

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

Christopher Busch^a Rocio Madera^b Fane Groes^c

^aLudwig Maximilian University Munich & CESifo

^bSouthern Methodist University

^cCopenhagen Business School

BANK OF SPAIN

June 15, 2022

Motivation

- ▶ Individuals face labor market risk → household earnings risk?
- ▶ 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)

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.

Motivation (cont.)

- ▶ Traditional focus:
 - ▶ HH-insurance: **out-of-LF female** reacting to male income shock
 - ▶ Measurement: individuals (males) or **stably married** HHs

But...

Motivation (cont.)

- ▶ Traditional focus:
 - ▶ HH-insurance: **out-of-LF female** reacting to male income shock
 - ▶ Measurement: individuals (males) or **stably married** HHs

But...

- ▶ Female labor force participation \uparrow 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

This Paper

Characterize earnings dynamics:

- ▶ in two-earner households
- ▶ with family formation and dissolution over the life-cycle
- ▶ in Denmark: high female LF participation throughout

Key role of

- ▶ **Correlation** of spouses' incomes (risk)
 - ▶ **Sorted** by: education, occupation, industry, firm, . . .

Implications for

- ▶ **Heterogeneity** of intra-household **insurance**

This Paper, more specifically

1. Analyze **co-movement** of earnings changes

This Paper, more specifically

1. Analyze **co-movement** of earnings changes
2. **Heterogeneity** by **labor market characteristics** of couples
 - ▶ More **similar** partners—→**worse** earnings stabilization
 - ▶ Matters within **different groups**: age, wealth

This Paper, more specifically

1. Analyze **co-movement** of earnings changes
2. **Heterogeneity** by **labor market characteristics** of couples
 - ▶ More **similar** partners—→**worse** earnings stabilization
 - ▶ Matters within **different groups**: age, wealth
3. Pass-through to household-level
 - ▶ Household income & **consumption**

This Paper, more specifically

1. Analyze **co-movement** of earnings changes
2. **Heterogeneity** by **labor market characteristics** of couples
 - ▶ More **similar** partners→**worse** earnings stabilization
 - ▶ Matters within **different groups**: age, wealth
3. Pass-through to household-level
 - ▶ Household income & **consumption**
4. Ongoing: Role of heterogeneity for life-cycle dynamics
 - ▶ Joint income process with singles/couples & marriage/divorce

Outline

Intro

Data

Joint Income Changes

Pass-Through to Household

A Joint Earnings Process

Amplification: Sorting Patterns

Summary and Outlook

Outline

Intro

Data

Joint Income Changes

Pass-Through to Household

A Joint Earnings Process

Amplification: Sorting Patterns

Summary and Outlook

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
- ▶ Benchmark analysis: **5.3** million couple-year observations

Data: Some Details

- ▶ Main data: IDA (Integrated Database for Labour Market Research)
 - ▶ BEF (Demographic characteristics and family linkages)
 - ▶ UDDA (Education)
 - ▶ AKM (Employment)
- ▶ Sample: age 18-59 with employment info
- ▶ Classifications
 - ▶ 2 Education groups: College and non-college (*High and Low*)
 - ▶ DISCO Classification: 2-digit level → 26 occupations
 - ▶ NACE Classification: Level 1 → 21 industries

Outline

Intro

Data

Joint Income Changes

Pass-Through to Household

A Joint Earnings Process

Amplification: Sorting Patterns

Summary and Outlook

Flexible Approach to Joint Income Changes

- Consider log earnings changes of head and spouse:

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

Flexible Approach to Joint Income Changes

- ▶ Consider log earnings changes of head and spouse:

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

- ▶ 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

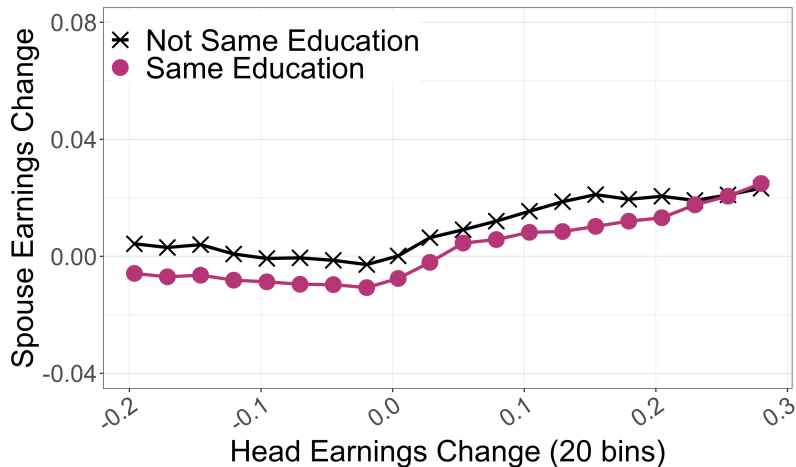
- Implied spousal earnings changes for each group

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

- 'Elasticities'

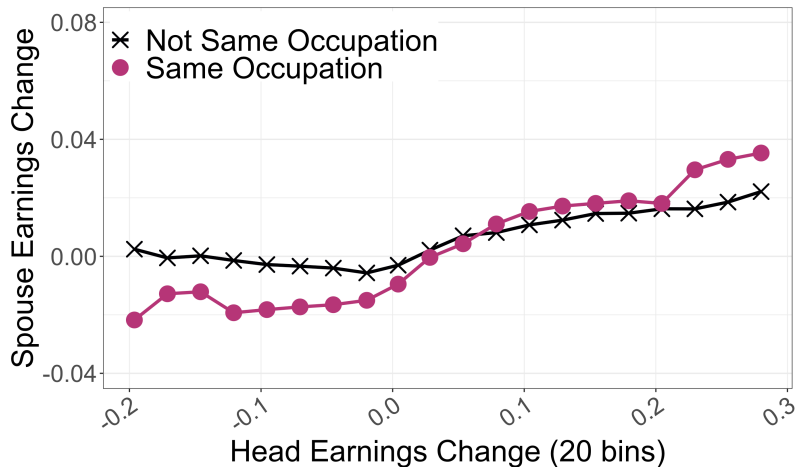
$$\hat{\epsilon}^{sp} = \frac{\hat{\Delta y}_t^{sp}}{\Delta y_t^{hd}} \quad (3)$$

