Appendix to "Bottlenecks: Sectoral Imbalances and the US Productivity Slowdown," by Daron Acemoglu, David Autor, and Christina Patterson, in *NBER Macroeconomics Annual 2023*, University of Chicago Press.

10 Appendix Tables

Table A1: Summary Statistics Table

	Downstream		Upstream Average		Upstream Variance	
	Mean	SD	Mean	SD	Mean	SD
Panel A: Manufacturing Industries						
Growth in log(TFP)	.018	.152	.033	.075	.022	.048
Growth in log(Patents)	.132	.19	.085	.119	.015	.012
Growth in Price Index	.134	.178	.125	.172	.033	.059
Growth in log(Employment)	-.08	.258	-.087	.115	.027	.021
Panel B: All Industries						
Growth in log(TFP)	.015	.155	.034	.079	.028	.057
Growth in Price Index	.095	.147	.081	.145	.04	.069
Growth in log(Employment)	-.079	.266	-.084	.123	.025	.023
Panel C: International panel						
Growth in log(TFP)	.046	0.16	.041	.068	.018	.023

Notes: Panel A reports average growth statistics across 462 six-digit, NAICS-based manufacturing industry codes and among stacked, sequential 5-year periods during 1977–2007. Panel B reports average growth statistics across 504 industries (462 six-digit, manufacturing codes plus 42 three-digit, non-manufacturing codes) and among stacked, sequential 5-year periods during 1987–2007. Panel C reports average growth in log TFP across 30 industries in 9 countries (Austria, Finland, France, Germany, Italy, Netherlands, Spain, UK, and US) and among stacked, sequential 5-year periods during 1987–2007. Upstream metrics are calculated using intermediate cost shares from the input-output matrix. Observations (industries) are unweighted.

Table A2: Top 10 Limiting and Limited Industries

Panel A: List of Fastest-Growing Industries that Drive Rising TFP Variance

1997–2002 Industries	*2002–2007 Industries*
Semiconductor and Related Devices	Semiconductor and Related Devices
Electronic Computers	Electronic Computers
Paper (except Newsprint) Mills	Computer Storage Devices
Other Animal Foods	Sawmills
Iron and Steel Mills	Biological Products (except Diagnostic)
All Other Plastics Products	Other Basic Inorganic Chemicals
Motor Vehicle Electrical and Electronic Equipment	Other Plastics Products
Soybean Processing	Motor vehicle transmission and power train parts
Gas engine and engine parts	Motor vehicle metal stamping
Motor Vehicle Metal Stamping	Petrochemicals

Panel B: List of Bottleneck Industries

1997–2002 Industries	*2002–2007 Industries*
Commercial Lithographic Printing	Petroleum Refineries
All Other Basic Organic Chemical	Pharmaceutical Preparation
Printed Circuit Assembly (Electronic Assembly)	Other Communication and Energy Wires
Corrugated and Solid Fiber Boxes	Manifold Business Forms Printing
Petrochemicals	Corrugated and Solid Fiber Boxes
Radio/TV Broadcasting	Rolled Steel Shape Manufacturing
Bare Printed Circuit Boards	Turbine and Turbine Generator Set Units
Electronic Connectors	Medicinal and Botanical Manufacturing
Other Electronic Components	Motor Vehicle Electrical and Electronic Equipment
Electronic Capacitors	Unsupported Plastics Film and Sheets

Panel C: List of Limited (Bottlenecked) Industries

1997–2002 Industries	*2002–2007 Industries*
Photographic and Photocopying Equipment	In-Vitro Diagnostic Substances
Relay and Industrial Control	Medicinal and Botanical
Sawmills	Guided Missile and Space Vehicles
Surgical and Medical Instruments	Wineries
Guided Missile and Space Vehicles	Petroleum Refineries
All Other Motor Vehicle Parts Manufacturing	All Other Basic Organic Chemicals
Motor Vehicle Transmission and Power Train Parts	Other Commercial and Service Industry Machinery
Gasoline Engine and Engine Parts	Cement
Motor Vehicle Metal Stamping	Relay and Industrial Controls
Motor Vehicle Electrical and Electronic Equipment	Industrial Valves

