Coming to the Rescue:
the Role of Government Venture Capital in the U.S.-China Trade War

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ABFER 9th Annual Conference

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Motivation

> *"Administrators may wish to respond to these industries conditions [under-funding of startups] by (i) focusing on technologies which are not currently popular among venture investors and (ii) providing follow-on capital to firms already funded by venture capitalists during periods when venture inflows are falling."*
> — Lerner, Josh. 2002. "*When Bureaucrats Meet Entrepreneurs: The Design of Effective Public Venture Capital' Programmes.*" The Economic Journal 112, 477: F73-F84.

- ► Government-funded venture capitals (GVCs) play an increasingly important role in innovation policies in the recent decades (Bai et al., 2021).

- ► However, it remains unclear...
    - ► Can GVCs address the under-investment problems during hard times?
    - ► Are there any social benefits stemming from GVCs' involvement in the market?

When GVCs Meet the Trade War...

- Impact of the trade war on VC activities in China
  - The U.S. tariffs mainly targets China's high-tech manufacturing industries.
  - The timing coincides with a collapse in China's VC market.
    - "... the landscape changed drastically recently as total funds raised by China-based start-ups fell to US$17 billion in the first half of last year, from US$61 billion in the first half of 2018." (SCMP, Jan 2020)

- The role of GVCs during the trade war
  - GVCs became important vehicles of China's industrial policies in the last decade.
    - "The implementation [of the Made in China effort] is overseen by an estimated 1,600 government-guided investment funds making investments across thousands of companies in chosen advanced industries." (PIIE, June 2019)
  - The natural experiment setting of the trade war allows us to study...
    - how GVCs invest in response to negative industry shocks;
    - the broad economic impact of GVC financing during hard times.

When GVCs Meet the Trade War...

- ▶ Example: **Advanced Manufacturing Industry Investment Fund (AMIIF)**.
  - ▶ Established in 2016 with an initial fund size of 50 billion RMB (> 7 billion USD).
  - ▶ The general partner (GP) is State Development & Investment Corporation (SDIC).
  - ▶ Primary objective: "the implementation of national strategic goals"
    - ▶ Initially part of the Made in China 2025 Initiative
  - ▶ AMIIF systematically changed its investment portfolio since the onset of the trade war.
    - ▶ 2017-2018Q2: 80% of its manufacturing investments were in chemical and pharmaceuticals
    - ▶ After 2018Q3: 100% of its manufacturing investments were in the targeted industries (i.e., electric motor manufacturing and slide bearing manufacturing)
- ▶ Is the case of AMIIF common among GVCs?

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We compile a novel dataset of China's VC market and employ difference-in-differences strategies to answer the following questions:

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      ▶ <u>Mechanism</u>: GVCs are less sensitive to changes in exit opportunities.

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     ▶ <u>Mechanism</u>: GVCs are less sensitive to changes in exit opportunities.

   ▶ GVCs **substitute** IVCs in financing startup innovation.

     ▶ GVCs' investments in follow-on rounds are more persistence.

     ▶ The more innovative VC-backed startups have higher chances to raise GVC capital.

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2. What is the broad economic impact of GVC financing during the trade war?

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2. What is the broad economic impact of GVC financing during the trade war?

   ▶ VC-backed startups in prefectures with higher levels of pre-existing GVC activity conduct more innovation (**a "compete-for-financing" effect**).

      ▶ This effect is primarily driven by local GVCs.

Contribution

1. Government's role in the VC industry

   ▶ The Effect of GVC Financing: Lerner (1999, 2002 & 2009); Grilli and Murtinu (2014); Brander, Du, and Hellmann (2015); Bertoni and Tykvova (2015); Cumming, Grilli, and Murtinu (2017); Bai et al. (2021)

      ▶ Our paper highlights GVCs' role as **financial vehicles for industrial policies**.

   ▶ Cyclicality of VC industry: Kaplan and Schoar (2005); Gompers et al. (2008); Robinson and Sensoy (2016); Nanda and Rhodes-Kropf (2013); Howell et al. (2021)

      ▶ Our paper provides new empirical evidence that GVC participation helps mitigate the **under-investment problems** during economic downturns.

   ▶ China's VC market: Huang and Tian (2020); Calder-Wang and Li (2021)

      ▶ Our paper is among the first that studies **China's VC market**.

2. Other related literature

   ▶ Innovation policies: David, Hall, and Toole (2000); Bloom, Griffith, and Van Reenen (2002); Howell (2017 & 2020); Bloom, Van Reenen, and Williams (2019)

   ▶ The U.S.-China trade war: Fajgelbaum, et al. (2020); Amiti, Redding, and Weinstein (2020); Cavallo, et al. (2021); Huang, et al. (2020); Charoenwong, Han, and Wu (2021)

Data and Empirical Strategy

The China VC Database

- ▶ Our data covers a majority of participants in China's VC market
  - ▶ Data source: BRD + AMAC (administrative data) + Zero2IPO (commercial data)
  - ▶ Components: VC firms (GPs) + VC funds + Portfolio companies
    - ▶ For the purpose of this study, we focus on the **manufacturing sector**.
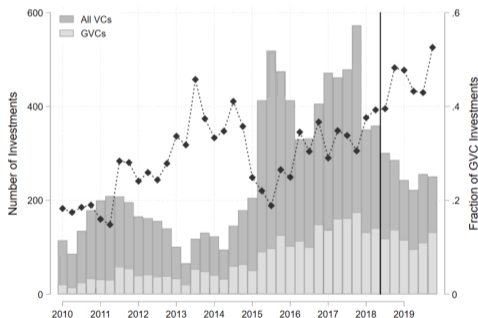 - ↠ Structure of the VC Market

- ▶ GVCs and IVCs
  - ▶ We define GVCs as VC funds with government equity ≥ 20%.
    - ▶ The rest are defined as IVCs.
    - ▶ We exclude CVCs (Ma 2020).
  - ↠ Examples of GVC Requirements

- ▶ VC activities in manu. sector
  - ▶ Booming from 2015-2017, followed by a sharp decline since 2018.
  - ▶ GVCs became increasingly important since 2015.
  - ↠ Summary Statistics

Note: The figure shows the count of deals between venture capital funds and target manufacturing companies in each quarter from 2010 to 2019. Light bars represent the count of GVC deals, and dark bars represent the count of non-GVC deals. The connected line represents the share of GVC deals in all deals.
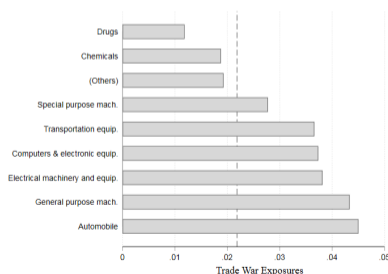
The Trade War Shocks

▶ We compute 2-digit industry-level trade war exposure (TWE) as:

$$\text{Exposure}_{st}^{\text{trade}} = \frac{\sum_{j \in \Omega(s)} \tau_{jt} \times X_j^{U.S.}}{\sum_{j \in \Omega(s)} X_j^W},$$

   ▶ s: 2-digit Chinese industry; $\Omega(s)$: set of HS-8 products in s; t: quarters in 18-19
   ▶ τ_{jt}: tariff revision of HS-6 product j at quarter t
   ▶ $X_j^{U.S.}$ (X_j^W): export value of product j from China to the U.S. (world) in 2017
   ↠ TWE of All Industries

▶ We separate industries into high-/low-exposure groups.

   ▶ $Treat_g = 1$ if and only if the average TWE is larger than the median.

▶ The treated group covers most of the high-tech MIC2025-related industries.

