

Top Inequality, Firms and
the Global Division of Labor:
Evidence from the Executive Labor Market

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Global Sourcing and Inequality in Industrialized Economies

- international fragmentation of production across national borders
 - driven by various technological and institutional developments in the world economy
 - more knowledge- and headquarter-intensive tasks continue to be undertaken domestically within industrialized economies
 - *“Designed by Apple in California - Assembled in China”*
- sharp increases in top incomes during past decades
 - rising top 1% income and wealth shares (e.g. Atkinson et al. (2011), Alvaredo et al. (2013), Piketty and Saez (2013))
 - ~ 1/3 of the top 1% in the U.S. income distribution (Bakija et al. (2008))

Does Global Sourcing Affect Top Inequality?

general idea:

- supply of cheaper/better inputs $\uparrow \Rightarrow$ productivity of firms in industrialized economies $\uparrow \Rightarrow$ superstar effects: managers in larger firms economize most \Rightarrow inequality \uparrow (within and across firms)

other aspects:

- What is the impact of global sourcing on equity wealth?
 - managers are partially compensated in stocks or options
- What is the impact of global sourcing on financial incentives?
 - equity has fluctuating market value
- How is the distribution of rents within firms affected?
 - between shareholders and management:
 - managers 'own' part of their employing firms as they are partially compensated in equity
 - between workforce and management:
 - within-firm pay gap

Plan of the Paper

- empirics: build matched manager-firm data for Europe and the U.S. to study the effects of global sourcing on top inequality
 - data allow to consider various aspects of inequality: within- and between-firm income inequality, wealth, financial incentives
 - use world input-output data to measure the extend of global sourcing
 - endogeneity: use variation in international transport margins and the foreign supply of inputs
- theory: develop an open-economy assignment model of executive compensation to rationalize empirical findings

Manager-Firm Panel Data

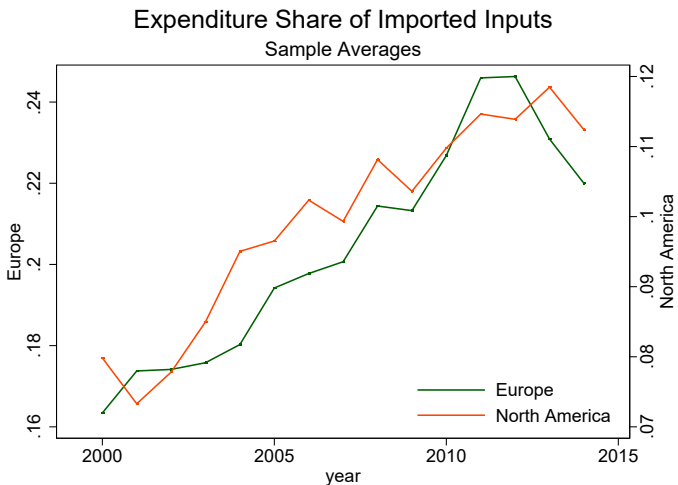
individual manager data are provided by BoardEx

- business intelligence service company
 - established in 1999 and acquired by TheStreet, Inc. in 2014
 - collects details on remuneration and biographical information on business leaders across the world
 - consolidates public domain information
- individuals are linked to their employers via ISINs and company name/ticker/country info
 - firm level data comes from FactSet
 - provides accounting data and information on primary industries
- to quantify an individual manager's exposure to globalization:
 - use data from the WIOD project (World Input Output Database)
 - WIOD tracks the flow of intermediate and final goods and services across countries and industries
 - data cover 43 countries and 56 sectors (based on ISIC Rev. 4)