Notes: Bottleneck industries (Panel B) are defined as those for which a 10% increase in TFP would result in the *largest* aggregate reduction in the variance of TFP growth across all supplying industries (i.e. VAR (ΔTFP_{jt}) from Equation 6). Fastest-growing industries (Panel A) are conversely defined as those for which a 10% increase in TFP would result in the *smallest* aggregate reduction in the variance of TFP growth across supplying industries. Limited ("bottlenecked") industries (Panel C) are defined as the 50 manufacturing industries with the highest variance of TFP among suppliers, after limiting to the 100 industries with the highest value-added. Sample is restricted to 462 manufacturing industries during 1997–2007. See Table 2 for a select list of 5 exemplar industries from each category.

Table A3: Robustness of Bottleneck Patterns to Including Within-Industry Variance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Input Average	0.509	0.090	0.202	-0.116	0.699	0.342	-0.084	-0.323
	(0.166)	(0.179)	(0.169)	(0.206)	(0.478)	(0.492)	(0.196)	(0.220)
Input Variance	-1.132		-1.502		-0.840		-1.068	
	(0.192)		(0.247)		(0.297)		(0.330)	
Input Within Industry Variance	0.265	0.031	0.010	-0.351	0.431	0.280	-0.368	-0.504
	(0.126)	(0.119)	(0.285)	(0.294)	(0.306)	(0.301)	(0.331)	(0.314)
Industry Fixed Effects	no	no	yes	yes	no	no	yes	yes
Industry Weighting	None	None	None	None	Nom. Sales	Nom. Sales	Nom. Sales	Nom. Sales
Observations	924	924	924	924	924	924	924	924
R-Squared	0.135	0.092	0.597	0.553	0.118	0.091	0.775	0.746

Notes: Within-industry (cross-establishment) variance comes from Dispersion Statistics on Productivity (DiSP) provided by the US Census Bureau. The sample includes stacked, sequential 5-year average changes for manufacturing industries during 1997–2002 and 2002–2007. Fixed effects for year are included in all regressions and industry fixed effects are included where indicated. For columns 1–4, observations are unweighted; for columns 5–8, each observation (industry) is weighted by its share of shipments across all industries.

Table A4: Relationship between industry TFP growth and supplier TFP growth using adjusted TFP in manufacturing

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				A. Manufacturing Only				
Input Average	0.261	0.524	0.264	0.510	0.013	1.023	0.305	0.115
	(0.153)	(0.163)	(0.089)	(0.200)	(0.124)	(0.462)	(0.097)	(0.182)
Input Variance		-0.480	-0.657			-0.628	-0.560	
		(0.109)	(0.101)			(0.222)	(0.106)	
Input Bottom Decile				-0.049	0.266			0.258
				(0.099)	(0.081)			(0.137)
Input Top Decile				-0.093	-0.073			-0.093
				(0.028)	(0.028)			(0.030)
Ind. Fixed Effects	no	no	yes	no	yes	no	yes	yes
Industry Weighting	None	None	None	None	None	Nom. Sales	Nom. Sales	Nom. Sales
Observations	2772	2772	2772	2772	2772	2772	2772	2772
R-Squared	0.055	0.067	0.365	0.061	0.361	0.121	0.614	0.614
				B. All Industries				
Input Average	0.160	0.573	0.394	0.452	0.094	0.552	0.088	0.018
	(0.190)	(0.188)	(0.121)	(0.232)	(0.167)	(0.471)	(0.231)	(0.276)
Input Variance		-0.613	-0.911			-0.200	-0.684	
		(0.138)	(0.165)			(0.235)	(0.219)	
Input Bottom Decile				0.031	0.316			0.211
				(0.108)	(0.106)			(0.159)
Input Top Decile				-0.097	-0.116			-0.138
				(0.035)	(0.037)			(0.058)
Ind. Fixed Effects	no	no	yes	no	yes	no	yes	yes
Industry Weighting	None	None	None	None	None	Nom. Sales	Nom. Sales	Nom. Sales
Observations	2016	2016	2016	2016	2016	2016	2016	2016
R-Squared	0.041	0.054	0.402	0.048	0.397	0.020	0.538	0.542

Notes: This table reports estimates of equation (6). The dependent variable is an industry's TFP growth in a five-year period and the two key right-hand side variables are mean and variance of TFP growth among that industry's suppliers. Time dummies are included in all regressions and industry dummies (corresponding to linear industry trends) are included in columns 3, 5, 7 and 8. Columns 1–5 report unweighted OLS regressions, and columns 6–8 use the industry's 1987 share of shipments as weights. Panel A is for manufacturing industries only from 1977-2007, and Panel B is for all industries from 1987-2007. Industries are defined using 1997 NAICS codes. Standard errors are clustered at the industry level.

