

Efficiency in Household Decision Making: Evidence from the Retirement Savings of US Couples

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Disclaimer

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This research was conducted while Goodman was an employee at the U.S. Department of the Treasury. Any taxpayer data used in this research was kept in a secured IRS data repository, and all results have been reviewed to ensure that no confidential information is disclosed.

How do couples make financial decisions?

Two views of the couple:

Independent Decisions

- Empirical work often relies on individual-level data
- Frequent implicit assumption: individual response to a policy does not affect their spouse's behavior

Efficient Coordination

- Most theoretical models assume efficient coordination:
 - ▶ Unitary model (a single utility function)
 - ▶ Collective models (e.g. efficient intrahousehold bargaining) [Chiappori'88](#), [Mazzocco'07](#)
- Individual-level data can be misleading about household-level behavior

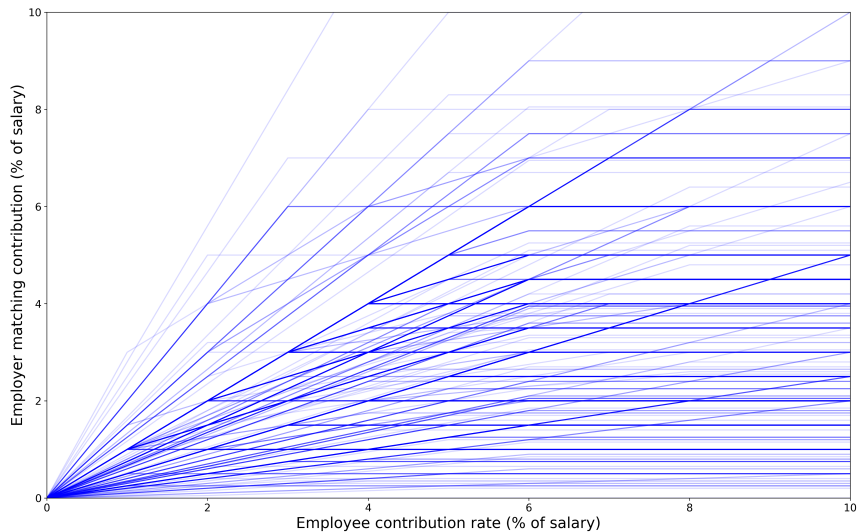
A New Test of Household Efficiency

Q: Do married couples efficiently save for retirement?

Some institutional context:

- Approx 60% of US workers now have a Defined Contribution pension ('401k')
- Pot of savings ...
 - ▶ ...controlled by the employee
 - ▶ ...employees choose how much contribute
 - ▶ ...their employer might also contribute
 - ▶ ...**over four-fifths of employees of employee have an 'employer match'**

Match Schedules in largest 5,000 US Plans



A New Test of Household Efficiency

Q: To what extent do married couples efficiently divide their retirement saving?

Example:

- Spouse 1 works at Firm A where contributions are matched dollar-for-dollar up to 5% of salary
- Spouse 2 works at Firm B where contributions are matched 50c on the dollar up to 6% of salary

Efficient Allocation:

- Spouse 2 should not contribute unless Spouse 1 has fully exploited their match
- Neither spouse should contribute beyond their match cap while other has some unexploited match.

Example: Each Spouse wants to Contribute \$600

Spouse 1's account

Match dollar-for-dollar up to \$1000

Spouse 2's account

Match 50cts on the dollar up to \$1000

An uncoordinated outcome

	<u>Spouse 1</u>	<u>Spouse 2</u>	
Contribution	\$600	\$600	
Employer match	\$600	\$300	= \$900

Invest \$1,200 => get \$900 in match

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Cooperative outcome

(i.e. unique efficient allocation)

	<u>Spouse 1</u>	<u>Spouse 2</u>
Contribution	\$1,000	\$200
Employer match	\$1,000	\$100 = \$1,100

Invest \$1,200 => get \$1,100 in match

Arbitrage opportunity: \$200 left on the table!

Are the outcomes of household decision-making efficient?

Using **consumption** data a large literature has failed to reject models assuming efficiency...

Using survey data of consumption from: the United States ([Chiappori et al, '02](#)), the United Kingdom ([Blundell et al, '07](#); [Dauphin et al, '11](#)), Canada ([Browning and Chiappori, '98](#)), Russia ([Cherchye et al, '09](#)), France ([Bourguignon et al, '93](#)), Mexico ([Bobonis, '09](#); [Attanasio and Lechene, '14](#)), Indonesia ([LaFave and Thomas, '17](#)), Burkina Fasso ([Rangel and Thomas, '20](#)).

Are the outcomes of household decision-making efficient?

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But mixed results for **productive** efficiency tests in developing countries

- **Udry '96**: households farm more intensively plots controlled by husbands. Rejection of Pareto Efficiency? Alternatively:
 - ▶ women have less secure tenure rights (**Goldstein & Udry, '08**)
 - ▶ differences in productivity could reflect measurement error (**Thomas & Rangel, '20**)
- Evidence of inefficiency in household choices in field experiments (**Ashraf'09, Schaner'15**).
- Do these results extend to:
 - ▶ Naturally-occurring decisions with repeated interactions?
 - ▶ Settings with different institutions and norms, culture?

Why Test Efficiency in Retirement Saving?

