Understanding Belief Formation: Evidence from Pension Reform in Europe

Emanuele Ciani  
Bank of Italy

Adeline Delavande  
University of Essex

Ben Etheridge  
University of Essex

Marco Francesconi  
University of Essex

14–15 Sep 2017, AIEL
1. How do beliefs/expectations get formed?
1. How do beliefs/expectations get formed?

2. Do expectations respond to changes in the environment in which people make decisions (e.g., reforms and/or announcements of reforms)?

3. Are there specific characteristics (e.g., education, numeracy, optimism) or channels (e.g., internet searches) underlying the relationship between beliefs and changes in individuals’ information set?

4. Salience: Do beliefs affect expected behavior? Does expected behavior affect actual behavior? Do beliefs affect behavior directly?
1. How do beliefs/expectations get formed?

2. Do expectations respond to changes in the environment in which people make decisions (e.g., reforms and/or announcements of reforms)?

3. Are there specific characteristics (e.g., education, numeracy, optimism) or channels (e.g., internet searches) underlying the relationship between beliefs and changes in individuals’ information set?

4. Salience: Do beliefs affect expected behavior? Does expected behavior affect actual behavior? Do beliefs affect behavior directly?
(a) Use data from five waves of the Survey of Health, Ageing and Retirement in Europe (SHARE) on 10 European countries between observed between 2004 and 2015.

(b) Focus on events (pension reforms) which a single individual has no control over. Thus, limit for private information to play a role.

(c) Take advantage of variation by country across time.

(d) Construct proxy for individuals’ information set based on:
   - public governmental announcements
   - actual reforms
   - Google Trends (rough measure for intensity about which social networks talk about pension reform)
Why?

Knowing how individuals form their beliefs is extremely important for

- **policy purposes**, e.g., design of pension schemes, provision of pension benefits, and retirement age

- **model building** and **testing** (rational expectations, Bayesian updating, consumption/saving and permanent income hypothesis, labor supply in old age, retirement consumption, annuity and bequests)
1. Literature on belief formation related to, and evolution of, expectations about pension reform is relatively **scant**

2. Large body of work on revision of expectations refers to events for which **private information** is likely to be important, e.g.

3. Other studies in which individuals cannot have salient private information are not on pension reform but refer to:

- inflation expectations – Armantier et al. (2013, 2015, 2016)
- equity returns – Dominitz and Manski (2011)
- housing price – Armona, Fuster, Zafar (2016)
3. Other studies in which individuals **cannot** have salient private information are **not** on pension reform but refer to:
   - inflation expectations – Armantier et al. (2013, 2015, 2016)
   - equity returns – Dominitz and Manski (2011)
   - housing price – Armona, Fuster, Zafar (2016)

4. Somewhat close to our work is the paper by Bottazzi, Jappelli, and Padula (2006, JPubE)
   - which estimates the effect of pension reform on households’ expectations of retirement and private wealth accumulation decisions in Italy (for us it is belief formation and Europe)
3. Other studies in which individuals cannot have salient private information are not on pension reform but refer to:
   - inflation expectations – Armantier et al. (2013, 2015, 2016)
   - equity returns – Dominitz and Manski (2011)
   - housing price – Armona, Fuster, Zafar (2016)

4. Somewhat close to our work is the paper by Bottazzi, Jappelli, and Padula (2006, JPubE)
   - which estimates the effect of pension reform on households’ expectations of retirement and private wealth accumulation decisions in Italy (for us it is belief formation and Europe)
   - and finds that workers revise expectations in the direction suggested by the reform and that there is substantial offset between private wealth and perceived pension wealth

5. Even closer is Giavazzi and McMahon (2012, REStat)
   - which analyzes how households respond to increase in uncertainty in the run-up to the 1998 German elections
3. Other studies in which individuals cannot have salient private information are not on pension reform but refer to:
   - inflation expectations – Armantier et al. (2013, 2015, 2016)
   - equity returns – Dominitz and Manski (2011)
   - housing price – Armona, Fuster, Zafar (2016)

4. Somewhat close to our work is the paper by Bottazzi, Jappelli, and Padula (2006, JPubE)
   - which estimates the effect of pension reform on households’ expectations of retirement and private wealth accumulation decisions in Italy (for us it is belief formation and Europe)
   - and finds that workers revise expectations in the direction suggested by the reform and that there is substantial offset between private wealth and perceived pension wealth

5. Even closer is Giavazzi and McMahon (2012, REStat)
   - which analyzes how households respond to increase in uncertainty in the run-up to the 1998 German elections
   - and finds that households increase their saving significantly
5. Our piece is also related to studies that analyze how (macro) information influences attitudes and behaviour (although this is mostly in the political domain)
5. Our piece is also related to studies that analyze how (macro) information influences attitudes and behaviour (although this is mostly in the political domain)

- Growing literature on the role of media exposure on political attitudes and behavior (in the field and in the lab), e.g.
Data come from SHARE

- 5 waves: 2004/05, 2006/07, 2011, 2013, 2015; so wave 3 (2008/09) is out, as it collects retrospective information on respondents’ life.
Data come from SHARE

- 5 waves: 2004/05, 2006/07, 2011, 2013, 2015; so wave 3 (2008/09) is out, as it collects retrospective information on respondents’ life

Focus on two expectations questions (asked only to those employed or self-employed, and are recorded from 0 to 100):

- What are the chances that before you retire the government will reduce the pension which you are entitled to?
- What are the chances that before you retire the government will raise your retirement age?
Issues related to data collection, e.g.

