illustration normalize:

\[ R_0 = B_0 = 1 = P_1 = P^T = T = 1 < Z = 3, \]

which implies \( b^T = 1 \) and \( P_1^* = 2 \).

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<thead>
<tr>
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<th>( F )</th>
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<tr>
<td></td>
<td>( PF \left( \lambda^* = 0 \right) )</td>
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<tr>
<td>( M )</td>
<td>( AM \left( P_1 = P^T = 1 \right) )</td>
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<tr>
<td></td>
<td>( \frac{B_1}{P_1} = \frac{1}{1} = b^T )</td>
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<td>Stable nominal debt</td>
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<tr>
<td>( P )</td>
<td>( PM \left( P_1^* = 2 \right) )</td>
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<td></td>
<td>( \frac{B_1}{P_1} = \frac{1}{2} &lt; b^T )</td>
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<td>Stable nominal debt</td>
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Normal Times (probability 1-\( p \))

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<tr>
<th></th>
<th>( PM )</th>
<th>( AM )</th>
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<tbody>
<tr>
<td>( M )</td>
<td>(- \phi_M - \frac{1}{4} - \delta_M, -\phi_F - \frac{1}{4} - \delta_F)</td>
<td>(- \delta_M, -\delta_F)</td>
<td>(-4, -4)</td>
<td>(- \phi_M, -\phi_F)</td>
</tr>
</tbody>
</table>

Naturally, in normal times assuming \( \max \{ \phi_M, \delta_F \} < 4 \), we get the Game of chicken:

\[
a > d > \max \{ b, c \} \quad \text{and} \quad z > w > \max \{ x, y \}.
\]