Table A5: Country-Specific Instruments using adjusted TFP in manufacturing

	(1)	(2)	(3)	(4)	(5)	(6)
			A: Average TFP Growth			
	OLS Estimates		IV Estimates			
Upstream Average	0.951	0.780	1.369	1.416	1.387	1.509
	(0.232)	(0.119)	(0.363)	(0.655)	(0.378)	(0.758)
Upstream Variance	-0.876	-1.066	-0.902	-0.887	-0.897	-0.795
	(0.155)	(0.135)	(0.385)	(0.527)	(0.391)	(0.588)
Estimate	OLS	OLS	2SLS	2SLS	LIML	LIML
Ind. Fixed Effects	no	yes	no	yes	no	yes
Observations	2478	2478	2478	2478	2478	2478
R-Squared	0	0	0	0	0	0
First-Stage F-Stat			1.38	.63	1.38	.63
			B: Rank of TFP growth			
	OLS Estimates		IV Estimates			
Upstream Average	0.951	0.780	0.928	1.093	0.928	1.094
	(0.232)	(0.119)	(0.338)	(0.348)	(0.342)	(0.349)
Upstream Variance	-0.876	-1.066	-0.667	-1.480	-0.664	-1.482
	(0.155)	(0.135)	(0.445)	(0.661)	(0.449)	(0.665)
Estimate	OLS	OLS	2SLS	2SLS	LIML	LIML
Ind. Fixed Effects	no	yes	no	yes	no	yes
Observations	2478	2478	2478	2478	2478	2478
R-Squared	0	0	0	0	0	0
First-Stage F-Stat			.8	2.1	.8	2.1

Notes: This table reports instrumental-variables estimates of equation (6) for all industries for 1982–2007. The dependent variable is an industry's TFP growth in a five-year period and the two key right-hand side variables are mean and variance of TFP growth among that industry's suppliers. Excluded instruments are mean and variance of supplier TFP growth in France, Germany and the UK. All columns report unweighted regressions. Time dummies are included in all columns and industry dummies (corresponding to linear industry trends) are included in even-numbered columns. Columns 3 and 4 report two-stage least squares (2SLS) estimates, and columns 5 and 6 report limited information maximum likelihood (LIML) estimates. Panel A defines the upstream moments, taking the average and variance of TFP growth across industries. In Panel B, we rank industries in each country according to their TFP growth and calculate the input-share weighted average and variance of TFP ranks. Standard errors are clustered at the aggregated KLEMS industry level.

Table A6: Relationship between industry TFP growth and the distribution of TFP growth using adjusted TFP in manufacturing

