

INCOME DYNAMICS OF COUPLES: CORRELATED RISKS AND HETEROGENEOUS WITHIN-HOUSEHOLD INSURANCE

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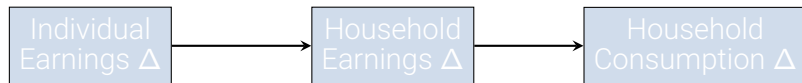
SED

July 1, 2023

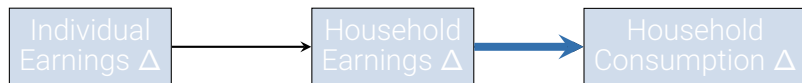
Motivation

- ▶ HH earnings risk matters for
 - ▶ Fiscal Policy: private vs. public insurance (e.g., Wu & Krueger)
 - ▶ Monetary Policy: MPCs (e.g., Bardóczy '20)
 - ▶ Macro models w/ micro data: ~~bachelor household~~ (e.g., HSV '10)
 - "Wages and hours worked are characteristics recorded at the **individual level**, while **consumption and welfare** are typically measured at the level of the **household**. This presents an obvious **challenge for the bachelor model** as a lens for interpreting micro data".*
- ▶ how does individual labor market risk $\xrightarrow{?}$ household earnings risk
- ▶ and why does it matter?

Overview

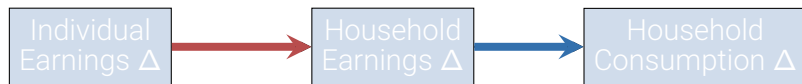


Overview



- ▶ Layers of “insurance” against individual income risk:
 - Household
 - Assets
 - Taxes/Transfers

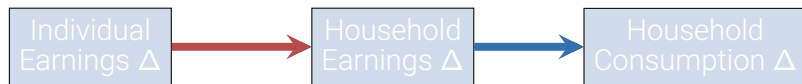
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Here: zoom on link Individual → Household Earnings

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- ▶ **Focus: earnings co-variation of earners within a HH**

Joint Income Dynamics (in the 21st century)

- ▶ Traditional focus:
 - ▶ HH-insurance: **out-of-LF female** reacting to male income shock
 - ▶ Measurement: **stably married** HHs or treat new HH as independent

! But...

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- ▶ Female labor force participation ↑ in most countries
 - Especially married women (e.g., Olsson '20)
- ▶ Same time: divorce and formation of new couples
 - on avg. 2.5 spouses / individual in our sample

⇒ Key role of

Joint Income Dynamics (in the 21st century)

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\Rightarrow Key role of

1. **Correlation** of spouses' incomes (risk)
 - **Sorted** by: education, occupation, industry, firm, ...
2. **HH formation/dissolution** over the life-cycle

This Paper

Characterize earnings dynamics:

- ▶ at individual level, for all adult individuals
- ▶ + family changes over the life-cycle
 - ⇒ HH earnings dynamics

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- ▶ at individual level, for all adult individuals
- ▶ + family changes over the life-cycle
 - ⇒ HH earnings dynamics
- ▶ in Denmark: high female LF participation throughout

Document:

- ▶ Systematic heterogeneity in earnings co-movement of spouses
 - linked to sorting in labor market
- ▶ Heterogeneous pass-through to consumption

Some Structural Guidance: Micro in Quant Macro

- ▶ *borrow*s from micro estimations:
 - ▶ e.g. param. of dynamic earnings/wage process using panel data

$$y_t^i = z_t^i + \varepsilon_t^i$$

$$z_t^i = z_{t-1}^i + \eta_t^i$$

$$\varepsilon_t^i \sim iid\mathcal{N}, \eta_t^i \sim iid\mathcal{N}$$

- ▶ We argue: empirical analysis often at odds with quant. question
 - ▶ Common assumption 1: unit of obs. is either **head** OR **family**
 - ▶ Common assumption 2: couples are stable

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- ▶ We argue: empirical analysis often at odds with quant. question
 - ▶ Common assumption 1: unit of obs. is either **head OR family**
 - ▶ Common assumption 2: couples are stable
- ⇒ Spouses' behavior is masked and a source of risk eliminated

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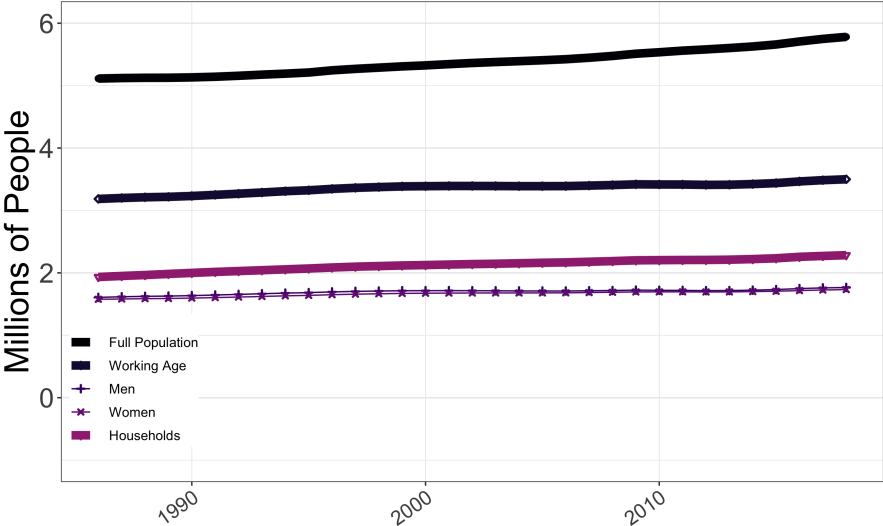
- ▶ BPS estimate a process similar to this on a “stable” sample
 - Find significant $\sigma_{\varepsilon\varepsilon} > \mathbf{0}$, insignificant $\sigma_{\eta\eta}$
- ▶ Now: Households heterogeneous in sorting + not “stable”
 - Look at **comovement** of earnings with flexible tools
 - Enrich the process by **heterogeneity**

Outline

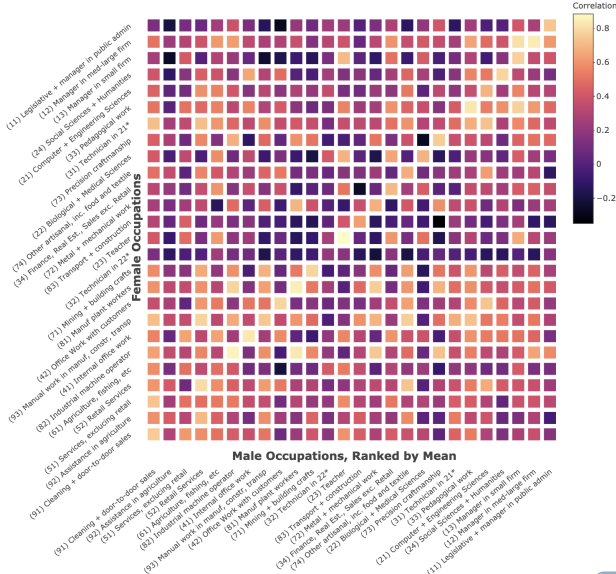
Data: Danish tax register & social security

- ▶ Whole Danish population panel 1991–2018
- ▶ Links individuals (couples)
- ▶ Info on:
 - ▶ Age, education, occupation, sector, firm
 - ▶ **Earnings: total annual labor earnings**
 - ▶ Taxes, transfers, assets
- ▶ (coming up) social security affiliation details for period 2008-2018
 - ▶ monthly
 - ▶ more details on extensive margin
- ▶ Sample for analysis: working age 18-65