Spousal Change—Education Groups



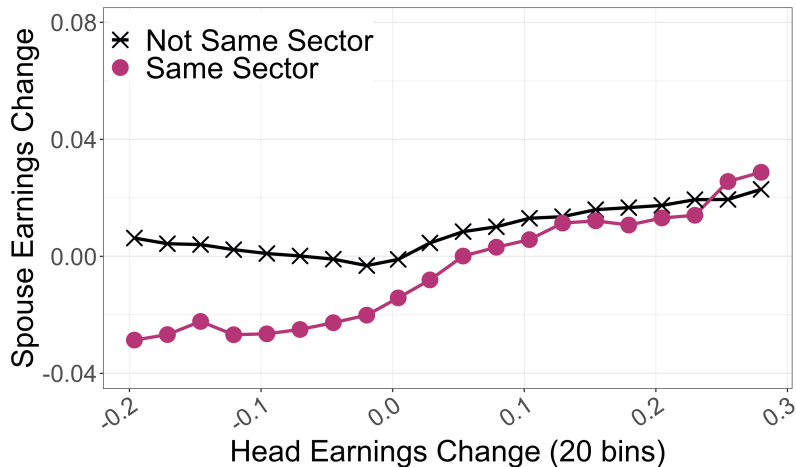
(a) Sorting by Education

Spousal Change—Occupation Groups



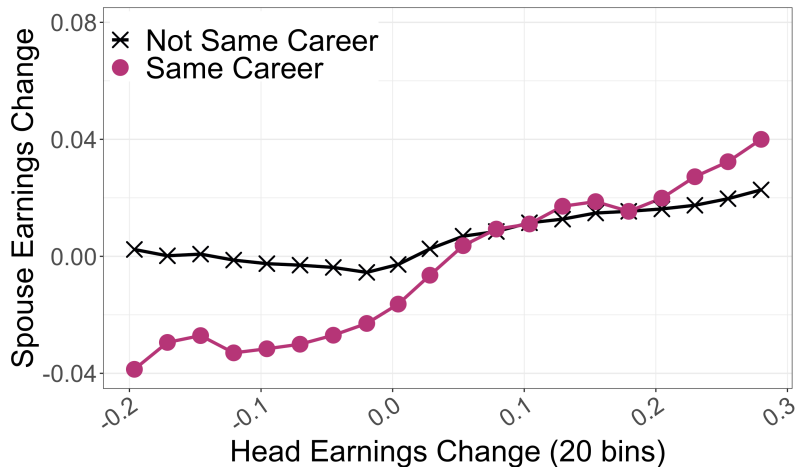
(b) Sorting by Occupation

Spousal Change—Sector Groups



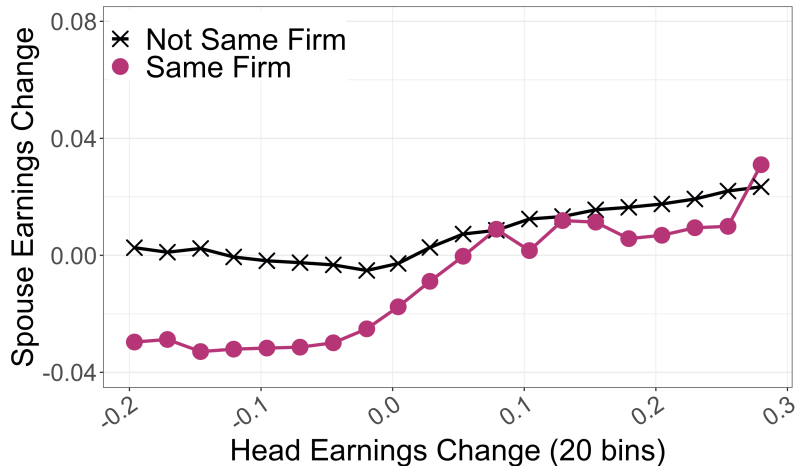
(c) Sorting by Sector

Spousal Change—Sector×Occupation Groups



(d) Sorting by Sector×Occupation

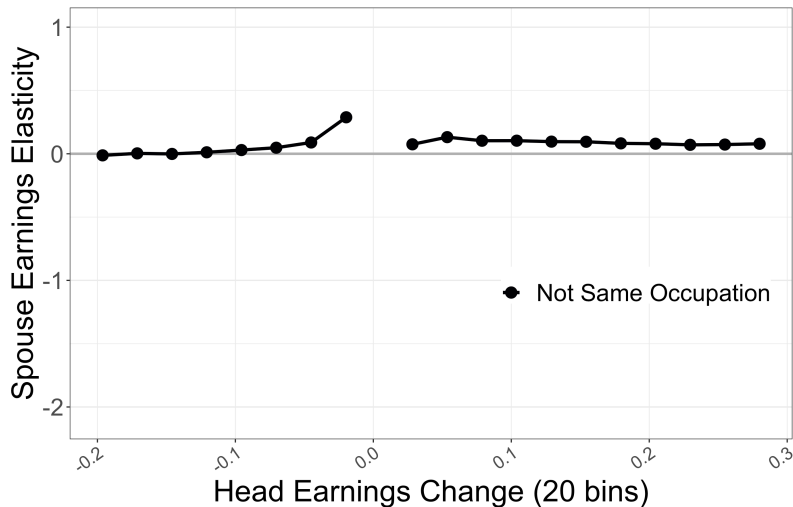
Spousal Change—Firm Groups



(e) Sorting by Firm

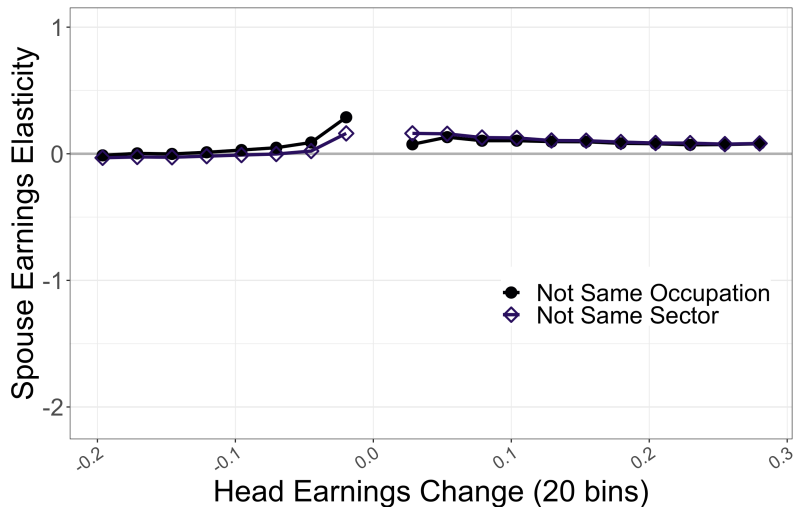
Implied Spousal Earnings **Elasticity**

Implied Spousal Earnings Elasticity



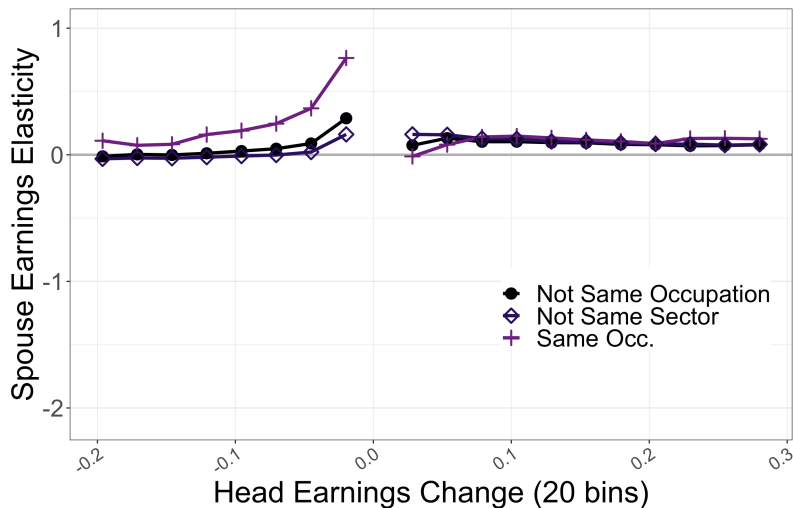
(f) Spousal Elasticity

Implied Spousal Earnings Elasticity



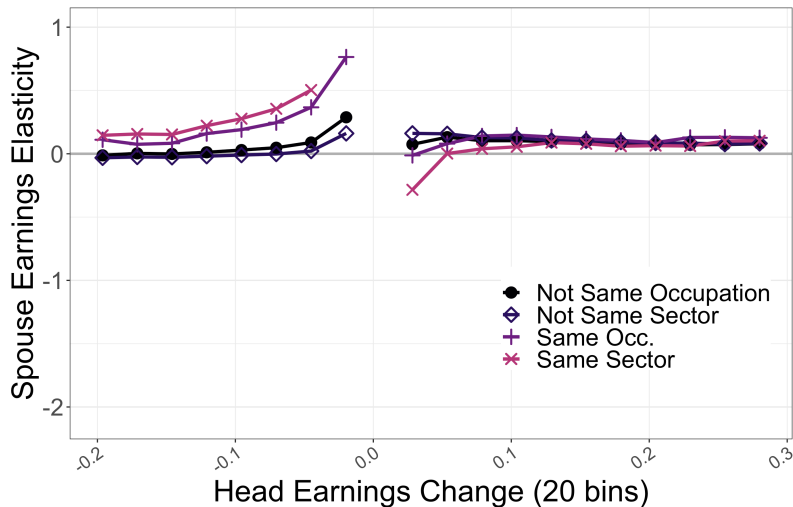
(f) Spousal Elasticity

Implied Spousal Earnings Elasticity



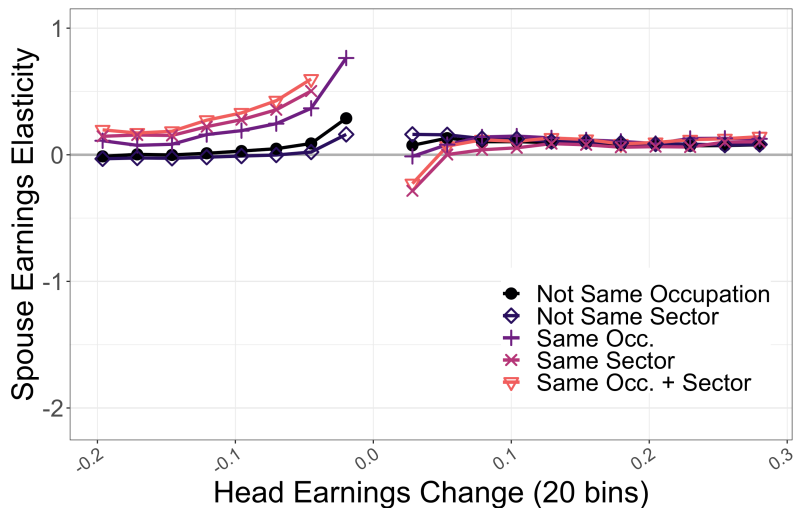
(f) Spousal Elasticity

Implied Spousal Earnings Elasticity



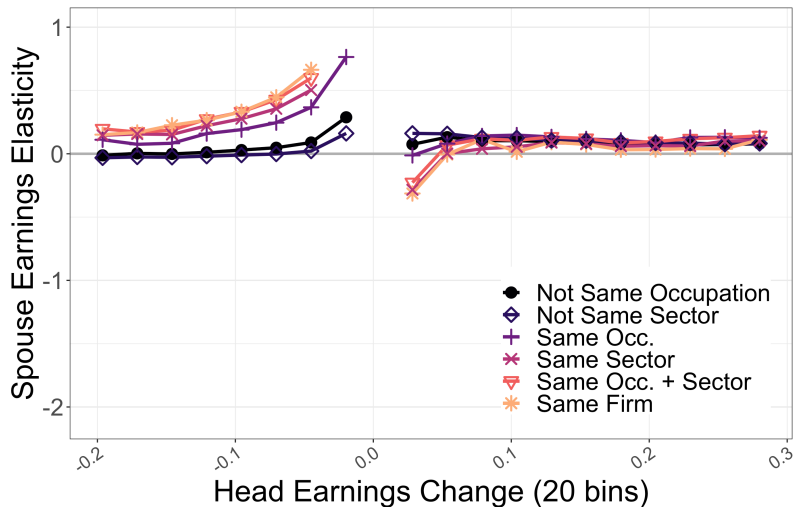
(f) Spousal Elasticity

Implied Spousal Earnings Elasticity



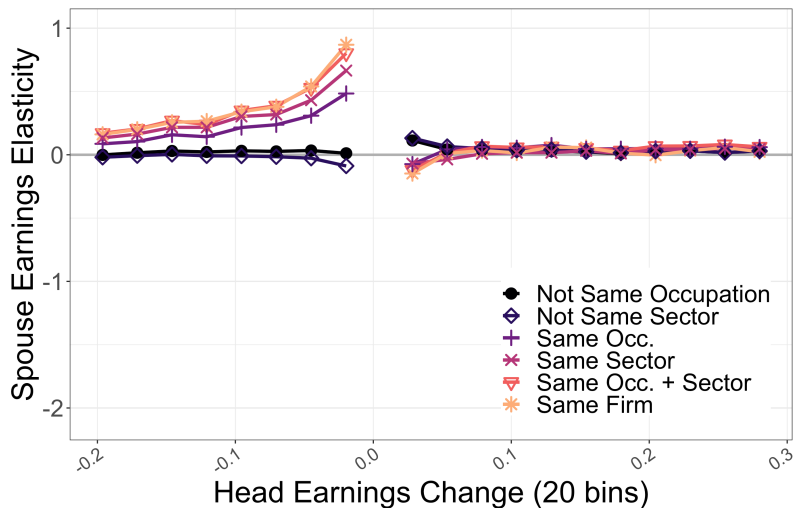
(f) Spousal Elasticity

Implied Spousal Earnings Elasticity



(f) Spousal Elasticity

Implied Spousal Earnings **Elasticity**—control age



(g) Spousal Elasticity

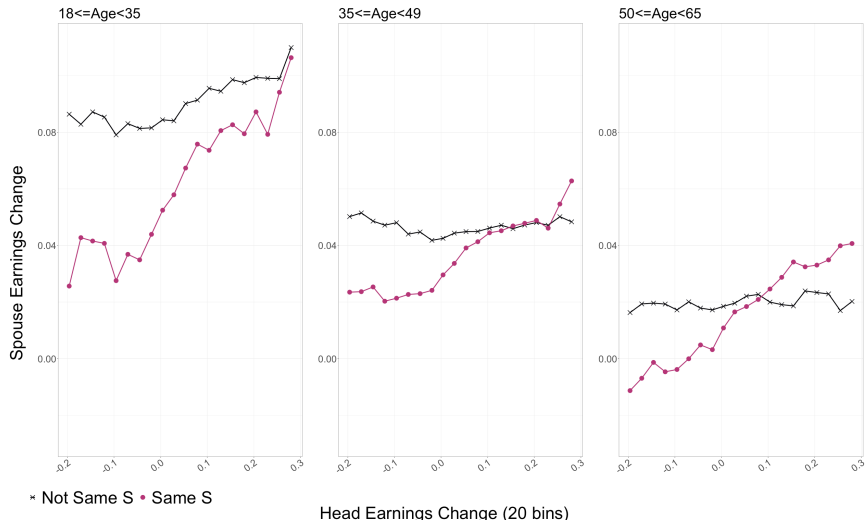
Other Sources of Heterogeneity

- ▶ Spousal labor income (adjustments) one channel of insurance
