How Firms Reorganize Around Informal Labor: Evidence from Turkey's Refugee Inflow

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Motivation

Forced Migration at Scale

- **42.5 million** refugees globally (June 2025)
- **71%** hosted in low/middle-income countries
- **66%** hosted in neighboring countries

The open question

In LMIC hosts, refugees concentrate in **informal employment**. How do such refugee inflows lead firms to **reorganize production** in **dual-labor-market** economies?

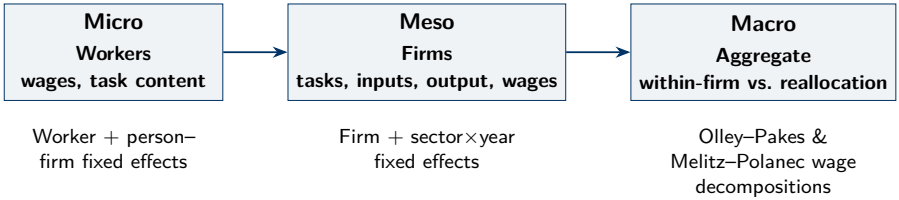
Turkey: world's largest refugee host since 2015

Year	Refugees
2012	170,912
2013	560,129
2014	1,622,839
2015	2,503,549
2018	≈4,000,000

One of the largest labor-supply shocks in recent history

What This Paper Does

A Unified Micro–Meso–Macro Framework



Three connected questions

1. **Workers:** How do refugee inflows affect native workers' wages and occupations — within continuing jobs?
2. **Firms:** How do firms reorganize production — their output, tasks, wages, and inputs? Do they substitute informal labor for capital, automate, or outsource?
3. **Aggregate:** Where does sector-wide **wage growth** come from — within-firm gains, reallocation toward higher-paying firms, or firm entry and exit?

Why Turkey Is the Right Setting

1. **Scale and persistence of the shock**
   2.5M refugees by end-2015, rising to ≈4M by 2018 — one of the largest labor-supply shocks on record
2. **Dual labor market with a large informal sector** (Ulyssea, 2020)
   ≈43% informal employment in 2011; Syrian refugees work **almost entirely informally** (97.9% among employed refugee men)
   ⇒ clear segmentation lets us isolate complementarity rather than head-to-head competition
3. **Rich administrative data**
   Workers' occupations & earnings + firms' production, costs, wages
   ⇒ micro–meso–macro analysis in a single framework

External validity

Turkey's features — dual labor market, task divisibility, barriers to formal refugee employment — characterize **Colombia, Pakistan, Uganda, Jordan, Lebanon, Bangladesh**, which host >40% of the world's refugees.

Preview of Findings

1. **Micro — workers:** refugee exposure **raises native wages** and shifts workers toward **cognitive tasks**, **within continuing matches**

2. **Meso — firms:** firms **expand output** and reorganize internally; the firm wage rises ≈**5%**; capital/sales **falls** ⇒ cheap labor, not automation

3. **Macro — aggregate:** decomposing aggregate **productivity (TFP)** (Olley–Pakes & Melitz–Polanec), **within-firm growth dominates**; reallocation is **small or negative**

The mechanism

Informal refugee labor absorbs manual tasks → formal natives upgrade to cognitive roles → firms reorganize → **native wages rise within firms**.

Fingerprint: effects concentrated where informality and manual intensity are highest.

Background & Conceptual Framework

Syrian Refugees in Turkey: Institutional Setting

Entry and status

- "Temporary protection" since Oct. 2011; open-door policy
- ≈10% in camps (2015); majority urban, concentrated in the south/southeast
- Younger (median 21 vs. 31), less educated (20.7% vs. 8.6% no schooling)

Labor market status (Demirci and Kırdar, 2023)

- <7,400 work permits issued before Jan. 2016
- Employment rate **close to natives** (61.8% vs. 68.9%) ⇒ **large informal supply**
- **97.9%** of employed refugee men work **informally** (natives: 19.1%)

Key implication

Refugees and formal natives operate in **separate employment regimes** — complementarity works through the task structure, not direct competition.