Danish Population and Sample

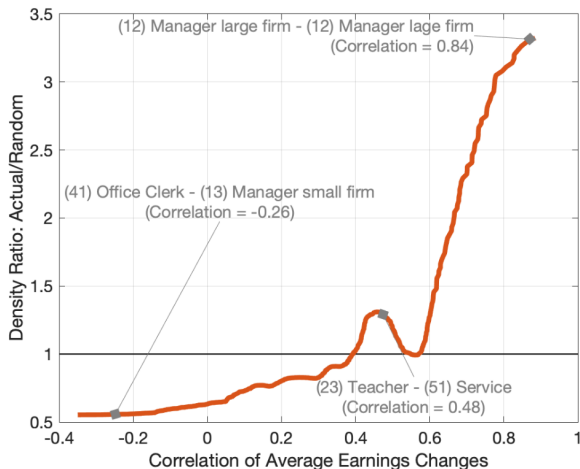


Example: Occupation Pairs



▶ Interactive Version

Sorting Coefficient Across Occupation-Pairs



(b) Sorting Coefficient

Taking Stock

- ▶ We use the whole adult Danish population
- ▶ Denmark is a good reference for our question:
 - ▶ Female LF participation has been high for longer time
- ▶ Some occupations more correlated than others on avg
- ▶ Couples are **sorted** on highly **correlated occupations**

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- ▶ Next: are these couples different in terms of HH income risk?

Outline

Income Changes in the Data

- ▶ Let Y_{it} denote the labor earnings of individual i
- ▶ We define two types income changes

- ▶ Arc Changes

$$\Delta^{arc} y_{it} = \frac{Y_{it+1} - Y_{it}}{(Y_{it+1} + Y_{it})/2}$$

- ▶ Useful to incorporate both intensive and extensive margins
- ▶ limitations when linking to structural decomposition

- ▶ Log Changes

$$\Delta y_{it} = \log Y_{it+1} - \log Y_{it}$$

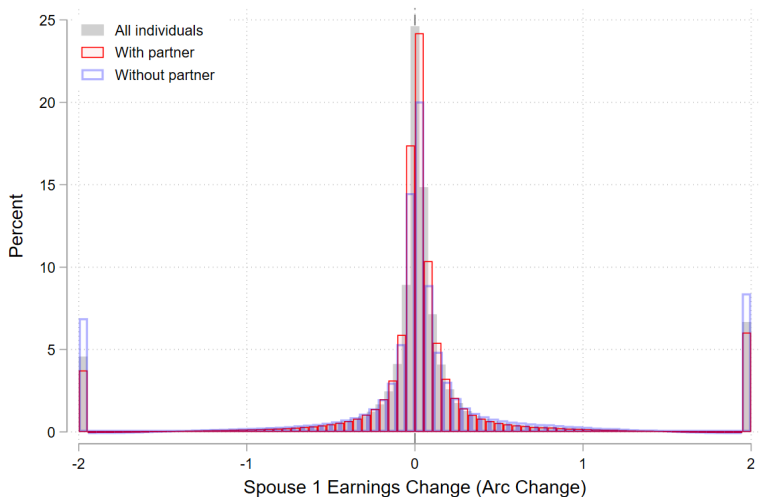
- ▶ Useful for interpretation of intensive margin + structural decomp.
- ▶ limitations when extensive margin changes (0s)

The Distribution of Everyone's Income Changes

Arc Changes, All Individuals

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The Distribution of Joint Income Changes

All Changes, All Individuals, Sorting by Occupation

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Graphs by Group 4 Earnings Change Groups

Flexible Approach to Joint Income Changes

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- ▶ Consider log earnings changes of head and spouse:

$$\Delta y_t^{sp} = f(\Delta y_t^{hd}) \quad (1)$$

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$$\Delta y_t^{sp} = f(\Delta y_t^{hd}) \quad (1)$$

- ▶ Specify $f(\cdot)$ flexibly:

1. **Non-linear** in Δy_t^{hd}
2. **Heterogeneity by similarity** of labor market characteristics
 - ▶ Education, Occupation, Industry, Firm
3. Other sources of heterogeneity
 - ▶ Age, Wealth
 - ▶ #Children

Measures of Spousal Earnings Comovement

- ▶ Implied spousal earnings changes for each group

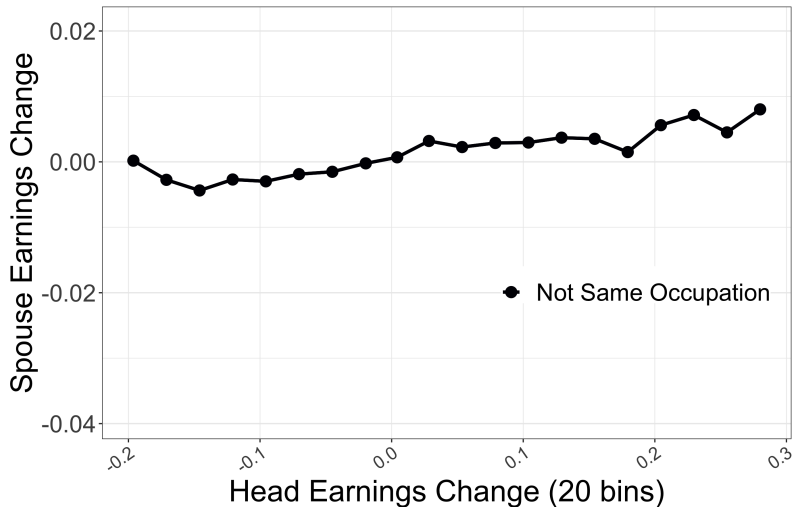
$$\hat{\Delta y}_t^{sp} = f(\Delta y_t^{hd}; \hat{\beta}) \quad (2)$$

- ▶ 'Elasticities'

$$\hat{\epsilon}^{sp} = \frac{\hat{\Delta y}_t^{sp}}{\Delta y_t^{hd}} \quad (3)$$

