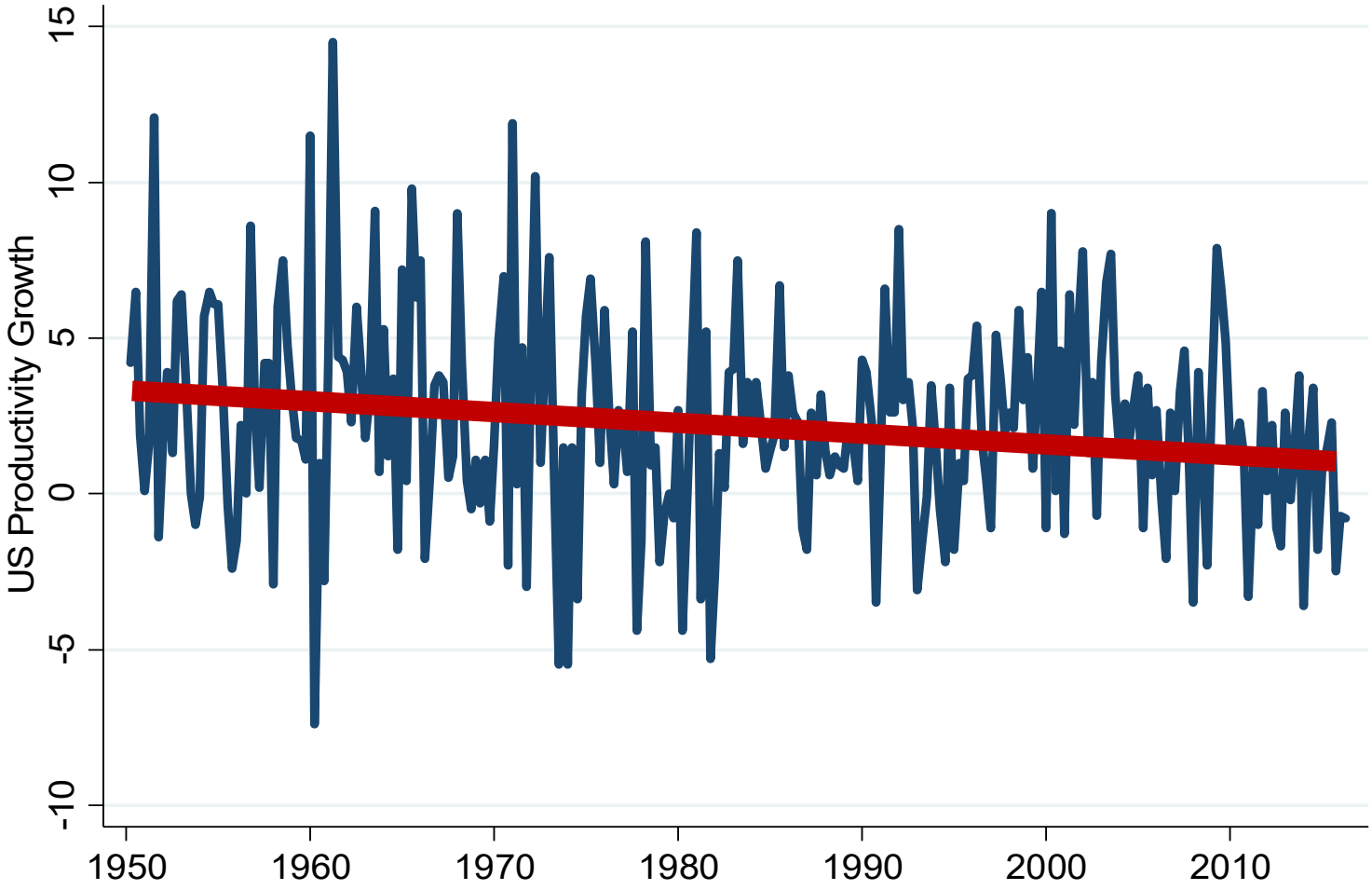
Discussion of “Colocation of Production and Innovation: Evidence from the United States”

by Fort, Keller, Schott, Yeaple and Zolas

Nick Bloom (Stanford)