- ▶ Other channels: household savings; public transfers
 - ▶ Interaction?
 - ▶ Different relative importance for different groups?

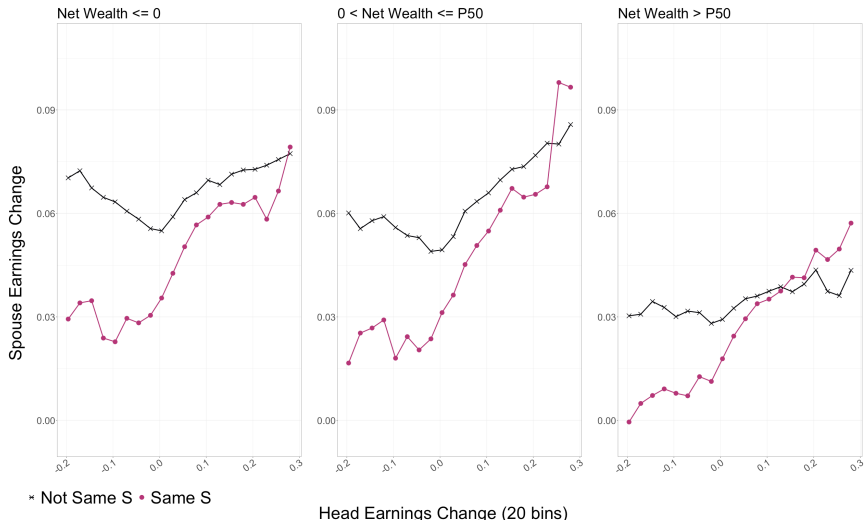
Other Sources of Heterogeneity

- ▶ Spousal labor income (adjustments) one channel of insurance
 - ▶ Other channels: household savings; public transfers
 - ▶ Interaction?
 - ▶ Different relative importance for different groups?
 - ▶ 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



By **Wealth** Groups: Spousal Earnings



Outline

Intro

Data

Joint Income Changes

Pass-Through to Household

A Joint Earnings Process

Amplification: Sorting Patterns

Summary and Outlook

Measures of *Pass-Through* to Household Earnings

- ▶ Head earnings change \rightarrow Spouse earnings change

Measures of *Pass-Through* to Household Earnings

- ▶ Head earnings change \rightarrow Household earnings change
- ▶ Combines **active** and **passive** intra-household insurance

Measures of *Pass-Through* to Household Earnings

- ▶ Head earnings change → Household earnings change
- ▶ Combines **active** and **passive** intra-household insurance
- ▶ Implied household earnings changes for each group

$$\hat{\Delta y}_t^{hh} = f(\Delta y_t^{hd}; \hat{\beta}) \quad (4)$$

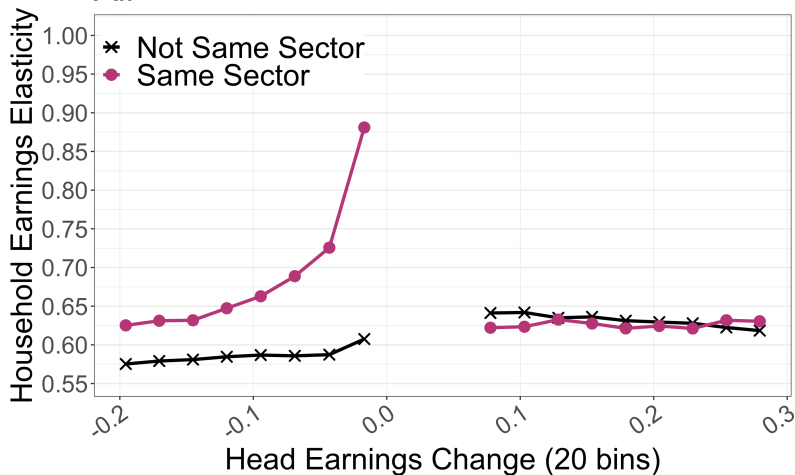
- ▶ 'Elasticities'

$$\hat{\epsilon}^{hh} = \frac{\hat{\Delta y}_t^{hh}}{\Delta y_t^{hd}} \quad (5)$$

