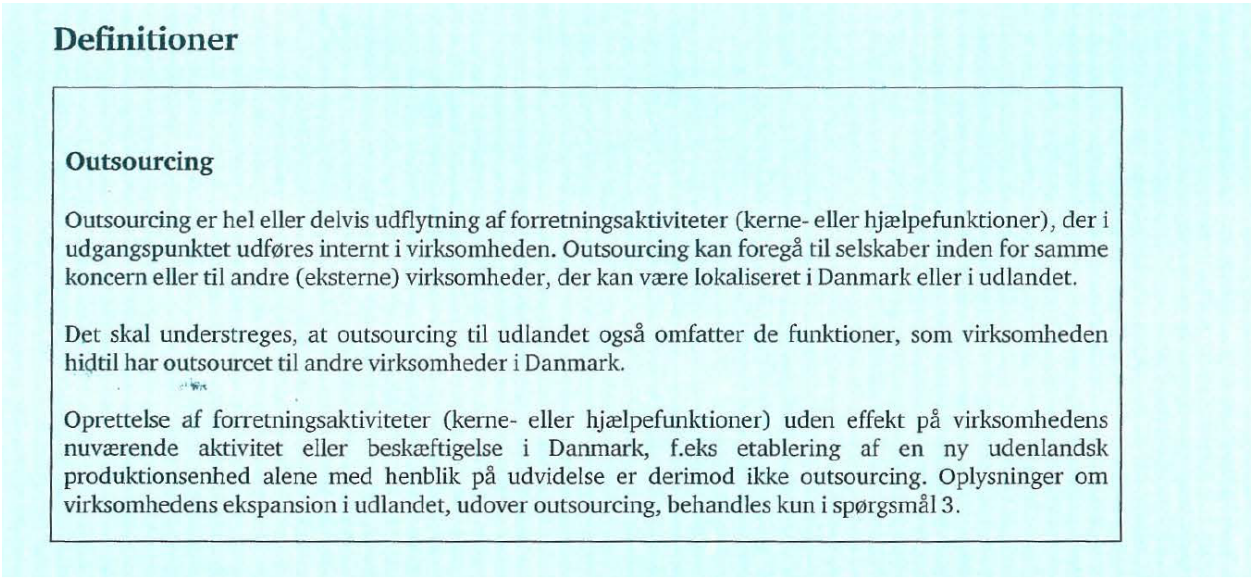
For Online Publication Only: Online Data Appendix for Heterogeneous Globalization: Offshoring and Reorganization, *by:* Bernard, Fort, Smeets, and Warzynski

This online Appendix for Bernard, Fort, Smeets, and Warzynski (2023) provides additional details on the data construction and the empirical patterns documented in the paper.

D Survey Question

Figure D.1 presents the original survey question in Danish. The work "udflytning" translates to "move out". The full survey is available here `https://www.dst.dk/da/Statistik/Publikationer/VisPub?cid=13110` from Statistics Denmark, or archived here `http://faculty.tuck.dartmouth.edu/images/uploads/faculty/teresa-fort/Danske_virksomheders_outsourcing_2007.pdf`.

Figure D.1: Question on offshoring in Danish



Definitioner

Outsourcing

Outsourcing er hel eller delvis udflytning af forretningsaktiviteter (kerne- eller hjælpefunktioner), der i udgangspunktet udføres internt i virksomheden. Outsourcing kan foregå til selskaber inden for samme koncern eller til andre (eksterne) virksomheder, der kan være lokaliseret i Danmark eller i udlandet.

Det skal understreges, at outsourcing til udlandet også omfatter de funktioner, som virksomheden hidtil har outsourcet til andre virksomheder i Danmark.

Oprettelse af forretningsaktiviteter (kerne- eller hjælpefunktioner) uden effekt på virksomhedens nuværende aktivitet eller beskæftigelse i Danmark, f.eks etablering af en ny udenlandsk produktionsenhed alene med henblik på udvidelse er derimod ikke outsourcing. Oplysninger om virksomhedens ekspansion i udlandet, udover outsourcing, behandles kun i spørgsmål 3.

E Details on production and imports

A potential concern with measuring produced-good imports is that firms may import a product, repackage it in Denmark, and then report that same product as domestic production. Figure E.1 presents the documentation from the Denmark's survey on production. The description of "Own goods" explicitly states that "Traded goods are not included." In addition, goods that the firm buys and resells without processing are explicitly reported as "Commercial (resale) turnover," and that description notes that goods that the firm repackages have not been processed. Repackaged goods are thus categorized as Resales, not as Own Goods.

E.1 Production by good type

Figure E.1: ProdCom definitions

2.4 Statistical concepts and definitions

Other turnover: Other turnover is for turnover not related to activities in manufacturing or mining and quarrying. This can be from construction, research and development or renting.

