Innovation Spurred
Evidence from South Korea's Big R&D Push
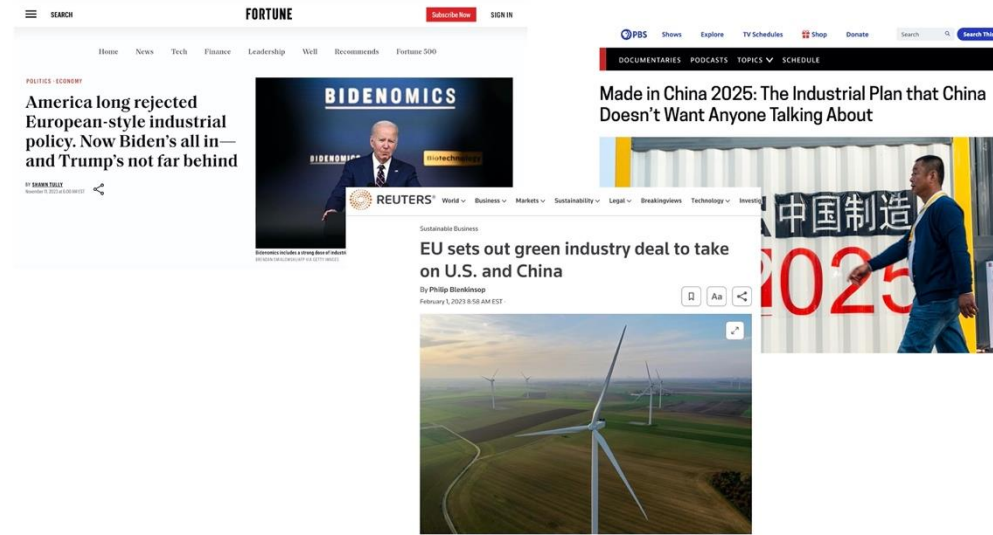
Luis F. Jaramillo (University of Maryland, JMP)

Chan Kim (University of Maryland)

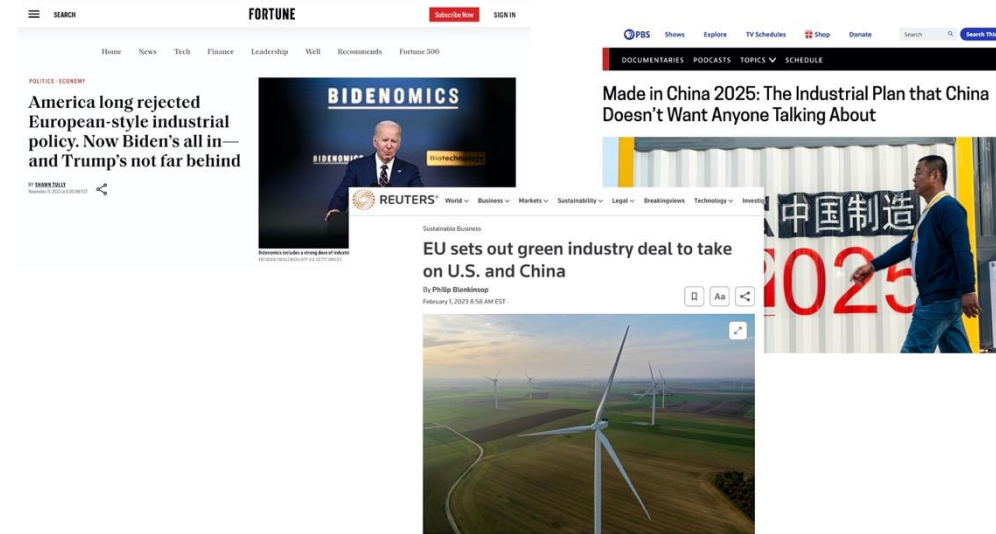2024 Meetings of the European Economic Association

Rotterdam, The Netherlands
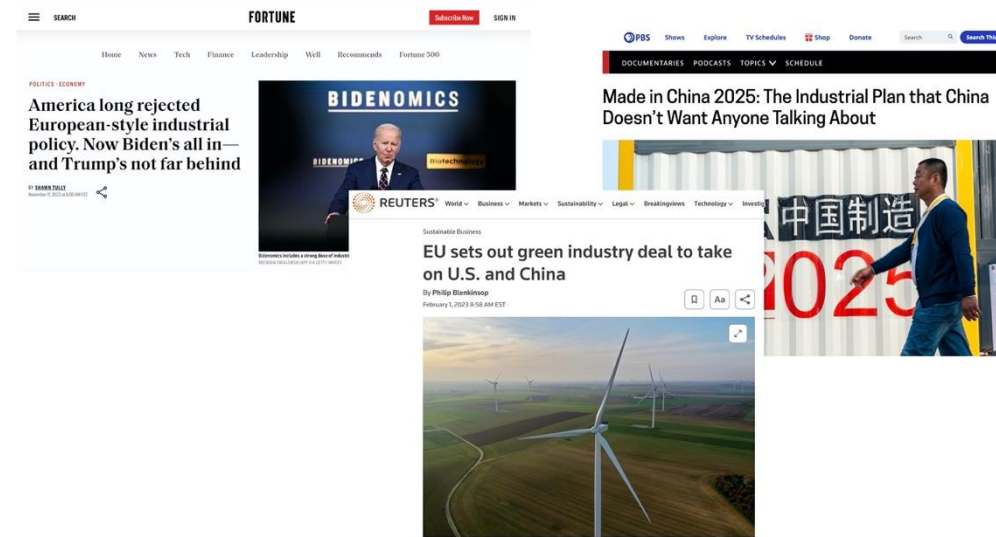
August 28th, 2024