Turkey's Dual Labor Market

Pre-shock (2011) informality

- Overall: **42.7%** of employed workers
- Agriculture 82.6%; Manufacturing 22.8%; Services 18.7%

Within-firm mixing

- Firms <10 employees: 51.9% informal
- Firms >250 employees: 2.6% informal
- Formal and informal workers **coexist in the same firm** — the intensive margin of informality (Ulyssea, 2018)

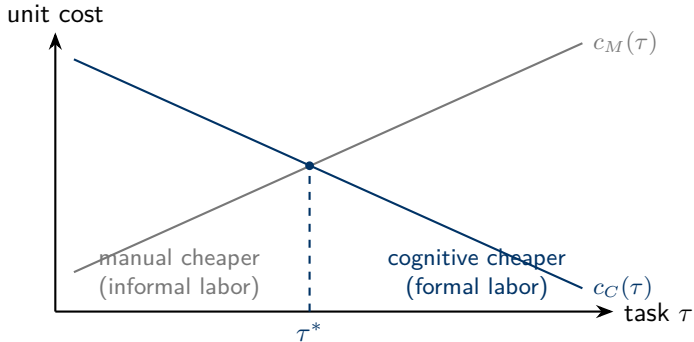
Transitions are common

Among informal wage earners in 2006: 15.0% → formal by 2007; 20.5% by 2008 ⇒ the formal–informal divide is not insurmountable

Pre-shock trend: rapid formalization

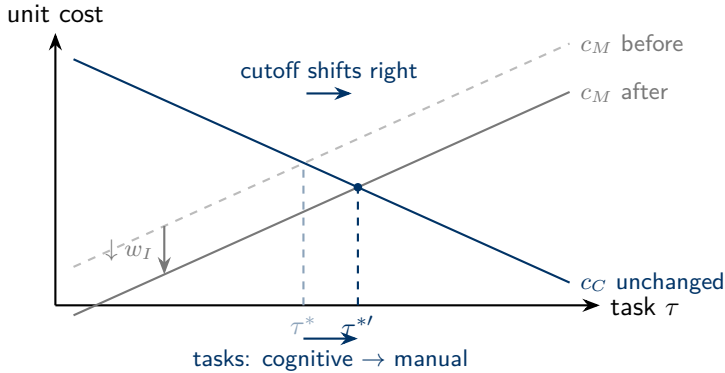
- Formal employment share 41.2% → 49.2% (2004–2011)
- Driven by growth, enforcement, subsidies

Model Setup: Comparative Advantage and the Task Cutoff



- Firm performs a **continuum of tasks** $\tau \in [0, 1]$; each task goes to whichever input bundle has the **lower unit cost**
- **Manual** tasks use **informal labor** (cost c_M, rising in τ); **cognitive** tasks use **formal labor** (cost c_C, falling in τ)
- The schedules cross **exactly once** $\Rightarrow$ a unique cutoff τ^*: tasks below are manual, tasks above cognitive

The Shock: Refugee Inflow $\Rightarrow \downarrow w_I$



- Cheaper informal labor **lowers** $c_M(\tau)$ **everywhere**; $c_C(\tau)$ unchanged in partial equilibrium
- Tasks in $[\tau^*, \tau^{*\prime}]$ migrate **from cognitive into the manual tier**
- Formal workers pushed toward a **strictly more complex** set of tasks $[\tau^{*\prime}, 1]$

Data

Data Sources

Source	Coverage	Period	Key variables
Social Security Institution (SSI)	Formal workers	2009–2018	Wages, occupations (4-digit ISCO), demographics
Revenue Administration	Private firms	2009–2018	Sales, profits, assets, investment
TURKSTAT Annual Survey	Industry/services	2009–2018	Value added, materials, employment
O*NET (crosswalked)	Occupations	Time-invariant	Task content (manual, cognitive, communication)
DGMM / AFAD	Refugees	2012–2018	Provincial refugee stocks

- Unique firm and individual IDs allow **linking workers to firms** across all sources
- Provided to CBRT with confidentiality-preserving identifiers