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Manufacturing Industries				All Industries			
				A. Future Supplier TFP Growth				
Future Input Average	0.157	0.150	-0.014	0.031	-0.017	-0.009	-0.088	-0.045
	(0.164)	(0.140)	(0.080)	(0.075)	(0.202)	(0.188)	(0.115)	(0.108)
Future Input Variance	0.057	0.066	-0.062	-0.048	0.234	0.291	0.177	0.053
	(0.101)	(0.124)	(0.104)	(0.108)	(0.134)	(0.154)	(0.148)	(0.141)
Input Average		0.493		0.271		0.518		0.381
		(0.149)		(0.087)		(0.177)		(0.117)
Input Variance		-0.569		-0.659		-0.700		-0.901
		(0.110)		(0.104)		(0.143)		(0.160)
Ind. Fixed Effects	no	no	yes	yes	no	no	yes	yes
Industry Weighting	None	None	None	None	None	None	None	None
Observations	2772	2772	2772	2772	2016	2016	2016	2016
R-Squared	0.049	0.073	0.347	0.365	0.043	0.060	0.383	0.402
				B. Customer TFP Growth				
Customer Average	0.586	0.528	0.391	0.327	0.361	0.287	0.327	0.215
	(0.087)	(0.078)	(0.074)	(0.074)	(0.110)	(0.111)	(0.117)	(0.117)
Customer Variance	-0.465	-0.314	-0.763	-0.531	-0.257	-0.071	-0.800	-0.493
	(0.219)	(0.245)	(0.148)	(0.135)	(0.289)	(0.326)	(0.245)	(0.229)
Input Average		0.236		0.165		0.467		0.360
		(0.137)		(0.090)		(0.196)		(0.124)
Input Variance		-0.361		-0.481		-0.586		-0.746
		(0.104)		(0.104)		(0.151)		(0.176)
Ind. Fixed Effects	no	no	yes	yes	no	no	yes	yes
Industry Weighting	None	None	None	None	None	None	None	None
Observations	2769	2769	2769	2769	2015	2015	2015	2015
R-Squared	0.107	0.114	0.369	0.378	0.054	0.065	0.395	0.406
				C. Lagged TFP Growth: Dependent Variable and Supplier Metrics				
Input Average	0.343	0.313	0.155	0.174	0.569	0.551	0.352	0.351
	(0.127)	(0.115)	(0.087)	(0.091)	(0.168)	(0.158)	(0.112)	(0.116)
Input Variance	-0.394	-0.477	-0.550	-0.556	-0.637	-0.721	-0.769	-0.844
	(0.103)	(0.108)	(0.101)	(0.108)	(0.135)	(0.150)	(0.144)	(0.152)
Lagged Input Average		0.152		0.092		0.098		0.167
		(0.114)		(0.083)		(0.132)		(0.115)
Lagged Input Variance		0.045		-0.328		0.107		-0.607
		(0.126)		(0.104)		(0.172)		(0.156)
Lagged Dep. Var.	0.141	0.138	-0.271	-0.287	0.121	0.121	-0.383	-0.406
	(0.107)	(0.108)	(0.044)	(0.046)	(0.126)	(0.129)	(0.048)	(0.052)
Ind. Fixed Effects	no	no	yes	yes	no	no	yes	yes
Industry Weighting	None	None	None	None	None	None	None	None
Observations	2310	2310	2310	2310	1974	1974	1974	1974
R-Squared	0.078	0.084	0.420	0.426	0.067	0.069	0.474	0.483

Notes: This table reports estimates of equation (6). The dependent variable is an industry's TFP growth in a five-year period and the right-hand side variables are mean and variance of TFP growth among that industry's suppliers, plus lead terms, mean and variance of TFP growth among the industry's customers, and lagged dependent variables. Time dummies are included in all regressions and industry dummies (corresponding to linear industry trends) are included in columns 3, 4, 7 and 8. Columns 1–4 are for manufacturing industries for 1977–2007 and 5–8 for all industries for for 1987–2007. All columns report unweighted OLS regressions. In addition to the mean and variance of TFP growth among an industry's suppliers, Panel A includes the five-year lead of the same variables. Panel B includes the mean and variance of TFP growth among the industry's customers. Panel C includes the five-year lagged mean and variance of TFP growth among the industry's suppliers and the lag of the dependent variable (the industry's TFP growth rate). Standard errors are clustered at the industry level.