- expectations information not elicited in waves 4 and 6 for longitudinal respondents, but only for refresher samples
- Germany and Sweden: no refresher samples in wave 4
- Netherlands: no survey in wave 6
- Austria, Germany, Sweden, Spain and Switzerland: few non-longitudinal respondents in wave 6
Issues related to data collection, e.g.
- expectations information not elicited in waves 4 and 6 for longitudinal respondents, but only for refresher samples
- Germany and Sweden: no refresher samples in wave 4
- Netherlands: no survey in wave 6
- Austria, Germany, Sweden, Spain and Switzerland: few non-longitudinal respondents in wave 6

10 countries over waves 1, 2, 4, 5, 6: Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Spain, Sweden, Switzerland

Final sample: employed and self-employed, men and women aged [50, 64] with non-missing information on beliefs and covariates: ~28,000 person wave observations
Using comprehensive information from the European Union and the OECD, we can time the date (year and month) of each reform in each of the countries in the sample, and distinguish between

- reforms that increase the national retirement age and
- reforms that reduce pension benefits
Using comprehensive information from the European Union and the OECD, we can time the date (year and month) of each reform in each of the countries in the sample, and distinguish between

- reforms that increase the national retirement age and
- reforms that reduce pension benefits

Since we know year of month of interview, we can build a new variable *proximity to reform* which

- is equal to 25 in the month of the reform and decreases one-to-one with distance in months away to/from the reform,
- and thus equal to 0 in all periods that are distant from the reform (both with respect to the future and to the past) more than 24 months
Timing of Reforms by Country

- Austria
- Germany
- Sweden
- Netherlands
- Spain
- Italy
- France
- Denmark
- Switzerland
- Belgium

Reform events marked with:
- Blue circle: Reform increasing NRA
- Red cross: Reform cutting benefits

- >=30 obs in SHARE

Legend:
- Blue circle: Reform increasing NRA
- Red cross: Reform cutting benefits

2002m1 – 2016m1
Proximity to Reform – (a) Reform increasing national retirement age

Data (5)
Data (6)

Proximity to Reform – (b) Reform decreasing pension benefits

Austria
Germany
Sweden
Netherlands
Spain
Italy
France
Denmark
Switzerland
Belgium

2002m1 2004m1 2006m1 2008m1 2010m1 2012m1 2014m1 2016m1

Understanding Belief Formation
14–15 Sep 2017, AIEL
The next two figures display the distribution of beliefs by reform type in the sample.

(a) high dispersion
(b) heaps at multiples of 10
(c) large fraction of individuals with highest uncertainty (at 0.5)
(d) many individuals report certainty, i.e. 0 = no change, or 1 = certainty of a reform
(e) dispersion remains large even after controlling for a wide set of covariates, which explain only about 10–15% of the variance in the chances of a reform that reduces benefits or increases age at retirement.
Descriptives (1)

The next two figures display the distribution of beliefs by reform type in the sample. They both show:

(a) **high dispersion in beliefs**
(b) **heaps at multiples of 10**
(c) **large fraction of individuals with highest uncertainty** (at 0.5)
(d) many individuals report **certainty**, i.e. 0 = no change, or 1 = certainty of a reform
(e) dispersion remains large even after **controlling** for a wide set of covariates, which explain only about 10–15% of the variance in the chances of a reform that reduces benefits or increases age at retirement
Descriptives (2)
Distribution of beliefs about increases in retirement age
Descriptives (3)

Distribution of beliefs about reduction in pension benefits

Chances reduction pension benefits

- The graph shows the distribution of beliefs about the chance of reduction in pension benefits.
- The x-axis represents the chances on a scale from 0 to 1.
- The y-axis represents the fraction of responses.
- The bars indicate the proportion of respondents who believe in the chances of pension benefits reduction at different levels.
The next figure displays the average expectations in the sample
The next figure displays the average expectations in the sample. It shows that:

(a) beliefs about a reform are broadly consistent with changes in the macroeconomic environment
(b) During economic downturns, average expectations of a reform go up
(c) At younger ages, average beliefs move away from the largest uncertainty to an average level of 70%
(d) Expectations of a reform are lower for older people, since the remaining time span before retirement is shorter and thus there are fewer chances that a reform can actually take place
Descriptives (5)
Average beliefs over time and by age

age [50-54]

age [55-59]

age [60-64]

Benefit red
Age increase

CDEF (BoI/Essex)  Understanding Belief Formation  14–15 Sep 2017, AIEL  18 / 47
Use *proximity to reform* to see how beliefs about the likelihood of a reform evolve around the time to/from an actual reform
Results: Beliefs and Reforms (1)

- Use *proximity to reform* to see how beliefs about the likelihood of a reform evolve around the time to/from an actual reform.

- Focus first on: six months (panel A) and one year (panel B) before/after a reform, with dummy variables.
Use *proximity to reform* to see how beliefs about the likelihood of a reform evolve around the time to/from an actual reform.

Focus first on: six months (panel A) and one year (panel B) before/after a reform, with dummy variables. The notation is:

- \(I(-6,-1)\) or \(I(-12,-1)\): six months *before* or 12 months *before*
- \(I(0,6)\) or \(I(0,12)\): six months *after* or 12 months *after*
Use *proximity to reform* to see how beliefs about the likelihood of a reform evolve around the time to/from an actual reform.

Focus first on: six months (panel A) and one year (panel B) before/after a reform, with dummy variables. The notation is:
- I(-6,-1) or I(-12,-1): six months before or 12 months before
- I(0,6) or I(0,12): six months after or 12 months after

Then, turn to the liner specification [25 is max value declining to 0 before/after the reform] (panel C).
Use *proximity to reform* to see how beliefs about the likelihood of a reform evolve around the time to/from an actual reform.

