Informative Social Interactions

Paper session: 'Subjective Expectations, Belief Formation, and Economic Behavior'

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Question and Motivation

- *Do social interactions matter for financial behaviour?* i.e.
  - Does stock market **information from/participation of others** affect own stockholdings?
  - If yes, how and why?
- Why do we care?
  - 2008 subprime mortgage crisis: Is there a role for **social interactions** in the spread of (*poor*) financial behavior?
  - Efficient dissemination of information on financial products/assets, e.g. 'fintech';
  - Regulation: designing and regulating successful/'fashionable' on-line investment clubs;
  - Public policies aiming at overcoming financial literacy limitations in the population, potentially responsible for raising wealth inequality, booms and busts in asset markets, etc.

What do We Do

We design and collect novel primary data, and find that **social interactions** affect individual stock market decisions mostly by being **informative** (peer information exchanges and *mindful* imitation); to a lesser extent, also by endorsement effects (*mindless* imitation)**:**
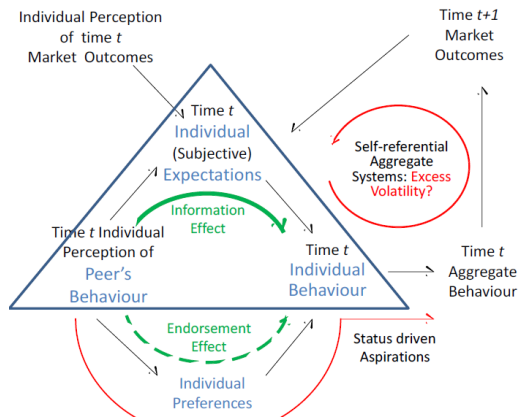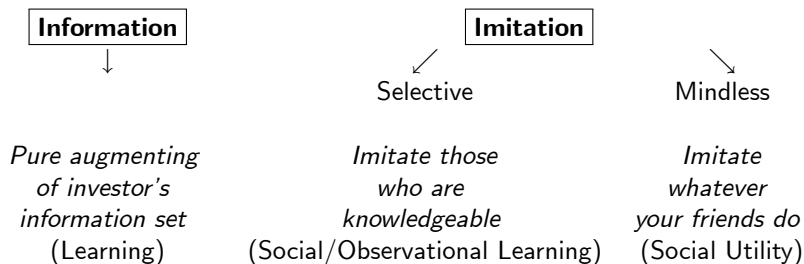
Literature

1. Literature on social interactions/peer effects on asset and debt behavior of households, e.g. Duflo and Saez (2002), Hong, Kubik and Stein (2004), Kaustia and Knüpfer (2012), Georgarakos, Haliassos and Pasini (2014), Haliassos, Jansson and Karabulut (2017) or Ouimet and Tate (2017).

2. Literature on the effects of social imitation and influence on financial behavior:
   - Banerjee, Chandrasekhar, Duflo and Jackson (2013): identify a pure information effect (new financial product, microfinance in India)
   - Bursztyn, Ederer, Ferman and Yuchtman (2014): identify both information and endorsement/social utility effects (experiment with new financial product amongst brokerage account holders in Brazil)
   - Burnside, Eichenbaum and Rebelo (2016) and Bailey, Cao, Kuchler and Stroebel (2016): model, calibrate and identify a social interactions effect on housing in the US, respectively.

Our contribution: complementary; we study the prevalence of social learning and imitation in a representative sample of the population of a financially developed country and for an established financial product (stock market).

What Do People Get Out of Social Interactions?

Information

↓

Pure augmenting
of investor's
information set
(Learning)

Imitation

↙ Selective

Imitate those
who are
knowledgeable
(Social/Observational Learning)

↘ Mindless

Imitate
whatever
your friends do
(Social Utility)

Informative social interactions

An Information Network within an Efficient Market

- Within Hellwig (1980),
    - Static asset pricing model with a risky and a riskless asset, where asset prices transmit information
    - Large number of heterogeneous agents with individual private signals on risky asset payoff (stocks)

- Ozsoylev and Walden (2011) embed an information network,
    - Network connections are exogenous
    - Agents pool information by averaging signals from others they are connected to
    - Agents form expectations about the net excess return on the basis of pooled signals and prices
    - *No social utility motive* (conformity, etc.) within expected utility function

