

Turbulence, Firm Decentralization and Growth in Bad Times

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Online Appendix

A Data Appendix

A.1 Industry-level variables

Exports

We measure changes in exports in an industry by country cell using the UN COMTRADE database of world trade. This is an international database of six-digit product level information on all bilateral imports and exports between any given pairs of countries. We first aggregate the COMTRADE value of export data (in US dollars) from its original six-digit product level to three-digit US SIC-1987 level using the Pierce and Schott (2010) concordance. We deflate the industry and country specific export value series by a country and year specific CPI from the OECD (2010 base year) to measure “real exports.” The Export growth variable is defined as the logarithmic change in exports in 2008-09 (the average in a cell across these two Great Recession years) relative to 2006-07 (the average across the two years immediately prior to the Great Recession). The real export growth variable is winsorized at the 5th and the 95th percentile.

Durability

Data on the average durability of the goods produced in the industry are drawn from Ramey and Nekarda (2013). This combines data gathered by Bils and Klenow (1998) with information from the Los Angeles HOA Management “Estimating Useful Life for Capital Assets” to assign a service life to the product of each four-digit industry. This is a continuous cross-sectional measure at the 4-digit industry level.

Bartik Instrument

In a robustness test we use a Bartik IV for export growth constructed as the change in world import demand (WID) for commodity m in country r between time t (2008 and 2009) and $t - 1$ (2006 and 2007), defined as $\Delta z_{mr,t} = \sum_p s_{mpr,t-1} * \Delta WID_{mpr',t}$ where $s_{mpr,t-1}$ is the share of exports of commodity m from country r to partner country p at time $t - 1$; $WID_{mpr',t}$ is the log change in total imports of commodity c in partner country p between t and $t - 1$ from all countries *excluding* country r (hence the r' sub-script). Commodity m is measured at the HS 6-digit level and then mapped into industry j three-digit SIC codes using the Pierce and Schott (2010) concordance.

A.2 World Management Survey (WMS) International Data

Firm-level Accounting Databases

Our sampling frame was based on the Bureau van Dijk (BVD) ORBIS which is composed of the BVD Amadeus dataset for Europe (France, Germany, Greece, Italy, Poland, Portugal, and the United Kingdom); BVD Icarus for the United States, BVD Oriana for Japan. These databases all provide sufficient information on companies to conduct a stratified telephone survey (company name, address, and a size indicator). These databases also typically have accounting information on employment, sales and assets. Apart from size, we did not insist on having accounting information to form the sampling population, however. Amadeus are constructed from a range of sources, primarily the National registries of companies (such as Companies House in the United Kingdom). Icarus is constructed from the Dun & Bradstreet database, which is a private database of over 5 million U.S. trading locations built up from credit records, business telephone directories, and direct research. Oriana is constructed from the Teikoku Database in Japan. The full WMS consists of 34 countries but because we need decentralization data in 2006 we are restricted to the 12 countries surveyed in the 2006 wave. Because we wanted to focus on mature economies we dropped

China and India which left us with 10 OECD countries (France, Great Britain, Germany, Greece, Italy, Japan, Poland, Portugal, Sweden and the US).

The Organizational Survey

In every country the sampling frame for the organization survey was all firms with a manufacturing primary industry code with between 50 and 5,000 employees on average over the most recent three years of data. Interviewers were each given a randomly selected list of firms from the sampling frame. More details are available in Bloom, Sadun and Van Reenen (2012) where we compare the sampling frame with Census demographic data from each country and show that the sample is broadly representative of medium sized manufacturing firms. We also analyzed sample selection - the response rate was 45% and respondents appear random with respect to company performance, although larger firms were slightly more likely to respond. We collected a detailed set of information on the interview process itself (number and type of prior contacts before obtaining the interviews, duration, local time-of-day, date and day-of-the-week), on the manager (gender, seniority, nationality, company and job tenure, internal and external employment experience, and location), and on the interviewer (we can include individual “analyst” fixed effects, time-of-day, and subjective reliability score). We used a subset of these “noise controls” (see text) to help reduce residual variation.

In analyzing organizational surveys across countries we also have to be extremely careful to ensure comparability of responses. One step was the team all operated from two large survey rooms in the London School of Economics. Every interviewer also had the same initial three days of interview training, which provided three “calibration” exercises, where the group would all score a role-played interview and then discuss scoring together of each question. This continued throughout the survey, with one calibration exercise every Friday afternoon as part of the weekly group training sessions. Finally, the analysts interviewed firms in multiple countries since they all spoke their native language plus English, so interviewers were able to interview firms from their own country plus the UK and US, enabling us to remove interviewer fixed effects.

The construction of the degree of decentralization measures (from Central Headquarters to Plant Manager) is discussed in some detail in the text. The questions are addressed to the plant manager. We only keep observations where at least two of the four decentralization questions were answered (and we include a control for the number of non-missing questions in the set of noise controls). We drop observations where the plant manager is also the CEO (5% of firms). In cases where the Central Headquarters is on the same site as the plant we interviewed we add a dummy variable to indicate this (one of the noise controls) to reflect potentially greater monitoring. We use the data from the 2006 wave in all cases except when we analyze changes in decentralization as an outcome where we exploit the fact that we ran another wave in 2009 and 2010 for a sub-sample of firms.

As a check of potential survey bias and measurement error we performed repeat interviews on 72 firms in 2006, contacting different managers in different plants at the same firm, using different interviewers. To the extent that our organizational measure is truly picking up company-wide practices these two scores should be correlated, while to the extent the measure is driven by noise the measures should be independent. The correlation of the first interview against the second interviews was 0.513 (p-value of 0.000), with no obvious (or statistically significant) relationship between the degree of measurement error and the decentralization score. That is to say, firms that reported very low or high decentralization scores in one plant appeared to be genuinely very centralized or decentralized in their other plants, rather than extreme draws of sampling measurement error.

Firm-level variables

Our firm accounting data on sales, employment, capital (fixed assets), profits and intermediate inputs came from BVD ORBIS. Whether the variable is reported depends on the accounting standards in different countries. Sales are deflated by a three digit industry producer price index. BVD has extensive information on ownership structure, so we can use this to identify whether the firm was part of a multinational enterprise. We also asked specific questions on the multinational status of the

firm (whether it owned plants abroad and the country where the parent company is headquartered) to be able to distinguish domestic multinationals from foreign multinationals.