Foundational assumption in almost all models of the household used in empirical work:

- Savings decisions, education decisions, fertility, investment in children, divorce

Advantage of this setting:

- Match incentives are large and transparent
- Efficient policy can be clearly defined & measurable to us

Favorable conditions for cooperation to emerge:

- Repeated decisions (can learn/build familiarity with the setting)
- Partially illiquid asset (facilitate commitment)
- Often spousal consent required for major plan actions
- Division in divorce is not affected by who made the contribution

The Role of Divorce and Death

- Legal system offers strong protections for spouses after marital separation (divorce/death)
 - ▶ creates strong incentives for coordination even if threat of separation
- **Death:** spouse must be the death beneficiary of DC plan unless consents to waive rights (Retirement Security Act 1984)
- **Divorce:** across U.S. states, 401(k) accumulations during marriage are a marital asset
 - ▶ Even if divorce is a certainty, the incentive exists to exploit most generous match
 - ▶ Even if the division in divorce was affected (which is not the case here), one might expect a set of Pareto-improving transfers that leaves both spouses strictly better off

▶ More

What we do

1. Construct new employee-employer merged dataset

- Collect detailed data on retirement plan features for >5,000 plans with >44m workers
- Merge with tax records to observe savings decisions

2. Find direct evidence of coordination for share of couples but non-coordination is widespread

- 20% of couples leave an average approx \$750 per year on the table
- Compared to $\approx 30\%$ couples inefficient in no-coordination benchmark

3. Interpretation: for those who are inefficient, it arises b/c ...

- ... individuals are inefficient?
 - ▶ limited evidence this is driven by inertia, equalizing heuristics, auto-enrollment
 - ▶ Inefficiency is correlated with financial literacy
- ... couples collectively fail to achieve efficiency?
 - ▶ Correlation of incidence of inefficiency and proxies of commitment

Models of the Household

- **Unitary model** – assumes family acts as if it maximizes a single utility function
 - ▶ Distribution of resources within household does not matter for household decisions.
- Distribution of resources often does matter for decisions
 - ▶ See review by Lundberg & Pollak (2017)
- **Collective model** admits decision-makers with own preferences (Chiappori '88, Browning and Chiappori '98) ▶ Model
 - ▶ Assumes that household decisions are Pareto-efficient
 - ▶ With dynamics, uncertainty: limited commitment versions retain the assumption of efficiency within each state (Ligon 2002, Mazzocco 2007)
- Models not built around efficiency:
 - ▶ Inefficiency: Basu (2006), Hertzberg (2016)
 - ▶ Threat-point is inefficient: Lundberg & Pollak (1996), Del Boca & Flinn (2012)

Form 5500 has *narrative* descriptions of:

- Eligibility
- Matching schedule
- Vesting schedule
- Auto-features

Note 1 - Description of the Plan

The following description of the Lowe's 401(k) Plan (the Plan) provides only general information. Participants should refer to the Plan document and summary plan description for more complete descriptions of the Plan's provisions.

General - The Plan, adopted effective February 1, 1984, is a defined contribution plan covering substantially all employees of Lowe's Companies, Inc. and subsidiaries (the Plan Sponsor or the Company). An employee of the Plan Sponsor is eligible to participate in the Plan six months after the employee's original hire date. The Administrative Committee of Lowe's Companies, Inc. (the Administrative Committee), as appointed by the Board of Directors, controls the management and administration of the Plan. The Plan's trustee and recordkeeper is Wells Fargo Bank, N.A. (Wells Fargo). The Plan is subject to the provisions of the Employee Retirement Income Security Act of 1974 (ERISA) and is a safe harbor-designed plan.

Contributions - Each year, participants may contribute from 1% to 50% of their pre-tax annual compensation, as defined by the Plan, subject to the Internal Revenue Code limitations. Eligible employees are automatically enrolled as participants at a contribution rate of 1% of their pre-tax annual compensation unless they elect otherwise. Participants age 50 and older, or who reach age 50 during the Plan year, are eligible to contribute an additional pre-tax dollar amount per year in addition to the deferral contribution. For 2011, the maximum annual amount of catch up that could be contributed was \$5,500. The Company makes contributions to the Plan each payroll period, based upon a matching formula applied to employee deferrals (the Company Match). The Company Match formula is as follows: the first 3% of contributions are matched by the Plan Sponsor at the rate of 100%; the next 2% of contributions are matched at the rate of 50%; and the next 1% of contributions are matched at the rate of 25%. Participants are eligible to receive the Company Match pursuant to the terms of the Plan. Participants may also contribute amounts representing eligible rollover distributions from other qualified plans.

Participant Accounts - Individual accounts are maintained for each Plan participant. Each participant's account is credited with the participant's contribution, the Company Match, and an allocation of Plan earnings, and charged with benefit payments and allocations of Plan losses and investment expenses. Allocations are based on participant earnings or account balances. The benefit to which a participant is entitled to is the benefit that can be provided from the participant's vested account balance.

Vesting - All participants are 100% vested in the Plan at all times.

Investments - During Plan Year 2011, the 24 investment options to which participants could direct their contributions included one investment contract (stable value) fund, 11 target retirement date funds (collective trusts), nine mutual funds consisting of two small-cap funds, two mid-cap funds, three large-cap funds, one intermediate-term bond fund, and one international fund, and Lowe's Companies, Inc. common stock. Excess cash is held in a non-interest bearing cash account.

Payment of Benefits - Subsequent to termination of service, a participant with a vested account value of \$1,000 or less will receive a lump-sum distribution equal to the participant's vested account balance. If the vested account value is greater than \$1,000, a participant may elect to receive a lump-sum distribution equal to the participant's vested account balance. If the participant does not make such an election and the vested account value is \$5,000 or less, the Plan performs a direct rollover to an individual retirement account designated by the participant or, if the participant has not designated an individual retirement account, to an individual retirement account designated by the Administrative Committee. If the vested account value is greater than \$5,000, the participant's vested account balance remains in the Plan and is not distributed without the participant's consent until the participant reaches age 62.

The Plan allows for in-service withdrawals to participants under age 59½ only in cases of financial hardship. Such withdrawals must total at least \$1,000 and be approved by the Plan's recordkeeper or the Administrative Committee. Participants who have attained age 59½ are entitled to a one-time in-service withdrawal of their accumulated balances.

