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Trade to aid: EU's temporary tariff waivers for flood-hit Pakistan

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ABSTRACT

In this paper, we study the effectiveness of the first large-scale unilateral trade concessions as foreign aid for disaster relief, i.e., EU tariff waivers on goods heavily exported by Pakistan, which was severely hit by the 2010 floods. Using a triple-difference approach and a synthetic control approach, we find that the tariff waivers substantially increased Pakistan's exports to the EU. The export hike occurred within a few months after the waivers became effective, and did not significantly depress exports by competing countries. While the export boost brought greater employment opportunities in the tariff-waived industries, we find little evidence that the greater labor demands from trade were particularly beneficial to the areas most affected by the floods. Our findings suggest that trade policy may complement traditional means of foreign aid—but trade concessions alone may be inadequate, as the areas most affected by natural disasters may be poorly targeted.

1. Introduction

Does foreign aid promote the economic growth of recipients? This has been a central question in the literature of development and has been a subject of intense debate. Empirical findings are mixed, often clouded with concerns about sample selection, measurement errors and identification problems (see e.g. Roodman, 2007; Bazzi and Clemens, 2013; Qian, 2015).

While aid may foster growth by promoting investments in public infrastructure and human capital, critics are skeptical about the effectiveness of aid. They worry that with the weak political institutions typical of less developed countries, aid may not be effectively translated into public investment (see e.g. Easterly, 2003; Svensson, 2003). In particular, the literature on foreign aid that has focused on the Official Development Assistance (ODA), which mainly consists of cash and in-kind transfers, shows that the evidence as to the effectiveness of ODA is weak at best; or, it shows that ODA may even adversely affect growth. For instance, ODA has sometimes been used for unproductive public consumption (Boon, 1996; Alesina and Dollar, 2000); it has also sometimes been used by recipient governments with weak political accountability to buy political support (Deaton, 2013); and it increases the incidence and duration of civil conflicts in conflict-prone regions (Crost et al., 2014; Nunn and Qian, 2014).

In this paper, we investigate trade concessions as an alternative means of aid to ODA. This form of foreign aid, while it has its own limitations, arguably does not have the drawbacks of ODA discussed above. For example, trade concessions do not transfer appropriable resources to recipient governments. Previous studies explored the impacts of preferential market access granted by the US for Africa and Vietnam. Frazer and van Biesebroeck (2010) find that, under the African Growth and Opportunity Act, lower tariffs to African countries increase African exports to the US by 28%. McCaig (2011) also documented the positive trade creation effects of US tariff cuts in reducing poverty in Vietnam especially for workers with a low level of education. These results suggest that trade concessions have the potential to be an alternative means of aiding post-disaster economic growth.

In 2010, Pakistan was hit by the most severe floods in its modern history. To aid the post-disaster recovery, the EU offered tariff waivers to a list of goods exported by Pakistan. The trade concessions became effective in late 2012 and constituted the first large-scale aid program in the form of trade concessions following a natural disaster. This paper evaluates the effectiveness of trade concessions as a foreign aid tool using the EU's temporary removal of tariffs to Pakistan in three respects: (i) whether the tariff waivers lead to trade creation without diverting exports from other countries to the EU; (ii) how soon the effect of the trade concessions materializes; and (iii) whether export expansions improve labor market outcomes such as earnings and employment.

While the EU's trade concessions to Pakistan were proposed as

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disaster relief immediately after the natural disaster, the tariff waivers became effective only after a lengthy delay in obtaining WTO approval. The timing of tariff waivers on the 75 products provided a trade-cost shock arguably exogenous to the performance of Pakistan's export sector. A difference-in-differences approach, comparing waived products to non-waived products before and after the trade concessions, seems a natural approach. However, one might be concerned that the selection of waived products reflects a differential trend of competitiveness in the related industries.