Sample Construction

Worker panel

- Our **2011 cohort**: all workers aged 20–60 formally employed (SSI-registered) in 2011, followed through 2018
- Task outcomes from 2012 (first year with occupation codes)
- Fixed cohort $\Rightarrow$ effects identified from changes among **stayers**, not the selective exit of manual workers

Firm panel

- Firms with an **existing formal workforce** at baseline: $\geq$1 SSI employee + a balance sheet in 2011
- $\approx$**97% of formal employment**, **98% of formal sales**
- Linked to Revenue Admin. balance sheets + TURKSTAT production data

Data coverage

SSI records cover **formal** workers only. Informal employment is not directly observed; the informal-labor channel is established **indirectly**, in the mechanism tests.

Task Measures: O*NET Crosswalk to ISCO-08

Construction

- O*NET descriptors → 4-digit ISCO-08 (standard crosswalk)
- Each occupation scored in three domains: **manual**, **cognitive**, **communication**
- Scores standardized to mean 0, SD 1

Complexity index

$$\text{Complexity}_o = \text{Cog}_o + \text{Comm}_o - \text{Manual}_o$$

Assignment

- *Worker:*
  $\text{Complexity}_{it} = \text{Complexity}_{o(i,t)}$
- *Firm:*
  $\text{Complexity}_{ft} = \sum_o s_{oft}\, \text{Complexity}_o$
  s_{oft} = employment share of occupation o in firm f, year t

Key feature

Time-invariant task vector + time-varying occupation assignment ⇒ task changes reflect **genuine job reallocation**, not measurement drift.

Refugee Exposure Measure

Exposure definition

$$\text{RefExp}_{pt} = \frac{\text{Refugees}_{pt}}{\text{NativePop}_{pt}}$$

- p = province, t = year; **zero** in pre-shock years (2009–2011)
- Normalized by native population $\Rightarrow$ comparable across provinces of different sizes

Variation

- By **2015**: Kilis >0.70, Hatay 0.18, Şanlıurfa 0.15, Gaziantep 0.13
- Some high-exposure provinces are **core manufacturing regions** (Gaziantep 7th, Adana 8th, Hatay 10th in firm sales)

Denominator concern

Could inflows induce native out-migration, inflating RefExp?

(Aksu et al., 2022): **no significant out-migration**.

Robustness: 2010 (pre-shock) native population $\rightarrow$ results unchanged.

Geographic Distribution of Refugee Exposure

2012

2014

2016

2018

Identification

The Instrument: Distance-Based Predicted Exposure

$$\widehat{\text{RefExp}}_{pt} = \sum_{s=1}^{13} \underbrace{\left(\frac{1/d_{s,T}}{\sum_X 1/d_{s,X}} \right)}_{\text{share to Turkey}} \times \underbrace{\pi_s}_{\text{origin share}} \times \underbrace{\frac{T_t}{d_{p,s}}}_{\text{allocation to } p}$$

- $d_{s,X}$: distance from governorate s to host country $X \in \{\text{Turkey, Lebanon, Jordan, Iraq}\}$ — closer to Turkey $\Rightarrow$ larger share to Turkey
- π_s: pre-war (2010) population share of s
- $d_{p,s}$: road distance, province p to governorate s
- T_t: total Syrian refugees in the four hosts

Distinctive feature: reweighting by competition from other hosts

Governorates reweighted by proximity to Turkey vs. Lebanon, Jordan, Iraq. Aleppo's raw share 21.6% $\rightarrow$ Turkey-adjusted **42.3%**, matching the 57.5% of 2018 TDHS refugee households reporting Aleppo origin.

Worker-Level Results

Worker-Level Specification

Baseline

$$y_{ifpt} = \beta \, \text{RefExp}_{pt} + \alpha_i + \eta_p + \delta_{s\times t} + \phi_{o\times t} + \psi_{r\times t} + X_{it}'\gamma + \varepsilon_{ifpt}$$

Outcomes

- Log real wage
- Occupational complexity
- Cognitive / physical / communication intensity

Progressive FE structure

1. α_i — worker FE
2. α_{ip} — worker $\times$ province FE
3. α_{if} — worker $\times$ firm FE
4. α_{ie} — worker $\times$ establishment FE

(1)→(4) increasingly isolates **within-match** change from reallocation across jobs.