Focus first on: six months (panel A) and one year (panel B) before/after a reform, with dummy variables. The notation is:

- $I(-6,-1)$ or $I(-12,-1)$: six months *before* or 12 months *before*
- $I(0,6)$ or $I(0,12)$: six months *after* or 12 months *after*

Then, turn to the liner specification [25 is max value declining to 0 before/after the reform] (panel C). The notation is:

- $PtR$(before): proximity to reform *before* the reform is implemented
- $PtR$(after): proximity to reform *after* the reform is implemented
Use *proximity to reform* to see how beliefs about the likelihood of a reform evolve around the time to/from an actual reform.

Focus first on: six months (panel A) and one year (panel B) before/after a reform, with dummy variables. The notation is:
- \(I(-6,-1)\) or \(I(-12,-1)\): six months *before* or 12 months *before*
- \(I(0,6)\) or \(I(0,12)\): six months *after* or 12 months *after*

Then, turn to the linear specification [25 is max value declining to 0 before/after the reform] (panel C). The notation is:
- \(PtR\) (before): proximity to reform *before* the reform is implemented
- \(PtR\) (after): proximity to reform *after* the reform is implemented

Dependent variable (chances): measured on a \([0–1]\) scale

\[s.e.\] clustered by country × month of interview (> 200 groups)
<table>
<thead>
<tr>
<th></th>
<th>Chances Govt Raises Retirement Age before resp. retires</th>
<th>Chances Govt Reduces Pension Benefits before resp. retires</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I(-6,-1)</td>
<td>0.078***</td>
<td>0.085***</td>
</tr>
<tr>
<td>I(0,6)</td>
<td>–0.012</td>
<td>0.093***</td>
</tr>
<tr>
<td><strong>Panel B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I(-12,-1)</td>
<td>0.096***</td>
<td>0.085***</td>
</tr>
<tr>
<td>I(0,12)</td>
<td>–0.029**</td>
<td>0.078***</td>
</tr>
<tr>
<td><strong>Panel C</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PtR(before)</td>
<td>0.005***</td>
<td>0.005***</td>
</tr>
<tr>
<td>PtR(after)</td>
<td>–0.003**</td>
<td>0.005***</td>
</tr>
</tbody>
</table>

Note: Controls for household income and net wealth, age, gender, education, private/public sector, self-employment, part-time employment, citizen, health status, marital status, household size, country, survey year, time of interview in months.
The length of time to/from a reform matters for the formation of beliefs.
The **length of time** to/from a **reform** matters for the formation of beliefs.

The time that **precedes** a reform (up to 24 months before) is as relevant as the time that **follows** the reform in the case of beliefs about *benefit reductions*.

- The expectation of a reform (that reduces pension benefits) 6-12 months **before** the implementation increases the belief that pension benefits will decline by about **9 percentage points**.
- The implementation of the same reform increases the same beliefs 6-12 months **after** by a **8–9 percentage points**.
- When taking the 24-month period, the impact is about **10 percentage points** both before and after the reform.
The length of time to/from a reform matters for the formation of beliefs.

The time that precedes a reform (up to 24 months before) is as relevant as the time that follows the reform in the case of beliefs about benefit reductions.

- The expectation of a reform (that reduces pension benefits) 6-12 months before the implementation increases the belief that pension benefits will decline by about 9 percentage points.
- The implementation of the same reform increases the same beliefs 6-12 months after by a 8–9 percentage points.
- When taking the 24-month period, the impact is about 10 percentage points both before and after the reform.

Asymmetry in the case of reforms that increase the national retirement age (NRA):

- Large impact on beliefs before the reform, 8–10 percentage point increase.
- Smaller impact after the reform, 3–7 percentage point reduction.
Results are robust to individual fixed effects

- The size of the estimates of the time span before a reform is just slightly smaller
- But the (negative) estimates after become significant in the case of beliefs about increases in NRA
Results are **robust** to individual **fixed effects**

- The size of the estimates of the time span *before* a reform is just slightly smaller
- But the (negative) estimates *after* become significant in the case of beliefs about increases in NRA

Results are also robust to **different time windows**, e.g.:

- changing the length up to 18 months before and after
- having times before and after the reform included separately
- having times split in subgroups (e.g. 0–6 months and 6–12 months in the same regression)
Does the reform itself generate the information that individuals value and use to form their expectations and behavior?
Does the reform itself generate the information that individuals value and use to form their expectations and behavior?

Or is it the case that the large effects before reforms are driven by announcements?
Beliefs, Reforms, and Announcements (1)

- Does the reform itself generate the information that individuals value and use to form their expectations and behavior?

- Or is it the case that the large effects before reforms are driven by announcements?

  - People may adjust their expectations (and eventually behavior) when reforms are announced, i.e., well before the reform (between announcement and implementation)
Beliefs, Reforms, and Announcements (1)

- Does the reform itself generate the information that individuals value and use to form their expectations and behavior?

- Or is it the case that the large effects before reforms are driven by announcements?

  - People may adjust their expectations (and eventually behavior) when reforms are announced, i.e., well before the reform (between announcement and implementation)

  - This is what we explore next

- **Notation:** \( I^U(-12,-1) \) and \( I^A(-12,-1) \): 12-to-1 months before an unannounced \((U)\) and announced \((A)\) reform, respectively
<table>
<thead>
<tr>
<th>Beliefs, Reforms, and Announcements (2)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Chances Govt Raises Retirement Age before resp. retires</th>
<th>Chances Govt Reduces Pension Benefits before resp. retires</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I^U(-12,-1)$</td>
<td>0.091***</td>
<td>0.086***</td>
</tr>
<tr>
<td>$I^A(-12,-1)$</td>
<td>0.109***</td>
<td>0.082**</td>
</tr>
<tr>
<td>$I(0,12)$</td>
<td>-0.029**</td>
<td>0.078***</td>
</tr>
<tr>
<td><strong>Panel B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I^U(-18,-1)$</td>
<td>0.096***</td>
<td>0.083***</td>
</tr>
<tr>
<td>$I^A(-18,-1)$</td>
<td>0.117***</td>
<td>0.057***</td>
</tr>
<tr>
<td>$I(0,12)$</td>
<td>-0.021</td>
<td>0.083***</td>
</tr>
</tbody>
</table>

*Note:* Controls for household income and net wealth, age, gender, education, private/public sector, self-employment, part-time employment, citizen, health status, marital status, household size, country, survey year, time of interview in months.
(a) Prior to reforms, impact on believes of unannounced reforms is very similar to that of announced reforms
(a) Prior to reforms, impact on believes of unannounced reforms is very similar to that of announced reforms.

