

Discussion of “Colocation of Production and Innovation: Evidence from the United States”

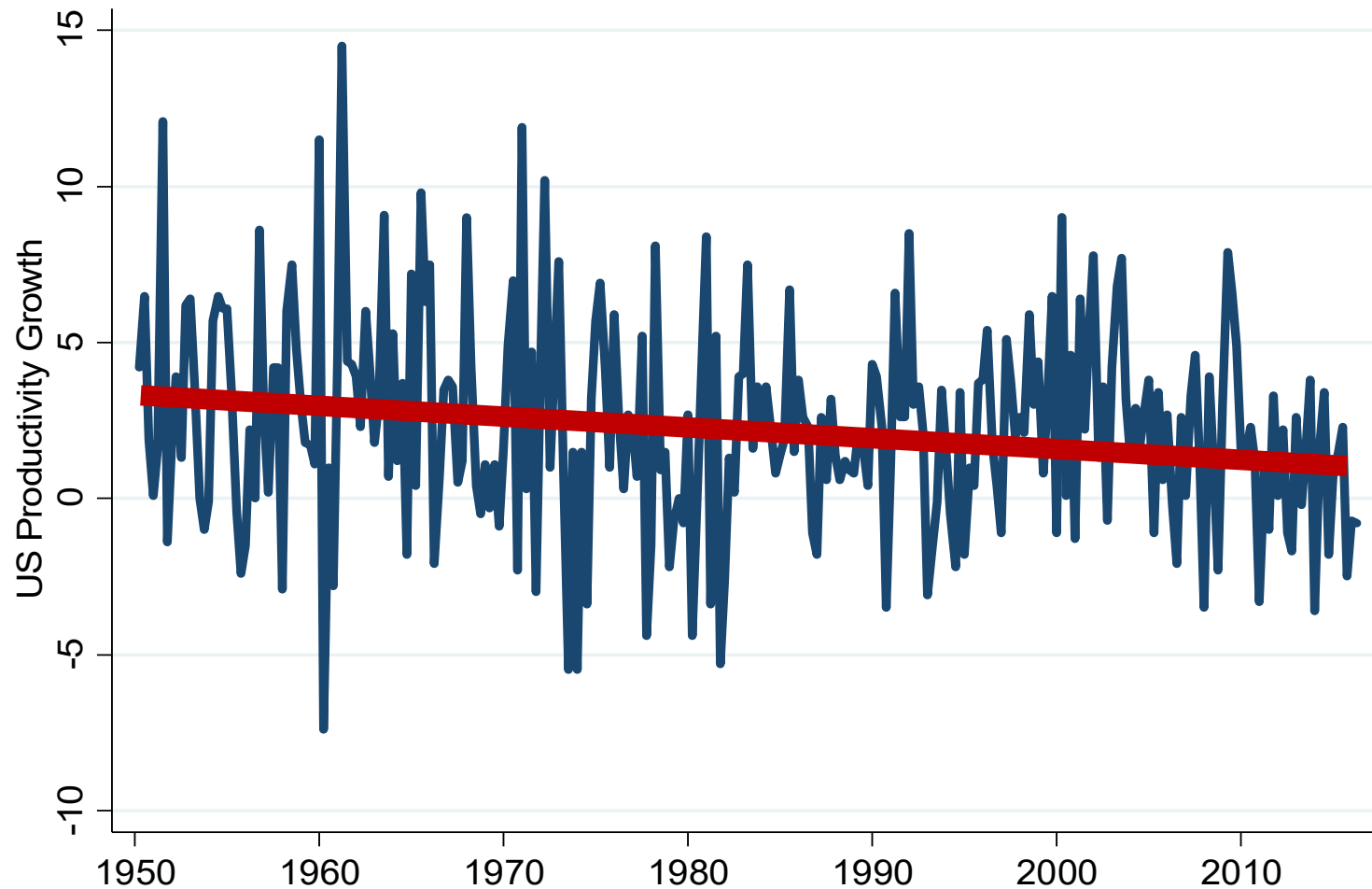
by Fort, Keller, Schott, Yeaple and Zolas