Household Earnings Elasticity

Household Earnings Elasticity

All



(i) Household Elasticity: Sector

From Income To Consumption

$$C = Y - T - \Delta A \quad (6)$$

From Income To Consumption

$$C = Y - T - \Delta A \quad (6)$$

- ▶ 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)

Measures of Pass-Through to Consumption

- Implied household consumption changes for each group

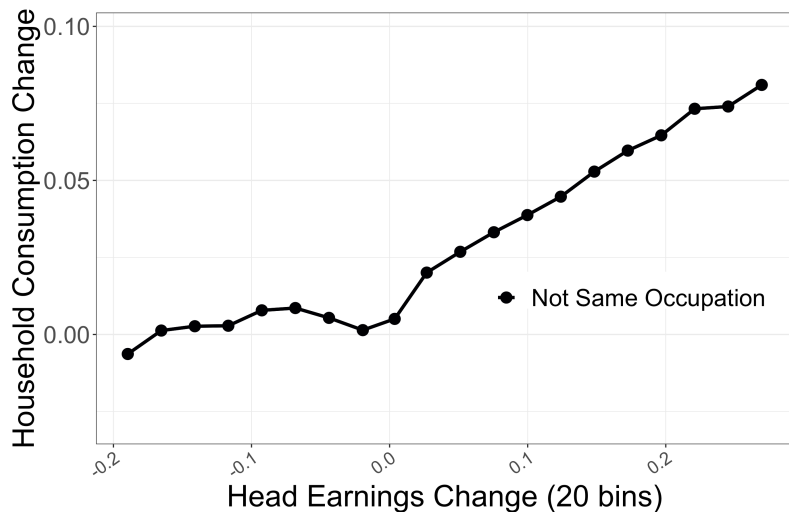
$$\Delta y_t^c = f(\Delta y_t^{hd}; \hat{\beta}) \quad (7)$$

- 'Elasticities'

$$\hat{\epsilon}^c = \frac{\Delta \hat{c}_t^{hh}}{\Delta y_t^{hd}} \quad (8)$$

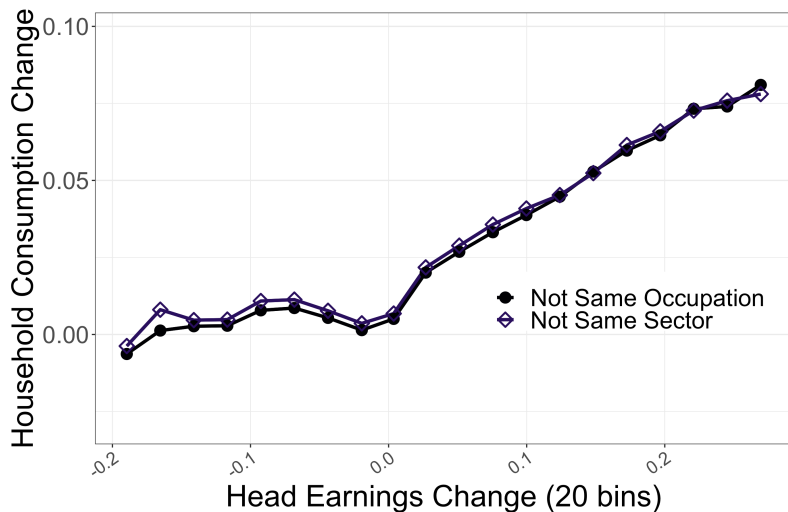
Household Consumption Change

Household Consumption Change



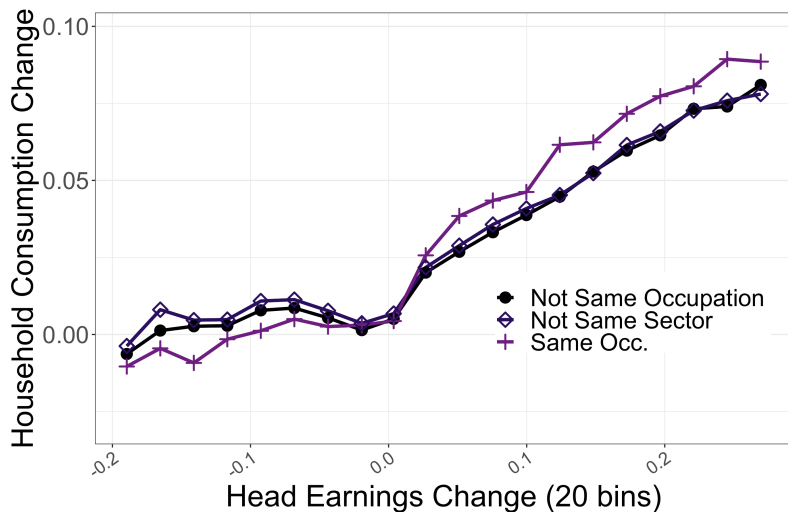
(j) Consumption Change: Step-by-Step

Household Consumption Change



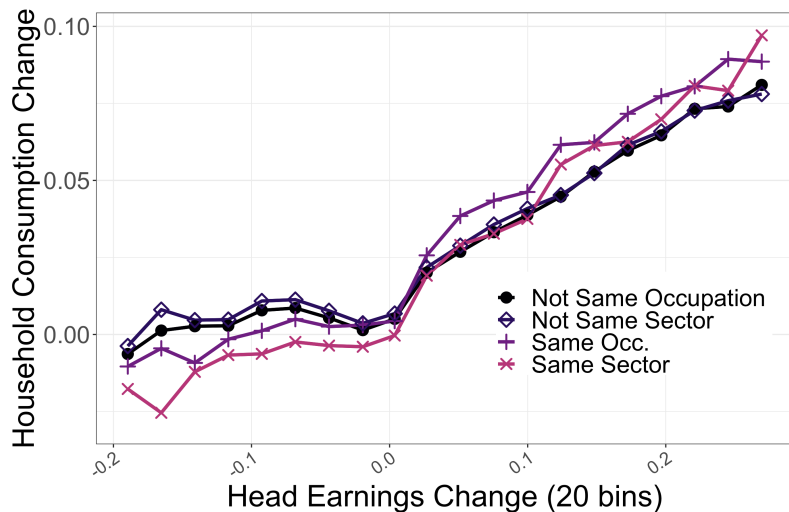
(j) Consumption Change: Step-by-Step

Household Consumption Change



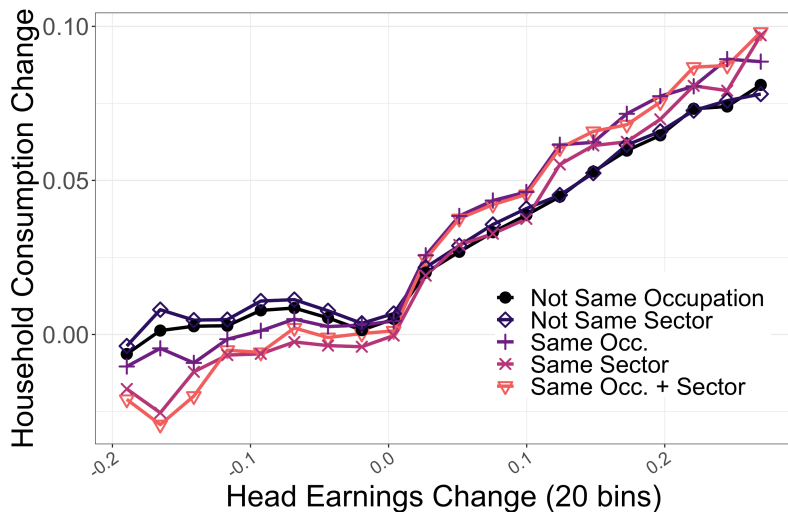
(j) Consumption Change: Step-by-Step

Household Consumption Change



(j) Consumption Change: Step-by-Step

Household Consumption Change



(j) Consumption Change: Step-by-Step

Outline

Intro

Data

Joint Income Changes

Pass-Through to Household

A Joint Earnings Process

Amplification: Sorting Patterns

Summary and Outlook

Income Dynamics: Adding Some Structure

Income Dynamics: Adding Some Structure

- ▶ Household earnings:

- ▶ Two earnings (processes)
- ▶ Correlated innovations
- ▶ Transitory-permanent decomposition

(e.g., Blundell, Pistaferri & Saporta-Eksten, AER'16)

- ▶ Used in quantitative models

(e.g., Attanasio, Low & Sánchez-Marcos, JEEA'05; Krueger & Wu, AEJ:M'21)

Income Dynamics: Adding Some Structure

- ▶ Household earnings:

- ▶ Two earnings (processes)
- ▶ Correlated innovations
- ▶ Transitory-permanent decomposition

(e.g., Blundell, Pistaferri & Saporta-Eksten, AER'16)

- ▶ Used in quantitative models

(e.g., Attanasio, Low & Sánchez-Marcos, JEEA'05; Krueger & Wu, AEJ:M'21)

- ▶ Allow for **heterogeneity** by couple-type!

