How Working Hours Limitation Affects Firms' Innovation Activities

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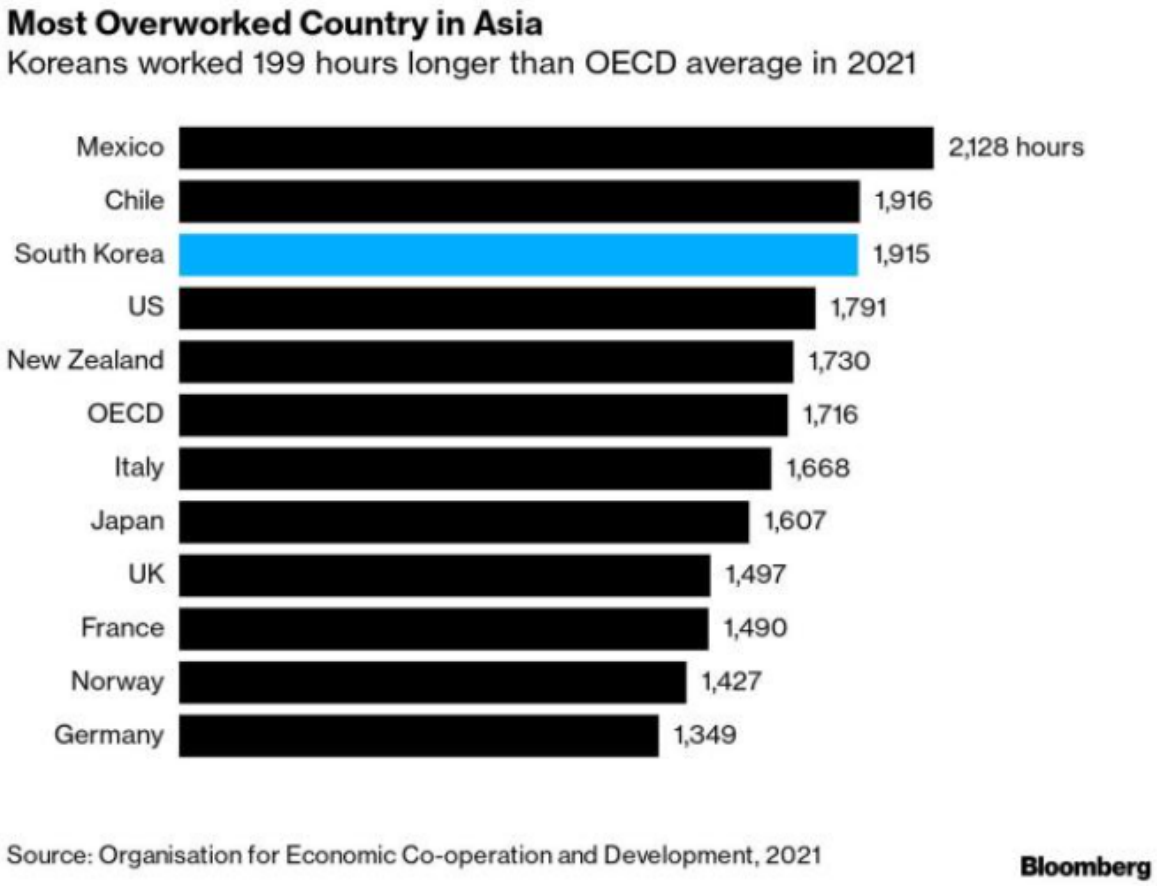
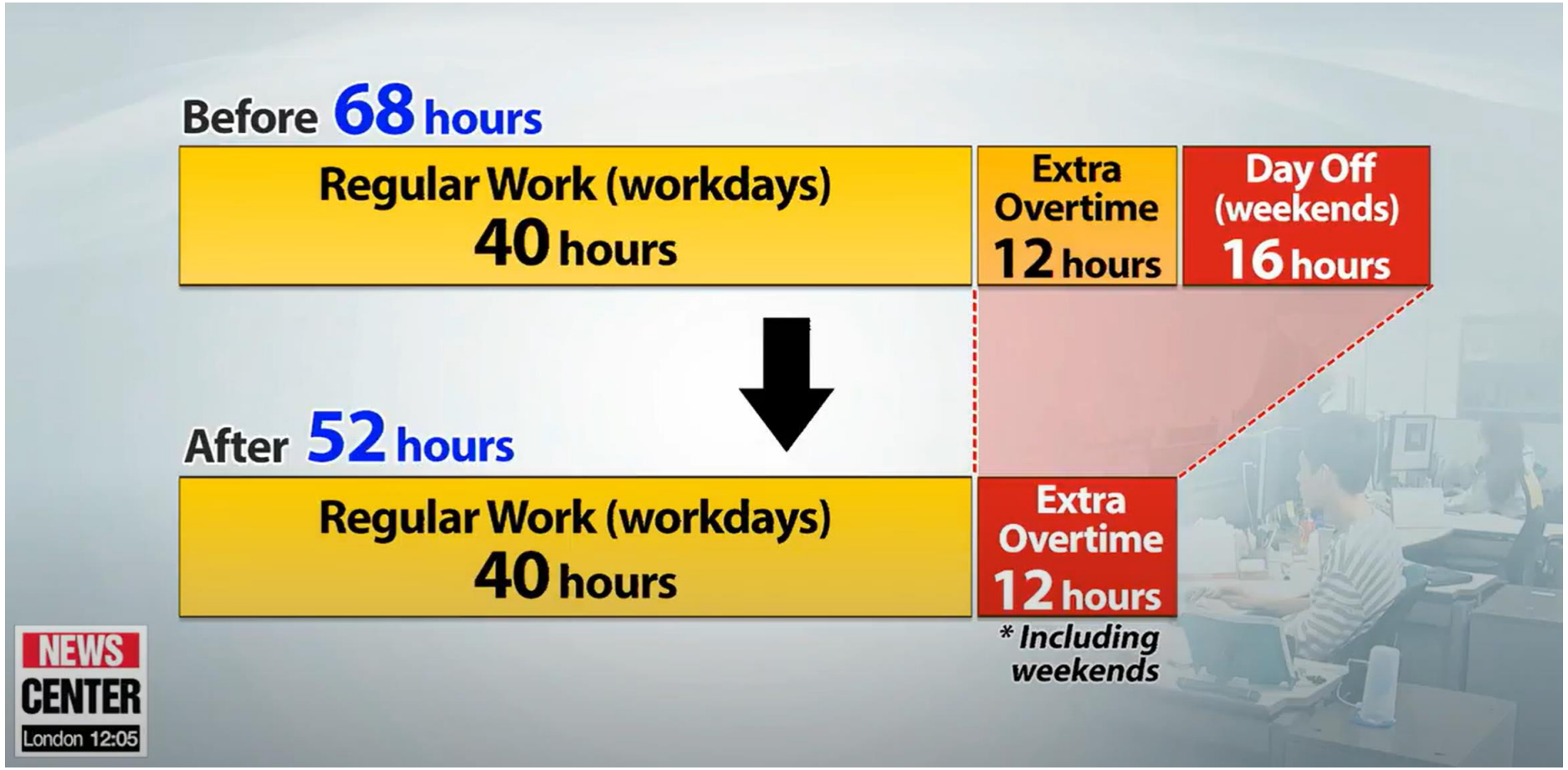
Background


