A Data

In this section, we discuss our data sources and data cleaning procedures (Appendix A.1 and A.2). In Appendix A.3, we then compare aggregates computed from our micro data sources to those in publicly available datasets. Much of the discrepancy between the two arises due to the lack of information on informal-economy workers in our micro datasets. Part of the discrepancy is due to the lack of coverage of our firm-level dataset in a few industries: Agriculture, Finance, and Public Administration. In Appendix A.4, we compute the share of employment that is informal in each industry-region cell, then re-compare aggregates from our micro data sources to those in publicly available datasets. In the same appendix, we then describe how we account for the lack of micro data coverage in the Agriculture, Finance, and Public Administration industries. Finally, in Appendix A.5 we discuss how we compute labor flows across industry-by-subsidy region pairs.

A.1 Details on Entrepreneur Information System (EIS)

The Entrepreneur Information System (EIS) is administered by the Ministry of Science, Industry and Technology in Turkey as of 2014. Data from seven public institutions (Ministry of Customs and Trade, Revenue Administration (GIB), Social Security Institution (SGK), Small and Medium Enterprises Development and Support Administration (KOSGEB), Turkish Statistical Institute (TÜİK), Turkish Patent Institute (TPI) and the Scientific and Technological Research Council of Turkey (TÜBİTAK) are brought together in the EIS by the Ministry. In this study, we use the following data sets from the EIS: the "Entrepreneurship Registry Microdata Set," the "Workplace Registry Microdata Set," and the "Balance Sheet Micro Dataset." While calculating the indirect effects and detailed employment effects, we also use the "Declaration-Buying/Selling (BA/BS) Micro Dataset" and the "Employee Micro Dataset." The EIS includes data for most Turkish manufacturing and service companies, but excludes the finance sector. Information on the agriculture sector and public personnel is not included in the EIS.

Table 13 lists the number of firms in our sample by year and industry. There are 212,458 unique firms in our sample, and 1,039,766 firm-year observations. At the beginning of the sample, approximately 69 percent of the firms in our sample are headquartered in Region 1; slightly less than 3 percent of the sample are from Region 6. The number of firms in the sample has grown by 5.8 percent per year, with faster growth in Regions 5 and 6 and slower growth in Region 1. By 2017 and 2018, near the end of the sample, 6 percent of the firms were headquartered in Region 6, 61 percent in Region 1.

Table 13: Firm Counts

Year\Region	1	2	3	4	5	6	Total
2006	33,117	5,440	3,797	2,497	1,568	1,286	47,705
2007	36,150	6,177	4,467	3,192	1,966	1,687	53,639
2008	38,758	6,578	4,912	3,651	2,352	2,161	58,412
2009	36,147	6,457	4,978	3,687	2,440	2,314	56,023
2010	39,386	7,243	5,541	4,200	2,769	2,856	61,995
2011	43,780	8,167	6,324	4,743	3,101	3,206	69,321
2012	47,638	9,215	7,229	5,327	3,562	4,025	76,996
2013	50,962	9,582	7,538	5,266	3,525	4,082	80,955
2014	53,743	10,105	8,066	5,531	3,655	4,542	85,642
2015	57,538	11,223	8,801	5,968	3,967	4,684	92,181
2016	56,891	11,430	8,683	5,872	3,998	4,813	91,687
2017	57,954	11,793	9,155	6,028	4,205	5,300	94,435
2018	58,768	11,868	9,294	6,114	4,250	5,571	95,865
2019	50,674	9,040	6,919	2,450	2,083	3,576	74,910
Total	133,887	25,878	20,366	13,858	9,961	12,879	212,458

A.2 Data Cleaning Procedures

To ensure the soundness of the study, some observations are excluded from the sample following a number of criteria. The data of companies with missing, negative or zero total assets, sales, and long-term and tangible assets are excluded from the analysis. In addition, the data of companies whose short-term and long-term liabilities, current assets, total bank loans, payments, other liabilities and long-term debts are negative are also removed from the sample. Apart from these, the variables with outlier observations are winsorized at 1 percent, 2 percent, or 5 percent, when necessary.

A.3 Auditing the Micro Data

In this section, we evaluate the coverage of the micro datasets listed in Appendix A.1. These firm and worker datasets measure activity only in the formal economy. The micro data additionally exclude most firms in the agriculture, finance, and public administration industries, as well as public firms in the education industry. The EIS data thus may miss a substantial fraction economic activity. Furthermore, the coverage of our micro data may vary with geography (with greater coverage in the larger cities and in the west) and industry (with greater coverage in the non-agricultural sectors of the economy). Our goal, for now, is to gauge the severity of these coverage issues. In Appendix A.4 and A.5, we describe how to impute the extent of informality by industry and subsidy region, then discuss how to account for informality when calibrating our Section 5 model.

We provide two sets of comparisons. In the first, we compare province-level employment in our micro data to its counterpart in aggregate datasets compiled by TürkStat (the Turkish Statistical Institute). In the second comparison, we compare industry-level output and factor shares according to our micro data to aggregate statistics derived from the Socio-Economic Accounts from the World Input-Output Database (WIOD).

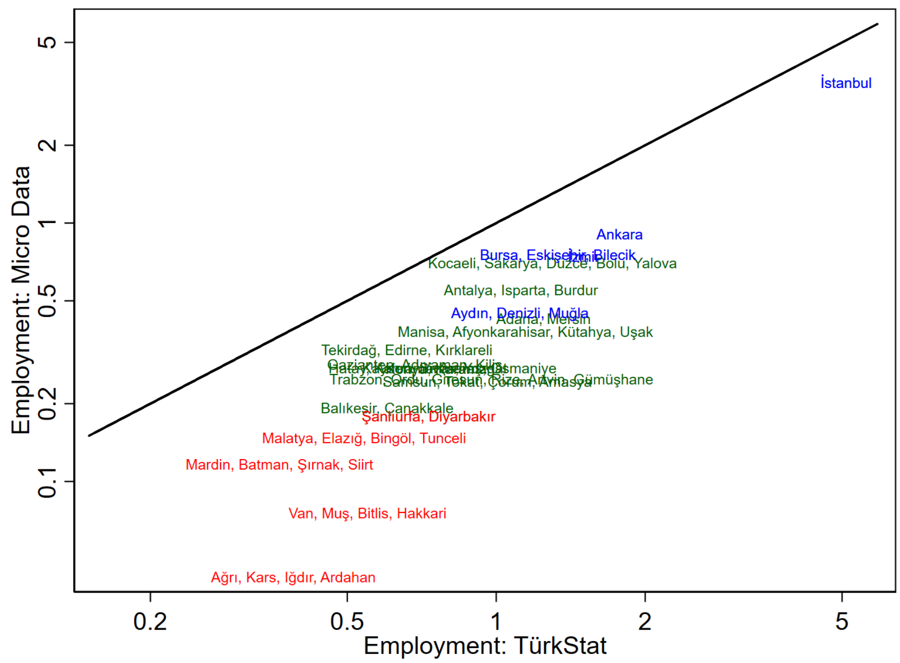

Figure 11: Comparison of Micro to Aggregate Data: Province Employment
Notes: The values on each axis are millions of workers. Groups of provinces overlapping with the least-heavily subsidized Region 1 are colored in blue; groups of provinces overlapping with the most-heavily subsidized Region 6 are colored in red. All other groups of provinces are colored in green.

In our first comparison, we aggregate the total employment among the firms in our micro data, summing across the firms within (groups of) provinces. We compare this employment figure to the number of employed individuals measured in TürkStat. Figure 11 presents this comparison for a single year, in 2014. Since our dataset omits informal-economy workers, the number of workers in our dataset is consistently below that in the aggregate dataset. Furthermore, this relative discrepancy is smaller in the first subsidy region (e.g., Ankara; İstanbul; Bursa, Eskişehir, and Bilecik) than in the sixth subsidy region (e.g., Van, Muş, Bitlis, and Hakkâri; Ağrı, Kars, Iğdır, and Ardahan; and Mardin, Batman, Şırnak, and Siirt).

In our second comparison, we aggregate different output and input measures — total wage compensation, total employment, and total gross output — among the firms in our micro dataset. Using these industry-level measures, we compute, at the industry level, total gross output, total employment, average wages per employee, and the ratio of labor expenditures to gross output. In Figure 12 we compare these four industry-level measures to their corresponding values in the World Input-Output Database. In addition to the two datasets' disparate treatment of informal economy workers, the World Input-Output Database applies a different industry definition relative to that in our micro dataset. For this reason, low concurrence across the two datasets is less of a concern than in Figure 11. With this caveat in mind, the correlations depicted in the four panels of Figure 12 are 0.39 (for gross output), 0.30 (for employment), 0.49 (for average wages), and 0.17 (for the labor share.) The Spearman rank correlations are somewhat higher: 0.57, 0.59, 0.53, and 0.15, respectively. The biggest difference in terms of industries' size is in the agriculture sector: According to the WIOD, the gross output of the agricultural sector was 147.8 billion TL as of 2012. Of this, only 12.0 billion TL are recorded in our micro database. For other industries, the difference is less stark. Overall, there are considerable differences in the output measures across the two data sources.

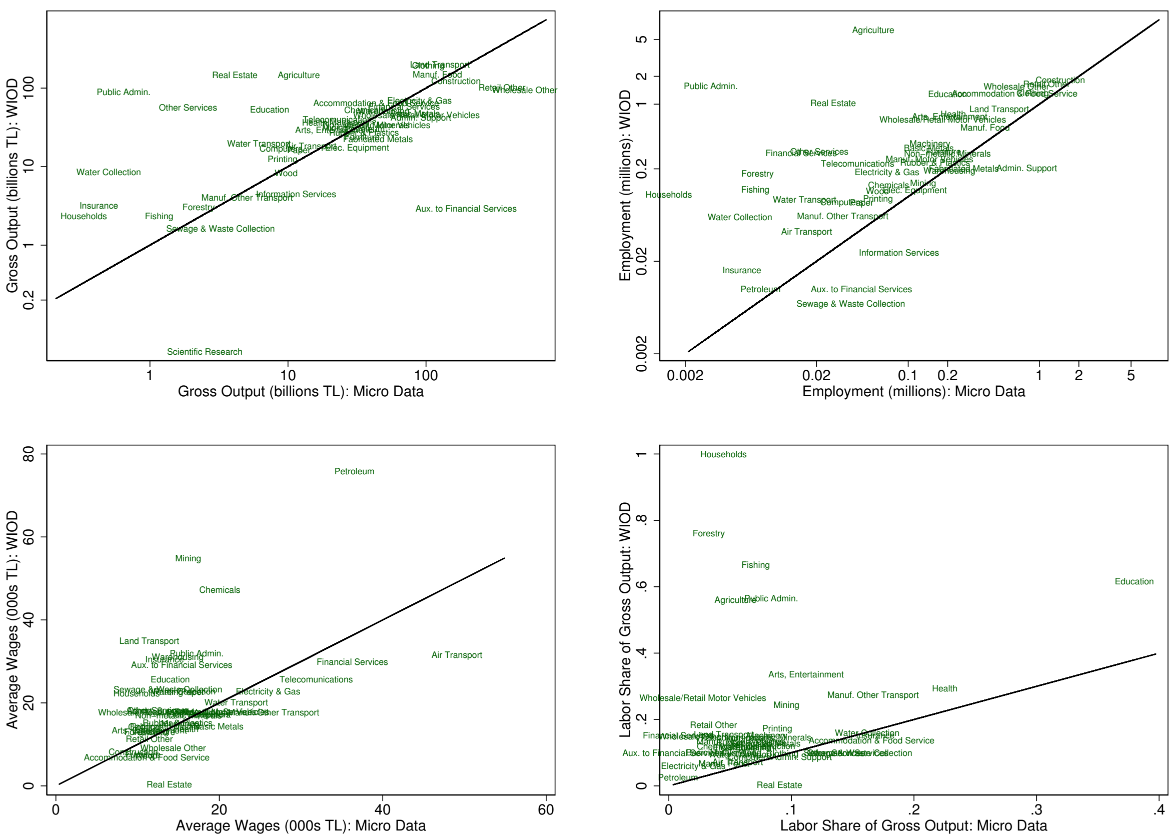

Figure 12: Comparison of Micro to Aggregate Data: Industry Activity
Notes: Values in the top left and bottom left panel are reported in 2010 Turkish Liras.

A.4 Accounting for Informality and Incomplete Data Coverage

In calibrating our aggregate model — in particular when calibrating output and employment by industry and subsidy region, and trade and migration flows across industry-region pairs — we require consistent measures of aggregate activity at the industry-region pair. (Widely available data sources, such as the WIOD, contain measures of economic activity at the industry-by-year level or the province-by-year level. The calibration of our Section 5 model requires information on the latter sets of moments, which we use our EIS data to calibrate.) In the previous subsection, we documented considerable discrepancies between aggregates computed using the EIS micro data and comparable aggregates from publicly available datasets. We hypothesized that part of this discrepancy was due to the fact that the EIS data captures only the formal economy. In addition, part relates to the lack of coverage in the EIS micro data in certain industries: Agriculture, Finance, Insurance, Real Estate, and Public Administration.

In this appendix, drawing on Acar and Carpio (2019), we explain how we estimate informality at the province-industry level. We then reproduce Figures 11 and 12, accounting for the lack of EIS data on the informal economy and, additionally, for incomplete coverage in the industries listed above. The end-result in this section is $\hat{\hat{\varphi}}_{pj,t}$, our estimate of the share of economic activity (in province p and industry j) that the EIS is able to capture.

Accounting for Informality

Acar and Carpio (2019) provide estimates of the share of employment that is formal — by broad sector and by groups of provinces — as of 2017. We reproduce these estimates in Tables 14 and 15. The formal share is lowest in Ağrı, Kars, Iğdır, and Ardahan (32 percent) and highest in Ankara (82 percent). Furthermore, the share of workers in the formal sector is lowest in Agriculture, Forestry and Fishing (17 percent) and highest in Mining (96 percent).

Table 14: Formal Share by Sector

Sector	Formal Share
Agriculture, Forestry, Fishing	17.0%
Mining	96.0%
Manufacturing	83.5%
Services, Transport	73.0%
Construction	64.0%
Wholesale, Retail	72.0%
Accommodation, Food Service	69.0%
Other Services	82.0%

Notes: This table reproduces Figure 25 of Acar and Carpio (2019). Acar and Carpio (2019) provide two estimates of the formal share for manufacturing — 77 percent in low/medium-skilled manufacturing and 90 percent in high-skilled manufacturing — and two estimates of the formal share for services — 69 percent in low/medium-skilled services and 95 percent in high-skilled service. For each sector we take the average of these two numbers.