(b) Relative to unannounced reforms, announcements:

- *increase* expectations in the case of reforms that raise NRA by about 2 percentage points.
- *decrease* expectations in the case of reforms that reduce pension benefits by 2.5 points when the time span is 18 months before the reform implementation.
Beliefs, Reforms, and Announcements (3)

(a) Prior to reforms, impact on believes of unannounced reforms is very similar to that of announced reforms.

(b) Relative to unannounced reforms, announcements:

- *increase* expectations in the case of reforms that raise NRA by about 2 percentage points.
- *decrease* expectations in the case of reforms that reduce pension benefits by 2.5 points when the time span is 18 months before the reform implementation.

(c) Announcements are quantitatively important but *cannot* be the whole story. Indeed, individuals

- keep *revising* their expectations even after the implementation of a given reform, and
- have *similar* responses even when reforms are unannounced.
Could it be that individuals update their information set (before and after the introduction of reforms) through social networks?

We proxy the strength of social networks with online search,
Could it be that individuals update their information set (before and after the introduction of reforms) through social networks?

We proxy the strength of social networks with online search, which is observed at the aggregate monthly level through Google Trends.

- over the sample period we look at search intensity, which is measured on a [0–1] scale
- for each country, we look at monthly searches only for the words "pension reform" (translated in each country's language)
- intensity is equal to 1 in the month in which there are most country-specific users searching for the words "pension reforms", any number between 0 and 1 in all the other cases in which there is search activity, and 0 if there is no search.
Could it be that individuals update their information set (before and after the introduction of reforms) through social networks?

We proxy the strength of social networks with online search, which is observed at the aggregate monthly level through Google Trends. In particular:

- over the sample period we look at search intensity, which is measured on a [0–1] scale
- for each country, we look at monthly searches only for the words “pension reform” (translated in each country’s language)
- intensity is equal to 1 in the month in which there are most country-specific users searching for the words “pension reforms”, any number between 0 and 1 in all the other cases in which there is search activity, and 0 if there is no search
<table>
<thead>
<tr>
<th></th>
<th>Chances Govt Raises Retirement Age before resp. retires</th>
<th>Chances Govt Reduces Pension Benefits before resp. retires</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Google Trends</strong></td>
<td>0.129**</td>
<td>0.164***</td>
</tr>
</tbody>
</table>

**Beliefs and Online Search (2)**
### Beliefs and Online Search (2)

<table>
<thead>
<tr>
<th>Google Trends</th>
<th>Chances Govt Raises Retirement Age before resp. retires</th>
<th>Chances Govt Reduces Pension Benefits before resp. retires</th>
</tr>
</thead>
<tbody>
<tr>
<td>over past 6 months</td>
<td>0.129**</td>
<td>0.164***</td>
</tr>
<tr>
<td></td>
<td>0.306***</td>
<td>0.525***</td>
</tr>
<tr>
<td>over past 12 months</td>
<td>–0.202</td>
<td>0.428***</td>
</tr>
</tbody>
</table>
(a) On average, a 1 standard deviation increase in the number of monthly searches is associated with
- a 2.2 percentage point increase in the belief that the government would raise the NRA (or 4% increase at the mean of beliefs) and
- a 2.8 percentage point increase in the belief that the government would reduce pension benefits (or 5.3% increase at the mean of beliefs)
(a) On average, a 1 standard deviation increase in the number of monthly searches is associated with

- a 2.2 percentage point increase in the belief that the government would raise the NRA (or 4% increase at the mean of beliefs) and
- a 2.8 percentage point increase in the belief that the government would reduce pension benefits (or 5.3% increase at the mean of beliefs)

(b) Thus, online search seems to be an important source of information that affects people’s information set
Beliefs and Online Search (3)

(a) On average, a 1 standard deviation increase in the number of monthly searches is associated with

- a 2.2 percentage point increase in the belief that the government would raise the NRA (or 4% increase at the mean of beliefs) and
- a 2.8 percentage point increase in the belief that the government would reduce pension benefits (or 5.3% increase at the mean of beliefs)

(b) Thus, online search seems to be an important source of information that affects people’s information set

Que: Is online search an alternative to announcements for individuals to obtain information and shape up their beliefs?
(a) On average, a 1 standard deviation increase in the number of monthly searches is associated with
- a 2.2 percentage point increase in the belief that the government would raise the NRA (or 4% increase at the mean of beliefs) and
- a 2.8 percentage point increase in the belief that the government would reduce pension benefits (or 5.3% increase at the mean of beliefs)

(b) Thus, online search seems to be an important source of information that affects people’s information set

Que: Is online search an alternative to announcements for individuals to obtain information and shape up their beliefs?

This is what we see next
(a) On average, a 1 standard deviation increase in the number of monthly searches is associated with
- a 2.2 percentage point increase in the belief that the government would raise the NRA (or 4% increase at the mean of beliefs) and
- a 2.8 percentage point increase in the belief that the government would reduce pension benefits (or 5.3% increase at the mean of beliefs)

(b) Thus, online search seems to be an important source of information that affects people’s information set

Que: Is online search an alternative to announcements for individuals to obtain information and shape up their beliefs?