To address such concerns, we adopt a triple-difference (DDD) approach in our main specification. We compare the difference between waived and non-waived products exported to EU countries to the same difference of exports to non-EU OECD countries. On top of the usual before-and-after differencing, such additional differencing effectively removes differential trends between tariff-waived and non-waived products. In the estimation, we follow Frazer and van Biesebroeck (2010) to include a full set of fixed effects, namely importer-year, importer-product, and product-year fixed effects, allowing for maximum flexibility in our specification.

We supplement our triple-difference analysis with a synthetic control analysis using monthly Pakistan-to-EU export data. In the synthetic control analysis, we create a synthetic control mimicking the time series variation of aggregate exports of the 75 products with tariff waivers before the waivers became effective. The synthetic control is constructed as a weighted sum of export volumes of EU-bound, no-waiver products in the 21 Harmonized System (HS) sections.

Our synthetic control analysis provides a transparent way of visualizing how large the waivers' impact on the aggregate export volume of all waived products was, and how fast such impacts showed up in the data. The synthetic control analysis could also mitigate a concern that exports of waived products may not follow a common time trend as do the non-waived products to EU and to non-EU countries. This was especially important because the set of waived products was unlikely to have been selected randomly from among all Pakistan's exports.

We find that tariff waivers increased Pakistan's exports of tariff-waived goods to the EU by about 45% and the probability of entering a new destination by 5%. The export expansion appeared within two months after the tariff concessions became effective. Furthermore, we find no significant evidence that exports to the EU are diverted away from major textile and clothing exporting countries during the concession period. Our results indicate that the trade concessions had strong trade creation effects for Pakistan, without causing substantial trade diversion effects to individual competing countries.

We do not find evidence that the waivers also increased waiver goods' exports to non-EU destinations or that exports of non-waiver goods were affected. The tariff waivers increased Pakistan's export to EU amounts to about 0.3% of Pakistan's GDP in 2012. In the absence of a strong multiplying effect, the aggregate impacts seem modest. However, a segment of population may still benefit from the increase in exports of the waiver goods. To identify this effect, we further examine the labor market outcomes of households affected by the 2010 floods and households in areas with a share of employment in the textile, garment and leather industries, whose products account for most of the goods with tariff waived.

Using household survey data, we find that households in areas most severely affected by the floods experienced slower growth in earnings. On the other hand, household earnings in areas with high textile employment had greater earnings in 2013 than in 2012. The increase in earnings was highest for households with low education attainment, which is consistent with the fact that the textile industries on average employ more workers with low education than other sectors.

The household earnings increased mainly because of the greater employment opportunities, particularly for women, rather than because of higher wages. However, since textile industries tend not to concentrate in areas most severely affected by floods, the expansion in textile employment may not have been of particular benefit to households who lost most during the floods.

We investigate two related channels through which these flood-affected households may still be able to benefit from the rise in textile employment even if they do not live in areas with textile industries. One is internal migration. Changes in households' age dependency ratios, which are the ratio of non-working age members to working age members, may indicate temporary migration as a means of responding to labor market opportunities. A decrease in the household age dependent ratio in an area may suggest inflows of working-age population. While we find that the household age dependency ratio dropped in 2013 in areas with large textile employment, we do not find that the age dependency ratio has increased in flood-affected areas since 2010.

Flood-affected households may still benefit from remittance sent by families in the textile industries. However, while we observed greater remittance received by households in flood areas in 2010 and 2011, we do not find that these households received more remittance in 2013. Neither do we find households in textile-concentrated areas were sent out more remittance in 2013.

In sum, tariff waivers were effective in boosting Pakistan's exports, which created labor market opportunities for women and people with low education attainment. But no evidence suggests that the export performance of textile industries was particularly beneficial to people living in areas most affected by the 2010 floods.

The rest of this paper is organized as following. Section 2 describes the 2010 floods and the EU's responses. Section 3 analyzes the impacts of the EU tariff waivers on the exports from Pakistan as well as on those from competing countries. Section 4 carries out a synthetic control analysis on the monthly Pakistan-to-EU export data. Section 5 examines the labor market impacts of the tariff waivers. Section 6 concludes.