Wage Effects

	Dep. var.: Log Real Wage			
	(1) Worker	(2) W×Prov	(3) W×Firm	(4) W×Estab
Panel A: OLS				
Ratio	0.064*	0.098**	0.091**	0.106**
Panel B: IV				
Ratio	0.055	0.115***	0.123***	**0.127****
Obs. (m)	53.3	51.5	45.3	43.4

- Sorting alone ⇒ coefficients should **attenuate**. Instead, exposure raises wages **within ongoing relationships**.
- Repeated cross-sections cannot separate composition (Aksu et al., 2022); match FE can.
- 10 pp increase in the refugee-to-native ratio ⇒ **≈1.3% wage gain** for incumbent formal workers.

Task Upgrading (IV Estimates)

	(5) Worker	(6) W×Prov	(7) W×Firm	(8) W×Estab
Complexity	0.246***	0.248***	0.252***	**0.255*** **
Physical ability	−0.097***	−0.118***	−0.124***	**−0.136*** **
Cognitive ability	0.148***	0.145***	0.160***	**0.164*** **
Communication	0.196***	0.210***	**0.066***	**0.053***

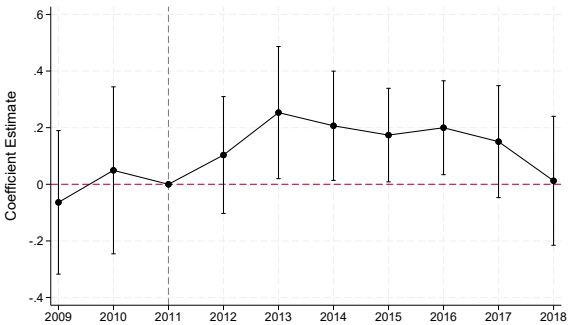
- **Complexity, cognitive, physical**: stable across all FE ⇒ upgrading occurs **within jobs**
- **Communication**: attenuates under match FE ⇒ operates through **job switching**

Why communication differs

Reshuffling tasks within a job vs. roles requiring a new organizational position and relationship network.

Contrast: in high-income settings upgrading runs through *job mobility* (Foged and Peri, 2016); here it occurs **within continuing matches**.

Event-Study: Native Wages



Pre-period (2009–2010)

- Coefficients ≈ 0, insignificant $\Rightarrow$ **parallel pre-trends**

Post-2011

- Effects emerge gradually
- Significant by 2014–2015, growing through 2018
- Tracks the **progressive** refugee build-up

Within-Firm Adjustment in Comparative Perspective

Foged and Peri (2016) find the **same** native upgrading from a comparable low-skilled refugee inflow in Denmark, but reached through worker **mobility**. We find the gains within **continuing matches**. The shock is the same; the **dual labor market** drives the different margin.

Turkey (this paper): within the firm

- Informal refugee labor is **cheap**: the hiring firm gains a **firm-specific** cost advantage
- It spends that advantage in-house: cheap labor replaces manual work and capital, and incumbents shift to cognitive tasks
- Flexible, informal pay lets it **re-price tasks** internally; high severance makes formal mobility costly

Denmark (Foged–Peri): across firms

- The migrant is hired **formally at the full wage**: no firm-specific windfall
- The supply shift works through the **market**: relative wages move, and natives sort into complex jobs by switching employers
- Wage compression blocks internal re-pricing; flexicurity keeps **mobility** a low-cost path

Next: The firm-level evidence tests this directly: the same exposure that upgrades incumbents reorganizes tasks, capital, and output **within the firm**.

