Income Receipt, Economic Activities, and Health: Evidence from Ambulance Transport Patterns

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Income receipt and health

- Short-term impact of income receipt on health is reported to be negative
  - A potential mechanism is an increase in the consumption of harmful goods and/or engagement in risky activities
  - A study found an increase in healthcare visits and mortality related to illicit drug use (Dobkin and Puller, 2007)
- Evans and Moore extended the analysis to encompass a broader spectrum of causes of death (Evans and Moore, 2011)
- They also reported a parallel monthly cycle in economic activities with mortality patterns, measured by purchases of lottery and movie tickets and foot traffic in malls (Evans and Moore, 2012)
  - A consequence of people not smoothing their consumption
  - Suggestive evidence that certain economic activities induce health deterioration

Unanswered questions

1. **Do economic activities contribute to health deterioration after income arrival?**
   - So far no analysis has been done using the single dataset that records daily activities and health conditions around the day of income arrival
2. **What types of economic activities are more likely to be boosted by income arrival?**
   - Evans and Moore (2012) suggested that shopping, watching movies, and playing the lottery increased after income arrival
3. **How are particular health problems related to certain economic activities?**
   - Medical literature showed that various activities could elevate the risk of cardiovascular events
   - Does the relationship extend to other health risks, and if so, how?

How to address these questions

- We focus on changes of ambulance transports upon income arrival

1. Ambulance transport data capture **non-fatal and immediate health changes**
    - Other types of medical utilization are often scheduled in advance
    - Ambulance data may reveal a causal change in health due to income arrival
2. The data represents changes in activities at **a specific time and location of health deterioration**
    - Location information is key to identify the direct link between economic activities and health
3. The data provides **a disease code for each transported patient**
    - This aids in linking economic activities with specific health problems

Japanese setting

- Our empirical analysis uses **pension payment** as an income shock (Evans and Moore, 2011; Gross et al., 2022)
    - Public pension payments are disbursed on the 15th of every other month
    - These payments constitute a large share of elderly people's income
    - Almost all individuals aged 65 years and above receive public pensions
- Ambulance transport is **free of charge**
    - This helps identify the increase in transports due to health deterioration, independent of income
- A **cash-oriented country**, where many people prefer to pay in cash

Large spike in ATM withdrawals on the day of pension payment

- Daily number of people in their 70s withdrawing cash, 2016
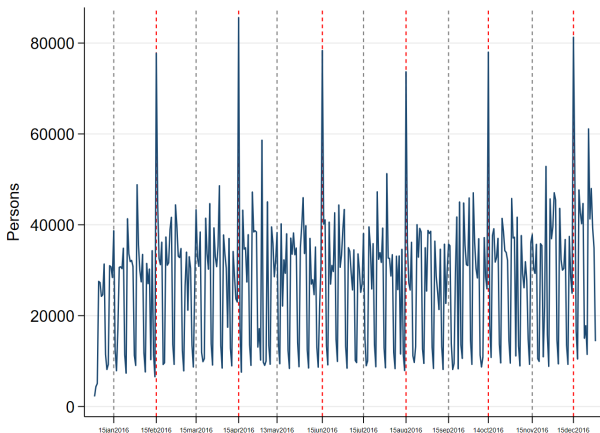
Hypothesis

Hypothesis

Pension arrival increases ambulance transports reflecting health deterioration, and the increase is generated by increased economic activities upon pension arrival.