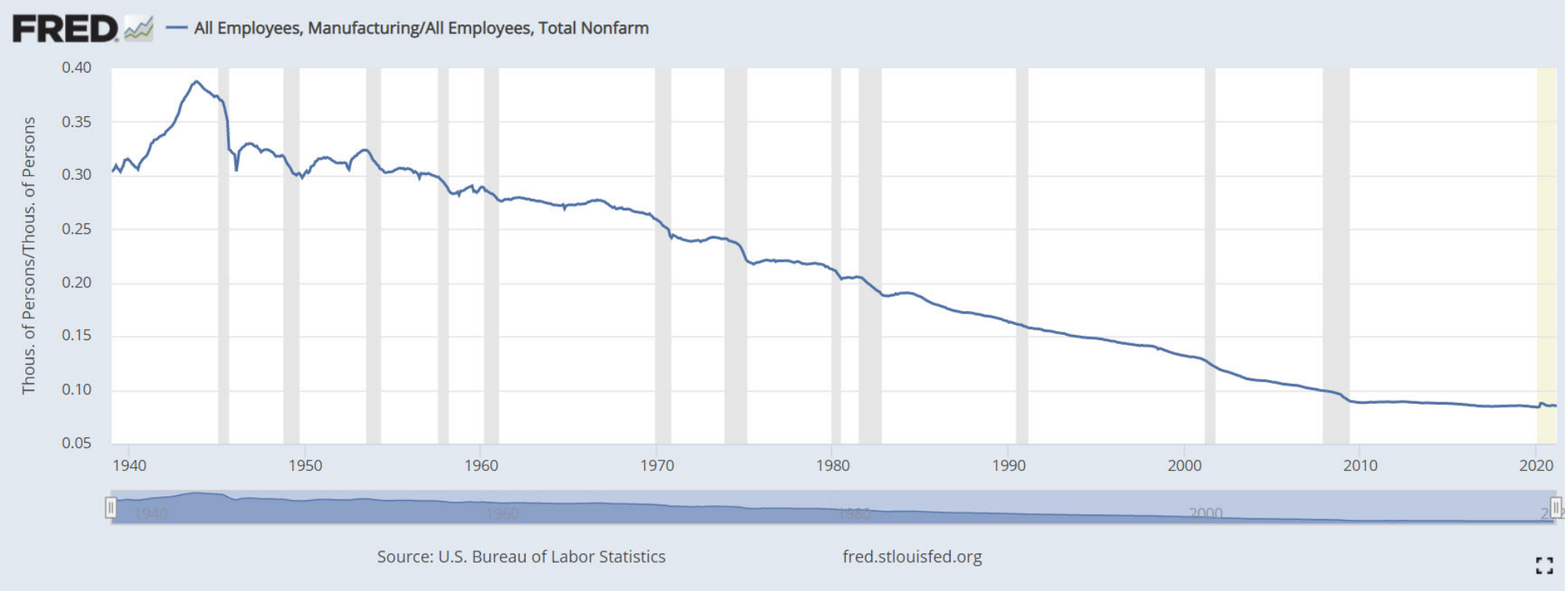
NAS 5/6/2021

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

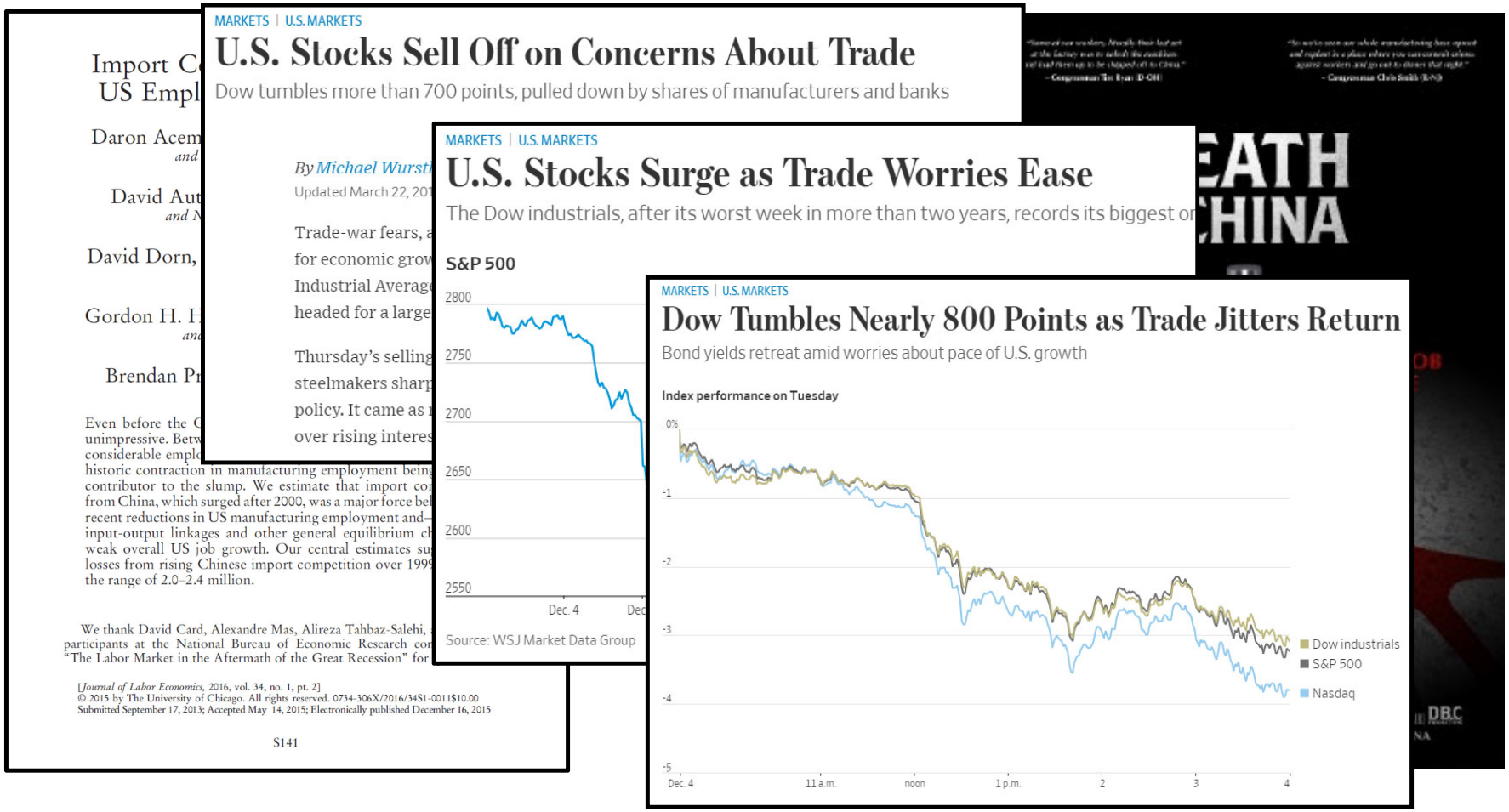


Source: US Bureau of Labor Statistics, growth of real output per hour (labor productivity), series PRS84006092