Most Overworked Country in Asia
Koreans worked 199 hours longer than OECD average in 2021
Mexico
2,128 hours
Chile
1,916
South Korea
1,915
US
1,791
New Zealand
1,730
OECD
1,716
Italy
1,668
Japan
1,607
UK
1,497
France
1,490
Norway
1,427
Germany
1,349
Source: Organisation for Economic Co-operation and Development, 2021
Bloomberg

The 52-workweek policy in S.Korea



Source: Arirang News

Introduction

- This phenomenon is not unique to S.Korea but is also a global trend.
- Growing attention on worker well-being and employment
  - Studies have reported reductions in working hours and improvements in employee well-being following policy implementations.
  - Comparatively fewer studies on employment
- Limited studies on the impact of rising labor costs, particularly from the firm's perspective
  - Most previous research has focused on the impact from the employee's perspective.
- Literature gap in understanding how firms have been affected and what strategic responses they have adopted

Research Question

1. How the 52-hour workweek policy in South Korea affects firms' innovation activities
   - RND activities and HR activities
2. Is the effect is different across different industry sectors?
   - high-tech vs. low-tech firms.
3. How the 52-hour workweek policy in South Korea affects firms’ complementary activities
   - Cooperation and IT adoption

Preview of Findings

1. How the 52-hour workweek policy in South Korea affects firms' innovation activities
   - Increase in RND activities while partial decrease in HR activities
2. Is the effect is different across different industry sectors?
   - The impact was pronounced in high-tech firms, which increased R&D investments while low-tech firms focused more on reducing hiring.
3. How the 52-hour workweek policy in South Korea affects firms’ complementary activities
   - Cooperation and IT adoption increased only in high-tech firms