This is what we see next [Google Trends over past 6 months: GT(−6)]
<table>
<thead>
<tr>
<th></th>
<th>Chances Govt Raises Retirement Age before resp. retires</th>
<th>Chances Govt Reduces Pension Benefits before resp. retires</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I^A(-6, -1)$</td>
<td>0.267***</td>
<td>0.183***</td>
</tr>
<tr>
<td>$GT(-6)$</td>
<td>0.232***</td>
<td>0.642***</td>
</tr>
<tr>
<td>$I^A(-6, -1) \times GT(-6)$</td>
<td>$-0.608^{***}$</td>
<td>$-0.619^{***}$</td>
</tr>
<tr>
<td>$I^U(-12, -1)$</td>
<td>0.038**</td>
<td>0.042***</td>
</tr>
<tr>
<td>$I^U(-12, -1) \times GT(-12)$</td>
<td>0.721***</td>
<td>0.514***</td>
</tr>
<tr>
<td>$I(0, 12)$</td>
<td>$-0.038^{***}$</td>
<td>0.105***</td>
</tr>
<tr>
<td>$I(0, 12) \times GT(+12)$</td>
<td>$-0.140$</td>
<td>$-0.300^{**}$</td>
</tr>
</tbody>
</table>
(a) Both reform announcements and social interactions about reforms affect beliefs **positively** and **strongly**
(a) Both reform announcements and social interactions about reforms affect beliefs **positively** and **strongly**

(b) Announcements and online search are **substitutes** in the formation of beliefs about pension reforms
(a) Both reform announcements and social interactions about reforms affect beliefs positively and strongly

(b) Announcements and online search are substitutes in the formation of beliefs about pension reforms

(c) Instead unannounced reforms and online search are complements:
   - gathering information online (and possibly through other social interactions, peers, etc.) is a crucial channel for belief formation when there is no formal announcement of reform
(a) Both reform announcements and social interactions about reforms affect beliefs positively and strongly.

(b) Announcements and online search are substitutes in the formation of beliefs about pension reforms.

(c) Instead, unannounced reforms and online search are complements:
   - gathering information online (and possibly through other social interactions, peers, etc.) is a crucial channel for belief formation when there is no formal announcement of reform.

(d) Implementation of a reform that raises NRA reduces beliefs in a subsequent reform, and online search does not affect beliefs with the implementation.

(e) But implementation of reform that reduces PB increases the expectations of a future reform, while implementation and online search are substitutes.
Reform implementations and announcements raise average beliefs.
Reform implementations and announcements raise average beliefs.

One may wonder if they also lead to **convergence of beliefs** across individuals.
Reform implementations and announcements raise average beliefs.

One may wonder if they also lead to convergence of beliefs across individuals.

Important to gauge the relationship of reform implementations and announcements with belief dispersion, since policy makers can better fine tune their interventions if they intend to expand people’s information sets and/or curb noise to signal.
Reform implementations and announcements raise average beliefs

One may wonder if they also lead to convergence of beliefs across individuals

Important to gauge the relationship of reform implementations and announcements with belief dispersion, since policy makers can better fine tune their interventions if they intend to expand people’s information sets and/or curb noise to signal

We do this next, taking as our dependent variable the square of the residuals from earlier regressions (Panel B slide 20, and Panel A slide 24)
<table>
<thead>
<tr>
<th></th>
<th>Square of Residuals</th>
<th>Square of Residuals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chances Govt Raises</td>
<td>Chances Govt Reduces</td>
</tr>
<tr>
<td>Retirement Age</td>
<td>before resp. retires</td>
<td>Pension Benefits</td>
</tr>
<tr>
<td>before resp. retires</td>
<td></td>
<td>before resp. retires</td>
</tr>
</tbody>
</table>

**Panel A**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I(-12,-1)</td>
<td>0.009**</td>
</tr>
<tr>
<td>I(0,12)</td>
<td>0.017***</td>
</tr>
<tr>
<td></td>
<td>−0.000</td>
</tr>
<tr>
<td></td>
<td>−0.008</td>
</tr>
</tbody>
</table>

**Panel B**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I^U(-12,−1)</td>
<td>0.003</td>
</tr>
<tr>
<td>I^A(-12,−1)</td>
<td>0.026**</td>
</tr>
<tr>
<td>I(0,12)</td>
<td>0.017***</td>
</tr>
</tbody>
</table>

Note: Controls for household income and net wealth, age, gender, education, private/public sector, self-employment, part-time employment, citizen, health status, marital status, household size, country, survey year, time of interview in months.
In the case of reforms that increase NRA, we find that:

- Up to 12 months before reforms, especially if they are announced, individual beliefs become more dispersed.
- Belief dispersion also increases within the 12 months after the implementation of reforms.

In the case of reforms that reduce pension benefits, we find no effect on belief dispersion.
In the case of reforms that increase NRA, we find that:

- Up to 12 months before reforms, especially if they are announced, individual beliefs become more dispersed.
- Belief dispersion also increases within the 12 months after the implementation of reforms.

In the case of reforms that reduce pension benefits, we find no effect on belief dispersion.

So there is not much belief convergence. If anything, belief dispersion increases when a reform is approaching or after its implementation.
In the case of reforms that increase NRA, we find that:

- Up to 12 months before reforms, especially if they are announced, individual beliefs become more dispersed.
- Belief dispersion also increases within the 12 months after the implementation of reforms.

In the case of reforms that reduce pension benefits, we find no effect on belief dispersion.

So there is not much belief convergence. If anything, belief dispersion increases when a reform is approaching or after its implementation.

This suggests there is a room for a lot of heterogeneity.
Heterogeneity (1)

- Not only are people’s beliefs correlated with a number of individual characteristics, they may also differ widely along the same characteristics.
Not only are people’s beliefs correlated with a number of individual characteristics, they may also differ widely along the same characteristics.