We collected many other variables through our survey including information on plant size, skills, organization, etc. as described in the main text. We also collected management practices data in the survey. These were scored following the methodology of Bloom and Van Reenen (2007), with practices grouped into four areas: operations (three practices), monitoring (five practices), targets (five practices), and incentives (five practices). The shop-floor operations section focuses on the introduction of lean manufacturing techniques, the documentation of processes improvements, and the rationale behind introductions of improvements. The monitoring section focuses on the tracking of performance of individuals, reviewing performance, and consequence management. The targets section examines the type of targets, the realism of the targets, the transparency of targets, and the range and interconnection of targets. Finally, the incentives section includes promotion criteria, pay and bonuses, and fixing or firing bad performers, where best practice is deemed the approach that gives strong rewards for those with both ability and effort. Our management measure uses the unweighted average of the z-scores of all 18 dimensions.

Our basic industry code is the U.S. SIC (1997) three digit level—which is our common industry definition in all countries. We allocate each firm to its main three digit sector (based on sales).

A.3 U.S. Census Bureau Data: MOPS

Sample

Table A2 shows how our sample is derived from the universe of U.S. business establishments. The U.S. Census Bureau data on decentralization comes from the 2010 Management and Organizational Practices Survey (MOPS), which was a supplement to the 2010 Annual Survey of Manufactures (ASM). The MOPS survey was sent to all ASM establishments in the ASM mail-out sample. Overall, 49,782 MOPS surveys were successfully delivered, and 37,177 responses were received, yielding a response rate of 78%.

The MOPS contains 36 multiple choice questions, split into 3 modules: management practices (16 questions), organization (13 questions), and background characteristics (7 questions). Decentralization measures come from the “Organization” module of the MOPS. Only establishments with headquarters located off-site are instructed to answer questions in the organization module. This reduces the sample to about 20,000 establishments. We also require matches to the 2006 and 2009 ASM in order to calculate the growth rates used in the analysis. This reduces the sample size substantially for two reasons. First, all of the establishments in our sample must have been operating in both 2006 and 2009. The second reason is related to the ASM sample design. The ASM is a rotating 5-year panel which samples large establishments with certainty but also includes a random sample of smaller establishments. The ASM sample is refreshed every five years, most recently in 2009, thus we lose establishments which were in the 2009 and 2010 ASM samples and responded to the MOPS, but were not in the 2006 ASM sample. Finally, we require that respondents answer all 6 of the questions about decentralization (described below) and have positive value added and imputed capital in 2010. The final sample contains 8,800 establishments and 3,150 firms.

Decentralization

Our measure of decentralization is constructed from 6 questions on the MOPS (questions 18 through 23), which measure the allocation of real decision making rights between manufacturing plant managers and their central headquarters. Respondents are asked whether decisions about hiring, pay increases, product introductions, pricing, and advertising are conducted at the establishment, headquarters or both, and about the largest capital expenditure plant managers can make without authorization from headquarters. The survey asks about organizational practices in 2005 and 2010. We use information on decentralization in 2005 in the main analysis because firms may endogenously respond to the crisis in 2010 by changing organizational structures.

Each of the 6 decentralization questions is normalized on a scale from zero to one, with one being most decentralized and zero being least decentralized. For example, question 18 reads “In 2005 and 2010, where were decisions on hiring permanent full-time employees made?” There are three possible responses: “Only at this establishment” which is assigned the value one; “Both at this establishment and at headquarters” which is assigned a value of one-half; “Only at headquarters” which is assigned a value of zero. We then standardize each question to have a mean equal to zero and standard deviation equal to one, take the mean over all six standardized questions, and then standardize this mean so that it has a mean equal to zero and standard deviation equal to one.

Exports

Our proxy for the Great Recession is a plant-specific export shock constructed by matching the product files of the 2006 ASM which disaggregate establishment revenues by product class to the Longitudinal Firm Trade Transactions (LFTTD) data which contain the universe of export shipments at the firm-product level. To construct our measure, we first match the product categories from LFTTD (ten-digit Harmonized System categories, or HS10) to the 7-digit NAICS product classes contained in the ASM using the Pierce and Schott (2009) concordance. Next, we aggregate exports to the 7-digit NAICS level and calculate the change in exports in each product over the Recession, defined as the logarithmic change in exports in 2008-09 (the average in a cell across these two Great Recession years) relative to 2006-07 (the average across the two years immediately prior to the Great Recession). Finally, we construct our plant-specific export shock as the weighted average of product export growth in the crisis, where for each plant, the weights assigned to each product category is that plant’s share of sales revenue in the product as measured before the crisis in the 2006 ASM.

Product Churn

Product churn is constructed using data come from the US Census Bureau’s Census of Manufactures (CM). The CM asks establishments to list the dollar value of annual shipments by 10-digit product code. Establishments receive a list of all the product codes typically produced by establishments in their industry, along with corresponding descriptions of each code.

We start by calculating the total number of 10-digit products by each establishment in a given year, as well as the number of added products and the number of dropped products for each establishment compared to the previous CM 5 years earlier. This of course restricts the sample to manufacturing establishments which were alive five years earlier. We further restrict the sample by dropping establishments producing fewer than 3 products in both Censuses. Product churn at the establishment level is measured as the number of products added or dropped between the previous Census and the current Census, divided by the average number of products produced in both Censuses. That is, product churn for establishment i in year t is defined as:

$$\text{Product Churn}_{i,t} = \frac{\text{Products Added}_{i,t} + \text{Products Dropped}_{i,t}}{0.5(\# \text{ Products}_{i,t} + \# \text{ Products}_{i,t-5})}$$

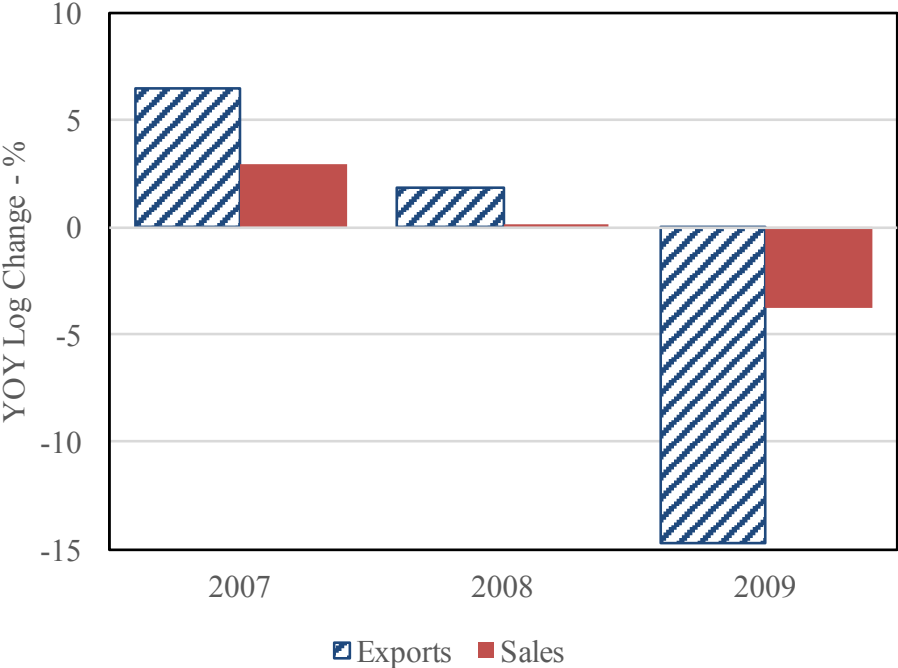
Industry product churn in year t is the average establishment-level product churn among establishments within an industry (three digit US SIC-1987). To calculate industry-level change in product churn, we simply subtract product churn in 2007 (constructed from the product data in the 2002 and 2007 Censuses) from product churn in 2012.

