Who Suffers from the COVID-19 Shock? Labor Market Heterogeneity and Welfare Consequences in Japan

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Picture: https://uroweb.org/covid19-resources-for-urologists/

Intro: COVID-19 Shock and Labor Market in Japan

- Aggregate impacts: Not as large as in the US or others
  - Decline in employment in Mar.- Apr. 2020 : US (14%) v.s. Japan (1%)

- Even with that aggregate magnitude (not as large as for the US), we expected large **heterogeneity in vulnerability**
  - Employment type (contingent workers)
  - Sector (with face-to-face services)
  - Occupation (without flexibility in teleworking)
  - Demographics (gender, age,…)

- **This paper: Short-run** heterogeneous impacts during the initial months after the onset of the COVID-19 crisis

Notes: FRED, LFS

What we do: Descriptive Evidence + Welfare Consequences

- Empirical facts about the COVID-19 shock in labor market
  - Changes in employment by employment types, gender, sector, occupation, age
  - Changes in earnings by employment types and sector

- Quantitative life-cycle model for welfare consequences
  - **Heterogeneity** by age, gender, employment type, education level, occupation, and sector
  - Household type distribution **exogenously fixed** to match to data

- **Preview of the results: Shocks are amplified for those who earned less prior to the crisis**
  - **Contingent, (young), female workers in social sectors and non-flexible occupations**

Related Literature (never exhaustive)

- **Heterogeneous impacts of COVID-19 shock** (Inequality and COVID-19 shock):
  - **US:** Dingel and Neiman (2020), Alon, Doepke, Olmstead-Rumsey, and Tertilt (2020), …
  - **UK:** Blundell, Costa Dias, Joyce, and Xu (2020)
  - **Germany:** Irlacher and Koch (2020)
  - **Italy:** Brunori, Maitino, Ravagli, and Sciclone (2020)
  - **Canada:** Gallacher and Hossain (2020)
  - **China:** Qiana and Fan (2020)

→ **This paper: Japan**

- **COVID-19 shock to Japanese economy:**
  - Consumption response: Watanabe and Omori (2020)
  - Job vacancy: Fukui, Kikuchi, and Goalist (2020), Kawata (2020)
  - SMEs: Kawaguchi, Kodama, and Tanaka (2020)
  - Entry/exit: Miyakawa, Oikawa, Ueda (2020)

→ **This paper: Heterogeneous impacts in labor market**

1. Empirical Facts
2. Quantitative Analysis
3. Conclusion

Data Source

- Employment from Labor Force Survey (LFS, 労働力調査)
  - By Age / Employment type
  - By Sector / Occupation

- Earnings from Monthly Labor Survey (MLS, 毎月勤労統計調査)
  - Contractual Monthly Earnings (決まって支給する給与)
    - By Employment type / Sector

- Joint distribution of many dimensions from Employment Status Survey conducted in 2017 (ESS, 就業構造基本調査)

Classification in Sector: Ordinary or Social

- Follow Kaplan, Moll, and Violante (2020)
- Classify 2 digit JSIC industries as Ordinary or Social

Ordinary (emp. share 48%)

- Agriculture, forestry and fishing
- Mining
- Construction
- Mining
- Manufacturing
- Utilities
- Information and communication
- Wholesale Trade
- Finance and Insurance

Social (emp. share 52%)

- Transport (except for commercial transport)
- Retail service
- Accommodations, eating, drinking services
- Educational Services
- Living-related services
- Medical, healthcare and welfare services

Notes: Authors' definition (manually). The listing here is not exhaustive. See the paper for details.

Classification in Occupation: Flexible or Non-flexible

- Follow Mongey, Pilossoph, and Weinberg (2020)
- Classify 1 digit JSOC occupations as Flexible or Non-flexible

Flexible (emp. share 60%)

- Management
- Office
- Professional and technical
- Sales

Non-flexible (emp. share 40%)

- Agriculture
- Services
- Transport and machine operators
- Carrying, cleaning, and packaging
- Security
- Manufacturing
- Construction and mining

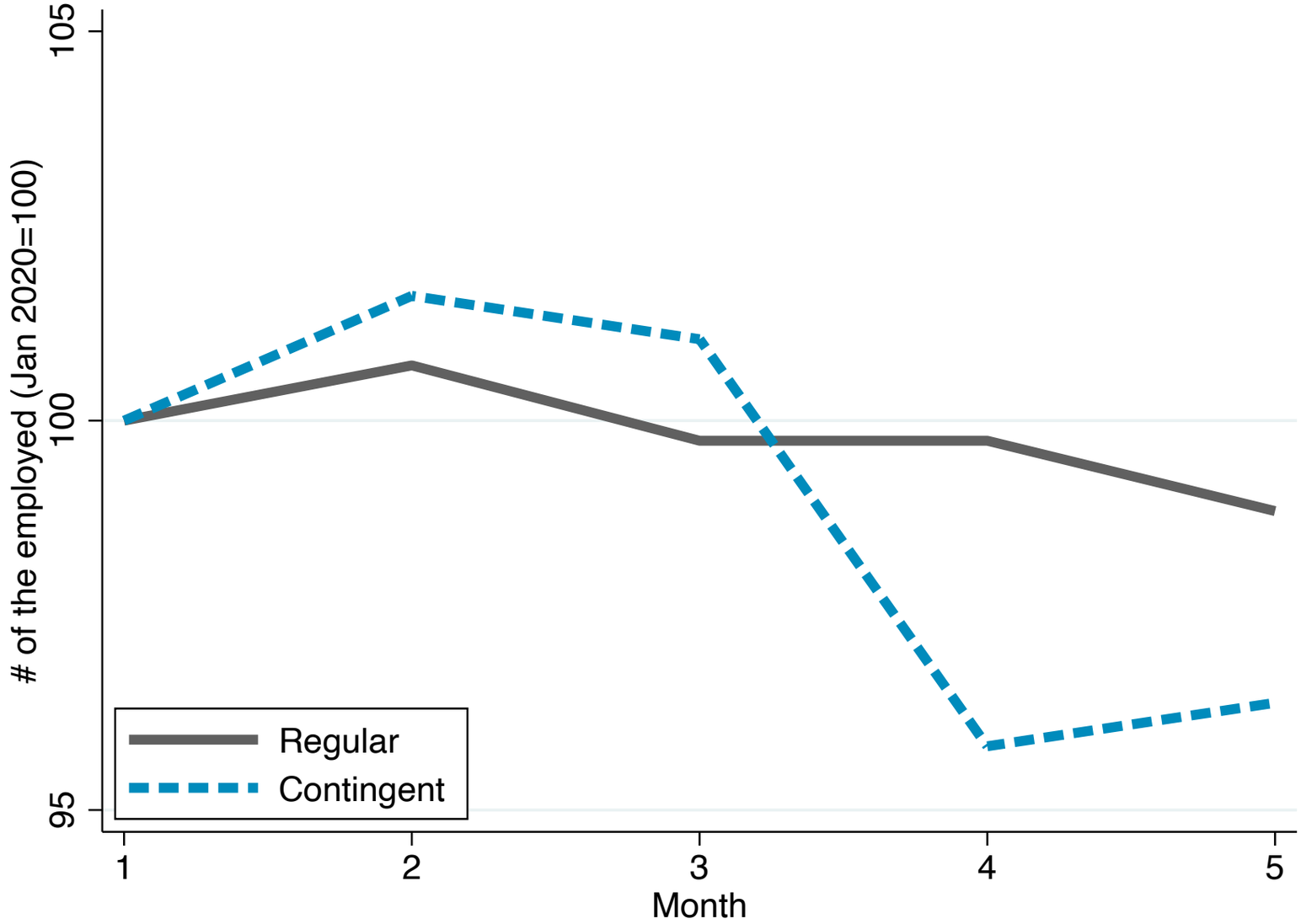
Notes: Authors' calculation based on O*NET and MPW 2020. See the paper for details.