Table 15: Formal Share by NUTS-2 Region

NUTS-2 Region	Formal Share	NUTS-2 Region	Formal Share
İstanbul	79%	Nevşehir, Aksaray, Kırşehir, Niğde, Kırıkkale	62%
Edirne, Tekirdağ, Kırklareli	67%	Kayseri, Sivas, Yozgat	69%
Balıkesir, Çanakkale	61%	Zonguldak, Karabük, Bartın	56%
İzmir	76%	Kastamonu, Çankırı, Sinop	45%
Denizli, Aydın, Muğla	66%	Samsun, Tokat, Çorum, Amasya	55%
Manisa, Afyonkarahisar, Uşak, Kütahya	61%	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane	49%
Bursa, Eskişehir, Bilecik	77%	Erzurum, Erzincan, Bayburt	52%
Kocaeli, Sakarya, Düzce, Bolu, Yalova	71%	Kars, Ağrı, Iğdır, Ardahan	32%
Ankara	82%	Malatya, Elâzığ, Bingöl, Tunceli	51%
Konya, Karaman	58%	Van, Muş, Bitilis, Hakkâri	37%
Antalya, Isparta, Burdur	68%	Adıyaman, Gaziantep, Kilis	61%
Adana, Mersin	60%	Diyarbakır, Şanlıurfa	38%
Hatay, Kahramanmaraş, Osmaniye	58%	Siirt, Mardin, Batman, Şırnak	60%

Notes: This table reproduces Figure 24 of Acar and Carpio (2019).

In addition Acar and Carpio (2019) present trends in the national economy-wide formality rate. Let $\hat{\varphi}_{p,2017}$ refer to Acar and Carpio (2019)'s estimate of the formal share in 2017 in province p and $\hat{\varphi}_{j,2017}$ refer to the corresponding estimate of the formal share in industry j. Our goal is to impute the formal share in an arbitrary year, for each industry-province pair. Call this object $\hat{\varphi}_{pjt}$.

To compute $\hat{\varphi}_{pnt}$ we follow a two-step procedure. In a first step, using $\bar{\varphi}_t$ to denote the economy-wide formal share in year t, we initially set $\check{\varphi}_{pjt} = \hat{\varphi}_{j,2017} \cdot \frac{\bar{\varphi}_t}{\bar{\varphi}_{2017}} = \hat{\varphi}_{j,2017} \cdot \frac{\bar{\varphi}_t}{0.66}$. This initial variable, $\check{\varphi}_{pjt}$, allows us to match formal shares at the industry level, but does not capture any between-province variation. In a second step, using $\overline{\check{\varphi}}_{pjt}$ to refer to the economy-wide average of $\check{\varphi}_{pjt}$, we replace $\check{\varphi}_{pjt}$ with $\hat{\varphi}_{pjt} = \check{\varphi}_{pjt} \cdot \frac{\hat{\varphi}_{p,t}}{\overline{\check{\varphi}}_{pjt}}$. Figure 13 plots the formal employment share by industry and subsidy region. According to this figure, there is heterogeneity in both dimensions: within each region, formal employment shares are higher in mining and lower in agriculture; and within each industry, formal shares are higher in Region 1 and lower in Region 6.

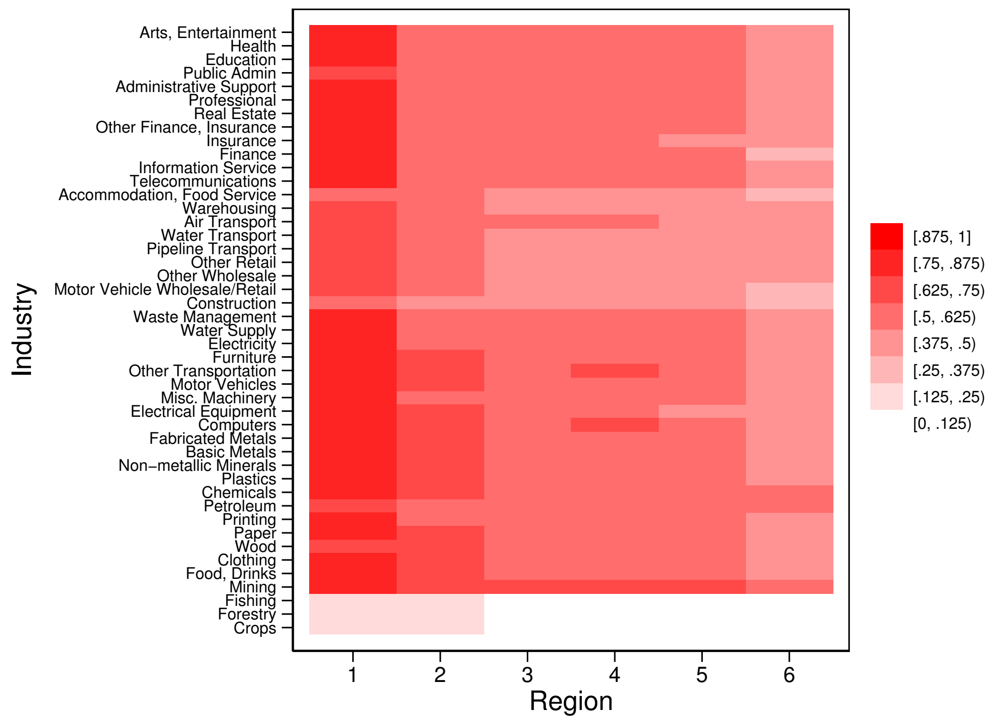

Figure 13: Formal Employment Share by Industry and Region

We reproduce Figure 11 using Acar and Carpio (2019)'s estimates of informality by group of province. For each group of provinces, we divide our measure of the micro data employment by $(1 - \hat{\varphi}_{p,2014}) = \left(1 - \hat{\varphi}_{p,2017} \cdot \frac{0.65}{0.66}\right)$, where the $\frac{0.65}{0.66}$ accounts for the fact that formal share increased by 1 percentage point, from 0.65 to 0.66, between 2014 and 2017.

We plot the informality-adjusted measure of employment in the EIS micro data against employment in the TürkStat data. When adjusted for differences in the share of formal workers by groups of provinces, the discrepancy between the two measures of employment is substantially smaller in Figure 14 than in Figure 11.

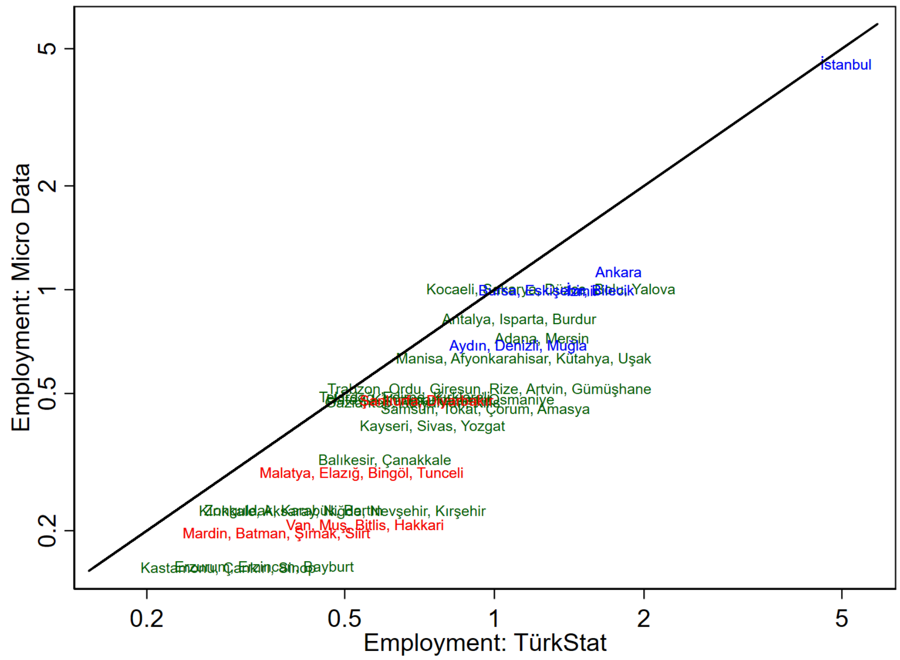

Figure 14: Comparison of Micro to Aggregate Data: Employment by NUTS-2 Geography
Notes: See the notes for Figure 11. In contrast to that figure, we adjust the micro data to account for differences in the share of informality across groups of provinces.

Accounting for Lack of Data in Certain Industries

In addition to informality, the EIS data sample frame only spans certain industries. The EIS aims to measure economic activity in the private sector, excluding as well firms in the Agriculture industry and in the Finance, Insurance, and Real Estate ("F.I.R.E.") sector. In practice, the dataset resulting from the EIS surveys includes a fraction of firms in these industries. Unfortunately, we lack any systematic evidence on the extent to which the EIS dataset under-represents formal-sector firms in these industries. One guide comes in the top two panels of Figure 12: There, we see that the EIS data severely under-represent activity in the Public Administration industry, and substantially (but not quite as severely) under-represent activity in the Agriculture and F.I.R.E. industries. (To be clear, part of these discrepancies are due to the lack of coverage of the informal economy.) We assume that the EIS data cover 25 percent of formal-sector activity in the Public Administration industry, 40 percent of activity in the Agriculture industry, and 40 percent of activity in F.I.R.E. industries. (In unreported exercises, we experiment with alternate assumptions. Our assessment of the regional inequality impacts of the policy are robust to reasonable alternate choices.) Letting $\hat{\hat{\varphi}}_{pjt}$ denote the share of economic activity in province p and industry j that is covered in year t by the micro EIS dataset, we thus set:

$$\begin{aligned}\hat{\hat{\varphi}}_{pj,t} &= \hat{\varphi}_{pjt} \cdot 0.25, \text{ for j=Public Administration;}\\ &= \hat{\varphi}_{pjt} \cdot 0.40, \text{ for j=Agriculture, Finance, Insurance,}\\ &\qquad\qquad \text{Other Finance and Insurance, Real Estate; and}\\ &= \hat{\varphi}_{pjt} \cdot 1.00, \text{ for all other industries.}\end{aligned}$$

Auditing the Micro Data after Adjusting for Informality and Missing Data

Figure 15 presents our estimates of $\hat{\hat{\varphi}}_{pjt}$ for t =2012. For all j with the exception of Agriculture, Finance, Insurance, Other Finance and Insurance, Real Estate, and Public Administration, the values displayed in Figure 15 equal those in Figure 13. For these 40 industries, $\hat{\hat{\varphi}}_{pjt} < 1$ only because a share of the firms within these industries are informal. For the remaining five industries, $\hat{\hat{\varphi}}_{pjt} < \hat{\varphi}_{pjt}$.

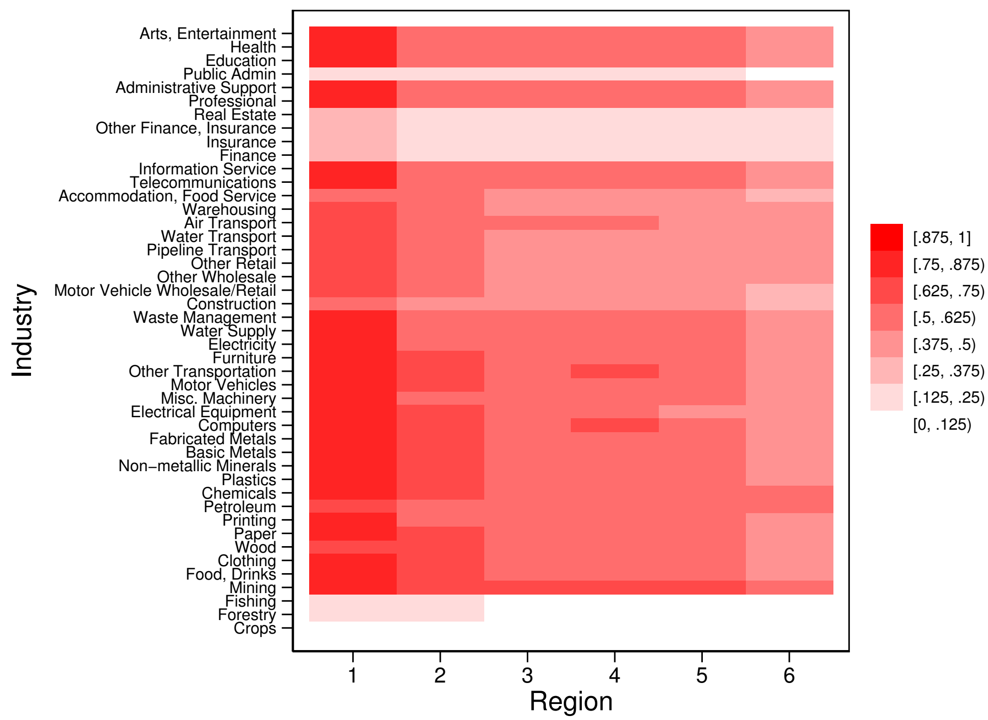

Figure 15: Share of Activity Represented In EIS Data

Figure 16 now compares sales and employment, according to the WIOD and the EIS. In contrast to Figure 12, our EIS measures are scaled up by $1/\hat{\hat{\varphi}}_{\cdot,j,2012}$ (that is, $\hat{\hat{\varphi}}_{pj,2012}$ as averaged across provinces, p). Overall, the two sales and employment measures' are more aligned with one another with this adjustment. The (WIOD-sales-weighted) correlation of log sales in the two data sources is 0.45 (compared to 0.30 in the top left panel of Figure 16). The (WIOD-employment-weighted) correlation of log employment in the two data sources is 0.53 (as compared to 0.28 in the top right panel of Figure 12).

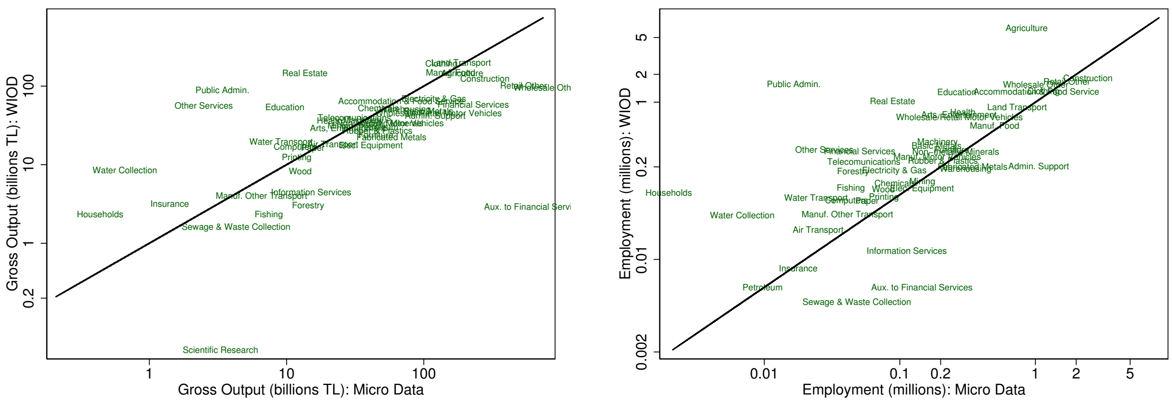

Figure 16: Comparison of Micro to Aggregate Data: Industry Activity
Notes: Values in the top left and bottom left panel are reported in 2010 Turkish Liras.