Reduction in Working Hours and Labor Costs

- Hourly Wages & Labor Costs
  - Working hours reduction often leads to increased hourly wages, raising overall labor costs (Fitzgerald, 1996; Boeri & Van Ours, 2014).
  - South Korea's 2003 and 2018 workweek regulations showed significant increases in labor costs due to reduced working hours (Yoo & Lee, 2014; Kim & Lee, 2012).
- South Korean Context
  - The 52-hour workweek policy further amplified this effect, particularly in industries with high overtime reliance (Han & Sohn, 2021; Lee & Hong, 2021).
  - Resulting wage hikes prompted shifts in firms' strategies, especially in managing productivity.

Labor Costs and Innovation Activities

- Induced Innovation Hypothesis
  - Higher labor costs push firms to innovate by investing in technology and human capital (Hicks, 1963; Acemoglu, 2010)
  - High-tech industries, in particular, may increase R&D and IT adoption to offset labor costs.
- Impeded Innovation Hypothesis
  - Conversely, rising labor costs can slow innovation, particularly in firms with less capacity for technological advancement (Nain & Wang, 2019; Shi & Liu, 2022)
  - Low-tech industries may prioritize cost-cutting measures, reducing investment in R&D and HR activities

Empirical Evidence & Gaps

- Existing Research
  - Limited studies on the direct impact of working hours reduction on innovation activities, with mixed findings (Jang et al., 2024; Nho & Kim, 2015).
  - Empirical studies on labor costs primarily focus on employment and productivity, leaving a gap in understanding innovation-related impacts.
- Study Focus
  - This study aims to fill this gap by examining how working hours limitation influences firms' innovation strategies, particularly in different technological contexts
- The 52-hour workweek policy as a Social Experiment

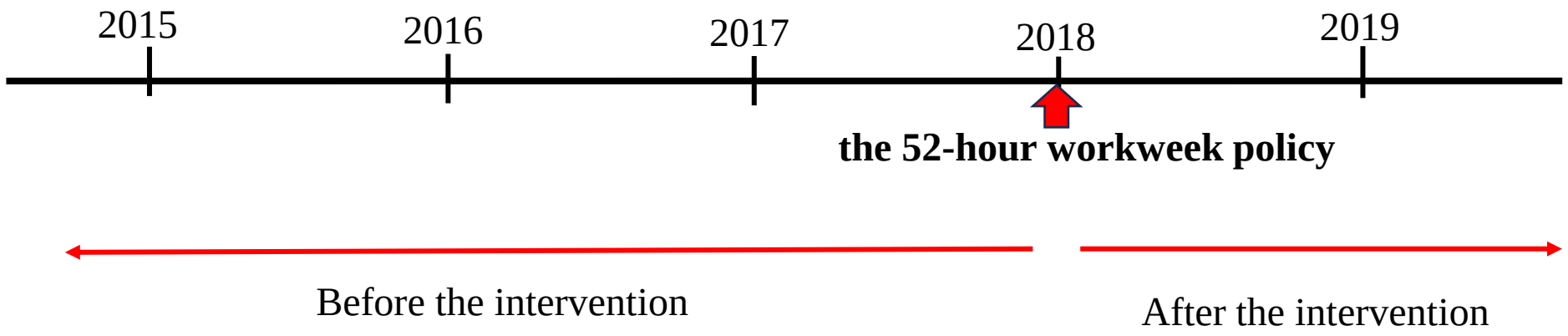
Schedule of the 52-hour workweek policy

Category	Scope	18.3.20 (Public Notice)	'18.7.1	'19.1.7	'20.1.1	'21.1.1	'21.7.1
Weekly Working Hours Reduction (68 -> 52 hours)	300+ Employees			Including Exempted Industries ('19.1.7~)			
	50-299 Employees (Including Exempted Industries)						
	5-49 Employees (Including Exempted Industries)						

- Exempted Industries: land transport, water transport, air transport, other transportation-related services, and health services

Policy Intervention

- In 2018, Large firms should follow the 52-hour workweek policy
  - Treatment group: firms with more than 300 employees
  - Comparison group: firms with less than 300 employees
  - Policy intervention: the 52-hour workweek policy
    - The policy is implemented in a stepwise manner.