Data

- Ambulance transport data (2007 - 2019), Ministry of Internal Affairs and Communications
    - Administrative data of all ambulance transports with basic patient attributes, incidence location, incidence type, and transport details
    - The total number of transports was about 6 million in 2019
- The analysis focuses on the transports of those aged 65 to 79 years
- We count the number of transports at the daily level
    - The sample size used in our estimations is 3,900 (=25 days in a synthetic month $\times$ 12 months $\times$ 13 years)

Empirical specification

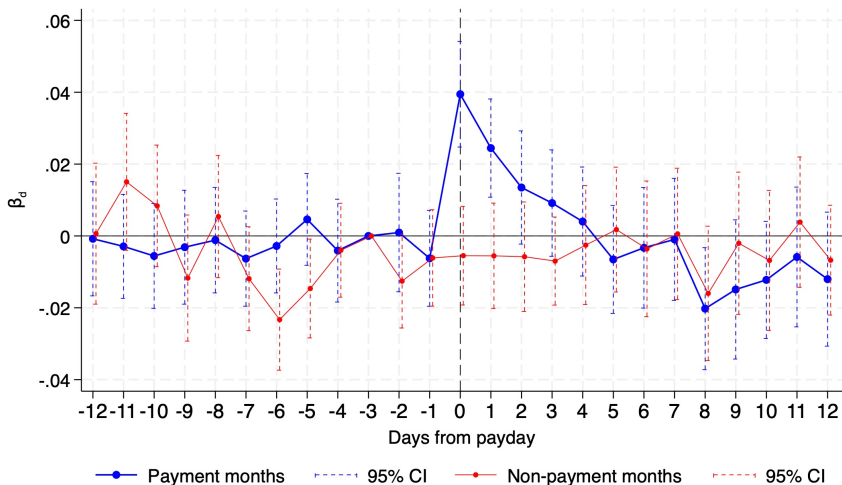$$\ln(Y_{dmy}) = \alpha + \sum_{d=-12, d \neq -3}^{12} \beta_d \{1(\text{Day from payment} = d) \times Paymonth(m)\}$$

$$+ \sum_{j=1}^{6} \gamma_j DOW(j)_{dmy} + \sum_{k=1}^{M} \eta_k Holiday(k)_{dmy} + \delta_d + \mu_m + \nu_y + \varepsilon_{dmy} \quad (1)$$

$$Paymonth(m) = \begin{cases} 1 & \text{if } m = 2, 4, 6, 8, 10, 12 \\ 0 & \text{otherwise, where } m \in \{1, 2, .., 11, 12\} \end{cases}$$