In sum, the EIS sample frame does not span the entire economy. First, the EIS sample excludes firms in the informal economy. In addition, for firms in certain industries, the EIS dataset does not measure activity even for all formal-economy firms. Accounting for these differences in the extent to which the EIS dataset misses activity within firms in individual province-industry pairs, the EIS data align reasonably well with existing estimates of industries' (or geographies') employment and gross output.

A.5 Imputing Employment Flows

In this section we discuss the construction of Figure 3. This figure describes flows of workers across subsidy region-industry cells across subsequent years. In computing these flows, we face two challenges. First, our micro data do not record transitions into or out of non-employment. (The data track individuals across time, permitting measurement of entry to and exit from firms within our dataset. However, since the dataset does not cover informal-sector firms, and additionally misses most firms in Agriculture, Finance, Insurance, Real Estate, and Public Administration industries, this dataset does not allow one to distinguish whether an individual is not-employed, employed in an informal-sector industry, or employed in a firm missed by our dataset.) Second, to maintain confidentiality, we were permitted by the Ministry of Industry and Technology to disclose flows of workers in slightly aggregated industries.[44] Below, let j denote one of the 45 industries in our baseline sample, and $\tilde{j}$ one of the more aggregated 13 sectors. Let $j = 0$ or $\tilde{j}$=0 denote non-employment. Our goal is to compute transition probabilities, $\mu^{nj,ik}$, giving the share of individuals who transition from industry-region pair nj to industry-region pair ik across two subsequent years. Below, use $\mathfrak{m}^{n\widetilde{j},i\widetilde{k}}$ to refer to the raw data on the number of transitions among broad-sector-by-region pairs.

In a first step, we compute the vector of the share of workers in each region-industry (n-j) pair. From Eurostat (2021a,b), we retrieve employment-to-population ratios and population (among individuals who are 25 to 64 years old) by NUTS-2 region. We aggregate NUTS-2 regions' employment-to-population ratios up to our 6-subsidy-region categorization, weighting NUTS-2 regions by population. This yields an expression for the employment-to-population by year and subsidy region. Call this object $\bar{l}_{nt}$. From the EIS, we observe the share of formal-sector national employment in region n and industry j . Call this object l_{njt}. To compute the share of total employment in region n and industry j, we divide l_{njt} by $\hat{\hat{\varphi}}_{pj,t}$ (the of subsidy region n and industry j that is captured by the EIS data; see Appendix A.4.) Call the resulting object $\widehat{l}_{njt}$. Given this, we can compute the share of the adult population belonging to region-industry pair n-j as

$$
\begin{aligned}
\widetilde{l}_{njt} &= \bar{l}_{nt} && \text{for } j = 0, \text{ and} \\
&= \left(1 - \bar{l}_{nt}\right) \hat{\hat{\varphi}}_{pj,t} && \text{for } j = \{1, ...J\}.
\end{aligned}
$$

In a second step, we account for the fact the flows of individuals across sectors and regions omits workers in firms that are not covered in our dataset. We scale up $\mathfrak{m}^{n\widetilde{j},i\widetilde{k}}$ by $\hat{\hat{\varphi}}_{n\widetilde{j}t}$ where $\widetilde{j}$ is the broad sector corresponding to industry j: ${\mu_t}^{n\widetilde{j},i\widetilde{k}} \equiv \mathfrak{m}^{n\widetilde{j},i\widetilde{k}}/\hat{\hat{\varphi}}_{n\widetilde{j}t}$.

In a third step, we combine information on $\widetilde{l}_{njt}$ and information on flows of formal-sector workers across region-broad-sector pairs to form our estimates of ${\mu_t}^{nj,ik}$. We consider three cases: whether (a) $n = i$ and $j = k$; whether (b) $n = i$ and $j \neq k$, but industries j and

[44] When disclosing the data, we were asked to aggregate crops (NACE= a01), forestry (NACE=a02), finishing (NACE=a03), and Mining (NACE=b) into one sector; food, beverage, and tobacco manufacturing (NACE=c10-c12) and textile, apparel, and leather manufacturing (c13-c15) into a second sector; and all other manufacturing (NACE c16-c33) into a third sector. We group electricity, gas, steam, and air conditioning (NACE=e) and construction (NACE=f) into a fourth sector; wholesale and retail (NACE=g) into a fifth sector; transportation and storage (NACE=h) into a sixth sector; accommodation (NACE=i) into a seventh sector; information and communication (NACE=j) into an eighth sector; finance, insurance, and real estate (NACE=k and NACE=l) into a ninth sector; professional, scientific, and technical activities (NACE=m) and administrative and support service activities (NACE=n) into a tenth sector; public administration (NACE=o) into an eleventh sector; education (NACE=p) into a twelfth sector; and human health and social work (NACE=q), arts, entertainment, and recreation (NACE=r), and other services (NACE=q) into a thirteenth sector.

k belong to the same broad sector; or (c) all other cases (either $n \neq i$, or j and k belong to different broad sectors). In case (c), we define ${\mu_t}^{nj,ik} \propto \widetilde{l}_{ikt}{\mu_t}^{n\widetilde{j},i\widetilde{k}}$ where $\sum_{k \in \widetilde{k}} {\mu_t}^{nj,ik} = {\mu_t}^{n\widetilde{j},i\widetilde{k}}$. That is, within each destination sector, the probability of transitioning to a particular industry is proportional to the employment share of that industry. We could have potentially applied this same definition for cases (a) and (b), as well. However, this would have led us to miss a key feature of transition probabilities documented elsewhere, namely that individuals are substantially more likely to stay within the same industry-region pair across subsequent years. For case (b), we set ${\mu_t}^{nj,ik}$ as the 75[th] percentile among the ${\mu_t}^{nj,i'k'}$ for which $i' = n$ and $\widetilde{j} \neq \widetilde{k}$. This definition allows for relatively high values for within-industry, within-broad-sector flows. For case (a), we set ${\mu_t}^{nj,ik}$ as the residual probability.

In a fourth step, we ensure that our μs are consistent with aggregate domestic migration data. The EIS data track individuals across industries and subsidy regions. In principle, these flows broadly align with aggregate migration flows in publicly available data. But, due to the incomplete coverage in the EIS data, there are some modest discrepancies between the two data sources. We compute the number of working-age domestic migrants using data from Turkish Statistical Institute (2022b). This dataset provides the number of migrants across province-pairs. Since we seek to track the number of migrants of individuals who are working age, we multiply these migrant flows by the share of the population that is between 25 to 64, using data from Turkish Statistical Institute (2022c). We sum up across the provinces within each origin and destination subsidy region, resulting in $\mathfrak{m}_{ni,t}$, the share of working-age region i individuals who migrate to region n in year t. We re-scale our flows of individuals across sectors and regions using $\mathfrak{m}_{ni,t}$ so that — for each source and destination region, n, i — the average (across source industries j) of ${\mu_t}^{nj,ik}$ equals $\mathfrak{m}_{ni,t}$.

Table 16 summarizes transition probabilities for a single year in our sample, 2012. The takeaway from this table is that flows are considerably higher when $i = n$ and $j = k$, somewhat lower when either $i = n$ or $j = k$, and lower still when neither $i = n$ nor $j = k$. Approximately 58.4 percent of individuals stay in their same industry-subsidy region pair across years; 40.0 percent($\approx 0.0089 \cdot \frac{12{,}420}{276}$) switch industries but not regions; and 1.6 percent switch subsidy regions.[45]

[45] Flows into and out of non-employment (which is one of our "industries") represent a large majority of the between-industry flows. Excluding these, the share of workers who switch industries from one year to the next is approximately 19 percent.

Table 16: Worker Flows Within and Across Industry-Region Pairs

Type of Flow	N	Mean	Percentile 25	50	75	90
Same Industry, Same Region ($i = n, j = k$)	276	0.5840	0.4409	0.6158	0.6813	0.6981
Different Industry, Same Region ($i = n, j \neq k$)	12,420	0.0089	0.0005	0.0019	0.0055	0.0169
Same Industry, Different Region ($i \neq n, j = k$)	1,380	0.0005	0.0000	0.0001	0.0006	0.0014
Different Industry, Different Region ($i \neq n, j \neq k$)	62,100	0.0001	0.0000	0.0000	0.0000	0.0001

B Turkish Investment and Wage Subsidies

This appendix provides additional detail on the 2012 subsidy program.

B.1 Subsidized Industries

According to the 2012 subsidy program, only projects within certain industries are eligible. The Turkish government provides a list of industries receiving subsidies at: `https://www.resmigazete.gov.tr/eskiler/2012/06/20120619-1-2.xls` . The column labeled "US-97 Kodu," within the "2A_Sektörler" worksheet refers to the NACE 1.1 code. The second worksheet, labeled "2B_Iller," provides a mapping between provinces and subsidized industries. In this section, we translate and summarize the key elements of these two Excel worksheets.

Table 17: Mapping Between Turkish Government Industries and NACE Industries

Sector	NACE 2 Industries	Sector	NACE 2 Industries
1	1.41, 1.42, 1.43, 1.44, 1.45, 1.47	26	23
2	3.22	27	24.54
3	10	28	25
4	13	29	25
5	14	30	28
6	15	31	23
7	15.11	32	28.23
8	15.12, 15.20	33	26, 27
9	16	34	26.30
10	17	35	32.50
11	20	36	29
12	20.15	37	33.16
13	20.20	38	30.91, 30.92
14	21.20	39	31, 32.20, 32.30, 32.40, 32.99, 33.20
15	20.42	40	31.09
16	20.51	41	55.10, 55.20, 55.90
17	22.11	42	55.90
18	23	43	52.10
19	23	44	55.10
20	23	45	85
21	23	46	86.10, 86.20, 86.90, 87.20, 87.30, 87.90
22	23	47	
23	23	48	
24	23	49	
25	23	50	

In Table 17, we provide a mapping between the Turkish government's numbering of subsidized sectors and NACE (version 2) industry codes.

In Table 18, we provide a list of subsidized industries and Turkish provinces.

Table 18: Lists of Subsidized Industries By Province

Code	Province	List of Subsidized Industries
1	Adana	1, 2, 3, 4, 8, 9, 10, 11, 20, 27, 28, 30, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43, 44, 45, 46, 47, 48, 50
2	Adıyaman	1, 2, 3, 4, 5, 8, 9, 10, 11, 18, 27, 28, 30, 32, 33, 34, 35, 36, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
3	Afyonkarahisar	1, 2, 3, 4, 5, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
4	Ağrı	1 through 50
68	Aksaray	1, 2, 3, 4, 5, 9, 10, 11, 26, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 48, 50
5	Amasya	1, 2, 3, 4, 5, 8, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
6	Ankara	1, 2, 3, 4, 8, 9, 10, 14, 22, 27, 30, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43, 44, 45, 46, 48, 50
7	Antalya	1, 2, 3, 9, 10, 13, 14, 15, 24, 27, 30, 32, 33, 34, 35, 37, 39, 41, 42, 43, 44, 45, 46, 48, 50
75	Ardahan	1 through 50
8	Artvin	1, 2, 3, 4, 5, 8, 9, 10, 14, 25, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
9	Aydın	1, 2, 3, 4, 9, 10, 20, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 50
10	Balıkesir	1, 2, 3, 5, 6, 9, 10, 16, 20, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 48, 50
74	Bartın	1, 2, 3, 5, 8, 9, 10, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
72	Batman	1 through 50
69	Bayburt	1, 2, 3, 4, 5, 8, 9, 10, 14, 19, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
11	Bilecik	1, 2, 3, 4, 5, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
12	Bingöl	1 through 50
13	Bitlis	1 through 50
14	Bolu	1, 2, 3, 4, 6, 9, 10, 11, 21, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 46, 48, 50

Notes: Continued on the following page.

Table 18 (Continued): Lists of Subsidized Industries By Province

Code	Province	List of Subsidized Industries
15	Burdur	1, 2, 3, 4, 5, 8, 9, 10, 13, 14, 15, 24, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 48, 50
16	Bursa	1, 2, 3, 4, 6, 9, 10, 14, 20, 27, 29, 30, 32, 33, 34, 35, 36, 39, 41, 42, 43, 44, 45, 46, 47, 48, 50
17	Çanakkale	1, 2, 3, 9, 10, 20, 27, 28, 30, 32, 33, 34, 35, 39, 41, 42, 43, 44, 45, 46, 48, 49, 50
18	Çankırı	1, 2, 3, 4, 5, 8, 9, 10, 14, 16, 17, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50
19	Çorum	1, 2, 3, 4, 5, 8, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
20	Denizli	1, 2, 3, 4, 6, 9, 10, 20, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 50
21	Diyarbakır	1 through 50
81	Düzce	1, 2, 3, 4, 5, 9, 10, 11, 21, 27, 28, 30, 32, 33, 34, 35, 36, 38, 40, 41, 42, 43, 44, 45, 46, 48, 50
22	Edirne	1, 2, 3, 4, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 50
23	Elâzığ	1, 2, 3, 4, 5, 8, 9, 10, 14, 25, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
24	Erzincan	1, 2, 3, 4, 5, 8, 9, 10, 14, 19, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
25	Erzurum	1, 2, 3, 4, 5, 8, 9, 10, 14, 19, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
26	Eskişehir	1, 2, 3, 4, 9, 10, 14, 20, 27, 29, 30, 32, 33, 34, 35, 36, 39, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50
27	Gaziantep	1, 2, 3, 4, 5, 8, 9, 10, 11, 18, 27, 28, 30, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
28	Giresun	1, 2, 3, 4, 5, 8, 9, 10, 14, 19, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
29	Gümüşhane	1, 2, 3, 4, 5, 8, 9, 10, 14, 19, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
30	Hakkâri	1 through 50
31	Hatay	1, 2, 3, 4, 5, 8, 9, 10, 11, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
76	Iğdır	1 through 50
32	Isparta	1, 2, 3, 4, 6, 9, 10, 12, 13, 14, 15, 24, 27, 28, 30, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43, 44, 45, 46, 48, 50
34	İstanbul	7, 14, 31, 32, 34, 35, 42, 45, 46, 48
35	İzmir	1, 2, 3, 8, 9, 10, 11, 23, 27, 30, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, 43, 44, 45, 46, 48, 50
46	Kahramanmaraş	1, 2, 3, 4, 5, 8, 9, 10, 11, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50

Notes: Continued on the following page.