Change in Employment

Employment Declines More for Contingent Worker

Changes in Employment by Employment Type

Jan 2020 =100, not seasonally adjusted

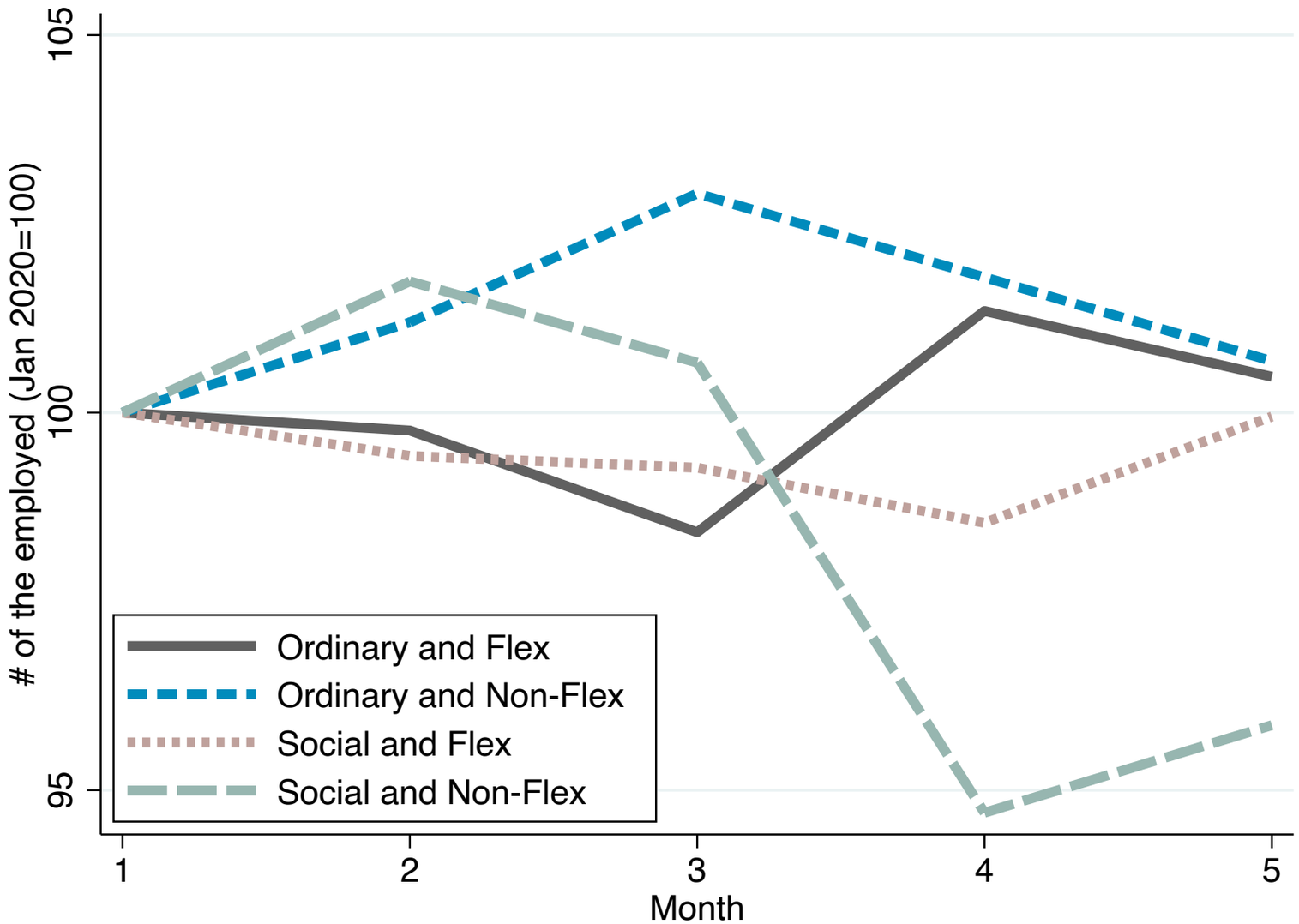


Source: LFS

Employment Declines More for Social/Non-Flex workers

Changes in Employment by Sector and Occupation Type

Jan 2020 =100, not seasonally adjusted

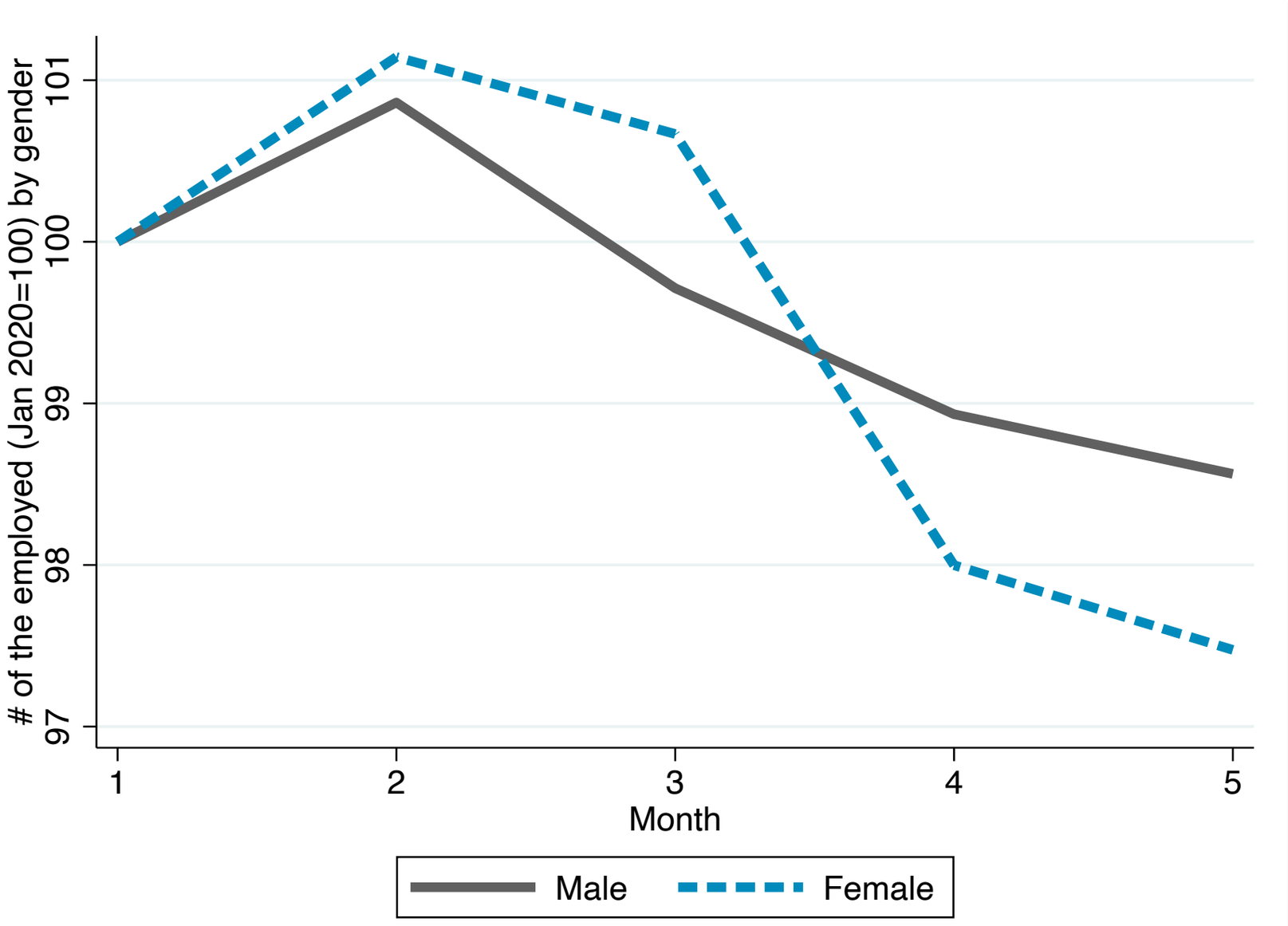


Source: LFS

Employment Declines More for Female Workers …

Changes in Employment by Gender

Jan 2020 =100, not seasonally adjusted

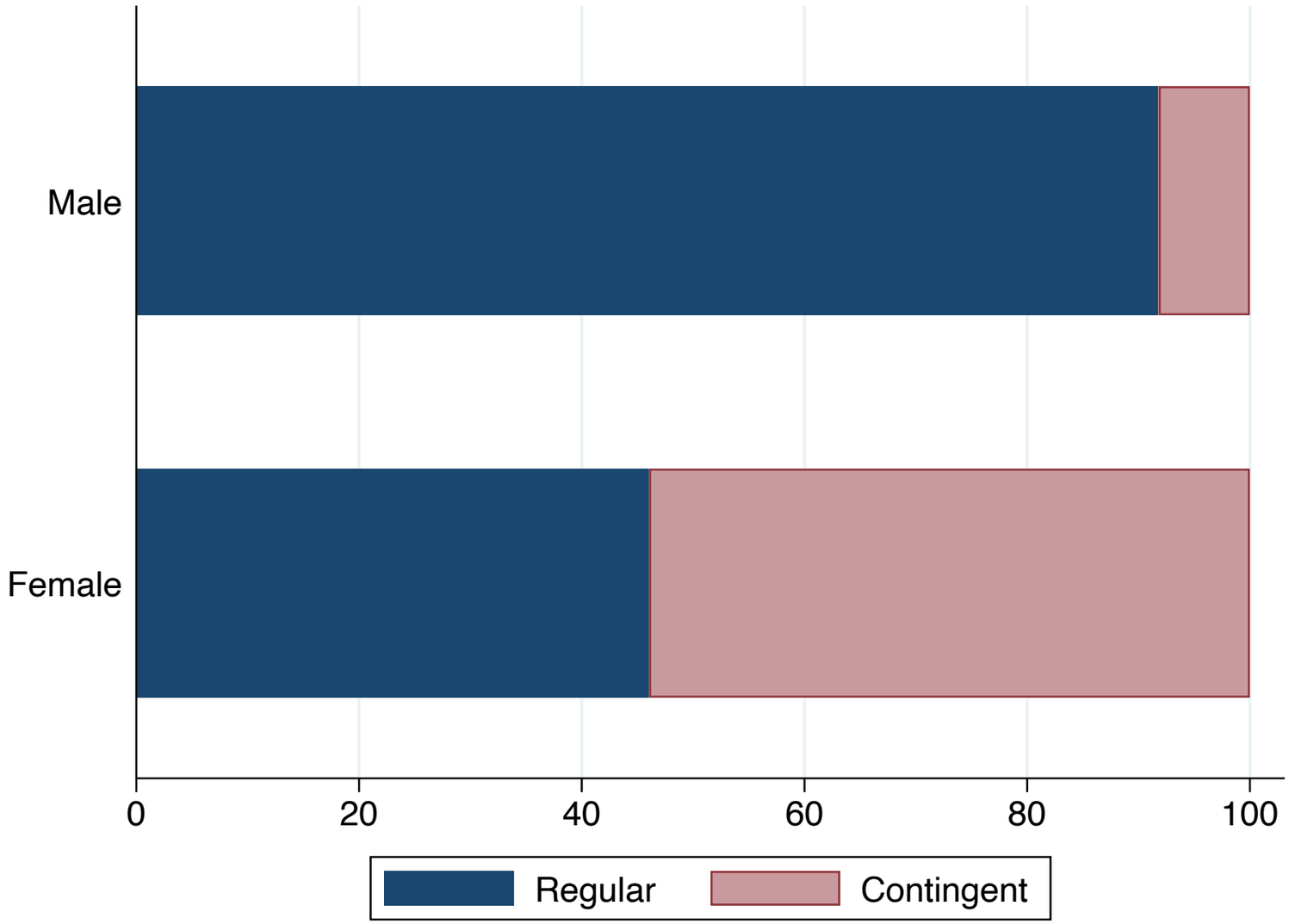


Source: LFS

… because Females are More in Contingent

Employment Type Distribution by Gender

%, 2017

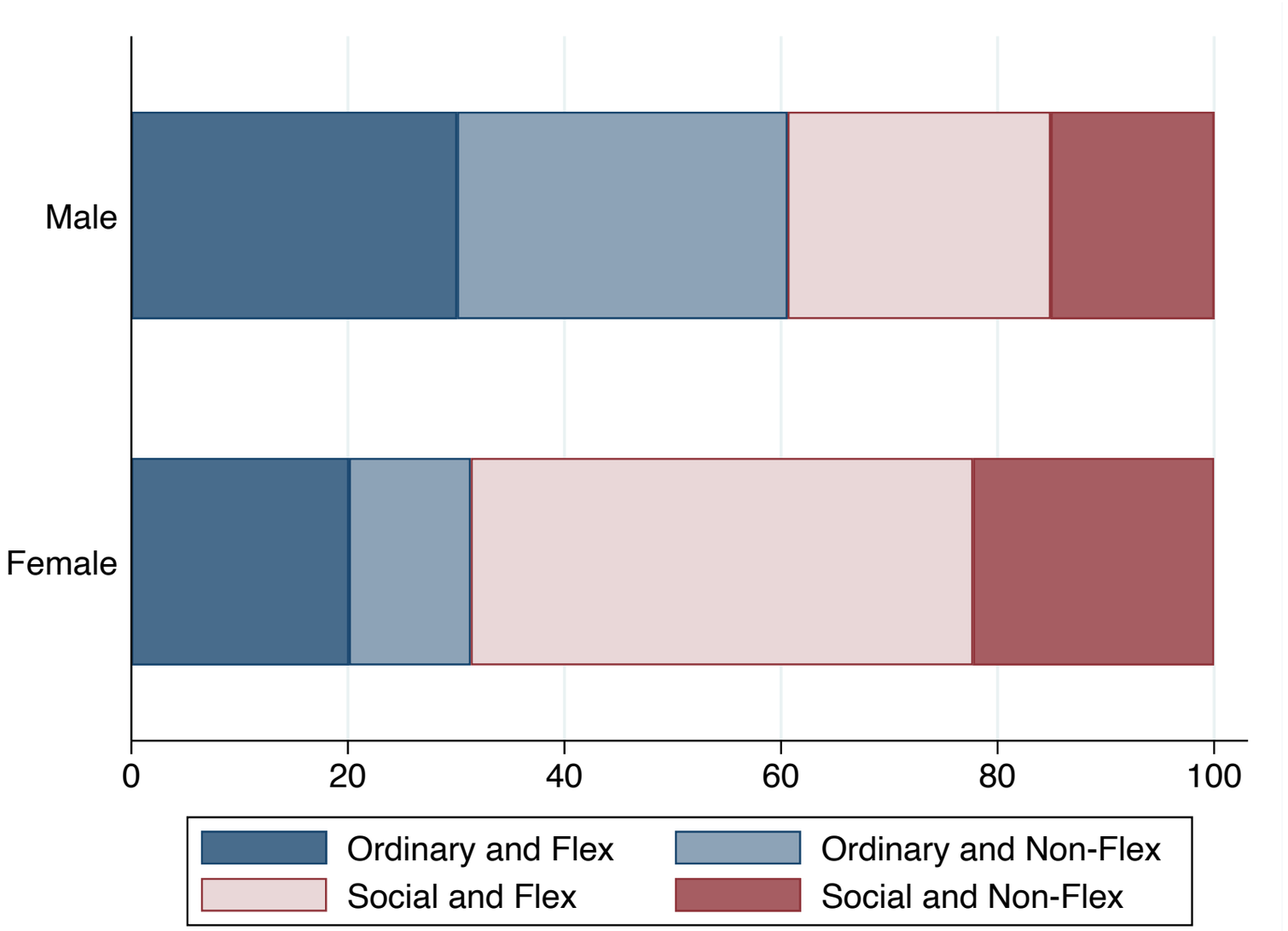


Source: ESS 2017

… and because Females are More in Social/Non-Flex

Sector and Occupation Distribution by Gender

%, 2017

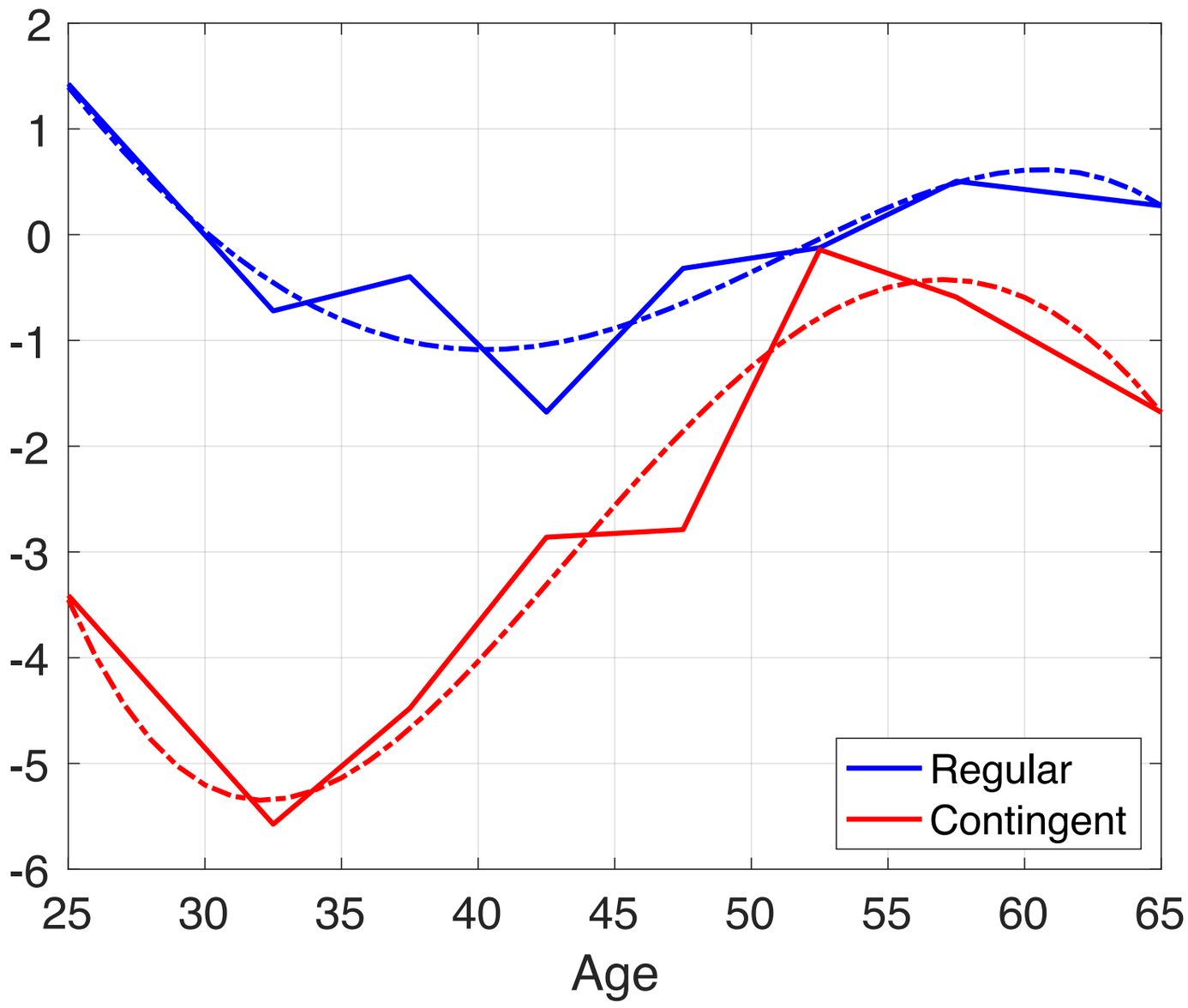


Source: ESS 2017

Younger generations experienced larger decline in employment

Change in Employment by Age and Employment Type

%, 2020 Q1 v.s. 2020 Q2, seasonally adjusted



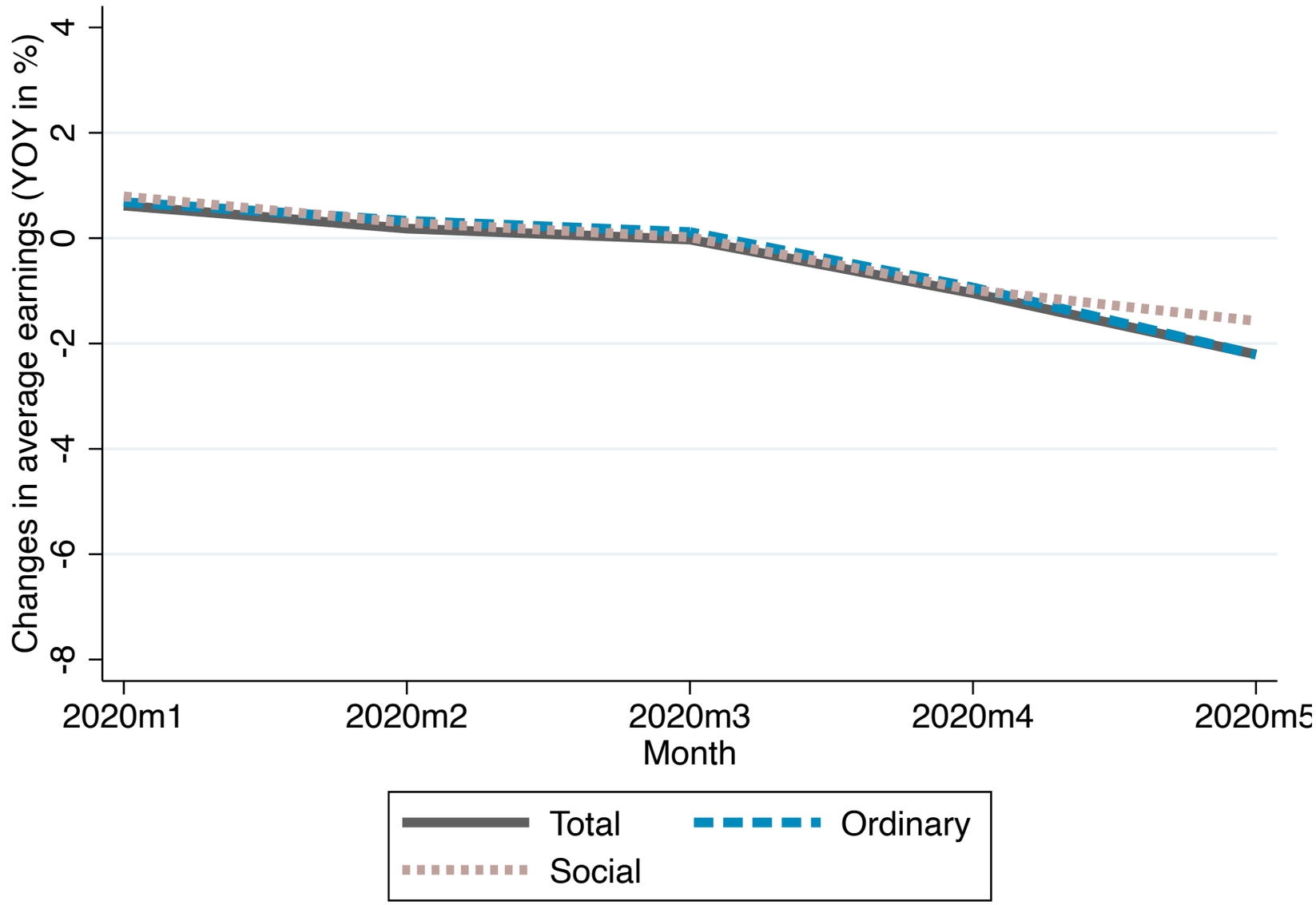
Source: LFS and Authors' calibration

Change in Earnings

Earnings for Regular Workers Declined Uniformly

Changes in Earnings for Regular Workers by Sector

%, YOY for contractual earnings

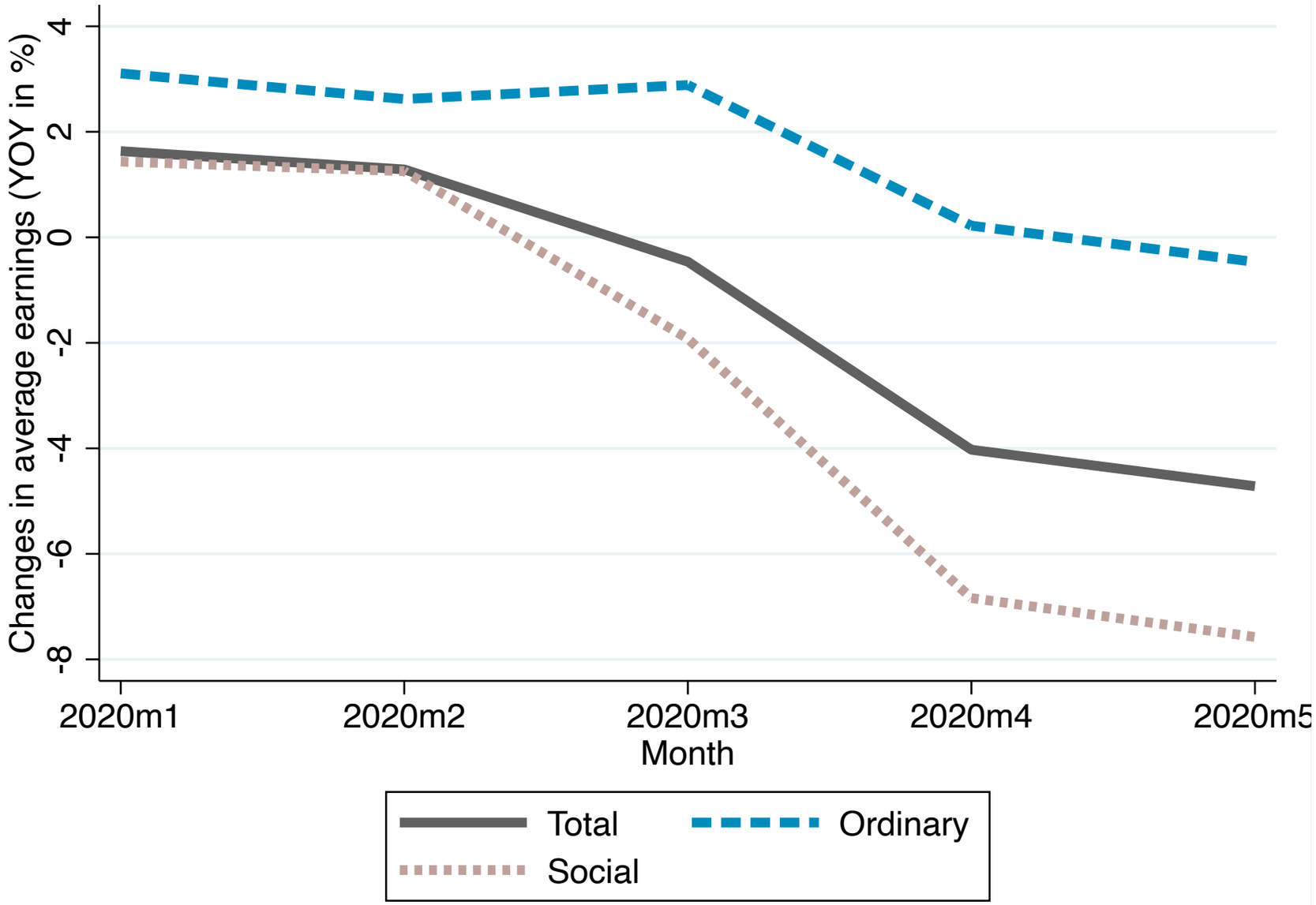


Source: MLS

Declines for Contingent Workers are Large and Heterogeneous

Changes in Earnings for Contingent Workers by Sector

%, YOY for contractual earnings



Source: MLS

Summary of Facts

- Employment declined for most workers and more for