Table A7: Robustness for Downstream TFP and Upstream TFP: All Industries

	(1) Baseline	(2) Weighted	(3) 10-year	(4) Cov.	(5) China Shock	(6) No Comp.	(7) Outlier Robust	(8) Fixed IO	(9) All Inputs	(10) 3-digit Leaveout
					A: Without Industry Trends					
Input Average	0.915	0.708	1.093	0.909	0.934	0.699	0.776	0.996	0.915	0.495
	(0.161)	(0.399)	(0.233)	(0.163)	(0.168)	(0.108)	(0.075)	(0.126)	(0.161)	(0.145)
Input Variance	-0.905	-0.303	-0.638	-0.798	-1.026	-2.029	-0.984	-0.845	-0.905	-1.039
	(0.158)	(0.280)	(0.117)	(0.176)	(0.159)	(0.710)	(0.087)	(0.207)	(0.158)	(0.196)
Input Covariance				-0.228						
				(0.204)						
Observations	2016	2016	1008	2016	1512	1904	2016	2016	2016	2016
R-Squared	0.102	0.033	0.070	0.103	0.116	0.103	0.170	0.119	0.102	0.083
					B: With Industry Trends					
Input Average	0.780	0.365	0.892	0.687	0.896	0.770	0.696	0.876	0.780	0.460
	(0.119)	(0.230)	(0.173)	(0.118)	(0.134)	(0.122)	(0.085)	(0.124)	(0.119)	(0.149)
Input Variance	-1.087	-0.712	-1.024	-0.907	-1.200	-1.490	-1.139	-1.139	-1.087	-1.207
	(0.191)	(0.280)	(0.251)	(0.196)	(0.214)	(0.767)	(0.104)	(0.204)	(0.191)	(0.231)
Input Covariance				-0.760						
				(0.196)						
Observations	2016	2016	1008	2016	1512	1904	2016	2016	2016	2016
R-Squared	0.399	0.522	0.665	0.406	0.471	0.291	0.589	0.409	0.399	0.384

Notes: This table reports estimates of equation (6) for all industries between 1977 and 2007. The dependent variable is an industry's TFP growth in a five-year period and the right-hand side variables are mean and variance of TFP growth among that industry's suppliers plus additional controls. Time dummies are included in all regressions. Panel B additionally includes industry dummies (corresponding to linear industry trends). Column 1 repeats our baseline regression from column 2 of Table 1. Column 2 weights observations by the industry's share of 1987 shipments. Column 3 uses 10-year observations. Column 4 controls for the covariance between the supplier TFP growth in the current and the prior five-year periods. Column 5 controls for the China shock following Autor et al. (2013). Column 6 excludes the computers and electronics manufacturing sector (NAICS 334) both from the regression sample and from the construction of the average and variance of TFP growth among suppliers. Column 7 runs an outlier-robust regression (rreg). Column 8 fixes the input-output table at 1987. Column 9 defines the input-output network to use the share among all inputs instead of among intermediaries. Column 10 excludes the industry's own three-digit NAICS code when constructing the input-output network.

Table A8: First Stage for International Instruments for TFP Growth

	Partial First Stage		First Stage		Partial First Stage		First Stage	
Dependent Variable:	Average	Variance	Average	Variance	Average	Variance	Average	Variance
				A: Level of TFP growth				
Upstream Average France	0.106		0.084	0.208	0.015		-0.020	0.095
	(0.172)		(0.168)	(0.144)	(0.114)		(0.101)	(0.073)
Upstream Average Germany	0.064		0.121	-0.039	0.052		0.131	-0.054
	(0.021)		(0.031)	(0.021)	(0.047)		(0.049)	(0.048)
Upstream Average UK	0.117		0.127	0.002	0.097		0.113	-0.053
	(0.066)		(0.061)	(0.022)	(0.077)		(0.076)	(0.049)
Upstream Variance France		0.395	0.312	0.228		0.385	0.429	0.114
		(0.287)	(0.362)	(0.210)		(0.232)	(0.338)	(0.088)
Upstream Variance Germany		-0.029	0.075	-0.040		-0.002	0.125	-0.045
		(0.021)	(0.038)	(0.024)		(0.005)	(0.044)	(0.038)
Upstream Variance UK		-0.477	-0.067	-0.027		-0.740	-0.260	-0.481
		(0.378)	(0.521)	(0.147)		(0.422)	(0.690)	(0.284)
Ind. Fixed Effects	no	no	no	no	yes	yes	yes	yes
Observations	2520	2520	2520	2520	2520	2520	2520	2520
R-Squared	0.250	0.091	0.256	0.144	0.524	0.524	0.533	0.534
				B: Rank of TFP growth				
Upstream Average France	-0.052		-0.042	-0.323	0.109		0.116	-0.175
	(0.265)		(0.254)	(0.219)	(0.166)		(0.170)	(0.120)
Upstream Average Germany	-0.344		-0.392	0.057	-0.435		-0.454	0.061
	(0.087)		(0.073)	(0.040)	(0.106)		(0.097)	(0.063)
Upstream Average UK	-0.120		-0.115	-0.089	-0.096		-0.079	0.008
	(0.109)		(0.108)	(0.057)	(0.111)		(0.114)	(0.053)
Upstream Variance France		0.032	0.038	0.037		0.040	0.031	0.037
		(0.022)	(0.032)	(0.026)		(0.028)	(0.033)	(0.025)
Upstream Variance Germany		-0.010	-0.024	-0.012		-0.024	-0.024	-0.027
		(0.012)	(0.020)	(0.012)		(0.027)	(0.041)	(0.027)
Upstream Variance UK		-0.017	-0.022	-0.012		-0.015	-0.018	-0.015
		(0.016)	(0.021)	(0.013)		(0.014)	(0.022)	(0.014)
Ind. Fixed Effects	no	no	no	no	yes	yes	yes	yes
Observations	2520	2520	2520	2520	2520	2520	2520	2520
R-Squared	0.265	0.106	0.285	0.171	0.551	0.539	0.563	0.550