Table 18 (Continued): Lists of Subsidized Industries By Province

Code	Province	List of Subsidized Industries
78	Karabük	1, 2, 3, 5, 8, 9, 10, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
70	Karaman	1, 2, 3, 5, 8, 9, 10, 11, 24, 27, 28, 30, 32, 33, 34, 35, 36, 38, 40, 41, 42, 43, 44, 45, 46, 48, 50
36	Kars	1 through 50
37	Kastamonu	1, 2, 3, 4, 5, 8, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
38	Kayseri	1, 2, 3, 4, 9, 10, 11, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
79	Kilis	1, 2, 3, 4, 5, 8, 9, 10, 11, 18, 27, 28, 30, 32, 33, 34, 35, 36, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
71	Kırıkkale	1, 2, 3, 4, 5, 9, 10, 11, 17, 26, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 48, 50
39	Kırklareli	1, 2, 3, 4, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 50
40	Kırşehir	1, 2, 3, 4, 5, 9, 10, 11, 17, 26, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 48, 50
41	Kocaeli	1, 2, 3, 4, 9, 10, 11, 17, 21, 27, 30, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 46, 48, 50
42	Konya	1, 2, 3, 8, 9, 10, 11, 24, 27, 28, 30, 32, 33, 34, 35, 36, 38, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50
43	Kütahya	1, 2, 3, 4, 5, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50
44	Malatya	1, 2, 3, 4, 5, 8, 9, 10, 14, 25, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
45	Manisa	1, 2, 3, 4, 5, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50
47	Mardin	1 through 50
33	Mersin	1, 2, 3, 4, 5, 8, 9, 10, 11, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
48	Muğla	1, 2, 3, 4, 9, 10, 20, 27, 30, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50
49	Muş	1 through 50
50	Nevşehir	1, 2, 3, 4, 5, 9, 10, 11, 17, 26, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 48, 50
51	Niğde	1, 2, 3, 4, 5, 6, 9, 10, 11, 26, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 48, 50
52	Ordu	1, 2, 3, 4, 5, 8, 9, 10, 14, 19, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
80	Osmaniye	1, 2, 3, 4, 5, 8, 9, 10, 11, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50

Notes: Continued on the following page.

Table 18 (Continued): Lists of Subsidized Industries By Province

Code	Province	List of Subsidized Industries
53	Rize	1, 2, 3, 4, 5, 8, 9, 10, 14, 25, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
54	Sakarya	1, 2, 3, 4, 9, 10, 11, 21, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 46, 48, 50
55	Samsun	1, 2, 3, 4, 5, 8, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 37, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
56	Şanlıurfa	1 through 50
57	Siirt	1, 2, 3, 4, 5, 8, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50
58	Sinop	1, 2, 3, 4, 5, 9, 10, 11, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50
63	Sivas	1 through 50
73	Şırnak	1 through 50
59	Tekirdağ	1, 2, 3, 4, 6, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 50
60	Tokat	1, 2, 3, 4, 5, 8, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
61	Trabzon	1, 2, 3, 4, 5, 8, 9, 10, 14, 25, 27, 28, 30, 32, 33, 34, 35, 37, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
62	Tunceli	1, 2, 3, 4, 5, 8, 9, 10, 14, 25, 27, 28, 30, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
64	Uşak	1, 2, 3, 4, 5, 6, 9, 10, 14, 20, 27, 28, 30, 32, 33, 34, 35, 36, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
65	Van	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31
77	Yalova	1, 2, 3, 4, 9, 10, 11, 21, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 46, 48, 50
66	Yozgat	1, 2, 3, 4, 5, 9, 10, 11, 19, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50
67	Zonguldak	1, 2, 3, 5, 8, 9, 10, 20, 27, 28, 30, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50

Notes: This table provides the correspondence between provinces and subsidized industries. For the correspondence between these 50 industries and NACE 2 codes see Table 17.

B.2 Criteria for Obtaining a Regional Investment Subsidy Certificate

The largest two investment subsidy programs in Turkey are "Regional Investments Subsidies" and "General Investment Subsidies." The latter program predates the 2012 reforms, and mainly provides VAT and customs duty exemptions for investments regardless of the region in which the firm operates. The Regional Investment Subsidy elements vary across regions, and entail eight different support elements. Among these, the VAT exemption, customs tax exemption, corporate tax credit, insurance premium employer share support, and interest expense support are granted to all complying investments to varying degrees across regions, while income tax withholding support and employee's social security premium support are provided only in the sixth region. The distribution of subsidy elements by regions is shown in Table 19.

Table 19: Support Elements of the Regional Investment Subsidy Programs

<table>
<tr><td colspan="3"></td><td colspan="6">Regions</td></tr>
<tr><td colspan="3">Support Elements</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td colspan="3">VAT exemption</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="3">Customs duty exemption</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td rowspan="3">Corporate tax deductions</td><td rowspan="2">Investment tax credit rate (ITC)</td><td>Non-OIZ</td><td>15</td><td>20</td><td>25</td><td>30</td><td>40</td><td>50</td></tr>
<tr><td>OIZ</td><td>20</td><td>25</td><td>30</td><td>40</td><td>50</td><td>55</td></tr>
<tr><td colspan="2">Deduction rate</td><td>50</td><td>55</td><td>60</td><td>70</td><td>80</td><td>90</td></tr>
<tr><td colspan="3">Employer's national insurance contribution support (years)</td><td>2</td><td>3</td><td>5</td><td>6</td><td>7</td><td>10</td></tr>
<tr><td rowspan="3">Interest expense support</td><td colspan="2">TL loan</td><td rowspan="3">No</td><td rowspan="3">No</td><td>3pp</td><td>4pp</td><td>5pp</td><td>7pp</td></tr>
<tr><td colspan="2">FX loan</td><td>1pp</td><td>1pp</td><td>2pp</td><td>2pp</td></tr>
<tr><td colspan="2">Cap (,000 TL)</td><td>500</td><td>600</td><td>700</td><td>900</td></tr>
<tr><td colspan="3">Employee's national insurance contribution support</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>10 years</td></tr>
<tr><td colspan="3">Income tax withholding support</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>10 years</td></tr>
</table>

Notes: OIZ refers to an Organized Industrial Zone.

The most important support elements in regional investment subsidies are the corporate tax credit provided by the investment tax credit (ITC), and social security insurance premium supports. How the corporate tax discount rate and investment contribution rate work is explained with the following example: Let's assume that ABC company is in Region 4 and plans to make an investment of 2,000,000 TL. Also, the annual corporate tax base of the company is 500,000 TL, on average. With the usual corporate tax rate, the company should pay 110,000 TL as corporate tax. In this case, where the investment tax credit rate is 30 percent, the tax deduction rate is 70 percent. The total tax credit amount is initially 600,000 (2,000,000×0.3) TL. The company pays 30 percent of its tax debt for the current year, that is, 33,000 TL. When 77,000 TL of tax credit is deducted from 600,000 TL, 523,000 TL will be transferred to futures years. The company continues to deduct 70 percent of the corporate tax bill from the remaining 523,000 TL. If the same real income and tax levels are maintained in the following years, the company depletes the tax credit in approximately 8 years.

B.3 Subsidy Expenditures

In this appendix, we provide estimates on government outlays of two of the main components of the Turkish subsidy program: those related to investment tax credits and those related to employment.[46]

Table 20 presents our estimates of Turkish government expenditures via investment tax credits. To compute this table, we first multiply the total fixed investment with the investment tax credit rate that each firm receives. We then sum across firms in each subsidy region for subsidy documents opened in each year. According to this table, expenditures on investment tax credits were 2.7 billion TL in 2012, increasing to 7.1 billion in 2019. Overall, investment tax credits were concentrated evenly distributed across the six subsidy regions. Regions 1 and 2 had the most firms and economic activity, but lower subsidization rates. Regions 5 and 6 had fewer firms (and, for Region 6, an even smaller share of firms in eligible industries) but greater subsidization rates.

Table 20: Expenditures on Investment Tax Credits

	2012	2013	2014	2015	2016	2017	2018	2019	Total
Region 1	225.5	407.6	320.9	199.7	250.2	1,160.0	1,560.0	1,582.0	5,705.8
Region 2	261.9	887.8	484.3	1,039.4	425.6	793.3	1,450.1	1,364.0	6,706.5
Region 3	581.3	779.0	672.6	513.1	512.6	993.0	1,448.0	1,311.5	6,811.2
Region 4	319.9	525.3	480.4	491.9	389.9	950.2	786.1	1,025.8	4,969.5
Region 5	662.2	740.8	392.7	560.6	496.4	816.0	952.4	669.8	5,290.9
Region 6	611.6	1,257.9	555.6	577.1	436.0	1,016.7	873.5	1,151.2	6,479.5
Total	2,662.4	4,598.5	2,906.4	3,381.7	2,510.8	5,729.1	7,070.1	7,104.3	35,963.4

Notes: Values are millions of 2010 TL.

Table 21 reports expenditures on employment subsidies. Translating the number of years (call this yrs_r) of social security support — the variable indicating the level of employment subsidy generosity in each region — to government expenditures requires a simple calculation.[47] In contrast to Table 20, Region 6 received the greatest share of employment subsidies.

[46] Government expenditures on customs duties rebates and interest rate support represent a much smaller share of the total expenditures related to the 2012 subsidy program.

[47] Mandated social security payments are paid both by the employer and by the employee. Those paid by the employer are equal to 15.5 percent of the national minimum wage, while those paid by the employee are 19 percent of the national minimum wage. Subsidized firms in all regions receive support for the employer-mandated payment, while those projects in Region 6 additionally receive support for the employee contribution. For each firm (with employment e_f) headquartered in Regions 1 through 5, we compute the employment subsidies received as $sub_f = e_f \cdot 0.155 \cdot mw_t \cdot \frac{1.05^{yrs_r - 1}}{0.05}$. For firms in Region 6, we compute the subsidy received as $sub_f = e_f \cdot (0.155 + 0.19) \cdot mw_t \cdot \frac{1.05^{yrs_r - 1}}{0.05}$. In other words, we compute the present-discounted subsidies (discounting at a rate of 5 percent per year over the years over which the subsidies will be received) in proportion to the firm's employment and the national minimum wage at the time at which the subsidy was received. To compute the total subsidies received within each region and year, we sum sub_f across all firms who received a subsidy that year.

This reflects both the increased statutory generosity — not only employer-mandated but also employee-mandated social security payments are subsidized in this region — and the fact that mandated social security payments are tied to the *national* minimum wage (which has an outsize effect in the low-wage Region 6).

Combining the two subsidy items and summing over 2012 to 2019, the national government spent approximately 56.6 billion TL on investment tax credits and reduced social security payments, with approximately 64 percent of these subsidies taking the form of investment tax credits. Annual expenditures more than doubled over the 2012 to 2019 period, going from 7.7 billion TL to 15.9 billion TL. Over the period, the regional composition of subsidy expenditures shifted from the high-subsidy to low-subsidy regions. Regions 5 and 6 received 51.4 percent of national government outlays in 2012 and 38.3 percent in 2019, while Region 1 received 9.3 percent in 2012 and 17.5 percent in 2019.

Table 21: Expenditures on Employment Subsidies

	2012	2013	2014	2015	2016	2017	2018	2019	Total
Region 1	167.9	233.4	313.9	163.0	134.9	358.5	351.0	292.7	2,015.3
Region 2	110.4	231.4	160.2	178.3	116.2	229.2	239.5	230.7	1,495.9
Region 3	240.3	260.3	296.5	175.2	149.5	232.6	279.5	214.1	1,848.0
Region 4	153.7	276.0	157.0	138.6	153.3	341.3	607.8	623.8	2,451.6
Region 5	267.7	497.7	395.5	275.6	289.2	556.4	623.4	494.2	3,399.8
Region 6	635.2	1,343.6	754.0	822.7	895.2	1,502.6	1,721.7	1,753.5	9,428.4
Total	1,575.2	2,842.3	2,077.1	1,753.3	1,738.4	3,220.7	3,823.0	3,609.0	20,639.0

Notes: Values are millions of 2010 TL.

C Production Function Estimates

In this section, we present our production function estimates.

For each 2-digit NACE industry in our sample, we estimate a value-added production function, with labor and capital stocks as the two inputs. We use the firm's wage-bill as the measure of labor inputs and the real value of the capital stock (computed from annual data on capital investment expenditures), using a perpetual inventory method, as the measure of the capital input. We estimate the parameters of industries' production functions using the method introduced by Ackerberg et al. (2015), implementing the STATA command developed by Rovigatti and Mollisi (2016). We assume that labor is free to vary intra-period, use the lag of investment and intermediate input purchases as proxy variables.[48]

[48] While we do not present estimated production function parameters under alternate methodological choices, we show in Section D.2 that the impact of subsidization on firm productivity is robust to varying the set of proxy variables or simply to defining productivity as value added per worker.

To estimate productivity, we require measures of firms' real capital stocks. Unfortunately, because of sizable inflation rates before our sample, the reported book values of capital that exist within the EIS dataset are not reliable. Instead, we compute capital stocks using a perpetual inventory method type procedure. We follow, as closely as possible, the methods outlined in the OECD Manual of Measurement of Capital Stocks, Consumption of Fixed Capital and Capital Services.[49] We define firms' real capital stocks iteratively:

$$K_{f,t+1} = K_{ut} \cdot (1-\delta) + \frac{\Delta PPE_{f,t}}{P_t},$$

where $\Delta PPE_{f,t}/P_t$ is the real investment by firm t, and δ is the depreciation rate (which we set to 0.0.83). To apply this equation, we need to compute the initial-period capital stocks. Assuming that firms are near a balanced growth path (whereby investment is growing by 4 percent per year) in their first few years of the sample, we can compute the initial-period capital stocks based on the average investment levels in the first few years of the sample:

$$\begin{aligned} K_{f,2006} &= \sum_{\tau=-\infty}^{2005} \frac{\Delta PPE_{f,\tau}}{P_\tau} \cdot (1-\delta)^{2006-\tau} \\ &= \sum_{\tau=-\infty}^{2005} \frac{\overline{\Delta PPE_f}}{P} \cdot (1-0.04)^{2006-\tau} \cdot (1-\delta)^{2006-\tau} \\ &= \frac{\overline{\Delta PPE_f}}{P} \cdot \frac{1}{1-(1-0.04)(1-\delta)}, \end{aligned}$$

where $\frac{\overline{\Delta PPE_f}}{P}$ equals the average real investment in the first five years of the sample. (The second equation follows from the first under the assumption that pre-2006 investment equals a 4-percent deflated average of investment in the first five years of the sample.)

With measures of real capital stocks in hand, we are able to estimate real value added production functions. Table 22 presents our estimated production function parameters for the ten industries with the greatest number of observations. (Estimates for the other 76 industries are available on request.) For the median 2-digit industry in our sample, the sum of the coefficients on capital and labor equals 1.06, consistent with slightly increasing returns to scale. The coefficient on capital is approximately one-tenth of that of labor.

[49] See `https://www.oecd.org/sdd/na/1876369.pdf`.