Industrial policy is back…

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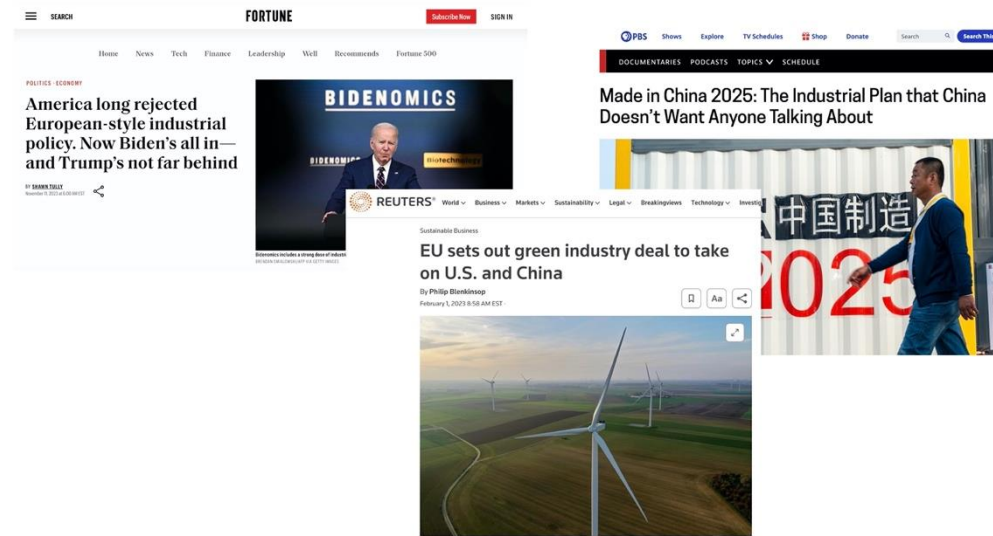- Despite clear theoretical grounds for interventions, open questions are: what works? what doesn't work?

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- We know little about "mission-oriented" programs: large endeavors where the public sector takes an active role in coordinating actors around cross-sectoral issues

- We study the G7 Program, South Korea's first "mission-oriented" National R&D Program, to investigate how **industrial policy** affects **research output and economic outcomes**

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- **Main findings**
  - By the 10th year after receiving program support, targeted technological classes doubled their citation-weighed patenting output and tripled their real exports relative to control classes
  - Targeted and control classes observed no differential trends in outcomes or economic characteristics before receiving support
  - The effect on patenting output materialized almost immediately. It took more time for exports (~5 years)
  - Ours findings persist in a cross-country setting
  - Technological classes with *less* concentrated scientific output before the program observe *greater* effects

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- The G7P shifted the direction in which the South Korean economy innovated, with important economic consequences

The G7 Program

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  - Soaring labour costs: real wages increased 70% between 1985 and 1992
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Type	Name	Implementation
Product	HDTV	1992 - 1994
	High-capacity semiconductor	1995 - 1999
	Next-generation car (electric vehicle)	1992 - 2001
	Next-generation flat panel display	1995 - 2000
	B-ISDN Devices for 10GB environments	1992 - 2001
	New medicines and agrochemicals	1992 - 1997
	Medical engineering	1995 - 2001
	Ultra-compact precision machinery	1995 - 2001
	High-speed train	1996 - 2001
Base	Information, electronics, and energy materials	1992 - 2001
	Biomaterials	1992 - 2001
	Advanced Production System	1992 - 2001
	Next-generation semiconductor	1993 - 1996
	Environmental Engineering	1992 - 2001
	Fuel-cell	1992 - 2001
	Next-generation nuclear reactor	1992 - 2001
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- Two types of projects: "product" and "base" technologies
- To address selection **concerns**, we leverage that some **high-potential projects** were **selected but not implemented** due to **budget shocks**
  - High Speed Ship
  - Aircraft Core Technology
  - Artificial Intelligence Computer
  - Automated Traffic Control System
  - Off-shore Manufacturing Plant

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- G7 Program Files
  - Newly digitized information on final goal and description of activities, participating firms, time span, and private and public contributions for over +4,700 G7P—related projects
  - We use a language model (IPCCAT) to match each research project to IPC technological classes

과제번호	과 제 명	연구기관 (책임자)	참여기업	연구기간	'95 연구개발비(단위:천원)			최종목표	연구내용
					정부	기업	계		
95-G-02-01-A	교환기술분야개발	전자통신연구소 (임주환)	한화정보통신 동아전기 삼성전자(주) 대우통신(주) 우진전자통신 (주) LG정보통신 (주)	'92 ~ '97 ('95/01/01 ~ '95/12/31)	32,868,000	44,237,000	77,105,000		
95-G-02-01-A-01	ATM 교환기 시스템 개발	전자통신연구소 (한치문)	한화정보통신 동아전기 삼성전자(주) 대우통신(주) 우진전자통신 (주) LG정보통신 (주)	'92 ~ '97 ('95/01/01 ~ '95/12/31)	27,520,000	38,669,000	66,189,000	정보화 사회의 구축에 핵심적인 광대역 ATM기술, 광교환기술 등 차세대 교환기술개발	○소형 ATM 교환기 개발 완료 ○중형 ATM 교환기 구조 설계
95-G-02-01-A-01-A	ATM 교환기에서의 과부하제어에 관한 연구	한남대학교 (최진규)					15,000		
95-G-02-01-A-01-AA	운용메시지의 음성화에 관한 연구	과학기술원 (오영환)					15,000		
95-G-02-01-A-01-AB	ATM 교환기의 내진동설계 및 해석에 관한연구	과학기술원 (엄윤용)					25,000		