ASM variables

Directly from the ASM we obtain material inputs, shipments (deflated by a three digit price deflator) as our sales measure and the headcount of employees for labor. Real capital stocks are constructed using the perpetual inventory method, following the methodology in Bloom, Floetotto, Jaimovich, Saporta-Eksten and Terry (2018). In particular, we combine detailed data on the book value of assets every 5 years from the CM with annual investment data from the ASM. We first convert CM capital stocks

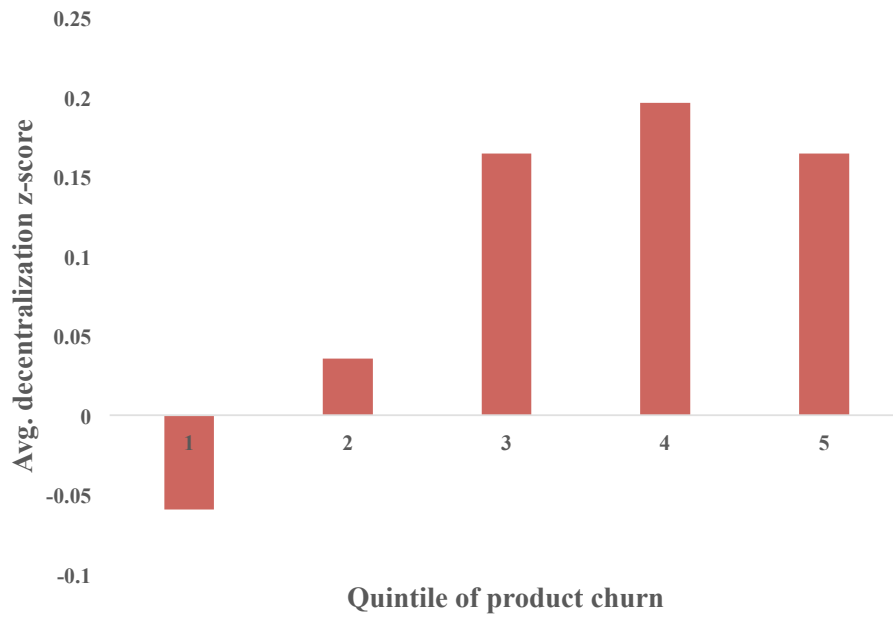
from book to market value using BEA fixed asset tables. We then deflate capital stocks and investment using industry-year price indices from the NBER-CES Manufacturing Industry Database. Finally, we apply the perpetual inventory method, using the formula $K_t = (1 - \delta_t)K_{t-1} + I_t$. This procedure is done separately for structures and for equipment. However, since the ASM contains investment broken down into investment in equipment and investment in structures, but the CM does not break down capital stocks into these two components, we must apportion plant capital stocks into each component. We do this by assigning the share of capital stock to equipment and structures which matches the share of investment in equipment and structures.

Figure A1: Change in Industry/Country Exports and Sales before and after the Great Recession



Notes: Each bar plots the yearly percentage change in real manufacturing exports. The countries included in the sample are France, Germany, Greece, Italy, Japan, Poland, Portugal, Sweden, UK and US.

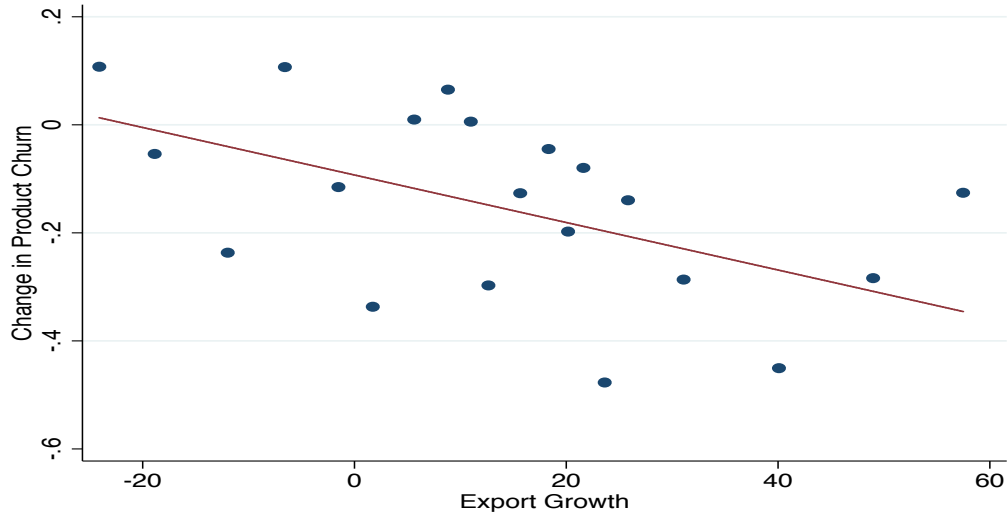
Figure A2: Average Decentralization Z-score by Quintile of Product Churn