Table 22: Production Function Estimates

	Wage-Bill		Capital			
Industry	$\hat{\beta}$	S.E	$\hat{\beta}$	S.E	Count	Firms
10	0.860	(0.000)	0.205	(0.000)	33,747	5,919
13	0.926	(0.000)	0.116	(0.000)	33,631	5,924
14	0.930	(0.000)	0.100	(0.000)	45,881	10,007
25	0.911	(0.000)	0.143	(0.000)	28,763	6,042
41	0.927	(0.000)	0.0802	(0.002)	70,475	25,968
46	0.954	(0.000)	0.145	(0.000)	93,885	23,515
47	0.847	(0.000)	0.148	(0.000)	69,791	17,030
49	0.933	(0.000)	0.091	(0.000)	31,156	7,778
56	0.942	(0.000)	0.083	(0.000)	38,679	9,773
85	1.003	(0.001)	0.055	(0.005)	26,172	5,949

D Sensitivity Analysis Related to Section 4 and 5

In this section, we collect sensitivity analyses and ancillary plots, complementing the material in Section 4 and 5.

D.1 Sensitivity Analysis Related to Section 4.2

This section considers the sensitivity of the relationship between industry-province level subsidization and economic activity. To preview, under most but not quite all of these sensitivity analyses, we continue to find that greater and more generous subsidies lead to increased economic activity.

In Table 5 we analyzed the relationship between revenues and subsidization at the industry-province level. In Table 23, we re-estimate Equation 1, weighting observations according to the average number of firms in the industry-province pair over the sample. Overall, while there are exceptions (columns 3 and 4), estimates of the relationship between subsidization and revenues are somewhat smaller than in the unweighted specifications. Yet, as in Table 5, the relationship is positive and statistically significant in most specifications.

Table 23: Industry-Province Level Observations

Panel A: OLS Estimates	(1)	(2)	(3)	(4)
Investment Tax Credit Rate	0.981** (0.494)		1.855*** (0.514)	
Closed Certificate		0.346** (0.166)		0.645*** (0.166)
N	238,206	238,206	237,747	237,747
Year FEs	Yes	Yes	No	No
Industry× Year FEs	No	No	Yes	Yes
R^2	0.949	0.949	0.976	0.976
Panel B: IV Estimates	(5)	(6)	(7)	(8)
Investment Tax Credit Rate	2.112* (1.275)		6.335*** (2.081)	
Closed Certificate		0.357 (0.884)		0.884 (0.970)
N	238,206	212,008	237,747	211,457
Year FEs	Yes	Yes	No	No
Industry× Year FEs	No	No	Yes	Yes
	First Stage			
Statutory investment tax credit rate	0.211*** (0.057)		0.161*** (0.038)	
Eligible for subsidy?		0.067*** (0.019)		0.052** (0.021)

Notes: See the notes for Table 5. In contrast to that table, observations are weighted by the number of firms — on average over the sample — in the industry-province pair.

In Table 24, we consider the impact of additional explanatory variables. In the first four columns, we consider the impact of accounting for the large and geographically heterogeneous inflow of Syrian refugees during the sample period. We control for the share of the population in the province that are Syrian refugees. In columns (5) and (6), we estimate a regression with an even-more comprehensive set of controls, with province-by-year fixed effects. With one exception — the specification listed in column 12, the IV regression with the share of firms with a closed subsidy certificate as our measure of S_{pnt} — the estimated effect of subsidization on firm revenues is similar positive, statistically significant, and similar to that in our baseline estimates depicted in Table 23.

Table 24: Industry-Province Level Observations

Panel A: OLS Estimates	(1)	(2)	(3)	(4)	(5)	(6)
Investment Tax Credit	1.264***		1.217***		0.927***	
Rate	(0.181)		(0.215)		(0.217)	
Closed Certificate		0.526***		0.567***		0.457***
		(0.099)		(0.106)		(0.107)
Syrian Refugee	0.351***	0.357***	0.980***	0.354***		
Population Share$_{t-1}$	(0.110)	(0.110)	(0.325)	(0.099)		
N	238,206	238,206	237,747	237,747	237,747	237,747
Year FEs	Yes	Yes	No	No	No	No
Province× Year FEs	No	No	No	No	Yes	Yes
Industry× Year FEs	No	No	Yes	Yes	Yes	Yes
R^2	0.885	0.885	0.913	0.913	0.914	0.914
Panel B: IV Estimates	(7)	(8)	(9)	(10)	(11)	(12)
Investment Tax Credit	4.016***		8.039***		4.223***	
Rate	(0.915)		(1.445)		(1.606)	
Closed Certificate		2.071***		2.065		-0.118
		(0.741)		(2.168)		(2.558)
Syrian Refugee	0.326***	0.326***	0.302***	0.332***		
Population Share$_{t-1}$	(0.110)	(0.115)	(0.099)	(0.103)		
N	238,206	212,008	237,747	211,457	237,747	211,457
Year FEs	Yes	Yes	No	No	No	No
Province× Year FEs	No	No	No	No	Yes	Yes
Industry× Year FEs	No	No	Yes	Yes	Yes	Yes
	First Stage					
Statutory investment	0.068***		0.082***		0.073***	
tax credit rate	(0.004)		(0.007)		(0.007)	
Eligible for subsidy?		0.024***		0.023***		0.019***
		(0.001)		(0.004)		(0.004)

Notes: See the notes for Table 5. In addition to the explanatory variables listed in that table, we include controls for the province's population share that are Syrian refugees (columns 1 trough 4) or province-by-year fixed effects (columns 5 and 6).

In Tables 25 and 26, we record the analogous relationship with two additional outcome variables: employment and firm counts. The OLS estimates for the relationships among economic activity and subsidization are positive and significant for these two alternate variables. For the IV specifications, the sign of the relationship between employment and subsidization depends on the set of fixed effects that one uses. Including only year fixed effects and industry-province fixed effects yields a negative relationship between subsidization and employment.

Table 25: Industry-Province Level Observations.

Panel A: OLS Estimates	(1)	(2)	(3)	(4)
Investment Tax Credit Rate	0.892***		1.150***	
	(0.157)		(0.172)	
Closed Certificate		0.419***		0.620***
		(0.092)		(0.090)
N	236,593	236,593	236,148	236,148
Year FEs	Yes	Yes	No	No
Industry× Year FEs	No	No	Yes	Yes
R^2	0.886	0.886	0.924	0.924
Panel B: IV Estimates	**(5)**	**(6)**	**(7)**	**(8)**
Investment Tax Credit Rate	-3.414***		3.651***	
	(0.832)		(1.130)	
Closed Certificate		-1.611**		1.741
		(0.657)		(1.814)
N	236,593	210,875	236,148	210,335
Year FEs	Yes	Yes	No	No
Industry× Year FEs	No	No	Yes	Yes
	First Stage			
Statutory investment tax credit rate	0.068***		0.082***	
	(0.004)		(0.007)	
Eligible for Subsidy?		0.024***		0.023***
		(0.001)		(0.004)

Notes: See the notes for Table 5. In contrast to that table, the outcome variable is the logarithm of total employment in the industry-province pair.

Table 26: Industry-Province Level Observations.

Panel A: OLS Estimates	(1)	(2)	(3)	(4)
Investment Tax Credit Rate	0.791***		0.679***	
	(0.101)		(0.097)	
Closed Certificate		0.328***		0.334***
		(0.061)		(0.054)
N	238,206	238,206	237,747	237,747
Year FEs	Yes	Yes	No	No
Industry× Year FEs	No	No	Yes	Yes
R^2	0.926	0.926	0.962	0.962
Panel B: IV Estimates	**(5)**	**(6)**	**(7)**	**(8)**
Investment Tax Credit Rate	1.713***		3.837***	
	(0.515)		(0.687)	
Closed Certificate		0.963**		1.458
		(0.439)		(0.995)
N	238,206	212,008	237,747	211,457
Year FEs	Yes	Yes	No	No
Industry× Year FEs	No	No	Yes	Yes
	First Stage			
Statutory investment tax credit rate	0.068***		0.082***	
	(0.004)		(0.007)	
Eligible for Subsidy?		0.024***		0.023***
		(0.001)		(0.004)

Notes: See the notes for Table 5. In contrast to that table, the outcome variable is the logarithm of the number of firms in the industry-province pair.

D.2 Sensitivity Analysis Related to Sections 4.3 and 4.4

Additional outcome variables

In this figure, we consider additional estimations of Equation 3 with three alternate dependent variables: (i) the wage-bill, (ii) the change in the real value of plant, property, and equipment capital, and (iii) the wage-bill per employee.

First, Table 27 considers a second measure of labor inputs: the firms' wage-bill. The coefficient estimates are essentially equal to those given in Table 7, in which we compared firms' employment to subsidization rates.

Table 27: The Impact of the Subsidy Program on Firm Wage-Bill

	OLS				
	(1)	(2)	(3)	(4)	(5)
Investment Tax Credit Rate	1.097*** (0.100)	1.015*** (0.089)			
Inv. Tax Credit Rate + Closed Certificate			1.349*** (0.101)	1.270*** (0.095)	
Closed Certificate					0.454*** (0.033)
N	924,285	924,285	905,069	905,069	905,069
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
R^2	0.881	0.885	0.884	0.888	0.888
	IV				
	(6)	(7)	(8)	(9)	(10)
Investment Tax Credit Rate	1.875*** (0.497)	1.370** (0.675)			
Inv. Tax Credit Rate + Closed Certificate			2.780*** (0.810)	2.336** (1.104)	
Closed Certificate					2.004** (0.927)
N	885,918	885,538	866,622	866,232	866,233
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
	First Stage				
Statutory investment tax credit rate	0.142*** (0.010)	0.135*** (0.019)	0.088*** (0.009)	0.079*** (0.015)	
Eligible for Subsidy?					0.026* (0.015)

Notes: The dependent variable is log (Wage-Bill) at the firm-year level. Standard errors are clustered at the province level.

Second, Table 28 estimates Equation 3, using the percent change in the firms' plant, property, and equipment capital as the dependent variable. In contrast to the other variables that we consider, the IV relationships that we estimate are sensitive to the sets of fixed effects we apply. Within firms in a given industry-year pair, firms with increased subsidization had *lower* rates of capital investment. While we do not have a clear intuition as to why the relationships we estimate are sensitive to the specification applied, part of this sensitivity could reflect the lumpy nature of firm investment.

Table 28: The Impact of the Subsidy Program on Firm Investment

	OLS				
	(1)	(2)	(3)	(4)	(5)
Investment Tax Credit Rate	0.455***	0.406***			
	(0.060)	(0.048)			
Inv. Tax Credit Rate + Closed Certificate			0.405***	0.370***	
			(0.056)	(0.046)	
Closed Certificate					0.116***
					(0.013)
N	817,466	817,466	798,978	798,978	798,978
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
R^2	0.260	0.271	0.265	0.276	0.276
	IV				
	(6)	(7)	(8)	(9)	(10)
Investment Tax Credit Rate	1.351***	-0.776**			
	(0.315)	(0.316)			
Inv. Tax Credit Rate + Closed Certificate			1.860***	-1.521***	
			(0.535)	(0.485)	
Closed Certificate					-0.253
					(0.270)
N	785,313	784,973	757,392	756,946	766,349
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
	First Stage				
Statutory investment tax credit rate	0.139***	0.129***	0.086***	0.075***	
	(0.010)	(0.019)	(0.009)	(0.015)	
Eligible for Subsidy?					0.024
					(0.015)

Notes: The dependent variable is $\Delta\log(\text{PPE})$ at the firm-year level. Standard errors are clustered at the province level.

Finally, in Table 29 we relate the wages paid per employee and the investment tax credit rate that firms receive. The OLS specifications yield a precisely estimated null relationship between the two variables. The IV estimates are negative in certain specifications (those with industry-by-year fixed effects) and positive (but insignificant) estimates in others. [50] Our main takeaway from Table 29 is that greater subsidies do not lead firms to pay their workers higher wages. This conclusions accords with the results from our aggregate exercise in Section 5, namely that significant positive relationships among subsidization, productivity,

[50] One important caveat in interpreting these coefficient estimates, potentially the composition of firms' workforces may vary according to subsidies received. Indeed, in unreported regressions, we find that greater subsidies lead firms to hire more female relative to male workers. Part of the negative relationships that we report in certain specifications may reflect a shift towards lower-wage workers.

and revenues is consistent with little relationship between subsidization and real wages.

Table 29: The Impact of the Subsidy Program on Firm Average Wages

			OLS		
	(1)	(2)	(3)	(4)	(5)
Investment Tax Credit Rate	0.021 (0.017)	-0.003 (0.012)			
Inv. Tax Credit Rate + Closed Certificate			0.008 (0.022)	-0.016 (0.016)	
Closed Certificate					-0.002 (0.006)
N	922,466	922,466	903,269	903,269	903,269
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
R^2	0.918	0.923	0.920	0.924	0.924
			IV		
	(6)	(7)	(8)	(9)	(10)
Investment Tax Credit Rate	0.107 (0.131)	-0.622*** (0.136)			
Inv. Tax Credit Rate + Closed Certificate			0.114 (0.201)	-1.128*** (0.260)	
Closed Certificate					-0.348* (0.205)
N	884,106	883,724	864,830	864,438	864,439
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
			First Stage		
Statutory investment tax credit rate	0.142*** (0.010)	0.135*** (0.019)	0.088*** (0.009)	0.079*** (0.015)	
Eligible for Subsidy?					0.026* (0.015)

Notes: The dependent variable is log(wage-bill per employee) at the firm-year level. Standard errors are clustered at the province level.

Additional Variable Measuring Subsidization

In Section 4, our primary measures of subsidization were (a) investment tax credits received, or (b) an indicator variable: whether the firm has a closed subsidy certificate. In Table 30, we consider the relationship between firm-level outcomes and an alternate measure of firm subsidization: the number of years for which the firm is relieved of its mandatory contributions to their employees' social security payments. As in Tables 6, 7, and 28, subsidization is positively and significantly related to firm outcomes in all OLS specifications, and in all but one IV specifications. (The negative coefficient in column 10 of Table 30 corresponds to the negative coefficient in column 9 of Table 6.) Furthermore, given that the employment-based measure of firm subsidization is approximately 20 times that of the investment-based measure (compare the fifth and eighth rows of Table 3), the magnitudes depicted in Table 30 are similar to those in Tables 6, 7, and 28. Our finding that the estimated relationships between firm outcomes and subsidization are invariant to the measure of subsidization reflects the fact that the different subsidies tend to be bundled with one another. Firms receiving a successful subsidy application tend to receive both subsidies to new capital investments and those to increasing or retaining employees.