2. Background

In late July 2010, unusually heavy rainfalls were recorded across all provinces of Pakistan. The rainfalls resulted in severe flooding in the Indus River basin. The floods, which were by far the worst in Pakistan's modern history, submerged vast land areas, destroyed crops, and extensively damaged highways, railways, schools and other public infrastructure. Using data from the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), we map the extent of the floods in Fig. 1. The floods brought about 2000 deaths, affected 20 million people, and caused damage estimated at $9.5 billion (Guha-Sapir et al., 2016).

In September 2010, European leaders reached an agreement to assist Pakistan's recovery by temporarily waiving tariffs on 75 products. These products mainly included textile, clothing and leather products, which were heavily exported by Pakistan to the European Union (EU). The initial package that the EU submitted to the World Trade Organization (WTO) went through a series of changes in response to opposition from other competing countries.[1] A revised waiver request was finally approved in February 2012 and was effectively implemented from November 15, 2012 to December 31, 2013.[2] The value of tariff-waived products amounted to a quarter of Pakistan's total annual exports to the EU, which is Pakistan's largest export market. The normal *ad valorem* tariff rates for waived products ranged from 4% to 12.8%, averaging around 9.5% as weighted by the trade volume in 2012.

3. Tariff waivers and Pakistan's exports

We use Pakistan's annual HS 6-digit product-level export data to

[1] Due to the most favored nation (MFN) clause in the GATT, the EU cannot grant preferential treatment to Pakistan without WTO approval.

[2] See Khorana and Yeung (2012) for details.

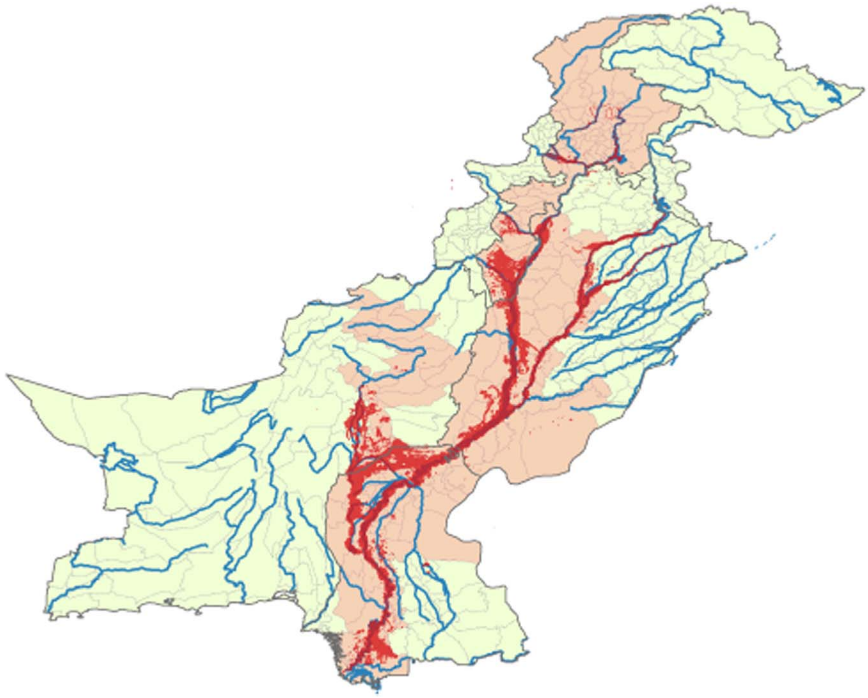

Fig. 1. 2010 Pakistan Floods.Notes: Blue curves indicate major rivers. Light red areas are flood-affected districts. Completed submerged areas are painted with dark red. GIS data of floods are from the Operational Satellite Applications Programme (UNOSAT) of the United Nations Institute for Training and Research (UNITAR). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

27-EU members and 13 non-EU OECD countries between 2002 and 2013 from UN Comtrade to estimate trade creation effects of tariff concessions in Pakistan.[3] In subsequent sections, we refer to products whose tariff would be waived from November 2012 as *waiver goods*, and others as *non-waiver goods*. We also refer to textile, garment and leather industries as textile industries for brevity.