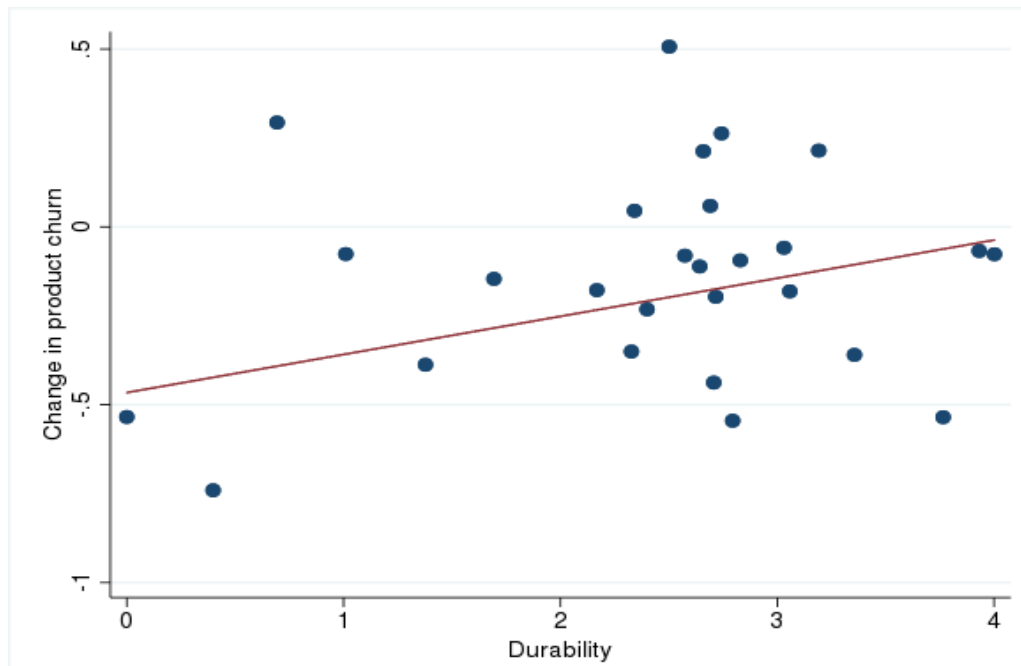
Notes: MOPS data. Industry product churn is the average of plant product churn. Plant product churn = $(\# \text{ products added from '02 to '07} + \# \text{ products dropped from '02 and '07}) / (0.5 * \# \text{ products produced in '02} + 0.5 * \# \text{ products produced in '07})$.

Figure A3: Change in Industry Product Churn and Economic Shocks

Panel A - Export Growth



Panel B - Product Durability



Notes: MOPS data. Change in product churn is industry product churn in 2012 minus industry product churn in 2007. "Export Growth" is the change in $\ln(\text{exports})$ from 2007 to 2012. "Durability" is the average durability of the goods produced in the industry (in years), drawn from Ramey and Nekarda (2013). All variables are winzORIZED at the 5th and 95th percentiles and measured at the level of the three-digit industry. Ventiles plotted.

Table A1: Decentralization questions

For Questions D1, D3, and D4 any score can be given, but the scoring guide is only provided for scores of 1, 3, and 5.	
Question D1: “To hire a FULL-TIME PERMANENT SHOPFLOOR worker what agreement would your plant need from CHQ (Central Head Quarters)?”	
Probe until you can accurately score the question—for example if they say “It is my decision, but I need sign-off from corporate HQ,” ask “How often would sign-off be given?”	Score 5
Scoring grid: No authority—even for replacement hires	Score 3
Requires sign-off from CHQ based on the business case. Typically agreed (i.e. about 80% or 90% of the time). Complete authority—it is my decision entirely	Score 1
Question D2: “What is the largest CAPITAL INVESTMENT your plant could make without prior authorization from CHQ?”	
Notes: (a) Ignore form-filling	
(b) Please cross check any zero response by asking “What about buying a new computer—would that be possible?” and then probe....	
(c) Challenge any very large numbers (e.g. >\$/Am in US) by asking “To confirm your plant could spend \$X on a new piece of equipment without prior clearance from CHQ?”	
(d) Use the national currency and do not omit zeros (i.e. for a U.S. firm twenty thousand dollars would be 20000).	
Question D3: “Where are decisions taken on new product introductions—at the plant, at the CHQ or both?”	
Probe until you can accurately score the question—for example if they say “It is complex, we both play a role,” ask “Could you talk me through the process for a recent product innovation?”	Score 5
Scoring grid: All new product introduction decisions are taken at the CHQ	Score 3
All new product introduction decisions are jointly determined by the plant and CHQ	Score 1
All new product introduction decisions taken at the plant level	
Question D4: “How much of sales and marketing is carried out at the plant level (rather than at the CHQ)?”	
Probe until you can accurately score the question. Also take an average score for sales and marketing if they are taken at different levels.	Score 5
Scoring grid: None—sales and marketing is all run by CHQ	Score 3
Sales and marketing decisions are split between the plant and CHQ	Score 1
The plant runs all sales and marketing	
Question D5: “Is the CHQ on the site being interviewed?”	
Notes: The electronic survey, training materials and survey video footage are available on www.worldmanagementsurvey.com	

Table A2: MOPS Sampling

Sample	Source	Sample Criteria	Number of establishments (in thousands)	Total employment (in thousands)	Average employment
(1) Universe of establishments	LBD	None	7,041	134,637	19.1
(2) Manufacturing	LBD	NAICS 31-33	298	12,027	40.4
(3) Annual Survey of Manufactures	ASM	NAICS 31-33, and either over 500 employees, or in ASM random sample. Positive employment and sales, and tabbed	51	7,387	143.5
(4) MOPS respondents	MOPS	As in (3), also responded to MOPS	36	5,629	155.8
(5) ORG module respondents	MOPS	As in (4), and responded to any of MOPS questions 18-23	20	3,580	178.4
(6) Regression sample	MOPS	As in (5), responded to all ORG "recall" questions, match to ASM 2006 and ASM 2009, positive value added and imputed capital in ASM 2010	9	2,135	243.3

Table A3: Decentralization, sales growth, and product churn in various subsamples

Dependent Variable: Sales growth ('07-12)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Baseline	Differentiated Products	Undifferentiated Products	Immature Industry	Mature Industry	Small Establishments	Large Establishments
Decentralization	1.524** (0.681)	2.464*** (0.711)	0.1530 (1.24)	1.6670 (1.003)	1.3880 (1.175)	2.355*** (1.009)	0.7670 (0.724)
Decent.*Product Churn	4.722*** (1.43)	5.582*** (1.755)	2.4280 (2.477)	6.176*** (1.874)	2.1520 (2.786)	6.150*** (1.81)	4.092*** (1.692)
Observations	8,200	4,500	3,700	4,300	4,000	4,100	4,100
Cluster	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3

Notes: MOPS data. *significant at 10%; ** 5%; *** 1%. Estimated by OLS with standard errors clustered at three-digit industry level. The dependent variable is the annualized five-year change of firm $\ln(\text{sales})$ 2012-07. Decentralization measured in 2005. "Product Churn" is the three digit industry of value of the average change in the (number of products added between t and $t-5$ plus the number products dropped between t and $t-5$)/(average number of products between t and $t-5$). All columns include three digit industry dummies, firm and plant size, skills and "noise controls" (plant manager's tenure and hierarchical seniority and the interview's reliability score, day of the week and duration, and whether the survey was answered online or by mail). Column (1) includes the baseline product churn sample. Columns (2) and (3) split this sample according to whether an establishment is in an industry which sells differentiated goods or not, according to Rauch's classification of differentiated and homogeneous goods (Rauch 1999). Column (4) includes establishments in "immature" industries, defined as industries which there are an above average share of firms which were born in the past 5 years, i.e. 2000 through 2005. Column (5) includes establishments in "mature" industries which had a below average share of firms born in the past 5 years. Column (6) includes the smallest 50% of establishments in the sample and Column (7) includes the largest 50% of establishments in the sample.