(2) US manufacturing share of employment has been falling



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

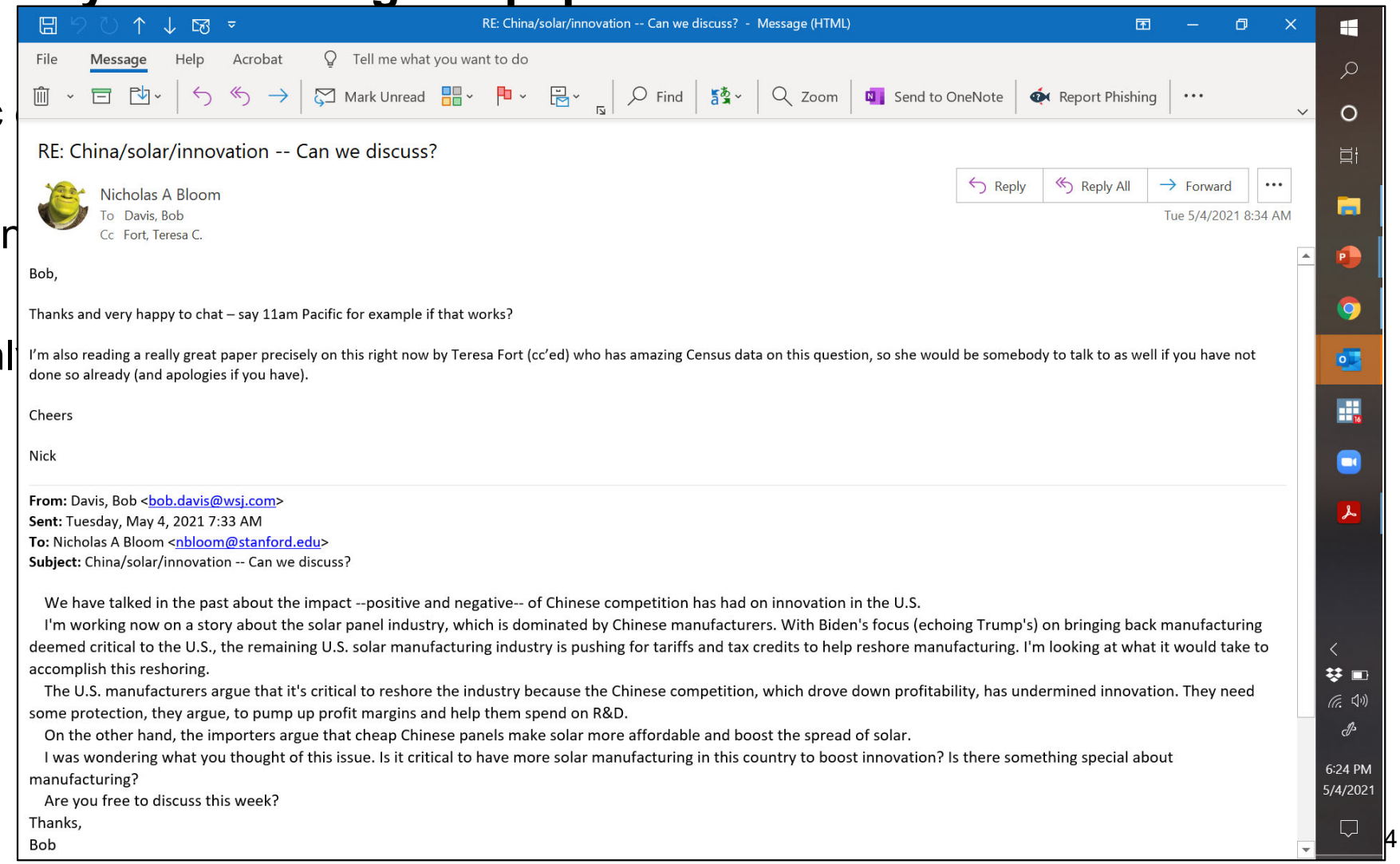


In summary this was a great paper

Fantastic

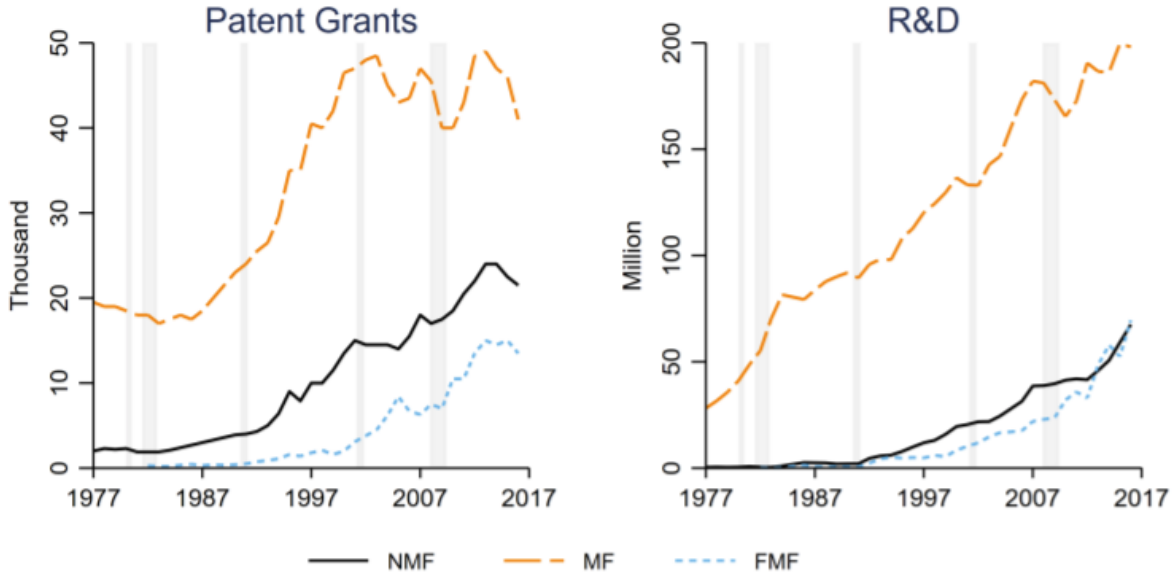
Tackling r

Also highl



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

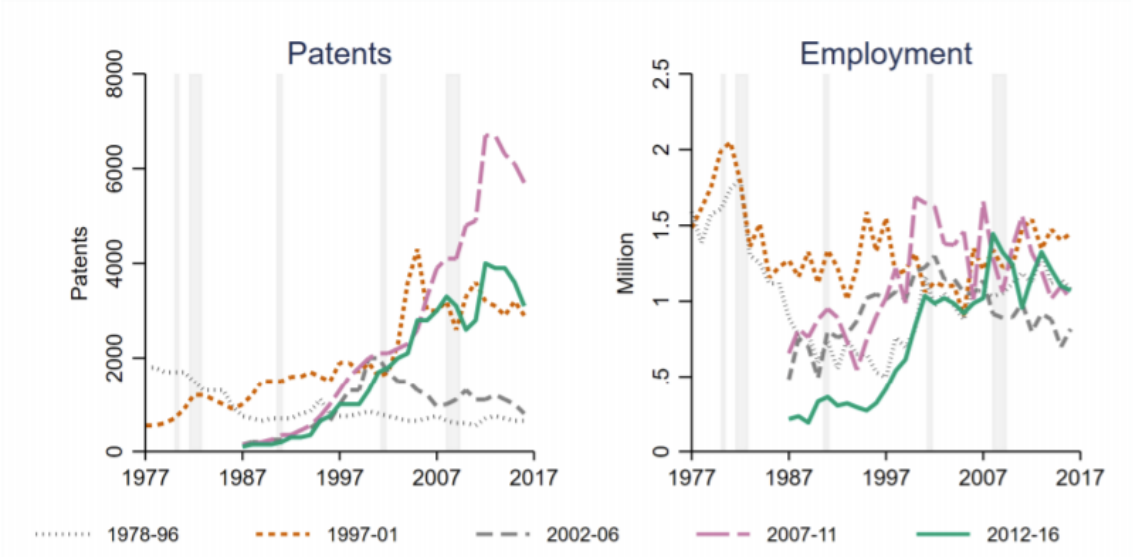


Source: LBD, BR, PatentsView, SIRD, BRDIS and author's calculations. Left and right panels report patents granted to US firms by their application year and total research and development (R&D) expenditures, by type of firm. Firm types are non-manufacturing firms (NMF), manufacturing firms (MF) and former 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 ≠ 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***	0.0376***	0.0365***	0.0149***	0.0179***	0.0174***
	(0.0003)	(0.0004)	(0.0003)	(0.0009)	(0.001)	(0.001)
P_{ft}	0.0172***	0.0172***	-0.213***	0.0047***	0.0047***	-0.0199