  - **Contingent** workers
  - **Social** sectors
  - **Non-flex** occupations
  - **Female** workers
  - **Younger** workers

- Earnings declined particularly for **contingent** workers
  - Larger decline for workers in **social** sectors

1. Empirical Facts
2. Quantitative Analysis
3. Conclusion

Overview: Quantitative Analysis

- Quantitative macroeconomic model with heterogeneity in age, gender, employment type, education level, occupation, and sector
  - Individual type distribution **exogenously fixed** to match to data
- Various **MIT, COVID-19 shocks**, which depends on types, from data
  - Employment and Earnings shock
  - [Extension] Add preference shock (share and inter-temporal)
  - [Extension] Change duration of shocks (decay in 6, 12, or 18 months)
- Examine **short-run welfare consequences**
  - Measure in present valued of consumption equivalent variation (PV-CEV, explained later)
  - [Extension] Add household types (Marriage pattern)

What we do NOT do

- Our focus: Short-run welfare consequences with **fixed types**
  - Feed observed changes in employment and earnings as given
  - Assume the economy goes back to **the original steady-state**

- We do **NOT**
  - Model production + occupational choice (structural change)
  - Labor supply intensive margin (changes in hours worked, absentees)
  - Heterogeneous MPC due to binding constraint
  - Heterogeneous health risk (e.g. multi-risk SIR)

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  - Assume the economy goes back to **the original steady-state**

- We do **NOT**
  - **Model production + occupational choice (structural change)**
    - Does not change results much if still assuming that steady-state does not change
    - Focus is short-run = not to project future industrial structure with/after COVID-19
    - To generate these decline, we need decline in price, which we do not observe
- Labor supply intensive margin (changes in hours worked, absentees)
- Heterogeneous MPC due to binding constraint
- Heterogeneous health risk (e.g. multi-risk SIR)

What we do NOT do

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  - Model production + occupational choice (structural change)
  - **Labor supply intensive margin (changes in hours worked, absentees)**
    - We capture # of employment and avg. earnings of remaining
    - Effects of hours worked (also absentees) included in avg. earnings
    - No data on types of absentees (and assume they get paid)
    - Larger layoff (future) risk for absentees = beyond our scope
  - Heterogeneous MPC due to binding constraint
  - Heterogeneous health risk (e.g. multi-risk SIR)

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  - **Heterogeneous MPC due to binding constraint**
    - Data limitation (who's borrowing, mobility, …)
  - Heterogeneous health risk (e.g. multi-risk SIR)

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- Our focus: Short-run welfare consequences with **fixed types**
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  - Heterogeneous MPC due to binding constraint
  - **Heterogeneous health risk (e.g. multi-risk SIR)**
    - Beyond our scope