Data: Workplace Panel Survey (WPS) - Korea

- **Rich longitudinal data on workforce, financials, R&D, and HR activities**
  - Initiated in 2006, conducted biennially
- **Data Used:** 2015, 2017, 2019
- **Treatment Group:** Large firms (>300 employees)
- **Control Group:** Smaller firms (<299 employees)
- **Sample:** Firms working >52 hours/week before policy change
- **Sector Focus:** Manufacturing (1,064 observations)

Descriptive Statistics

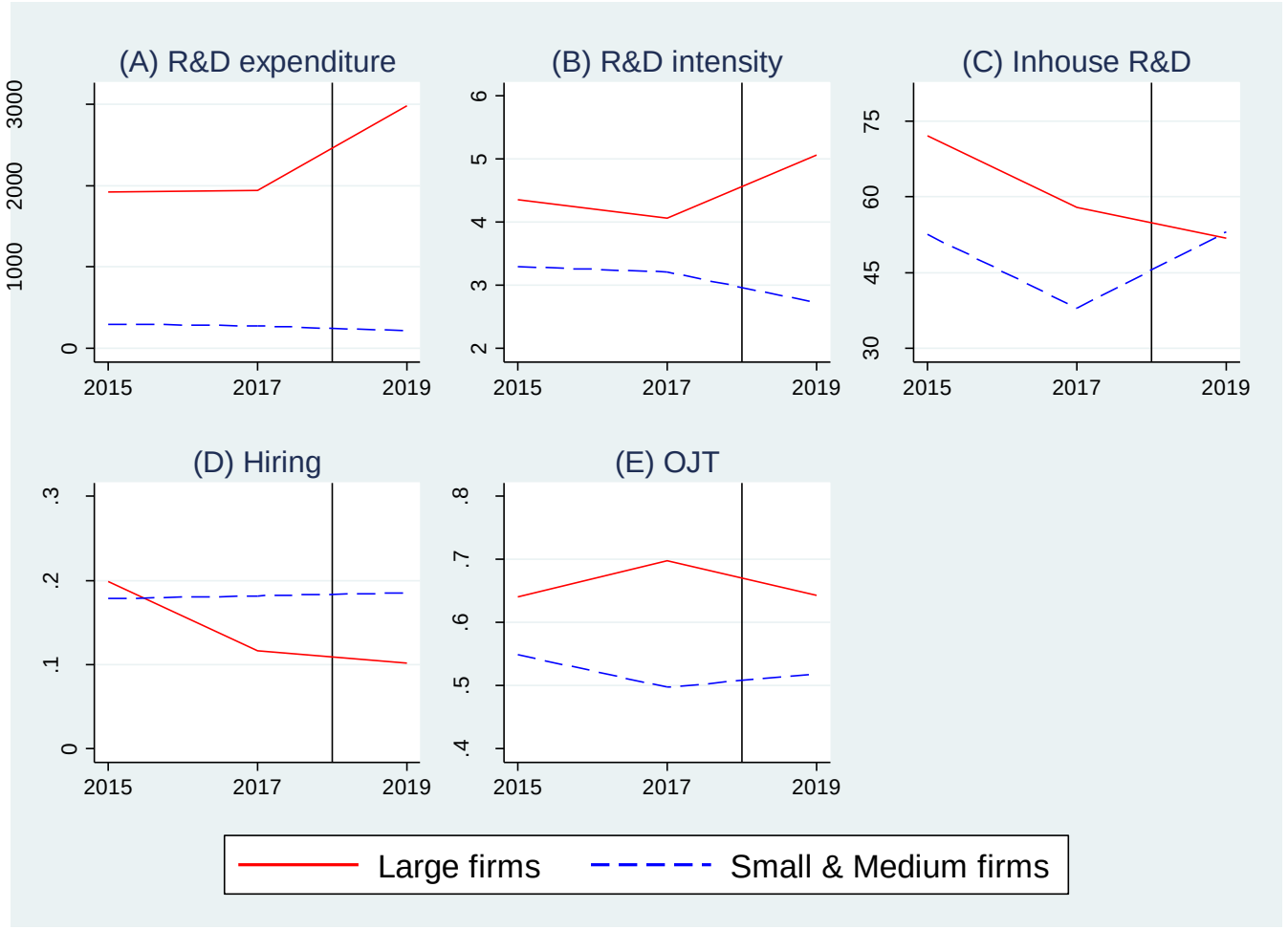
Table 1. Descriptive statistics

	Mean	SD	Min	Max	N
Large firm	0.113	0.316	0.000	1.000	1,064
High-tech industry	0.482	0.500	0.000	1.000	1,064
Low-tech industry	0.518	0.500	0.000	1.000	1,064
R&D expenditure	480.071	2,068.520	0.000	25,231.305	1,064
R&D intensity	3.233	13.742	0.000	304.348	1,064
Inhouse R&D	50.231	41.159	0.000	100.000	440
Hiring	0.177	0.203	0.000	1.544	1,064
OJT	0.537	0.499	0.000	1.000	1,064
lnSales	10.534	1.723	5.447	16.854	1,064
lnWorker	4.485	0.914	0.000	8.068	1,064
Middle firm	0.572	0.495	0.000	1.000	1,064
Listed	0.159	0.366	0.000	1.000	1,064
Professional manager	0.199	0.400	0.000	1.000	1,064
Female ratio	0.243	0.211	0.000	0.913	1,064
Labor union	0.217	0.412	0.000	1.000	1,064
Operation sites	3.047	6.508	1.000	109.000	1,064
Overseas ratio	0.047	0.150	0.000	0.909	1,064
Capital intensity	1.423	2.383	0.068	38.670	1,064