The Plan allows for a one-time in-service withdrawal to participants in the former Lowe's Companies Employee Stock Ownership Plan (the ESOP) who have attained 20 or more years of service with the Plan Sponsor. The ESOP was merged into the Plan effective September 15, 2002. Eligible participants may withdraw up to 50% of their former

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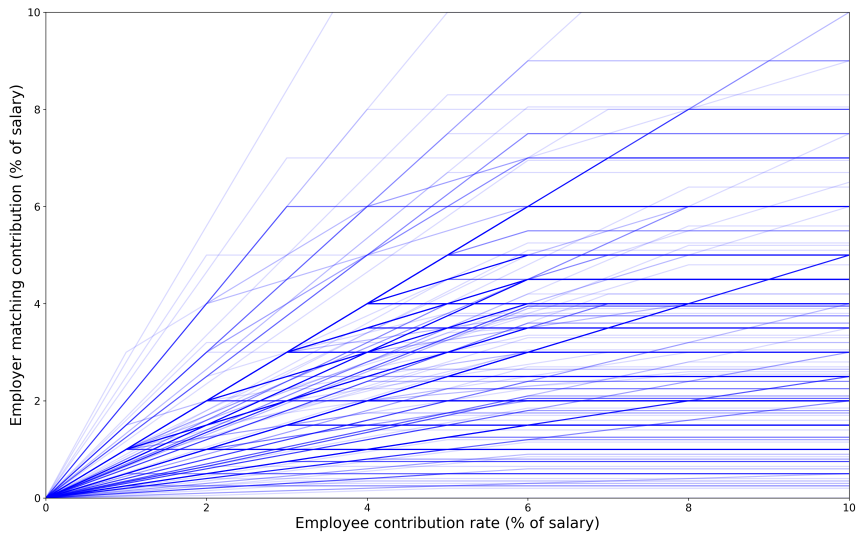
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Data: what we do

- We codify this data for:
 - ▶ The largest 5,000 DC plans
 - ▶ A random sample (approx 1,000) of smaller plans
- Years 2003-2018
- And link to tax return data which
 - ▶ Links spouses
 - ▶ Has their 401k saving choices

This gives us a merged employee-employer data set with **44 million eligible workers**

Wide variation in match incentives



Merging into Tax Records: Our Sample

Population we study ($\approx 1/3$ of joint filers). Couples:

- ① File a tax return
- ② Both spouse are employed
- ③ Both spouses have access to DC plan, plus one contributes
- Further restriction: need to be in our merged sample
 - ▶ Approx 500,000 couples in merged employee-employer dataset

	Income		Age	Marriage length	Population size
	Mean	Median			
Panel A: Population	\$136,100	\$101,300	43.8	11.1	27,381,000
Panel B: Analysis Sample	\$159,200	\$219,800	45.1	11.4	424,000

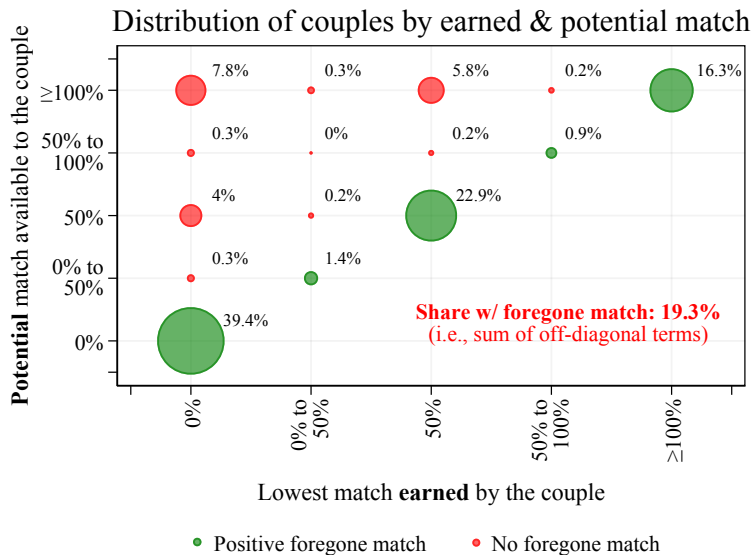
Notes: For disclosure avoidance, all quantiles in these slides are quasi-quantiles, equal to the mean of the 20 observations nearest the true quantile.

The incidence of non-coordination

- Forgone Match: $FM = (\text{match if allocated efficiently}) - (\text{actual match})$
- $FM = 0$ is a **testable implication** of efficiency

	(1) N	(2) Prop.
All	424,280	24.4%
(1) No unvested	260,520	20.0%
(2) Baseline age restriction	339,410	22.6%
(3) No short tenure	294,340	20.8%
Baseline: (1), (2), and (3)	184,620	19.3%
(4) Baseline + no Equitable Division	45,210	19.7%
(5) Baseline + no low earnings	163,540	19.3%
(6) Baseline + no age ≥ 55	149,820	18.9%
(7) All Restrictions (4)-(6)	33,010	19.5%

Earned and Potential Match



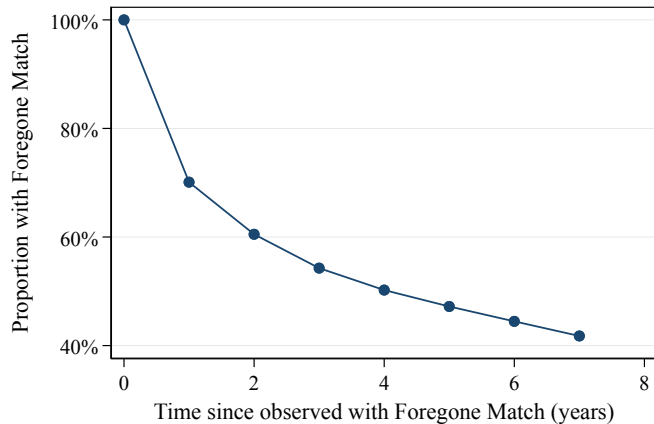
How costly is non-coordination?