Demographics and Types

- Type vector of individuals: $x = \{j, g, s, e, o, d\}$
  - $j = \{1,...,J\}$: Age. Born at $j = 1$, retire at $j = j^R$, live up to $j = J$.
  - $g = \{M, F\}$: Gender
  - $s = \{H, L\}$: Skill (education) type
  - $e = \{R, C\}$: Employment type. Regular and Contingent
  - $o = \{o_1, o_2\}$: Occupation type. Flexible and Not-flexible
  - $d = \{d_1, d_2\}$: Sector type. Ordinary and Social

- Population share of type : μ_x
  - Exogenously given from data (ESS, 2017)
- Survival rate S_j (exogeneous)
- Accidental bequest, b , equally distributed

Earnings and Preferences

- Earnings of an individual in state x at time t:

$$y_{x,t} = \lambda_{x,t}\eta_x w_t$$

  - $\lambda_{x,t}$: **Shocks that affect earnings of type x at time t**
  - η_x : Efficiency unit of labor type x, Embed life-cycle and skill profiles
  - w_t : Market wage per efficiency unit (no role)

- Per-period preference: consume ordinary goods and social goods

$$U(c_1, c_2) = \xi_t \frac{[c_1^{\gamma_t} c_2^{1-\gamma_t}]^{1-\sigma}}{1-\sigma}$$

  - ξ_t : Inter-temporal preference shifter (=1 before shock)
  - γ_t : Weight on ordinary goods

Life-cycle Problem

- Inter-temporal preference ordering of an individual of type x born at time t

$$U(\{c_{1,t+j-1}, c_{2,t+j-1}\}_{j=1}^{J}) = \sum_{j=1}^{J} \beta^{j-1} S_j \xi_{t+j-1} \frac{\left[c_{1,t+j-1}^{\gamma_{t+j-1}} c_{2,t+j-1}^{1-\gamma_{t+j-1}}\right]^{1-\sigma}}{1-\sigma}$$

subject to

$$(1+\tau_{c,t})(c_{1,t}+c_{2,t}) + a_{t+1} = (1-\tau_{l,t})\lambda_{x,t}\eta_x w_t + R_t(a_t+b_t) + \tau_{ls,t} : j < j^R$$

$$(1+\tau_{c,t})(c_{1,t}+c_{2,t}) + a_{t+1} = p_t + R_t(a_t+b_t) + \tau_{ls,t} : j \geq j^R$$

where

- $\{a, b, p\}$: asset, bequest, pension benefit
- $R = 1 + (1-\tau_a)r$: net-of-tax gross interest rate
- $\{\tau_c, \tau_l, \tau_a, \tau_{ls}\}$: tax of consumption, labor, asset, and lump-sum transfer

Calibration of Initial Economy (before COVID-19)

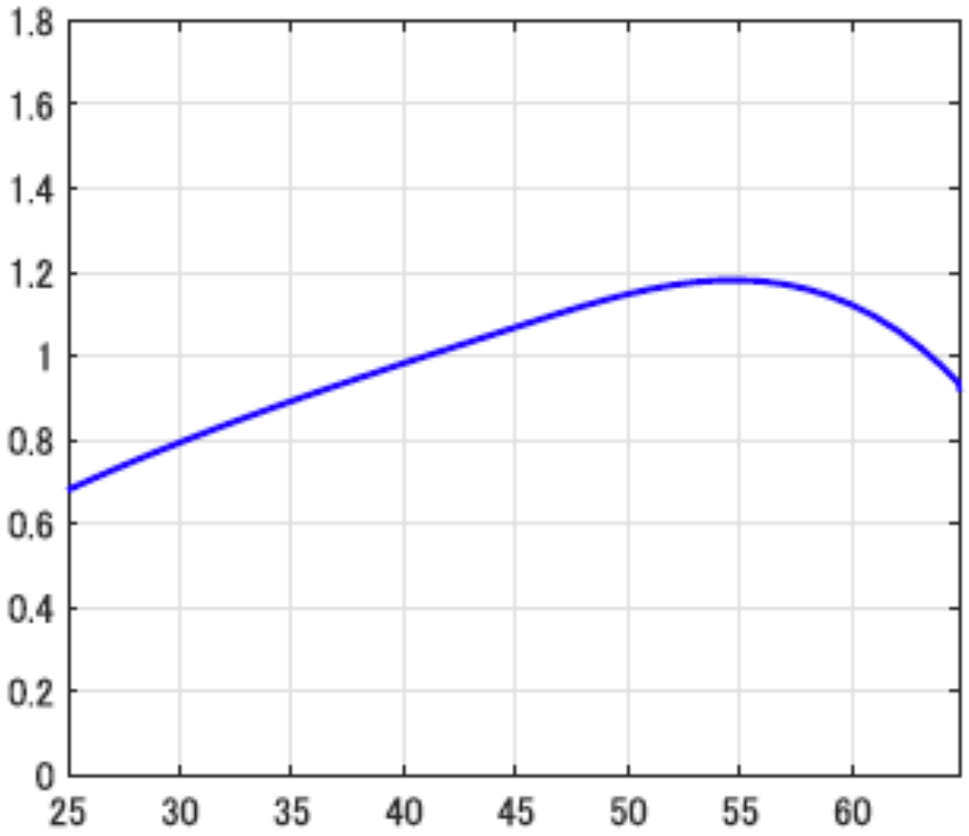
Parameter	Description	Value
Demographics		
J^R	retirement age	65 years old
J	maximum age	100 years old
$\mu_{j,g,s,e,o,d}$	population share	ESS data
Preference		
β	subjective discount factor	1.0215 (annual)
σ	risk aversion parameter	2.0
γ	expenditure share on regular goods	0.789 (FIES)
ξ	intertemporal weight	1 (before shock)
Human Capital		
$\eta_{j,g,s,e,o,d}$	life-cycle human capital	ESS data
λ	shocks to earnings	1 (before shock)
Government		
τ_c	consumption tax rate	10%
τ_l	labor income tax rate	13%
τ_a	capital income tax rate	20%
τ_{ls}	lump-sum tax/transfer	4.8% of avg. earn
p	social security benefit	30% of avg. earn
Other Parameters		
r	interest rate	0%
w	wage rate	normalization

- β : match average growth of consumption (growth b/w 25-50)
- $\{\tau_l, \tau_a\}$: Imrohoroglu et al (2019)
- τ_{ls} : Balanced budget (equilibrium object)

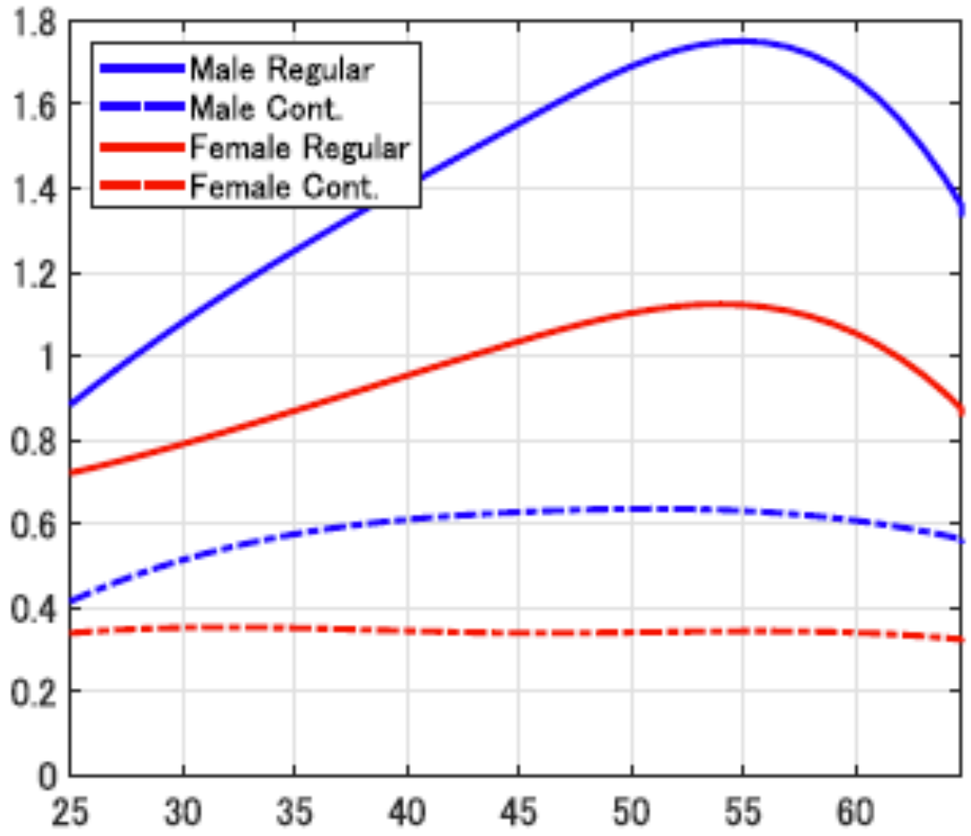
Age Profiles of Earnings in the Initial Economy

Earnings in the Initial Economy

In model units, average earnings = 1



(a) By Age



(b) By Age, Gender and Emp. Type

Source: Authors' calibration

COVID-19 Shock

Baseline: COVID-19 Shock in Quantitative Model (1)

- Baseline: Shocks to earnings = avg. earnings per worker and employment

$$\lambda_{x,t} = \omega_{e,d,t}\phi_{o,d,t}\nu_{j,e,t}$$

Next page

$\omega_{e,d,t}$: **Earnings shock, specific to employment and sector types**
%, 2020Q1-Q2