A Simple (Joint) Income Process

A Simple (Joint) Income Process

$$\begin{aligned}y_t^i &= z_t^i + \epsilon_t^i \\z_t^i &= z_{t-1}^i + \eta_t^i\end{aligned}\tag{9}$$

- ▶ If in couple in t , ϵ_t^i & η_t^i **correlated**
- ▶ Covariances $\sigma_{\eta\eta}(\mathbf{s}_t)$ & $\sigma_{\epsilon\epsilon}(\mathbf{s}_t)$ depend on *sorting group* \mathbf{s}_t

A Simple (Joint) Income Process

$$\begin{aligned}y_t^i &= z_t^i + \varepsilon_t^i \\z_t^i &= z_{t-1}^i + \eta_t^i\end{aligned}\tag{9}$$

- ▶ If in couple in t , ε_t^i & η_t^i **correlated**
- ▶ Covariances $\sigma_{\eta\eta}(\mathbf{s}_t)$ & $\sigma_{\varepsilon\varepsilon}(\mathbf{s}_t)$ depend on *sorting group* \mathbf{s}_t
- Estimate on (co-)moments of *differences*:

$$\begin{aligned}\text{var}(\Delta y_t^i) &= \sigma_{\eta}^2 + 2\sigma_{\varepsilon}^2 \\ \text{cov}(\Delta y_t^i, \Delta y_{t+1}^i) &= -\sigma_{\varepsilon}^2 \\ \text{cov}(\Delta y_t^m, \Delta y_{t+1}^f | \mathbf{s}_t = \mathbf{s}; \mathbf{s}_{t+1} = \mathbf{s}') &= \sigma_{\eta\eta}(\mathbf{s}') + \sigma_{\varepsilon\varepsilon}(\mathbf{s}) + \sigma_{\varepsilon\varepsilon}(\mathbf{s}') \\ \text{cov}(\Delta y_t^m, \Delta y_{t+1}^f | \mathbf{s}_t = \mathbf{s}; \mathbf{s}_{t+1} = \mathbf{s}') &= -\sigma_{\varepsilon\varepsilon}(\mathbf{s}')\end{aligned}$$

Estimates

- ▶ Consider different versions for \mathbf{s} :
 1. none
 2. Education sorting: $\mathbf{s} \in \{\text{same educ}, \text{not same educ}\}$
 3. Occupation sorting: same occ vs. not same occ
 4. Sector, Career, Firm

Estimates

► Consider different versions for \mathbf{s} :

1. none
2. Education sorting: $\mathbf{s} \in \{\text{same educ}, \text{not same educ}\}$
3. Occupation sorting: same occ vs. not same occ
4. Sector, Career, Firm

→ Correlations (old version): $\rho_{\varepsilon} = -2.69\%$ and $\rho_{\eta} = 3.74\%$

► With educ sorting:

$$\rho_{\varepsilon}(\text{same}) = -4.42\%, \rho_{\varepsilon}(\text{not}) = -2.86\%,$$

$$\rho_{\eta}(\text{same}) = 5.14\%, \rho_{\eta}(\text{not}) = 2.28\%$$

► With occup sorting:

$$\rho_{\varepsilon}(\text{same}) = -3.73\%, \rho_{\varepsilon}(\text{not}) = -7.03\%,$$

$$\rho_{\eta}(\text{same}) = 10.45\%, \rho_{\eta}(\text{not}) = 3.21\%$$

Richer Income Process

- ▶ Process estimated on 'stable couples' not representative
 - Estimate individual male and female processes
 - ...using male and females data
 - ...together with process of 'marriage' and 'divorce'
- ▶ Resulting income dynamics:
 - ▶ Correlated shocks while in couple
 - ▶ Additional conditional income shock upon divorce

$$\begin{aligned}y_t^i &= z_t^i + \varepsilon_t^i + \delta_t^{\varepsilon i} \cdot 1\{\mathbf{div}_t = 1\} \\z_t^i &= z_{t-1}^i + \eta_t^i + \delta_t^{\eta i} \cdot 1\{\mathbf{div}_t = 1\}\end{aligned}\tag{10}$$

Richer Income Process

- ▶ Process estimated on 'stable couples' not representative
 - Estimate individual male and female processes
 - ...using male and females data
 - ...together with process of 'marriage' and 'divorce'
- ▶ Resulting income dynamics:
 - ▶ Correlated shocks while in couple
 - ▶ Additional conditional income shock upon divorce

$$\begin{aligned}y_t^i &= z_t^i + \varepsilon_t^i + \delta_t^{\varepsilon i} \cdot 1\{\text{div}_t = 1\} \\z_t^i &= z_{t-1}^i + \eta_t^i + \delta_t^{\eta i} \cdot 1\{\text{div}_t = 1\}\end{aligned}\tag{10}$$

- ▶ Marriage and divorce shocks orthogonal to income shocks
 - Separately identified!

Earnings dynamics and family changes

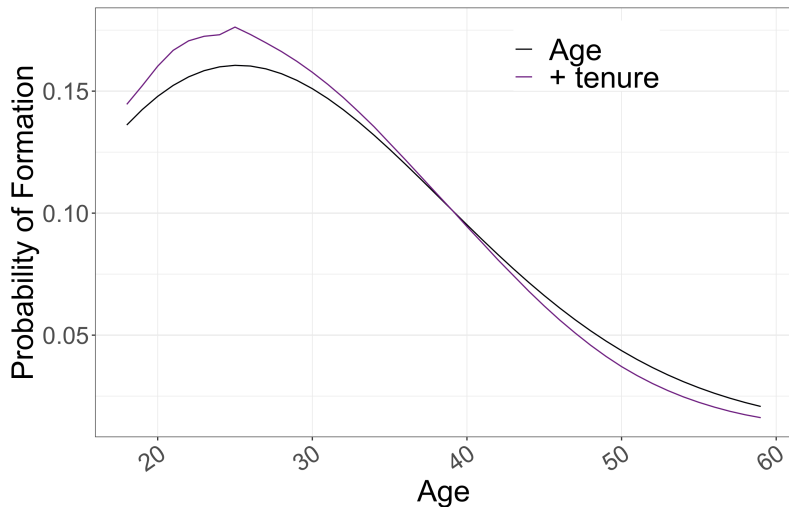
At every age, each single male and female can:

- ▶ form a couple with probability p^{form} : receive ε, η , correlated with her spouse's ε, η in the next period
- ▶ stay single: receive ε, η

At every age, each male and female in couples can:

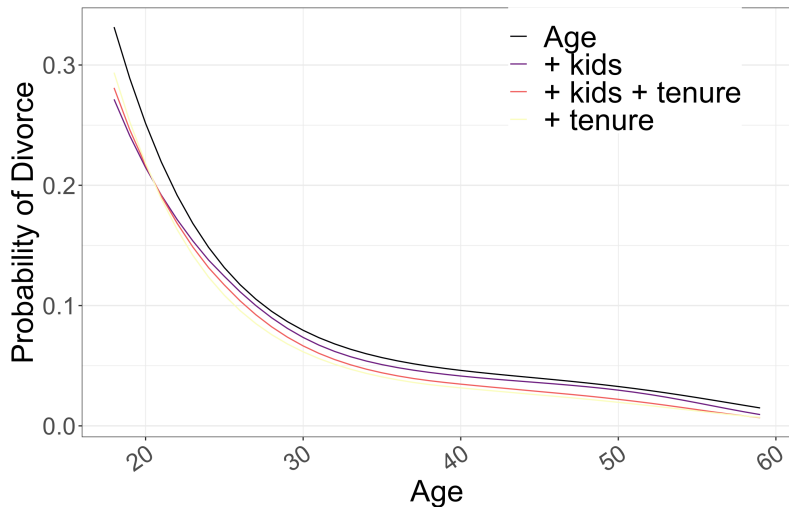
- ▶ divorce with probability p^{div} : receive ε, η , correlated with her (outgoing) spouse's ε, η AND $\delta\eta, \delta\varepsilon$
- ▶ stay in the couple: receive ε, η , correlated with her spouse's ε, η

Couple formation Process (p^{form})



(k) HH Formation

Divorce Process (p^{div})



(I) Divorce

Outline

Intro

Data

Joint Income Changes

Pass-Through to Household

A Joint Earnings Process

Amplification: Sorting Patterns

Summary and Outlook

Sorting Patterns

- One simple measure (Eika, Mogstad, Zafar, JPE'19):

$$s(a, b) = \frac{\overbrace{P(e^{sp} = a, e^{hd} = b)}^{\text{actual joint distribution}}}{\underbrace{P(e^{sp} = a)P(e^{hd} = b)}_{\text{random: product of marginals}}} \quad (11)$$