Nick Bloom (Stanford)

NAS 5/6/2021

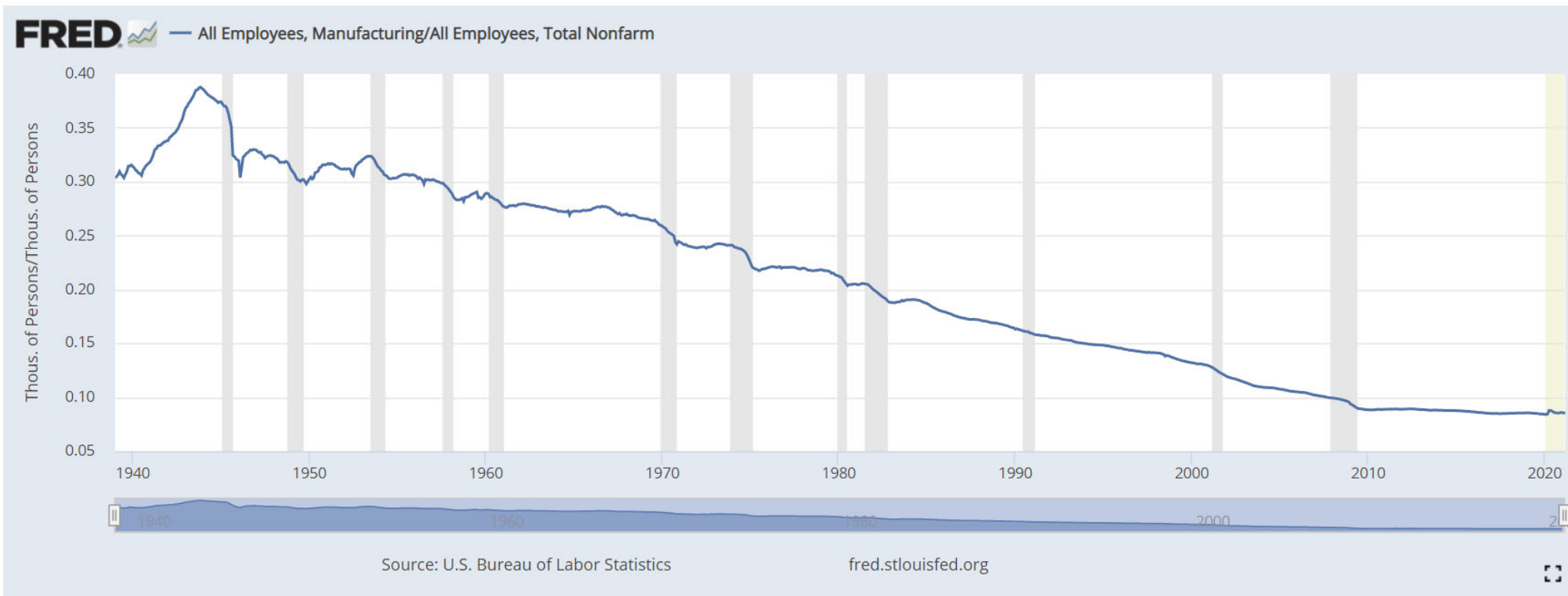


Paper builds on two key trends: (1) US productivity growth is slowing



Source: US Bureau of Labor Statistics, growth of real output per hour (labor productivity), series PRS84006092

(2) US manufacturing share of employment has been falling



Paper asks to what extent these are connected – is declining manufacturing slowing innovation?

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Daron Acem
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David Aut
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David Dorn,

Gordon H. H
and

Brendan Pr

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unimpressive. Betw
considerable empl
historic contraction in manufacturing employment being
contributor to the slump. We estimate that import com
from China, which surged after 2000, was a major force be
recent reductions in US manufacturing employment and
input-output linkages and other general equilibrium ch
weak overall US job growth. Our central estimates su
losses from rising Chinese import competition over 1999
the range of 2.0–2.4 million.