Table: Distribution of *FM* (foregone match) (per year, for those not coordinating)

	(1)	(2)
Stat	Dollars	Prop of Employee Cont.
Mean	\$757	13%
p10	\$59	1%
p25	\$155	3%
p50	\$383	8%
p75	\$883	17%
p90	\$1,940	31%

Notes: For disclosure avoidance, all quantiles in these slides are quasi-quantiles, equal to the mean of the 20 observations nearest the true quantile.

Non-coordination is persistent



How (lifetime) costly is non-coordination?

Table: Distribution of lifetime cost of *FM*

	(1)	(2)
Stat	Sum of Foregone Dollars	Foregone wealth at age 65
Mean	\$3,778	\$13,807
p10	\$0	\$0
p25	\$0	\$0
p50	\$1,485	\$4,805
p75	\$5,481	\$18,917
p90	\$11,243	\$41,495

Interpreting Proportion With Foregone Match

- 80% of couples with no foregone match are not necessarily coordinating:
 - ▶ Unilateral decisions could happen to be aligned with efficient allocation
 - ▶ Example: both spouses are fully exploiting their match
- Need a benchmark for foregone match under non-coordination
- Two approaches:
 1. Generate placebo couples
 - ▶ Re-arranging spouses (find 'fake' spouse matching age, gender, earnings as real spouse)
 - ▶ Marrying up singles (match on firm, gender, age, earnings and contributions)
 2. Inspect change in foregone match in event time wrt. to marriage and divorce

Interpreting Proportion With Foregone Match

Placebo couples

Comparing non-coordination in true vs. synthetic couples:

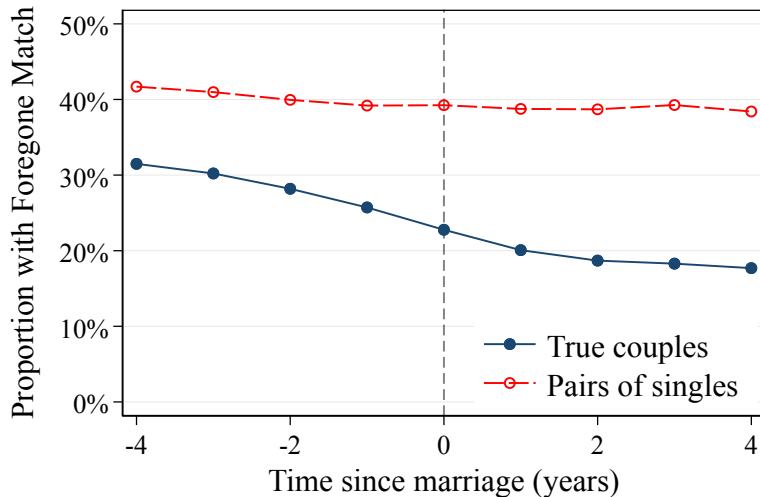
	True Sample	Re-arranging married couples	Marrying up singles
Proportion with $FM > 0$	19.3%	33.1%	33.6%
Implied share non-coordinating		58.2%	57.4%

Our interpretation:

- Evidence of coordination among a substantial minority of couples ...
- ... but a substantial fraction of couples are collectively inefficient

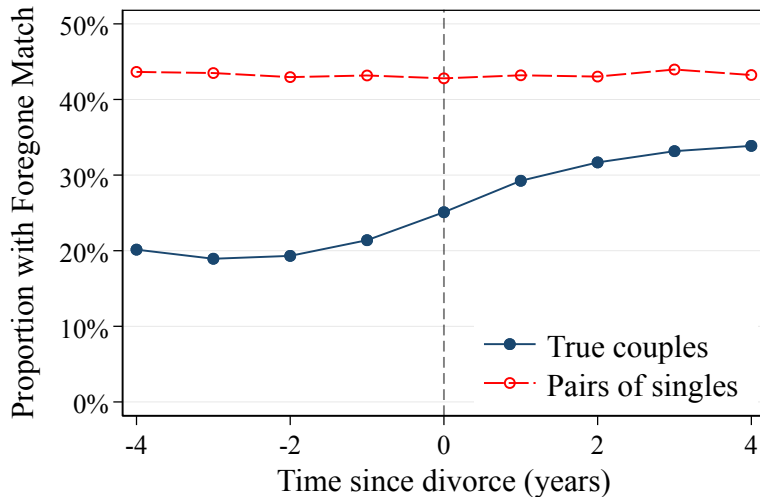
Interpreting Proportion With Foregone Match

Marriage and Divorce



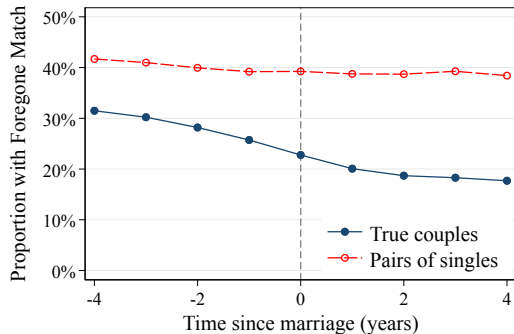
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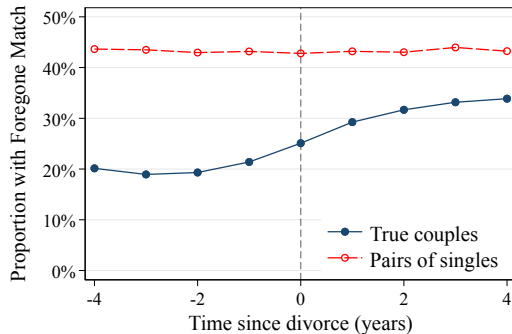


Interpreting Proportion With Foregone Match

Marriage and Divorce



(a) Marriage



(b) Divorce

Mechanisms: Supplementary Survey Evidence

We ran a survey on the platform Prolific:

- Sample of 1,000 married individuals
- Who have a retirement plan
- Aged between 21 and 59
- Balanced between men and women

Survey had:

- Hypothetical choice experiment in the style of our actual setting
- Demographics, **financial literacy**, and awareness of opportunities to coordination

Hypothetical Choice Experiment Follow-up

Your choices would lead to your household receiving a total of \$2250 in 'employer-matching'.