- We extend Ozsoylev and Walden (2011) to:
    - Heterogeneity in signal precision and risk preferences (Cabrales et al., 2013, 2017)
    - Agents pooled information is **weighted** by the precisions of connections' signals

Model
Main result

- Let the *connectedness* of investor i be

  (1) $\quad k_i = \sum_{k=1}^{n} \dfrac{a_{ik}}{s_k^2}$

- Let the average connectedness of the information network be

  $$\lim_{n \to \infty} \frac{1}{n} \sum_{i=1}^{n} \frac{k_i}{\rho_i} = \beta + o\left(1\right), \ \beta < \infty$$

- Under reasonable/interpretable assumptions, as $n \to \infty$, there exists a NREE price p for the risky asset, which *depends on a single network statistic*: average risk-adjusted network connectedness β

Main Predictions of the Model

- In a large anonymous financial market, agents with more/better informed connections, k_i^*:

  1. Form expectations of returns that give more weight to connections' signals (i's pooled signal x_i),

  $$\mathbb{E}\left(X|\mathcal{I}_i\right) = \frac{k_i^* \sigma^2 \Delta^2}{k_i^* \sigma^2 \Delta^2 + \Delta^2 + \sigma^2 \beta^2} x_i + \left(\frac{\sigma^2 \beta^2 + \Delta^2}{k_i^* \sigma^2 \Delta^2 + \Delta^2 + \sigma^2 \beta^2}\right) \bar{X}$$

  2. Invest a higher proportion of their financial wealth in risky assets,

  $$D_i^* = \frac{\mathbb{E}\left[(X - p)|\mathcal{I}_i\right]}{\rho_i \, Var\left[X|\mathcal{I}_i\right]} = \frac{\left(\mathbb{E}\left(X|\mathcal{I}_i\right) - p\right)}{\rho_i} \left(\frac{1}{\sigma^2} + k_i^* + \frac{\beta^2}{\Delta^2}\right)$$

 i.e. they hold a *lower posterior variance of returns*.

Survey Design

- Survey designed to look for information effect of social interactions on stockholding by households;
- Part of ongoing survey on a representative sample of the French population by age and asset classes (PAT€R);
- Two questionnaires (TNS2014 and follow-up TNS2015), sent to 4,000 households: Unit responses to TNS2014 = 3,670. Of those, unit responses to TNS2015 = 2,587 (70.5% response rate);
- Questions on:
  - Respondent's risk preferences, socio-economic and demographic characteristics
  - Financial wealth (total and % invested in the stock market)
  - Perceptions and expectations about stock market returns (CAC-40) elicited probabilistically (Manski, 2004)
  - Detailed questionnaire for measures of individual connectedness, information and participation of peers
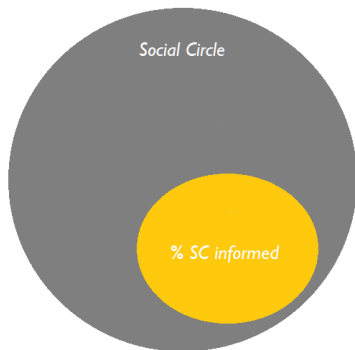
Proxy for Connectedness: Social Circle

C1: *'Approximately how many people are there in your social circle of acquaintances?'*
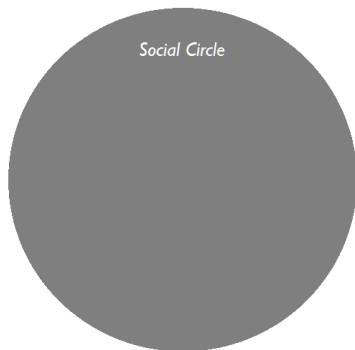
Social Circle

(Average: 53 approx.)
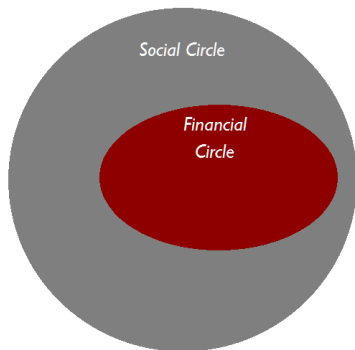
Proxy for Connectedness: Social Circle

C7i: '*In your opinion, what is the proportion of people in your social circle that is informed about/follows the stock market?*'

(Average: 13% approx.)