Multinational	0.045	0.208	0.000	1.000	1,064
year2015	0.316	0.465	0.000	1.000	1,064
year2017	0.384	0.487	0.000	1.000	1,064
year2019	0.300	0.458	0.000	1.000	1,064

Notes: R&D expenditure is measured in thousands of dollars. R&D intensity is calculated as R&D spending per employee, with each unit representing thousands of dollars. In-house R&D is restricted to firms investing in R&D, with data available for 440 observations.

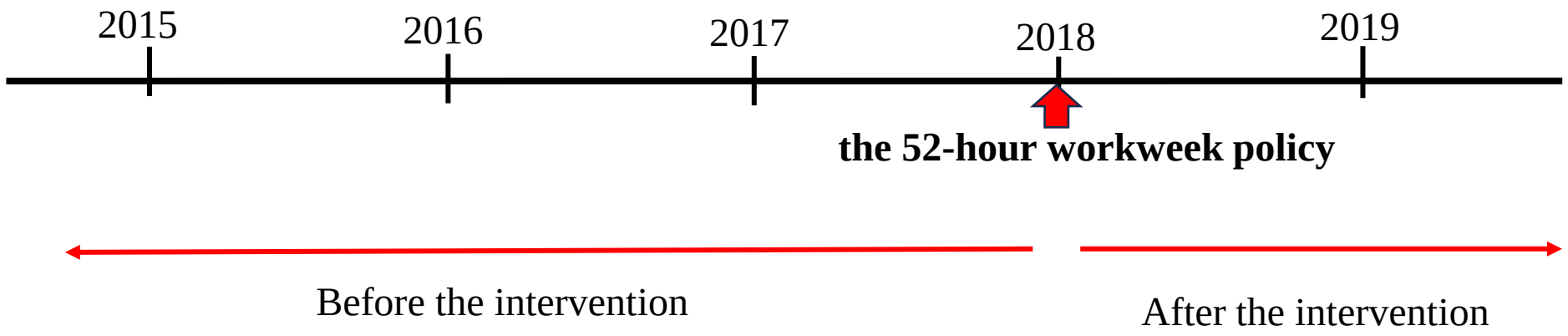
- Sample:
  - Large Firms (Treatment Group): 11.3%
  - High-tech Industries: 48.2%
  - Low-tech Industries: 51.8%
- Key Dependent Variables:
  - R&D Expenditure: $480 thousand (average)
  - R&D Intensity: $3.23 thousand per employee
  - In-house R&D: 50.23% of total R&D activities
  - Hiring Rate: 17.7% of total employment
  - OJT (On-the-Job Training): 53.7% of firms
- Control Variables:
  - Average Sales (lnSales): $37,571 thousand (10.534 in natural log)
  - Average Firm Size (lnWorkers): 89 employees (4.485 in natural log)
  - Medium-sized Firms: 57.2%
  - Listed Companies: 15.9%
  - Firms with Professional Managers: 19.9%
  - Female Workforce Ratio: 24.3%
  - Firms with Labor Unions: 21.7%
  - Average Number of Sites: 3.05
  - Overseas Operations: 4.7%
  - Multinational Firms: 4.5%
  - Capital Intensity: 1.423 (Assets > Sales by 42.3%)