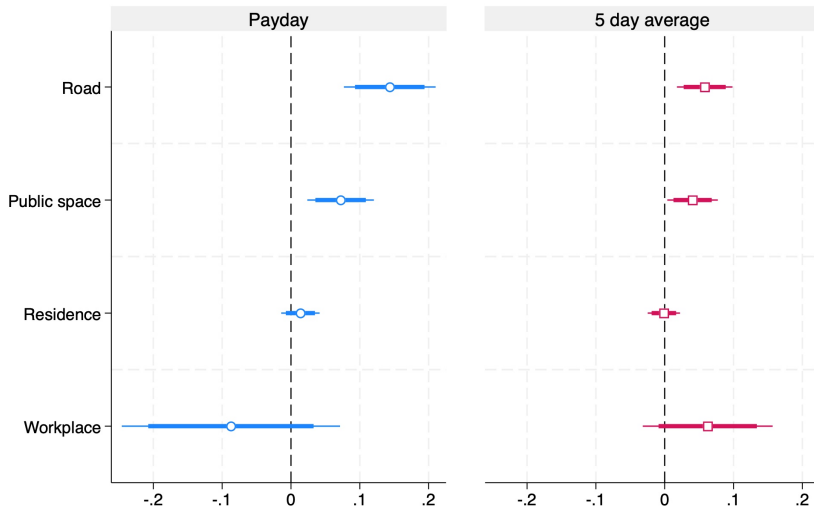# Response of ambulance transports to pension arrival
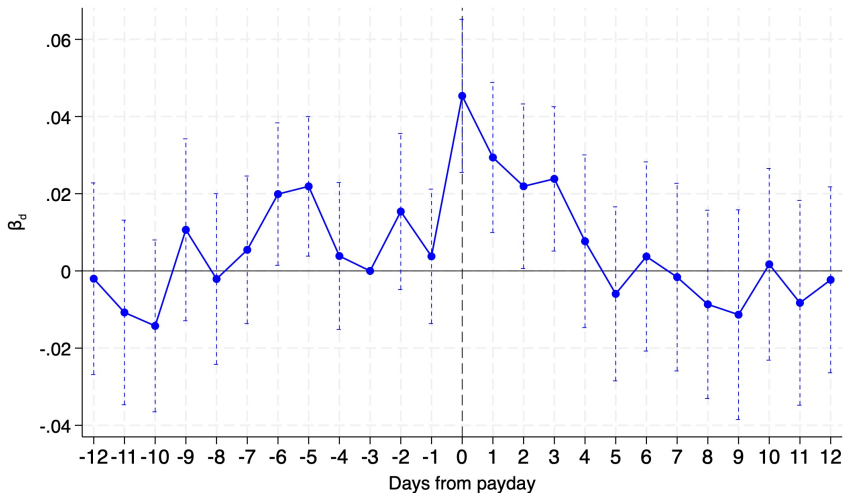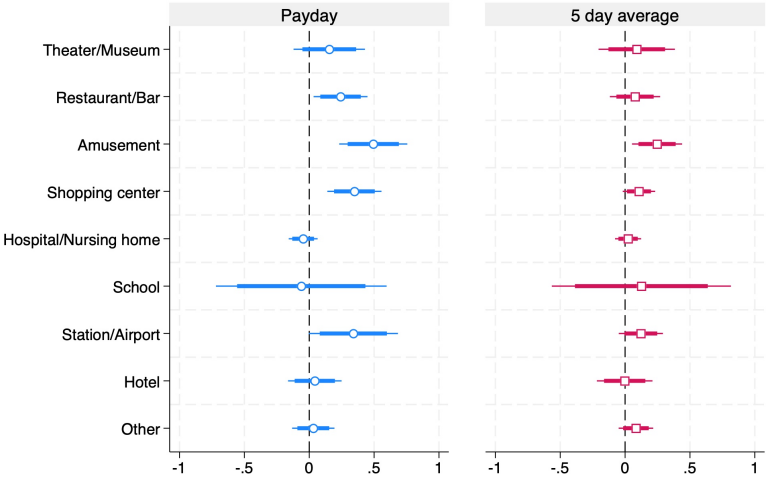
Payment and non-payment months

Incidence location

Incidence location: Public space details
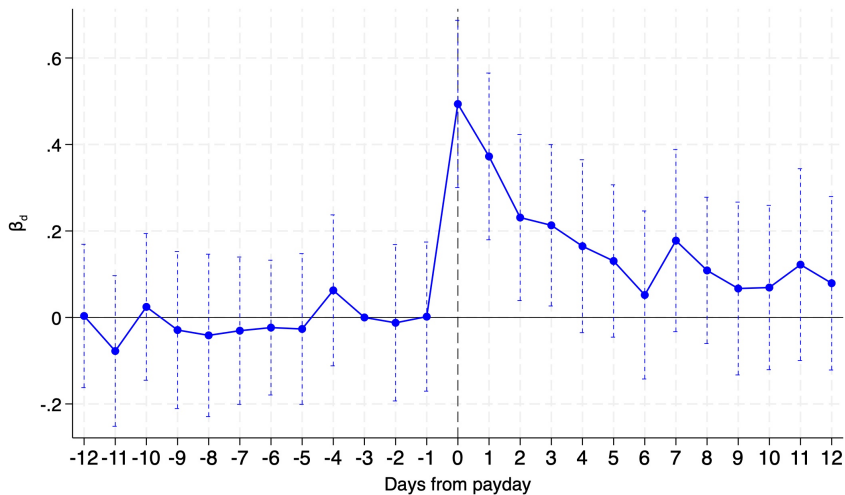
Pachinko parlor