   ▶ Automobiles/transportation equip.
   ▶ General/special purpose mach.
   ▶ Electrical/electronic equip.

Note: The figure presents the exposure of MIC2025-related Industries to the trade war tariff shocks. The exposure is calculated by the ratio of U.S. tariff burdens in total Chinese exports.

Empirical Strategy I

VC(i)-industry group(g)-quarter(t) level analysis (Ewens et al., 2018)

$$\mathbb{1}(Inv_{igt} = 1) = \beta_1 Treat_g \times Post_t +$$

$$\boxed{} + \delta_{ig} + \mu_t + \epsilon_{igt},$$

- ▶ Sample: VC funds that have made any investment in manufacturing before 2020
- ▶ $\mathbb{1}(Inv_{igt})$: indicator of fund i investing in industry group g at t
  - ▶ $\mathbb{1}(Inv_{igt}^d)$: indicator of fund i making a type-d investment in industry group g at t
- ▶ $Treat_g$: industry group g's treatment status; $Post$: 2018Q3 or later
- ▶ δ_{ig}: VC-industry group fixed effects; μ_t: year-quarter fixed effects

Empirical Strategy I

<u>VC(i)-industry group(g)-quarter(t) level analysis</u> (Ewens et al., 2018)

$$\mathbb{1}(Inv_{igt} = 1) = \beta_1 Treat_g \times Post_t +$$
$$\boxed{\beta_2 Treat_g \times Post_t \times GVC_i + \beta_3 Post_t \times GVC_i} + \delta_{ig} + \mu_t + \epsilon_{igt},$$

- ▶ Sample: VC funds that have made any investment in manufacturing before 2020
- ▶ $\mathbb{1}(Inv_{igt})$: indicator of fund i investing in industry group g at t
  - ▶ $\mathbb{1}(Inv_{igt}^d)$: indicator of fund i making a type-d investment in industry group g at t
- ▶ $Treat_g$: industry group g's treatment status; $Post$: 2018Q3 or later
- ▶ δ_{ig}: VC-industry group fixed effects; μ_t: year-quarter fixed effects

Extension: triple-differences with GVC indicator

- ▶ GVC_i: indicator of fund i received $\geq 20\%$ government capital.

Empirical Strategy II

VC(i)-portfolio company(j)-period(t: pre/post) level analysis (Bernstein et al. 2016)

$$Y_{ij\tau} = \beta_1 Treat_j \times Post_\tau + \beta_2 Post_\tau +$$

$$\boxed{} + \delta_{ij} + \nu_{ij\tau},$$

- ▶ Sample: VC-portfolio company pairs
    - ▶ VC-backed manufacturing companies founded before 2017
- ▶ $Y_{ij\tau}$: VC exit; indicator of follow-on investment; log patent applications
- ▶ $Treat_j$: indicator of company j belonging to the high-exposure industry group
- ▶ δ_{ij}: VC-portfolio company fixed effects

Empirical Strategy II

VC(i)-portfolio company(j)-period(t: pre/post) level analysis (Bernstein et al. 2016)

$$Y_{ij\tau} = \beta_1 Treat_j \times Post_\tau + \beta_2 Post_\tau +$$
$$\beta_3 Treat_j \times Post_\tau \times Pat_j/Int_{c(j)} + \beta_4 Post_\tau \times Pat_j/Int_{c(j)} + \delta_{ij} + \nu_{ij\tau},$$

▶ Sample: VC-portfolio company pairs

    ▶ VC-backed manufacturing companies founded before 2017

▶ $Y_{ij\tau}$: VC exit; indicator of follow-on investment; log patent applications

▶ $Treat_j$: indicator of company j belonging to the high-exposure industry group

▶ δ_{ij}: VC-portfolio company fixed effects

Extension: triple-differences with

▶ Pat_j: lagged log patent applications (when $Y_{ij\tau}$ = follow-on financing)

▶ $Int_{c(j)}$: prefecture level GVC intensity (when $Y_{ij\tau}$ = log patent applications)

GVC Investment during the Trade War

Investment Activities

Dependent variable: VC investment

	(1)	(2)	(3)	(4)
Treat×Post	-2.083***	-2.083***	-2.169***	-2.241***
	(0.228)	(0.228)	(0.227)	(0.227)
Treat×Post×GVC				
Post×GVC				
Controls	No	Yes	Yes	Yes
VC fund FE	Yes	Yes	No	No
Industry group FE	Yes	Yes	No	No
VC-industry FE	No	No	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Sample	IVC	IVC	IVC	Pre-existing IVC
Mean of dep. var. (p.p.)	2.575	2.575	2.575	2.446
Observations	78,746	78,746	78,746	74,976
R-squared	0.051	0.087	0.130	0.130

Notes: This table reports the effects of trade war on VC investment in the high-/low-exposure industry group. A unit of observation is a VC fund-industry group pair in a given quarter between 2017Q1 and 2019Q4. The dependent variable is an indicator variable equal to 1 if and only if a VC fund makes any investment in the corresponding industry group in a quarter. *Treat* is an indicator variable equal to 1 if and only if the industry group is highly exposed to the trade war. *Post* is an indicator variable equal to 1 if and only if the quarter is after 2018 Q2. *GVC* is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 20%. The control variables include the fund's order under GP's management, the fund's portfolio size, an indicator of whether the fund has invested in manufacturing, and an indicator of whether the fund has invested in the high-exposure industry group. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

➤ Event Study Plot   ➤ Quartile Coefficient Plots   ➤ 2-digit Industry Level Regressions

Investment Activities

Dependent variable: VC investment

	(1)	(2)	(3)	(4)	(5)	(6)
Treat×Post	-2.083***	-2.083***	-2.169***	-2.241***	-0.337	-0.570
	(0.228)	(0.228)	(0.227)	(0.227)	(0.396)	(0.402)
Treat×Post×GVC						
Post×GVC						
Controls	No	Yes	Yes	Yes	Yes	Yes
VC fund FE	Yes	Yes	No	No	No	No
Industry group FE	Yes	Yes	No	No	No	No
VC-industry FE	No	No	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	IVC	IVC	IVC	Pre-existing IVC	GVC	Pre-existing GVC
Mean of dep. var. (p.p.)	2.575	2.575	2.575	2.446	3.855	3.695
Observations	78,746	78,746	78,746	74,976	38,882	36,480
R-squared	0.051	0.087	0.130	0.130	0.125	0.125

Notes: This table reports the effects of trade war on VC investment in the high-/low-exposure industry group. A unit of observation is a VC fund-industry group pair in a given quarter between 2017Q1 and 2019Q4. The dependent variable is an indicator variable equal to 1 if and only if a VC fund makes any investment in the corresponding industry group in a quarter. *Treat* is an indicator variable equal to 1 if and only if the industry group is highly exposed to the trade war. *Post* is an indicator variable equal to 1 if and only if the quarter is after 2018 Q2. *GVC* is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 20%. The control variables include the fund's order under GP's management, the fund's portfolio size, an indicator of whether the fund has invested in manufacturing, and an indicator of whether the fund has invested in the high-exposure industry group. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat×Post	-2.083***	-2.083***	-2.169***	-2.241***	-0.337	-0.570	-2.169***	-2.241***
	(0.228)	(0.228)	(0.227)	(0.227)	(0.396)	(0.402)	(0.227)	(0.227)
Treat×Post×GVC							1.832***	1.671***
							(0.457)	(0.462)
Post×GVC							0.359	0.133
							(0.277)	(0.277)
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VC fund FE	Yes	Yes	No	No	No	No	No	No
Industry group FE	Yes	Yes	No	No	No	No	No	No
VC-industry FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	IVC	IVC	IVC	Pre-existing IVC	GVC	Pre-existing GVC	All	Pre-existing all
Mean of dep. var. (p.p.)	2.575	2.575	2.575	2.446	3.855	3.695	2.998	2.855
Observations	78,746	78,746	78,746	74,976	38,882	36,480	117,628	111,456
R-squared	0.051	0.087	0.130	0.130	0.125	0.125	0.127	0.126