	(0.0004)	(0.0004)	(0.0206)	(0.0006)	(0.0006)	(0.0126)
MP_{ft}	0.665***	0.665***	0.707***	0.147***	0.147***	0.154***
	(0.0132)	(0.0133)	(0.0149)	(0.0082)	(0.0082)	(0.0090)
FMF_{ft}		0.0046*	-0.016***		0.0081***	0.0061***
		(0.0024)	(0.0015)		(0.0019)	(0.0016)
$FMF_{ft} \times P_{ft}$			0.231***			0.0247*
			(0.0206)			(0.0127)
$Workers_{ft}$						
10 - 99	0.0059***	0.0059***	0.0059***	0.0021***	0.0021***	0.0021***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
100 - 499	0.0518***	0.0518***	0.0521***	0.0226***	0.0225***	0.0226***
	(0.0009)	(0.0009)	(0.0009)	(0.0007)	(0.0007)	(0.0007)
500 - 4999	0.255***	0.256***	0.257***	0.112***	0.111***	0.111***
	(0.0050)	(0.0050)	(0.0050)	(0.0035)	(0.0035)	(0.0035)
5000+	1.505***	1.506***	1.515***	0.563***	0.562***	0.562***
	(0.0398)	(0.0398)	(0.0397)	(0.0216)	(0.0216)	(0.0216)
Age_{ft}						
5 - 9	-0.0017***	-0.0017***	-0.0017***	-0.0012***	-0.0012***	-0.0012***
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