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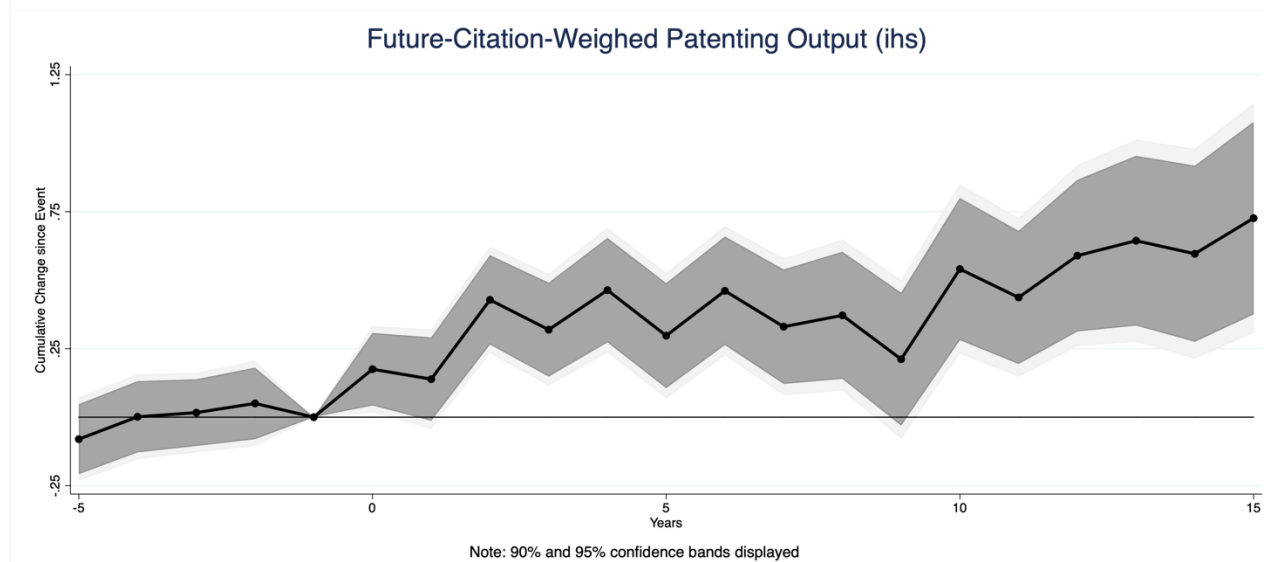$$\Delta G7P_{s,g+h} = G7P_{s,g+h} - G7P_{s,g-1}$$