We thank David Card, Alexandre Mas, Alireza Tahbaz-Salehi,
participants at the National Bureau of Economic Research con
“The Labor Market in the Aftermath of the Great Recession” for

[*Journal of Labor Economics*, 2016, vol. 34, no. 1, pt. 2]
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S141

MARKETS | U.S. MARKETS

U.S. Stocks Sell Off on Concerns About Trade

Dow tumbles more than 700 points, pulled down by shares of manufacturers and banks

By Michael Wurster

Updated March 22, 2017

Trade-war fears, a
for economic grow
Industrial Average
headed for a large
Thursday's selling
steelmakers sharp
policy. It came as t
over rising interes

MARKETS | U.S. MARKETS

U.S. Stocks Surge as Trade Worries Ease

The Dow industrials, after its worst week in more than two years, records its biggest one-day gain

S&P 500



Source: WSJ Market Data Group

MARKETS | U.S. MARKETS

Dow Tumbles Nearly 800 Points as Trade Jitters Return

Bond yields retreat amid worries about pace of U.S. growth

Index performance on Tuesday



"Some of our workers, already their last job at the factory, were in such a condition that they had to be shipped off to China."
— Congressman Tim Ryan (D-OH)

"No worker ever saw where manufacturing jobs opened and replaced in a place where you can control unions against workers and protect to others that right."
— Congressman Chris Smith (R-NJ)