©MichaelMaggs. Source: https://commons.wikimedia.org/w/index.php?curid=5648468

Amusement

Incidence type
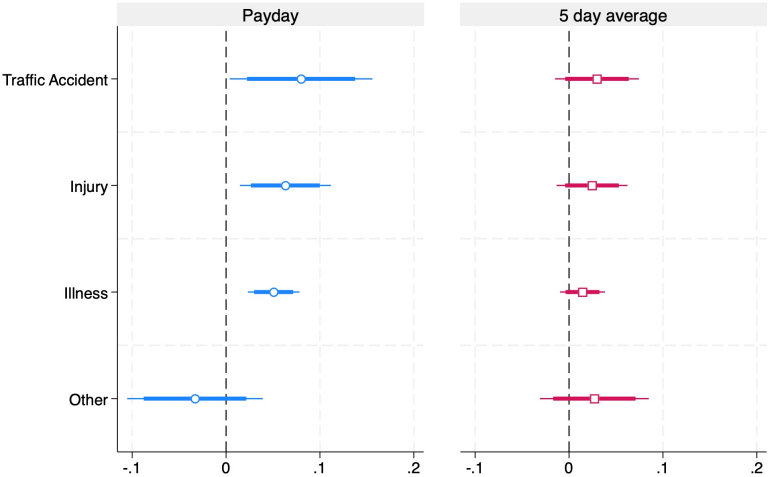
Illness: Disease details
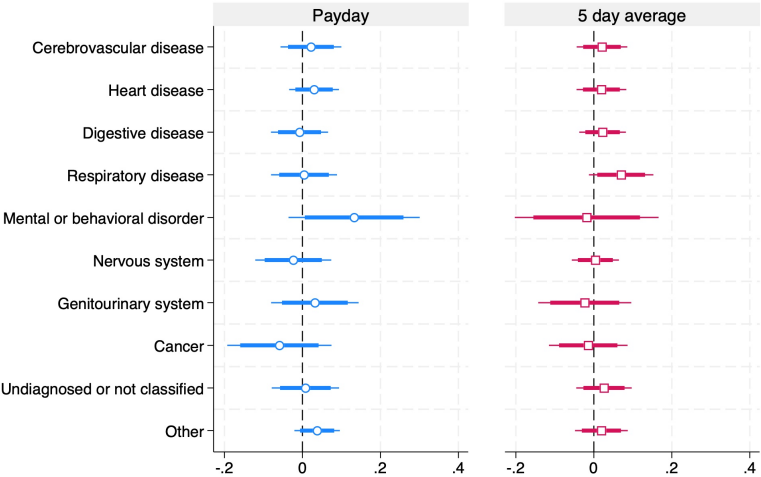
Location x disease

Figure: Heart disease
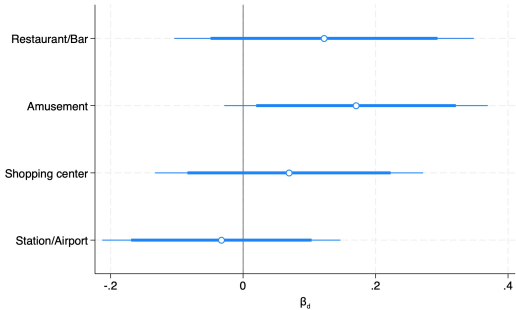
Figure: Mental or behavioral disorder
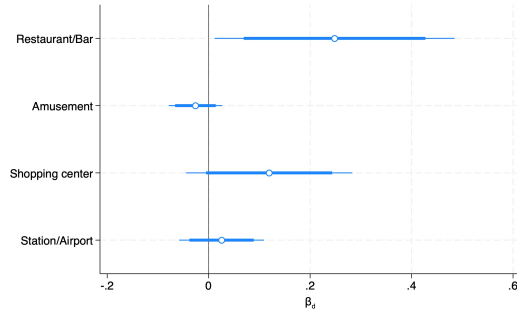
Mechanism: Liquidity constraints