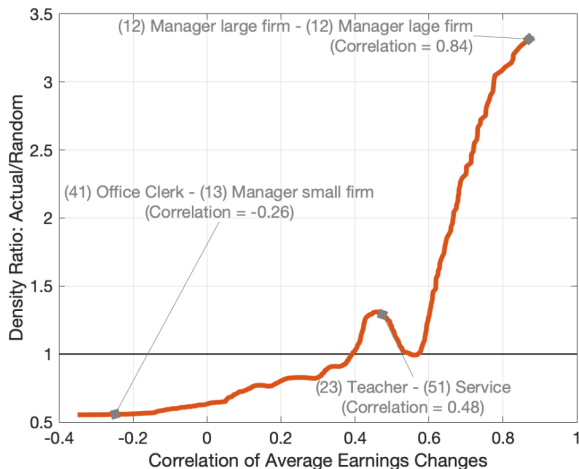
Sorting Patterns

- ▶ One simple measure (Eika, Mogstad, Zafar, JPE'19):

$$s(a, b) = \frac{\overbrace{P(e^{sp} = a, e^{hd} = b)}^{\text{actual joint distribution}}}{\underbrace{P(e^{sp} = a)P(e^{hd} = b)}_{\text{random: product of marginals}}} \quad (11)$$

- ▶ Couples positively sorted by characteristics
 - ▶ Education Sorting: $s(H, H) \approx 2$ and $s(L, L) \approx 1.2$
 - ▶ Occupation and Sector: ≈ 2.2
 - ⇒ Amplifies **aggregate** importance of above channels

Sorting Coefficient Across Occupation-Pairs



(m) Sorting Coefficient

Outline

Intro

Data

Joint Income Changes

Pass-Through to Household

A Joint Earnings Process

Amplification: Sorting Patterns

Summary and Outlook

Summary

- ▶ Full population Danish register data

Summary

- ▶ Full population Danish register data
- ▶ Study couples' income co-movement

Summary

- ▶ Full population Danish register data
- ▶ Study couples' income co-movement
- ▶ **Heterogeneity** of joint labor market **characteristics**
 - Matters for joint **earnings changes**
 - Holds within groups of age, wealth
 - Translates to household outcomes: **consumption**

Summary

- ▶ Full population Danish register data
- ▶ Study couples' income co-movement
- ▶ **Heterogeneity** of joint labor market **characteristics**
 - Matters for joint **earnings changes**
 - Holds within groups of age, wealth
 - Translates to household outcomes: **consumption**
- ▶ Couples **sort**:
 - ▶ Education, sector, occupation
 - ▶ Amplifies role of similarity for aggregate

Outlook: Current & Future Steps

- ▶ Life-cycle dynamics for different sorting groups
 - ▶ Use panel dimension of data
 - ▶ Divorce risk, marriage risk
- ▶ Decompose spousal labor supply vs. savings vs. transfers
- ▶ Extensive margin of adjustment
 - ▶ Subsample: spell data
- ▶ Source of heterogeneous reaction to policy

Next: Quantitative Model

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

Next: Quantitative Model

- ▶ 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:

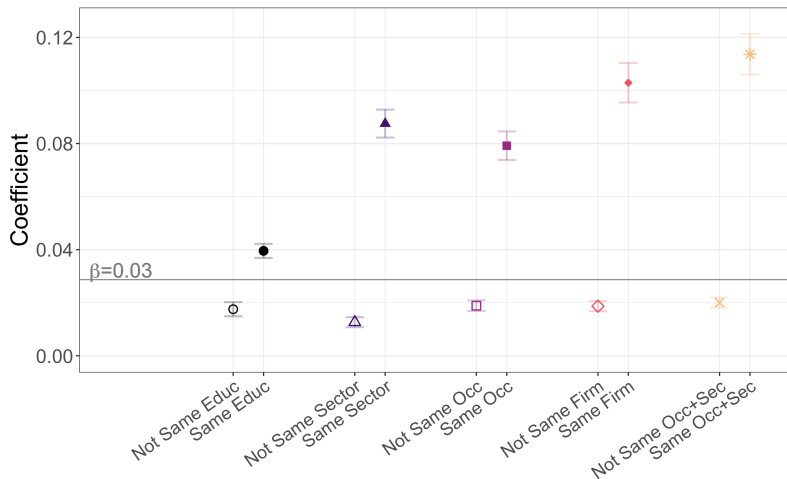
$$\Delta y_t^{sp} = \beta_0 + \tilde{f}(\Delta y_t^{hd}) + \mathbf{X}_t^{sp} \gamma + \mathbf{Y} \delta + u_{st} \quad (12)$$

with

$$\tilde{f}(\Delta y_t^{hd}) = (I_{o_t^{hd} \neq o_t^{sp}} \beta^{\text{not same x}} + I_{o_t^{hd} = o_t^{sp}} \beta^{\text{same x}}) \Delta y_t^{hd} \quad (13)$$

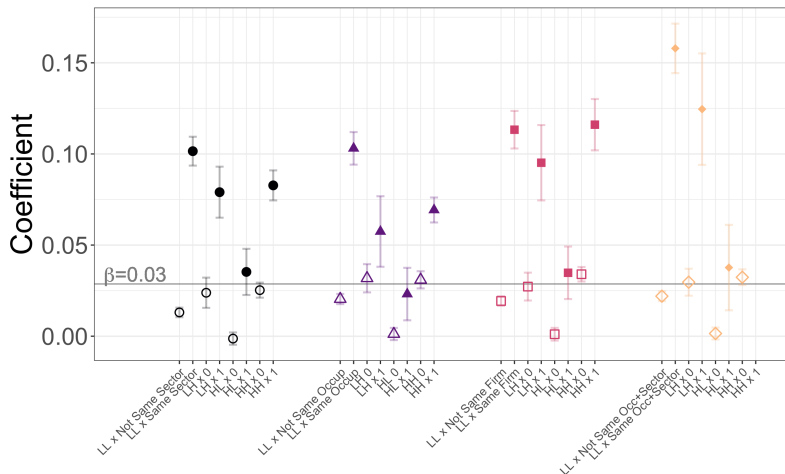
- \mathbf{X}_t^{sp} : age quadratic, education dummies, occupation dummies
- \mathbf{Y} : year dummies
- Δy_t^i : 1-year income change

Group-Specific Coefficients



(n) Elasticities for Different Sorting Vars

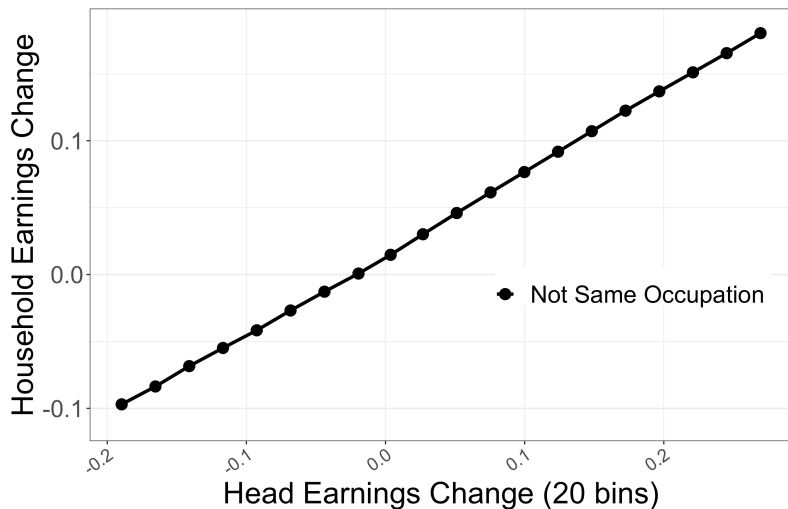
Group-Specific Coefficients: By Education Pairs



