

Slide 2: Throughout the world, governments have introduced place-based policies to mitigate inequality that exists across regions within their countries. This presentation discusses one such policy, introduced in Turkey in 2012. It involved a mix of different subsidies to firms: rebates on mandatory social security contributions, investment subsidies, along with other incentives, with greater generosity in certain provinces, mainly in the poorer eastern part of the country, and with firms only in certain industries able to apply. A main stated goal of the policy was to reduce income inequality between the poorer and richer parts of the country.

In the “micro” part of our talk, following much of the literature on place-based policies, we examine the direct impacts of the policy, identifying the impact of additional subsidies on firms’ economic activity. Unique relative to the existing literature, we have excellent data on buyer-supplier relationships in Turkey, meaning we can trace out the impact of the subsidies to suppliers or customers of subsidized firms. In the “macro” part of the talk, we apply a dynamic general equilibrium model to assess whether the policy reduced wage inequality within Turkey. The model is useful in that it allows us to gauge the channels through which subsidies in regions the government targeted spill over to parts of the country it didn’t.

Slide 3: We have three main research questions. First, narrowly did the policy increase economic activity for firms that were eligible to receive the subsidy? Second, did the subsidies spill over within the production network? And, third, to what extent did the new policy reduce regional wage inequality?

Slide 4-5: Looking at direct effects, we find that that subsidized firms’ activity increased along multiple dimensions: higher revenues, employment, and measured total factor productivity, with pretty large effects. Second, we observe meaningful spillovers from subsidized firms to their suppliers and customers. Finally, however, the policy only has a modest impact on reducing real wage inequality between the richer western part and the poorer eastern part of the country. There are two reasons for this modest impact. First, many of the suppliers or customers of heavily subsidized firms are in regions the government did not target, and some of the benefits spill over to them. Second, especially in the long run, the new subsidies induced migration towards the subsidized regions. This increase in labor supply in the poorer parts of the country mitigate the inequality-reducing direct effects of the subsidy policy.

Slide 6: In this paper, we synthesize three separate literatures listed here. We examine spillovers of subsidies among customers and suppliers, and apply existing dynamic multi-region, multi-industry g.e. models, to understand how place-based policies may impact both targeted and untargeted areas.

Slide 7-8: Here is an outline for the remaining parts of the talk.

Slide 9: In 2012, the Turkish government introduced a set of place-based subsidies, with the aim of increasing aggregate investment and reducing regional inequality. The country was split into six subsidy regions. Here is a map. Region 1 includes the largest and richest cities, in the west, and region 6 includes the southeastern part of the country, bordering Iran and Iraq.

Slide 10: According to the policy, only certain industries were eligible to receive subsidies, mainly within the primary and manufacturing sectors. Higher numbered regions received more generous support. The policy involved a mix of tax reductions, interest rate supports, and rebates on mandatory social security contributions.

Slide 11: While there are multiple types of subsidies that firms may receive, in practice these were bundled with one another. Ideally, we would have a firm-specific index of these measures that completely characterizes firms' exposure to subsidization. Not quite able to do that, we are going to pick one measure, the investment tax credit rate, that we feel provides a good albeit imperfect summary of the extent to which firms' inputs are subsidized. What this measure is precisely is the fraction of the investment expenditures that can be deducted from firms' future corporate taxes.

Slide 12-13: Here is again our map. A few important pieces of heterogeneity: First, the policy was targeted towards areas with lower gdp per capita. Second, in the decades before the policy, there was net migration from the eastern to western parts of the country. As we'll see, one of the effects of the policy will be to slow down this migration. Finally, in the years before the policy, the poorer higher numbered regions were growing relatively quickly compared to regions 1 and 2.

Slide 15: We have access to standard firm balance-sheet data, data on the firm-to-firm production network, measures of subsidy take-up rates, and finally, for the purpose of computing worker flows across province-industry pairs (which will be a key input into our macro model) we have linked employer-employee data. There are a couple limitations of these micro data to be mindful of. They only cover the formal economy, and for many variables are at the firm and not establishment level. These are important limitations, but one we can address at least partially

Slide 16-19: Our main empirical setup to detect direct effects is one of a difference-in-difference regression. Here,  $y$  is some measure of firm activity. We compare this measure to the level of firm subsidization at that given point in time. We include firm and industry-year fixed effects to control for the overall scale of economic activity in the firm or for macroeconomic shocks that differentially impact different types of industries.

Now there are two concerns with setup. First, the subsidies were targeted to poorer but already-fast growing regions. This prompts a worry about pre-trends. Second, not every firm who was eligible actually applied to or received the subsidy. Meaning that, to compute the average treatment effect, we wouldn't want to simply regress on investment tax credits received. Further, as I mentioned, our subsidy variable is one measured with error.

In the paper, but not in this presentation, we examine the issue of pretrends in detail. Briefly, while it's true that, when looking across provinces, subsidization is correlated with pre-policy growth rates, the same correlation does not hold when comparing province-industry growth rates and conditioning with province fixed effects. For the second concern, we'll instrument received subsidies with measures of statutory eligibility/generosity for that province-industry pair at that given point in time.