- A possible mechanism is a relaxation of liquidity constraints
- We examine whether liquidity-constrained elderly withdraw cash on the day of pension payment
- We conducted an online survey of people's behavior during the three days around the pension payment of June 2023
  - 1,000 individuals aged 65 or older
  - We asked their behavior on each day as well as if they were liquidity-constrained
  - Liquidity constrained: those who have neither sufficient pension benefits, own financial assets, nor receive any financial assistance from family
- We compare ATM/bank use and footsteps before and after the pension payment by liquidity constraint
  - Use a three-day panel at the respondent level
  - Control for respondent fixed effects

ATM/bank use and footsteps by liquidity constraint

	All	Not constrained	Constrained
Dependent variable	**Dummy for using ATM or bank**		
Post payment	0.105***	0.100***	0.161**
	(0.0120)	(0.0124)	(0.0492)
Number of obs.	2640	2463	177
Dependent variable	**Footstep counts**		
Post payment	315.4*	274.3	1231.8
	(144.1)	(147.3)	(683.1)
Number of obs.	1354	1292	62

Mechanism: Supply-side factors?

- Retailers, such as supermarkets, may offer special discounts on pension payment days to attract more customers and increase their revenues
- We test this possibility using DDD analysis
  - Taking a difference in the change of transports on the day of payment between 65-79 (treatment) and 55-59 (control), we can difference out the effect of special discounts
  - We control for non-age specific effect associated with pension payment
- The DDD analysis reveals that the size of the transport increase on the day of payment change little from the results obtained by estimating eq. (1)
  - The response is evident only among those eligible for a pension
  - The increased ambulance transports are most likely driven by **income arrival**

Conclusion

- Our answers to the research questions
1. Do economic activities contribute to health deterioration after income arrival?
   - Yes
2. What types of economic activities are more likely to be boosted by income arrival?
   - Dining out, shopping, and engagement in amusement or gambling
3. How are particular health problems related to certain economic activities?
   - Activities in amusement places increase heart disease
   - Dining out (drinking) increase alcohol-related health problems
- Our findings have policy implications on
   - How to prepare the healthcare system for income arrival
   - Design of public pension payments

Summary statistics for original data

	N	% Female	Age		Location (%)				Type (%)				Severity (%)			
		Percent	Mean	SD	Home	Public Space	Workplace	Road	Accident	Injury	Illness	Other	Death/Fatal	Serious	Severe	Mild
2007	3555127	47.62	56.345	26.184	55.52	24.54	2.75	17.18	13.24	13.03	59.90	13.83	2.35	10.17	37.09	50.39
2008	3931716	47.48	57.469	26.036	55.81	24.86	2.68	16.65	12.39	13.42	60.35	13.83	2.11	9.87	37.86	50.16
2009	4053987	47.54	57.800	26.189	56.62	24.74	2.39	16.24	12.01	13.51	60.91	13.56	2.01	9.67	38.35	49.97
2010	4327256	47.84	58.956	25.964	57.03	24.93	2.51	15.53	11.44	13.57	61.68	13.30	2.04	9.41	38.78	49.77
2011	4543799	47.95	59.650	25.900	57.76	24.92	2.49	14.83	10.83	13.97	62.19	13.02	2.01	9.19	38.85	49.95
2012	4603173	48.17	60.160	25.914	55.96	28.18	2.30	13.56	10.48	14.09	62.64	12.79	2.06	8.30	38.74	50.91
2013	5224172	48.08	60.287	25.768	57.21	25.67	2.48	14.64	10.15	14.12	63.09	12.65	1.94	8.73	39.49	49.84
2014	5279417	48.08	60.759	25.769	57.26	26.10	2.48	14.16	9.70	14.52	63.21	12.57	1.91	8.60	40.34	49.15
2015	4805224	48.51	61.456	25.742	57.28	26.81	2.47	13.44	9.18	14.58	63.56	12.68	1.84	8.44	40.88	48.85
2016	5594941	48.56	61.310	25.959	57.59	26.72	2.51	13.18	8.35	15.25	65.00	11.41	2.30	11.56	42.90	43.24
2017	5826673	48.68	61.963	25.954	57.36	27.22	2.50	12.92	8.17	15.52	64.78	11.53	1.85	7.93	41.64	48.58
2018	5867716	48.97	62.485	25.816	57.87	27.23	2.67	12.23	7.34	15.43	65.87	11.36	1.72	7.76	41.67	48.85
2019	5978155	49.03	62.668	26.064	58.10	27.54	2.49	11.87	6.94	15.62	66.17	11.27	1.70	7.72	42.57	48.01
Total	6.36e+07	48.30	60.541	25.988	57.20	26.14	2.53	14.13	9.73	14.48	63.32	12.47	1.97	8.96	40.22	48.86