(o) Elasticities—Educ \otimes Sorting Var

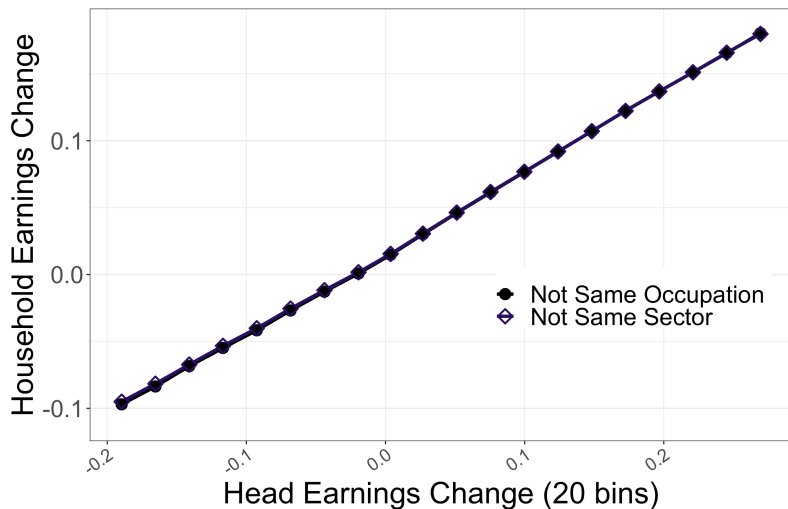
Household Change—Step-Wise Conditioning

Household Change—Step-Wise Conditioning



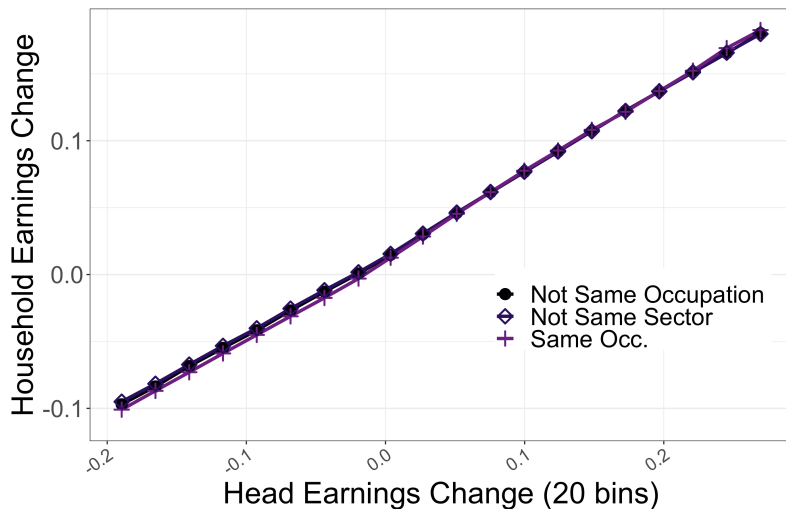
(p) Household Change: Step-by-Step

Household Change—Step-Wise Conditioning



(p) Household Change: Step-by-Step

Household Change—Step-Wise Conditioning



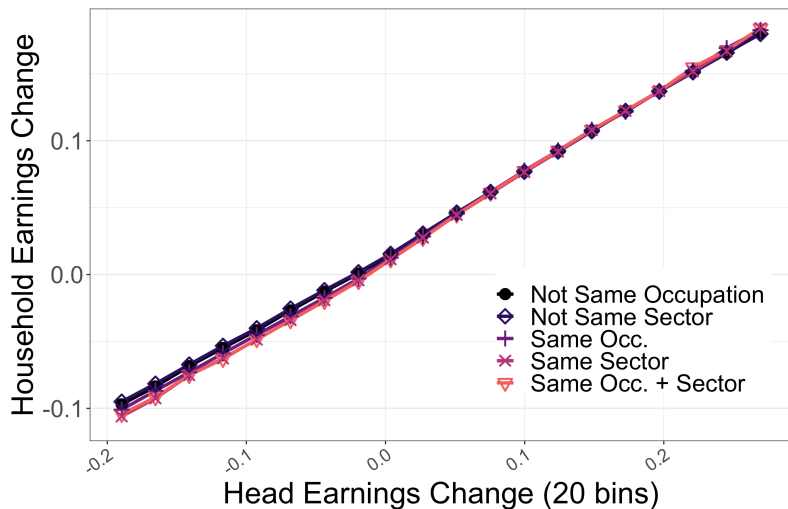
(p) Household Change: Step-by-Step

Household Change—Step-Wise Conditioning



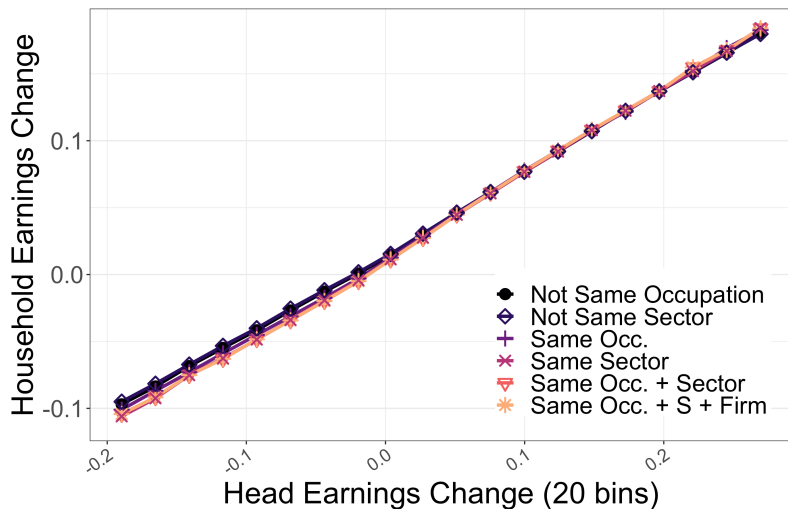
(p) Household Change: Step-by-Step

Household Change—Step-Wise Conditioning



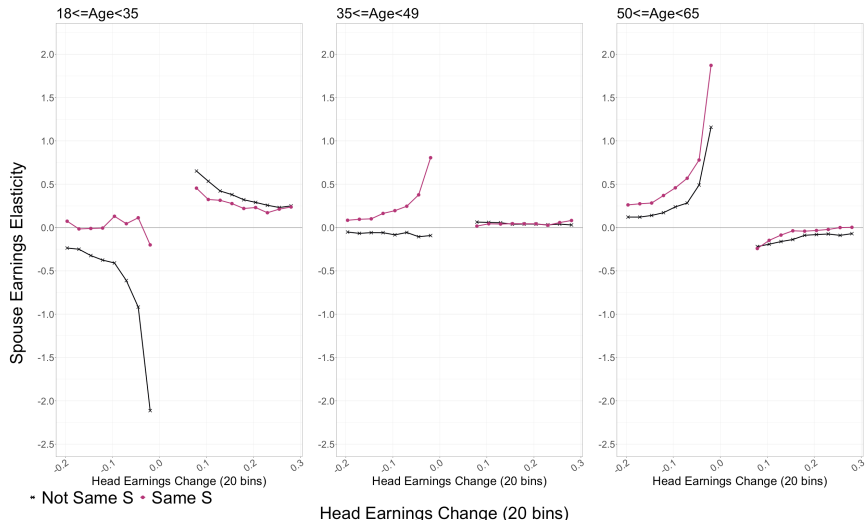
(p) Household Change: Step-by-Step

Household Change—Step-Wise Conditioning



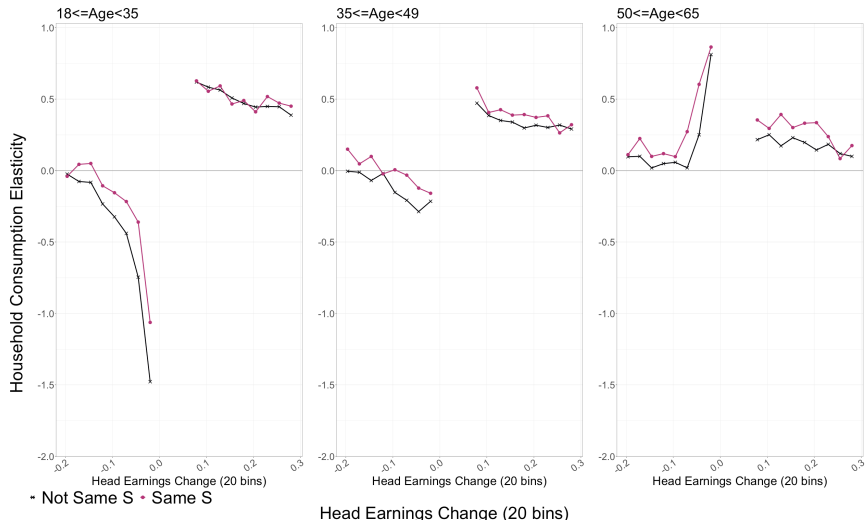