Proxy for Connectedness: Financial Circle

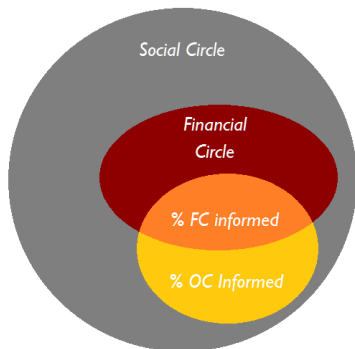D1: '*With how many people from your social circle do you interact with regarding your financial/investment matters?*'

(Average: 3 approx.)

Proxy for Connectedness: **Info** from Financial Circle

D16i: '*In your opinion, what is the proportion of people in your financial circle that follows the stock market?*'

Social Circle

Financial Circle

% FC informed

% OC Informed

(Average: 22% approx.)

Selective Imitation

Repeat analysis but asking survey questions (C7ii) regarding the **participation** of acquaintances in the stock market...
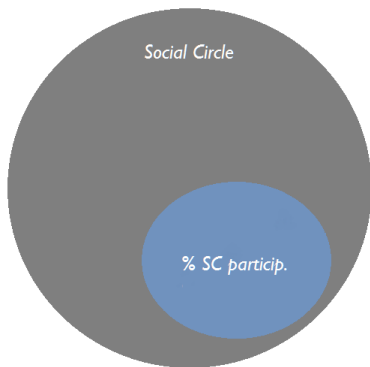
(Average: 11% approx.)

Selective Imitation: Financial Circle

... separating those with whom the respondent exchanges on financial matters (Fin. Circle, FC) from those with whom s/he does not (Outer Circle, OC):

(Average: 20% approx.)

Do Social Interactions Influence Expectations of Returns?

- OLS Econometric specification(s):

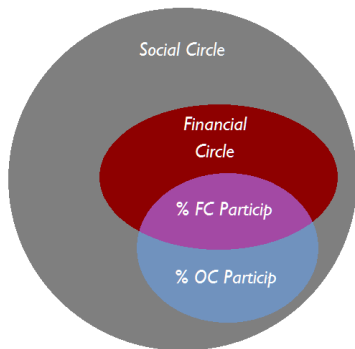$$Expec. \ R_i = \kappa_0 + \kappa_1 k_i^* + \boldsymbol{\tau}_i \boldsymbol{\kappa} + e_i$$

- Proxies for connectedness k_i^*: %SC Inform, $k_{i,SC}^*$ the share of respondents' social circle (SC) informed about the stock market, which we then *split* into %FC Inform, $k_{i,FC}^*$ and %OC Inform, $k_{i,OC}^*$:

$$Expec. \ R_i = \kappa_0 + \underset{(+)}{\kappa_{1,FC} k_{i,FC}^*} + \underset{(0)}{\kappa_{1,OC} k_{i,OC}^*} + \boldsymbol{\tau}_i \boldsymbol{\kappa} + e_i$$

- (Proxies for selective and mindless'imitation' D_i^e : %SC Particip, *split* into %FC Particip, %OC Particip)

- Controls, $\boldsymbol{\tau}_i$: Age, gender, marital status, No. of children at home, education, region of residence, employment status, borrowing constraints, quartiles for wealth, income and (last 12-month) saving, *own perception about population behaviour/information*, elicited risk (RA_i) and *for relative standing* (profession, edu., wealth) *preferences*.

Social Interactions Effect on Expectations: the Informed

	Expec R	Expec R
% SC Inform.	0.0238	
	(0.0230)	
% FC Inform.		0.0283**
		(0.0136)
% OC Inform.		-0.0050
		(0.0269)
% Pop. Inform.	-0.0085	-0.0039
	(0.019)	(0.019)
Risk aversion	-0.0504	-0.0584
	(0.0399)	(0.0393)
Rel. Stand. Pref.	n.s.	n.s.
Controls	*Yes*	*Yes*
F (p-value)	2.43 (0)	2.33 (0)
R^2	0.043	0.046
Observations	2,535	2,535

Social Interactions Effect on Expectations: Information/(Selective) Imitation

	Expec R	Expec R
% SC Particip.	0.0282	
	(0.0279)	
% FC Particip.		0.0236*
		(0.0126)
% OC Particip.		0.00453
		(0.0358)
% Pop. Particip.	-0.0060	-0.0014
	(0.023)	(0.023)
Risk aversion	-0.0513	-0.060
	(0.040)	(0.0393)
Rel. Stand. Pref.	n.s.	n.s.
Controls	*Yes*	*Yes*
F (*p*-value)	2.39 (0)	2.38 (0)
R^2	0.044	0.046
Observations	2,535	2,535