Summary statistics for original data, 65-79

	N	% Female	Age		Location (%)				Type (%)				Severity (%)			
		Percent	Mean	SD	Home	Public Space	Workplace	Road	Accident	Injury	Illness	Other	Death/Fatal	Serious	Severe	Mild
2007	718304	44.61	72.629	4.281	64.11	23.37	1.06	11.47	7.25	13.31	66.09	13.35	2.96	13.29	43.36	40.39
2008	802307	44.31	72.677	4.292	63.97	23.61	1.09	11.33	7.06	13.76	65.80	13.37	2.75	13.23	43.81	40.21
2009	869274	44.43	72.679	4.306	64.16	23.40	1.00	11.44	7.10	14.00	65.88	13.02	2.58	12.70	43.79	40.92
2010	959793	44.72	72.778	4.277	64.68	23.21	1.03	11.08	6.81	14.05	66.53	12.61	2.52	12.01	43.73	41.73
2011	1013810	44.76	72.872	4.227	65.18	22.93	1.07	10.83	6.50	14.48	66.81	12.21	2.39	11.51	43.50	42.60
2012	1053411	44.77	72.838	4.273	62.65	25.83	0.98	10.54	6.42	14.57	66.98	12.04	2.46	10.51	43.28	43.75
2013	1282242	44.51	72.683	4.341	64.33	23.02	1.18	11.48	6.32	14.68	67.42	11.57	2.14	10.24	43.34	44.28
2014	1315231	44.31	72.604	4.394	64.08	23.25	1.25	11.41	6.23	14.99	67.27	11.51	2.12	10.00	43.96	43.92
2015	1307446	44.53	72.587	4.397	64.21	23.47	1.31	11.01	6.15	14.73	67.41	11.70	2.03	9.77	44.07	44.14
2016	1477851	44.22	72.565	4.361	64.00	23.28	1.39	11.33	5.85	15.37	68.05	10.74	2.60	12.94	45.03	39.44
2017	1526934	43.91	72.623	4.297	63.82	23.54	1.45	11.18	5.75	15.54	68.00	10.71	2.08	9.24	44.83	43.85
2018	1566268	44.00	72.688	4.236	64.48	23.02	1.56	10.94	5.34	15.43	68.62	10.61	1.91	9.09	44.66	44.33
2019	1588206	43.84	72.851	4.208	64.17	23.47	1.53	10.83	5.18	15.68	68.41	10.73	1.91	9.08	45.57	43.44
Total	1.55e+07	44.32	72.694	4.302	64.22	23.34	1.28	11.16	6.16	14.83	67.39	11.63	2.27	10.75	44.22	42.75