	Ordinary	Social
Reg.	0.0	-0.1
Cont.	- 1.0	- 5.4

$\phi_{o,d,t}$: **Emp. shock, specific to occupation/sector types**
%, 2020Q1-Q2

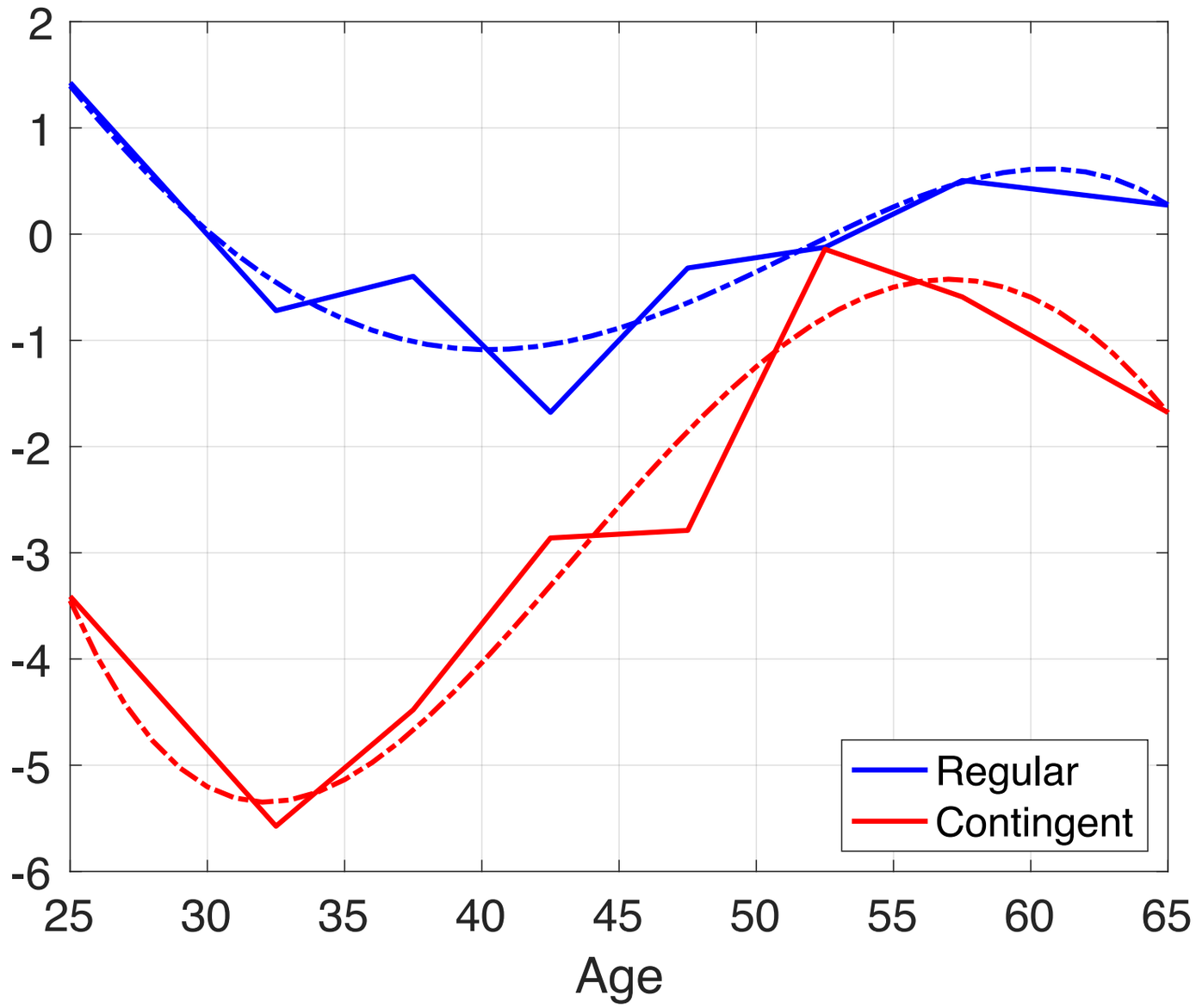
	Ordinary	Social
Flex	+ 0.3	-0.4
Non-flex	- 1.0	- 4.4

Source: LFS, MLS and Authors' calibration. Seasonally adjusted.

Baseline: COVID-19 Shock in Quantitative Model (2)

$\nu_{j,e,t}$: Employment shock, specific to age and employment types

%, 2020 Q1 v.s. Q2, seasonally adjusted



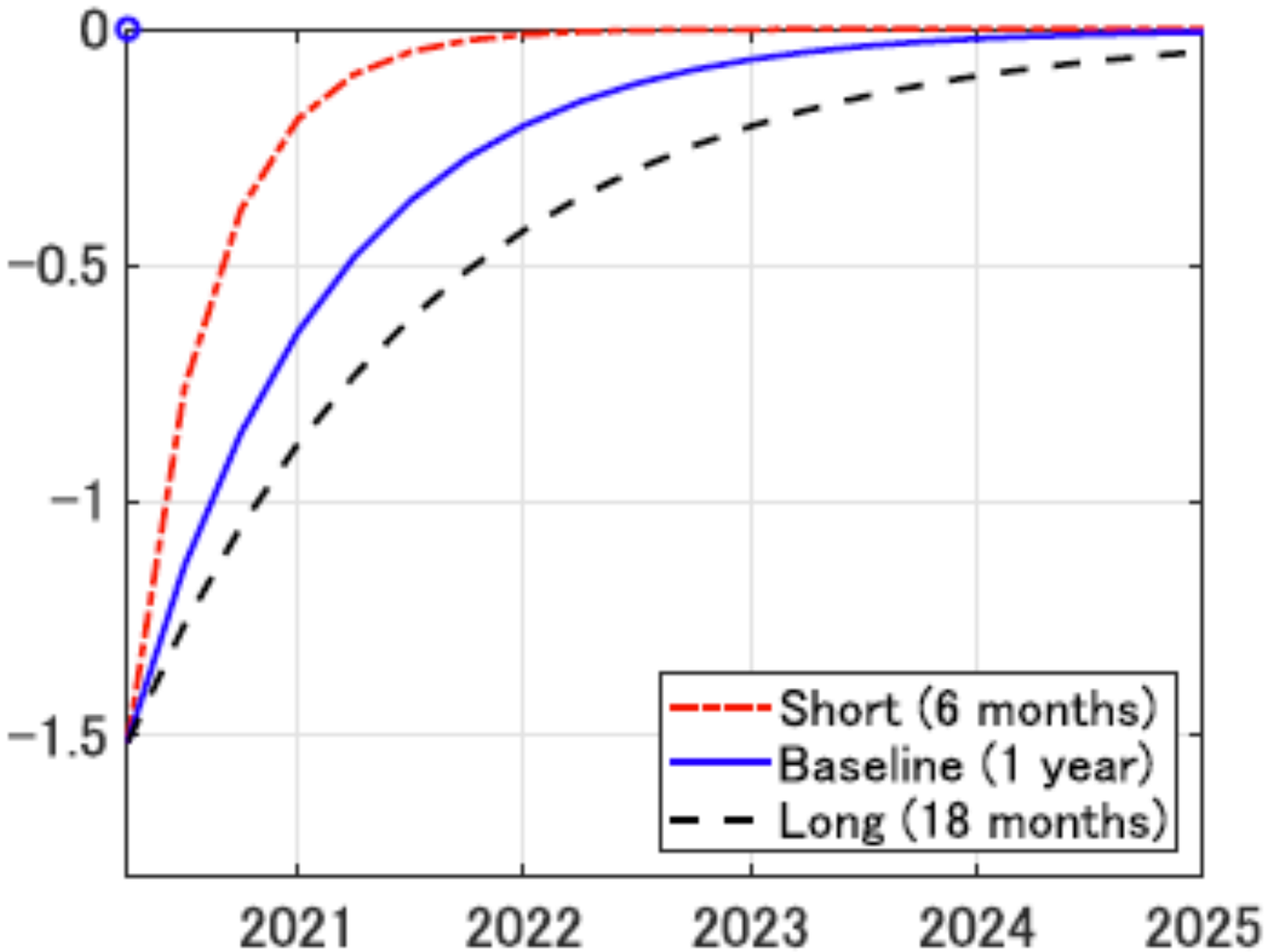
Normalize average of regular workers to 0 when feeding to the model

Source: LFS and Authors' calibration

Duration: Changes in Earnings in Different Scenarios

Changes in Average Earnings in Different Scenarios

%, 2020Q1-Q2



Source: LFS, MLS and Authors' calibration

Welfare Measure: PV-CEV

- **CEV:** Adjustment in consumption (in percentage points) for the **rest of your entire life**, which makes you indifferent, for each type $x = \{j, g, s, e, o, d\}$

$$\sum_{j=k}^{J} \beta^{j-1} S_j U(c_{1,x}^{**}, c_{2,x}^{**}) = \sum_{j=k}^{J} \beta^{j-1} S_j U((1+\pi_x)c_{1,x}^{*}, (1+\pi_x)c_{2,x}^{*})$$

With Shock | Without Shock

  - "- 1%" for age-20: "- 1%" consumption change for 80 years to go
  - "- 1%" for age-90: "- 1%" consumption change for 10 years to go

- **PV-CEV:** PV of adjustment of consumption in terms of average earnings of own types (to account for age differences)

$$\text{PV-CEV} = \frac{\sum_{j=k}^{J} \left(\frac{\beta}{R}\right)^{j-1} S_j \, \pi_x (c_{1,x}^{*} + c_{2,x}^{*})}{y_x}$$