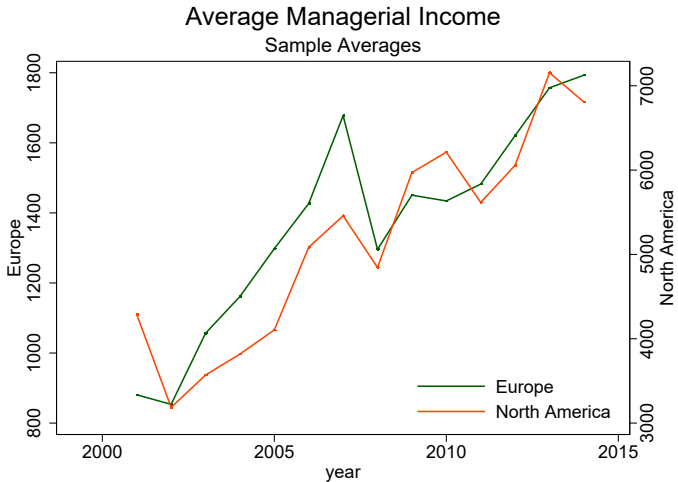
Summary Statistics

Variable	Obs.	Mean	Std. Dev.	25th pct.	Median	75th pct.
manager-year level						
Total Pay (in Thd. USD)	108,943	3,068	5,068	403	1,223	3,400
Equity Pay (in Thd. USD)	79,046	3,179	5,483	343	1,238	3,484
Wealth Delta (in Thd. USD per %)	102,257	219	546	11	48	171
Ownership (in %)	59,174	1.39	6.86	0.01	0.02	0.16
firm-year level						
Total Assets (in Mio. USD)	21,948	15,439	70,502	56	367	2,948
MNE (Dummy)	21,951	0.49	0.50	0	0	1
Leverage (Share)	21,940	0.26	1.67	0.02	0.25	0.47
Enterprise Value (in Mio. USD)	21,697	9374	33153	45	357	3353
country-industry-year level						
Offshoring (% of Input Expenditure)	1,596	26.39	17.11	13.14	22.21	35.85
Output (in Mio. USD)	1,596	72,824	128,723	13,288	31,793	79,405
Imports (in Mio. USD)	1,596	11,869	18,056	1,612	4,387	14,423
Exports (in Mio. USD)	1,596	11,967	22,016	1,414	5,181	13,361

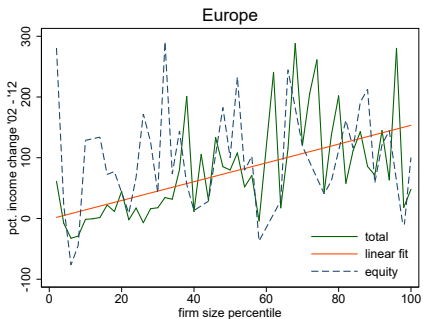
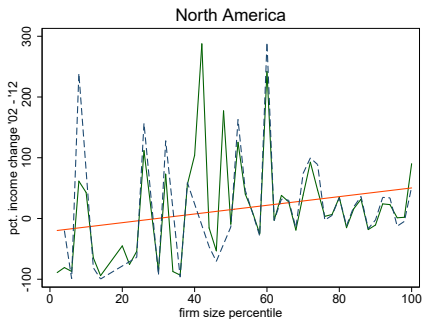
Global Sourcing in North America and Europe



Changing Managerial Income Levels in North America and Europe



Changing Top Inequality Across the Firm Size Distribution



Empirical Specification

Identification:

$$I_{mfict} = \alpha_0 + \alpha_1 \times \text{off}_{cit} \times q_f + \Delta_{mfict} + \mu_{m/f} + \mu_{\bar{c}t} + \varepsilon_{mfict}$$

- m: manager, f: firm, i: industry, c: country, t: year
- I_{mfict} : measures of *income*, *wealth* or *incentives* (in logs)
- off_{cit} : measure of *offshoring* from WIOD:

$$\frac{\text{imported intermediate inputs (\$)}}{\text{total intermediate inputs (\$)}}$$

- inequality across firm size:
 - interaction with firm quantile dummies q_f (time invariant)
- Δ_{mfict} : control variables: manager controls (...), industry controls, firm controls
- $\mu_{m/f}$: firm, individual or match-specific fixed effects
- $\mu_{\bar{c}t}$: region \bar{c} (Europe or North America) - year fixed effects

Endogeneity and IV Strategy

- endogeneity concerns:
 - reversed causality: incomes in industrialized countries affect sourcing decisions
 - omitted variables: unobservable demand-side or supply-side shocks
- potential biases can go in any direction

instrumental variable strategy with 2 IVs:

- international transport margins:
 - WIOD provides trade and transport margins t_{tm} (wedge between fob and cif)
 - ad-valorem
 - calculate input specific transport margins by weighting ad-valorem t_{tm} according to IO table input shares in base year
 - since these are highly correlated with the output transport margins, subtract these

$$TTM_{ict} = \left[\sum_{\hat{i}, \hat{c}} \theta(\hat{i}, \hat{c})_{2000} \times \frac{\text{total } t_{tm}_{\hat{i}\hat{c}t}}{\text{total exports}_{\hat{i}\hat{c}t}} \right] - \frac{\text{total } t_{tm}_{ict}}{\text{total exports}_{ict}}$$

Endogeneity and IV Strategy

- world export supply:
 - follow Hummels et al. (AER, 2014) with Bartik-IV
 - total value of inputs produced in the world (excluding the country under consideration)
 - exported to other countries (again excluding the country under consideration)
 - weighted according to 2000 country-industry input coefficients
 - captures developments of comparative advantages of the input supplying countries

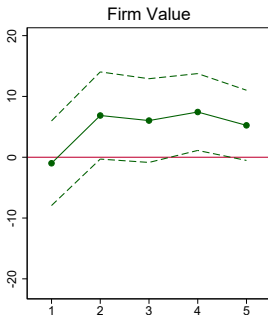
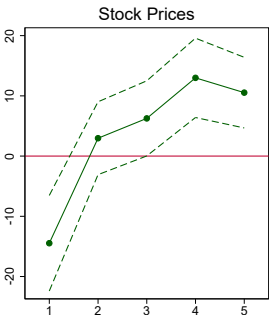
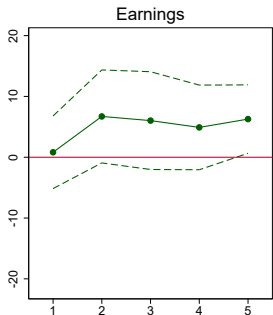
$$WES_{ict} = \ln \left[\sum_{\hat{i}, \hat{c}} \theta(\hat{i}, \hat{c})_{2000} \times \text{total exports excluding those to } c_{\hat{i}\hat{c}t} \right]$$

A First Look: Global Sourcing and Firm-Level Outcomes

How does an industry shock in the global sourcing pattern affect firm outcomes?

- consider a change in the expenditure share on foreign inputs $\frac{\text{imported intermediate inputs (\$)}}{\text{total intermediate inputs (\$)}}$
- instrument these with the trade and transport margin and the world export supply IVs
- firm-level regressions
- consider how offshoring affects ...
 - EBITDA
 - stock prices
 - firm values (\sim end of year market capitalization + value of debt)
- ... for different firm size quintiles

A First Look: Global Sourcing and Firm-Level Outcomes



- use firm outcomes: earnings (EBITDA), stock price, firm value as the dependent variable
- observe heterogeneous responses across firms
 - particularly for stock price movements

Global Sourcing and Annual Income Effects - IV Estimates

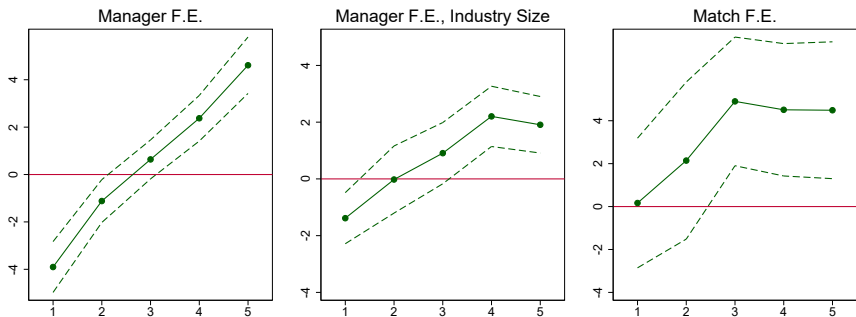
How does an industry shock in the global sourcing pattern affect the incomes of managers across the firm size distribution?