Own goods: The statistics measures sales of own goods, that is goods extracted, produced, processed or assembled by the reporting enterprise. Own goods are also products manufactured by a subcontractor, if the reporting enterprises owns the inputs for the subcontracted manufacturing. Traded goods are not included.

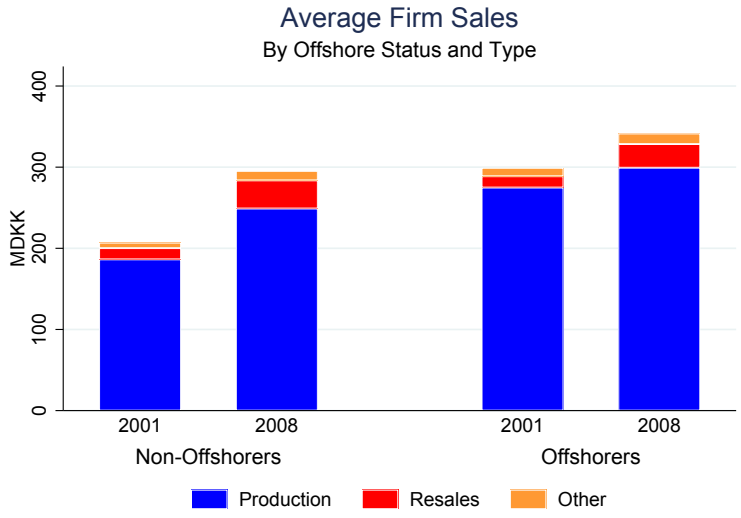
Commercial (resale) turnover: Commercial (resale) turnover is turnover from sales of goods that are bought and sold with any processing. Repackaging does not constitute processing.

Contract work for other enterprises: Contract work for other enterprises is work done for another enterprise, which owns the input for the manufacturing work.

Sales: Sales are in current prices, excluding VAT. All sales are included, domestic and export markets.

Notes: Definition from Statistics Denmark "Documentation of statistics for Manufacturers' Sales of Goods 2017 Quarter 1."