Notes: The table specifies the upstream average and variance of TFP growth statistics in France, Germany, and UK in order to instrument for downstream TFP growth in the US (as in Table 3). Panel A specifies the upstream average and variance using TFP growth. Panel B ranks industries in each country according to their TFP growth and specifies the upstream average and variance using the input-share weighted mean and variance of TFP ranks (then multiplied by 100). Standard errors are clustered at the industry level. Time fixed effects are included in all specifications and industry fixed effects are included in columns 5–8.

Table A9: Evidence on Bottlenecks from Cross-Country Regressions Using Domestic and Foreign TFP

	(1)	(2)	(3)	(4)
Upstream Domestic Average	0.145	0.149	0.128	-0.129
	(0.081)	(0.087)	(0.047)	(0.110)
Upstream Domestic Variance		-0.523	-0.417	-0.423
		(0.165)	(0.101)	(0.107)
Upstream Foreign Average	0.176	0.149	0.346	0.395
	(0.114)	(0.155)	(0.205)	(0.217)
Upstream Foreign Variance		-0.027	0.225	0.353
		(0.186)	(0.234)	(0.277)
Year FEs	yes	yes	no	no
Country FEs	yes	yes	yes	no
Year*Country FEs	no	no	no	yes
Year*Industry FEs	no	no	yes	yes
Observations	3647	3647	3647	3647
R-Squared	0.066	0.073	0.361	0.393

Notes: Standard errors are clustered at the industry level. All regressions include stacked 5-year changes from 1987-2007 for 30 industries and 9 countries: Spain, France, the US, Austria, Finland, the Netherlands, Italy, Germany and the UK. Domestic upstream average and variance are calculated across industries in their own country, using the 2000 input share as the weight. Foreign upstream average and variance are calculated across industries for all other countries in the sample, using the input share of the country–industry pair as the weight.

Table A10: Bottleneck Results for United States, Aggregating to KLEMS codes

Upstream Average	0.901	0.971	1.086	1.037	0.742	0.721	0.783	0.826
	(0.571)	(0.573)	(0.691)	(0.611)	(0.411)	(0.308)	(0.449)	(0.401)
Upstream Variance	-5.757	-5.870	-5.748	-5.844	-6.096	-5.180	-6.323	-4.770
	(2.572)	(2.364)	(3.567)	(3.379)	(1.551)	(0.862)	(2.316)	(1.298)
Year FEs	yes	yes	yes	yes	yes	yes	yes	yes
Industry FEs	no	no	no	no	yes	yes	yes	yes
Industry Weight	None	None	Nom. VA	Nom. VA	None	None	Nom. VA	Nom. VA
Lagged Dep. Var.	No	Yes	No	Yes	No	Yes	No	Yes
Observations	112	84	112	84	112	84	112	84
R-Squared	0.130	0.206	0.125	0.161	0.578	0.707	0.532	0.687

Notes: Standard errors are clustered at the industry level. The input-output table is defined using the GGDC World Input-Output Database for the year 2000, limited to only the US. All regressions include stacked, sequential 5-year changes during 1987–2007 for the 30 KLEMS industry classifications used for the cross-country regressions reported in Table 13. Each observation (industry) is weighted by its share of nominal value-added, across all industries, in 1987.