Notes: This table reports the effects of trade war on VC investment in the high-/low-exposure industry group. A unit of observation is a VC fund-industry group pair in a given quarter between 2017Q1 and 2019Q4. The dependent variable is an indicator variable equal to 1 if and only if a VC fund makes any investment in the corresponding industry group in a quarter. *Treat* is an indicator variable equal to 1 if and only if the industry group is highly exposed to the trade war. *Post* is an indicator variable equal to 1 if and only if the quarter is after 2018 Q2. *GVC* is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 20%. The control variables include the fund's order under GP's management, the fund's portfolio size, an indicator of whether the fund has invested in manufacturing, and an indicator of whether the fund has invested in the high-exposure industry group. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

➤ Event Study Plot   ➤ Quartile Coefficient Plots   ➤ 2-digit Industry Level Regressions

GVC Investment during the Trade War

1. GVC investments are more resilient to the trade war shocks.
   - The likelihood of IVC investment is reduced by **2.17 p.p.** (80% of the avg.)
   - The trade war shocks have weaker and statistically insignificant impact on GVC investments (**-0.34 p.p.**).
     - GVC investment rate is raised by **1.83 p.p.** compared to IVCs.

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2. GVCs face similar reduction in exit opportunities in the targeted industries.
   - The reductions in IPO rates are similar across GVCs and IVCs.
     - **-2.36 p.p.** for IVCs; **-2.79 p.p.** for GVCs.

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- <u>Implication</u>: GVC investments are more persistent and less sensitive to exit opportunities under the trade war shocks.

GVC Financing for Startup Innovation

How Do GVCs Invest?

Dependent variables: indicator of follow-on investment

	Made by all VCs				Made by IVCs	Made by GVCs
	(1)	(2)	(3)	(4)		
Treat×Post	-1.069	-1.069	-1.069	-1.685		
	(1.244)	(1.487)	(1.244)	(1.387)		
Post	-16.651***	-16.651***	-16.651***	-12.297***		
	(1.083)	(1.295)	(1.083)	(1.182)		
Treat×Post×Lagged Patent Applications				3.199		
				(2.042)		
Post×Lagged Patent Applications				-10.154***		
				(1.758)		
Controls	Yes	No	No	No		
VC fund FE	No	Yes	No	No		
Portfolio firm FE	No	Yes	No	No		
VC-firm FE	No	No	Yes	Yes		
Mean of dep. var. (p.p.)	17.65	17.65	17.65	17.65		
Observations	13,878	13,878	13,878	13,878		
R-squared	0.067	0.617	0.617	0.623		

Notes: This table reports the effects of trade war on startups' follow-on financing. A unit of observation is a VC fund-portfolio company pair in a given period (pre or post). The dependent variable is an indicator equal to 1 if and only if the portfolio company receives a follow-on investment from a given type of VC funds in a given period. *Treat* is an indicator variable equal to 1 if and only if the portfolio company belongs to the high-exposure industry group. *Post* is an indicator variable equal to 1 if and only if the observation is in the post-period (after 2018 Q2). *LaggedPatentApplications* is the log number of patent applications filed by the portfolio company during the 6 quarters before the pre/post-period. The control variables include the portfolio company's log registration capital and log number of patent applications prior to 2017Q1, and the fund's order under GP's management and log registration capital. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

▶▶ Follow-on Investments of Central and Local GVCs

How Do GVCs Invest?

Dependent variables: indicator of follow-on investment

	Made by all VCs				Made by IVCs		Made by GVCs
	(1)	(2)	(3)	(4)	(5)	(6)	
Treat×Post	-1.069	-1.069	-1.069	-1.685	-1.636	-1.308	
	(1.244)	(1.487)	(1.244)	(1.387)	(1.181)	(1.316)	
Post	-16.651***	-16.651***	-16.651***	-12.297***	-15.090***	-11.310***	
	(1.083)	(1.295)	(1.083)	(1.182)	(1.024)	(1.132)	
Treat×Post×Lagged Patent Applications				3.199		0.986	
				(2.042)		(1.959)	
Post×Lagged Patent Applications				-10.154***		-8.687***	
				(1.758)		(1.720)	
Controls	Yes	No	No	No	No	No	
VC fund FE	No	Yes	No	No	No	No	
Portfolio firm FE	No	Yes	No	No	No	No	
VC-firm FE	No	No	Yes	Yes	Yes	Yes	
Mean of dep. var. (p.p.)	17.65	17.65	17.65	17.65	15.28	15.28	
Observations	13,878	13,878	13,878	13,878	13,878	13,878	
R-squared	0.067	0.617	0.617	0.623	0.619	0.626	

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➤ Follow-on Investments of Central and Local GVCs

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Dependent variables: indicator of follow-on investment

	Made by all VCs				Made by IVCs		Made by GVCs	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat×Post	-1.069	-1.069	-1.069	-1.685	-1.636	-1.308	2.616**	1.860
	(1.244)	(1.487)	(1.244)	(1.387)	(1.181)	(1.316)	(1.032)	(1.155)
Post	-16.651***	-16.651***	-16.651***	-12.297***	-15.090***	-11.310***	-10.927***	-7.864***
	(1.083)	(1.295)	(1.083)	(1.182)	(1.024)	(1.132)	(0.900)	(0.994)
Treat×Post×Lagged Patent Applications				3.199		0.986		3.611**
				(2.042)		(1.959)		(1.792)
Post×Lagged Patent Applications				-10.154***		-8.687***		-7.015***
				(1.758)		(1.720)		(1.568)
Controls	Yes	No	No	No	No	No	No	No
VC fund FE	No	Yes	No	No	No	No	No	No
Portfolio firm FE	No	Yes	No	No	No	No	No	No
VC-firm FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Mean of dep. var. (p.p.)	17.65	17.65	17.65	17.65	15.28	15.28	10.56	10.56
Observations	13,878	13,878	13,878	13,878	13,878	13,878	13,878	13,878
R-squared	0.067	0.617	0.617	0.623	0.619	0.626	0.601	0.606

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➡ Follow-on Investments of Central and Local GVCs

GVC Financing for Startup Innovation

1. GVCs invest disproportionally more in innovative VC-backed startups.
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   ↠ Portfolio Adjustments

   ▶ The trade war shocks significantly reduce GVCs' participation in joint (with IVCs) and first-round deals.

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▶ <u>Implication</u>: the combined evidence is consistent with a **policy shift** explanation.

   ▶ GVCs place a greater emphasis on financing the more mature and technologically advanced startups to encourage technological spillovers (Lerner, 2002) during downturns.

The Economic Impact of GVC Financing

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- ▶ The pro-cyclicality of IVCs might be socially detrimental during the trade war.
  - ▶ IVCs underinvest in projects with technological externalities during economic downturns (Howell et al., 2020).

- ▶ <u>Question</u>: can GVC financing mitigate such under-investment problems?

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- ▶ <u>Question</u>: can GVC financing mitigate such under-investment problems?

- ▶ The "compete-for-financing" hypothesis
  1. Startups face shortages of capital from IVC investors;
  2. Competition for GVC financing intensifies among startups in need of funds;
  3. Startups conduct more innovation as signals to GVC investors.