Figure E.2: Composition of Firm Sales by Offshore Status

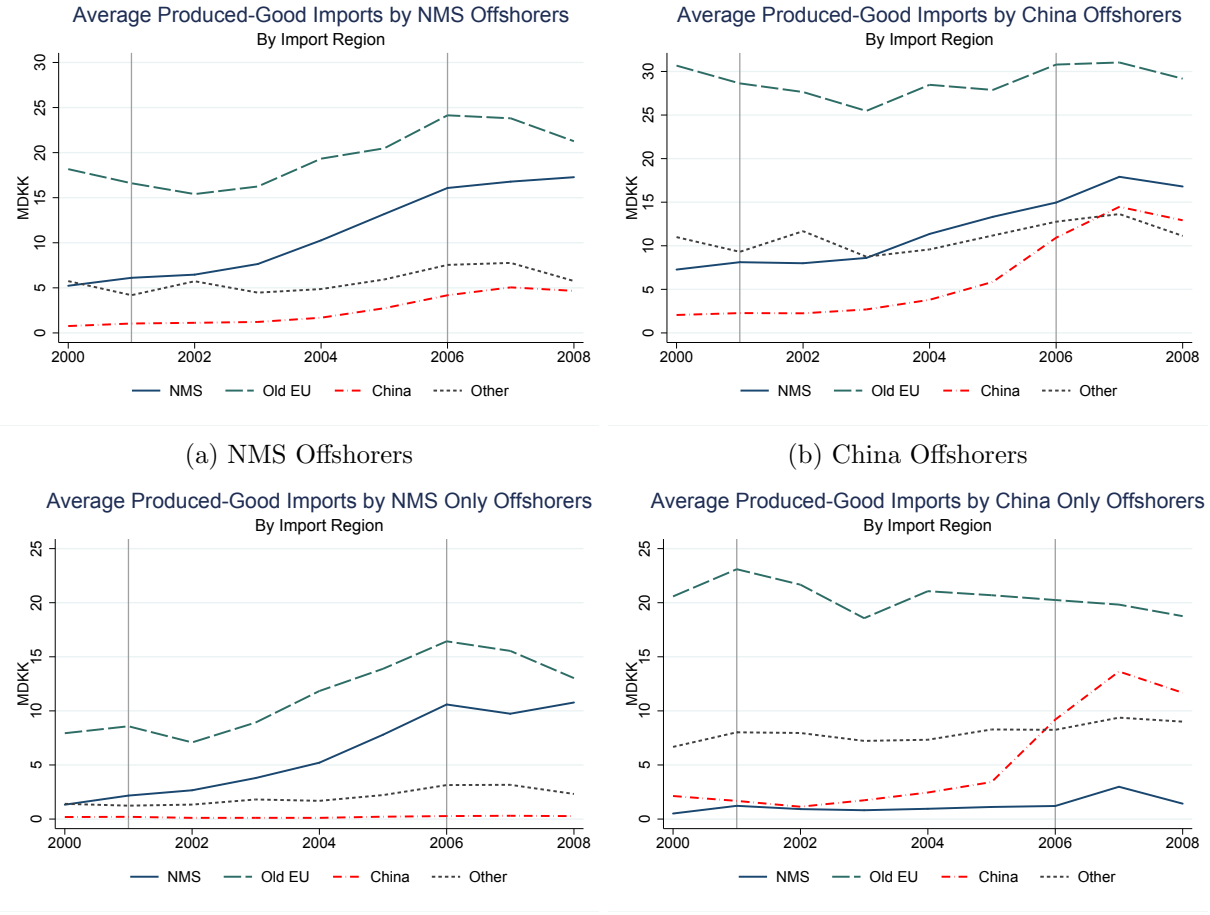


Notes: Figure presents the weighted-average of total firm sales reported in ProdCom, split apart by type of sales. Production is "sales of own goods," (i.e., goods that are produced by the firm). Resales are sales of goods that are bought and sold without any processing, where repackaging does not constitute processing. Other includes contract work, installation, and packaging and repair. Sample is a balanced panel of firms in the offshoring survey that exist from 2000 to 2008 and report production in ProdCom in at least one of these years.

Here we depict total ProdCom sales by main categories. Production represents firms' "sales of own goods", which is the focus in the paper, both since these sales represent actual production in Denmark by the firm, and since they are broken out by detailed CN8 product code. We also plot resales here to show that sales of goods that the firm purchases and then repackages or relabels are explicitly measured in a different category.

E.2 Produced-goods imports by region

Figure E.3: Average produced good imports by region and offshore status



(a) NMS Offshorers

(b) China Offshorers

(c) NMS Only offshorers

(d) China Only Offshorers

Notes: Top panel presents weighted average of firms' imports by region of goods that they also produce domestically in the same year, for firms that offshore to NMS (left panel) and or China (right panel). Bottom panel presents weighted average of firms' imports by region of goods that they also produce domestically in the same year, for firms that offshore to NMS and not China (left panel) or China but not NMS (bottom panel). Sample is a balanced panel of firms in the offshoring survey that exist from 2000 to 2008 and are ever in ProdCom.

In this section, we show that offshoring firms have relatively high levels of produced-good imports prior to offshoring largely due to their imports of produced-goods from the original EU member countries.

We decompose firm imports by region of the imports, for firms that offshore to NMS and China.

The top, left panel of Figure E.3 shows that firms that offshore to the NMS between 2001 to 2006 grow their produced-good imports from that region the most over the period. It is also evident that NMS offshorers start with relatively high levels of average produced-good imports from the old EU countries. The top right panel of Figure E.3 shows similar patterns for firms that offshore to China, with even higher levels of produced good imports from the old EU in 2001, and slight declines in those imports in the initial years of the offshoring period.

To understand how firms' offshoring decisions may be interrelated across space, the bottom panel of Figure E.3 presents similar figures for firms that offshore to NMS but not China and for firms that offshore to China, but not the NMS countries. Here, the patterns are more stark. While both sets of firms have high levels of produced-good imports from the old EU in 2001, the NMS offshorers grow those imports as they also increase their produced good imports from the NMS countries. In contrast, firms that offshore to China but not the NMS exhibit declines in their average produced good imports from the old EU. These figures not only show how closely produced-good imports match with an explicit relocation of production as identified by firms, but also highlight the potential for produced-good imports to show how global value chains are structured across space.

F Event Study Coefficients

Table F.1: Event Study Regressions

	Produced goods			
Years since initial importing from NMS or China	log domestic unit value	log domestic quantity	log imported unit value	log imported weight
t-3	0.002	-0.072		
	(0.021)	(0.049)		
t-2	0.003	-0.016		
	(0.013)	(0.030)		
t	0.005	0.001		
	(0.012)	(0.035)		
t+1	0.032*	-0.032	-0.011	0.883***
	(0.017)	(0.044)	(0.016)	(0.056)
t+2	0.040**	-0.051	-0.062***	1.093***
	(0.019)	(0.055)	(0.019)	(0.064)
t+3	0.036	-0.127*	-0.032	0.966***
	(0.023)	(0.066)	(0.023)	(0.083)
R^2	0.02	0.01	0.02	0.08
Observations	3,638	3,638	4,612	4,612

Notes: The log unit values and quantity or weight are normalized to one in the initial import year. Coefficients normalized to zero in the initial import year ($t-1$). The domestic specifications include year fixed effects, while the import specifications include year and country fixed effects. Domestic unit value sample limited to firms that produce a CN8 good at least two years without importing, begin to import the CN8 good from NMS or China in year t, and continue to produce the CN8 good domestically for at least 3 more years. Import unit value sample limited to firms that produce a good in $t-2$ and or $t-1$, start to import the good in year 0, and continue importing the good for at least 3 years. Standard errors clustered by CN8 product. * p<0.10, ** p<0.05, *** p<0.01.