- consider the total (realized) annual income of managers:
 - includes direct compensation (\sim salary and bonus)
 - includes indirect compensation (\sim *granted* stocks and options with uncertain value)
 - value of options is priced by Black Scholes formula

Global Sourcing and Annual Income Effects - IV Estimates

	(1)	(2)	(3)
offsh. $\times q_1$	-3.903***	-1.384***	0.166
offsh. $\times q_2$	-1.119**	-0.0208	2.143
offsh. $\times q_3$	0.638	0.908*	4.902***
offsh. $\times q_4$	2.374***	2.205***	4.510***
offsh. $\times q_5$	4.612***	1.908***	4.489***
CEO	0.546***	0.561***	0.560***
Other Executive	0.150***	0.164***	0.165***
Leverage	0.00318	0.00313	0.00321
MNE Activity	0.0317	0.0267	0.0158
industry output $\times q_i$		yes	
$H_0: q_1 = q_5$ p-Val.	< 0.001	< 0.001	0.034
$H_0: q_2 = q_4$ p-Val.	< 0.001	< 0.001	0.151
Manager F.E.	yes	yes	
Manager-Firm F.E.			yes
Region-Year F.E.	yes	yes	yes
Observations	102274	102274	101368
Firms	3496	3496	3436
Managers	19989	19989	19881
Country-Industry Clusters	289	289	289
1st Stage F-Test	2307.5	2131.7	713.4
Overid. p-Val.	0.255	0.131	0.397

Global Sourcing and Annual Income Effects - IV Estimates



- global sourcing increases income inequality among managers across firms
- although the firms in the sample are relatively large, for some smaller sample firms the managerial income effects are $\sim / < 0$

Global Sourcing and Within-Firm Inequality - IV Estimates

How does an industry shock in the global sourcing pattern affect the distribution of rents between managers and other employees within firms?

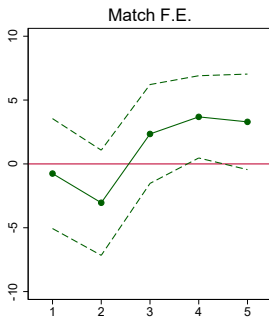
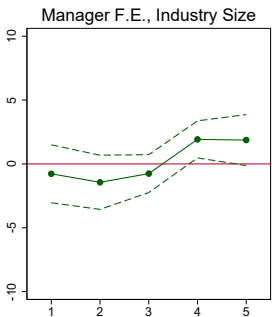
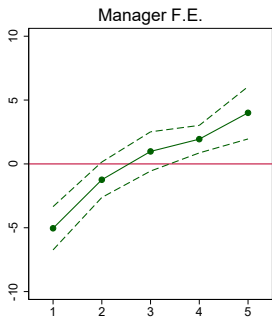
- we have seen that global sourcing increases top inequality across firms
- Is the increase in inequality in managerial incomes similar to that of other employees across firms?
 - consider the wage gap between managers and employees to see if these also became more unequal as well

$$\ln \left[\frac{\text{annual income } (\$)_{mft}}{(\text{total labor expenditures } (\$) / \text{total employment})_{ft}} \right]$$

Global Sourcing and Within-Firm Inequality - IV Estimates

	(1)	(2)	(3)
offsh. $\times q_1$	-5.041***	-0.774	-0.755
offsh. $\times q_2$	-1.240*	-1.440	-3.042
offsh. $\times q_3$	0.978	-0.757	2.345
offsh. $\times q_4$	1.940***	1.923***	3.686**
offsh. $\times q_5$	4.003***	1.869*	3.295*
CEO	0.381***	0.397***	0.419***
Other Executive	0.0585	0.0765	0.125
Leverage	0.00612	0.00572	0.00504
MNE Activity	0.0525**	0.0464*	0.0290
industry output $\times q_i$		yes	
$H_0: q_1 = q_5$ p-Val.	< 0.001	0.081	0.109
$H_0: q_2 = q_4$ p-Val.	< 0.001	< 0.001	< 0.001
Manager F.E.	yes	yes	
Manager-Firm F.E.			yes
Region-Year F.E.	yes	yes	yes
Observations	63420	63420	62826
Firms	2704	2704	2634
Managers	12771	12771	12695
Country-Industry Clusters	265	265	263
1st Stage F-Test	1730.9	1501.8	427.0
Overid. p-Val.	0.601	0.278	0.633

Global Sourcing and Within-Firm Inequality - IV Estimates



- for large parts of the firm distribution in the sample, within-firm income inequality does not increase
- changes in within-firm inequality differ across firm size quintiles
- \Rightarrow some redistribution of rents from workers towards managers but effects on across firm inequality seems to dominate

Global Sourcing and Wealth Effects - IV Estimates

How does an industry shock in the global sourcing pattern affect the equity wealth of managers across the firm size distribution?