(p) Household Change: Step-by-Step

By **Age** Groups: Spousal Earnings



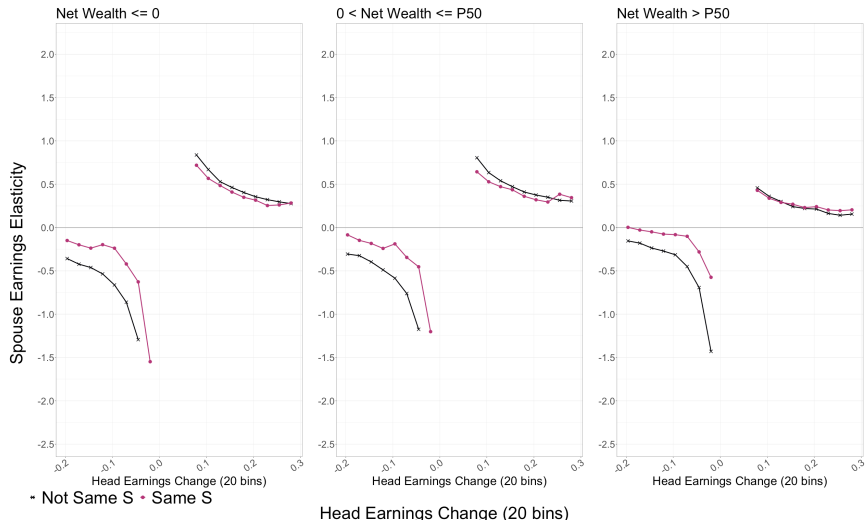
► Change

By **Age** Groups: Household Consumption



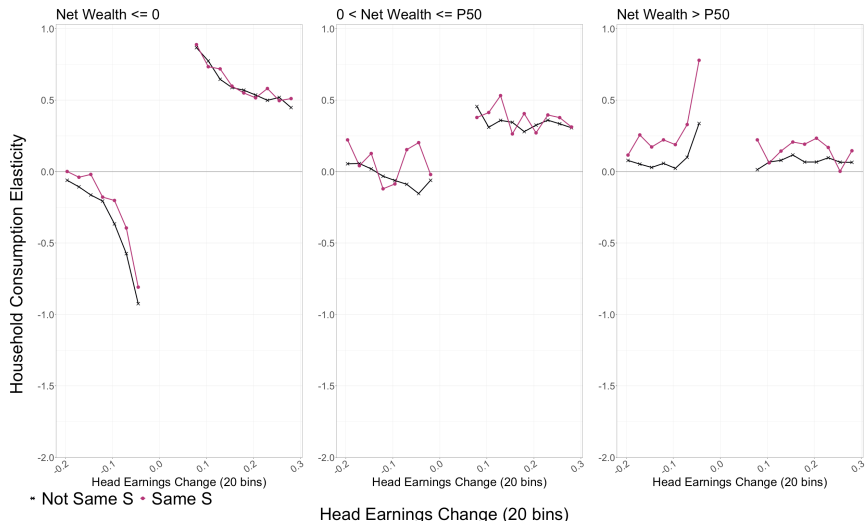
► Change

By **Wealth** Groups: Spousal Earnings



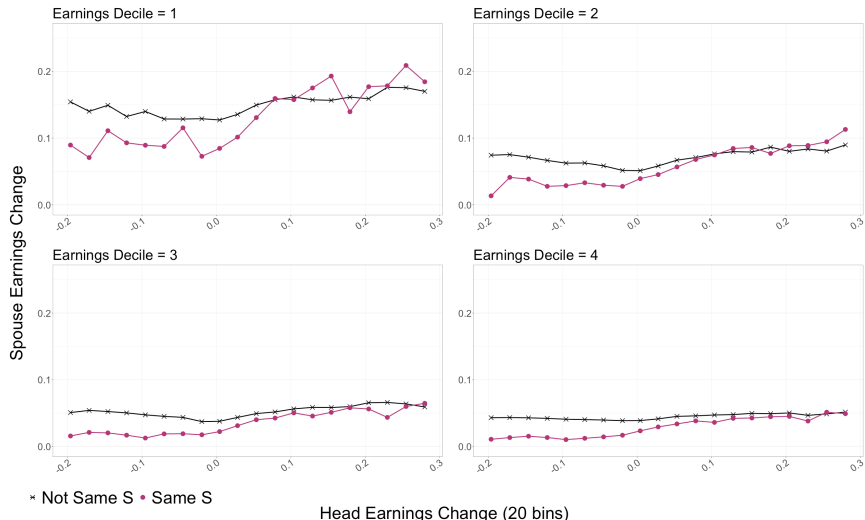
► Change

By **Wealth** Groups: Household Consumption

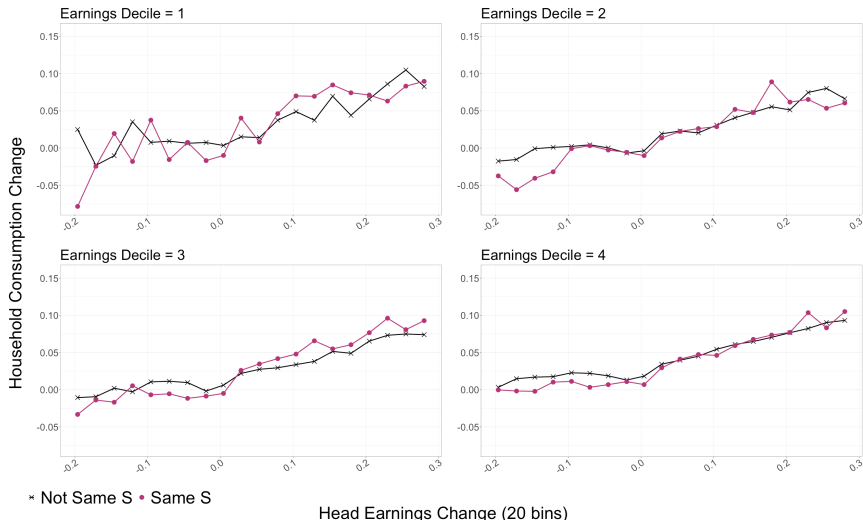


► Change

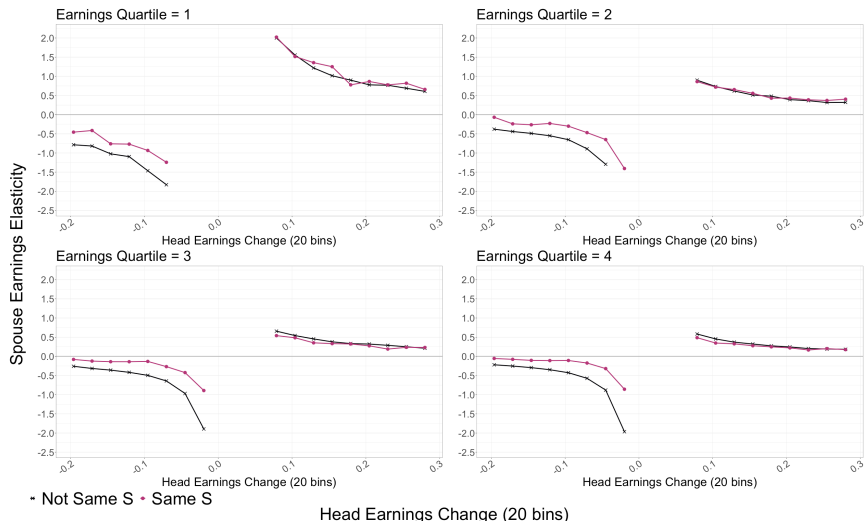
By **Recent Income** Groups: Spousal Earnings



By **Recent Income** Groups: Household Consumption

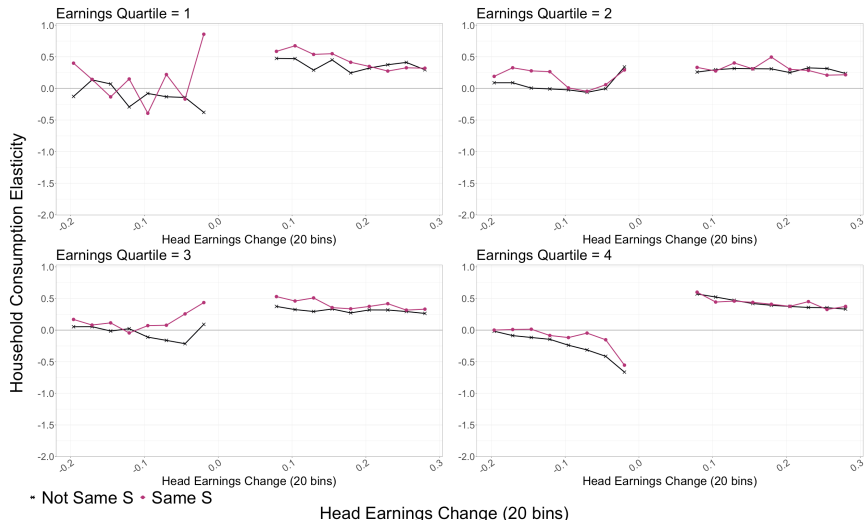


By **Recent Income** Groups: Spousal Earnings



► Change

By **Recent Income** Groups: Household Consumption



► Change

676 Underlying Occupation Pairs