Table 30: The Impact of the Subsidy Program on Firm Outcomes

Panel A: OLS Estimates	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Employment		Investment		Revenues	
SSEP–Years of Support	0.072***	0.068***	0.020***	0.018***	0.058***	0.054***
Received+Closed Certificate	(0.006)	(0.006)	(0.003)	(0.003)	(0.005)	(0.005)
N	905,146	905,146	798,978	798,978	901,332	901,332
Year FEs	Yes	No	Yes	No	Yes	No
Year× Industry FEs	No	Yes	No	Yes	No	Yes
R^2	0.853	0.858	0.265	0.276	0.834	0.839
Panel B: IV Estimates	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Dependent Variable	Employment		Investment		Revenues	
SSEP–Years of Support	0.136***	0.150**	0.087***	-0.075***	0.236***	0.270***
Received+Closed Certificate	(0.045)	(0.060)	(0.032)	(0.021)	(0.057)	(0.077)
N	866,693	866,303	766,699	766,349	862,809	862,407
Year FEs	Yes	No	Yes	No	Yes	No
Year× Industry FEs	No	Yes	No	Yes	No	Yes
	First Stage					
Statutory Years of Social	0.085***	0.082***	0.083***	0.078***	0.084***	0.079***
Security Support	(0.010)	(0.016)	(0.010)	(0.016)	(0.010)	(0.016)

Notes: SSEP refers to the number of years of support for employer's mandatory contributions to social security premiums. Investment refers to $\Delta \log \text{PPE}$. All regressions additionally include firm fixed effects. Standard errors are clustered at the province level.

Firms with all of their establishments in a single industry-province pair

The sample in our benchmark analysis includes firms that have establishments in multiple industry-province pairs. For firms that receive a subsidy from the Turkish government, we observe the location and industry through which the firm receives the subsidy. However, for unsubsidized multi-establishment firms, there is no clear way to define the instrument: Because there are multiple industries or provinces through which a firm may apply for a subsidy, there are multiple potential statutory rates that one could defensibly apply. For this reason, we consider a robustness exercise in which we compare firm-level measures of economic activity — revenues, employment, and TFPR — to subsidization for the subset of firms with all of their establishments in a single industry-province pair. Overall, we find similar results with this restricted sample, with the effects of subsidization somewhat larger for certain specifications (e.g., most of the specifications with employment and revenues as the outcome variable) and comparable in other specifications (e.g., most of the specifications with TFP as the outcome variable). In contrast to Table 8, in Table 33 the OLS regression estimates of the relationship between the investment tax credit rate and measured TFP is not statistically significant.

Table 31: The Impact of the Subsidy Program on Revenues

			OLS		
	(1)	(2)	(3)	(4)	(5)
Investment Tax Credit Rate	0.961***	0.816***			
	(0.114)	(0.099)			
Inv. Tax Credit Rate + Closed Certificate			1.306***	1.196***	
			(0.141)	(0.133)	
Closed Certificate					0.461***
					(0.043)
N	454,877	454,877	445,845	445,845	445,845
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
R^2	0.860	0.866	0.864	0.870	0.870
			IV		
	(6)	(7)	(8)	(9)	(10)
Investment Tax Credit Rate	2.802***	2.587***			
	0.599	0.620			
Inv. Tax Credit Rate + Closed Certificate			4.539***	4.526***	
			(1.153)	(1.219)	
Closed Certificate					2.757***
					(0.984)
N	422,166	421,542	413,115	412,484	412,485
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
6			First Stage		
Statutory investment tax credit rate	0.134***	0.154***	0.079***	0.090***	
	(0.009)	(0.016)	(0.009)	(0.014)	
Eligible for Subsidy?					0.031***
					(0.010)

Notes: See the notes for Table 6. In contrast to that table, the sample in the current table includes only firms who have all of their establishment in a single province-industry pair.

Table 32: The Impact of the Subsidy Program on Firm Employment

	OLS				
	(1)	(2)	(3)	(4)	(5)
Investment Tax Credit Rate	0.989***	0.883***			
	(0.119)	(0.101)			
Inv. Tax Credit Rate + Closed Certificate			1.377***	1.257***	
			(0.139)	(0.119)	
Closed Certificate					0.476***
					(0.041)
N	458,243	458,243	448,741	448,741	448,741
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
R^2	0.861	0.868	0.864	0.871	0.868
	IV				
	(6)	(7)	(8)	(9)	(10)
Investment Tax Credit Rate	1.849***	1.540**			
	(0.549)	(0.653)			
Inv. Tax Credit Rate + Closed Certificate			2.883***	2.730**	
			(0.955)	(1.099)	
Closed Certificate					2.041***
					(0.032)
N	425,579	424,964	416,014	415,395	415,396
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
	First Stage				
Statutory investment tax credit rate	0.137***	0.159***	0.081***	0.093***	
	(0.009)	(0.017)	(0.009)	(0.015)	
Eligible for Subsidy?					0.032***
					(0.011)

Notes: See the notes for Table 7. In contrast to that table, the sample in the current table includes only firms who have all of their establishment in a single province-industry pair.

Table 33: The Impact of the Subsidy Program on Firm TFP

			OLS		
	(1)	(2)	(3)	(4)	(5)
Investment Tax Credit Rate	0.012 (0.034)	-0.028 (0.032)			
Inv. Tax Credit Rate + Closed Certificate			0.012 (0.055)	-0.030 (0.049)	
Closed Certificate					-0.012 (0.016)
N	421,369	421,369	413,105	413,105	413,105
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
R^2	0.663	0.679	0.623	0.636	0.684
			IV		
	(6)	(7)	(8)	(9)	(10)
Investment Tax Credit Rate	1.151*** (0.185)	0.461** (0.223)			
Inv. Tax Credit Rate + Closed Certificate			1.854*** (0.358)	0.608 (0.408)	
Closed Certificate					-0.056 (0.275)
N	391,430	390,768	383,165	382,491	382,492
Year FEs	Yes	No	Yes	No	No
Year× Industry FEs	No	Yes	No	Yes	Yes
			First Stage		
Statutory investment tax credit rate	0.136*** (0.009)	0.157*** (0.017)	0.081*** (0.010)	0.092*** (0.015)	
Eligible for Subsidy?					0.031 (0.010)

Notes: See the notes for Table 8. In contrast to that table, the sample in the current table includes only firms who have all of their establishment in a single province-industry pair.

Alternate Productivity Measures

In this section, we reproduce Tables 9 and 10 with two alternate measures of productivity. In our benchmark analysis, we estimated a value added production function with labor (measured by the wage-bill) and capital (measured by the real value of the capital stock, computed using a perpetual inventory method type procedure) as the two inputs. We estimated this production function using the estimator introduced in Ackerberg et al. (2015), using investment and intermediate inputs purchases as the two proxy variables. We found a negative relationship — sometimes not statistically significant — between productivity and subsidization in our OLS regressions, but a positive relationship when subsidization is instrumented with statutory subsidy eligibility and generosity. In Table 34, we re-estimate these relationships between subsidization and productivity with two alternate productivity measures: the logarithm of value added per worker, and the logarithm of TFP, wherein only investment is used as a proxy variable. We find little differences between the results presented in Table 34 and those in Tables 9 and 10.

Specifications without Firm Fixed Effects

In the results we presented in Sections 4.3 and 4.4, our regressions include firm fixed effects. In this section, we provide corresponding results without firm fixed effects. We include, instead, a set of controls, describing the firm in the year prior to the introduction of the subsidy program. These controls are the logarithm of real total assets, an exporter dummy, the bank loans to total asset ratio, the long term debt ratio, and the total debt ratio. Without firm fixed effects, the OLS estimates of the relationship between economic activity and subsidization are somewhat weaker for revenues and employment; the IV estimates are more modest for investment. (Compare the odd-numbered columns of Tables 9 and 10 to these in Table 35.) Overall, as with our baseline estimates in Section 4.4, we find that greater subsidization (and customers' subsidization) is associated with greater economic activity.

Table 34: The Impact of the Subsidy Program on Firm Activity: IV Estimates

	VA per Worker				TFP, with Investment as a Proxy Variable			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inv. Tax Credit Rate	-0.343***	-0.402***	0.927**	0.417	-0.080***	-0.108***	0.984***	0.639***
	(0.062)	(0.054)	(0.439)	(0.475)	(0.030)	(0.028)	(0.206)	(0.186)
Weight of subsidized	0.019	-0.000	0.017	-0.002	0.001	-0.006	-0.002	-0.008
firms in total sales	(0.013)	(0.014)	(0.012)	(0.013)	(0.007)	(0.007)	(0.007)	(0.007)
Weight of subsidized	0.040**	0.038*	0.04.316	0.028	0.055***	0.041***	0.033**	0.031**
firms in total purchases	(0.018)	(0.021)	(0.023)	(0.023)	(0.011)	(0.012)	(0.015)	(0.012)
Log daily wage	0.041***	0.021*	0.038***	0.022**	-0.015**	-0.007	-0.018***	-0.007
	(0.010)	(0.011)	(0.010)	(0.010)	(0.007)	(0.006)	(0.007)	(0.006)
N	735,355	735,355	686,630	686,231	791,523	791,523	744,754	744,384
Year FEs	Yes	No	Yes	No	Yes	No	Yes	No
Year× Industry FEs	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.683	0.693			0.645	0.656		
First Stage Estimates								
Statutory investment			0.130***	0.117***			0.137***	0.127***
tax credit rate			(0.010)	(0.018)			(0.010)	(0.020)
Weight of subsidized			0.002	0.002			0.002	0.002
firms in total sales			(0.002)	(0.001)			(0.002)	(0.001)
Weight of subsidized			0.017***	0.012***			0.018***	0.013***
firms in total purchases			(0.003)	(0.002)			(0.003)	(0.002)
Log daily wage			0.000	-0.001			0.001	-0.001
			(0.001)	(0.001)			(0.001)	(0.001)

Notes: All regressions include firm fixed effects. Standard errors are clustered at the province level.

Table 35: The Impact of the Subsidy Program on Firm Activity

Dependent Variable	Revenues		Employment		Investment		TFP	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Investment Tax Credit	0.049	2.696***	0.335*	0.958**	0.381***	0.328**	-0.099***	0.859***
Rate	(0.060)	(0.431)	(0.185)	(0.400)	(0.026)	(0.150)	(0.037)	(0.153)
Weight of subsidized	0.138***	0.131***	0.162***	0.160***	0.024***	0.025***	0.020***	0.018***
firms in total sales	(0.027)	(0.026)	(0.024)	(0.023)	(0.006)	(0.006)	(0.006)	(0.006)
Weight of subsidized	0.433***	0.390***	0.032	0.022	-0.063***	-0.063***	0.040***	0.024
firms in total purchases	(0.013)	(0.014)	(0.033)	(0.035)	(0.005)	(0.005)	(0.015)	(0.015)
Log daily wage	0.090***	0.086***	0.006	0.005	0.001	0.001	-0.013**	-0.015***
	(0.013)	(0.011)	(0.007)	(0.007)	(0.008)	(0.008)	(0.006)	(0.006)
N	841,453	839,112	842,514	840,169	750,737	748,527	791,523	789,196
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year× Industry FEs	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.556		0.400		0.037		0.278	
First-Stage Estimates								
Statutory investment		0.164***		0.164***		0.167***		0.163***
tax credit rate		(0.011)		(0.011)		(0.011)		(0.011)
Weight of subsidized		0.002		0.002		0.003***		0.002
firms in total sales		(0.001)		(0.001)		(0.001)		(0.001)
Weight of subsidized		0.014***		0.014***		0.014***		0.015***
firms in total purchases		(0.002)		(0.002)		(0.002)		(0.003)
Log daily wage		-0.000		-0.000		0.001		-0.000
		(0.001)		(0.001)		(0.001)		(0.001)

Notes: All regressions include province-industry fixed effects but (in contrast to Tables 9 and 10) exclude firm fixed effects.. Standard errors are clustered at the province level.

D.3 Additional Plots Related to Section 5

In this appendix, we present four additional figures to supplement the analysis in Section 5.

First, Figure D.3 displays the average investment tax credit received by firms, by region and by industry, in 2019. As in Figure 5, investment subsidies differ both because of statutory differences in subsidy generosity as well as the differences in take-up rates across industries and regions. Both take-up rates and subsidy generosity were higher in Region 6 than in other regions, and in manufacturing than in services.

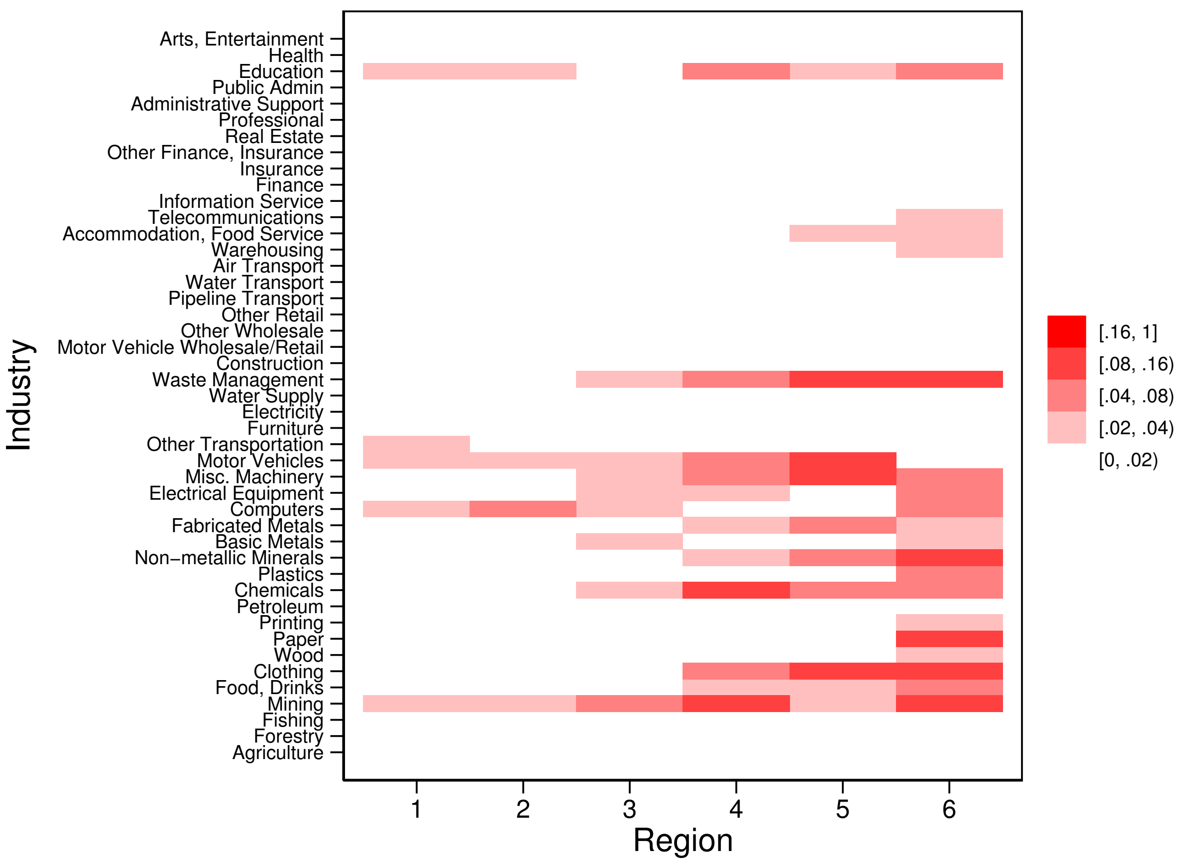

Figure 17: Investment Subsidies

Notes: The plot gives the average investment tax credit for each region and industry.