Firm-Level Results

Firm-Level Analysis: Setup

$$y_{fpt} = \beta \, \text{RefExp}_{pt} + \gamma_f + \eta_p + \delta_{s \times t} + \psi_{r \times t} + \varepsilon_{fpt}$$

Task composition

- Firm-level complexity, cognitive, physical, communication

Employment-weighted O*NET scores over the firm's *full* formal workforce (incl. post-2011 hires, pre-2018 separations)

Performance and mechanism

- Sales, assets, employment, **wages**
- Value added, TFP (corroborating; ACF)
- Capital/sales, capital/labor, investment, intermediate/sales

L_{ft} = **formal labor only** $\Rightarrow$ informal contribution absorbed into the residual

Firm-Level Task Composition

	Complexity	Physical	Cognitive	Communication
OLS	0.484***	−0.068**	0.119**	0.030**
	(0.158)	(0.028)	(0.051)	(0.014)
IV	**0.475****	**−0.065****	**0.122****	**0.031****
	(0.221)	(0.032)	(0.067)	(0.016)
KP F		89.38		Obs. (m): 2.258

- 10-pp increase ⇒ firm complexity ↑ **0.048 SD**
- Physical ↓; cognitive & communication ↑
- **Individual upgrading aggregates into organizational change**

Note

Averages over *all* formal workers ⇒ captures the full organizational response, not just incumbents.

Firm Performance and the Nature of Adjustment (IV)

	Sales	Total Assets	Employment	**Wages**	Value Added	TFP
Ratio	0.625***	0.227**	0.308*	**0.480****	0.410**	0.390***
	(0.113)	(0.104)	(0.157)	(0.187)	(0.143)	(0.105)

	Capital/Sales	Investment	Capital/Labor	Interm. Input/Sales
Ratio	**−0.278*****	−0.096	0.010	−0.036
	(0.087)	(0.101)	(0.199)	(0.022)

Scale and wages (10 pp exposure):

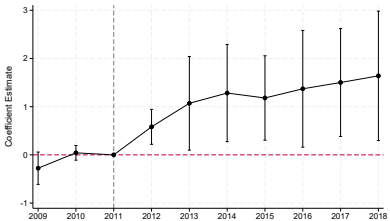
Wages ↑4.8%, Sales ↑6.3%, VA ↑4.1%, TFP ↑3.9% (corrob.)

Two channels ruled out:

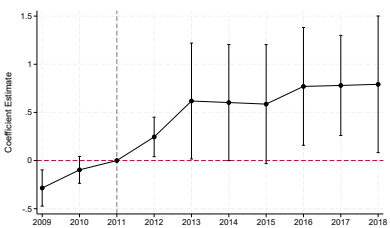
- **Not automation**: capital/sales falls, investment flat
- **Not outsourcing**: intermediates/sales flat

Event Studies: Scale, Wages, and Value Added

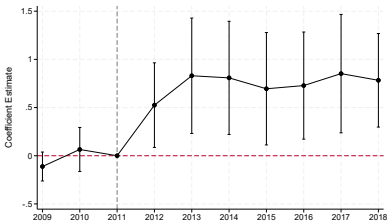
Sales



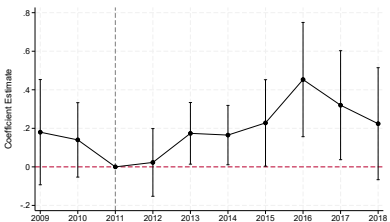
Average Wages



Value Added

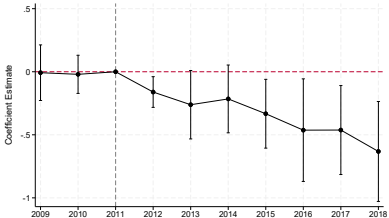


TFP (corroborating)

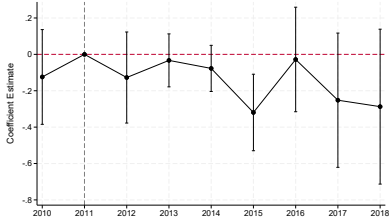


Forensic Evidence: Capital and Intermediates

Capital/Sales

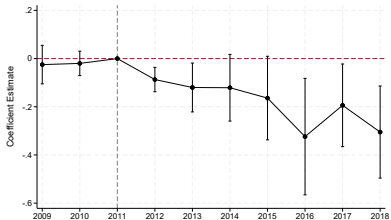


Investment



Capital/Labor

Intermediate Input/Sales



Mechanism Test 1: Sectoral Informality (Institutional Margin)

Two heterogeneity tests: **institutional margin** (sectoral informality, here) and **technological margin** (firm manual intensity, next).