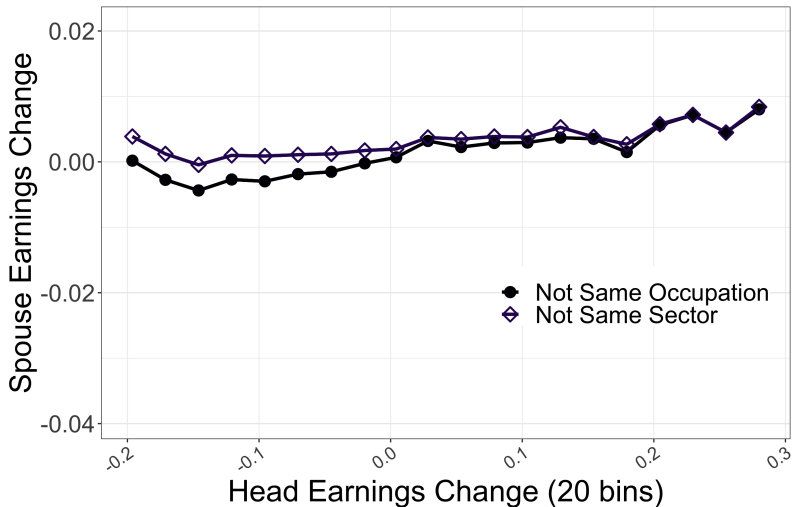
Spousal Change

Spousal Change



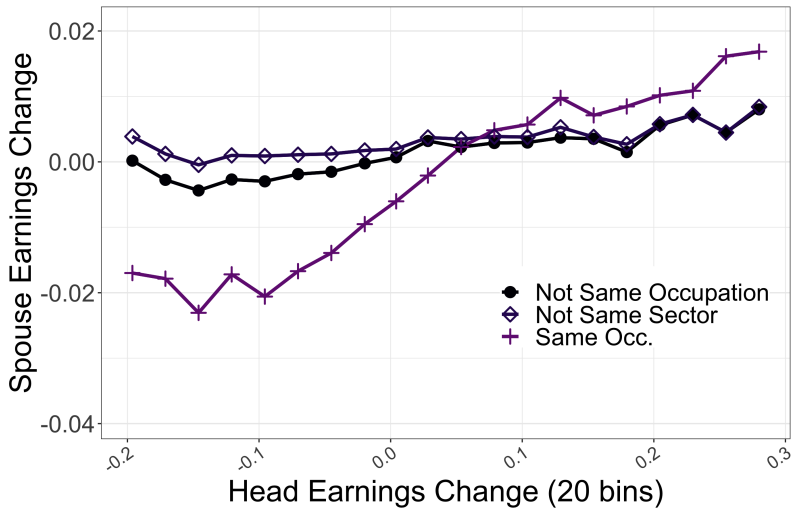
(c) Spousal Change: Step-by-Step

Spousal Change



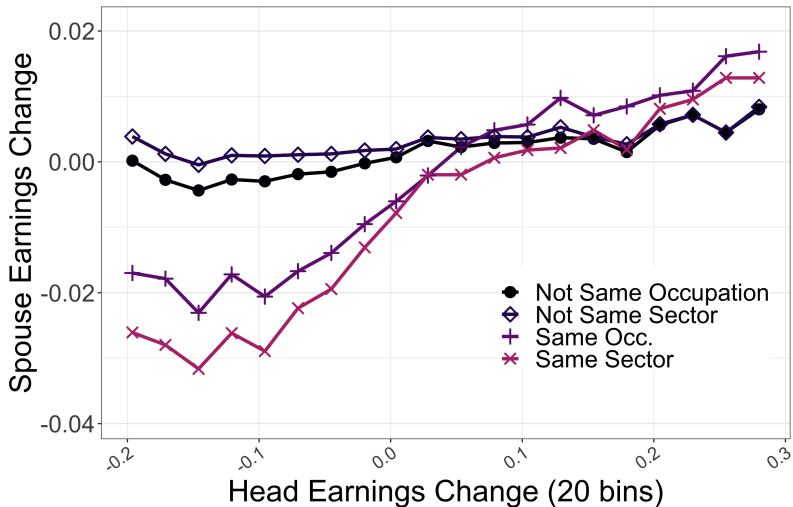
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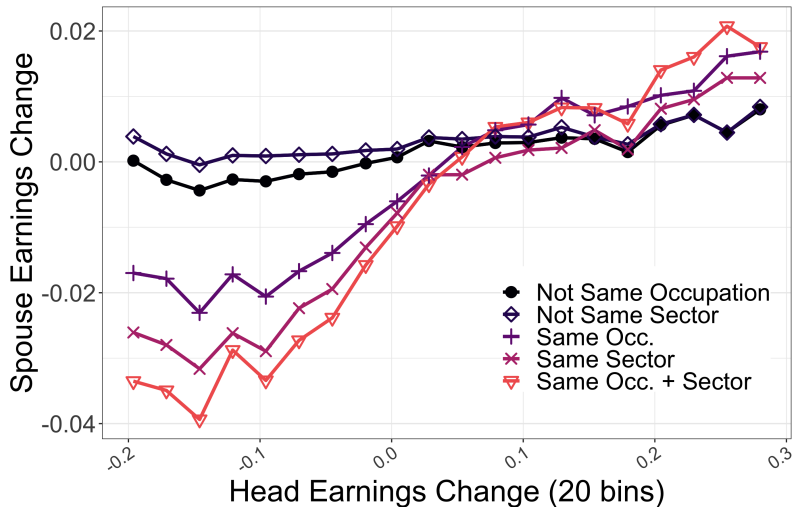
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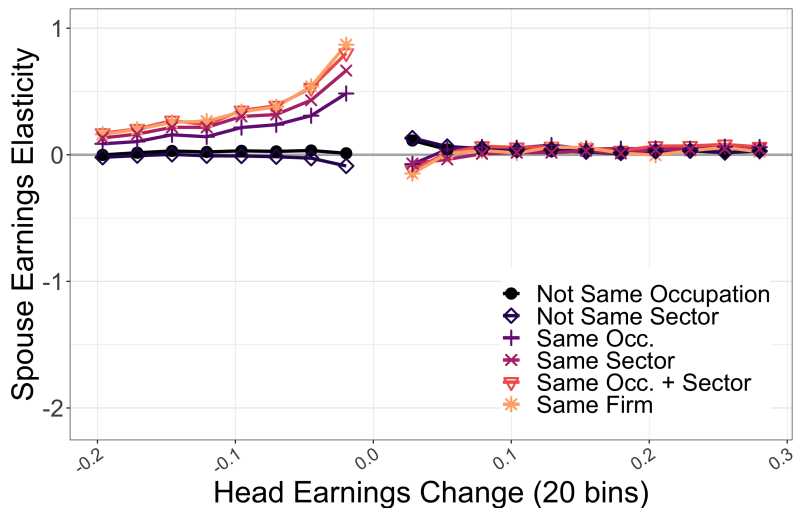
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Implied Spousal Earnings Elasticity

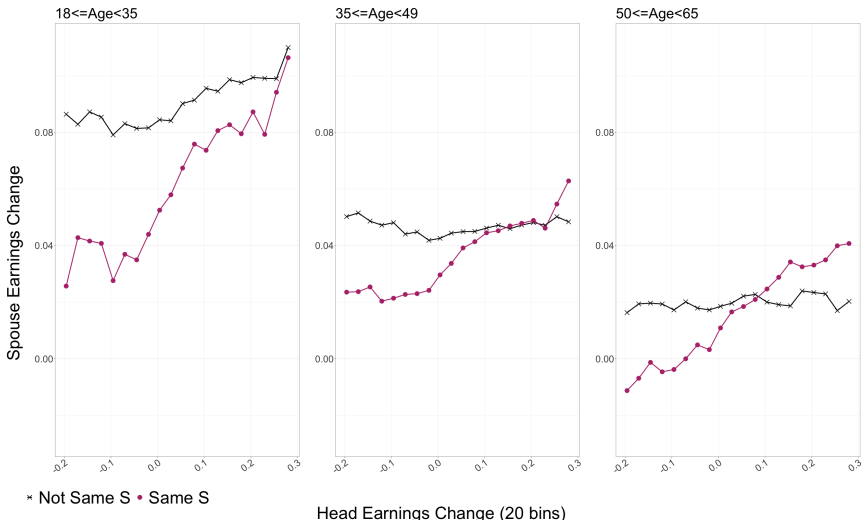


(d) Spousal Elasticity

Heterogeneity by Other Characteristics

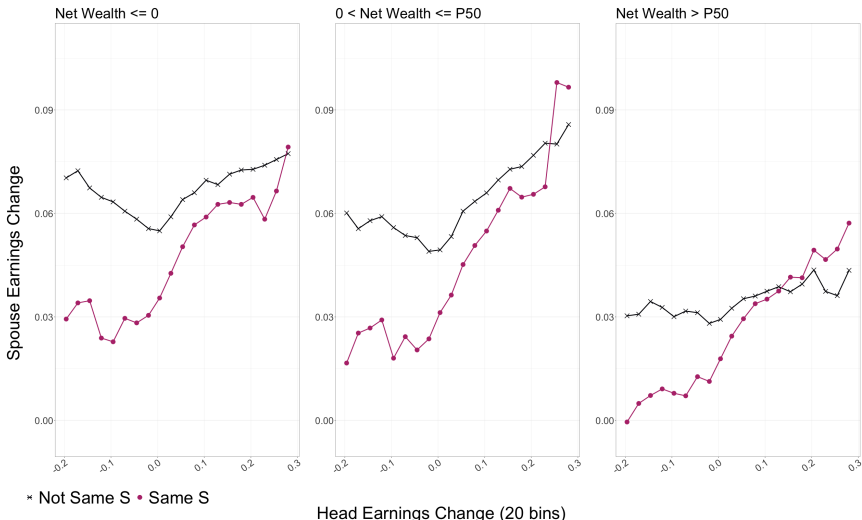
- ▶ Role of labor market sorting by:
 - ▶ Age
 - ▶ Wealth (before change)
(cash+deposits+stocks+shares+property+cars–liabilities)
- ⇒ Sorting matters within groups