Second, we assess the sensitivity of our quantification of the 2012 subsidy program to the subsidy measure. In our benchmark analysis, we used the average investment tax credit as our measure subsidy measure. Figure 18 presents the analogue of Figure 7 using the fraction of subsidized firms as our measure. As in Figure 7, Region 5 has the largest real wage increases as a result of the subsidy program, with migration and trade flows substantially mitigating the impact of the policy on inter-regional real wage inequality.

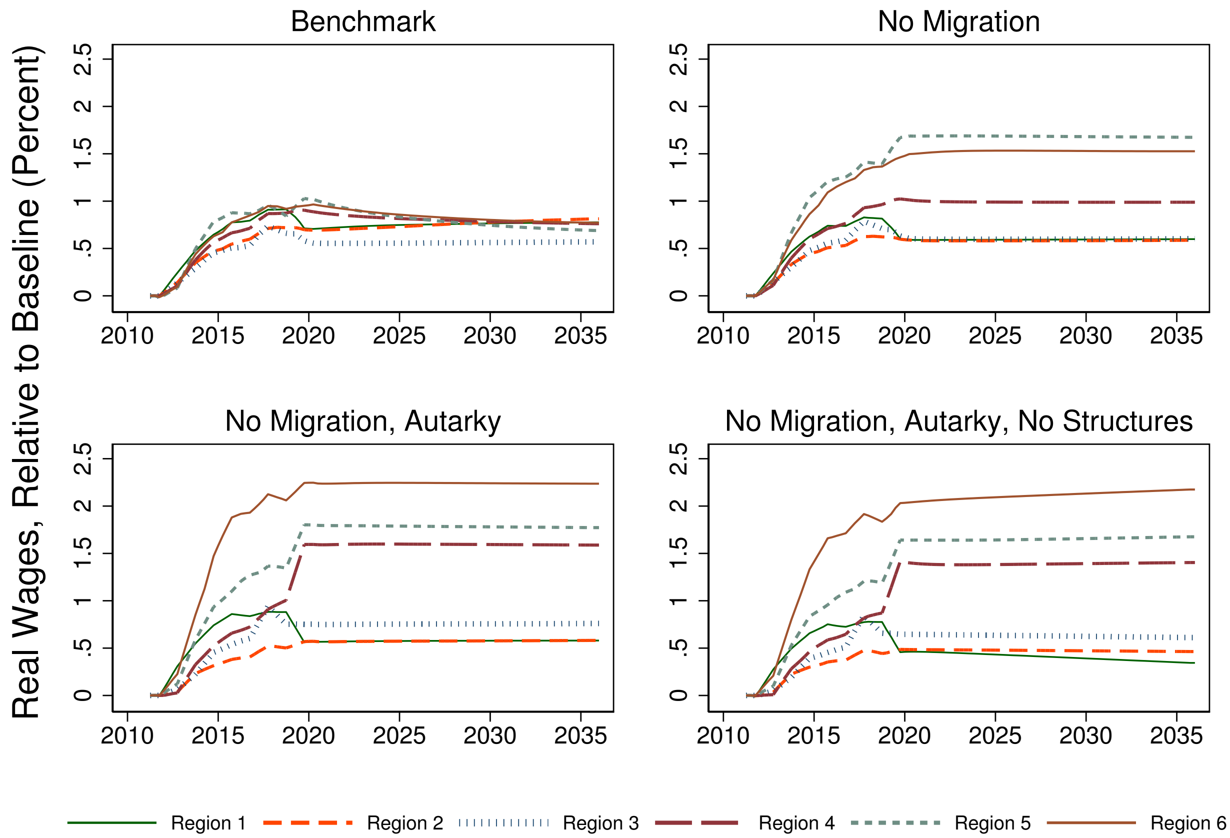

Figure 18: Real Wage Trajectories
Notes: See the notes for Figure 8. In contrast to that figure, here we consider a calibration based on the share of subsidized firms — as opposed to the average investment tax credit received — as our measure of firm subsidization by province-industry year.

Finally, Figure 19 plots average investment tax credits received among firms in the formal economy. (This is the analogue of Figure 5, which presented our measures of subsidization for both formal economy and informal economy firms, and attempts to account for the lack of comprehensiveness of measurement of firms in Agriculture, Finance, Insurance, Real Estate, and Public Administration industries.) The measures of subsidization that we observe in the raw data pertain only to formal economy firms. To produce Figure 5, we used the fact that informal-economy firms are ineligible to receive investment subsidies and thus divided the average investment tax credits received by the share of workers in each industry-region pair that is employed in the formal economy (using the method discussed in Appendix A.4.) In Figure 19, instead, we plot the investment tax credits received by the firms appearing in our dataset. These are substantially higher, especially for Region 6: While the 2019 value for average investment tax credits received was 2.2 percent, here it is 5.9 percent. In Figure 20, we plot counterfactual wage impacts of the subsidy reform in which we apply the subsidization rates in 19. Here, the implied impacts of the subsidy reform are magnified compared to those in Figure 7.

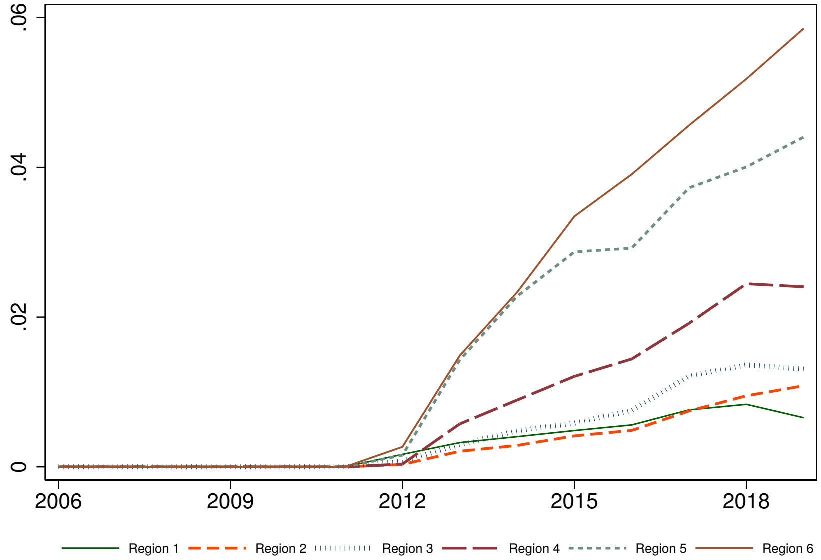

Figure 19: Investment Subsidies

Notes: See the notes of 5. In contrast to that figure, we do not attempt to account for the incomplete nature of the EIS data.

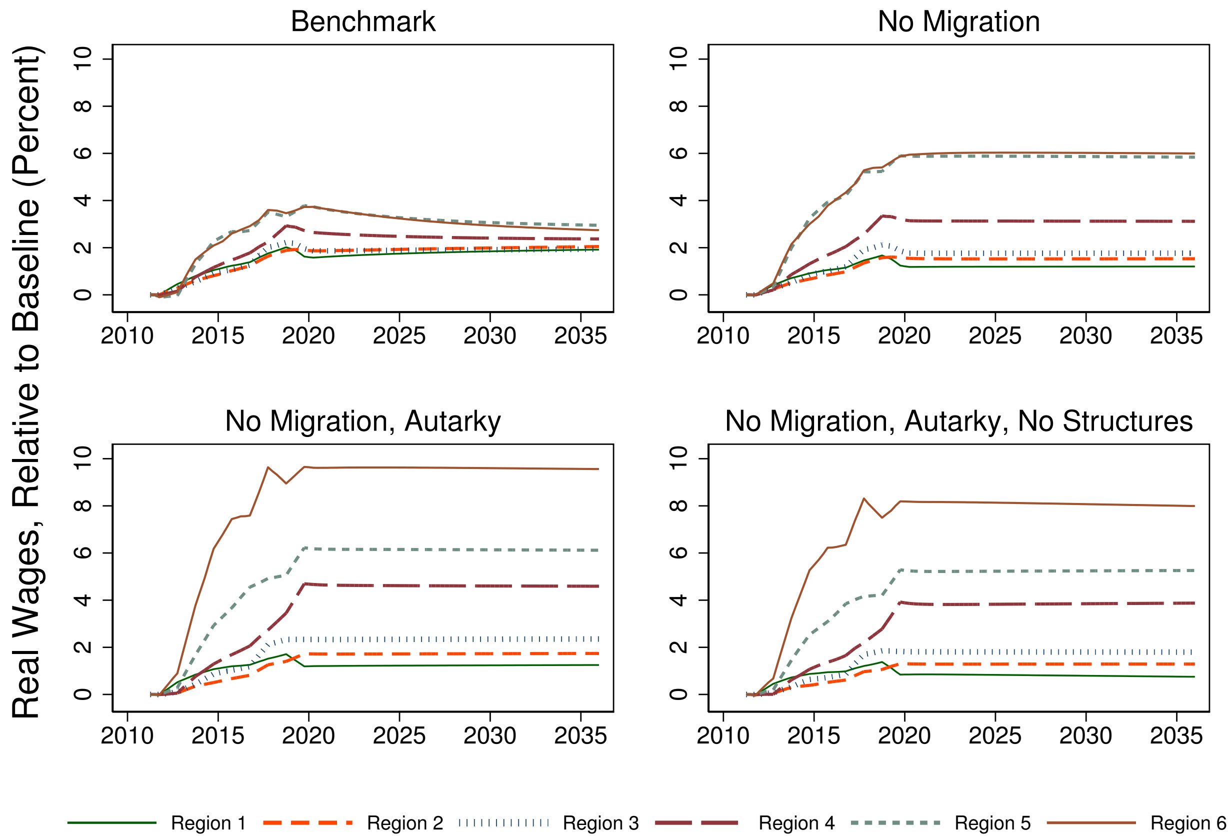

Figure 20: Real Wage Effects of the 2012 Subsidy Program
Notes: See the notes for Figure 8. In contrast to that figure, in our calibration of trade and worker flows across industry-subsidy region pairs and in our calibration of the average investment tax credits received by industry and subsidy region, we do not make any adjustments for firms and employment in the informal economy.

E Description of Caliendo et al. (2019)

E.1 Setup

For the reader's convenience, in this appendix we describe the elements of the Caliendo et al. (2019) framework that are salient for our analysis. The economy consists of intermediate goods producers, households, and rentiers (who own the structures). Both intermediate input producers and households are indexed by the region ($n \in \{1, ...N\}$) in which they reside and the industry ($j \in \{0, 1, ...J\}$) in which they produce/work ($j = 0$ indexes not working), while rentiers are indexed by the region in which they reside. Time is by t.

The innovation of Caliendo et al. (2019)'s *dynamic hat algebra* is to provide a tractable method of determining counterfactual responses to changes in the model's exogenous variables (e.g., changes to trade costs, or changes to productivity) without having to identify these variables' levels at any given point in time.[51] Caliendo et al. (2019) show (in Proposition 3 of their paper) that one can solve for counterfactual dynamic equilibria without knowing the levels of the model's exogenous variables. Specifying the initial allocation of the economy — in terms of labor supplied to different industries and regions, migration and trade shares, and expenditures on each industry-region pair — as well differences in the growth rates of the exogenous variables will suffice.

Households

For each region-industry pair (nj), there is a continuum of households. Within each period, each household earns labor income (w_t^{nj}), and spends this income to purchase the different production goods. (For households who do not work, for whom $j = 0$, their total consumption expenditures equal a constant b^n.) Let $P_t^{nj,k}$ and $c_t^{nj,k}$ respectively denote the unit price and household purchases of the different goods $k \in \{1, ...J\}$ in period t. Moreover, each period households may choose to move to another industry-region pair. Migration involves a utility cost $\tau^{nj,ik} + \nu\epsilon_t^{ik}$; $\tau^{nj,ik}$ equals the systematic, time-invariant utility cost of transitioning from region-industry nj to region-industry ik, while ϵ_t^{ik} is a type-1 extreme value distributed random variable, independent across individual households, time, and industry-region pairs. We assume — following Caliendo et al. (2019) — that the static utility function is Cobb-Douglas and that the intertemporal elasticity of substitution in consumption equals one, so that the discounted expected utility of a household residing in region-industry pair (nj) equals:

$$U_t^{nj} = \sum_{k=1}^{J} \alpha^k \log\left(c_t^{nj,k}\right) + \max_{\{i,k\}} \beta\mathbb{E}\left[U_{t+1}^{ik} - \tau^{nj,ik} + \nu\epsilon_t^{ik}\right] . \tag{6}$$

Let $V_t^{nj} \equiv \mathbb{E}\left[U_t^{nj}\right]$ denote the expected lifetime utility of a representative household in industry-region nj, where the expectation is taken over the ϵ_t^{ik} preference shocks. Given the setup, the expected lifetime utility evolves according to the following system of equations.

$$V_t^{nj} = \sum_{k=1}^{J} \alpha^k \log\left(c_t^{nj,k}\right) + \nu \log\left(\sum_{i=1}^{N}\sum_{k=0}^{J} \exp\left(\beta V_{t+1}^{ik} - \tau^{nj,ik}\right)^{1/\nu}\right)$$

[51]In static setups, the hat algebra approach — to solve for counterfactual impacts of productivity or trade policy changes — traces back to Jones (1965), and was more recently popularized by Dekle et al. (2007). See Dingel (2018) for brief history.

$$= \log\left(w_t^{nj}\right) - \sum_{k=1}^{J} \alpha^k \log\left(\frac{P_t^{nk}}{\alpha^k}\right) + \nu \log\left(\sum_{i=1}^{N}\sum_{k=0}^{J} \exp\left(\beta V_{t+1}^{ik} - \tau^{nj,ik}\right)^{1/\nu}\right) ,$$

where w_t^{nj} equals the wage of workers residing in region n and employed in industry j and P_t^{nk} is the ideal price index for households residing in region n and employed in industry k. The first equation follows from the dynamic optimization of the household over its location and industry choices. The second equation follows from the first given the static optimization over consumption choices.

Household utility maximization, over its decision of which region-industry pair to transition to in period $t+1$, yields relatively simple expressions for the probability that a household in move from region-industry pair nj in period t to region-industry pair ik in period $t+1$:

$$\mu_t^{nj,ik} = \frac{\exp\left(\beta V_{t+1}^{ik} - \tau^{nj,ik}\right)^{1/\nu}}{\sum_{m=1}^{N}\sum_{h=0}^{J} \exp\left(\beta V_{t+1}^{mh} - \tau^{nj,mh}\right)^{1/\nu}} . \tag{7}$$

This probability is increasing in the continuation value of residing in region-industry pair ik in period $t+1$ and negatively on the systematic utility cost, of $\tau^{nj,ik}$, moving from nj to ik.