If, instead, you had allocated \$2,000 to your spouse's account and the remaining \$1,000 to your account, your household could have received \$2,500 of matching contributions. **This way you could have received an additional \$250!**

When you were answering the previous question, **did you realize** that your household would have received more employer-matching dollars if you had allocated your saving differently?

- ☐ Yes, I did realize I could have received more employer-matching
- ☐ No, I did not realize I could have received more employer-matching
- ☐ I don't understand this question



Hypothetical Choice Experiment

Some employers offer retirement plans where they 'match' the saving of their employees. This is known as '**employer-matching**'. This question asks what you would hypothetically do if both you and your spouse were offered such a plan.

Suppose that...

- ...for each \$1 **you** save up to \$3,000, your employer adds \$0.50c.
- ...for each \$1 **your spouse** saves up to \$3,000, their employer adds \$1.

Now suppose that you and your spouse decide to save \$3,000 this year (in total) for both of your future retirement needs.

How would you prefer to allocate this \$3,000 across accounts?



Survey Evidence

Table: Foregone match, and its types in the survey data

	(1) N	(2) Prop. of total	(3) Prop. of those w/ foregone match
No foregone match	594	60.2	
Has foregone match	393	39.8	
<i>of which</i>			
...Accidental foregone match	177	17.9%	45.0%
...Deliberate foregone match	187	18.9%	47.6%
...Other	29	2.9%	7.4%

Two Types of Drivers

Accidental Foregone Match (e.g. behavioral biases or optimization frictions)

VS

Deliberate Foregone Match

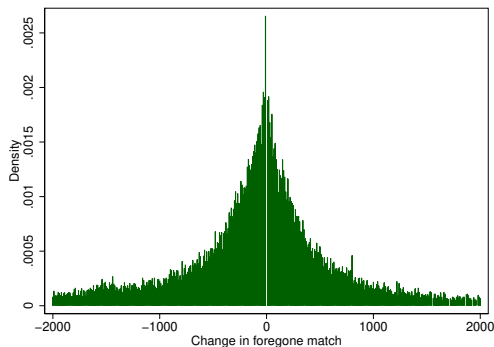
Drivers of accidental foregone match

A role for financial mistakes? [Choi et al. \(2011\)](#), [Gathergood et al. \(2019\)](#), [Goodman et al. \(2023\)](#)

- The role of inertia
 - After **active** contribution changes, couples do not become much better coordinated
 - Non-coordination similar with and without autoenrollment
- The role of equal-saving heuristics
 - Those who equalize are *more* likely to coordinate
- The role of Rational Inattention
 - Incidence of inefficiency is insensitive to the stakes of coordination
- Financial literacy/information plays a role
- Inattention (though not of a rational type)

The role of inertia & adjustment frictions

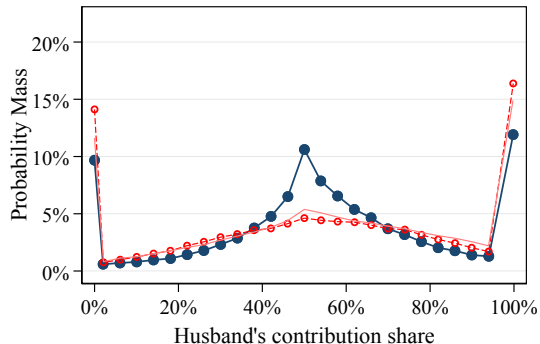
Consider the *change* in Foregone Match when both spouses change their contributions:



Mean change -\$22, with 10.4% increasing the size of foregone match and 13.3% decreasing it.

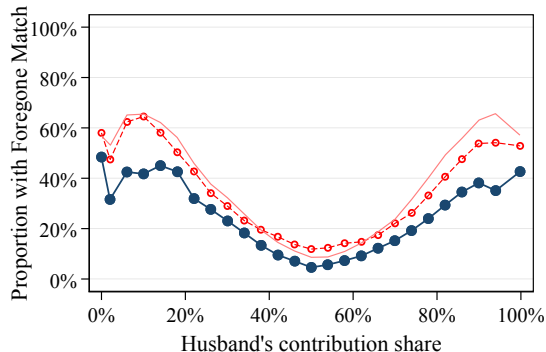
When making **active** contribution changes, couples do not become much better coordinated

Equal Saving Heuristics



—●— True couples - - -○- - Reshuffled couples — Pairs of singles

(a) Dist. of Husband's Share of Contribution (Dollars)