G Regression Section

Here we present robustness and additional details for the results in the Section 4.

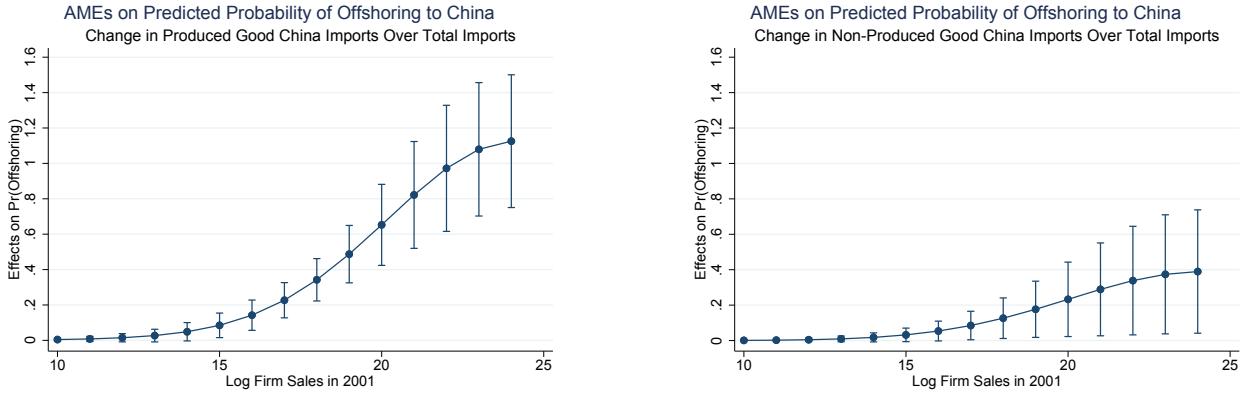
G.1 Produced-good imports and offshoring to China

Here we also present the results from estimating

$$Pr(\Delta Off_f^{China} = 1) = \alpha + \beta_{PG}\Delta\frac{PG\ Imports_f^{China}}{Imports_f} + \beta_s log(sales_f^{2001}) + Ind_f, \tag{10}$$

where $\Delta\frac{PG\ Imports_f^{China}}{Imports_f}$ is the change in the firm's produced-good import share from 2001 to 2006, Ind_f are two-digit NACE fixed effects, and $log(sales_f^{2001})$ is the firm's sales in 2001. Figure F.1a reports the average marginal effects (AME) of changes in import shares on predicted offshoring to China during 2001-2006. The AME is positive and significant across the entire range of firm sizes but is strongest for the largest firms. Figure F.1b shows AME effects when the RHS variable is the change in the import share of non-produced goods from China. Non-produced good imports from China have a much smaller and less precisely estimated relationship with the probability of offshoring.

Figure G.1: China Offshoring and Produced-Good Imports



(a) Produced good import share (b) Non-Produced good import share

Notes: The left panel presents the average marginal effects as a function of firm sales in 2001 of changes from 2001 to 2006 in a firm's produced-good imports from China over total imports on the probability that the firm reports relocating its core activity to China from 2001 to 2006. The right panel presents the average marginal effects of changes from 2001 to 2006 in a firm's non-produced good imports from China over total imports on the probability that the firm reports relocating its core activity to China from 2001 to 2006. Sample is a balanced panel of firms in the offshoring survey that exist from 2001 to 2006 and that report production in ProdCom.

G.2 Regression coefficients for probability of offshoring in survey

Here we present the coefficient estimates for estimating equation (3) via Logistic regression. The marginal effects that correspond to these estimates are presented in Figure 7, evaluated at different measures of firm size.

Table G.1: Import shares by imported good input and production status, and firm offshore status