Intermediate Goods Producers and Final Goods Producers

With industry j and region n, heterogeneous intermediate goods producers operate in a perfectly competitive environment. They combine labor (l_t^{nj}), structures (h_t^{nj}), and material inputs ($M_t^{nj,nk}$) with the following production function:

$$q_t^{nj} = z^{nj}\left(A_t^{nj}\left(h_t^{nj}\right)^{\xi^n}\left(l_t^{nj}\right)^{1-\xi^n}\right)^{\gamma^{nj}} \prod_{k=1}^{J}\left(M_t^{nj,nk}\right)^{\gamma^{nj,nk}} .$$

In this equation, A_t^{nj} equals productivity in region n and industry j in period t, while z^{nj} denotes the idiosyncratic productivity (drawn from a Frechet distribution) of an individual firm within the region and industry. The parameters ξ^n, γ^{nj}, and $\gamma^{nj,nk}$ characterize the importance of structures, labor, and material inputs in production. Given this production function, the marginal cost of production equals:

$$x_t^{nj} = B^{nj} \frac{\left[\left(r^{nj}\right)^{\xi^n}\left(w^{nj}\right)^{1-\xi^n}\right]^{\gamma^{nj}}}{z^{nj}\left(A_t^{nj}\right)^{\gamma^{nj}}} \prod_{k=1}^{J}\left(P_t^{nk}\right)^{\gamma^{nj,nk}} .$$

Here, r^{nj} and w^{nj} refer to the rental price of structures and the wage rate in industry-region pair nj, and B^{nj} is a constant which depends on the model's underlying parameters.[52]

Shipments of industry j intermediate inputs from region i to region n incur "iceberg" trade costs $\kappa_{nj,ij}$. So, the price of a unit of the intermediate good in destination region-industry nj equals $x_t^{ij} \cdot \kappa_{nj,ij}$.

Within each region and industry, a final goods producer combines intermediate goods to produce an output that can either be consumed or sold as a material input.

The output for a final goods producer in region n and industry j is given by the following constant elasticity of substitution production function:

$$Q_t^{nj} = \left[\int_{R_+^N} \left[\tilde{q}_t^{nj} \left(z^j \right) \right]^{\left(\frac{\eta^{nj}-1}{\eta^{nj}} \right)} d\phi^j \left(z^j \right) \right]^{\left(\frac{\eta^{nj}}{\eta^{nj}-1} \right)}.$$

Here $\phi \left(z^j \right) \equiv \exp \left[- \sum_{n=1}^{N} \left(z^{nj} \right)^{-\theta^j} \right]$ is the joint distribution of idiosyncratic productivity levels of the intermediate goods producers from the different supplying regions n.

For each commodity (j), the final goods producer purchases from the intermediate good producer who can deliver at the lowest price. Given the properties of the Frechet distribution, the probability that region i provides the lowest price variety is given by:

$$\pi_t^{nj,ij} = \frac{\left(x_t^{ij} \cdot \kappa_{nj,ij} \right)^{-\theta^j}}{\sum_{m=1}^{N} \left(x_t^{mj} \cdot \kappa_{nj,mj} \right)^{-\theta^j}}.$$

This is also equal to the share of intermediate input purchases that are sourced from region n. Cost minimization implies that the price of good j in region n at time t is:

$$P_t^{nj} = \Gamma \left(1 + \frac{1 - \eta^{nj}}{\theta^j} \right) \cdot \left(\sum_{i=1}^{N} \left(x_t^{nj} \cdot \kappa_{nj,ij} \right)^{-\theta^j} \right)^{-1/\theta^j},$$

where $\Gamma()$ is the Gamma function.

Finally, cost minimization on the part of individual intermediate input producers yields the following equations for labor and structures demand in region n industry j:[53]

$$L_t^{nj} = \frac{\gamma^{nj} \left(1 - \xi^n \right)}{w_t^{nj}} \cdot \left(\sum_{i=1}^{N} \pi_t^{ij,nj} X_t^{ij} \right), \text{and} \tag{8}$$

[52] $B^{nm} = \left[\left(\xi^n \right)^{\xi^n} \left(1 - \xi^n \right)^{1-\xi^n} \right]^{-\gamma^{nj}} \prod_{k=1}^{J} \left(\gamma^{nj,nk} \right)^{-\gamma^{nj,nk}}.$

[53] The total stock of structures in each industry-region pair is fixed. See Kleinman et al. (2021) for a related model with dynamic capital investment decisions.

$$H^{nj} = \frac{\gamma^{nj}\xi^{n}}{r_t^{nj}} \cdot \left(\sum_{i=1}^{N} \pi_t^{ij,nj} X_t^{ij} \right). \tag{9}$$

Rentiers, Total Expenditures, and Market Clearing

Within each region n a continuum of rentiers earn income from renting out structures. According to the Caliendo et al. (2019) setup, rentiers send their income from renting structures to a global portfolio. Rentiers in region n receive a share ι^n from this global portfolio. Unlike households, rentiers are not allowed to relocate to other regions. We are now in a position to write out the market-clearing condition for intermediate good j produced in region n:

$$X_t^{nj} = \sum_{k=1}^{J} \sum_{i=1}^{N} \gamma^{nk,nj} \pi_t^{ik,nk} X_t^{ik} + \alpha^j \left(\sum_{k=1}^{J} w_t^{nk} L_t^{nk} + \iota^n \sum_{i=1}^{N} \sum_{k=1}^{J} r_t^{ik} H^{ik} \right). \tag{10}$$

The first sum on Equation 10 equals the total purchases through input-output linkages. The second sum equals total purchases of good j to households or rentiers residing in region n.

Equilibrium Definition

Given a path of productivity levels, A_t^{nj}, an equilibrium of this economy consists of a sequence of wages (w_t^{nj}) and prices (P_t^{nj}), expenditures (X_t^{nj}), trade shares ($\pi_t^{ij,nj}$), and labor allocations (L_t^{nj}) such that:

- Across successive periods, migration rates and initial labor supply determine next period-labor supply:
$$L_{t+1}^{ik} = \sum_{n=1}^{N} \sum_{j=1}^{J} \mu_t^{nj,ik} L_t^{nj}, \tag{11}$$
where $\mu_t^{nj,ik}$ is given by Equation 7;
- Within each period, the markets for structures and labor clear (Equations 8 and 9);
- For each intermediate good j produced in region n, the goods market clears (Equation 10);
- Households choose consumption to maximize period utility and migration to maximize lifetime utility, with preferences given by Equation 6; and
- Intermediate input goods producers and final goods producers maximize profits period by period.

E.2 Calibration

Calibration of the model requires information on the time paths of labor flows across industries and subsidy regions, trade flows across regions for each industry, value added in each industry-region pair, employment in each industry-region pair, and productivity changes that are directly due to the subsidy program. Our economy has six regions and 45 industries; we list these industries and regions in Appendix E.3. We record these time paths for t =2011Q1,....2018Q4. While our data are recorded on an annual basis, we follow Caliendo et al. (2019) and set a time period to refer to an individual quarter. In addition, we require parameters governing (i) consumers' preferences, (ii) production function cost shares, (iii) heterogeneity in individual households' preferences over different locations and individual firms' productivity and (iv) the regions in which rentiers' income are spent. These last four sets of parameters are time invariant.

To calibrate our model, we rely on information from the World Input-Output Database and the micro estimates from Section 4.3. The former database is informative about aggregate moments, while the latter will pin down flows of goods across industries and regions and the flows of workers across industries and regions.

Time-Invariant Parameters

The parameters α^k characterize the relative importance of each industry commodity k in consumers' preferences. These parameters are allowed to vary by year. From the 2016 vintage of the World Input-Output Database, for each we compute the sum of the value private household consumption expenditures, consumption expenditures by non-profit organizations serving households, governmental consumption expenditures, and exports. We take data from 2010. We then compute the share of industry k among these total expenditures.

The parameters ξ^n characterize the relative importance of structures, relative to labor, in value added for intermediate goods producers in region n. For the country as a whole, we compute this as one minus the cost share of labor relative to value added. While, in principle, these parameters are allowed to vary by subsidy region, the World Input-Output Database do not capture this geographic variation. As a result, we set ξ^n to be identical across all regions.

The parameters $\gamma^{nj,nk}$ characterize the importance of commodity k in the production of intermediate good j when producing in region n. We set $\gamma^{nj,nk}$ as industry k's share of material input expenditures (from 2010) within the production of commodity j, using the 2016 vintage of the World Input-Output Database. As with ξ^n parameters, while the Caliendo et al. (2019) model permits these parameters to vary by industry, out data do not capture this variation.

We take parameters —θ^j and ν — respectively characterizing the heterogeneity in productivity and individuals' idiosyncratic utility from working in a given industry-region pair from Caliendo et al. (2019). We set $\theta^j = 4.55$ for all industries j and $\nu = 5.3436$. Finally, we set the quarterly discount factor, β, to be 0.99, again following Caliendo et al. (2019).

Finally, we set ι^n — the share of rentier profits accruing to each region — to be proportional to that region's employment: $\iota = [0.523, 0.150\ , 0.129, 0.086, 0.059, 0.054]$. This approach differs from that in Caliendo et al. (2019), who use observed trade imbalances (measured by Equation 10) to identify ι^n.

Time-Varying Trade and Migration Flows, Value Added, Employment, and Counterfactual TFP

First, we describe how we measure $\pi_t^{nj,ij}$, trade shares across region pairs (i supplying n) for a particular commodity j in quarter t. First, for each year y between 2010 to 2018, we compute the trade flows across subsidy regions for each of the 45 aggregated industries j. We record $\tilde{\pi}_y^{nj,ij}$as the share of region i's purchases of industry product j coming from region n. For quarter t, we then interpolate the values of $\pi_t^{nj,ij}$ based on the yearly values of $\tilde{\pi}_y^{nj,ij}$.[54]

To measure flows of workers across industries and subsidy regions, $\mu_t^{nj,ik}$, we draw on information from the Entrepreneur Information System dataset. Given considerably volatility in the observed flows of workers from year to year, the $\mu_t^{nj,ik}$ that we use in our calibration are four-year moving averages of those described in Appendix A.5

For each origin region-industry pair, for each year, we compute the share of workers who end up in each region-industry pair in the subsequent year. Use $\widetilde{\mu}_y^{nj,ik}$ to denote these annual flows in from year y to year $y+1$. Since our model is at the quarter level, we need a couple of simple calculations to compute $\mu_t^{nj,ik}$from the $\widetilde{\mu}_y^{nj,ik}$. Define $\widetilde{M}_y$ as the matrix with $\widetilde{\mu}_y^{nj,ik}$ in its $j+n(J-1)$, $k+i(J-1)$ element. Then define $\mu_t^{nj,ik}$ as the $j+n(J-1)$, $k+i(J-1)$ element of the matrix given by $\left(\widetilde{M}_y\right)^{1/4}$.

Third, to compute L_t^{nj} for each quarter in our sample, we begin by assigning L_0^{nj} using the number of workers in each industry-region pair from the Entrepreneur Information System dataset, using data from 2012.[55] We then iteratively apply Equation 11, using the values of $\mu_t^{nj,ik}$ described in the previous paragraph.

Finally, to compute the direct productivity impact of the subsidy program, we employ information on subsidy take-up rates and the incremental productivity gain from the subsidy. In our benchmark analysis, we compute the average investment tax credit in each year,

[54]For the first quarter of our sample, we set the first value of $\pi_t^{nj,ij}$ as $\tilde{\pi}_y^{nj,ij}$. We then iteratively define $\pi_t^{nj,ij}= \left(\tilde{\pi}_{y+1}^{nj,ij}/\tilde{\pi}_y^{nj,ij}\right)^{1/4} \cdot \pi_{t-1}^{nj,ij}$, where y refers to the year in which quarter t appears.

[55]This is the first observation according to this dataset. Ideally, we would have taken data from 2010.

subsidy region, and industry. For each quarter t in year y, define I_t^{nj} as this take-up rate. We then multiply this average by 0.697, which is, according to Table 8, the treatment effect on log firm-level productivity of a 100 percent increase in the investment tax credit. We consider our counterfactual economy to be one in which these subsidies were not implemented, and so where TFP, A_t^{nj},was lower by a factor of $\exp\left[0.668 \cdot I_t^{nj}\right]$. In sensitivity analysis, in Appendix D.3, we consider an alternate measure of counterfactual A_t^{nj} based on the fraction of firms in region-industry nj which have newly closed subsidy certificates in year y.

E.3 List of Industries

This section lists the 45 industries in the economy of our calibration of Caliendo et al. (2019). The Turkish National Input-Output Tables, as collected by the World Input-Output Database, applies an industry classification scheme with 56 industries. The input-output table includes 11 industries with 0 values in all of the data entries. We drop these 11 industries from our analysis.[56] The 45 industries in our analysis include: Crops (NACE A01); Forestry (NACE A02); Fishing (NACE A03); Mining (NACE B); Food, Drinks (NACE C10-C12); Clothing (NACE C13-C15); Wood (NACE C16); Paper (NACE C17); Printing (NACE C18); Petroleum (NACE C19); Chemicals (NACE C20); Plastics (NACE C22); Non-metallic Minerals (NACE C23); Basic Metals (NACE C24); Fabricated Metals (NACE C25); Computers (NACE C26); Electrical Equipment (NACE C27); Misc. Machinery (NACE C28); Motor Vehicles (NACE C29); Other Transportation (NACE C30); Furniture (NACE C31-C32); Electricity (NACE D35); Water Supply (NACE E36); Waste Management (NACE E37-E39); Construction (NACE F); Motor Vehicle Wholesale/Retail (NACE G45); Other Wholesale (NACE G46); Other Retail (NACE G47); Pipeline Transport (NACE H49); Water Transport (NACE H50); Air Transport (NACE H51); Warehousing (NACE H52); Accommodation, Food Service (NACE I); Telecommunications (NACE J61); Information Service (NACE J62, J63); Finance (NACE K64); Insurance (NACE K65); Other Finance, Insurance (NACE K66); Real Estate (NACE L68); Professional (NACE M74-M75); Administrative Support (NACE N); Public Admin. (NACE O84); Education (NACE P85); Health (NACE Q); and Arts, Entertainment (NACE R-S).

[56] They are Pharmaceutical Manufacturing (NACE C21); Repair and installation of machinery and equipment (NACE C33); Postal and courier activities (NACE H53); Publishing activities (NACE J58); Motion picture, video, and television program production and planning (NACE J58-J59); Legal, accounting, and management consultancy activities (NACE M69-M70); Architectural and engineering activities (NACE M71); Advertising and market research (NACE M73); Activities of extraterritorial organizations and bodies NACE (T); Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use (NACE U).