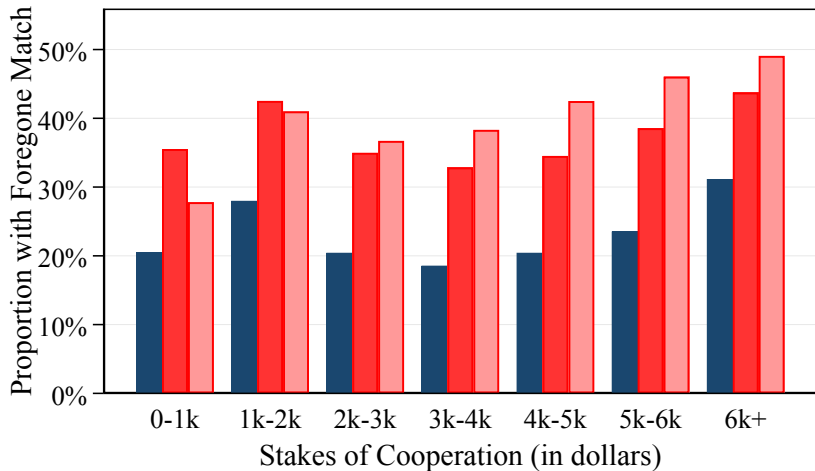


—●— True couples - - -○- - Reshuffled couples — Pairs of singles

(b) Share with *FM*, By Husband's Share (Dollars)

Stakes of Coordination

Maximum possible Foregone Match amount (in Dollars)



True couples Reshuffled couples Pairs of singles

Financial Literacy

- Growing literature shows importance of financial literacy in financial decision-making (review: [Lusardi and Mitchell, 2023](#))
- Measure financial literacy based on the responses to five questions:
 - ▶ Q1,2,3 on compound interest, inflation & diversification from [Lusardi and Mitchell \(2011\)](#)
 - ▶ Q4 on bond prices from [Lusardi \(2008\)](#)
 - ▶ Q5 (new) on the tax treatment of traditional 401(k)

Financial Literacy

Table: Financial Literacy

	(1) Prop. of sample	(2) Prop. w/ FM	(3) Prop. w/ delib FM	(4) Prop. w/ accid. FM	(5) Prop. w/ other FM
≤ 2	17.4	64.0	29.1	29.1	5.8
3	22.1	49.1	27.1	18.8	3.2
4	36.9	32.1	14.6	15.9	1.6
5	23.6	25.3	10.7	12.0	2.6

A role for attention?

Table: Have you considered the gains to co-ordination

	(1) N	(2) Prop. of sample	(3) Prop. w/ any FM	(4) Prop. w/ deliberate FM	(5) Prop. w/ accidental FM
Considered; are coordinating	137	39.6	21.2	8.8	11.7
Considered; maybe coordinating	33	9.5	45.5	24.2	18.2
Considered; not coordinating	50	14.5	58.0	40.0	14.0
Not considered; still won't	50	14.5	44.0	22.0	20.0
Not considered; now will	76	22.0	55.3	18.4	34.2
Total	346	100.0			

Two Types of Drivers

Accidental Foregone Match (e.g. behavioral biases or optimization frictions)

VS

Deliberate Foregone Match

Deliberate Foregone Match?

- ① Correlates of commitment (admin data)
- ② Knowledge of divorce law (survey data)
- ③ A role for gender (admin and survey data)

The role of commitment and the family

- Efficiency in marriage is often justified by appealing to the repeated nature of the ‘game’
 - ▶ Facilitated by the “proximity and durability of the relationship” ([Chiappori & Mazzocco 2017](#))
- Does capacity to fully realize surplus differ by the nature and degree of commitment?
 - ▶ We look for associations between plausible proxies for commitment in the tax data and incidence of inefficiency

Collective inefficiency?

- Conditional on contributions and income, probability of having foregone match: [More](#)
 - ▶ ↘ with length of marriage
 - ▶ ↘ with having kids
 - ▶ ↘ with having a mortgage
 - ▶ ↗ with subsequent divorce
 - ▶ ↘ with having a joint account pre marriage

The role of commitment and the family

	a) Prop. with foregone match		b) Foregone match as prop. of emp'ee contribution	
	(1)	(2)	(3)	(4)
Length of marriage	-0.0010 (0.0002)	-0.0019 (0.0006)	-0.0141 (0.0039)	-0.0292 (0.0117)
Kids	-0.0057 (0.0020)	-0.0110 (0.0039)	-0.1975 (0.0401)	-0.1764 (0.0740)
Future divorce	0.0181 (0.0031)	0.0108 (0.0054)	0.2416 (0.0679)	0.1192 (0.1058)
Mortgage	-0.0244 (0.0025)	-0.0321 (0.0055)	-0.3487 (0.0541)	-0.4088 (0.1097)
Joint account prior to marriage		-0.0151 (0.0053)		-0.2849 (0.0990)
Baseline mean	0.1929	0.1830	2.4302	2.1510
Partial R^2	0.0011	0.0021	0.0007	0.0012
Inc. x Contrs. Controls	X	X	X	X
Full Controls	X	X	X	X
Observations	184,570	44,440	184,570	44,440

Knowledge of Divorce Law

Table: Knowledge of Divorce Law and Association with Forgone March

	(1) Prop. of sample	(2) Prop. w/ any FM	(3) Prop. w/ delib. FM	(4) Prop. w/ accid. FM	(5) Prop. w/ other FM
Keep own	34.2%	51.2%	27.8%	19.2%	4.1%
Split/Other	46.9%	36.9%	15.3%	19.0%	2.6%
Don't know	18.8%	26.3%	11.8%	12.9%	1.6%

The Role of Gender

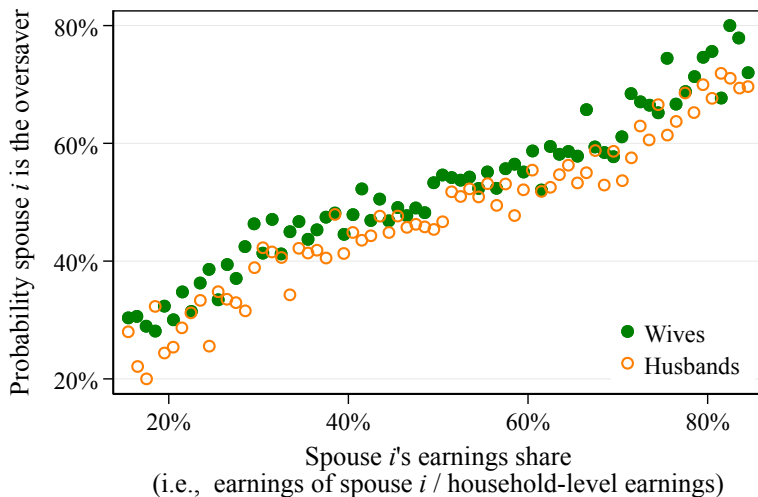
- When maximizing the match requires putting all the savings in the spouse's account:
 - ▶ female respondents are more likely to have deliberate FM than male respondents (i.e., 31.5% v 24.7%)