- ▶ We exploit the geographic variations in GVC activities to test the hypothesis.
  - ▶ **Prediction**: startups in places with more GVC activities should innovate more.
  - ▶ Measuring GVC intensity at prefecture c between 2013Q1 and 2016Q4

$$GVC\ Intensity_c = \log(\frac{\{Total\ Capital\ of\ Active\ GVCs\}_c}{\{Total\ \#\ VC\text{-}backed\ companies\}_c})$$

The "Compete-for-Financing" Effect

Dependent variable: Log patent applications

	(1)	(2)	(3)	(4)	(5)
Treat×Post	0.067***	0.067***	0.067***	0.079***	0.044*
	(0.016)	(0.019)	(0.016)	(0.020)	(0.026)
Post	-0.178***	-0.178***	-0.178***	-0.208***	-0.123***
	(0.014)	(0.016)	(0.014)	(0.017)	(0.022)
Treat×Post×GVC Intensity					
Post×GVC Intensity					
Treat×Post×VC Intensity					
Post×VC Intensity					
Controls	Yes	No	No	No	No
VC fund FE	No	Yes	No	No	No
Portfolio firm FE	No	Yes	No	No	No
VC-firm FE	No	No	Yes	Yes	Yes
Sample	All	All	All	IVC-backed	GVC-backed
Mean of dep. var. (p.p.)	0.339	0.339	0.339	0.363	0.296
Observations	13,878	13,878	13,878	8,920	4,958
R-squared	0.104	0.801	0.801	0.803	0.788

Notes: This table reports the effects of trade war on portfolio companies' innovation. A unit of observation is a VC fund-portfolio company pair in a given period (pre or post). The dependent variable is log number of patent applications in a given period. *Treat* is an indicator variable equal to 1 if and only if the portfolio company belongs to the high-exposure industry group. *Post* is an indicator variable equal to 1 if and only if the observation is in the post-period (after 2018 Q2). *GVCIntensity* (*VCIntensity*) is the log of total registration capital of *GVCs* (*VCs*) divided by the total number of VC-backed companies within each city of the portfolio company. The control variables include the portfolio company's log registration capital and log number of patent applications prior to 2017Q1, and the fund's order under GP's management and log registration capital. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

⇥ Alternative Measure: Indicators of GVC Presence

The "Compete-for-Financing" Effect

Dependent variable: Log patent applications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat×Post	0.067***	0.067***	0.067***	0.079***	0.044*	0.068***	0.083***	0.046*
	(0.016)	(0.019)	(0.016)	(0.020)	(0.026)	(0.016)	(0.020)	(0.025)
Post	-0.178***	-0.178***	-0.178***	-0.208***	-0.123***	-0.179***	-0.212***	-0.124***
	(0.014)	(0.016)	(0.014)	(0.017)	(0.022)	(0.014)	(0.017)	(0.022)
Treat×Post×GVC Intensity						0.036***	0.054***	-0.005
						(0.013)	(0.015)	(0.026)
Post×GVC Intensity						-0.030***	-0.048***	-0.004
						(0.011)	(0.012)	(0.018)
Treat×Post×VC Intensity						-0.015	-0.050**	0.029
						(0.014)	(0.022)	(0.022)
Post×VC Intensity						0.009	0.037**	-0.022
						(0.010)	(0.017)	(0.014)
Controls	Yes	No	No	No	No	No	No	No
VC fund FE	No	Yes	No	No	No	No	No	No
Portfolio firm FE	No	Yes	No	No	No	No	No	No
VC-firm FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	All	All	IVC-backed	GVC-backed	All	IVC-backed	GVC-backed
Mean of dep. var. (p.p.)	0.339	0.339	0.339	0.363	0.296	0.339	0.363	0.296
Observations	13,878	13,878	13,878	8,920	4,958	13,878	8,920	4,958
R-squared	0.104	0.801	0.801	0.803	0.788	0.798	0.803	0.789

Notes: This table reports the effects of trade war on portfolio companies' innovation. A unit of observation is a VC fund-portfolio company pair in a given period (pre or post). The dependent variable is log number of patent applications in a given period. *Treat* is an indicator variable equal to 1 if and only if the portfolio company belongs to the high-exposure industry group. *Post* is an indicator variable equal to 1 if and only if the observation is in the post-period (after 2018 Q2). *GVCIntensity* (*VCIntensity*) is the log of total registration capital of *GVCs* (*VCs*) divided by the total number of VC-backed companies within each city of the portfolio company. The control variables include the portfolio company's log registration capital and log number of patent applications prior to 2017Q1, and the fund's order under GP's management and log registration capital. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

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The "Compete-for-Financing" Effect

1. VC-backed startups in prefectures with higher GVC intensity conduct more innovation in response to the trade war shocks.
   - A one std. deviation in GVC intensity improves patent applications by **3.6%**.
   - The "compete-for-financing" effect only exists for IVC-backed startups.
     - GVC-backed startups face less competition for follow-on GVC financing.

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      ▶ GVC-backed startups face less competition for follow-on GVC financing.

2. The "compete-for-financing" effect is mainly driven by local rather than central GVCs.
   ↠ Local and Central GVCs

   ▶ Local GVCs account for over 80% of GVC investment.
   ▶ Central GVCs mainly invest in late-stage companies with strategic interests, while local GVCs invest more in small/medium-size startups with regional spillovers.
      ↠ Interview Examples

Conclusion

Concluding Remarks

<u>Summary of Findings</u>

1. GVCs serve as financial vehicles of industrial policies during the trade war.

   ▶ GVC investments are more persistent in the targeted industries.
   ▶ GVCs serve as a substitute for IVCs in funding startup innovation.
      ▶ Follow-on investments in innovative startups

2. GVCs' activities lead to a "compete-for-financing" effect.

   ▶ Startups in prefectures with more frequent GVC activities innovate more.
   ▶ The effect is mostly driven by local GVCs.

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<u>Summary of Findings</u>

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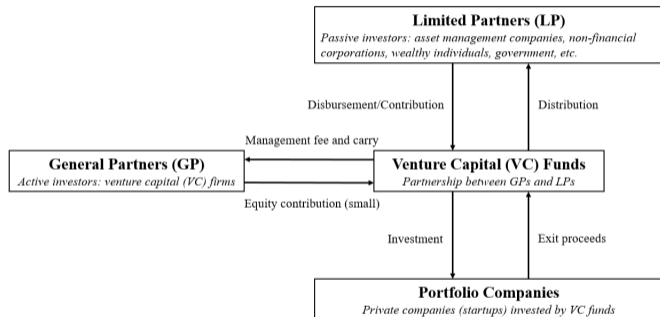
<u>Future Works</u>

1. Evaluate the quality of innovation financed by GVC investment.

2. Study the long-run effects of trade war and GVC presence.

Thanks!

Appendix

Structure of the VC Market

Structure of the VC Market

Note: The figure presents the structure of the VC market. It is a replicate of Figure 1 in Da Rin, Hellmann and Puri (2013).

Examples of GVC Requirements

	China SME Development Fund	Shenzhen Government Guidance Fund	Chongqing Industry Guidance Fund
Registration	None	Shenzhen	Chongqing
Local Investment	None	No less than 60%	No less than 80%
Industry	None	Industries supported by the Shenzhen government	Industries supported by the Chongqing government
Investment Stage	No less than 60% in seed and initial stage companies	No less than 60% in initial, early and medium stage companies	None
Govt Has Veto Power	No	Yes	Yes
Deal Needs Govt Approval	No	Yes	Yes
Conditions of Termination	1. Non-compliance with requirements on policy goals, investment stages and industries; 2. major changes in the board of the managing VC firm; 3. no deals made within six months/one year of founding; 4. insufficient contribution from other LPs.		