To illustrate the effects of the EU tariff waivers on Pakistan's exports, we plot three time series in Fig. 2: (i) the total value of Pakistan's exports of waiver products to the EU; (ii) the total value of Pakistan's exports of non-waiver products to EU; and (iii) the total value of Pakistan's waiver products exported to non-EU OECD countries. The exports of all three sets of products had an upward trend. Moreover, non-waived products exported to the EU and waived products exported to non-EU OECD countries fluctuated in the same directions as waived products exported to the EU. During the treatment year of 2013, products with EU waivers exported to EU countries increased dramatically by 27%, while non-waived products exported to EU countries experienced a modest increase; and the value of waived products exported to non-EU countries experienced a small drop.

Pakistan's exports to the EU appears to fluctuate considerably. In particular, exports to the EU dropped in 2005, 2009 and 2012. In 2005, a WTO ruling terminated the EU's preferential treatment to Pakistan under a GSP anti-drug-trafficking scheme (Grossman and Sykes, 2005).[4] There were two years during our sample period in which the EU had negative GDP growth. At the peak of the Great Recession, EU-28's GDP decreased by 4.5% in 2009. The European debt crisis also induced a negative GDP growth rate in 2012. Moreover, Pakistan experienced a wide-spread power shortage in 2012. Industrial production in Pakistan has been hindered by chronic electricity shortage (Ali, 2015). In 2012, the shortage was particular severe. During the summer, power was down for as many as 20 hours a day in many areas, provoking riots in these places (Banyan, 2012).

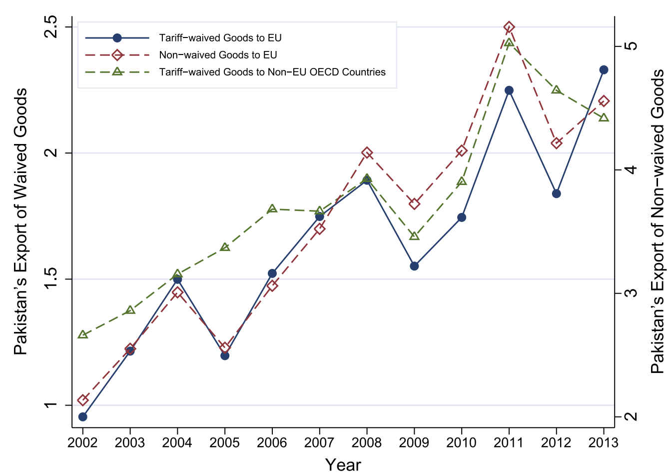

Fig. 2. Pakistan's exports over time (billions US$).

These fluctuations may be a potential concern in a difference-in-differences analysis. In the next subsection, we describe our triple-difference approach, which addresses such concern with the inclusion of destination-year and product-year fixed effects.

3.1. Intensive margin

Tariff is a variable cost. In classical trade models, a fall in bilateral tariffs lowers the relative price of the exporting country's products. As a result, it raises relative demand in the importing country. As in Krugman (1980) and Helpman et al. (2008), the intensive margin measures the export volumes of existing exporters. Thus, a decrease in tariffs as trade barriers is expected to increase bilateral trade flows as long as the elasticity of substitution

[3] Croatia joined the EU in July 2013 and was excluded in the estimations.

[4] Under the GSP Drug Arrangements program, the EU provided preferential market access to eleven Latin American countries and Pakistan, providing them with incentives to combat illicit drugs trafficking.

Table 1
Tariff waivers and Pakistan's exports to the EU.