Quantitative Result

Baseline: Quantitative Results (1) Employment Type

Welfare Effects by Employment Type

%, in PV-CEV, aged 25-64

	Employment Type		
	All	Regular	Cont.
All	- 1.87	- 0.92	- 9.05
Male	- 1.14	- 0.91	- 7.47
Female	- 3.44	- 0.94	- 9.47

- On average, workers suffer by **1.87%**
- **Contingent** workers suffer **10x** more (=9.05/0.92)
- Female workers suffer **3x** more (=3.44/1.14)

Source: Authors' calibration

Baseline: Quantitative Results (2) Sector and Occupation

Welfare Effects by Sector and Occupation

%, in PV-CEV, aged 25-64

	Ordinary		Social	
	Flex	Non-flex	Flex	Non-flex
All	- 0.16	- 1.75	- 1.82	- 6.83
Male	+ 0.05	- 1.44	- 0.83	- 5.16
Female	- 0.85	- 3.90	- 2.90	- 9.75

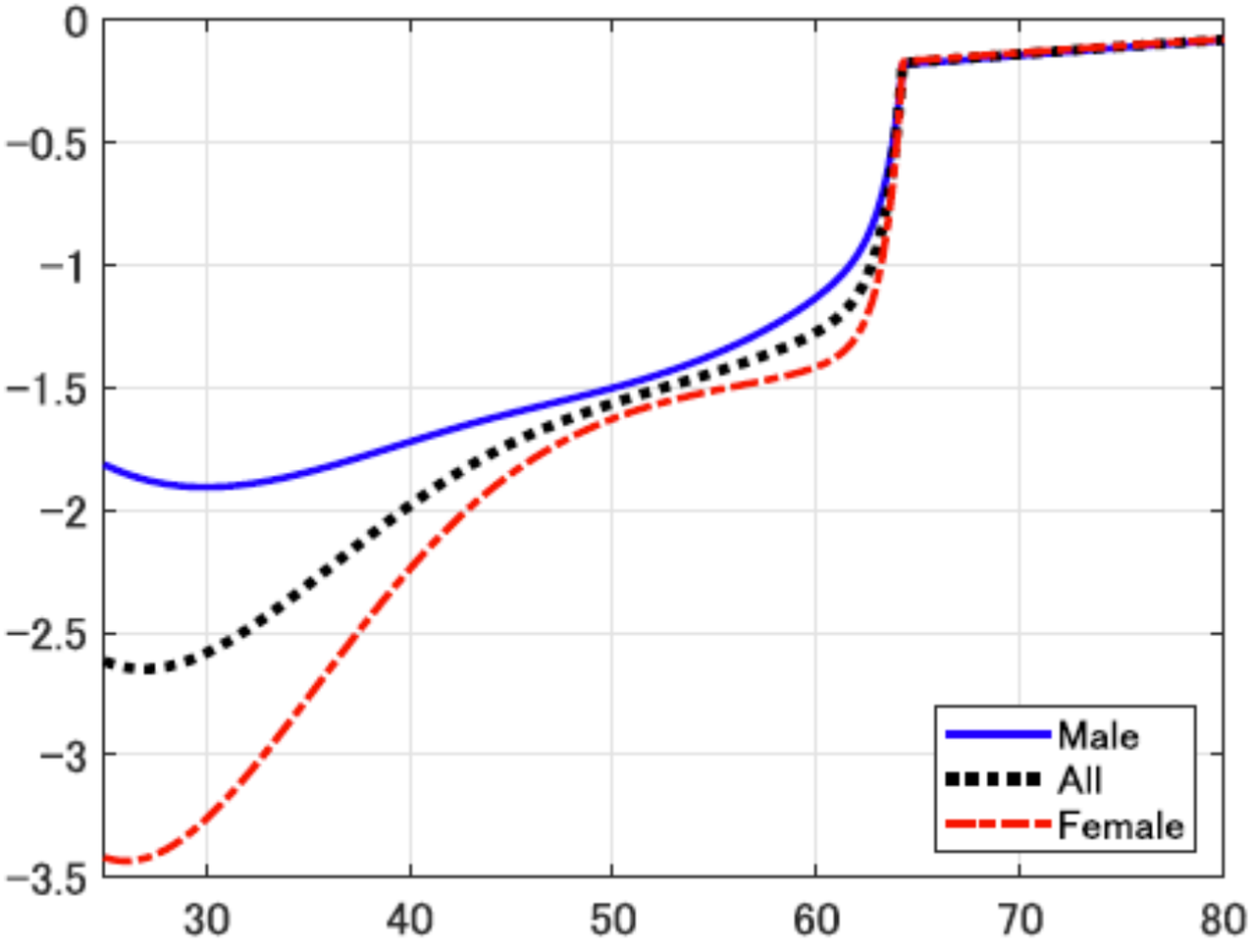
- **Ordinary and flexible** jobs suffer the least (0.16%)
- **Social and non-flexible** jobs suffer the most (6.83%)
- **Female** workers suffer more within sectors/ occupations

Source: Authors' calibration

Baseline: Quantitative Results (3) Age and Gender

Welfare Effects by Age and Gender

%, in PV-CEV



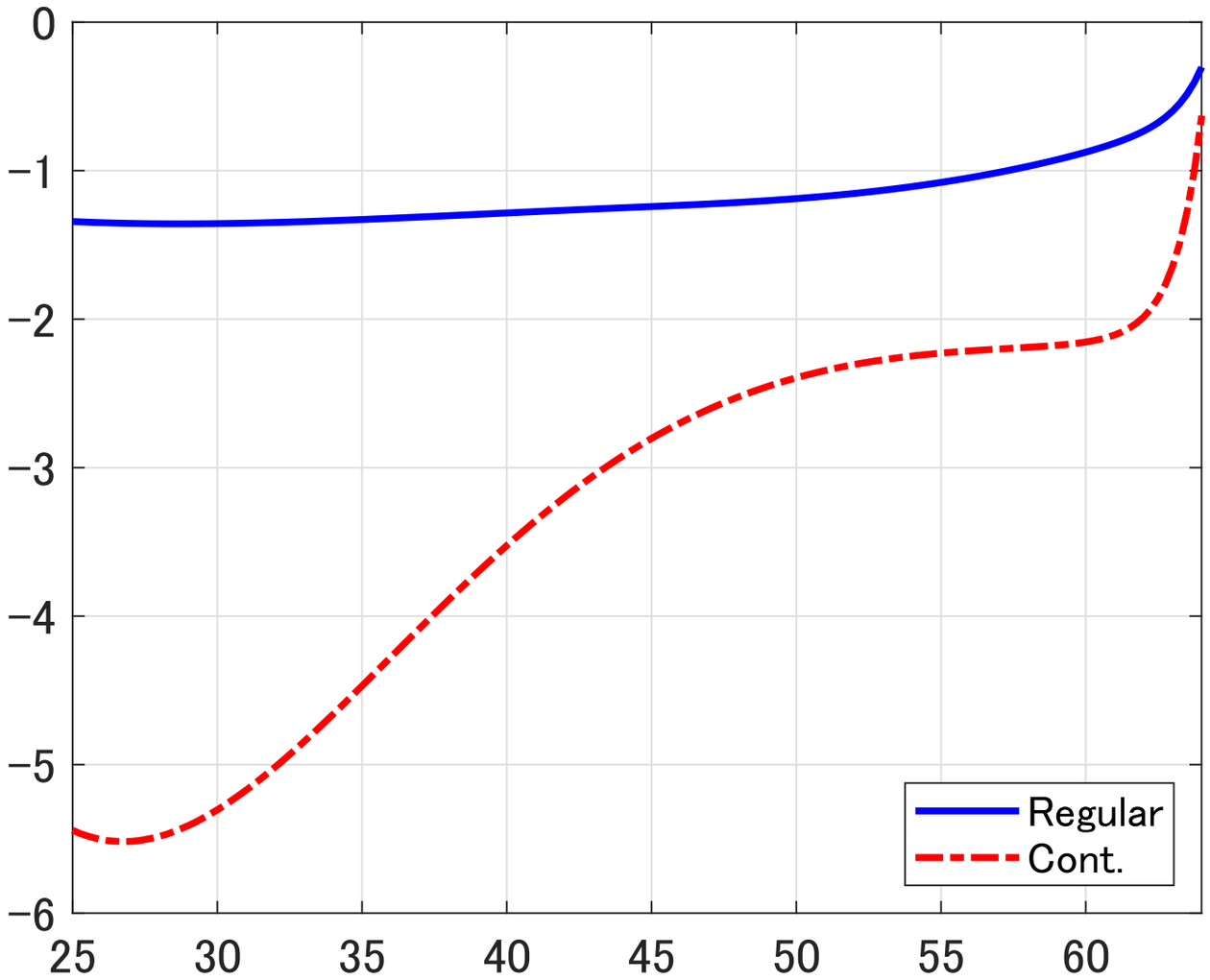
- In all age groups, **female** workers suffer more
- The gender gap is **larger for younger workers**

Source: Authors' calibration

Baseline: Quantitative Results (4) Age and Employment Type

Welfare Effects by Age and Employment Types

%, in PV-CEV



- In all age groups, **contingent** workers suffer more
- The gap is **larger for younger workers**

Source: Authors' calibration

Robustness Checks and Extension

1. Welfare effects with preference shock

Extension 1

- Add preference shock matched to realized decline in expenditure
- Similar patterns of heterogeneous impacts

2. Welfare effects with different shock duration

Extension 2

- Change durations from 12 months to 6 months or 18 months
- More persistent shocks give larger welfare loss
- Similar patterns of heterogeneous impacts

3. Welfare effects across household types

Extension 3

- Construct hypothetical pairs of earners
- Compare different pairs and singles
- Hardest: Contingent, low-skilled females with same-type spouses