By Age Groups: Spousal Earnings



► Elasticity

By **Wealth** Groups: Spousal Earnings



► Elasticity

Outline

From Income To Consumption

$$C = Y - T - \Delta A \quad (4)$$

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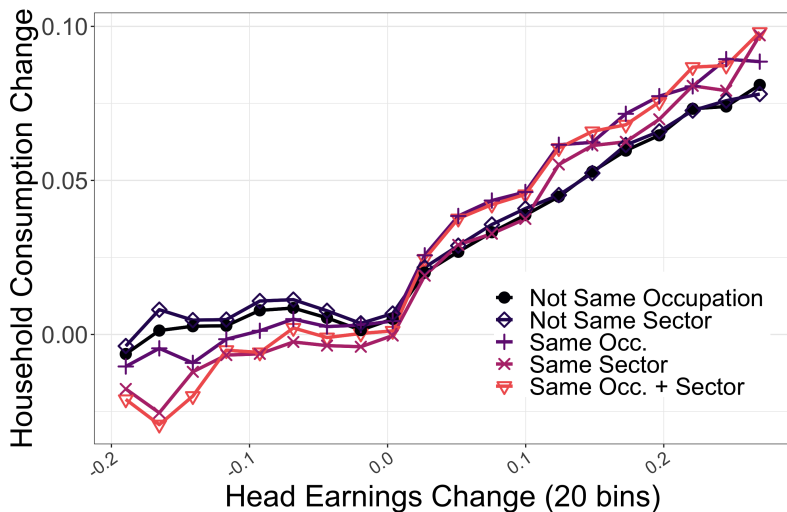
- ▶ Components of budget in data:
 - ▶ Y : Labor + capital income (+imputed cons. value housing)
 - ▶ T : Tax payments – transfer receipts
 - ▶ ΔA : Change asset value
(cash+deposits+stocks+shares+property+cars–liabilities)

⇒ Consumption

- ▶ Lines up with Expenditure Survey
(De Giorgi, Frederiksen & Pistaferri, ReStud'20)

Household Consumption Change

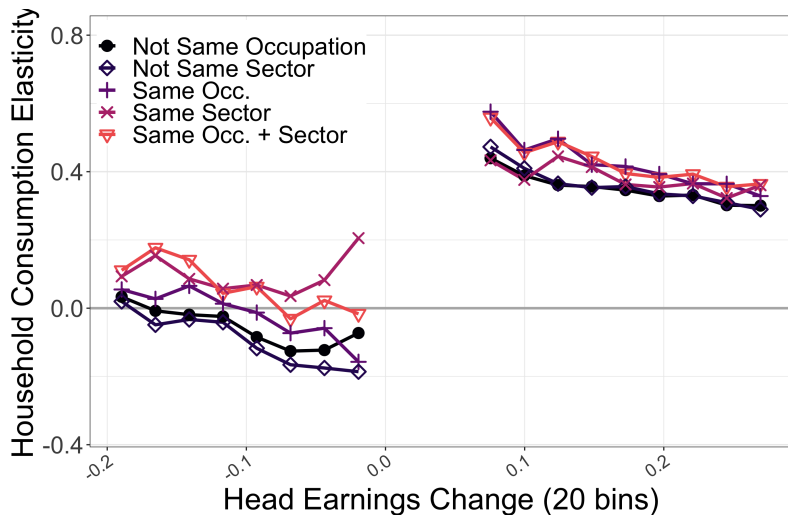
Household Consumption Change



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Consumption Elasticities

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Taking Stock

- ▶ Couples in \sim occupations/sectors: correlated earnings Δ
- ▶ Especially in the case of negative earnings Δ
- ▶ Passes through to family consumption...

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- ▶ Couples in \sim occupations/sectors: correlated earnings Δ
- ▶ Especially in the case of negative earnings Δ
- ▶ Passes through to family consumption...
- ▶ Incorporate heterogeneity in income process
 - ... allows to decompose permanent vs. transitory fluctuations

A Household Income Process for Macro Analysis

Estimate process for all individuals (singles/couples) which features

1. Individual-level income process (separately for men&women)
 - ▶ Couple-level corr of shocks, heterogeneous by sorting groups
2. Process of 'marriage' and 'divorce'
 - ▶ Assume marriage/divorce shocks & income shocks orthogonal

An Income Process for *All* Households

At every age, each **single or married** male and female:

- ▶ receives (permanent and transitory) shocks to income
- ▶ and to family status

If **single**:

- ▶ form a couple with probability p^{form}

If **in couple**:

- ▶ divorce with probability p^{div} :
 - ▶ income shocks correlated with outgoing spouse's shocks
 - ▶ AND receive **divorce shocks**
- ▶ stay in the couple:
 - ▶ income shocks correlated with spouse's shocks

Income Process

Income Process

$i = \text{spouse } 1, 2$

$$\begin{aligned}y_t^i &= z_t^i + \varepsilon_t^i \\z_t^i &= z_{t-1}^i + \eta_t^i\end{aligned}\tag{5}$$

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Income Process

$i = \text{spouse } 1, 2$

$$\begin{aligned}y_t^i &= z_t^i + \varepsilon_t^i + \delta_t^{\varepsilon i} \cdot \mathbf{1}\{\text{div}_t = 1\} \\z_t^i &= z_{t-1}^i + \eta_t^i + \delta_t^{\eta i} \cdot \mathbf{1}\{\text{div}_t = 1\}\end{aligned}\tag{5}$$

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▷ Household dissolution → divorce shocks (extra risk)

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- ▶ Household dissolution → divorce shocks (extra risk)
- ▶ Household formation → correlation between spouses

Estimation

Estimation

- ▶ Estimate in first differences
- ▶ GMM: analytical moments of individual processes

$$\text{var}(\Delta y_t^i | \text{div}_t = \text{div}_{t+1} = 0) = \sigma_{\eta i}^2 + 2\sigma_{\varepsilon i}^2$$

$$\text{cov}(\Delta y_t^i, \Delta y_{t+1}^i | \text{div}_t = \text{div}_{t+1} = 0) = -\sigma_{\varepsilon i}^2$$

$$\text{cov}(\Delta y_t^i, \Delta y_{t+1}^i | \text{div}_{t+1} = 1) = -\sigma_{\varepsilon i}^2 - \sigma_{\delta \varepsilon i}^2$$

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- ▶ ... and co-moments by sorting status \mathbf{s} :