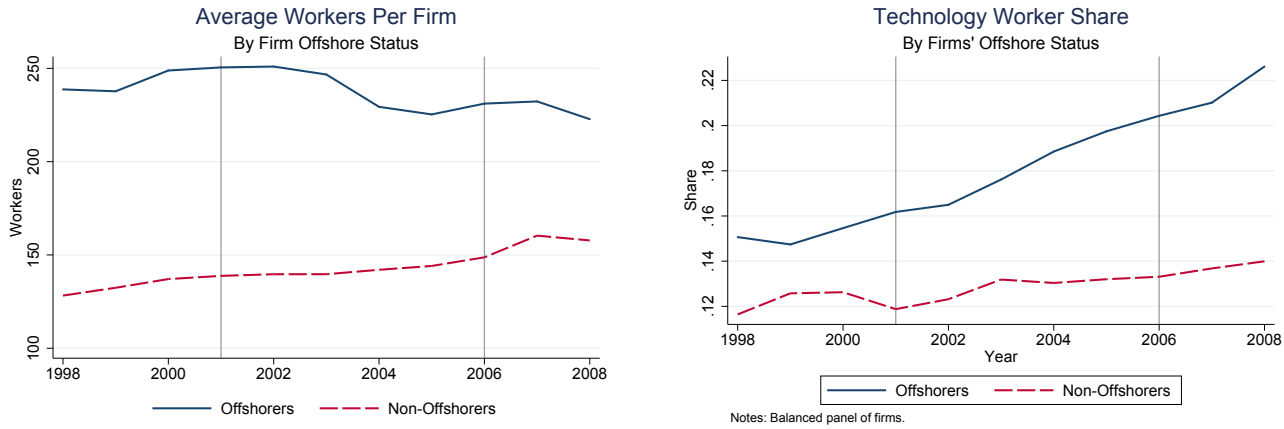
Dependent variable is an indicator if firm offshores to:				
	NMS		China	
$\Delta PG\ ImpSh_f^{Region}$	1.713***		3.117***	
	(0.413)		(0.535)	
$\Delta NPG\ ImpSh_f^{Region}$		-0.199		1.069**
		(0.258)		(0.492)
$log(sales_f^{2001})$	0.208***	0.218***	0.278***	0.265***
	(0.043)	(0.043)	(0.052)	(0.051)
Observations	1174	1174	1057	1057

Notes: Table presents results from estimating equation (3) via Logistic regression. Dependent variable is an indicator equal to 1 if the firm reports relocating its core activity to a particular region from 2001 to 2006. $\Delta PG\ ImpSh_f^{Region}$ is the change in the firm's produced-good imports from the region over that period. $\Delta NPG\ ImpSh_f^{Region}$ is the change in the firm's non-produced-good imports from the region over that period.

G.3 Employment patterns for regression sample

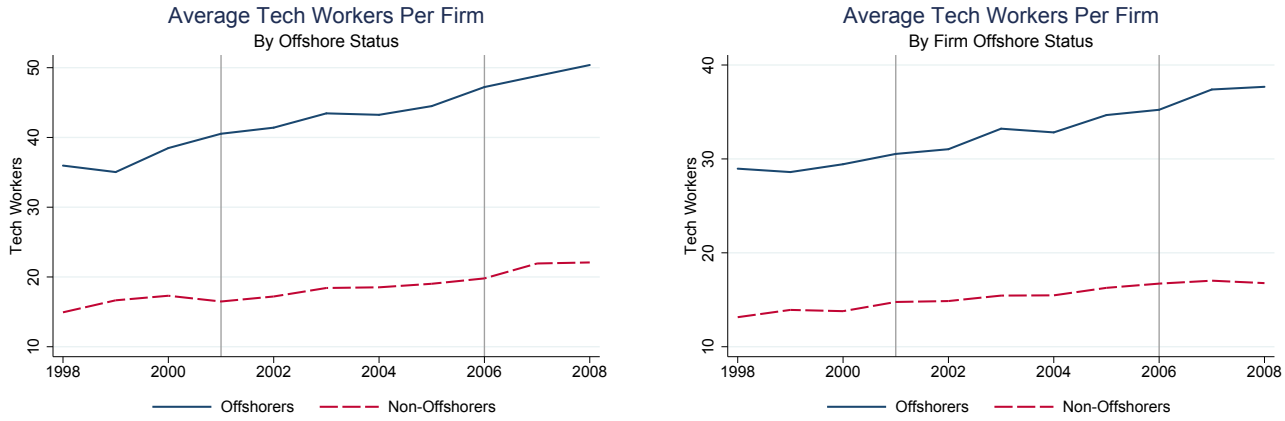
Here we replicate Figure 6 for the entire sample of firms in the offshoring survey, regardless of their ProdCom status. The total employment declines and disproportionate increase in tech workers for offshoring firms are both persistent in the full sample.

Figure G.2: Employment by firms' offshore status



Notes: The left panel presents the weighted average of employment at firms that offshore to new foreign locations between 2001 to 2006 and those that do not. The right panel presents the weighted average of the share of tech workers by firm offshore status. Sample is a balanced panel of firms in the offshoring survey that exist from 1998 to 2008.

Figure G.3: Average Tech Workers by firms' offshore status for offshoring and ProdCom samples



Notes: Figure presents the weighted average of employment in technology occupations at firms that offshore to new foreign locations between 2001 to 2006 and those that do not. The left panel sample is a balanced panel of firms in the offshoring survey that exist from 1998 to 2008. The right panel is the subset of firms in the left panel that are ever in ProdCom over the period.

G.4 Summary statistics for regression variables

Here we provide summary statistics for the variables used in the regression analysis on workers and offshoring.