- managers own equity in their firm that they have earned during their tenure
 - can be stocks, options or other things like equity-linked retirement plans
- instead of looking at current income effects, this perspective includes previous equity-linked earnings
 - assumption here: managers do not sell their equity-linked income

Global Sourcing and Wealth Effects - IV Estimates

	(1)	(2)	(3)
offsh. $\times q_1$	-4.643***	-1.969*	-6.800**
offsh. $\times q_2$	-1.076	0.477	1.995
offsh. $\times q_3$	2.113***	2.231**	5.272*
offsh. $\times q_4$	5.006***	4.551***	12.19***
offsh. $\times q_5$	7.407***	4.805***	17.75***
CEO	0.580***	0.596***	0.557***
Other Executive	0.241***	0.257***	0.257***
Leverage	-0.00655	-0.00690	-0.00351
MNE Activity	0.00854	0.00326	0.0377
industry output $\times q_i$		yes	
$H_0: q_1 = q_5$ p-Val.	< 0.001	< 0.001	< 0.001
$H_0: q_2 = q_4$ p-Val.	< 0.001	< 0.001	0.002
Manager F.E.	yes	yes	
Manager-Firm F.E.			yes
Region-Year F.E.	yes	yes	yes
Observations	100084	100084	99288
Firms	3455	3455	3405
Managers	19404	19404	19320
Country-Industry Clusters	279	279	278
1st Stage F-Test	2317.9	2157.1	708.9
Overid. p-Val.	0.0497	0.0851	0.189

Global Sourcing and Wealth Effects - IV Estimates



- global sourcing has strong effects on wealth inequality across firms
- effects are quantitatively larger than income effects

Global Sourcing and Incentives - IV Estimates

How does an industry shock in the global sourcing pattern affect the incentives of managers across the firm size distribution?

- consider the delta of equity wealth:
 - By how many dollars thd. USD does wealth increase when the stock price increases by 1%?
 - in logs

Global Sourcing and Incentives - IV Estimates

	(1)	(2)	(3)
offsh. $\times q_1$	-4.054***	-1.924*	-6.478**
offsh. $\times q_2$	-1.061	0.811	0.835
offsh. $\times q_3$	1.919***	2.074**	2.816
offsh. $\times q_4$	4.246***	4.149***	10.20***
offsh. $\times q_5$	6.441***	3.935***	14.86***
CEO	0.548***	0.564***	0.551***
Other Executive	0.247***	0.264***	0.269***
Leverage	-0.0114	-0.0117	-0.00908
MNE Activity	0.00989	0.00543	0.0346
industry output $\times q_i$		yes	
$H_0: q_1 = q_5$ p-Val.	< 0.001	< 0.001	< 0.001
$H_0: q_2 = q_4$ p-Val.	< 0.001	< 0.001	0.001
Manager F.E.	yes	yes	
Manager-Firm F.E.			yes
Region-Year F.E.	yes	yes	yes
Observations	94450	94450	93688
Firms	3388	3388	3340
Managers	18426	18426	18341
Country-Industry Clusters	275	275	275
1st Stage F-Test	2135.7	1991.8	663.9
Overid. p-Val.	0.102	0.151	0.162

Towards a Theory of Executive Pay and Global Sourcing

- aim: develop a model to rationalize the empirical findings
- CEO pay literature: incentive contracts in assignment models with an exogenous mass of firms facing exogenous demand
 - models describe the cross-section of CEO contracts across firms
 - do not allow comparative statics that 'shock the economy' as firms/consumer demand is exogenous
- offshoring literature: labor market effects of global sourcing in general or industry equilibrium models
 - models describe effects of global sourcing on income inequality
 - but: empirically, equity wealth matters a lot
- model should combine both:
 - study comparative statics of global sourcing on incentive contracts across firms