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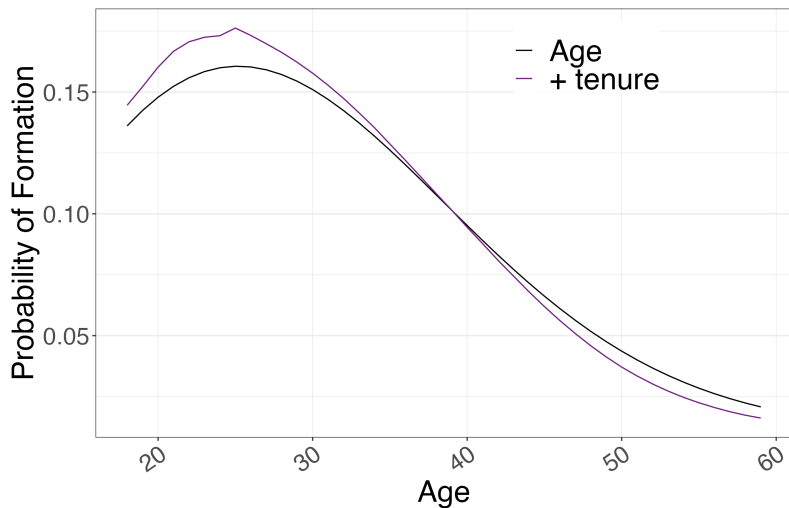
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- ▶ ... and co-moments by sorting status \mathbf{s} :

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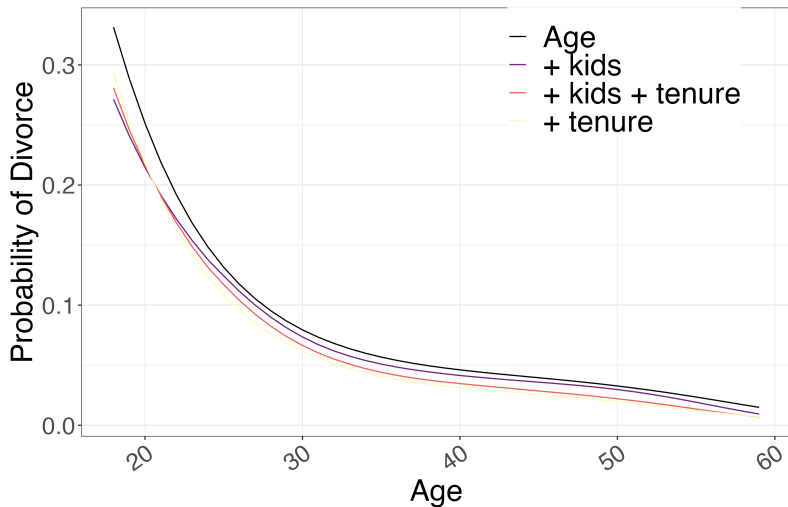
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Couple formation Process (p^{form})



(e) HH Formation

Divorce Process (p^{div})



(f) Divorce

Estimates

Estimates

	Individual Moments	
	<i>Income (ε, η)</i>	<i>+ if divorce ($\delta_\varepsilon, \delta_\eta$)</i>
σ_ε^2	0.102	0.130
σ_η^2	0.272	0.205

Table: Estimates, Sorting Along Occupations

- ▶ BPS estimates are (for wages) $\sim \sigma_\varepsilon^2 = 0.02, \sigma_\eta^2 = 0.03$

Estimates

	Couples' Moments	
	<i>Covariances</i>	<i>Implied Correlations</i>
$\sigma_{\varepsilon\varepsilon}(\mathbf{s} = 1)$	-0.003	-0.027
$\sigma_{\varepsilon\varepsilon}(\mathbf{s} = 0)$	-0.009	-0.081
$\sigma_{\eta\eta}(\mathbf{s} = 1)$	0.044	0.159
$\sigma_{\eta\eta}(\mathbf{s} = 0)$	0.015	0.054
$\sigma_{\delta_\varepsilon, \delta_\varepsilon}$	0.011	0.092
$\sigma_{\delta_\eta, \delta_\eta}$	0.043	0.206

Table: Estimates, Sorting Along Occupations

- ▶ **3 × higher correlation in permanent shocks**

Ongoing

- ▶ Increase in life-cycle increase $\log y_t$ with our process?
 - ▶ For males and **females**
- ▶ Quantify relative roles of sources of risk
 - ▶ Individual lifetime risk: role of divorce risk
 - ▶ Household risk: role of sorting (given evidence on corr. risk)

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 1. Statistical decomposition
 2. Structural model (future)

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Summary

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 - Holds within groups of age, wealth
 - Translates to household outcomes: **consumption**

Summary

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- ▶ **Heterogeneity** of joint labor market **characteristics**
 - Matters for joint **earnings changes**
 - Holds within groups of age, wealth
 - Translates to household outcomes: **consumption**
- ▶ Structurally, correlated risk shows up in the permanent component of earnings changes
- ▶ In a full model, this component passes through to consumption and welfare

Next: Quantitative Model

- ▶ Sorting/distribution of couples matters for
 - ▶ Within-household insurance (“added worker effect”)
 - ▶ Evaluation of public insurance

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- ▶ Sorting/distribution of couples matters for
 - ▶ Within-household insurance (“added worker effect”)
 - ▶ Evaluation of public insurance
- ▶ Model featuring:
 - ▶ Incomplete markets
 - ▶ Distribution of couples over pairs of occupation
 - ▶ Head earnings process; Spouse *wage* process
 - Endogenous labor supply of spouse
 - ▶ Tax & transfer function

Joint Dynamics: Average by Group

- ▶ Spousal income changes:

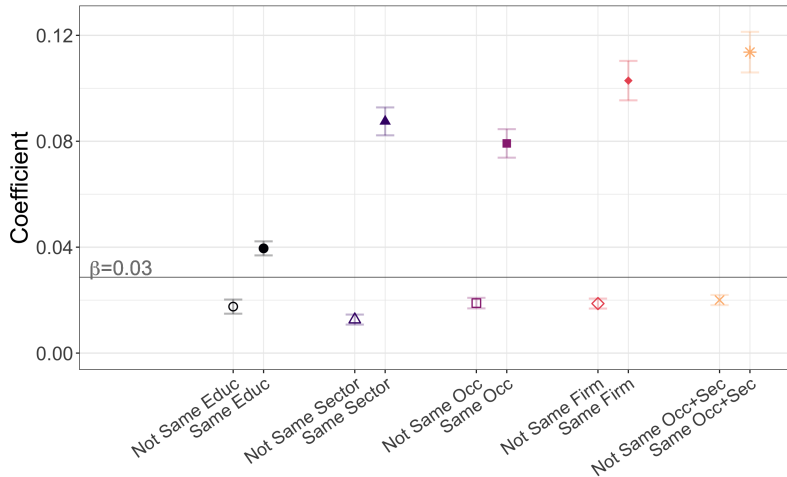
$$\Delta y_t^{sp} = \beta_0 + \tilde{f}(\Delta y_t^{hd}) + \mathbf{X}_t^{sp} \gamma + \mathbf{Y} \delta + u_{st} \quad (6)$$

with

$$\tilde{f}(\Delta y_t^{hd}) = (I_{o_t^{hd} \neq o_t^{sp}} \beta^{\text{not same x}} + I_{o_t^{hd} = o_t^{sp}} \beta^{\text{same x}}) \Delta y_t^{hd} \quad (7)$$

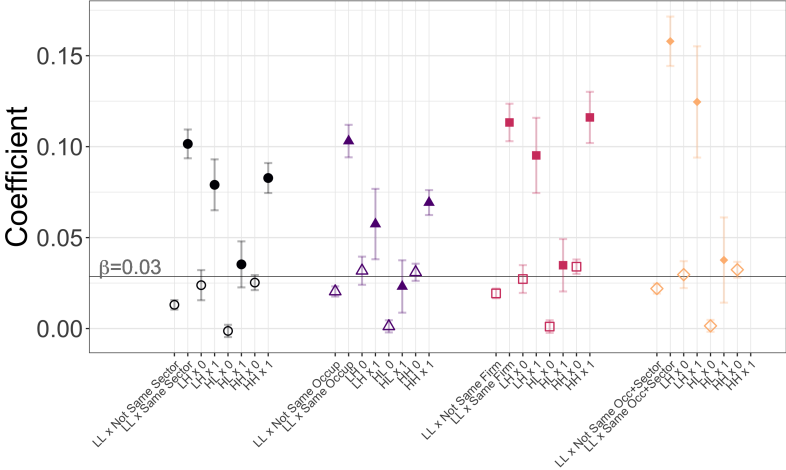
- ▶ \mathbf{X}_t^{sp} : age quadratic, education dummies, occupation dummies
- ▶ \mathbf{Y} : year dummies
- ▶ Δy_t^i : 1-year income change