When achieving efficiency does not require giving up control over the savings

- ▶ We find little differences in deliberate foregone by gender (i.e., 14.3% v 14.1%)

The Role of Gender

Figure: Differences by Relative Earnings and Gender



The role of commitment and the family

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Summary

1. Construct new employee-employer merged dataset

- Collect detailed data on retirement plan features for $>5,000$ plans with $>44\text{m}$ workers
- Merge with tax records to observe savings decisions

2. Find direct evidence of coordination for share of couples but non-coordination is widespread

- $\approx 20\%$ of couples leave an average approx \$750 per year on the table
- Compared to $\approx 30\%$ inefficient couple in no-coordination benchmark

3. Interpretation for those who are inefficient. Arises both because ...

- ... financial mistakes
- ... couples collectively fail to achieve efficiency?

Conclusion

- We provide evidence of efficiency for a share of couples
- A significant share of couples are failing to coordinate efficiently
- Financial mistakes (corr. w/ low financial literacy) and a lack of commitment play a role
- Larger role for models that don't achieve efficiency?
 - ▶ *Inefficient* bargaining Basu, (2006) – your wealth gives you bargaining power.

Divorce

- Simplified version of intertemporal Limited Commitment model of Mazzocco (2007)
- Introduce participation constraint using reservation utility in period 2 for spouse j is $\underline{u}_2^j(\mathbf{X})$
- Divorce occurs if no surplus division allows both participation constraints to be satisfied

$$\max_{\{c_t^i, s_t^i\}_{t=1,2}^{i=A,B}} \alpha(\mathbf{X})(u_1^A(c_1^A) + u_2^A(c_2^A)) + (1 - \alpha(\mathbf{X}))(u_1^B(c_1^B) + u_2^B(c_2^B))$$

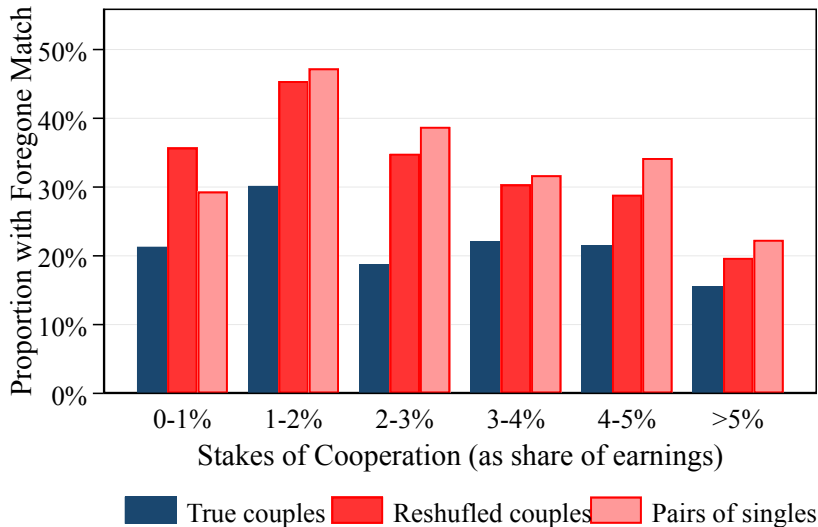
$$\text{s.t.} \quad \sum_{i=A,B} c_1^i + c_2^i \leq \sum_{i=A,B} (y_1^i - s^i) + w_2^i$$

$$u_2^j(c_2^j) \geq \underline{u}_2^j(\mathbf{X}) \quad j = A, B$$

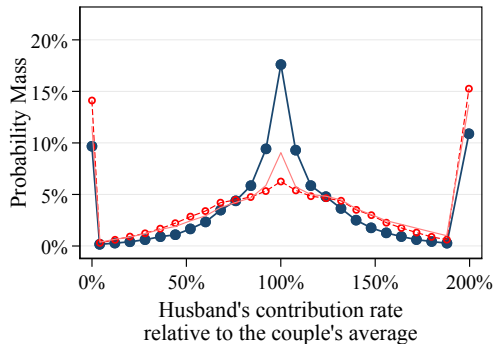
- These models relax 'ex-ante efficiency', across time and states
- Retain 'ex-post efficiency' assumption within states – contemporaneous surplus is realized