Summary statistics

		N	Mean	S.D.	Min	Max
Total		3900	3259.63	852.62	1569	5849
	Residence	3900	1943.02	696.45	313	3844
	Public space	3900	707.18	263.25	100	1413
	Work place	3900	38.72	23.02	0	173
Location	Road	3900	337.55	124.88	37	723
	Accident	3900	199.74	45.23	72	353
	Injury	3900	481.53	151.75	179	1086
	Illness	3900	2191.25	602.05	1030	4250
	Other	3900	376.51	125.85	113	726
Severity	Death/Fatal	3900	72.87	22.80	24	167
	Serious	3900	344.34	85.71	161	759
	Severe	3900	1414.29	413.08	674	2787
	Mild	3900	1369.14	409.89	589	2814
Public space	Theater/Museum	1500	24.40	10.48	4	73
	Restaurant/Bar	1500	57.77	23.36	14	194
	Amusement arcade	1500	34.66	14.07	7	89
	Shopping center	1500	75.42	17.13	30	148
	Hospital/Nursing home	1500	571.63	144.12	246	943
	School	1500	6.55	5.74	0	69
	Station/Airport	1500	32.91	9.22	2	75
	Hotel	1500	29.76	8.97	10	68
	Other	1500	73.09	17.18	35	161
Diagnosis	Cerebrovascular diseases	1500	280.28	32.96	194	404
	Heart diseases	1500	294.25	40.79	198	441
	Digestive diseases	1500	259.27	25.78	179	388
	Respiratory diseases	1500	238.72	64.48	147	623
	Mental and behavioral disorders	1500	43.67	7.90	19	79
	Neurological diseases	1500	121.97	15.33	78	189
	Kidney diseases	1500	83.69	15.84	47	150
	Cancer	1500	72.01	12.41	40	132
	Other	1500	509.98	112.32	340	1304
	Undiagnosed or not classified	1500	954.37	150.96	600	1555

Data availability

| | Data availability | | Availability of detailed categories | | | |
| | | | Public space | | Code for illness | |
	46 prefectures	Tokyo	46 prefectures	Tokyo	46 prefectures	Tokyo
2007	✓	n.a.	n.a.	n.a.	n.a.	n.a.
2008	✓	n.a.	n.a.	n.a.	n.a.	n.a.
2009	✓	n.a.	n.a.	n.a.	n.a.	n.a.
2010	✓	n.a.	n.a.	n.a.	n.a.	n.a.
2011	✓	n.a.	n.a.	n.a.	n.a.	n.a.
2012	✓	n.a.	n.a.	n.a.	n.a.	n.a.
2013	✓	n.a.	n.a.	n.a.	n.a.	n.a.
2014	✓	n.a.	n.a.	n.a.	n.a.	n.a.
2015	✓	n.a.	✓	n.a.	✓	n.a.
2016	✓	✓	✓	✓	✓	✓
2017	✓	✓	✓	✓	✓	✓
2018	✓	✓	✓	✓	✓	✓
2019	✓	✓	✓	✓	✓	✓

Location categories

	Main category		Subcategory	
	Category	Definition	Category	Examples
Location	Residence			
	Public space		Theater/Museum	Theaters, movie theaters, halls, libraries, museums, galleries
			Restaurant/Bar	Restaurants, bars, night clubs
			Amusement	Amusement place, *pachinko*, bowling center
			Shopping center	Department store, supermarket, small shops, shopping malls
			Hospital/Nursing home	Hospitals, clinics, nursing homes
			School	Preschools, K12, universities, vocational colleges, special needs schools
			Station/Airport	Stations, trains, airports
			Hotel	Hotels, accommodations
			Other	Temples, churches, parks, city halls, pools
	Workplace			
	Road			