Group-Specific Coefficients



(g) Elasticities for Different Sorting Vars

Group-Specific Coefficients: By Education Pairs

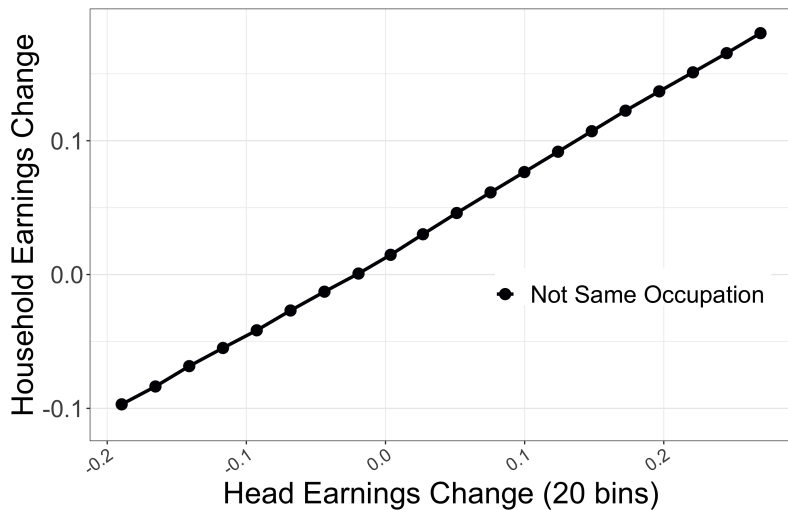


(h) Elasticities—Educ⊗Sorting Var

▶ Back to Average

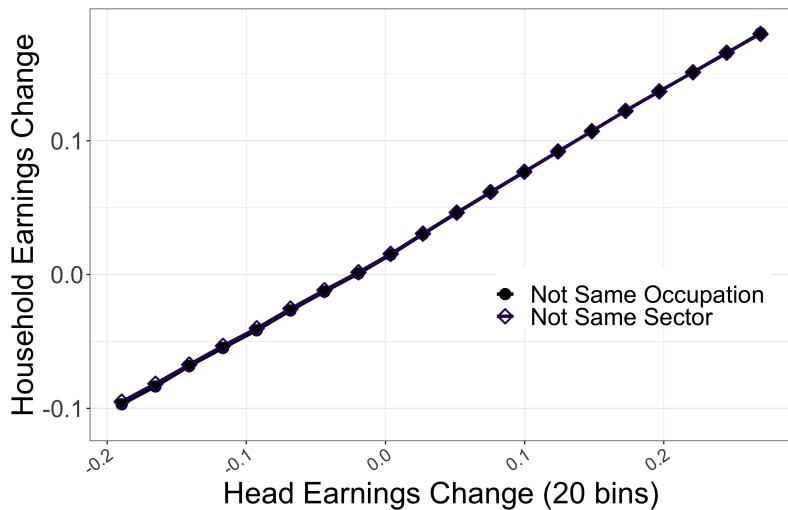
Household Change—Step-Wise Conditioning

Household Change—Step-Wise Conditioning



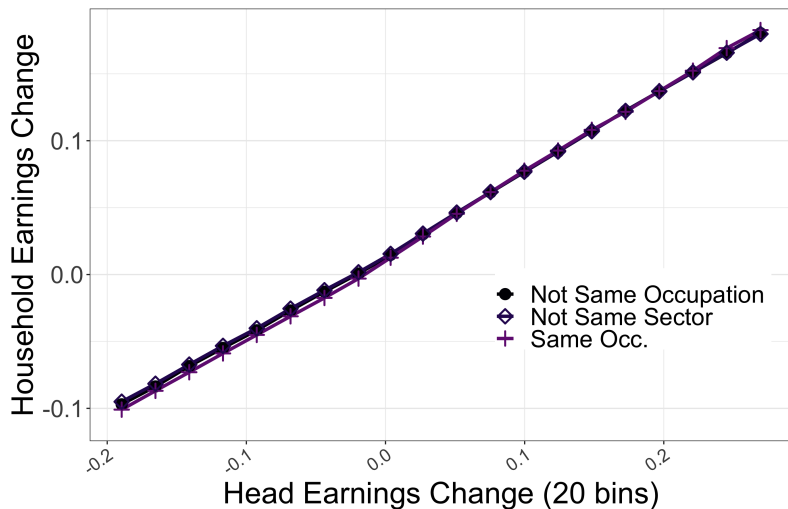
(i) Household Change: Step-by-Step

Household Change—Step-Wise Conditioning



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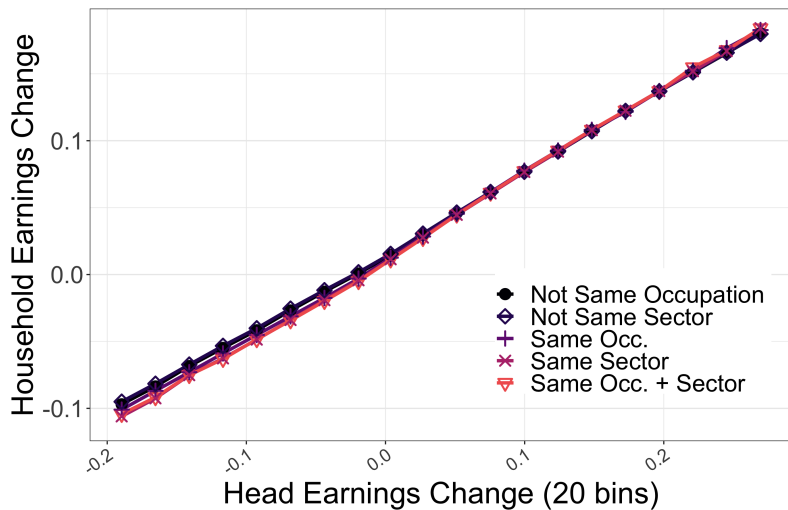
(i) Household Change: Step-by-Step