Notes: This table summarizes the investment requirements for GVCs supported by three government-guided funds: China SME Development Fund, Shenzhen Government Guidance Fund, and Chongqing Industry Guidance Fund. The first is a national fund, and the latter two are city-level funds established by the Shenzhen and Chongqing governments respectively.

Summary Statistics

Panel A. Summary Statistics of VC Funds (Sample size: 5,518)

Variable name	Mean	s.d.	p10	p50	p90
Independent VCs (3,881)					
Registration capital (million USD)	28.24	157.19	1.01	8.40	51.69
Fund age (as of 2019Q4)	5.81	4.32	2	4	11
Order of establishment under GP	2.03	3.64	1	1	4
Number of portfolio companies	6.95	25.22	1	2	12
Government-funded VCs (1,637)					
Registration capital (million USD)	25.83	107.85	0.81	7.24	48.10
Fund age (as of 2019Q4)	5.45	4.92	2	4	10
Order of establishment under GP	3.32	5.25	1	1	7
Number of portfolio companies	6.98	23.15	1	4	13

*Panel B. Summary Statistics of Portfolio Companies (Sample size: 5,202)*

Variable name	Mean	s.d.	p10	p50	p90
Registration capital (million USD)	25.87	134.54	1.30	8.19	41.98
Treatment	0.70	0.46	0	1	1
Firm age (as of 2019Q4)	13.49	6.23	5	13	21
Number of investors	1.86	1.91	1	1	4
Number of patents (1 period lagged)	1.47	10.56	0	0	3

Notes: This table reports the summary statistics of VC funds' and portfolio companies' characteristics. Panel A shows the summary statistics of key variables of IVC and GVC funds, including registration capital, fund age, fund's order under GP's management, and number of portfolio companies. Panel B shows the summary statistics of key variables of VC funds' portfolio companies, including registration capital, treatment (high-exposure to the trade war shocks), firm age, and number of patents between 2017Q1 and 2018 Q2.
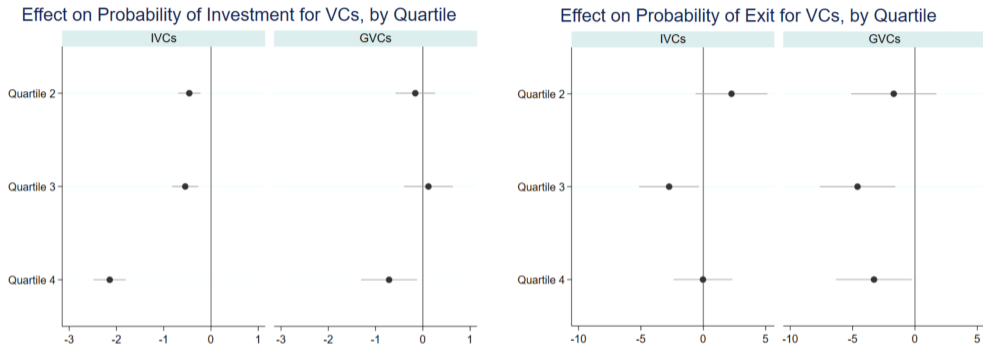
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TWE of All Industries

Rank	2-digit code	Industry name	Trade war exposure (%)	Treatment
1	21	Furniture	5.95	1
2	36	Automobiles	4.63	1
3	34	General purpose machinery	4.23	1
4	38	Electrical machinery and equipment	4.08	1
5	37	Transportation equipment	3.79	1
6	23	Printing and recorded media	3.69	1
7	33	Metal products	3.36	1
8	39	Computers and other electronic equipment	3.32	1
9	20	Timber and wood products	3.02	1
10	29	Rubber and plastic products	2.97	1
11	35	Special purpose machinery	2.55	1
12	14	Food	2.23	1
13	22	Paper and paper products	2.23	1
14	41	Other manufacturing	2.22	1
15	30	Non-metallic mineral products	2.17	1
16	24	Articles for culture, education, art, sports, and entertainment	2.13	0
17	13	Processing of agricultural products	2.12	0
18	40	Measuring instruments	2.11	0
19	26	Chemicals	1.89	0
20	19	Leather, fur, feather and related products	1.61	0
21	15	Beverage	1.46	0
22	25	Processing of petroleum	1.43	0
23	28	Chemical fibers	1.28	0
24	27	Drugs	1.09	0
25	17	Textiles	1.07	0
26	18	Apparels	0.59	0
27	32	Processing of non-ferrous metals	0.53	0
28	31	Processing of ferrous metals	0.41	0
29	16	Tobacco	0.34	0

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Event Study Plot
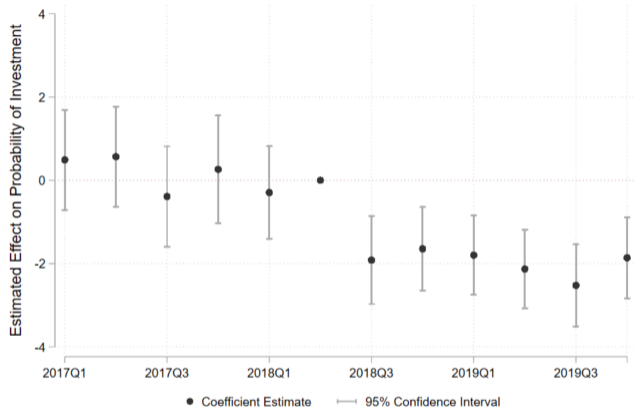
Note: This figure plots the coefficients for the interaction terms of each quarter and the treated dummy. The underlying regression controls for quarter and VC firm-treat fixed effects. 2018Q2 is set as the base period. Standard errors are clustered at VC fund level.

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Coefficient Plots I

Effect on Probability of Investment for VCs, by Quartile

Effect on Probability of Exit for VCs, by Quartile

Estimated Coefficients of Trade War Exposure Quartiles

Note: The graphs show the estimated coefficients of TWE quartiles. The left panel reports the coefficients of regressing investment indicator on TWE quartiles, for IVC and GVC samples separately, following the VC-industry group-quarter level specification. The right panel reports the coefficients of regressing exit indicator on TWE quartiles, for IVC and GVC samples separately, following the VC-portfolio company-period level specification. Standard errors are clustered at VC fund level.

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Coefficient Plots II
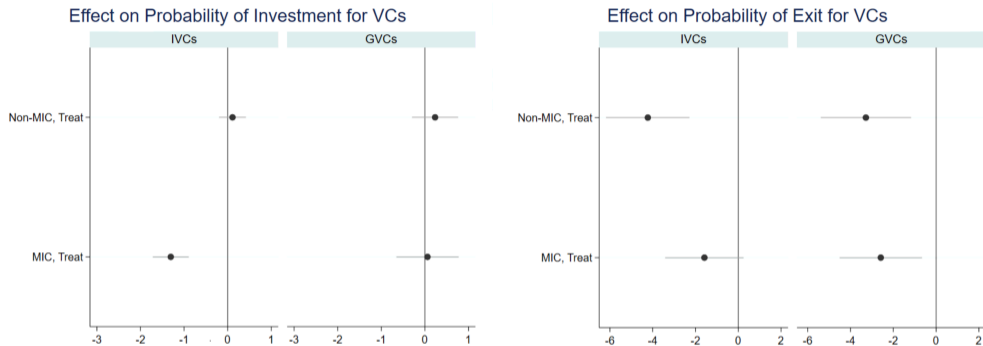
Estimated Coefficients of Trade War Exposure, MIC2025 versus Non-MIC2025 Industries

Note: The graphs show the estimated coefficients of TWE by MIC2025 and Non-MIC2025 Industries. Specifically, we separate industries into 3 groups: treated-MIC2025, treated-non MIC2025, and control. The left panel reports the coefficients of regressing investment indicator on the group indicators, for IVC and GVC samples separately, following the VC-industry group-quarter level specification. The right panel reports the coefficients of regressing exit indicator on the group indicators, for IVC and GVC samples separately, following the VC-portfolio company-period level specification. Standard errors are clustered at VC fund level.