Table A4: Decentralization, Agency Costs and Financial Constraints

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable = Sales Growth							
Decentralization	0.2651 (0.4770)	0.3506 (0.76)	1.3797 (2.3903)	0.1752 (0.401)	0.0764 (1.2689)	0.349** (0.1585)	0.2570 (0.4831)
EXPORT Growth	-3.1877 (3.1895)		-3.1550 (3.2298)		-2.8774 (3.2005)		-3.2104 (3.1932)
Decent*EXPORT Growth	-0.0392 (0.0241)		-0.0407* (0.0244)		-0.0394 (0.0241)		-0.0392 (0.0240)
ABX exposure		-0.4003* (0.2374)	-0.9120 (0.8330)				
Decent.*ABX exposure		-0.0031 (0.2042)	-0.2883 (0.6164)				
Lehman exposure				x	x		
Decent.*Lehman exposure				x	x		
Lender health				x	x		
Decent*Lender health				x	x		
Observations	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Controls							
Firm & plant employment, skills	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Lender	Lender	Lender	Lender	Lender	Lender	Lender

Notes: *significant at 10%; ** 5%; *** 1% level. Estimated by OLS with standard errors clustered by the firm's primary lender. The dependent variable is the annualized three-year change of firm ln(sales) from 2009-06. Decentralization is measured in 2005. "EXPORT Growth" is average change (2008/2009 average compared to 2006/2007 average) in ln(exports) at the product level (HS7) for the products the plant produced just prior to the Great Recession in 2006. "Lehman exposure" is the fraction of the firm's lender's syndicated loan portfolio where Lehman Brothers had a lead role in the loan deal. "ABX exposure" is the correlation of the firm's lender's daily stock returns with the return on the ABX AAA 2006-H1 index, which follows the price mortgage-backed securities issued with a AAA rating. "Lender health" is an aggregation of lender balance sheet variables including trading account losses, real estate charge-offs, and the deposits to liabilities ratio. We combine these variables into one lender health measure by normalizing each to have mean 0 and standard deviation 1, taking an average, and then normalizing this average to have mean 0 and standard deviation 1. All columns include "noise controls" (plant manager's tenure and hierarchical seniority and the interview's reliability score, day of the week and duration, whether the survey was answered online or by mail). Firm and plant size are ln(employment) are skills is the ln(percentage of employees with a college degree).

Table A5: Robustness of results to interactions of export growth with other firm-level variables in WMS data

Dependent Variable: Sales Growth	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Decentralization	0.041 (0.417)	0.026 (0.416)	-0.098 (0.423)	0.050 (0.440)	0.046 (0.431)	-0.241 (0.451)	0.044 (0.417)	-0.078 (0.424)	8.306 (10.153)
Decentralization*EXPORT Growth	-0.047** (0.018)	-0.046** (0.018)	-0.054*** (0.018)	-0.043** (0.019)	-0.043** (0.018)	-0.049** (0.020)	-0.047** (0.018)	-0.049** (0.019)	-0.044* (0.022)
Log(% employees with a college degree)	0.470 (0.330)	0.506 (0.333)	0.439 (0.329)	0.312 (0.346)	0.419 (0.336)	0.486 (0.356)	0.483 (0.334)	0.423 (0.340)	0.127 (0.401)
Log(% employees with a college degree)*EXPORT Growth		0.023 (0.038)							-0.084 (0.435)
Management			0.977 (0.664)						1.025 (0.695)
Management*EXPORT Growth			0.042* (0.025)						0.528 (0.617)
Profit Margin (pre recession)				7.643 (4.833)					6.684 (5.414)
Profit Margin (pre recession)*EXPORT Growth				0.117 (0.208)					-0.020 (4.903)
Workers' decentralization					-0.038 (1.015)				1.022 (1.135)
Workers' decentralization*EXPORT Growth					-0.074* (0.040)				-0.047 (0.890)
Foreign Plant Manager						0.478 (2.293)			3.215 (2.049)
Foreign Plant Manager*EXPORT Growth						0.182*** (0.069)			-4.668* (2.786)
Male Plant Manager							-0.392 (1.662)		1.569 (1.599)
Male Plant Manager*EXPORT Growth							0.046 (0.052)		0.051 (1.557)
Plant Manager Age								-3.687 (2.966)	-2.278 (3.417)
Plant Manager Age*Export Growth								-0.104 (0.093)	-2.601 (2.577)
Observations	3151	3151	3151	2905	3097	2784	3151	3125	2523
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm & plant employment, skills	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry by country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty

Notes: WMS Data. *significant at 10%; ** 5%; *** 1% level. Estimated by OLS with standard errors clustered at three-digit industry by country level in all columns. Specifications are the same as Table 2 column (3) except augmented with additional variables from the WMS (linear and interacted with export growth). Management is the z-scored average of 18 z-scored management questions (see Bloom and Van Reenen 2007 for details). "Log(percentage of employees with a college degree)" is the natural logarithm of the percent of employees with a bachelors degree. Profit margin is the pre-recession level of profit over sales. Worker decentralization is the z-scored average of 2 questions on worker autonomy. Foreign/Male plant manager=1 if plant manager is from a foreign country or male, respectively. Baseline controls are year dummies and "noise controls" (plant manager's tenure and hierarchical seniority and the interview's reliability score, day of the week and duration, and analyst dummies. Firm and plant employment are measured as log(employment), and skills are measured as ln(% of employees with a college degree).

Table A6: Robustness of results to interactions of export growth with other firm-level variables in MOPS data

Dependent Variable: Sales Growth	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Decentralization	0.583** (0.23)	0.573** (0.228)	0.524** (0.227)	0.566** (0.229)	0.587** (0.23)	0.565** (0.23)	0.597* (0.309)	0.531* (0.298)
Decentralization*EXPORT Growth	-0.023** (0.009)	-0.023** (0.009)	-0.024** (0.009)	-0.023** (0.009)	-0.023** (0.009)	-0.023** (0.009)	-0.023** (0.01)	-0.023** (0.01)
Management		-0.242 (0.229)					-0.128 (0.252)	
Management*EXPORT Growth		0.007 (0.006)					0.006 (0.008)	
Profit margin (pre-recession)			-7.458** (1.153)				-7.47** (1.15)	
Profit margin (pre-recession)*EXPORT Growth			-0.051 (0.048)				-0.05 (0.047)	
Data-Driven Decision-Making				-0.345 (0.206)			-0.31 (0.221)	
Data-Driven Decision-Making*EXPORT Growth				0.332 (0.64)			0.039 (0.894)	
Log(% employees with a college degree)*EXPORT Growth					0.101 (0.117)		0.097 (0.119)	
Union						-1.237** (0.667)	-1.358** (0.685)	
Union*EXPORT Growth						0.001 (0.026)	0.006 (0.025)	
Firm Decentralization							-0.019 (0.461)	
Firm Decentralization*EXPORT Growth							0.001 (0.015)	
Firms	3,150	3,150	3,150	3,150	3,150	3,150	3,150	3,150
Observations	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm & plant employment, skills	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3