Table G.2: Summary statistics for regression variables, Table 6

	$\Delta \frac{PG\ Imports_{ft}^{NMS}}{Imports_{ft}}$	$Shock_f^{NMS}$	Change in firm log emp	log prod	share tech	share support	share prod
Mean	0.0066	0.011	-0.058	0.18	0.0068	0.0048	-0.033
Std. Dev	0.12	0.025	0.48	0.68	0.065	0.091	0.13

Table G.3: Summary statistics for regression variables, , Table 7

	DHS tech	DHS support	DHS prod	Δ Switchers
Mean	0.026	-0.049	-0.11	0.00042
Std. Dev	0.92	0.75	0.52	0.029

G.5 Robustness of the IV and Reduced-Form Estimates

Table G.4: Main Results with BHJ Standard Errors

	Δ log Emp	Δ log Production	Δ Share of Workers in Tech	Support	Production
Reduced Form					
$\Delta ExportSh_f^{NMS}$	-0.731*	-0.047	0.078*	0.088	-0.213**
	(0.404)	(0.881)	(0.046)	(0.055)	(0.085)
IV Estimates					
$\Delta PG\ ImpSh_f^{NMS}$	-2.024	-0.130	0.215*	0.243*	-0.589**
	(1.382)	(2.434)	(0.125)	(0.126)	(0.248)
KP-Fstat	5.722	5.722	5.722	5.722	5.722
AR Chi-sq P-val	0.07	0.96	0.10	0.11	0.02
Firms-by-year	5,159	5,159	5,159	5,159	5,159
Products-by-year	3,521	3,521	3,521	3,521	3,521

	Growth Rate of Workers in Tech	Support	Production	Δ Share Tech Switchers
Reduced Form				
$\Delta ExportSh_f^{NMS}$	0.889*	0.032	-1.033***	0.031**
	(0.482)	(0.489)	(0.386)	(0.015)
IV Estimates				
$\Delta PG\ ImpSh_f^{NMS}$	2.464	0.088	-2.863*	0.086
	(1.567)	(1.339)	(1.488)	(0.055)
KP-Fstat	5.722	5.722	5.722	5.722
AR Chi-sq P-val	0.08	0.95	0.01	0.04
Firms-by-year	5,159	5,159	5,159	5,159
Products-by-year	3,521	3,521	3,521	3,521

Notes: This tables reproduces the main results of Tables 6 and 7 following Borusyak et al. (2022) to compute standard errors, transforming the data from firm-year to product-year observations (HS6 level) to take into account the fact that shocks are at the product-year level. Standard errors are clustered by HS2 sector.

Table G.5: Robustness of the IV Estimates

	Δ log Emp	Δ log Production	Δ Share of Workers in Tech	Support	Production
$\Delta PG\ ImpSh_f^{NMS}$	-2.324**	-0.068	0.243**	0.283**	-0.655**
	(1.148)	(2.734)	(0.111)	(0.141)	(0.276)
$\Delta ImpPen_{i,NMS}$	0.010	0.634	-0.058*	-0.026	0.112
	(0.283)	(0.978)	(0.030)	(0.039)	(0.072)
$\Delta ImpPen_{i,CN}$	-0.561	0.113	0.020	0.092*	-0.204
	(0.549)	(0.547)	(0.052)	(0.052)	(0.126)
MNC	-0.003	0.069	-0.004	-0.004	0.000
	(0.050)	(0.059)	(0.003)	(0.004)	(0.008)
$log(emp_f^t)$	-0.020	0.007	0.001	0.003	0.001
	(0.013)	(0.029)	(0.001)	(0.002)	(0.004)
KP-Fstat	9.053	9.053	9.053	9.053	9.053
AR Chi-sq P-val	0.01	0.98	0.01	0.08	0.01
Observations	5,159	5,159	5,159	5,159	5,159

	Growth Rate of Workers in Tech	Support	Production	Δ Share Tech Switchers
$\Delta PG\ ImpSh_f^{NMS}$	2.455*	0.036	-3.374**	0.087*
	(1.474)	(1.232)	(1.368)	(0.051)
$\Delta ImpPen_{i,NMS}$	-0.661	0.041	0.423	-0.012
	(0.518)	(0.351)	(0.297)	(0.017)
$\Delta ImpPen_{i,CN}$	-0.264	-0.369	-0.955	0.013
	(0.566)	(0.488)	(0.609)	(0.017)
MNC	0.026	0.010	0.019	0.000
	(0.046)	(0.042)	(0.064)	(0.001)
$log(emp_f^t)$	-0.032*	-0.002	-0.025	-0.001
	(0.017)	(0.016)	(0.018)	(0.001)
KP-Fstat	9.053	9.053	9.053	9.053
AR Chi-sq P-val	0.03	0.98	0.00	0.03
Observations	5,159	5,159	5,159	5,159