VC-2 digit Industry-Quarter Level Analysis

Dependent variable: indicator of VC investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TWE×Post	-0.057***	-0.057***	-0.058***	-0.059***	-0.023**	-0.026***	-0.058***	-0.059***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.010)	(0.010)	(0.005)	(0.005)
TWE×Post×GVC							0.035***	0.033***
							(0.011)	(0.011)
Post×GVC							0.006	-0.014
							(0.030)	(0.030)
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VC fund FE	Yes	Yes	No	No	No	No	No	No
Industry group FE	Yes	Yes	No	No	No	No	No	No
VC-industry FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	IVC	IVC	IVC	Pre-existing IVC	GVC	Pre-existing GVC	All	Pre-existing all
Mean of dep. var. (p.p.)	0.189	0.189	0.189	0.180	0.293	0.281	0.224	0.213
Observations	1,102,444	1,102,444	1,102,444	1,049,664	544,348	510,720	1,646,792	1,560,384
R-squared	0.004	0.007	0.097	0.095	0.102	0.100	0.099	0.097

Notes: This table reports the effects of trade war on VC investment in each 2 digit industries. A unit of observation is a VC fund-2digit industry pair in a given quarter between 2017Q1 and 2019Q4. The dependent variable is an indicator variable equal to 1 if and only if a VC fund makes any investment in the corresponding industry group in a quarter. TWE is the measured 2 digit industry level trade war exposures. $Post$ is an indicator variable equal to 1 if and only if the quarter is after 2018 Q2. $GVC(10\%)$ is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 10%. The control variables include the fund's order under GP's management, the fund's portfolio size, an indicator of whether the fund has invested in manufacturing, and an indicator of whether the fund has invested in the high-exposure industry group. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Exit through IPO

	(1)	(2)	(3)	(4)	(5)	(6)
Treat×Post	-2.509***	-2.509***	-2.509***	-2.359***	-2.794***	-2.359***
	(0.653)	(0.780)	(0.653)	(0.941)	(0.870)	(0.870)
Post	7.048***	7.048***	7.048***	7.965***	5.409***	7.965***
	(0.615)	(0.735)	(0.615)	(0.833)	(0.879)	(0.833)
Treat×Post×GVC						-0.435
						(1.281)
Post×GVC						-2.556**
						(1.211)
Controls	Yes	No	No	No	No	No
VC fund FE	No	Yes	No	No	No	No
Portfolio firm FE	No	Yes	No	No	No	No
VC-firm FE	No	No	Yes	Yes	Yes	Yes
Sample	All	All	All	IVC	GVC	All
Mean of dep. var. (p.p.)	2.652	2.652	2.652	3.161	1.735	2.652
Observations	13,878	13,878	13,878	8,920	4,958	13,878
R-squared	0.055	0.515	0.515	0.517	0.511	0.517

Notes: This table reports the effects of the U.S.-China trade war on VC exits through IPOs in China. A unit of observation is a VC fund-portfolio company pair in a given period (pre or post). The dependent variable is an indicator equal to 1 if and only if the portfolio company successfully goes public in the given period. *Treat* is an indicator variable equal to 1 if and only if the portfolio company belongs to the high-exposure industry group. *Post* is an indicator variable equal to 1 if and only if the observation is in the post-period (after 2018 Q2). *GVC* is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 20%. The control variables include the portfolio company's log registration capital and log number of patent applications prior to 2017Q1, and the fund's order under GP's management and log registration capital. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Exit through IPO or Acquisition

Dependent variable: indicator exit through IPO or acquisition

	(1)	(2)	(3)	(4)	(5)	(6)
Treat×Post	-2.514***	-2.514***	-2.514***	-2.300***	-2.915***	-2.300**
	(0.672)	(0.803)	(0.672)	(0.896)	(0.967)	(0.896)
Post	7.758***	7.758***	7.758***	8.776***	5.937***	8.776***
	(0.622)	(0.743)	(0.621)	(0.833)	(0.907)	(0.833)
Treat×Pos×GVC						-0.615
						(1.318)
Post×GVC						-2.839**
						(1.231)
Controls	Yes	No	No	No	No	No
VC fund FE	No	Yes	No	No	No	No
Portfolio firm FE	No	Yes	No	No	No	No
VC-firm FE	No	No	Yes	Yes	Yes	Yes
Sample	All	All	All	IVC	GVC	All
Mean of dep. var. (p.p.)	3.005	3.005	3.005	3.587	1.956	3.005
Observations	13,878	13,878	13,878	8,920	4,958	13,878
R-squared	0.061	0.517	0.517	0.519	0.512	0.519

Notes: This table reports the effects of the U.S.-China trade war on VC exits in China. A unit of observation is a VC fund-portfolio company pair in a given period (pre or post). The dependent variable is an indicator equal to 1 if and only if the portfolio company successfully goes public or is acquired through an M&A with a return multiple larger than 2 in the given period. *Treat* is an indicator variable equal to 1 if and only if the portfolio company belongs to the high-exposure industry group. *Post* is an indicator variable equal to 1 if and only if the observation is in the post-period (after 2018 Q2). *GVC* is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 20%. The control variables include the portfolio company's log registration capital and log number of patent applications prior to 2017Q1, and the fund's order under GP's management and log registration capital. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

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Alternative Definition of GVCs: Exit

Dependent variable: indicator of exit through IPO

	(1)	(2)	(3)	(4)	(5)	(6)
Treat×Post	-2.494***	-2.494***	-2.494***	-2.371***	-2.672***	-2.371***
	(0.651)	(0.779)	(0.651)	(0.889)	(0.932)	(0.889)
Post	6.977***	6.977***	6.977***	7.820***	5.707***	7.820***
	(0.613)	(0.733)	(0.612)	(0.859)	(0.850)	(0.859)
Treat×Post×GVC						-0.301
						(1.288)
Post×GVC						-2.112*
						(1.208)
Controls	Yes	No	No	No	No	No
VC fund FE	No	Yes	No	No	No	No
Portfolio firm FE	No	Yes	No	No	No	No
VC-firm FE	No	No	Yes	Yes	Yes	Yes
Sample	All	All	All	IVC	GVC	All
Mean of dep. var. (p.p.)	2.623	2.623	2.623	3.088	1.926	2.623
Observations	13,762	13,762	13,762	8,258	5,504	13,762
R-squared	0.055	0.515	0.515	0.517	0.512	0.516

Notes: This table reports the effects of the U.S.-China trade war on VC exits through IPOs in China. A unit of observation is a VC fund-portfolio company pair in a given period (pre or post). The dependent variable is an indicator equal to 1 if and only if the portfolio company successfully goes public in the given period. *Treat* is an indicator variable equal to 1 if and only if the portfolio company belongs to the high-exposure industry group. *Post* is an indicator variable equal to 1 if and only if the observation is in the post-period (after 2018 Q2). *GVC* is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 10%. The control variables include the portfolio company's log registration capital and log number of patent applications prior to 2017Q1, and the fund's order under GP's management and log registration capital. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Alternative Definition of GVCs: Investment