DEATH
CHINA

OB

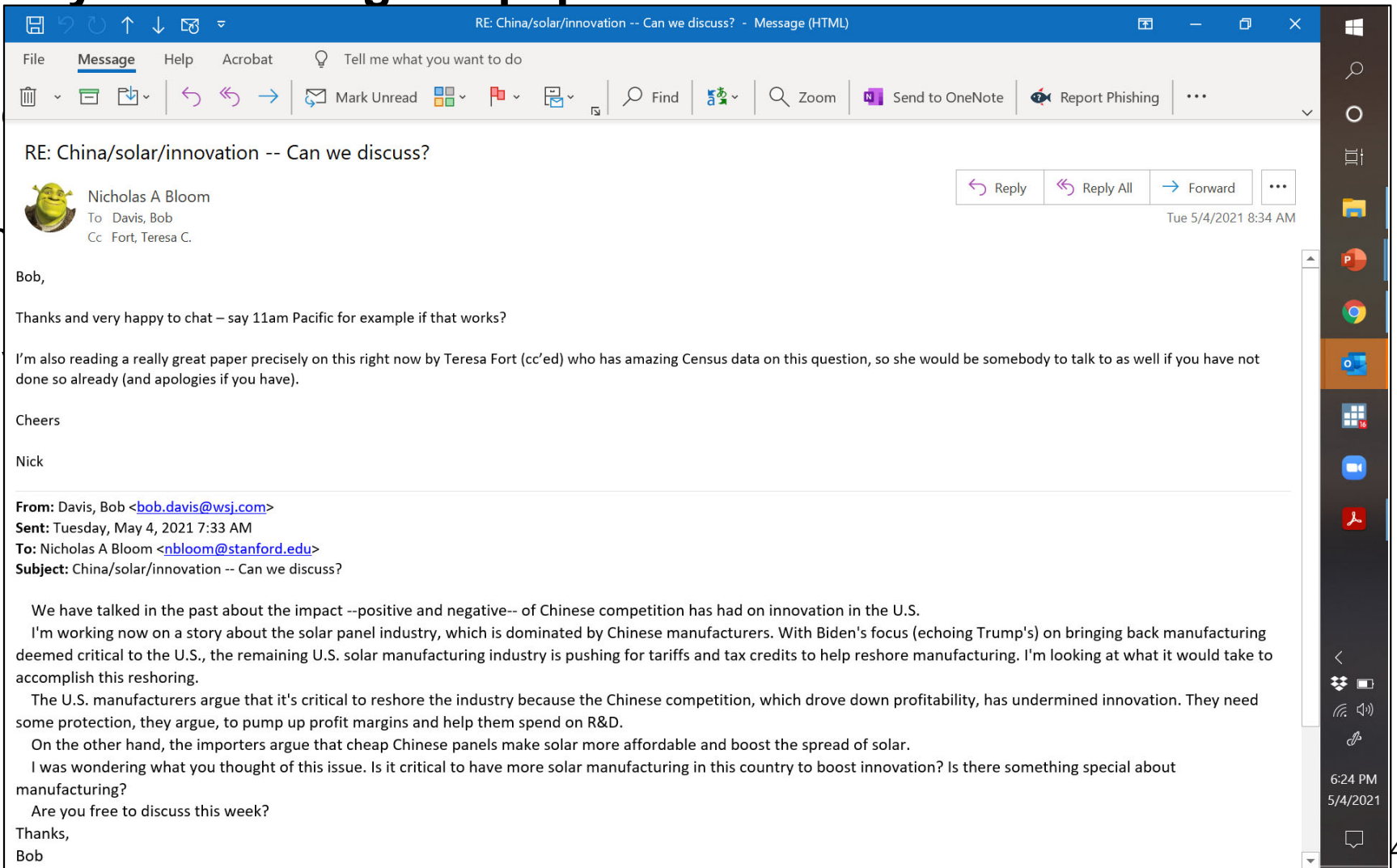
DBC
NA

In summary this was a great paper

Fantastic

Tackling r

Also highl



The screenshot shows a Windows Mail application window titled "RE: China/solar/innovation -- Can we discuss? - Message (HTML)". The interface includes a menu bar with "File", "Message", "Help", and "Acrobat", along with a search bar and various action buttons like "Mark Unread", "Find", "Zoom", "Send to OneNote", and "Report Phishing".

The email content is as follows:

RE: China/solar/innovation -- Can we discuss?

 **Nicholas A Bloom**
To: Davis, Bob
Cc: Fort, Teresa C.

Tue 5/4/2021 8:34 AM

Bob,

Thanks and very happy to chat – say 11am Pacific for example if that works?

I'm also reading a really great paper precisely on this right now by Teresa Fort (cc'ed) who has amazing Census data on this question, so she would be somebody to talk to as well if you have not done so already (and apologies if you have).

Cheers

Nick

From: Davis, Bob <bob.davis@wsj.com>
Sent: Tuesday, May 4, 2021 7:33 AM
To: Nicholas A Bloom <nbloom@stanford.edu>
Subject: China/solar/innovation -- Can we discuss?

We have talked in the past about the impact --positive and negative-- of Chinese competition has had on innovation in the U.S.

I'm working now on a story about the solar panel industry, which is dominated by Chinese manufacturers. With Biden's focus (echoing Trump's) on bringing back manufacturing deemed critical to the U.S., the remaining U.S. solar manufacturing industry is pushing for tariffs and tax credits to help reshore manufacturing. I'm looking at what it would take to accomplish this reshoring.

The U.S. manufacturers argue that it's critical to reshore the industry because the Chinese competition, which drove down profitability, has undermined innovation. They need some protection, they argue, to pump up profit margins and help them spend on R&D.

On the other hand, the importers argue that cheap Chinese panels make solar more affordable and boost the spread of solar.

I was wondering what you thought of this issue. Is it critical to have more solar manufacturing in this country to boost innovation? Is there something special about manufacturing?