Slide 20: Here we display the results from our regression, using firm revenues as our measure of economic activity. We find, in both the OLS and IV specifications, that greater

subsidization increases firm revenues. To give you some idea of the magnitudes involved, the difference in investment tax credits rates received by firms in eligible industries between Region 6 and Region 1 is approximately 5 percentage points. This difference corresponds to roughly 16 percent higher firm revenues.

Slide 21: We apply a similar regression for firm-level TFP. The total factor productivity measure here is revenue tfp, which we estimate for each firm using standard io methods. Our interpretation here is that the subsidies lowered the unit price at which firms hire labor or rent capital, thus are equivalent to lower marginal costs of production, and in turn higher measured total factor productivity.

Slide 22-23: Next, we amend our regressions to consider what I'll call indirect effects. There are two aims in this section. First, we're inherently interested in documenting how the subsidies spill over to the customers or suppliers of subsidized firms. Second, in the calibration of the model that I'll discuss next, a key object of interest is direct productivity impact of subsidization on productivity. To the extent that (i) firms' own subsidization status is correlated with that of their suppliers or customers, and that (ii) counterparties' subsidization leads to higher own-firm TFP, our previous regression estimates could suffer from omitted variable bias. For a similar reason, we'll want to include an additional control for the wages in the firms' local labor market.

So, we apply a regression in which we now additionally include controls for the average wage in the local labor market in which the firm is operating and the share of the firm's suppliers or customers that receive a subsidy.

Slide 24-26: There are three main results this amended regression. First, inclusion of these extra terms does not alter our main estimate of the direct impact of subsidies on TFP. Second, having subsidized customers and suppliers leads to higher revenues. Third, on the other hand, the evidence for spillovers onto TFP is more mixed and muted.

Slide 27: In the final part of the presentation, we'll assess the impact of the subsidy policy on regional inequality. We apply a dynamic general equilibrium model, due to Caliendo, Dvorkin, and Parro's 2019 paper. This model, helpfully, permits consideration of many of the channels through which a subsidy to firms in one industry and province can dissipate or propagate to other parts of the economy.

Slide 28: In this slide and the next, I'll describe the model to you in words. Within each industry and region there are households who supply their labor and consume in proportion to their labor income; they may also be not employed. Each period they face a dynamic migration decision, deciding whether to switch to another industry or region, fully anticipating the paths of real wages in the future, and subject to a utility cost of switching.

We include landlords in the model to allow for the possibility of inter-regional spillovers through land rental income, but this turns out not to matter quantitatively.

Slide 29: On the firm side, within each industry and subsidy region, we have intermediate goods firms, that hire labor, rent land, and purchase material inputs. They have time-varying total factor productivity. The way that we're thinking of the impact of the subsidies is that they mechanically shift down marginal costs – or, equivalently, shift up TFP – more

so in region-industry pairs where firms received generous subsidies. These firms sell their output to final goods producers who bundle the intermediate goods. The share of varieties sourced from a given region depends on suppliers' marginal cost and iceberg trade costs across space.

Slide 30: There are three key spatial spillovers in this model. First due to input-output linkages, the customers of subsidized firms enjoy lower material input prices and the suppliers of subsidized firms have greater demand for their products. Second, there is migration across regions. The subsidy scheme (relative to a world without the policy) will slow net migration out of Regions 5 and 6, depressing (in the long run) real wages in those labor markets relative to a no-policy counterfactual. Finally, in this model, landlords own structures in areas other than where they live. Subsidies in one region lead to higher land rental prices there, but these increased rents may lead to higher consumption in other, untargeted regions. Below we'll isolate the impact of these three spillover channels.

Slide 31: With this model, we're interested in performing the following counterfactual exercise: What would the path of the economy have looked like – when measuring things like real wages or labor allocations– if the policy had not been introduced? We consider an alternate economy in which the fundamental productivity of intermediate goods firms in each industry-region pair is scaled down in proportion to (first) investment tax credits received there and (second) the slope of the relationship between the investment tax credit rate received and firm productivity, a relationship we had estimated in the previous part of the talk.

Here is the impact of the policy on real wages. Five years into the program, the policy led to a 1.6 percent increase in Region 6 real wages, compared to 1.1. percent in Region 1; so real wage inequality falls by half a percentage point. Over time, the impact of the policy on Region 6 vs. Region 1 inequality diminishes.

Slide 32: To better understand the modest inequality impacts, we consider three alternate calibrations of our model. In the first, the utility cost of migrating across subsidy regions is infinite. Households can still switch industries within their same region. In the second, we additionally restrict trade flows across the six subsidy regions. Again, there can be trade among industries within the same region. In the final calibration, we impose that the rental income of the landlords equal zero.

Slide 33: Here, we depict the regional inequality impacts of the subsidy policy in the three alternate calibrations. From the table we see a 2 percentage point difference between the first and second calibrations and between the second and third calibrations. The conclusion then is that the actual policy has had a modest impact on regional inequality, especially in the long run, because of trade and labor market spillovers that exist within Turkey. These two sets of spillovers have roughly equal impact.

Slide 34: That's all for the talk. There are two broader lessons that I'd like you to take away. First, since migration responds slowly to real wage differentials, place-based policies' short and long run impacts differ. Second, general equilibrium spillovers may come from faraway locations. We still have a number of open questions as part of this project, though some of which may be left for future work.