Dependent variable: indicator of VC investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat×Post	-2.119***	-2.119***	-2.203***	-2.286***	-0.529	-0.732**	-2.186***	-2.260***
	(0.236)	(0.236)	(0.235)	(0.234)	(0.365)	(0.370)	(0.227)	(0.227)
Treat×Post×GVC							1.849***	1.690***
							(0.457)	(0.462)
Post×GVC							0.404	0.174
							(0.278)	(0.277)
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VC fund FE	Yes	Yes	No	No	No	No	No	No
Industry group FE	Yes	Yes	No	No	No	No	No	No
VC-industry FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	IVC	IVC	IVC	Pre-existing IVC	GVC	Pre-existing GVC	All	Pre-existing all
Mean of dep. var. (p.p.)	2.549	2.549	2.549	2.417	3.728	3.572	2.993	2.850
Observations	73,004	73,004	73,004	69,456	44,126	41,544	117,130	111,000
R-squared	0.052	0.089	0.132	0.131	0.123	0.123	0.127	0.126

Notes: This table reports the effects of trade war on VC investment in the high-/low-exposure industry group. A unit of observation is a VC fund-industry group pair in a given quarter between 2017Q1 and 2019Q4. The dependent variable is an indicator variable equal to 1 if and only if a VC fund makes any investment in the corresponding industry group in a quarter. *Treat* is an indicator variable equal to 1 if and only if the industry group is highly exposed to the trade war. *Post* is an indicator variable equal to 1 if and only if the quarter is after 2018 Q2. *GVC*(10%) is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 10%. The control variables include the fund's order under GP's management, the fund's portfolio size, an indicator of whether the fund has invested in manufacturing, and an indicator of whether the fund has invested in the high-exposure industry group. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

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Follow-on Investments of State and Local GVCs

Dependent variables: indicator of follow-on investment

	Made by GVCs		Made by State GVCs		Made by Local GVCs	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat×Post	2.616**	1.860	1.996***	1.570**	3.121***	1.491
	(1.032)	(1.155)	(0.620)	(0.619)	(0.987)	(1.082)
Post	-10.927***	-7.864***	-3.737***	-2.739***	-9.981***	-6.693***
	(0.900)	(0.994)	(0.511)	(0.514)	(0.859)	(0.926)
Treat×Post×Lagged Patent Applications		3.611**		1.806		5.863***
		(1.792)		(1.149)		(1.689)
Post×Lagged Patent Applications		-7.015***		-2.664***		-7.643***
		(1.568)		(0.871)		(1.542)
Controls	No	No	No	No	No	No
VC fund FE	No	No	No	No	No	No
Portfolio firm FE	No	No	No	No	No	No
VC-firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean of dep. var. (p.p.)	10.56	10.56	2.904	2.904	9.021	9.021
Observations	13,878	13,878	13,878	13,878	13,878	13,878
R-squared	0.601	0.606	0.509	0.511	0.593	0.599

Notes: This table reports the effects of trade war on startups' follow-on financing. A unit of observation is a VC fund-portfolio company pair in a given period (pre or post). The dependent variable is an indicator equal to 1 if and only if the portfolio company receives a follow-on investment from a given type of VC funds in a given period. *Treat* is an indicator variable equal to 1 if and only if the portfolio company belongs to the high-exposure industry group. *Post* is an indicator variable equal to 1 if and only if the observation is in the post-period (after 2018 Q2). *LaggedPatentApplications* is the log number of patent applications filed by the portfolio company during the 6 quarters before the pre/post-period. The control variables include the portfolio company's log registration capital and log number of patent applications prior to 2017Q1, and the fund's order under GP's management and log registration capital. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Portfolio Adjustments

Panel A. Decomposition of IVC investment

	Syndicated (1)	Solo (2)	Joint (3)	Non-joint (4)	Early (5)	Late (6)	First-round (7)	Follow-on (8)
Treat×post	-1.298***	-0.922***	-0.389***	-1.791***	-0.766***	-1.456***	-1.133***	-1.123***
	(0.164)	(0.161)	(0.113)	(0.199)	(0.154)	(0.167)	(0.167)	(0.154)
Mean of dep. var. (p.p.)	1.299	1.304	0.624	0.965	1.170	1.424	1.405	1.195
Observations	78,746	78,746	78,746	78,746	78,746	78,746	78,746	78,746
R-squared	0.111	0.117	0.100	0.124	0.113	0.115	0.118	0.108

Panel B. Decomposition of GVC investment

	Syndicated (1)	Solo (2)	Joint (3)	Non-joint (4)	Early (5)	Late (6)	First-round (7)	Follow-on (8)
Treat×post	-0.308	-0.116	-0.481**	0.088	-0.234	-0.146	-0.689**	0.289
	(0.258)	(0.303)	(0.226)	(0.331)	(0.285)	(0.274)	(0.303)	(0.256)
Mean of dep. var. (p.p.)	1.566	2.356	1.196	2.713	2.153	1.762	2.423	1.494
Observations	38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882
R-squared	0.114	0.122	0.107	0.123	0.119	0.115	0.113	0.116

Notes: This table reports the effects of trade war on each type of VC investment on the high-/low-exposure industry group. A unit of observation is a VC fund-industry group pair in a given quarter between 2017Q1 and 2019Q4. The dependent variable is an indicator equal to 1 if and only if a VC fund makes any investment deals in the given category in the high-/low-exposure industries in a quarter. *Treat* is an indicator variable equal to 1 if and only if the industry group is highly exposed to the trade war. *Post* is an indicator variable equal to 1 if and only if the quarter is after 2018 Q2. *GVC* is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 20%. All columns control for a VC fund-industry fixed effect, a quarter fixed effect, and a list of control variables, including the fund's order under GP's management, the fund's portfolio size, an indicator of whether the fund has invested in manufacturing, and an indicator of whether the fund has invested in the high-exposure industry group. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Alternative Explanations

1. <u>Preferential access to better investment opportunities</u>

    ▶ GVCs invest more intensively in the affected industries because they have preferential access to better investment opportunities, especially during economic downturns.

        ▶ If that's the case, then government-managed VCs (GGP-GVCs) should invest more compared to other GVCs because government-managed VCs can leverage more government resources.

        ▶ However, the trade war has similar effects on investment rates of GGP-GVCs and other GVCs. ◂ The Effect of Trade War on VC Investment (by GVC Types)

2. <u>Differences in professional expertise</u>

    ▶ GVCs respond less to the trade war shocks because they are incapable of adjusting investment strategies timely to prevent further losses (Grilli and Murtinu, 2014; Kovner and Lerner, 2015; Calder-Wang and Li, 2021).

        ▶ If that's the case, then more experienced GVCs (GVCs with successful exits previously) should behave more similarly to IVCs.