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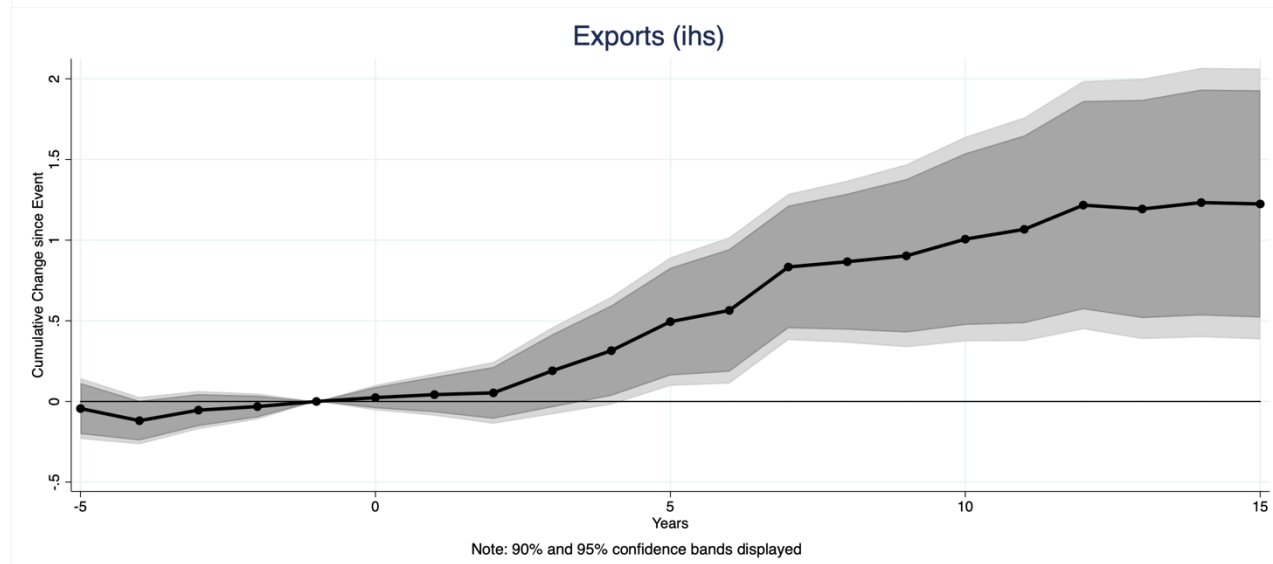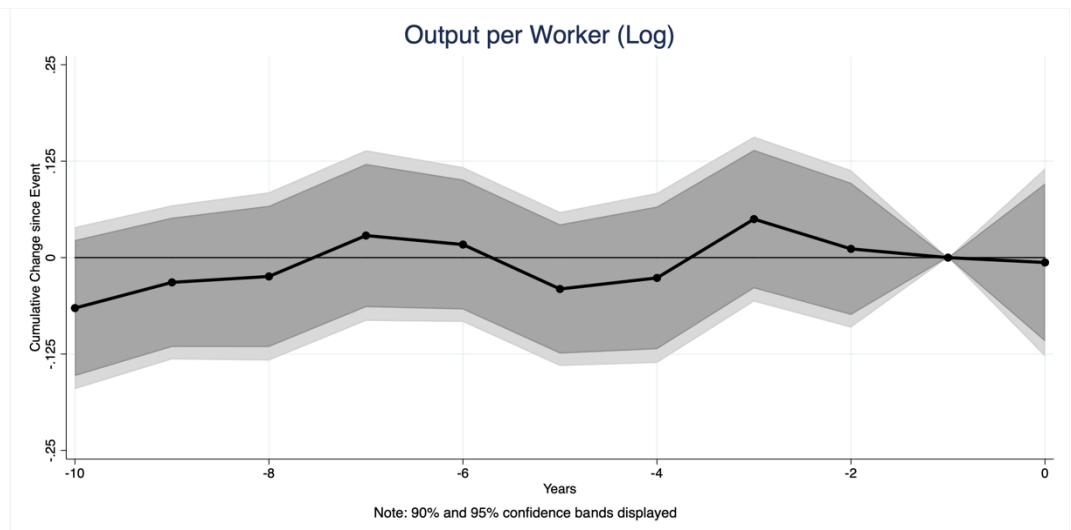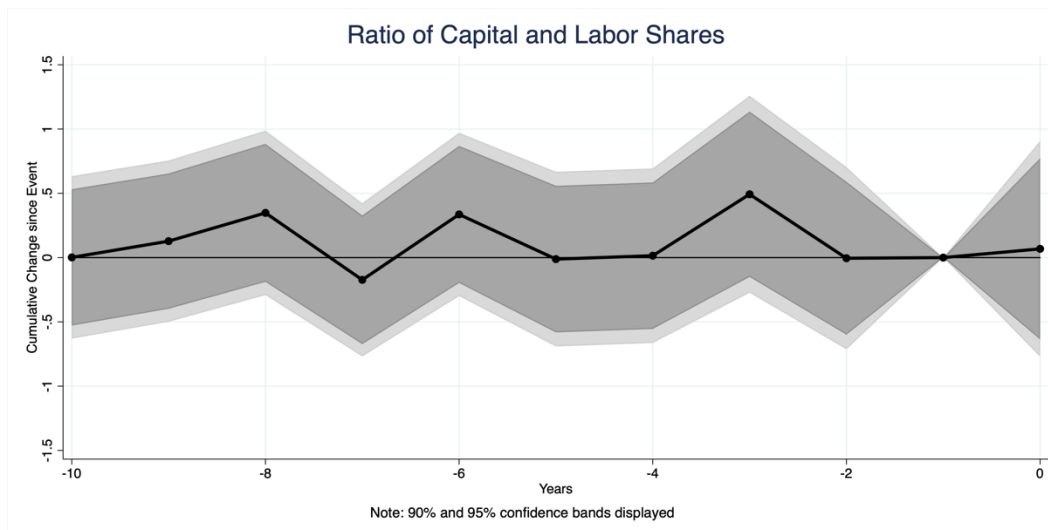
Korean
Sample
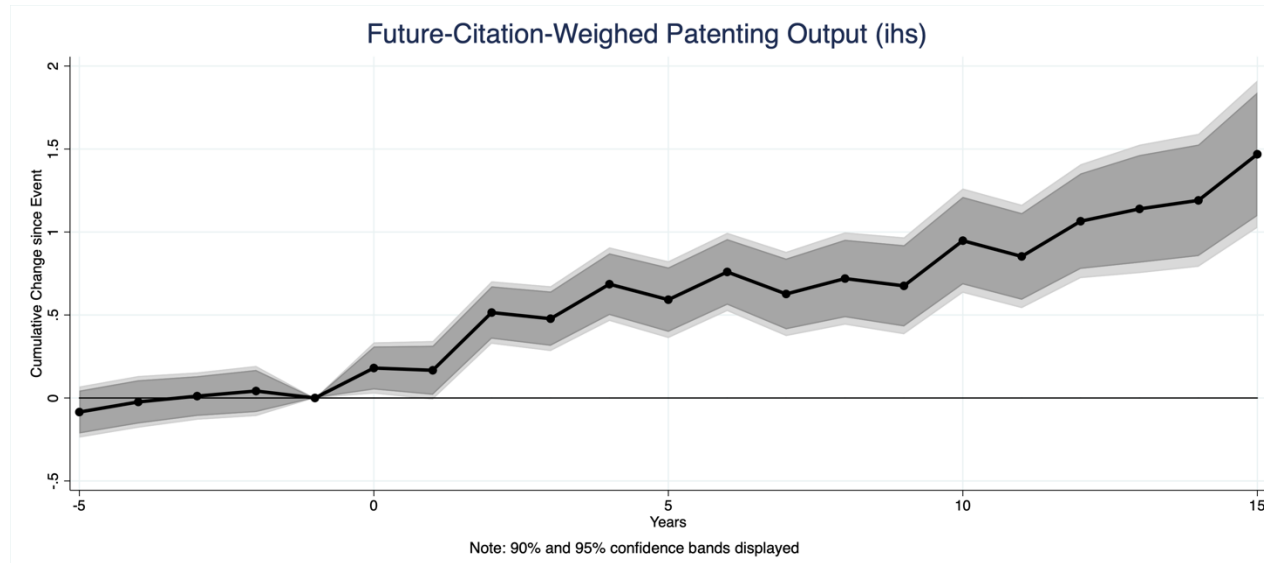
Cross-Country