We explore heterogeneity along a number of cues: (a) education; (b) numeracy; (c) age; (d) optimism; (e) anchoring.

Optimism: obtained from difference between reported probability of being alive at age 75 and the one reported by mortality tables (source: Eurostat); this has then been regressed on covariates and we use the residuals. Scale: \([-1,1]\) (after censoring the 1st percentile to avoid a long lower tail).

Anchoring: defined as proportion of answers equal to 0, 50, or 100 to the questions “What do you think the chances are that it will be sunny tomorrow?” and “Thinking about the next ten years, what are the chances that you will receive any inheritance, including property and other valuables?”
Not only are people’s beliefs correlated with a number of individual characteristics, they may also differ widely along the same characteristics.

We explore heterogeneity along a number of cues: (a) education; (b) numeracy; (c) age; (d) optimism; (e) anchoring.

- **Optimism**: obtained from difference between reported probability of being alive at age 75 and the one reported by mortality tables (source: Eurostat); this has then been regressed on covariates and we use the residuals. Scale: [-1,1] (after censoring the 1st percentile to avoid a long lower tail).
Not only are people’s beliefs correlated with a number of individual characteristics, they may also differ widely along the same characteristics.

We explore **heterogeneity** along a number of cues: (a) education; (b) numeracy; (c) age; (d) optimism; (e) anchoring.

- **Optimism**: obtained from difference between reported probability of being alive at age 75 and the one reported by mortality tables (source: Eurostat); this has then been regressed on covariates and we use the residuals. Scale: \([-1,1]\) (after censoring the 1st percentile to avoid a long lower tail).

- **Anchoring**: defined as proportion of answers equal to 0, 50, or 100 to the questions “What do you think the chances are that it will be sunny tomorrow?” and “Thinking about the next ten years, what are the chances that you will receive any inheritance, including property and other valuables?”
Heterogeneity – Reforms (2)

<table>
<thead>
<tr>
<th></th>
<th>University degree</th>
<th>Numeracy</th>
<th>Age–50</th>
<th>Optimism</th>
<th>Anchoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chances that government increases NRA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cue</td>
<td>0.007</td>
<td>0.003</td>
<td>−0.000***</td>
<td>0.069***</td>
<td>−0.001</td>
</tr>
<tr>
<td>I(-12,-1)</td>
<td>0.028**</td>
<td>−0.002</td>
<td>0.008***</td>
<td>0.020</td>
<td>−0.072**</td>
</tr>
<tr>
<td>I(0,12)</td>
<td>0.001</td>
<td>0.001</td>
<td>0.007***</td>
<td>0.000</td>
<td>0.069***</td>
</tr>
</tbody>
</table>

| **Chances that government reduces pension benefits** |          |          |          |          |           |
| Cue            | 0.023**          | 0.008*** | −0.000***| 0.032*   | 0.005     |
| I(-12,-1)      | 0.005            | −0.009   | 0.005**  | 0.016    | −0.128*** |
| I(0,12)        | 0.036**          | 0.026**  | −0.001   | 0.126*   | 0.001     |

*Note*: Each coefficient in the bottom two rows of each block is the interaction between the proximity-to-reform indicator with the corresponding cue.
### Heterogeneity – Announcements (3)

<table>
<thead>
<tr>
<th>University degree</th>
<th>Numeracy</th>
<th>Age–50</th>
<th>Optimism</th>
<th>Anchoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chances that government increases NRA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cue</td>
<td>0.007</td>
<td>−0.008</td>
<td>−0.000***</td>
<td>0.069***</td>
</tr>
<tr>
<td>$I^U(−12, −1)$</td>
<td>0.011</td>
<td>−0.002</td>
<td>0.009***</td>
<td>0.036</td>
</tr>
<tr>
<td>$I^A(−12, −1)$</td>
<td>0.086***</td>
<td>0.018</td>
<td>0.006</td>
<td>−0.035</td>
</tr>
<tr>
<td>$I(0,12)$</td>
<td>0.001</td>
<td>0.001</td>
<td>0.007***</td>
<td>−0.000</td>
</tr>
</tbody>
</table>

| **Chances that government reduces pension benefits** | | | | |
| Cue               | 0.023**  | 0.008*** | −0.000*** | 0.032*    | 0.004  |
| $I^U(−12, −1)$    | −0.007   | −0.012*  | 0.005*    | 0.037     | −0.106*** |
| $I^A(−12, −1)$    | 0.048**  | 0.001   | 0.006     | −0.048    | −0.200*** |
| $I(0,12)$         | 0.036**  | 0.026** | −0.001    | 0.126*    | 0.002  |

**Note:** Each coefficient in the bottom three rows of each block is the interaction between the proximity-to-reform indicator with the corresponding cue.
Heterogeneity – *Google Trends* (3)

<table>
<thead>
<tr>
<th>University degree</th>
<th>Numeracy</th>
<th>Age–50</th>
<th>Optimism</th>
<th>Anchoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cue</strong></td>
<td>0.020*</td>
<td>0.002</td>
<td>−0.000***</td>
<td>0.067***</td>
</tr>
<tr>
<td><strong>Google Trends</strong></td>
<td>0.007</td>
<td>0.016</td>
<td>0.022***</td>
<td>0.077</td>
</tr>
</tbody>
</table>

**Chances that government increases NRA**

| **Cue**           | 0.044*** | 0.008*** | −0.000*** | 0.038**  | −0.013    |
| **Google Trends** | 0.004    | 0.014    | 0.011*    | 0.139    | −0.063    |

**Chances that government reduces pension benefits**

*Note*: Each coefficient is the interaction between the *Google Trend* intensity measure with the corresponding cue.
1. Older individuals tend to hold lower expectations of reforms (shorter time horizon), while
1. Older individuals tend to hold **lower expectations** of reforms (shorter time horizon), while