Notes: Dependent variables in top panel are the change in the firm outcome noted in column headers. Dependent variables in bottom panel are the growth rate of worker types denoted in column headers, defined as $\frac{(Occup_{f,t+5}-Occup_{f,t})}{0.5(Occup_{f,t+5}+Occup_{f,t})}$. Δ Share Tech Switchers is the change in the share of tech workers that switched into tech occupations within the firm. $\Delta PG\ ImpSh_f^{NMS}$ is the change in the firm's produced-good import share from NMS, based on the firm's initial-period domestic production. $\Delta ImpPen_f^{NMS}$ and $\Delta ImpPen_f^{China}$ are firm-specific measures of the change in import penetration from NMS and China, based on the firm's initial-period domestic production shares. The firm's own imports and production are excluded from the product-level import-penetration measures. Two stacked five year differences for 1998 - 2008. Regressions are weighted by initial employment and include industry (NACE2) and year fixed effects. Standard errors clustered by HS2 sector. * p<0.10, ** p<0.05, *** p<0.01.

Table G.6: Robustness of the Reduced-Form Estimates with BHJ Standard Errors

	Δ log Emp	Δ log Production	Δ Share of Workers in Tech	Support	Production
$\Delta ExportSh_f^{NMS}$	-0.830**	-0.024	0.087*	0.101*	-0.234***
	(0.396)	(0.907)	(0.048)	(0.056)	(0.087)
Firm-level controls:					
$\Delta ImpPen_{i,NMS}$	✓	✓	✓	✓	✓
$\Delta ImpPen_{i,CN}$	✓	✓	✓	✓	✓
MNC, $log(emp_f^t)$	✓	✓	✓	✓	✓
$log(emp_f^t)$	✓	✓	✓	✓	✓
Count of firms-by-year	5,159	5,159	5,159	5,159	5,159
Count of products-by-year	3,521	3,521	3,521	3,521	3,521

	Growth Rate of Workers in Tech	Support	Production	Δ Share Tech Switchers
$\Delta ExportSh_f^{NMS}$	0.877*	0.013	-1.205***	0.031**
	(0.486)	(0.490)	(0.372)	(0.015)
Firm-level controls:				
$\Delta ImpPen_{i,NMS}$	✓	✓	✓	✓
$\Delta ImpPen_{i,CN}$	✓	✓	✓	✓
MNC, $log(emp_f^t)$	✓	✓	✓	✓
$log(emp_f^t)$	✓	✓	✓	✓
Count of firms-by-year	5,159	5,159	5,159	5,159
Count of products-by-year	3,521	3,521	3,521	3,521

Notes: This table reproduces the results in Table 8 using the method to calculate standard errors in Borusyak et al. (2022).

H Characteristics of produced-good imports at the industry level

We first define a measure of import penetration similar to what is typically done in the literature, but where the numerator can vary by good-importer type. Specifically, we measure the change in import penetration as

$$\Delta ImpPen_{pT}^{R} = \Delta \frac{Imports_{pT}^{R}}{Imports_{p} + DomProd_{p}}, \tag{11}$$

where R denotes region (China or NMS), p denotes HS6 product, and T denotes the good-importer type. Product type T can be all imports, non-produced good imports, and produced-good imports. Produced-good (PG) imports are imports of HS6 products that the importer also produces domestically in that year, while non-produced good (NPG) imports are imports of products that the importing firm did not produce. Since our aim in this section is to provide new insights into prior work that has focused on Chinese import competition, we consider 10 year changes in these import penetration measures from 1998 to 2008.[31]

To assess differences across types of import penetration, we first calculate their correlation coefficients within a region. For both China and NMS, the change in import penetration based on all imports is highly correlated with the change in non-produced good import penetration, with correlation coefficients of about 0.99. The change in produced-good import penetration is also correlated with standard measures, but with lower correlation coefficients of 0.09 and 0.28 for China and NMS, respectively. In contrast, changes in produced and non-produced good import penetration measures are uncorrelated, as reported in Table G.2. Standard import penetration measures therefore capture both types of import flows, even though produced and non-produced good flows are uncorrelated.

We also assess the extent to which these distinct measures of import penetration from China are correlated with import penetration measures from NMS, reported in Table G.1. There is a negative and significant relationship between increased import penetration from China versus NMS for all imports (-.09) and for non-produced goods (-.08). Those products in which China gained market share in Denmark are thus different from the ones in which NMS countries grew. In contrast, we document a positive and significant correlation between changes in produced-good import penetration from NMS versus China (0.06). Produced-good import flows therefore seem to be more similar across source countries, consistent with the premise that produced good imports reflect Danish firms' leveraging certain capabilities in particular products across different countries.

To gain insight into the characteristics of produced versus non-produced good imports, we assess how changes in import penetration measures relate to product-level measures of tech worker intensity and price dispersion. We measure the importance of technology workers in the production of a particular product as the share of tech workers used in firms that make that product in 1998. We construct a measure of an HS6 product's price dispersion based on the ratio of the 90th percentile of the product's domestic unit value relative to the 10th percentile of the unit value. This measure is thus a proxy for the potential to differentiate quality within a particular product, as studied by Khandelwal (2010).