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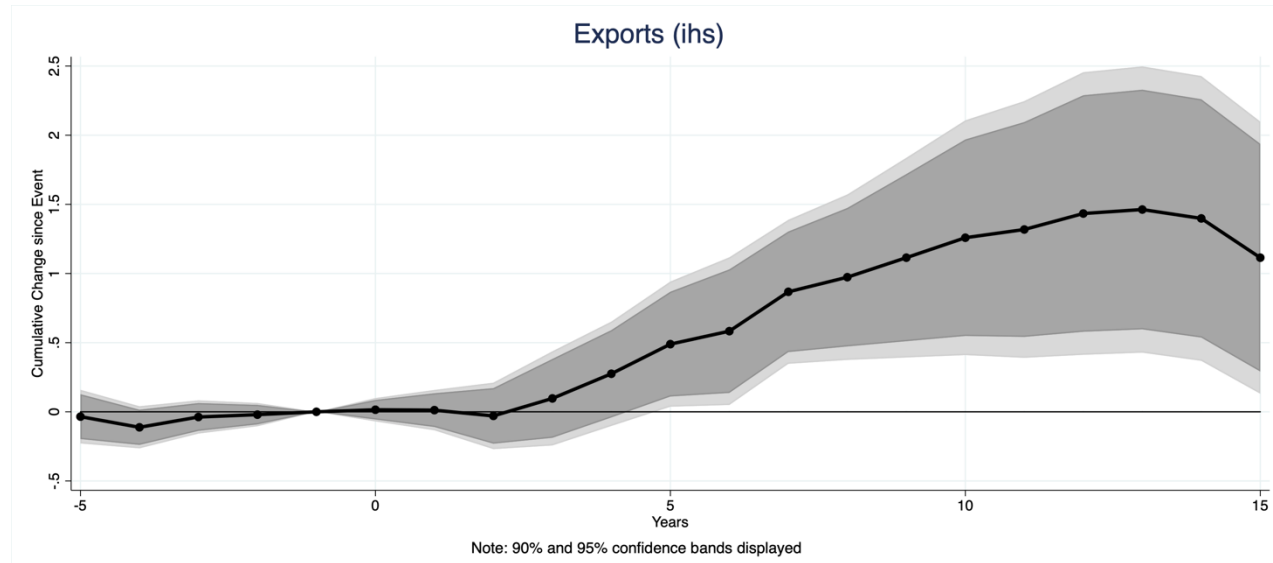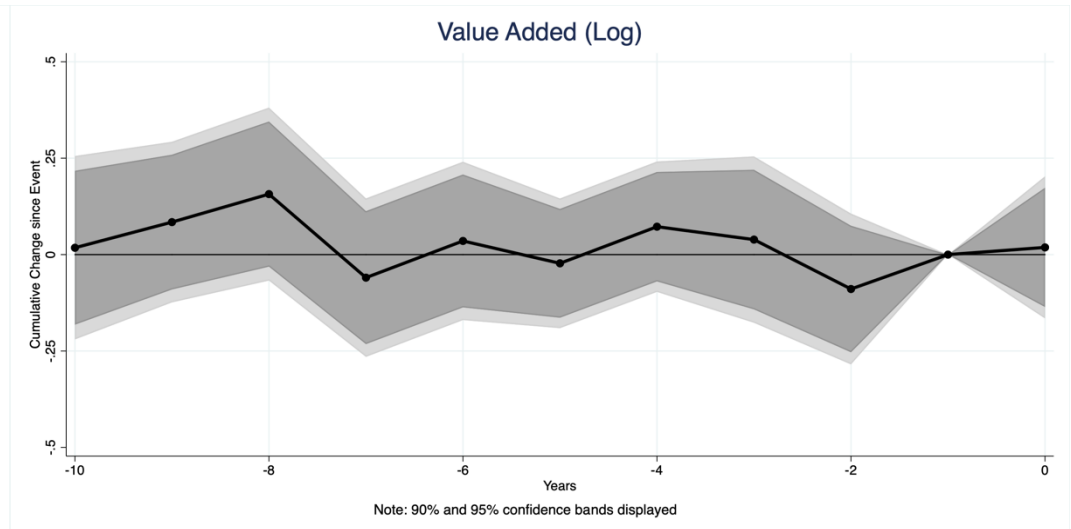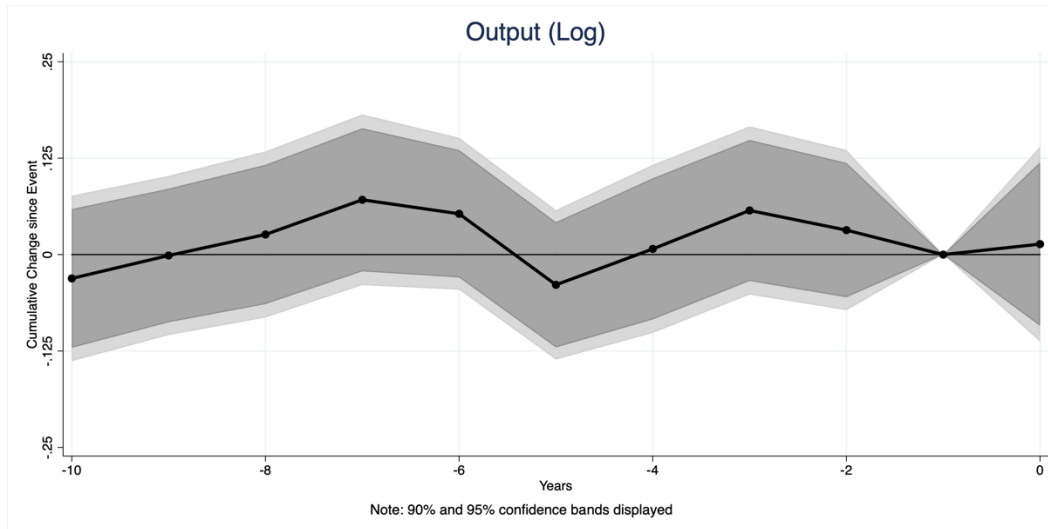
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Results