10+	-0.0030***	-0.0030***	-0.0030***	-0.0018***	-0.0018***	-0.0018***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(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***	0.149***	0.0201	0.116***
	(0.0284)	(0.0300)	(0.0131)	(0.0279)
$dist_{ft}^{min} \in (5,60)$	-0.0230	0.0984***	0.00690	0.0764***
	(0.0303)	(0.0298)	(0.0148)	(0.0281)
$ln(Patent\ Stock_{f,t-1}^{dep})$			0.833***	0.278***
			(0.00526)	(0.0148)
$Workers_{ft}$				
10 - 99	0.0543	0.0121	0.0133	-0.0366
	(0.0513)	(0.0471)	(0.0333)	(0.0509)
100 - 499	0.365***	0.0902*	0.0612*	0.0178
	(0.0517)	(0.0495)	(0.0330)	(0.0529)
500 - 4999	1.273***	0.283***	0.193***	0.172***
	(0.0562)	(0.0544)	(0.0340)	(0.0570)
5000+	3.125***	0.868***	0.504***	0.638***
	(0.0866)	(0.0721)	(0.0405)	(0.0714)
Age_{ft}				
5 - 9	-0.0871*	-0.0710**	-0.136***	-0.0777**
	(0.0453)	(0.0346)	(0.0364)	(0.0337)
10+	-0.108**	-0.115**	-0.236***	-0.130***
	(0.0536)	(0.0490)	(0.0351)	(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