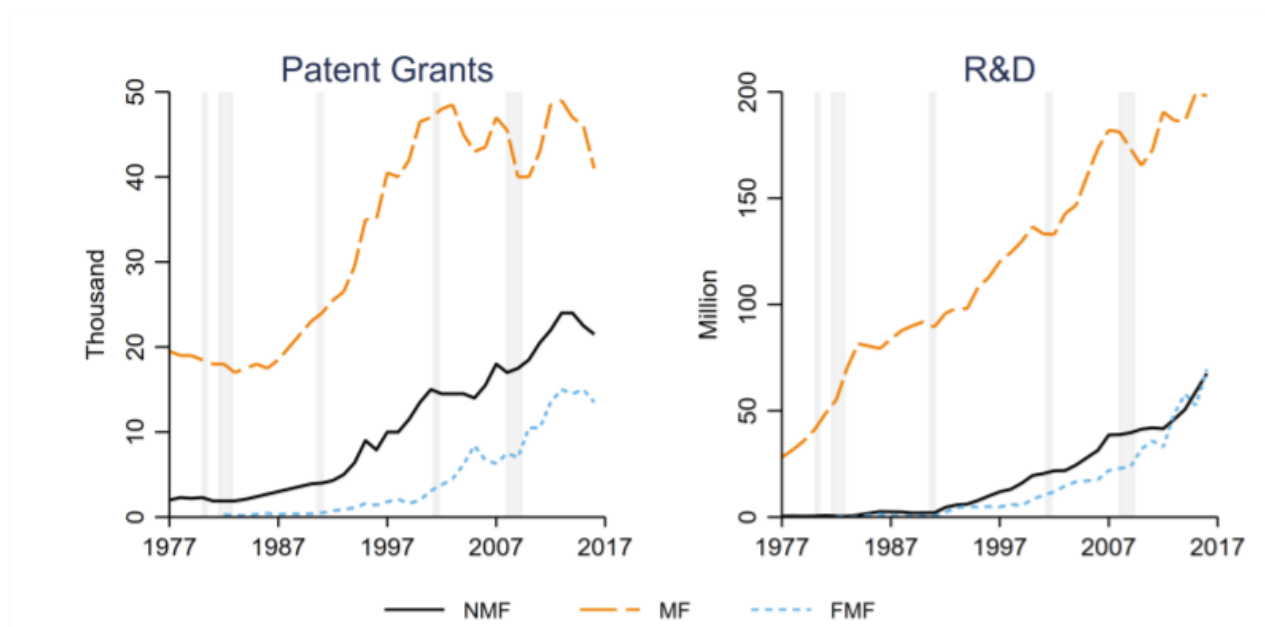
Are you free to discuss this week?

Thanks,
Bob

On the right side of the window, the Windows taskbar is visible, showing icons for the Start menu, Search, Task View, File Explorer, Microsoft Edge, PowerPoint, Google Chrome, Outlook, and the system tray with icons for network, volume, and battery. The system clock shows 6:24 PM on 5/4/2021.

Key findings for me: (1) Non-manufacturing firms now account for 46% of total US patents (up from 9% in 1977)