Trend of Innovation activities



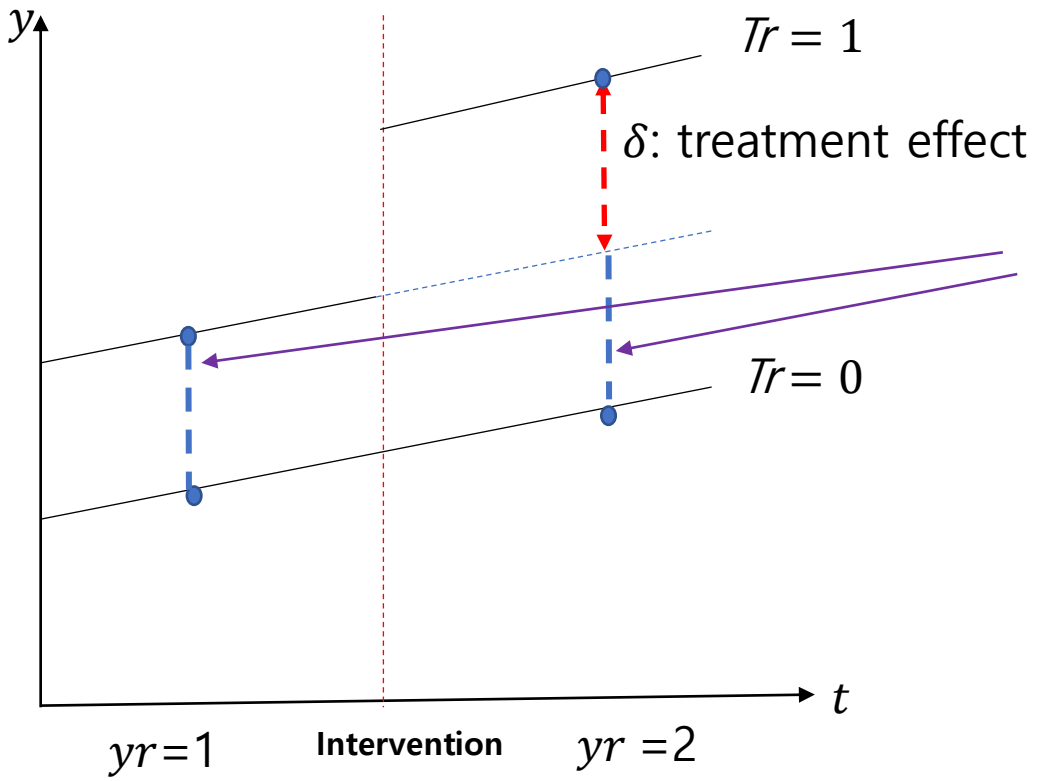
Empirical strategy

- Difference-in-Differences Method
  - Treatment group: firms with more than 300 employees
  - Comparison group: firms with less than 300 employees
  - Policy intervention: the 52-hour workweek policy
    - The policy is implemented in a stepwise manner.
- Parallel Assumption



Difference-in-Differences Method

- Better than Before-and-After analysis and simple cross-sectional analysis after intervention
- $Y_{it} = \alpha + \gamma_1 Treatment_i + \gamma_2 Year_{it} + \delta\,(Treatment_i * Year_{it}) + \beta X_{it} + U_{it}$



Should be the same if there were no intervention – Parallel Assumption

Empirical strategy

- Panel Data:
  - Fixed effects and clustered robust standard errors employed.
- Control Variables:
  - Sales, Number of Workers, Company Type (Medium firm, Listed, Professional Manager), Workforce Composition (Female ratio, Labor Union presence), Operational Details (Operation Sites, Overseas Ratio, Capital Intensity, Multinational status)
- Analysis Sample:
  - After excluding missing data in key variables, the final sample includes 1,064 observations from the manufacturing sector.

Table 2. The effect of working hours regulation on R&D activities within manufacturing industry

	R&D expenditure		R&D intensity		Inhouse R&D	
	OLS	FE	OLS	FE	OLS	FE
Large x Year 2017	1.539	-277.153	-0.249	0.414	2.888	5.763
	(522.987)	(542.306)	(1.601)	(1.768)	(8.764)	(8.310)
Large x Year 2019	945.154	1,040.489*	0.475	2.677	-21.070*	-10.011
	(908.201)	(629.278)	(2.433)	(2.578)	(11.020)	(9.935)
Large	1,044.099	552.225	3.829	3.121	3.216	0.140
	(735.948)	(610.608)	(3.063)	(2.803)	(16.088)	(14.094)
Year 2017	-59.187	-85.420	-0.493	-1.598	-14.748***	-10.149*
	(87.023)	(52.128)	(1.128)	(1.072)	(4.871)	(5.329)
Year 2019	-86.813	-100.409*	-0.817	-1.597	0.731	1.076
	(70.571)	(57.345)	(0.946)	(1.132)	(5.096)	(5.502)
Control variables	Yes					
R^2	0.119	0.037	0.028	0.006	0.083	0.000
N	1064	1064	1064	1064	440	440

Notes: R&D expenditure is measured in thousands of dollars. R&D intensity is calculated as R&D spending per employee, with each unit representing thousands of dollars. In-house R&D is restricted to firms investing in R&D, with data available for 440 observations.