Mechanisms

Future-Citation-Weighed Patenting Output (ihs)
Heterogeneity by (Pre-G7P) Asignee Citation Share HHI

Note: 90% and 95% confidence bands displayed
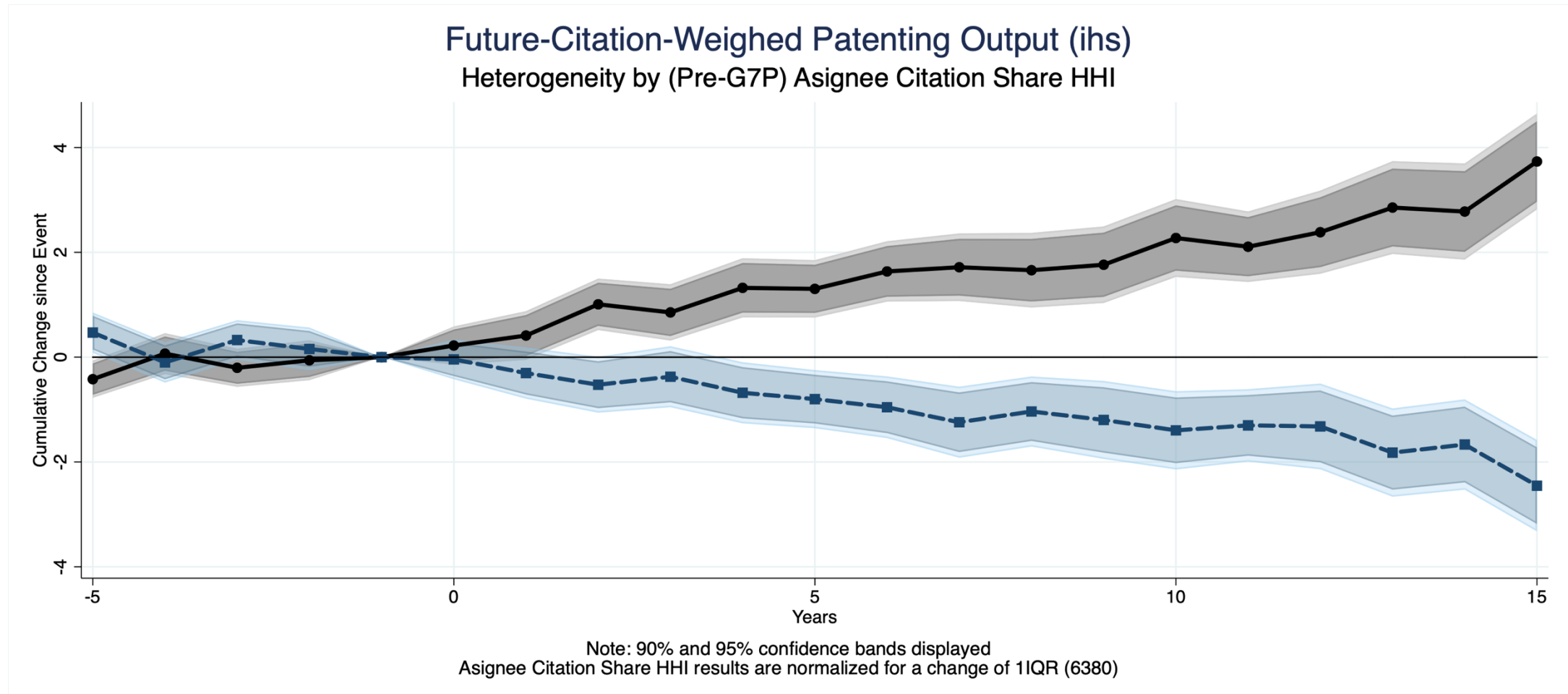Asignee Citation Share HHI results are normalized for a change of 1IQR (6380)

Conclusion

- The G7P shifted the direction in which the South Korean economy innovated
  - Large, persistent impact on citation-weighed patenting output for targeted technological classes
  - Almost immediate effects
  - Larger effects in technological classes with *less* concentrated scientific production