Directly Informative Social Interactions
...Reduce the Posterior Variance of Returns

- Tobit (Probit) peer effects econometric specification(s):

$$D_i = \max\{0, \ \lambda_0 + \lambda_1 \underset{(+)}{k_i^*} + \lambda_2 \underset{(+)}{Expec.\ R_i} + \boldsymbol{\tau}_i'\boldsymbol{\lambda} + u_i\}$$

- Where $D_i \equiv \%FW_i$ denotes the share of respondent's financial wealth invested into stocks (Tobit), whilst $D_i \equiv \Pr(Stocks_i > 0)$ denotes the likelihood of individual i being a stockholder (Probit)
- Proxies for k_i^*: *%SC Inform*, *split* into *%FC Inform*, *%OC Inform*
- (Proxies for selective and mindless'imitation' D_i^e : *%SC Particip*, *split* into *%FC Particip*, *%OC Particip*)

Pure Information: Stockholding

	Pr(Stocks>0)	%FW	Pr(Stocks>0)	%FW
% SC Inform.	0.00256**	0.0823**		
	(0.00104)	(0.0341)		
% FC Inform.			0.00267***	0.0289
			(0.000588)	(0.0197)
% OC Inform.			0.000234	0.0409
			(0.00132)	(0.0419)
% Pop. Inform.	n.s.	(-)*	n.s.	n.s.
Expec R	0.00220**	0.103***	0.00201**	0.104***
	(0.000963)	(0.0337)	(0.000958)	(0.0352)
Risk aversion	-0.00422**	-0.101*	-0.00415**	-0.108*
	(0.00188)	(0.0575)	(0.00187)	(0.0600)
Rel. Stand. Pref.	n.s.	n.s.	n.s.	n.s.
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Log-likelihood	-1201	-3625	-1192	-3623
LR χ^2 (p-value)	420.2 (0)	394.5 (0)	445.0 (0)	398.5 (0)
Pseudo-R^2	0.169	0.0516	0.175	0.0521
Observations	2,525	2,294	2,525	2,294

Selective Imitation: Stockholding

	Pr(Stocks>0)	%FW	Pr(Stocks>0)	%FW
% SC Particip.	0.00498***	0.0865***		
	(0.000936)	(0.0293)		
% FC Particip.			0.00217***	0.0325*
			(0.000649)	(0.0192)
% OC Particip.			0.00246*	0.0791**
			(0.00127)	(0.0402)
% Pop. Particip.	n.s.	n.s.	n.s.	n.s.
Expec R	0.00204**	0.103***	0.00195**	0.106***
	(0.000932)	(0.0343)	(0.000934)	(0.0368)
Risk aversion	-0.0039**	-0.096*	-0.00396**	-0.107*
	(0.00179)	(0.0568)	(0.00180)	(0.0624)
Rel. Stand. Pref.	n.s.	n.s.	n.s.	n.s.
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Log-likelihood	–1196	–3623	–1194	–3629
LR χ^2 (p-value)	440.6 (0)	398.7 (0)	434.6 (0)	403.3 (0)
Pseudo-R^2	0.172	0.0522	0.174	0.0528
Observations	2,525	2,294	2,525	2,294

Mechanism: Social Interactions Affect Own Information

- We have evidence of informed peer effects on own subjective expectations of returns and own stockholding:
  a higher proportion of informed/participating peers *increases subjective sharpe ratios* and thereby, stockholding at both margins...

- Does talking to optimists make you more optimistic?
  No: Talking to informed peers makes you better informed about *facts*

- Relevant fact No.1 $\approx$ the (most recently) realised (3-year) cumulative stock return $R_t(3)$ was 34.57%

- We elicit probabilistically respondents' perception about $R_t(3)$, and compute the mean response for each individual, R_t^i denoted '*Perc. R_i*'.
  Cross-sectional sample mean is 3.6%, i.e. the average respondent has a **perception gap** which *underestimates the truth* by around *ten times*.