1. Empirical Facts
2. Quantitative Analysis
3. Conclusion

Conclusion

- Document **heterogeneous responses** toward the COVID-19 shock
  - **Scope: Short-run** during the initial months after the onset of the crisis
  - Method: Data and Quantitative macro model

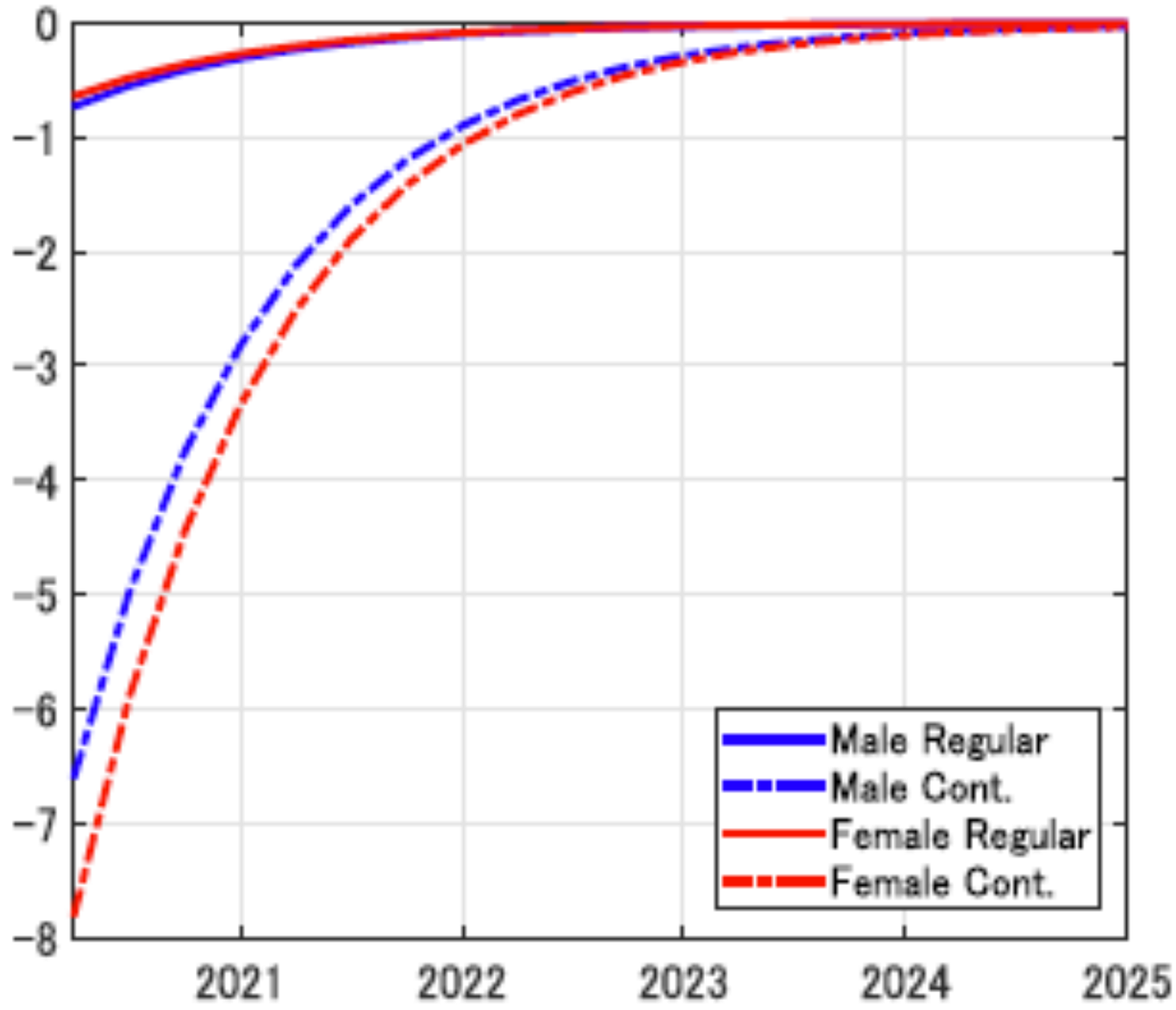
- Negative effects in the labor market significantly vary across groups, and are **amplified for those who earn less prior to the crisis**
  - Contingent than regular workers
  - Younger than older workers
  - Female than male workers
  - Social sectors than ordinary sectors
  - Not-flexible occupations than flexible occupations

Back-ups

Baseline: Changes in Earnings (2)

Change in Average Earnings by Gender and Employment Type

%, relative to the initial economy



Source: LFS, MLS and Authors' calibration

Robustness: Quantitative Results (1) Preference Shock

Welfare Effects by Employment Type

%, in PV-CEV, aged 25-64

	Employment Type		
	All	Regular	Cont.
All	- 0.43	0.45	- 7.09
Male	+ 0.23	0.45	- 5.90
Female	- 1.85	0.45	- 7.40

- CEV evaluated using pre-shock utility = **caution interpretation to numbers**
- **Contingent** workers suffer more
- **Female** workers suffer more

Source: Authors' calibration

Back

Robustness: Quantitative Results (2) Shock Persistence

Welfare Effects by Shock Persistence

%, in PV-CEV, aged 25-64

	6 mo.	12 mo.	18 mo.
All	- 0.94	- 1.87	- 2.78
Male	- 0.58	- 1.14	- 1.71
Female	- 1.74	- 3.44	- 5.11

- Baseline = 12 months
- More persistent shocks generate larger welfare loss
- A pattern of heterogeneity remains the same

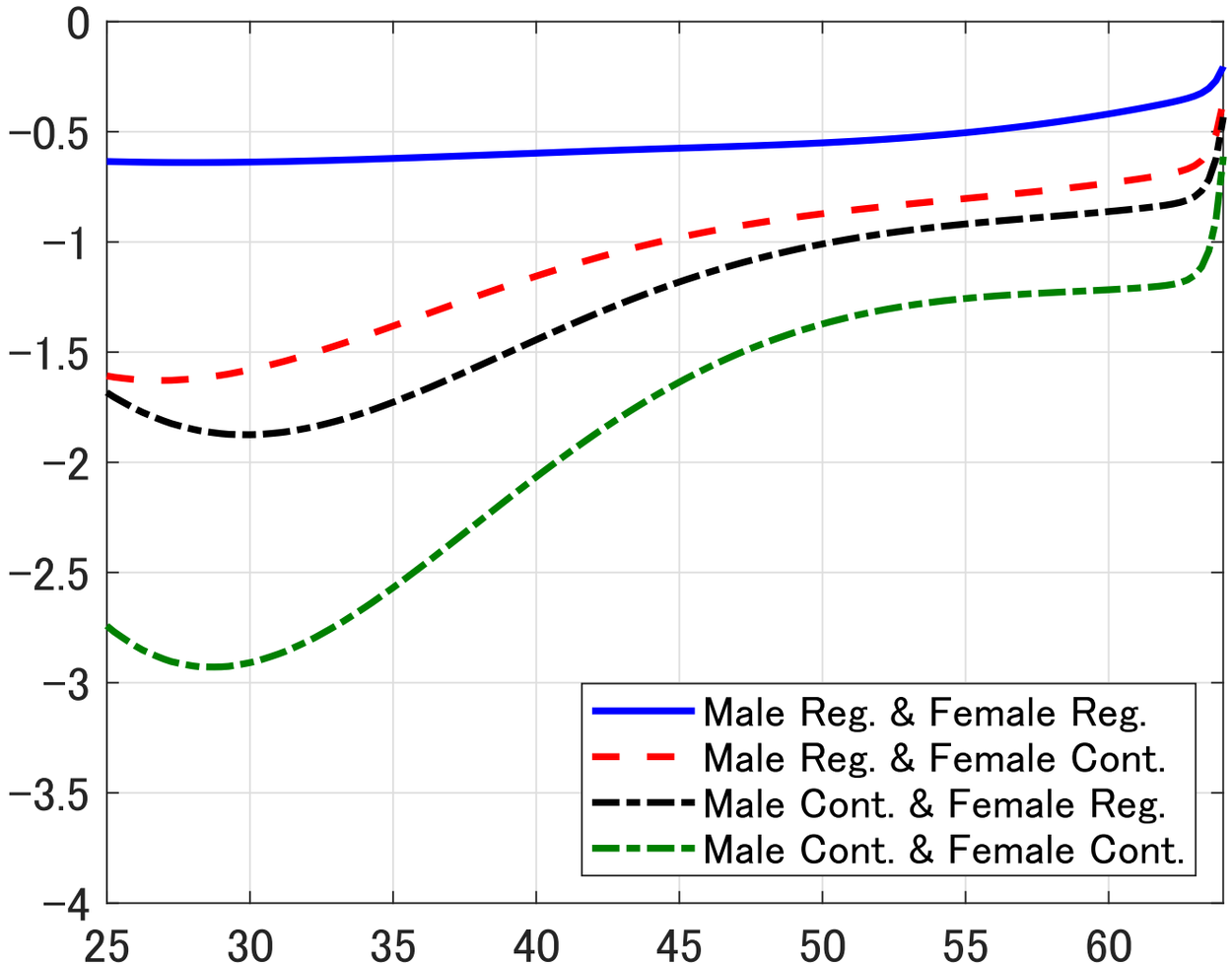
Back

Source: Authors' calibration

Robustness: Quantitative Results (3) Household Type

Welfare Effects by Age and Household Type (married couples)

%, in PV-CEV



- **Contingent-contingent** couples suffer the most
- The gap is larger for younger workers

Source: Authors' calibration

Back