	Sales	Assets	Emp	Wages	VA	TFP
Ratio	0.544***	0.301**	0.362**	0.379***	0.437***	0.384*
Ratio × Informality	0.157***	0.231**	0.216**	0.250*	0.303**	0.225*
	Cap/Sales	Invest	Cap/Lab	Interm. Input/Sales		
Ratio	0.140	−0.132	0.149	0.055		
Ratio × Informality	**−0.658***	0.136	−0.524	**−0.341***		

- Performance effects **amplified in high-informality sectors**
- Capital/sales **negative**: substitute away from capital where informal labor is feasible
- Intermediates **negative**: production in-house, not outsourced

Direct evidence for the channel

Effects amplify where the institutional cost of informal hiring is low (Ponczek and Ulyssea, 2022) — adjustment on the informal margin.

Mechanism Test 2: Firm Manual Intensity (Technological Margin)

Within-sector identification: cannot be driven by sectoral demand, technology, tradability, or product mix.

	Sales	Assets	Emp	Wages	VA	TFP
Ratio	0.519***	0.289**	0.347**	0.365***	0.414**	0.368*
Ratio × Manual Intensity	**0.051****	**0.073***	**0.068***	**0.081***	**0.097***	**0.069***

	Cap/Sales	Invest	Cap/Lab	Interm. Input/Sales
Ratio	0.130	−0.127	0.135	0.048
Ratio × Manual Intensity	0.052	0.039	0.043	0.035

- All six performance interactions **positive and significant**
- Within-sector ID rules out the sectoral confounders behind Test 1
- Input-ratio interactions insignificant: **uninformative**, not contradictory

Joint takeaway

Both margins confirmed. The combined pattern is hard to reconcile with any explanation that does not operate through informal labor.

Ruling Out Demand and Capacity Utilization

Could the gains be local demand, not reorganization?

Capacity utilization: refugees raise local demand ⇒ firms run existing capital harder ⇒ revenue-based TFP rises mechanically.

Consistent with:

- ✓ rising sales and wages
- ✓ TFP rises (mechanically)
- ✓ capital/sales falls (capital used harder)
- ✓ intermediate/sales flat (materials track output)

Inconsistent with:

- × **within-match task upgrading** (predicts the same tasks, not recomposition; refined story: incumbents promoted, new hires take the manual jobs)
- × **informality and manual-intensity concentration** (no reason to vary by either)
- × **tradability**: gains just as large where local demand is irrelevant (next slide)

The Tradability Test

Isolating supply from demand

Tradable sectors (manufacturing, mining) sell to national/international markets — local refugee demand is irrelevant. Demand predicts $\beta_2 < 0$ (tradables gain less); supply-side reorganization predicts $\beta_2 \geq 0$.

	Sales	VA	TFP	Cap/Lab	Interm. Input/Sales
Ratio	0.622***	0.335*	**0.339*** **	0.009	−0.011
Ratio × Tradable	0.018	0.357	**0.247**	0.001	**−0.119****

- TFP interaction **positive, insignificant**: tradables gain at least as much ⇒ **rules out demand**
- Intermediate interaction **negative, significant**: tradables bring production in-house — consistent with informal labor

Managerial Capacity as a Complementary Input

The hypothesis

Coordinating a dual formal–informal workforce requires **managerial capacity**: gains concentrate in firms best positioned to exploit improved labor access (Beerli et al., 2021).

Pre-shock proxy. MQ_f = firm-average AKM worker effect $\hat{\alpha}_i$ (2009–2012) of its 2012 managers (ISCO 11–13) — the **portable** pay component, net of firm policy; standardized.

	Sales	Tot. Assets	Emp.	Wages	VA	TFP
Ratio	0.523***	0.292**	0.351**	0.368***	0.419**	0.371*
Ratio × MQ	**0.083*** **	**0.121** **	**0.109** **	**0.128***	**0.158** **	**0.111***

- **All six interactions positive and significant**: a 1-SD rise in MQ amplifies the sales response by ∼16%

Interpretation: Pre-shock organizational capability **mediates** the response — the mechanism works best where firms can implement it.