Household Change—Step-Wise Conditioning



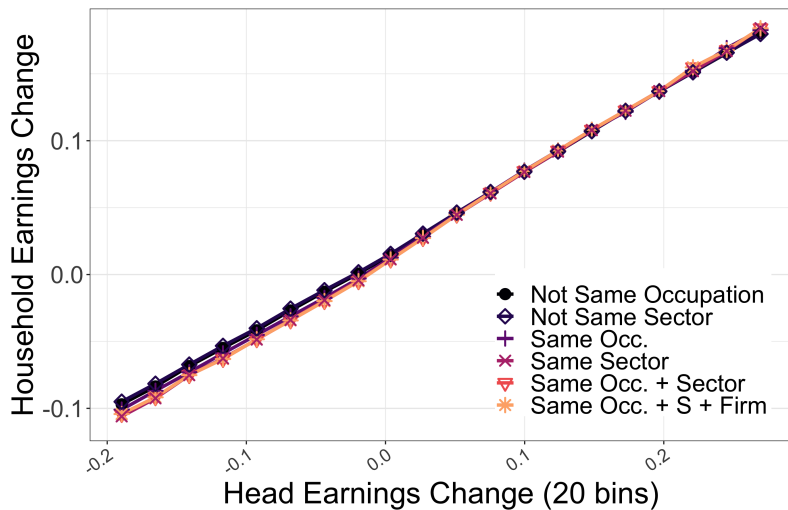
(i) Household Change: Step-by-Step

Household Change—Step-Wise Conditioning



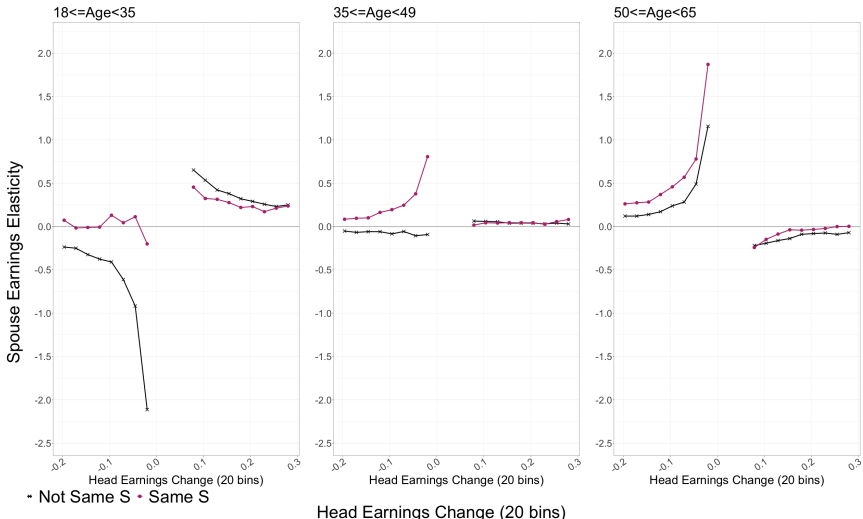
(i) Household Change: Step-by-Step

Household Change—Step-Wise Conditioning



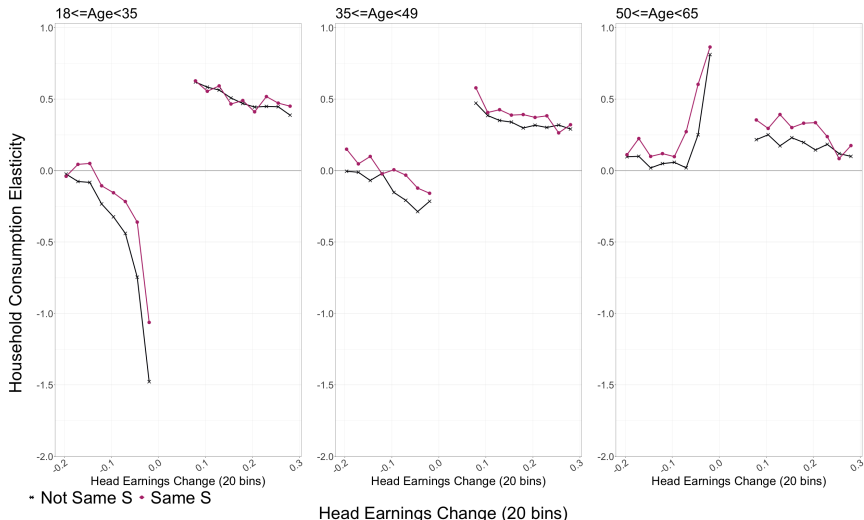
(i) Household Change: Step-by-Step

By Age Groups: Spousal Earnings



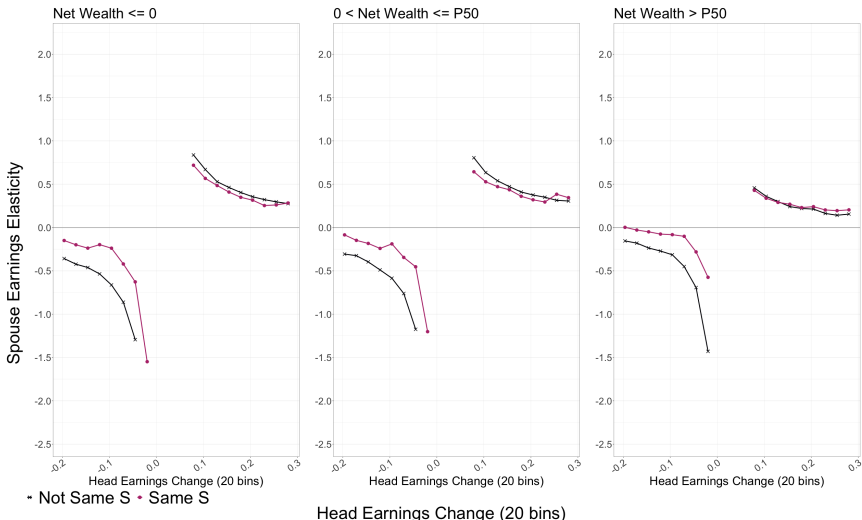
▶ Change

By Age Groups: Household Consumption



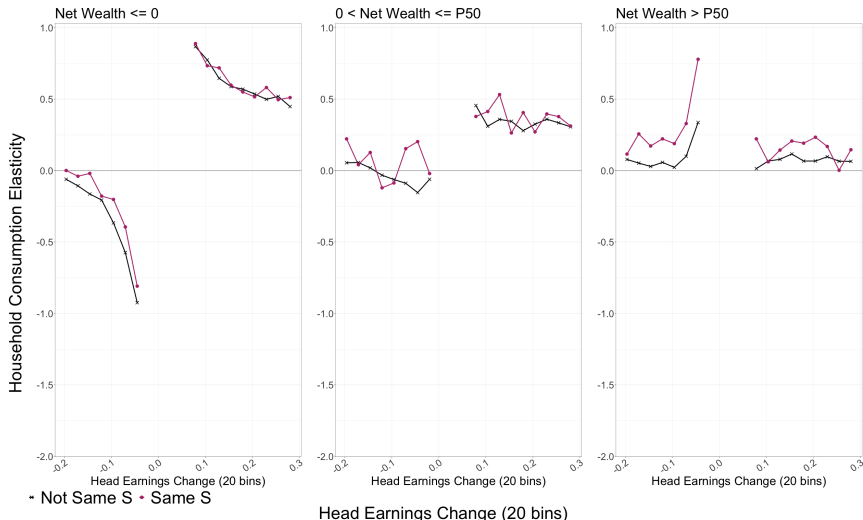
► Change

By **Wealth** Groups: Spousal Earnings



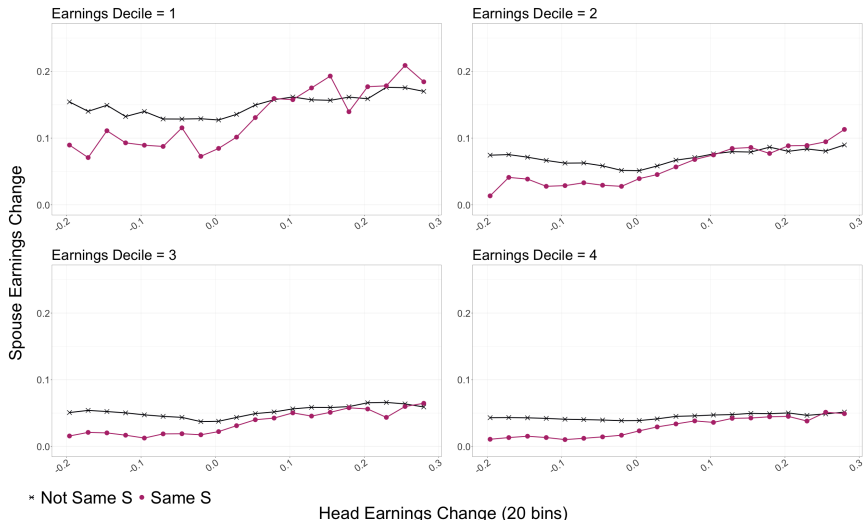
► Change

By **Wealth** Groups: Household Consumption



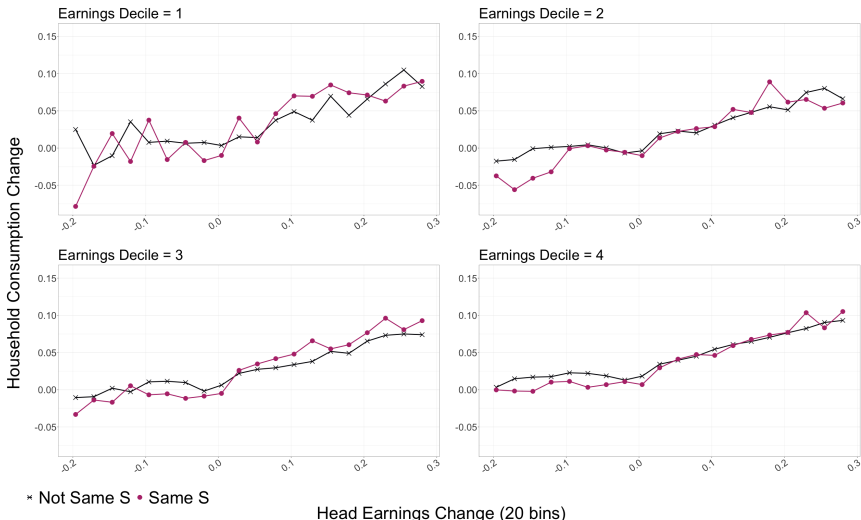
► Change

By **Recent Income** Groups: Spousal Earnings