Conclusion

- The G7P shifted the direction in which the South Korean economy innovated
  - Large, persistent impact on citation-weighed patenting output for targeted technological classes
  - Almost immediate effects
  - Larger effects in technological classes with *less* concentrated scientific production
- Such shift had a relevant impact on the real economy
  - Large, long-lasting impact on exports for targeted technological classes
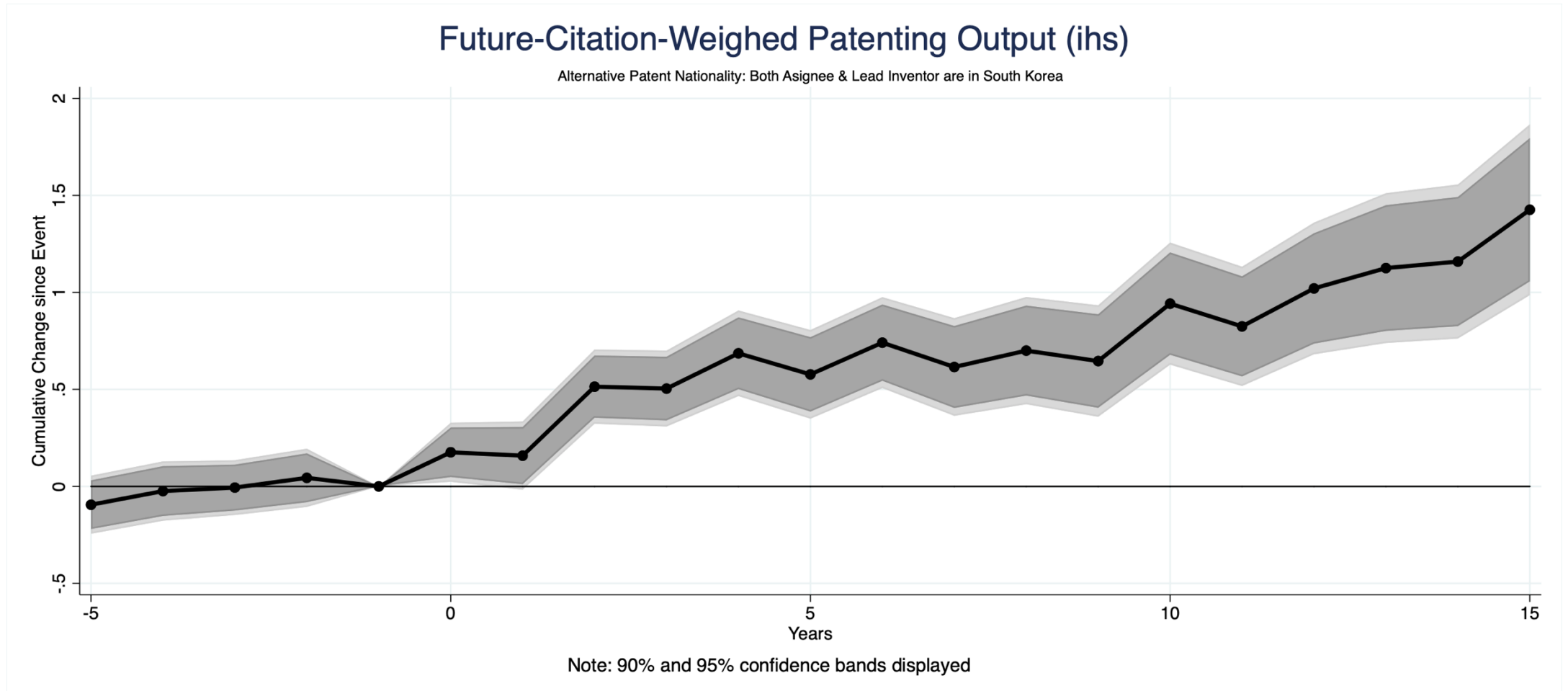 - Effects took some time to materialize
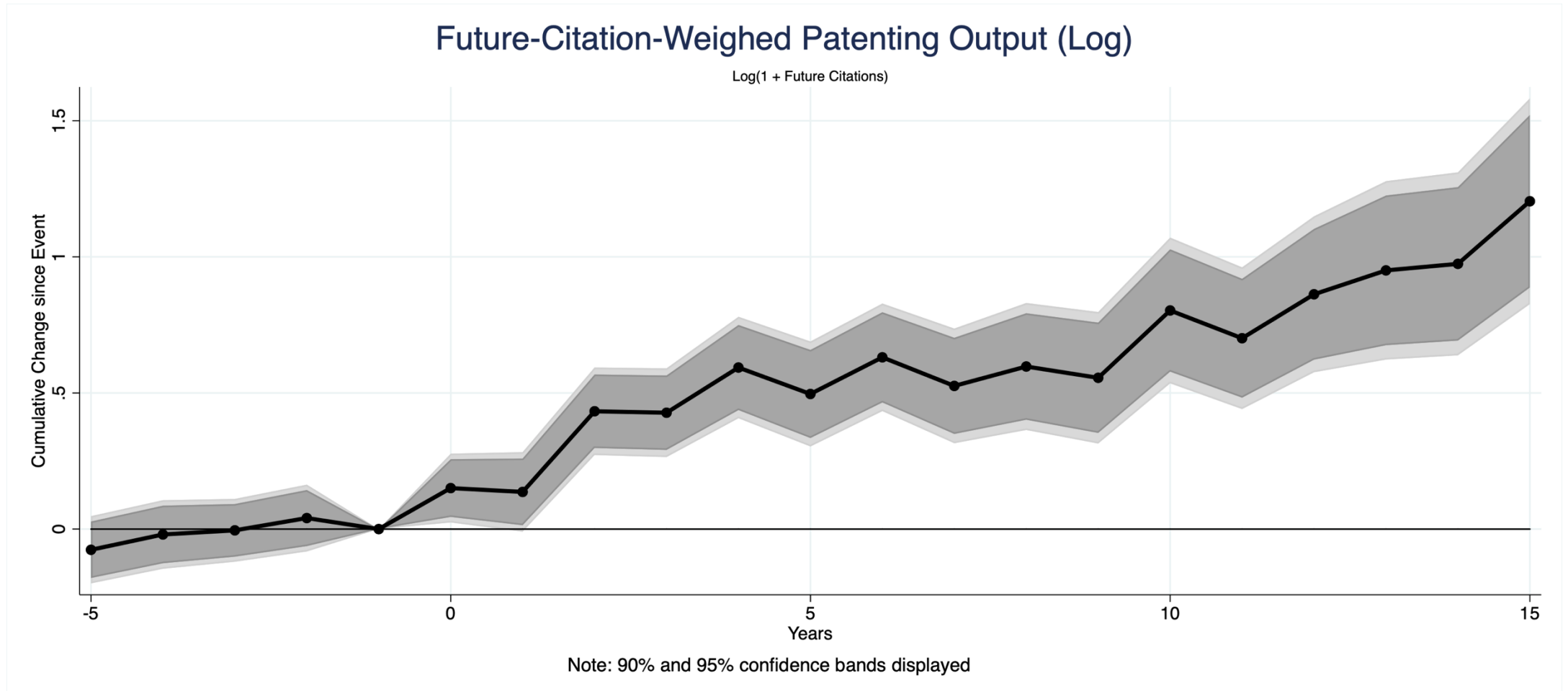
감사합니다!

(Thank you!)