2. university educated, numeracy more able, and optimistic individuals tend to hold **greater beliefs** of reform
1. Older individuals tend to hold lower expectations of reforms (shorter time horizon), while

2. university educated, numeracy more able, and optimistic individuals tend to hold greater beliefs of reform

3. But up to 12 months before a (unannounced) reform and 12 months after the implementation, older individuals generally adjust their beliefs up and search more online, while
1. Older individuals tend to hold **lower expectations** of reforms (shorter time horizon), while

2. university educated, numeracy more able, and optimistic individuals tend to hold **greater beliefs** of reform

3. But up to 12 months before a (unannounced) reform and 12 months after the implementation, older individuals generally adjust their beliefs **up** and search **more online**, while

4. individuals with **lower judgement sophistication** (those who anchor their beliefs at 0, .5, or 1) typically revise **down** their beliefs before reforms and search **less**
An issue most papers on expectations must face is related to whether the expectations information is relevant for behavior.
An issue most papers on expectations must face is related to whether the expectations information is relevant for behavior.

This is what we address next, and from three different perspectives.
An issue most papers on expectations must face is related to whether the expectations information is relevant for behavior.

This is what we address next, and from underlined three different perspectives:

1. Effect of beliefs on expected behavior
An issue most papers on expectations must face is related to whether the expectations information is relevant for behavior.

This is what we address next, and from underlinethree different perspectives:

1. Effect of beliefs on expected behavior

2. Effect of expected behavior on actual behavior
An issue most papers on expectations must face is related to whether the expectations information is *relevant for behavior*

This is what we address next, and from underlinethree different perspectives:

1. Effect of **beliefs** on **expected** behavior

2. Effect of **expected** behavior on **actual** behavior

2. Effect of **beliefs** on **actual** behavior
Notation:

Chances the government raises national retirement age before respondent retires $\equiv$ Chances $\uparrow$ NRA
Chances the government reduces pension benefits before respondent retires $\equiv$ Chances $\downarrow$ PB
Notation:

Chances the government raises national retirement age before respondent retires ≡ Chances ↑ NRA
Chances the government reduces pension benefits before respondent retires ≡ Chances ↓ PB

Look at two outcomes for expected behavior:

1. Probability that respondent works full time after age 63; Prob FT 63+
   - Sample of employed/self-employed, aged 50–60 (waves 2,4,5,6)
Notation:

Chances the government raises national retirement age before respondent retires ≡ Chances \( \uparrow \) NRA
Chances the government reduces pension benefits before respondent retires ≡ Chances \( \downarrow \) PB

Look at two outcomes for expected behavior:

(1) Probability that respondent works full time after age 63; Prob FT \( 63^+ \)
   - Sample of employed/self-employed, aged 50–60 (waves 2,4,5,6)

(2) Expected age at collection of public pension benefits: \( E(\text{Age}) \) PB
   - Sample of employed/self-employed entitled to receive public pension, aged 50–64 (waves 1,2,4,5,6)
Notation:
Chances the government raises national retirement age before respondent retires ≡ Chances ↑ NRA
Chances the government reduces pension benefits before respondent retires ≡ Chances ↓ PB

Look at two outcomes for expected behavior:
1. Probability that respondent works full time after age 63; Prob FT 63+
   - Sample of employed/self-employed, aged 50–60 (waves 2,4,5,6)
2. Expected age at collection of public pension benefits: E(Age) PB
   - Sample of employed/self-employed entitled to receive public pension, aged 50–64 (waves 1,2,4,5,6)

Look at two outcomes for actual behavior:
1. In work at time \( t + 1 \)
2. In full-time work at \( t + 1 \)
### External Validity (4)

**Beliefs → Expected Behavior**

<table>
<thead>
<tr>
<th></th>
<th>Prob FT 63+</th>
<th></th>
<th>E(Age) PB</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>FE</td>
<td>OLS</td>
<td>FE</td>
</tr>
<tr>
<td>Chances ↑ NRA</td>
<td>0.162***</td>
<td>0.120***</td>
<td>0.583***</td>
<td>0.177***</td>
</tr>
<tr>
<td>Chances ↓ PB</td>
<td>0.085***</td>
<td>0.073***</td>
<td>0.426***</td>
<td>0.213***</td>
</tr>
</tbody>
</table>

*Note:* OLS controls for household income and net wealth, age, gender, education, private/public sector, self-employment, part-time employment, citizen, health status, marital status, household size, country, survey year, country × year; s.e. clustered at the household level.
External Validity (4)
Beliefs → Expected Behavior

<table>
<thead>
<tr>
<th></th>
<th>Prob FT 63+</th>
<th>E(Age) PB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>FE</td>
</tr>
<tr>
<td>Chances ↑ NRA</td>
<td>0.162***</td>
<td>0.120***</td>
</tr>
<tr>
<td>Chances ↓ PB</td>
<td>0.085***</td>
<td>0.073***</td>
</tr>
</tbody>
</table>

Note: OLS controls for household income and net wealth, age, gender, education, private/public sector, self-employment, part-time employment, citizen, health status, marital status, household size, country, survey year, country × year; s.e. clustered at the household level.