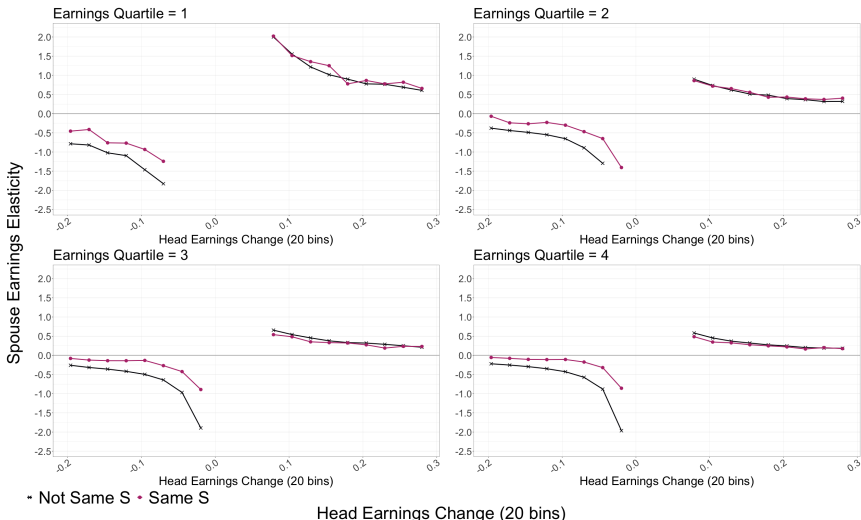
► Elasticity

By **Recent Income** Groups: Household Consumption



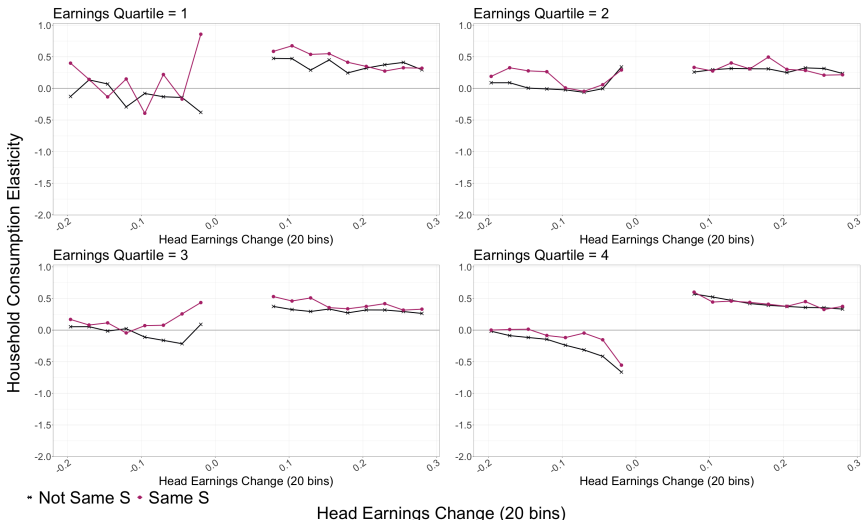
► Elasticity

By **Recent Income** Groups: Spousal Earnings



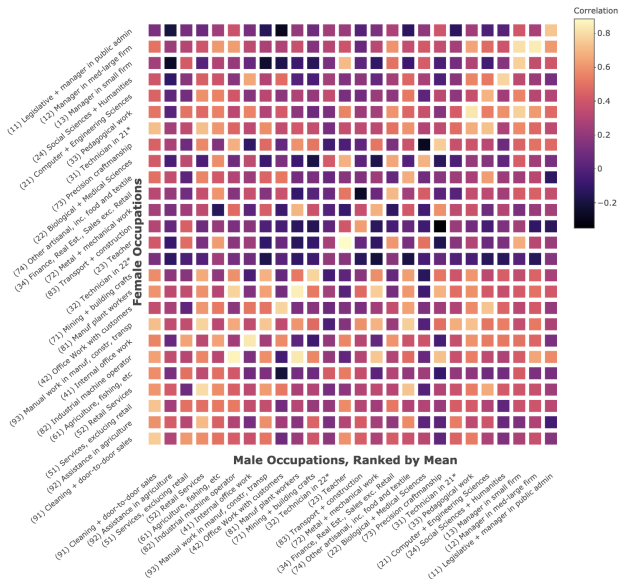
► Change

By **Recent Income** Groups: Household Consumption



► Change

676 Underlying Occupation Pairs



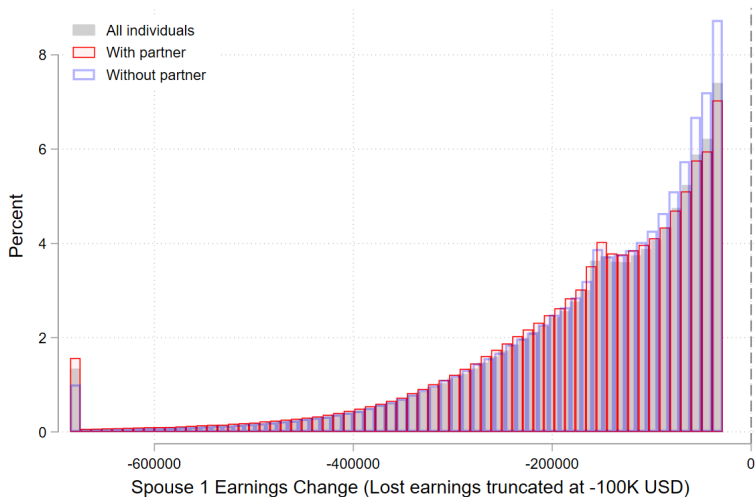
▶ Back to 2d

The Distribution of Everyone's Income Changes

Negative Extensive Changes, All Individuals

The Distribution of Everyone's Income Changes

Negative Extensive Changes, All Individuals



The Distribution of Everyone's Income Changes

Positive Extensive Changes, All Individuals

The Distribution of Everyone's Income Changes

Positive Extensive Changes, All Individuals