Robustness checks

- Alternative definition of patent nationality

- Logarithmic transformation

- Alternative quality thresholds for language model's predictions

- Additional pre-treatment lags

Robustness Checks
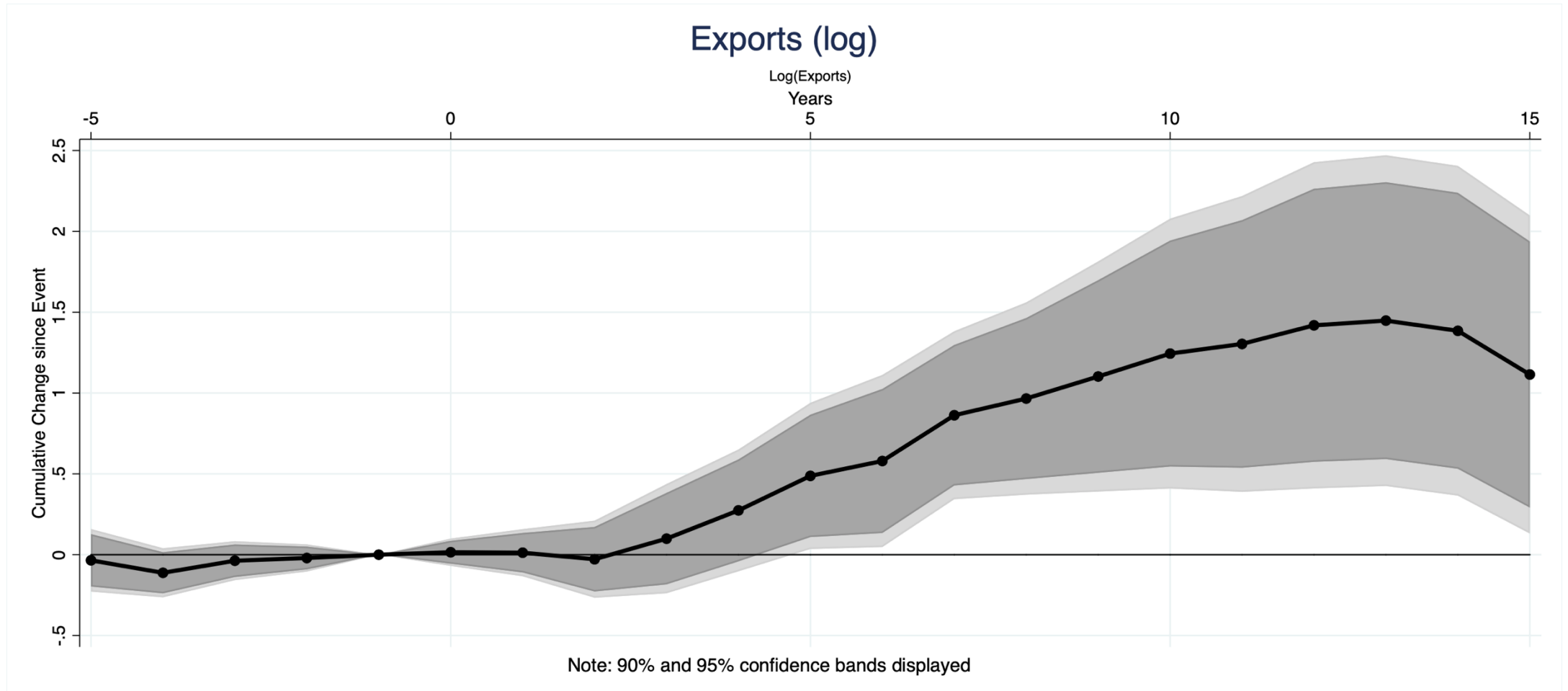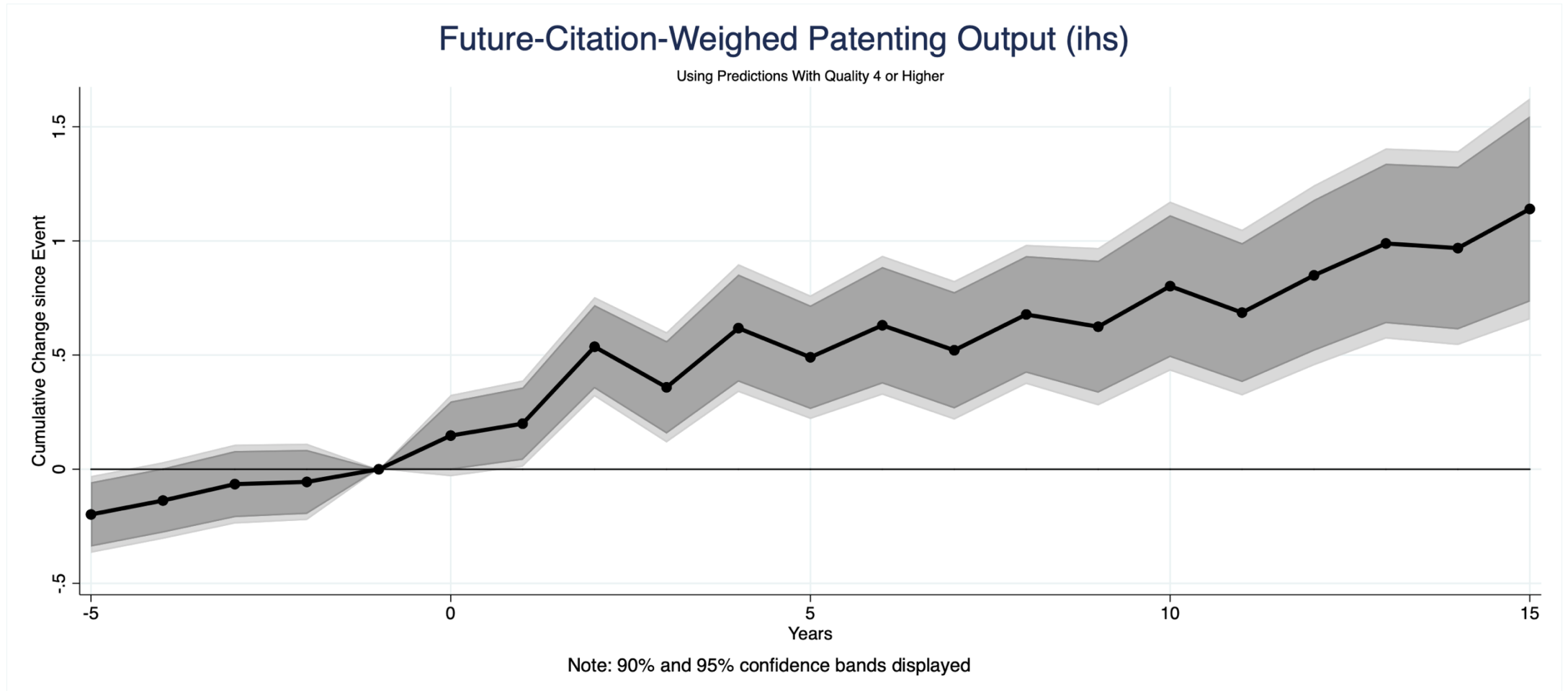

Future-Citation-Weighed Patenting Output (ihs)

Alternative Patent Nationality: Both Asignee & Lead Inventor are in South Korea

Note: 90% and 95% confidence bands displayed

Robustness Checks

Future-Citation-Weighed Patenting Output (Log)

Log(1 + Future Citations)

Note: 90% and 95% confidence bands displayed

Robustness Checks

Exports (log)

Log(Exports)

Note: 90% and 95% confidence bands displayed

Robustness Checks

Future-Citation-Weighed Patenting Output (ihs)

Using Predictions With Quality 4 or Higher

Note: 90% and 95% confidence bands displayed

Robustness Checks

Exports (ihs)

Including Predictions With Quality 4 or higher

Note: 90% and 95% confidence bands displayed

Robustness Checks

Robustness Checks

Exports (ihs)

Additional Pre-Treatment Lags

Note: 90% and 95% confidence bands displayed