Figure 3: Innovation by Firm Type



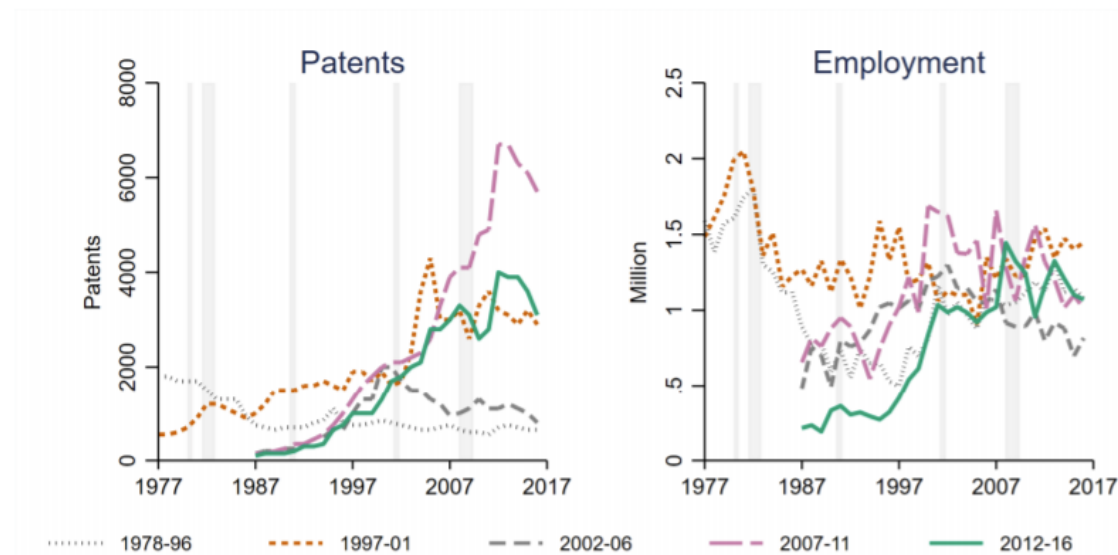
Source: LBD, BR, PatentsView, SIRD, BRDIS and author's calculations. Left and right panels report patents granted to US firms by their application year and total research and development (R&D) expenditures, by type of firm. Firm types are non-manufacturing firms (NMF), manufacturing firms (MF) and former manufacturing firms (FMF), as defined in text. Data for FMF are suppressed prior to 1982.

All very consistent with the “Coastal” story



Key findings for me: (2) Offshoring firms are still innovating in the US – factories going abroad $\neq$ end of innovation

Figure 4: Patenting and Employment by Permanent *FMF* Cohort



Source: LBD, LFTTD, PatentsView, and author's calculations. Panels report patents granted to permanent former manufacturing firms by cohort. Permanent *FMFs* are assigned to one of five cohorts depending upon the year in which they dropped their last manufacturing establishment during the sample period. For example, the lines for the 1977 and 1996 cohorts represent the patents granted to and the employment of all firms for which the last year in which they are observed to have a manufacturing establishment is 1977 to 1996. Patent counts prior to 1987 are suppressed for *FMFs* in the final three cohorts. Cohort lines include firms that exit prior to the end of the sample period.

Key findings for me: (3) Firms with manufacturing and innovation nearby appear to patent more

Dependent variable is $\ln(Patents_{f,t:t+4})$: firm f 's total patent grants from t to $t + 4$

	(1)	(2)	(3)	(4)	(5)	(6)
M_{ft}	0.0374*** (0.0003)	0.0378*** (0.0004)	0.0365*** (0.0003)	0.0149*** (0.0009)	0.0179*** (0.001)	0.0174*** (0.001)
P_{ft}	0.0172*** (0.0004)	0.0172*** (0.0004)	-0.213*** (0.0206)	0.0047*** (0.0006)	0.0047*** (0.0006)	-0.0199 (0.0126)
MP_{ft}	0.665*** (0.0132)	0.666*** (0.0133)	0.707*** (0.0149)	0.147*** (0.0082)	0.147*** (0.0082)	0.154*** (0.0090)
FMF_{ft}		0.0046* (0.0024)	-0.016*** (0.0015)		0.0081*** (0.0019)	0.0061*** (0.0016)
$FMF_{ft} \times P_{ft}$			0.231*** (0.0206)			0.0247* (0.0127)
$Workers_{ft}$						
10 - 99	0.0059*** (0.0001)	0.0059*** (0.0001)	0.0059*** (0.0001)	0.0021*** (0.0001)	0.0021*** (0.0001)	0.0021*** (0.0001)
100 - 499	0.0518*** (0.0009)	0.0518*** (0.0009)	0.0521*** (0.0009)	0.0226*** (0.0007)	0.0225*** (0.0007)	0.0226*** (0.0007)
500 - 4999	0.255*** (0.0050)	0.256*** (0.0050)	0.257*** (0.0050)	0.112*** (0.0035)	0.111*** (0.0035)	0.111*** (0.0035)
5000+	1.505*** (0.0398)	1.506*** (0.0398)	1.515*** (0.0397)	0.563*** (0.0216)	0.562*** (0.0216)	0.562*** (0.0216)
Age_{ft}						
5 - 9	-0.0017*** (0.0000)	-0.0017*** (0.0000)	-0.0017*** (0.0000)	-0.0012*** (0.0001)	-0.0012*** (0.0001)	-0.0012*** (0.0001)
10+	-0.0030*** (0.0001)	-0.0030*** (0.0001)	-0.0030*** (0.0001)	-0.0018*** (0.0001)	-0.0018*** (0.0001)	-0.0018*** (0.0001)
FIPS Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	No	No	Yes	Yes	Yes
R-squared	0.152	0.152	0.153	0.742	0.742	0.742
N (millions)	27	27	27	27	27	27