        ▶ However, the trade war has similar effects on investment rates of experienced and inexperienced GVCs. ◂ The Effect of Trade War on VC Investment (by VCs' Success Experiences)

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The Effect of Trade War on VC Investment (by GVC Types)

Dependent variable: indicator of VC investment

	(1)	(2)	(3)	(4)
Treat×Post	-2.169***	-0.788	-0.073	-2.169***
	(0.227)	(0.655)	(0.498)	(0.227)
Treat×Post×GGP-GVC				2.096***
				(0.547)
Treat×Post×IGP-GVC				1.381**
				(0.693)
Post×GGP-GVC				0.137
				(0.314)
Post×IGP-GVC				0.736*
				(0.445)
Controls	Yes	Yes	Yes	Yes
VC-industry FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Sample	IVC	IGP-GVC	GGP-GVC	All
Mean of dep. var. (p.p.)	2.575	3.977	3.784	2.998
Observations	78,746	14,356	24,526	117,628
R-squared	0.130	0.116	0.132	0.127

Notes: This table reports the effects of trade war on VC investment in the high-/low-exposure industry group. A unit of observation is a VC fund-industry group pair in a given quarter between 2017Q1 and 2019Q4. The dependent variable is an indicator variable equal to 1 if and only if a VC fund makes any investment in the corresponding industry group in a quarter. *Treat* is an indicator variable equal to 1 if and only if the industry group is highly exposed to the trade war. *Post* is an indicator variable equal to 1 if and only if the quarter is after 2018 Q2. *GVC* is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 20%. *GGP − GVC* is an indicator variable equal to 1 if and only if the VC firm (GP) is founded by the government. The control variables include the fund's order under GP's management, the fund's portfolio size, an indicator of whether the fund has invested in manufacturing, and an indicator of whether the fund has invested in the high-exposure industry group. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

The Effect of Trade War on VC Investment (by VCs' Success Experiences)

Dependent variable: indicator of VC investment

	(1)	(2)	(3)	(4)	(5)
Treat×Post	-1.836***	-2.155***	-0.079	-0.259	-2.169***
	(0.487)	(0.262)	(0.781)	(0.477)	(0.227)
Treat×Post×GVC w/ success					2.047**
					(0.802)
Treat×Post×GVC w/o success					1.942***
					(0.526)
Post×GVC w/ success					-0.593
					(0.506)
Post×GVC w/o success					0.833***
					(0.313)
Controls	Yes	Yes	Yes	Yes	Yes
VC-industry FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Sample	IVCs w/ success	IVCs w/o success	GVCs w/ success	GVCs w/o success	All
Mean of dep. var. (p.p.)	1.878	2.756	3.014	4.143	2.998
Observations	15,854	62,470	9,796	28,912	117,628
R-squared	0.173	0.138	0.182	0.125	0.127

Notes: This table reports the effects of trade war on VC investment in the high-/low-exposure industry group. A unit of observation is a VC fund-industry group pair in a given quarter between 2017Q1 and 2019Q4. The dependent variable is an indicator variable equal to 1 if and only if a VC fund makes any investment in the corresponding industry group in a quarter. *Treat* is an indicator variable equal to 1 if and only if the industry group is highly exposed to the trade war. *Post* is an indicator variable equal to 1 if and only if the quarter is after 2018 Q2. *GVC* is an indicator variable equal to 1 if and only if share of government capital in the VC fund exceeds 20%. A VC firm is considered to have success experiences if it has exited successfully from any VC investment (through IPOs or M&As) before the trade war. The control variables include the fund's order under GP's management, the fund's portfolio size, an indicator of whether the fund has invested in manufacturing, and an indicator of whether the fund has invested in the high-exposure industry group. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

The "Compete-for-financing" Effect, Indicators of GVC Presence

Dependent variable: Log patent applications

	(1)	(2)	(3)
Treat×Post	-0.079	-0.158	0.222*
	(0.087)	(0.105)	(0.129)
Post	-0.051	-0.030	-0.085
	(0.071)	(0.087)	(0.089)
Treat×Post×Active GVC	0.150*	0.244**	-0.178
	(0.090)	(0.109)	(0.135)
Post×Active GVC	-0.131*	-0.184**	-0.040
	(0.074)	(0.090)	(0.094)
Treat×Post×VC Intensity	-0.002	-0.027	0.036**
	(0.013)	(0.020)	(0.018)
Post×VC Intensity	-0.002	0.015	-0.022*
	(0.009)	(0.015)	(0.012)
VC-firm FE	Yes	Yes	Yes
Sample	All	IVC	GVC
Mean of dep. var. (p.p.)	0.339	0.363	0.296
Observations	13,878	8,920	4,958
R-squared	0.798	0.803	0.789

Notes: This table reports the effects of trade war on portfolio companies' innovation. A unit of observation is a VC fund-portfolio company pair in a given period (pre or post). The dependent variable is log number of patent applications in a given period. $Treat$ is an indicator variable equal to 1 if and only if the portfolio company belongs to the high-exposure industry group. $Post$ is an indicator variable equal to 1 if and only if the observation is in the post-period (after 2018 Q2). $Active\ GVC$ is an indicator variable with value 1 if and only if the prefecture has recorded at least one GVC investment before the sample period. The control variables include the portfolio company's log registration capital and log number of patent applications prior to 2017Q1, and the fund's order under GP's management and log registration capital. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

The "Compete-for-financing" Effect, Local and Central GVCs

Dependent variable: Log patent applications

	(1)	(2)	(3)	(4)	(5)
Treat×Post	0.079***	0.067***	0.079***	0.098***	0.054***
	(0.016)	(0.016)	(0.016)	(0.021)	(0.026)
Post	-0.179***	-0.188***	-0.188***	-0.221***	-0.132***
	(0.014)	(0.014)	(0.014)	(0.017)	(0.022)
Treat×Post×SGVC Intensity	0.009		0.008	-0.020	0.050**
	(0.015)		(0.015)	(0.020)	(0.024)
Treat×Post×LGVC Intensity		0.035***	0.032**	0.058***	-0.008
		(0.013)	(0.013)	(0.016)	(0.025)
Post×CGVC Intensity	-0.055***		-0.054***	-0.054***	-0.055***
	(0.011)		(0.011)	(0.015)	(0.018)
Post×LGVC Intensity		-0.024**	-0.021*	-0.039***	-0.011
		(0.011)	(0.011)	(0.013)	(0.014)
Treat×Post×VC Intensity	0.008	-0.012	-0.010	-0.030	0.017
	(0.013)	(0.013)	(0.014)	(0.023)	(0.021)
Post×VC Intensity	0.007	0.003	0.019*	0.048***	-0.011
	(0.010)	(0.010)	(0.011)	(0.018)	(0.014)
VC-firm FE	Yes	Yes	Yes	Yes	Yes
Sample	All	All	All	IVC	GVC
Mean of dep. var. (p.p.)	0.339	0.339	0.339	0.363	0.296
Observations	13,878	13,878	13,878	8,920	4,958
R-squared	0.799	0.798	0.800	0.805	0.789

Notes: This table reports the effects of trade war on portfolio companies' innovation. A unit of observation is a VC fund-portfolio company pair in a given period (pre or post). The dependent variable is log number of patent applications in a given period. *Treat* is an indicator variable equal to 1 if and only if the portfolio company belongs to the high-exposure industry group. *Post* is an indicator variable equal to 1 if and only if the observation is in the post-period (after 2018 Q2). GVC Intensity (VC Intensity) is defined as the standardized log of total registration capital of active GVCs (VCs) divided by the total number of VC-backed companies within each city where the startup locates before the trade war starts. The control variables include the portfolio company's log registration capital and log number of patent applications prior to 2017Q1, and the fund's order under GP's management and log registration capital. Robust standard errors, clustered by VC fund, are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

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Interview Examples

- "...The national level industrial funds are mostly backed by central ministries and commissions... so they are different from the local funds, which are more likely to support regional startups... the national level industrial funds have clear goals of carrying out industrial policies."
- "... The national funds focus more on late stage [startups] and support the growth of leading companies. In some sense they're like industrial policies. The local funds focus more on early stage [startups]. They prefer projects that can attract investment and create jobs."