Notes: MOPS Data. *significant at 10%; ** 5%; *** 1% level. Estimated by OLS with standard errors clustered at three-digit industry level in all columns. Specifications are the same as Table 2 column (5) except augmented with additional variables from the MOPS (linear and interacted with export growth). Management is the z-scored average of 18 z-scored management questions (see Bloom et al. 2013 for details). Profit margin is the pre-recession level of profit over sales. "Data-Driven Decision-Making" is the z-scored average of 2 questions on the use and availability of data in decision-making. "Log(percentage of employees with a college degree)" is the natural logarithm of the percent of employees with a bachelors degree. "Union" is the percentage of employees that are members of a labor union. "Data-Driven Decision-Making*EXPORT Growth" is equal to 100 times "Data-Driven Decision-Making" times export growth. Baseline controls are year dummies and "noise controls" (plant manager's tenure and hierarchical seniority and the interview's reliability score, day of the week and duration, whether the survey was answered online or by mail). Firm and plant employment are measured as log(employment), and skills are measured as ln(% of employees with a college degree).

Table A7: Is Decentralization Proxying for Coordination? WMS Data

Dependent Variable: Sales Growth	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Decentralization	0.041 (0.417)	0.050 (0.418)	0.062 (0.417)	0.115 (0.422)	0.046 (0.413)	0.117 (0.415)	0.127 (0.413)	-0.013 (0.448)	0.361 (0.983)	-1.646 (3.515)
Decentralization*EXPORT Growth	-0.047** (0.018)	-0.047** (0.018)	-0.045** (0.018)	-0.046** (0.018)	-0.047** (0.018)	-0.052*** (0.019)	-0.050*** (0.018)	-0.046** (0.019)	-0.094** (0.047)	-0.049** (0.024)
Ln(employees)*EXPORT Growth		-0.940 (0.816)								0.055 (0.532)
Ln(plant employees)			-0.228 (0.513)							-0.326 (0.562)
Ln(plant employees)*EXPORT Growth			0.008 (0.021)							0.641 (0.594)
No. of production sites				-0.003 (0.027)						-0.023 (0.031)
No. of production sites*EXPORT Growth				0.003 (0.002)						-0.024 (0.040)
Diversification					1.302 (0.898)					2.196** (0.973)
Diversification*EXPORT Growth					0.027 (0.055)					-0.698 (0.754)
Multinational						-2.478* (1.384)				-0.710 (1.078)
Multinational*EXPORT Growth						1.691 (1.730)				0.165 (1.025)
Foreign Multinational dummy							-1.820** (0.833)			-1.929** (1.061)
Foreign Multinational*EXPORT Growth							0.016 (0.039)			0.024 (0.900)
Ln(share outsourced production)								-0.090 (0.281)		0.034 (0.292)
Ln(share outsourced production)*EXPORT Growth								0.001 (0.012)		-0.260 (0.275)
Materials Share									-6.991 (7.065)	1.544 (5.192)
Materials Share*EXPORT Growth									0.817** (0.357)	-2.681 (4.938)
Observations	3,151	3,151	3,105	3,127	3,151	3,151	3,151	3,029	1,201	2,968
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm & plant employment, skills	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry by country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty

Notes: *significant at 10%; ** 5%; *** 1% level. Specifications are the same as Table 2 column (3) except augmented with additional variables (linear and interacted with export growth). Multinational = 1 if the plant belongs to a foreign or domestic multinational. Diversified = 1 if the firm has multiple primary SIC4 codes. Share of outsourced production is a question in the WMS survey. Materials share is the fraction of sales that are intermediate goods inputs (from ORBIS). Baseline controls are year dummies and "noise controls" (plant manager's tenure and hierarchical seniority and the interview's reliability score, day of the week and duration, and analyst dummies. Firm and plant employment are measured as log(employment), and skills are measured as ln(% of employees with a college degree).

Table A8: Is Decentralization Proxying for Coordination? MOPS Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable: Sales Growth										
Decentralization	0.583** (0.23)	0.611*** (0.228)	0.583** (0.23)	-0.885 (0.798)	0.115 (0.329)	0.376 (0.267)	0.636** (0.281)	0.345 (0.267)	0.856*** (0.266)	-1.539 (1.519)
Decentralization*EXPORT Growth	-0.023** (0.009)	-0.0232** (0.009)	-0.023** (0.009)	-0.022** (0.009)	-0.024** (0.009)	-0.023** (0.009)	-0.023** (0.009)	-0.022** (0.009)	-0.023** (0.009)	-0.023** (0.008)
Multiproduct		-1.060** (0.495)								-1.047** (0.489)
Multiproduct*EXPORT Growth		0.0164 (0.0185)								0.016 (0.019)
Ln(plant employment)*EXPORT Growth			0.003 (0.006)							0.002 (0.006)
Ln(firm employment)*EXPORT Growth			0.075 (0.22)							-0.086 (0.243)
Ln(firm employment)*Decentralization				0.198* (0.118)						0.315 (0.252)
Ln(No. of plants)					-0.557* (0.327)					-2.069** (0.818)
Ln(No. of plants)*Decentralization					0.196 (0.139)					0.0648 (0.415)
Ln(No. of states w/ plants)						-0.022 (0.030)				0.114 (0.073)
Ln(No. of states w/ plants)*Decentralization						0.020 (0.016)				-0.048 (0.050)
Plant is in same state as largest plant							1.013* (0.554)			1.339** (0.568)
Same state as largest plant*Decentralization							-0.148 (0.349)			0.373 (0.423)
Ln(No. of manufacturing industries)								-0.047 (0.029)		-0.063 (0.043)
Ln(No. of manufacturing industries)*Decentralization								0.362* (0.020)		0.033 (0.035)
Plant is in same industry as largest plant									0.762 (0.512)	0.533 (0.575)
Same industry as largest plant*Decentralization									-0.498 (0.374)	-0.38 (0.512)
Observations	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm & plant employment, skills	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3

Notes: **significant at 10%; * 5%; *** 1% level. Specification are the same as Table 2 column (5). "Multiproduct" equals 1 if a plant produced at least two products (7-digit NAICS) in 2009 and 0 otherwise. "Ln(No. of manufacturing industries)" is the log of the number of unique primary industry codes (6-Digit NAICS) assigned to the firm's manufacturing establishments in 2009. "Plant is in same state as largest plant" equals 1 if plant is in the same U.S. state as the firm's largest plant by employment in 2009, and 0 otherwise. "Plant is in same industry as largest plant" is defined similarly with an industry defined as 6-digit NAICS code. "Ln(firm employment)*EXPORT Growth" is equal to 100 times the natural log of firm employment times export growth. Baseline controls are year dummies and "noise controls" (plant manager's tenure and hierarchical seniority and the interview's reliability score, day of the week and duration, whether the survey was answered online or by mail). Firm and plant employment are measured as log(employment), and skills are measured as ln(% of employees with a college degree).