Building Blocks of the Theory

- consider tractable incentive contracts to endogenize pay-(wealth-)performance elasticities
 - borrows from Edmans et al. (RFS, 2009)
- introduce these into talent assignment model with a monopolistically competitive market
- study the effect of international integration
 - borrows from Antràs et al. (QJE, 2006): globalization = supply shock of relatively low-skilled agents
- pay contracts are shaped by both:
 - the labor market determines expected compensation (i.e. reservation wages)
 - incentive contracts rationalize equity pay that is subject to (idiosyncratic) shocks

Building Blocks of the Theory

- **endowments:**

- North: mass of agents and (potential) production technologies normalized to 1
 - agents differ in their level of management skills $s \sim U[0, 1]$
 - technologies differ in efficiency $z \sim U[0, 1]$
- South: mass of L agents and technologies
 - comparative statics on L ; autarky: $L = 0$
 - Southern s and z are uniformly distributed between 0 and $\alpha < 1$
- similar to Chaney (AER, 2008): mass of technologies = mass of potential market entrants

- **production:** monopolistic competition

- unit labor costs: $w / (z^{1-\mu} s^\mu)$, $\mu \in (0, 1)$
- profit per variety:

$$\pi(z, s) = M (z^{1-\mu} s^\mu)^{\sigma-1}, \quad M \equiv \frac{1}{\sigma} \left(\frac{\sigma}{\sigma-1} \right)^{1-\sigma} \chi P^{\sigma-1}$$

Building Blocks of the Theory

- **preferences:** agents have *multiplicative* preferences over consumption (c.e.s.) and leisure
 - utility gains from leisure are increasing with compensation
 - indirect utility: $V(s, e) = E \left[\frac{w(s)}{P} g(e) \right]$
 - binary effort $e \in \{\underline{e}, \bar{e}\}$, normalized to $\bar{e} = 0 > \underline{e} > -1$
 - leisure function:

$$g(e) = \begin{cases} 1 & \text{if } e = \bar{e} \\ \frac{1}{1+\Lambda \underline{e}} & \text{if } e = \underline{e}, \quad \Lambda \in [0, 1) \end{cases},$$

- low effort \underline{e} increases utility by a fraction $\Lambda |\underline{e}|$
- **agency friction:** limited liability + unobservable effort
 - firm produces a continuum of varieties: $(1 + \eta)(1 + e)$, $\eta \geq -1$ is stochastic noise with mean 0
 - expected mass of projects when $e = \bar{e}$ is 1
 - each variety generates a profit stream of $\pi(z, s)$
 - low effort reduces firm value by a fraction \underline{e}

Equilibrium and Comparative Statics

- positive assignment, labor market clearing, zero cutoff condition:
 - determine profits, job selection, (expected) managerial incomes
- optimal contracts:
 - determine split of expected income into cash and equity
- **comparative statics:**
 - pay- performance-pay sensitivity measured as the change of an executive's dollar value of compensation as a response to the realized return:

$$\frac{\partial w(s)}{\partial \theta} = \Lambda \left[\mu \left(\left(\frac{s}{s_c} \right)^{\sigma-1} - 1 \right) + 1 \right] \approx \frac{\Delta \$ \text{ Compensation}}{\Delta \ln \text{ Firm Profits}}.$$

Conclusion and Future Work

- studied effects of global sourcing on top inequality:
 - higher income inequality between managers of different firms, small income effects for managers in smaller firms
 - within-firm income inequality also increased but more mildly
 - large effects of wealth inequality across firms, steeper financial incentives within larger firms
- sketched a theory that explains these findings
 - combination of general equ. open economy model and CEO incentive contracts
- future work:
 - consider firm ownership shares, differences between Europe and North America, ...
 - quantification exercise: how much has global sourcing contributed to inequality given these estimates?
 - theory: derive different incentive measures, other extensions

Thank you very much for your attention

Relevance of Instruments

- plot residuals from regressing offshoring, transport margins and world export supply on a full set of year and country-industry dummies
- create a bin scatterplot plotting each percentile of the sample

Bin Scatterplots of Residuals