Table G.3 presents the correlation coefficients between these product characteristics and changes in import penetration. The top panel shows that although import penetration from NMS increases

[31] This timeframe captures China's WTO accession and the main surge in China's imports to developed countries.

relatively more in tech worker-intensive goods and in goods with more scope for quality differentiation, these relationships are present only for produced-good imports. In contrast, Chinese import penetration increases most in low tech worker-intensive goods, but this pattern is accounted for only by non-produced good imports. Across both China and NMS, it is thus the case that changes in produced good import penetration are higher relative to non-produced good imports for tech worker-intensive goods. These patterns are consistent with the premise that produced good imports occur in goods with more scope for quality differentiation and in which tech workers are relatively more important.

Table H.1: Correlations of import penetration measures within source

	$\Delta ImpPen_{pT}^{NMS}$		$\Delta ImpPen_{pT}^{China}$	
	All	NPG	All	NPG
NPG	0.9664***		0.9974***	
PG	0.2782***	0.022	0.0882***	0.0167

Notes: Table reports correlation coefficients between changes in import penetration measures from 1998 to 2008. Import penetration is defined according to equation (11). All, NPG, and PG correspond to the numerator with all imports, non-produced good imports, and produced good imports in the numerator, respectively.

Table H.2: Correlations of import penetration measures across sources

	All	NPG	PG
NMS vs China	-0.091***	-0.0781***	0.0601***

Notes: Changes in import penetration measures of All imports, non-produced good imports (NPG), and produced good imports (PG) from 1998 to 2008.

Table H.3: Correlations of import penetration measures and product characteristics

NMS	All	NPG	PG
Tech Share$_p$	0.0709*	0.0068	0.1161**
Price Dispersion$_p$	0.1083**	-0.0042	0.1905***
China			
Tech Share$_p$	-0.2004***	-0.1975***	-0.0458
Price Dispersion$_p$	-0.0267	-0.0261	-0.0108

Notes: Table reports correlation coefficients between HS6 product characteristics and changes in import penetration measures of All imports, non-produced good imports (NPG), and produced good imports (PG) from 1998 to 2008. Tech share is the share of tech workers used to produce a product. Price dispersion is the 90-10 ratio of the product's domestic unit values.

I Cleaning occupation codes

The occupation code data require significant cleaning prior to use. First, we follow documentation in Statistics Denmark to distinguish between occupation codes that are most reliable versus those that are likely imputed.[32] In effect, observations for which the pstill variable has 1, 2, 4, or 10 are high quality. Second, we fill in missing occupation codes by assigning a worker to the same occupation if that worker remains in the same firm and is missing occupation information in a particular year.

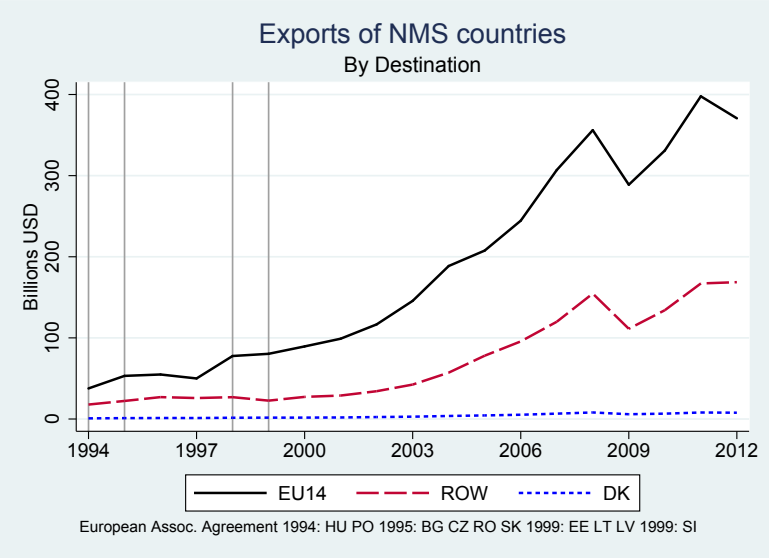
The occupation types are listed in a separate file available here: `http://faculty.tuck.dartmouth.edu/images/uploads/faculty/teresa-fort/occupation_list.pdf`.

[32] See `http://www.dst.dk/da/Statistik/dokumentation/Times/personindkomst/discotyp.aspx` for details.

J Aggregate NMS exports

Here we present exports by NMS countries over time and by region. Figure I.1 shows that Denmark is a relatively small player for NMS countries. Given its small size, we do not expect Danish offshoring decisions to influence NMS ROW export shares.

Figure J.1: Aggregate exports by NMS countries



Notes: Figure presents aggregate exports by destination of the New Member States.