Aggregate Decomposition

Aggregate Wage Decomposition: Framework

The macro question

Even if each firm raises the wages it pays, aggregate wage growth could come from within-firm gains, **reallocation** of workers toward higher-paying firms, or firm **entry/exit**.

Compute within each **4-digit sector** g × **province** p × **year** t cell,

where w_{fgpt} = firm log wage and θ_{fgpt} = **employment** share,

$$\text{OP:}\quad \bar{W}^{OP}_{gpt} = \underbrace{\bar{w}_{gpt}}_{\text{within}} + \underbrace{\textstyle\sum_{f\in\Omega_{gpt}} (\theta_{fgpt} - \bar{\theta}_{gpt})(w_{fgpt} - \bar{w}_{gpt})}_{\text{reallocation}}$$

$$\text{MP:}\quad \Delta\bar{W}_{gpt} = \underbrace{\Delta\bar{w}_S}_{\text{within}} + \underbrace{\Delta\text{Cov}_S}_{\text{realloc}} + \text{entry} + \text{exit}$$

Estimating equation (y_{gpt}: within or reallocation component)

$$y_{gpt} = \beta\,\text{RefExp}_{pt} + \alpha_p + \gamma_g + \delta_{s(g)\times r} + \lambda_{s(g)\times t} + \psi_{r\times t} + \varepsilon_{gpt}$$

Aggregate Wage Decomposition: Within-Firm Dominates

	OP		MP	
	Within	Realloc	Within	Realloc
OLS	0.374**	0.010	0.418***	0.005
	(0.119)	(0.078)	(0.086)	(0.035)
IV	**0.489****	0.008	**0.521****	0.010
	(0.168)	(0.070)	(0.199)	(0.090)
KP F	12.55	12.36	13.81	13.66

Aggregate wage growth comes from firms **paying more**, through internal reorganization

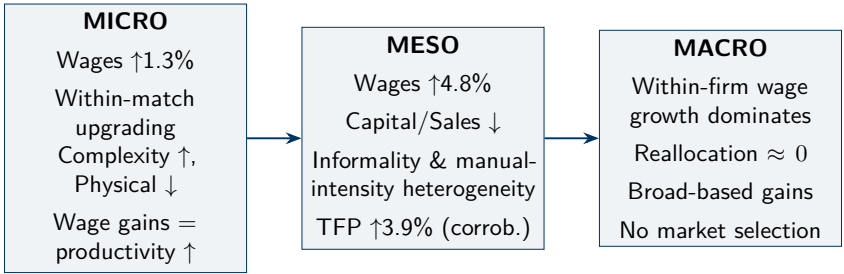
No shift of employment toward higher-paying firms $\Rightarrow$ **no market selection**

Comparison with Dustmann et al. (2022)

Applying the *same* OP/MP framework to firm **wages** (German minimum wage), they find **between-firm reallocation dominates**. The wage decomposition here shows the **opposite** — within-firm dominates, reallocation ≈ 0 — a direct reversal.

Summary

Putting It Together: The Three-Level Story



Informal refugee labor absorbs manual tasks → formal natives upgrade to cognitive roles → firms reorganize → ***native wages rise within firms, broadly across incumbents***

Three Contributions

1. **Wage gains and task upgrading in a middle-income dual labor market.** Gains occur **within continuing matches** and reflect genuine marginal-product increases, not composition — where high-income evidence runs through job mobility (Foged and Peri, 2016).

2. **The informal labor channel.** Informal manual labor → task reallocation → capital substitution, with no deepening or outsourcing — a different margin from skilled immigration and innovation (Beerli et al., 2021).

3. **First OP/MP decomposition of firm wages** in an immigration setting. Within-firm wage growth dominates; reallocation is **negligible** — **reversing** the reallocation-driven pattern in Dustmann et al. (2022).

Thank You

Comments and questions welcome

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