Stakes of Coordination

Share of Earnings

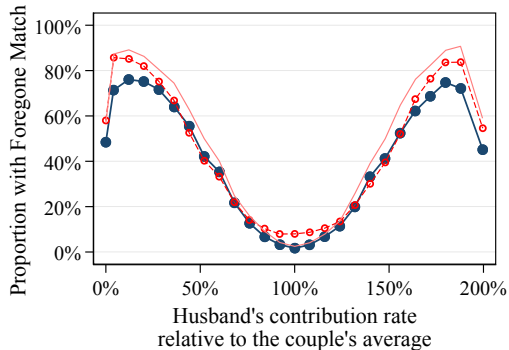


Equal Saving Heuristics



—●— True couples - - - ○ - - - Reshuffled couples — Pairs of singles

(a) Distribution of Husband's Contribution Share



—●— True couples - - - ○ - - - Reshuffled couples — Pairs of singles

(b) Prop with *FM*, by Husband's Contribution Share

Proportion not coordinating

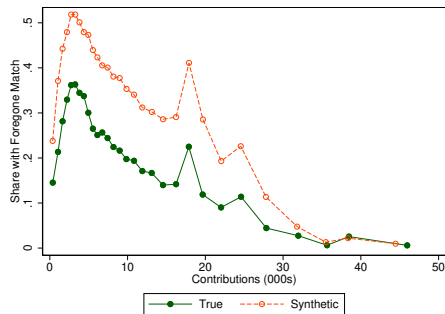


Figure: Comparison with Married Placebo

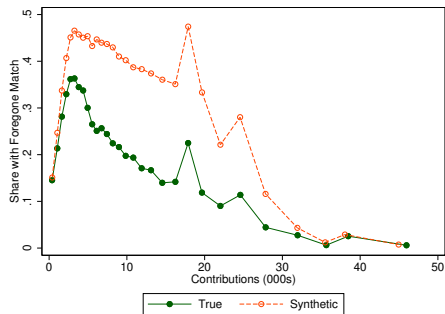


Figure: Comparison with Single Placebo

Foregone match

For any S , Foregone Match rate is max potential match rate less actual match rate:

$$FM = \underbrace{\left(m^A(s^{*A}(S)) + m^B(s^{*B}(S)) \right)}_{\text{Max Match Rate}} - \underbrace{\left(m^A(s^A) + m^B(s^B) \right)}_{\text{Actual Match Rate}}$$

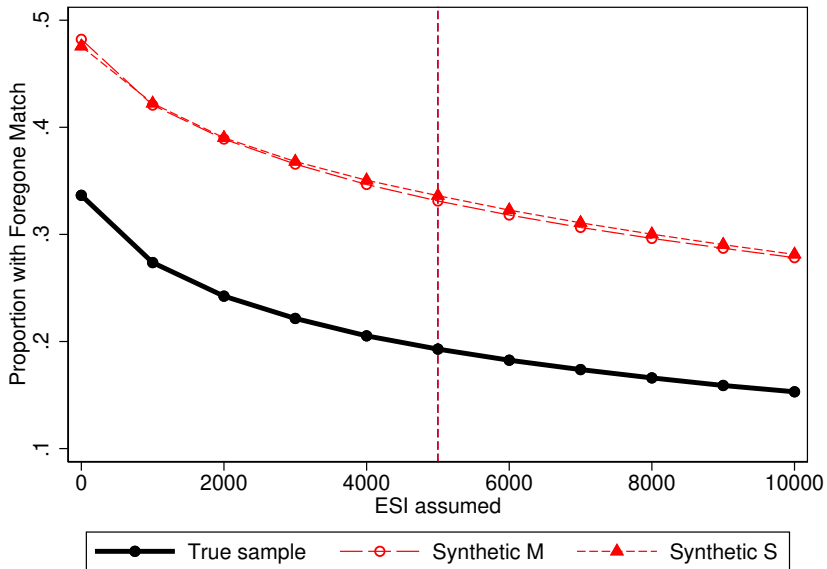
For Max Match:

- We assume no deductions
- The income measure for both spouses is an underestimate for all individuals
- The proportion of saving that each spouse is doing is an overestimate
- The max match rate is an underestimate

For Actual Match:

- We assume deduction of \$5,000 (over-estimate on average)
- The income measure for both spouses is an overestimate on average
- The proportion of saving that each spouse is doing is (on average) an underestimate
- The actual match rate is (on average) an overestimate

Sensitivity to ESI assumption



Foregone match

Consider an individual with:

- True (base-for-match) income of \$50,000
- Deductions of \$2,500
- Saving of \$3,000
- Dollar for dollar match up to to 3% of salary

Scenario	Income	Saving	Saving Rate	Prop. of saving matched
True	\$50,000	\$3,000	6.0%	50%
For Max Match	\$47,500	\$3,000	6.3%	48%
For Actual Match	\$52,500	\$3,000	5.7%	53%

A Simple Collective Model

Back

- A married couple with spouses A and B ; two time periods: 1 and 2
- Each individual i with income y^i in period 1 chooses saving s^i
- Each individual has a different saving technology: $w_2^i = s^i \times r^i (s^i)$
- Household Problem:

$$\max_{\{c_t^i, s_t^i\}_{t=1,2}^{i=A,B}} \alpha(\mathbf{X})(u_1^A(c_1^A) + u_2^A(c_2^A)) + (1 - \alpha(\mathbf{X}))(u_1^B(c_1^B) + u_2^B(c_2^B))$$

$$\text{s.t. } \sum_{i=A,B} c_1^i + c_2^i \leq \sum_{i=A,B} (y_1^i - s^i) + w_2^i$$

- Pareto Weights for A and B : $\alpha(\mathbf{X})$ and $1 - \alpha(\mathbf{X})$
- Weights depend on exogenous **distribution factors** \mathbf{X}

A Simple Collective Model

- An assumption of efficiency will imply savings allocations on the Pareto Frontier
- With saving $S \equiv s^A + s^B$, the allocation of saving between spouses must satisfy:

$$\{s^{*A}, s^{*B}\} \in \arg \max r^A(s^A) + r^B(s^B) \quad \text{s.t.} \quad s^A + s^B \leq S$$

- Define Foregone Match (FM):

$$FM = (r(s^{*A}) + r(s^{*B})) - (r(s^A) + r(s^B))$$

- ▶ FM : extra match that could have been achieved by reallocating contributions
 - ▶ Dual condition: consumption today could have been higher at no cost to retirement wealth
- $FM = 0$ is a **testable implication** of productive efficiency given variation, within household, in saving technology $r^A(\cdot), r^B(\cdot)$