Table A9: Differences Across Decentralization Questions

	(1)	(2)	(3)	(4)	(5)	(6)
	World Management Survey (WMS)			U.S. Census Data (MOPS)		
Dependent Variable: Sales Growth						
Decentralization	0.041 (0.417)			0.583** (0.230)		
Decentralization *EXPORT Growth	-0.047** (0.018)			-0.023** (0.009)		
Decentralization - Hiring & Investment		0.063 (0.396)			0.808** (0.236)	
Decentralization - Hiring & Investment *EXPORT Growth		-0.002 (0.019)			-0.013 (0.008)	
Decentralization - Sales & New Products			-0.135 (0.379)			0.171 (0.218)
Decentralization - Sales & New Products *EXPORT Growth			-0.060** (0.017)			-0.025** (0.010)
Firms	1,330	1,330	1,330	3,150	3,150	3,150
Observations	3,151	3,151	3,151	8,800	8,800	8,800
Cluster	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3	SIC3	SIC3

Notes: *significant at 10%; ** 5%; *** 1% level. Estimated by OLS with standard errors clustered at three-digit industry by country level. The dependent variable is the annualized three-year change of firm ln(sales). 2011-08, 2010-07 and 2009-06 are pooled in WMS (columns (1)-(3)) and just 2009-2006 in MOPS (columns (4) to (6)). Decentralization measured in 2006 for WMS and 2005 for MOPS. "EXPORT Growth" is change in ln(exports) in country by three digit industry cell between the 2008 and 2009 average (the main Great Recession years) compared to the 2006 and 2007 average (the latest pre-Recession years) in columns (1)-(3), and is the average change (2008/2009 average compared to 2006/2007) in ln(exports) at the product level (HS7) for the products the plant produced just prior to the Great Recession in 2006 in columns (4)-(6). All columns include three digit industry, country and year dummies and "noise controls" (plant manager's tenure and hierarchical seniority and the interview's reliability score, day of the week and duration, WMS also includes analyst dummies and MOPS whether the survey was answered online or by mail). Firm and plant size are ln(employment) are skills is the ln(% of employees with a college degree). "Decentralization - Hiring & Investment" is the z-scored average of the z-scored measures of plant manager autonomy in hiring and capital investments (and also pay increases in the MOPS data). "Decentralization - Sales & New Products" is average for product introduction and marketing.

Table A10: Robustness of results to interactions of Decentralization with other industry-level variables

Dependent Variable	(1)	(2)	(3)	(4)
		Sales Growth		
Decentralization	-0.920 (1.788)	0.222 (2.482)	0.386 (0.603)	-0.030 (1.485)
Decentralization*EXPORT Growth	-0.050*** (0.019)	-0.047** (0.020)	-0.052*** (0.019)	-0.046** (0.019)
Decentralization*Asset tangibility	3.404 (6.019)			
Decentralization*Inventory/Sales		-1.107 (15.510)		
Decentralization*External finance dependency			-1.185 (1.604)	
Decentralization*Labor costs				0.381 (7.916)
Firms	1,330	1,330	1,330	1,330
Observations	3,151	3,151	3,151	3,151
Cluster	SIC3* Cty	SIC3* Cty	SIC3* Cty	SIC3* Cty

Notes: WMS Data. *significant at 10%; ** 5%; *** 1% level. Estimated by OLS with standard errors clustered at three-digit industry by country level in all columns. Specifications are the same as Table 2 column (3) except augmented with additional variables. "Asset Tangibility" is the ratio of tangible assets, i.e. net property, plant and equipment, to total assets for the corresponding industry in the US over the period 1980-1989, computed at the ISIC 3 rev 1 level (inverse measure of credit constraints). "Inventory/Sales" is measured as the inventories to total sales for the corresponding industry in the US over the period 1980-1989 (measure of liquidity dependence). "External finance dependency" is measured as capital expenditures minus cash flow divided by cash flow for the corresponding industry in the US over the period 1980-1989 (measure of credit constraint). "Labor costs" is measured as the total labor costs to total sales for the corresponding industry in the US over the period 1980-1989 (another measure of liquidity dependence).

Table A11: Decentralization and Product Churn

	(1)	(2)	(3)	(4)	(5)	(6)
	<u>U.S. Census Data - MOPS</u>					
Dependent Variable: Decentralization z-score						
Decentralization Questions	All					
Product Churn	0.016*** (0.004)	0.016*** (0.004)	0.004 (0.004)	0.008** (0.004)	0.020*** (0.004)	0.017*** (0.004)
Management		-0.010*** (0.004)		0.005 (0.004)		-0.019*** (0.004)
Log(% employees with a college degree)		0.057*** (0.004)		0.044*** (0.004)		0.049*** (0.004)
Log(plant employment)		0.035*** (0.004)		0.056*** (0.004)		0.006* (0.004)
log(firm employment)		-0.012*** (0.002)		-0.002 (0.002)		-0.016*** (0.002)
Observations	8,800	8,800	8,800	8,800	8,800	8,800
Controls						
Industry (SIC3)		Yes	Yes	Yes	Yes	Yes
Noise		Yes	Yes	Yes	Yes	Yes
Cluster	SIC3	SIC3	SIC3	SIC3	SIC3	SIC3

Notes: MOPS Data. *significant at 10%; ** 5%; *** 1% level. Estimated by OLS with standard errors clustered at three-digit industry level. The dependent variable in columns (1) and (2) is overall decentralization z-score. The dependent variable in columns (3) and (4) is the z-scored average of the z-scored measures of plant manager autonomy in hiring, capital investments, and pay raises. The dependent variable in columns (5) and (6) is the z-scored average for product introduction and marketing questions. "Product Churn" is the three digit industry level value of the average change in the (number of products added between t and t-5 plus the number products dropped between t and t-5)/(average number of products between t and t-5).