Incidence/Disease categories

	Main category		Subcategory	
	Category	Definition	Category	Definition
Incidence/Disease	Traffic accident	Traffic-involved accidents		
	Injury	Injuries caused by events other than traffic accidents, criminal incidences, self-harms, work-related accidents, sports competition, swimming, or natural disasters		
	Illness		Stroke	IX Diseases of the circulatory system, Stroke(a-0904) and Other cerebrovascular diseases(a-0905)
			Heath attack	IX Diseases of the circulatory system, Hypertension(a-0901) to other heart diseases(a-0903), and other cardiovascular diseases(a-0906)
			Digestive diseases	XI Diseases of the digestive system
			Respiratory diseases	X Diseases of the respiratory system
			Mental behavioral disorders	V Mental and behavioral disorders
			Neurology	VI Disease of the nervous system, VII Diseases of the eye and adnexa, VIII Diseases of the ear and mastoid process
			Kidney	XIV Diseases of the genitourinary system
			Cancer	II Neoplasms
			Other	I, III, IV, XII, XIII, XV, XVI, XVII, XIX, XX, and XXI
			Unknown or undiagnosed	IVIII Symptoms, sings and abnormal clinical and laboratory findings, not elsewhere classified
	Other	Criminal incidences, self-harms, work-related accidents, sports competition, swimming, or natural disasters, not elsewhere classified		

Severity categories

	Category	Definition
Severity	Fatal/Death	Fatal is a life-threatening condition
	Serious	Requires hospitalization for 3 or more weeks
	Severe	Does not fall in other categories
	Mild	Does not require hospitalization

Time of the incidence

Figure: Day of pension payment
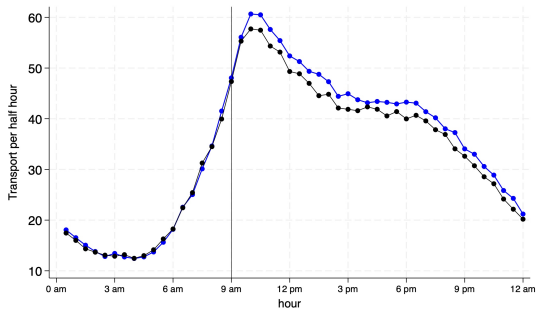
Figure: 3 days before payment

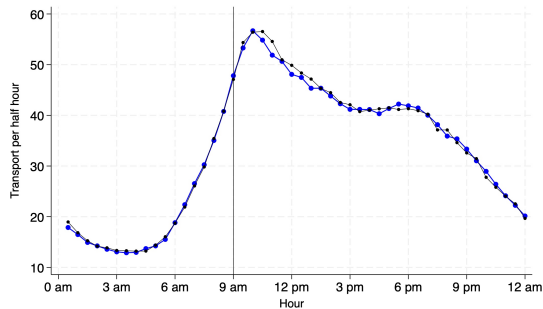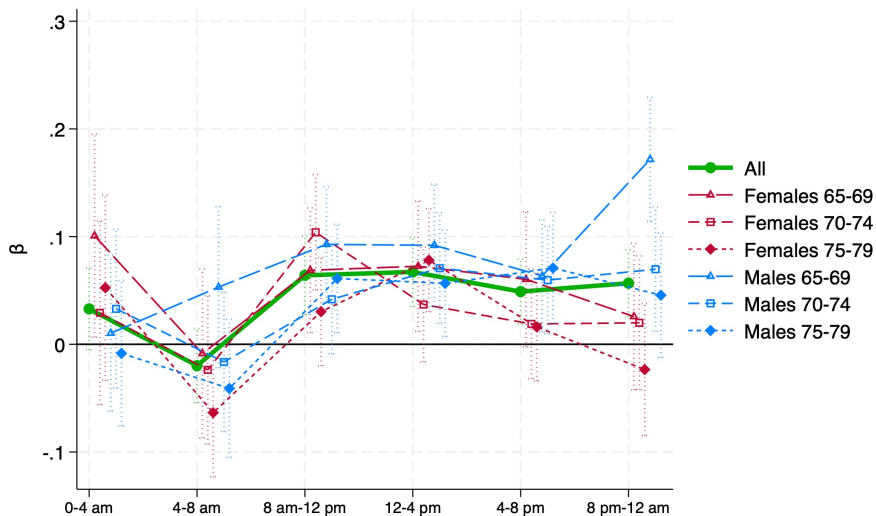# Time of the incidence: Statistical analysis

Heterogeneous impact