- We therefore examine whether a larger share of informed peers *reduces* the 'perception gap', as follows:

$$Perc.\ R_i = \eta_0 + \underset{(+)}{\eta_{1,FC}\, k_{i,FC}^*} + \underset{(0)}{\eta_{1,OC}\, k_{i,OC}^*} + \mathbf{v}_i \boldsymbol{\eta} + \varrho_i$$

Mechanism: Social interactions Affect Own Information

	Perc. R.	Perc. R.	Expec. R.	Expec. R.	Expec. R.
% FC Inform.	0.0554***			0.0135	
	(0.0208)			(0.0135)	
% OC Inform.	0.0091			-0.00651	
	(0.0372)			(0.0250)	
% Pop. Inform.	n.s.		n.s.	n.s.	
% FC Particip.		0.0481**			0.0102
		(0.0214)			(0.0124)
% OC Particip.		0.0523			-0.00563
		(0.0474)			(0.0347)
% Pop. Particip.		n.s.	n.s.		n.s.
Perc. R.			0.282***	0.282***	0.283***
			(0.0265)	(0.0264)	(0.0264)
Rel. Stand. Pref.	n.s.	n.s.	n.s.	n.s.	n.s.
Controls	Yes	Yes	Yes	Yes	Yes
F ($p-value$)	4.149 (0)	4.152 (0)	4.391 (0)	4.262 (0)	4.332 (0)
R^2	0.0975	0.0971	0.157	0.159	0.159
Observations	2,328	2,328	2,535	2,535	2,535

Findings

- Socially interacting with informed peers *raises own subjective sharpe ratios*, levelling up respondents' (scant) information with publicly available data:
  - a 1StDev increase in informed peers (about 1 additional informed person) *reduces the perception gap* by +1 p.p. (by 27% relative to the unconditional mean, *u.m.*, perception of +3.6%);
- Conditioning on expectations, informed peer information and stockholdings increase own stockholdings (by reducing the posterior variance of returns):
  - a 1StDev increase in informed/stockholding peers increases own stockholdings by +7/6.3 p.p. (or by about 34%/28% relative to the *u.m.*) and the conditional share by +0.92 p.p., or by about 4.3% relative to the *u.m.*
- Evidence supports an overall positive effect of **informative social interactions**
- There are smaller albeit significant effects of share of **outer circle** participating on stockholdings, without affecting respondents' expectations or perceptions of returns ⟹ some evidence of mindless imitation:
  - a 1StDev increase in OC peer stockholding increases own stockholdings by +4.2 p.p. (i.e. a 19.5% increase relative to the *u.m.*) and the conditional share by +1.3 p.p., or by about 6.3% relative to the *u.m.*

Unobserved Heterogeneity

1. We exploit within-respondent variation in peer group behaviour/information to find statistical evidence *only* in support of 'financial circle' effects ('**double ring**' methodology, Grinblatt *et al.*, 2008)

2. The effects are conditional on individual perceptions of population behaviour/information, as one guard against **correlated effects,** e.g. from a 'news shock' or a 'market trend' (i.e. a novel 'triple ring' methodology)

3. We include very **detailed individual covariates**, *including* questions about how do respondents view themselves relative to the members of the social and financial circles to control for social utility motives, and find no evidence in support of the latter

4. We conduct counterfactual **placebo tests**, by randomizing individual responses to questions on financial circle information and participation: artificial 'in-sample' bins constructed on age, education and region of residence provide no evidence in support of an unobserved group effect

5. Results robust to **selection of peers/acquaintances** with whom to interact on respondents' financial matters, which supports the identification of an information peer effect on individual stockholdings (Blume *et al.* 2011, 2015)

Summary and Going Forward

- Theory suggests that social interactions improve investors information about the stock market

- i.e. investors are more likely to invest, and to invest more, the higher the number/quality of 'informed peers'

- We find evidence in support of this: social interactions raise own subjective sharpe ratios, better aligning own (scant) information with publicly available (historical) evidence.

- Main result: strong evidence of a social interactions' **information channel** in a *developed country mature financial market*

- '*Herding is less prevalent than you think*'... but we also find some evidence of 'mindless imitation' in stock market decisions

- Social interactions reduce *factual perception gaps*, creating the potential for financial literacy interventions (Beshears, Choi, Laibson, Madrian and Milkman, 2015) that can vehiculate a social multiplier effect with the aim of reducing wealth inequality (Lusardi, Michaud and Mitchell, 2016).