Source: LBD, BR, USPTO and authors' calculations. Table reports the results of estimating Equation 1 using the universe of firms in the US in Economic Census years 1977 to 2012 that are present in at least two Census years. This restriction ensures that the samples are identical across all specifications, including those with firm fixed effects, and does not alter the results. Dependent variable is the inverse hyperbolic sine transformation of the total patents granted to

Key findings for me: (4) Firms with manufacturing and innovation patent more particularly if the labs and factories are close

Dependent variable is: $\ln(Patents_{f,t:t+4})$				
	(1)	(2)	(3)	(4)
$dist_{ft}^{min} \in (0, 5)$	0.131*** (0.0284)	0.149*** (0.0300)	0.0201 (0.0131)	0.116*** (0.0279)
$dist_{ft}^{min} \in (5, 60)$	-0.0230 (0.0303)	0.0984*** (0.0298)	0.00690 (0.0148)	0.0764*** (0.0281)
$\ln(Patent Stock_{f,t-1}^{dep})$			0.833*** (0.00526)	0.278*** (0.0148)
$Workers_{ft}$				
10 - 99	0.0543 (0.0513)	0.0121 (0.0471)	0.0133 (0.0333)	-0.0366 (0.0509)
100 - 499	0.365*** (0.0517)	0.0902* (0.0495)	0.0612* (0.0330)	0.0178 (0.0529)
500 - 4999	1.273*** (0.0562)	0.283*** (0.0544)	0.193*** (0.0340)	0.172*** (0.0570)
5000+	3.125*** (0.0866)	0.868*** (0.0721)	0.504*** (0.0405)	0.638*** (0.0714)
Age_{ft}				
5 - 9	-0.0871* (0.0453)	-0.0710** (0.0346)	-0.136*** (0.0364)	-0.0777** (0.0337)
10+	-0.108** (0.0536)	-0.115** (0.0490)	-0.236*** (0.0351)	-0.130*** (0.0466)
Year Fixed Effects	Yes	Yes	Yes	Yes
FIPS Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	Yes	No	Yes
R-Squared	0.401	0.875	0.787	0.881
Observations	34,500	34,500	34,500	34,500

Source: LBD, BR, USPTO and authors' calculations. Table reports the results of estimating Equation 3 on US firms with both M and P establishments in at least two Census years from 1977 to 2012. Dependent variable is the inverse hyperbolic sine transformation of the sum of subsequently granted patents applied for by firm f in years t to $t+4$. Its mean and standard deviation are 1.114 and 1.768. $dist_{ft}^{min} \in (0, 5)$ and $dist_{ft}^{min} \in (5, 60)$

So, the question is does manufacturing and R&D co-location *cause* more innovation, or is just a consequence of (say) good management?



1. If co-location is critical we might want to introduce tariffs and subsidize domestic manufacturing
2. If instead US firms can innovate at home and produce abroad I would support R&D and education

The Biden administration is actively discussing these questions, so this paper is hugely timely