Table 3. The effect of working hours regulation on HR activities within manufacturing industry

	Hiring		OJT	
	OLS	FE	OLS	FE
Large x Year 2017	-0.068	-0.036	0.087	0.040
	(0.043)	(0.030)	(0.084)	(0.093)
Large x Year 2019	-0.091**	-0.030	0.011	-0.003
	(0.042)	(0.033)	(0.117)	(0.120)
Large	-0.027	-0.120	0.020	-0.133
	(0.058)	(0.078)	(0.128)	(0.158)
Year 2017	0.011	0.007	-0.059*	-0.038
	(0.015)	(0.016)	(0.035)	(0.039)
Year 2019	0.009	-0.007	-0.028	-0.031
	(0.015)	(0.016)	(0.038)	(0.042)
Control variables	Yes			
R^2	0.089	0.002	0.040	0.018
N	1064	1064	1064	1064

Notes: Hiring measures the number of new hires in the past year relative to total employment. OJT (on-the-job training) is a binary variable indicating whether the company conducted job training for current employees last year to acquire the necessary skills and competences required for their operations.

Table 4. Heterogeneous Effects of Technological Levels

Panel A. R&D Activities						
	R&D expenditure		R&D intensity		Inhouse R&D	
	High-Tech	Low-Tech	High-Tech	Low-Tech	High-Tech	Low-Tech
Large x Year 2017	765.453	-802.047	3.904	-0.897	4.584	4.893
	(483.527)	(710.708)	(3.045)	(1.415)	(10.812)	(12.694)
Large x Year 2019	2,039.508*	713.725	8.163*	2.445	-4.340	-23.477
	(1,075.109)	(1,253.920)	(4.249)	(2.453)	(12.316)	(20.521)
R^2	0.008	0.037	0.021	0.010	0.001	0.001
N	513	551	513	551	240	200
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: R&D expenditure is measured in thousands of dollars. R&D intensity is calculated as R&D spending per employee, with each unit representing thousands of dollars. In-house R&D is restricted to firms investing in R&D, with data available for 440 observations.

Panel B. HR Activities				
	Hiring		OJT	
	High-Tech	Low-Tech	High-Tech	Low-Tech
Large x Year 2017	-0.033	-0.070	0.018	-0.025
	(0.028)	(0.059)	(0.109)	(0.141)
Large x Year 2019	-0.008	-0.104*	0.059	-0.048
	(0.027)	(0.062)	(0.129)	(0.198)
R^2	0.001	0.001	0.020	0.043
N	513	551	513	551
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: Hiring measures the number of new hires in the past year relative to total employment. OJT (on-the-job training) is a binary variable indicating whether the company conducted job training for current employees last year to acquire the necessary skills and competences required for their operations.

Further Analysis: Complementary Activities

Table 5. The effect of working hours regulation on complementary activities

	Cooperation			IT adoption		
	All	High-Tech	Low-Tech	All	High-Tech	Low-Tech
Large x Year 2017	0.172	0.129	0.135	0.084	0.345	-0.207
	(0.105)	(0.132)	(0.165)	(0.173)	(0.230)	(0.206)
Large x Year 2019	0.253**	0.244*	0.195	0.157	0.667***	-0.351
	(0.112)	(0.147)	(0.166)	(0.192)	(0.234)	(0.227)
R^2	0.000	0.003	0.001	0.004	0.088	0.012
N	1064	513	551	1064	513	551
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Cooperation is measured as a binary variable, coded as 1 if subcontracting was received and 0 otherwise. IT Adoption is binary variable, utilizing a 5-point scale ranging from 'not at all' to 'very much so,' indicating the extent of IT investment expansion within the company.