Table A12: Decentralization and Product Churn, by type of Decentralization
Panel A: Decentralization of Sales, Marketing, and New Products

Dependent Variable: Sales growth ('12-'07)	
Decentralization	0.171 (0.218)
Decent*Change in Product Churn	0.191 (0.1518) 1.859*** (0.370)
Decent*Export Growth ('12-'07)	-0.025** (0.010)
Decent*Durability	0.304* (0.1622) 1.587** (0.396) -0.011 (0.008)
Firms	3,004
Observations	8,243

Panel A: Decentralization of Hiring & Investment	
Dependent Variable: Sales growth ('12-'07)	
Decentralization	0.692*** (0.157)
Decent*Change in Product Churn	0.604* (0.330)
Decent*Export Growth ('12-'07)	-0.013 (0.008)
Decent*Durability	0.743*** (0.166) 0.541 (0.351) -0.004 (0.008)
Firms	3,004
Observations	8,243
Cluster	SIC3
	SIC3
	SIC3

Notes: *significant at 10%; ** 5%; *** 1% level. Estimated by OLS with standard errors clustered at three-digit industry level. The dependent variable is the annualized five-year change of firm $\ln(\text{sales})$, 2012-2007. The dependent variable in Panel A is the z-scored average of the z-scored measures of plant manager autonomy in hiring, capital investments, and pay raises. The dependent variable in Panel B is the z-scored average for product introduction and marketing questions. The variable "Change in Product Churn" is measured by subtracting 2007-2002 industry product churn from 2012-2007 industry product churn. "EXPORT Growth" is 2012-2007 change in $\ln(\text{exports})$ at the product level (HS7) for the products the plant produced just prior to the Great Recession in 2006. All columns include three digit industry dummies and controls for firm and plant size, skills and "noise" (plant manager's tenure and hierarchical seniority and the interview's reliability score, day of the week and duration, whether the survey was answered online or by mail).

Table A13: Decentralization and Sales Growth, by Export Status

	(1)	(2)
	<u>U.S. Census Data (MOPS)</u>	
Dependent Variable = Sales Growth		
Sample	Exporters	Non-exporters
Decentralization	0.4452 (0.2769)	0.5524* (0.3245)
Decent.*EXPORT Growth	-0.0358*** (0.0115)	-0.0105 (0.0117)
Observations	4200	4600
Cluster	SIC3* Cty	SIC3* Cty

Notes: *significant at 10%; ** 5%; *** 1% level. Estimated by OLS with standard errors clustered at three-digit industry. Sales growth is the annualized three-year change of firm ln(sales). "EXPORT Growth" is the average change (2008/2009 average compared to 2006/2007) in ln(exports) at the product level (HS7) for the products the plant produced just prior to the Great Recession in 2006. All columns include three digit industry dummies and controls for firm and plant size, skills and "noise" controls.

Table A14: Changes in Decentralization

	(1)	(2)
	<u>World Management Survey</u>	<u>U.S. Census Data</u>
Dependent Variable	Change in Decentralization (2010/2009 - 2006)	Change in Decentralization (2010-2005)
EXPORT Growth	-0.011* (0.006)	-0.0232 (0.0204)
Observations	222	8,800
Controls		
Country	Yes	
Year	Yes	
Industry (SIC2)	Yes	Yes
Log firm and plant employment	Yes	Yes
Skills	Yes	Yes
Noise	Yes	Yes
Cluster	SIC3* Cty	SIC3

Notes: *significant at 10%; ** 5%; *** 1% level. Estimated by OLS with standard errors clustered at three-digit industry by country level in column (1) and just industry in column (2). The dependent variable is the 2010/2009-2006 change in z-scored decentralization in column (1) and the 2010-2005 change in column (2). "EXPORT Growth" is change in ln(exports) in country by three digit industry cell between the 2008 and 2009 average (the main Great Recession years) compared to the 2006 and 2007 average (the latest pre-Recession years) in column (1), and is the average change (2008/2009 average compared to 2006/2007) in ln(exports) at the product level (HS7) for the products the plant produced just prior to the Great Recession in 2006 in column (2). All columns include two digit industry, country and year dummies and "noise controls" (plant manager's tenure and hierarchical seniority and the interview's reliability score, day of the week and duration, WMS also includes analyst dummies and MOPS whether the survey was answered online or by mail). Firm and plant size are ln(employment) are skills is the ln(percentage of employees with a college degree).

Table A15: Is Decentralization correlated with within-firm dispersion of plant input decisions and plant output? MOPS data

	(1)	(2)	(3)
Dependent Variable is standard deviation of:	Employment Growth ('12-'07)	Product Additions ('12-'07)	Sales Growth ('12-'07)
Decentralization	0.012** (0.005)	0.024*** (0.007)	0.0164** (0.007)
Constant	0.452*** (0.007)	0.333*** (0.011)	0.560*** (0.009)
Observations	8,800	8,200	8,800

Notes: *significant at 10%; ** 5%; *** 1%. Estimated by OLS with standard errors clustered at the firm level. In column (1) the dependent variable is the parent firm's coefficient of variation of establishment sales growth - the annualized five-year change of establishment ln(sales) - across all the firm's establishments. In column (2) the dependent variable is the parent firm's coefficient of variation of establishment product additions, and in column (3) the dependent variable is the parent firm's coefficient of variation of establishment sales growth. The independent variable in all columns is establishment decentralization.

Table A16: Decentralization and Cross-Country Growth

	(1)	(2)	(3)	(4)	(5)	(6)
Decentralization Index	Implied GDP Growth	Difference in implied GDP growth relative to US	Actual annual average GDP growth (2012-2008)	Difference in actual GDP growth relative to US	% of growth difference accounted for by Decentralization	
France	-0.357	-0.72	-0.453	0.24	-0.473	96%
GB	0.292	-0.28	-0.007	0.074	-0.64	1%
Germany	0.134	-0.39	-0.116	0.443	-0.271	43%
Greece	-0.801	-1.03	-0.758	-5.438	-6.152	12%
Italy	-0.242	-0.64	-0.374	-1.243	-1.957	19%
Japan	-0.642	-0.92	-0.648	0.029	-0.685	95%
Poland	-0.344	-0.71	-0.444	2.534	1.82	-24%
Portugal	-0.264	-0.66	-0.389	-1.42	-2.134	18%
Sweden	0.544	-0.1	0.166	0.567	-0.147	-113%
US	0.303	-0.27		0.714		
Average	1	-0.572	-0.336	-0.35	-1.182	15%

Notes: All GDP growth numbers in percentage points. Implied GDP growth in column (2) uses the coefficients on the model of column (2) Table 2 combined with the value of decentralization from (1) and an assumed shock of 7.7 percent (the empirical fall in aggregate US exports in the Great Recession as in our model). Actual GDP growth in column (4) is taken from the World Bank market sector GDP series. Relative values in column (3) and (5) are the simple differences from the US base. Sweden has a negative value in column (6) because it is the only country more decentralized than US, but had a weaker GDP performance. Poland has a negative value because it had faster growth than the US despite being more centralized (it is still in a catch up phase of growth).