- Same results hold for men and women separately
- FE estimates less precisely estimated for men in the case of $E(Age)$ PB
### External Validity (4)

**Expected Behavior → Actual Behavior**

<table>
<thead>
<tr>
<th></th>
<th>In Work at $t + 1$</th>
<th>In FT Work at $t + 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>FE</td>
</tr>
<tr>
<td>$I[E(Age) \ PB_t &gt; Age_{t+1}]$</td>
<td>0.467***</td>
<td>0.406**</td>
</tr>
<tr>
<td>Prob FT 63+</td>
<td>0.159***</td>
<td>0.065***</td>
</tr>
</tbody>
</table>

**Note:** $I[E(Age) \ PB_t > Age_{t+1}]$ : indicator that the expected age at collection of public pension benefits at wave $t$ exceeds the age in the following wave, $t + 1$. Sample of 50–64 year olds entitled to public pension, waves 1,2,4,5.
### External Validity (4)

**Expected Behavior → Actual Behavior**

<table>
<thead>
<tr>
<th></th>
<th>In Work at $t + 1$</th>
<th>In FT Work at $t + 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>FE</td>
</tr>
<tr>
<td>$I[E(Age) \text{ PB}<em>t &gt; \text{ Age}</em>{t+1}]$</td>
<td>0.467***</td>
<td>0.406**</td>
</tr>
<tr>
<td>Prob FT 63+</td>
<td>0.159***</td>
<td>0.065***</td>
</tr>
</tbody>
</table>

**Note:** $I[E(Age) \text{ PB}_t > \text{ Age}_{t+1}]$ : indicator that the expected age at collection of public pension benefits at wave $t$ exceeds the age in the following wave, $t + 1$. Sample of 50–64 year olds entitled to public pension, waves 1,2,4,5.

- Same results hold for men and women separately
### External Validity (5)

Beliefs → Actual Behavior

<table>
<thead>
<tr>
<th></th>
<th>In Work at $t+1$</th>
<th>In FT Work at $t+1$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>FE</td>
</tr>
<tr>
<td>Chances ↑ NRA</td>
<td>0.091***</td>
<td>0.061***</td>
</tr>
<tr>
<td>Chances ↓ PB</td>
<td>0.030***</td>
<td>0.034**</td>
</tr>
</tbody>
</table>

*Note: $t$ stands for wave.*
### External Validity (5)

Beliefs → Actual Behavior

<table>
<thead>
<tr>
<th></th>
<th>In Work at $t + 1$</th>
<th>In FT Work at $t + 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>FE</td>
</tr>
<tr>
<td>Chances ↑ NRA</td>
<td>0.091***</td>
<td>0.061***</td>
</tr>
<tr>
<td>Chances ↓ PB</td>
<td>0.030***</td>
<td>0.034**</td>
</tr>
</tbody>
</table>

*Note: $t$ stands for wave.*

- Same results hold for men and women separately
- FE estimates less precisely estimated for men in the case of Chances ↓ PB
We look at a number of other outcomes
We look at a number of other outcomes.

- We find that stronger expectations of a reform are associated with a greater propensity to provide inter vivos care and (both up and downstream) inter vivos financial transfers (both up and downstream).
We look at a number of other outcomes

- We find that **stronger expectations** of a reform are associated with a **greater propensity** to provide inter vivos care and (both up and downstream) inter vivos financial transfers (both up and downstream)

- But we also find **no effect** on the likelihood of having an occupational or private pension, the likelihood of providing care to grandchildren, and intended bequests
Strong evidence that beliefs have economic salience
Strong evidence that beliefs have economic salience

(a) **Beliefs** about pension reforms shape *expected behavior*
Strong evidence that beliefs have economic salience

(a) **Beliefs** about pension reforms shape *expected behavior*, in particular:

- the probability of working FT at a certain (future) age
- the expected age at collection of public pension benefits
Strong evidence that beliefs have economic salience

(a) **Beliefs** about pension reforms shape *expected behavior*, in particular:
   - the probability of working FT at a certain (future) age
   - the expected age at collection of public pension benefits

(b) **Beliefs** also shape *actual behavior* directly
Strong evidence that beliefs have economic salience

(a) **Beliefs** about pension reforms shape **expected behavior**, in particular:
   - the probability of working FT at a certain (future) age
   - the expected age at collection of public pension benefits

(b) **Beliefs** also shape **actual behavior** directly, in particular:
   - future employment
   - future FT employment
   - inter vivos care and financial transfers
(a) **Reforms** and discussions of pension reforms (through formal announcements) are huge catalysts of belief formation.
(a) **Reforms** and discussions of pension reforms (through formal announcements) are **huge catalysts** of belief formation

- This is true not only in anticipation of a reform, i.e., in the time running up to the reform,
(a) **Reforms** and discussions of pension reforms (through formal announcements) are huge catalysts of belief formation

- This is true not only in anticipation of a reform, i.e., in the time running up to the reform,
- but it is true also after the reform is implemented
(a) **Reforms** and discussions of pension reforms (through formal announcements) are huge catalysts of belief formation

- This is true not only in anticipation of a reform, i.e., in the time running up to the reform,
- but it is true also after the reform is implemented

(b) **Online search** of salient information is an important factor that shapes individuals’ beliefs

(c) We find little evidence of belief convergence, and a fair amount of heterogeneity along a number of observable cues

(d) Beliefs about reforms do **affect** expected behavior as well as actual behavior
Where to go next?

(a) Explore issues related to sample selection
(b) Robustness: add more controls, consider different specifications, and explore alternative timings
(c) Build a structural model in which we use expectations data to estimate deep parameters (Van der Klaauw and Wolpin 2008; DeNardi, French, and Jones 2010; French and Jones 2011; Haan and Prowse 2014)
Conclusion (2)

Where to go next?

(a) Explore issues related to sample selection

(b) Robustness: add more controls, consider different specifications, and explore alternative timings
Conclusion (2)

Where to go next?

(a) Explore issues related to sample selection

(b) Robustness: add more controls, consider different specifications, and explore alternative timings

(c) Build a structural model in which we use expectations data to estimate deep parameters (Van der Klaauw and Wolpin 2008; DeNardi, French, and Jones 2010; French and Jones 2011; Haan and Prowse 2014)