Sensitivity Analysis

Table 6. Sensitivity analysis

Panel A. R&D activities

	R&D expenditure			R&D intensity			Inhouse R&D		
	All	High-Tech	Low-Tech	All	High-Tech	Low-Tech	All	High-Tech	Low-Tech
Large x Year 2017	-277.950	782.312	-830.409	-0.523	2.188	-1.666	8.935	12.401	5.321
	(543.527)	(490.778)	(712.778)	(1.535)	(2.541)	(1.244)	(8.649)	(13.888)	(13.646)
Large x Year 2019	1,071.490*	2,022.956*	796.184	1.413	5.516	2.045	-4.536	8.378	-25.195
	(648.335)	(1,086.270)	(1,296.097)	(2.485)	(4.043)	(2.525)	(10.477)	(15.534)	(21.306)
R^2	0.033	0.008	0.028	0.003	0.025	0.008	0.000	0.000	0.000
N	729	368	361	729	368	361	329	179	150
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: R&D expenditure is measured in thousands of dollars. R&D intensity is calculated as R&D spending per employee, with each unit representing thousands of dollars. In-house R&D is restricted to firms investing in R&D, with data available for 329 observations.

Panel B. HR activities

	Hiring			OJT		
	All	High-Tech	Low-Tech	All	High-Tech	Low-Tech
Large x Year 2017	-0.003	-0.017	-0.029	0.030	0.011	-0.037
	(0.031)	(0.029)	(0.059)	(0.096)	(0.114)	(0.150)
Large x Year 2019	0.002	0.006	-0.061	-0.040	0.083	-0.138
	(0.035)	(0.029)	(0.061)	(0.125)	(0.137)	(0.204)
R^2	0.010	0.002	0.008	0.014	0.019	0.053
N	729	368	361	729	368	361
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Hiring measures the number of new hires in the past year relative to total employment. OJT (on-the-job training) is a binary variable indicating whether the company conducted job training for current employees last year to acquire the necessary skills and competences required for their operations.

Panel C. Complementary R&D activities

	Cooperation			IT adoption		
	All	High-Tech	Low-Tech	All	High-Tech	Low-Tech
Large x Year 2017	0.178	0.111	0.164	0.123	0.304	-0.135
	(0.109)	(0.142)	(0.170)	(0.183)	(0.243)	(0.219)
Large x Year 2019	0.245**	0.228	0.199	0.131	0.576**	-0.338
	(0.115)	(0.160)	(0.162)	(0.203)	(0.249)	(0.239)
R^2	0.000	0.006	0.000	0.002	0.047	0.000
N	729	368	361	729	368	361
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Cooperation is measured as a binary variable, coded as 1 if subcontracting was received and 0 otherwise. IT Adoption is binary variable, utilizing a 5-point scale ranging from 'not at all' to 'very much so,' indicating the extent of IT investment expansion within the company.

Findings

1. How the 52-hour workweek policy in South Korea affects firms' innovation activities
   - Increase in RND activities while partial decrease in HR activities
2. Is the effect is different across different industry sectors?
   - The impact was pronounced in high-tech firms, which increased R&D investments while low-tech firms focused more on reducing hiring.
3. How the 52-hour workweek policy in South Korea affects firms’ complementary activities
   - Cooperation and IT adoption increased only in high-tech firms

Contribution of Research

1. First Empirical Study on Working Hours & Innovation
   - First to comprehensively analyze how reduced working hours influence corporate innovation strategies.
2. Supports Induced Innovation Hypothesis, in terms of RND activities
   - Demonstrates that rising labor costs can drive firms to increase R&D investments, contributing to ongoing discussions in the literature (Deng et al., 2022; Li et al., 2020).
3. Evidence for Impeded Innovation Hypothesis, in terms of HR activities
   - Provides empirical support for the impeded innovation hypothesis, showing decreased employment post-policy, adding to the debate on the effects of working hours reduction.
4. Novel Insight into Technological Levels
   - Highlights how technological levels moderate the effects of labor costs on innovation activities, filling a gap in the existing research focused on labor and capital intensity (Kong et al., 2021; Li et al., 2022).

Policy Implication

1. Implement labor laws that encourage firms to innovate in response to wage increases
2. Introduce HR-focused subsidies, tax incentives, and financial supports to enhance firms' innovation capacity through human resource development
3. Avoid one-size-fits-all policies; tailor them to different industrial sectors
    - Apply supportive measures for low-tech industries even if uniform policies are implemented.

Limitations

- DATA
  - The analysis captures only the short-term effects of the 52-hour workweek policy.
    - 2020 data was deliberately excluded due to the disruptive impact of COVID-19 on market conditions for both treatment and control groups.
  - Unable to directly measure the increase in labor costs per employee due to the absence of detailed data on working hours.
- Methodological Constraints:
  - Risk of parallel assumption violation due to unaccounted factors.
- Despite these limitations, this study rigorously analyzes the impact of working hours limitation on firm's innovation activities using a quasi-experimental design, providing a basis for future academic and policy discussions.

Thank you
Q&A