	(1)	(2)	(3)	(4)	(5)	(6)
EU×Waiver	0.218			0.189		
	(0.223)			(0.188)		
Waiver×Post		0.026			0.0001	
		(0.142)			(0.149)	
EU×Waiver×Post	0.338*	0.308**	0.323**	0.361**	0.330**	0.372**
	(0.176)	(0.139)	(0.154)	(0.151)	(0.144)	(0.147)
Fixed Effects:						
Importer×Year	Y	Y	Y	Y	Y	Y
Product×Importer		Y	Y		Y	Y
Product×Year	Y		Y	Y		Y
Initial Sample				Y	Y	Y
No. of Observations	209,301	209,301	209,301	116,430	116,430	116,430
R^2	0.641	0.825	–	0.680	0.820	–

Notes: Each observation is about the export of one product to one importer in one year. The dependent variable is the log value of exports. Standard errors in parentheses are adjusted for two-way clustering at importer and product levels. The product, product-year, and product-importer fixed effects, are all at the HS-6 digit level. When there are three fixed effects, R^2 is not comparable to other cases as one of fixed effects is accounted for by within transformation. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$.

between varieties is positive.[5] We examine whether tariff waivers on Pakistan's exports to the EU had trade creation effects in the intensive margin using the following triple-difference specification in a gravity framework:

$$\log(Export_{jkt}) = \alpha_0 + \alpha_1 Post_t + \alpha_2 Waiver_k + \alpha_3 EU_j + \beta_1(EU_j \times Post_t) + \beta_2(EU_j \times Waiver_k) + \beta_3(Waiver_k \times Post_t) + \gamma(EU_j \times Waiver_k \times Post_t) + u_{jkt} \quad (1)$$

where $\log(Export_{jkt})$ is the log value of exports of product k from Pakistan to country j during year t (only positive values are included); $Post_t$ is an indicator variable indicating whether the tariff waivers are effective; $Post_t$ equals one for year 2013 and zero otherwise; $Waiver_k$ is an indicator variable if product k contains one or more goods with EU tariff waivers and zero otherwise; EU_j equals one if country j is an EU member and zero otherwise; and the error term is given by:

$$u_{jkt} = \mu_{jt} + \sigma_{jk} + \eta_{kt} + \epsilon_{jkt}$$

where μ_{jt}, σ_{jk}, and η_{kt} are importer-year, importer-product, and product-year fixed effects respectively. These fixed effects absorb all variables typically included in a gravity equation, including Pakistan and importing countries' GDP, GDP per capita and multilateral resistance terms (see Anderson and van Wincoop, 2003; Magee, 2008); and pair variables such as distance and cultural ties, among others; and ϵ_{jkt} is a residual error term. Including each of three fixed effects could be important to avoid potential endogenous bias. For instance, σ_{jk} is an effective way of controlling for preferential trade policies on certain products from importers such as Generalized System of Preference (GSP). GSP has been widely used to provide preferential tariffs on certain products imported from developing countries by some industrial countries including EU members. Rose (2004) finds that preferential tariffs through GSP has a positive effect on trade volumes. Further discussion on these fixed effects can be found in Frazer and van Biesebroeck (2010).

Table 1 reports the estimates for the coefficients that are not subsumed by fixed effects. In the first three columns, the sample includes all export volumes that are positive. In the last three columns, we restrict the sample to importers and products that had positive flows at the beginning of the sample, i.e $Export_{jk,2002}>0$.

In Eq. (1), γ captures the effect of the EU trade concessions on Pakistan in the intensive margin of exports at the product level. For instance, $EU_j \times Post_t$ is subsumed by importer-year fixed effects. Depending on the set of fixed effects included, EU tariff waivers increased Pakistan's exports of tariff-waived products to the EU by between 31 log points (Column 2) and 37 log points (Column 6), which amount to a 36% and 45% increase, respectively. Throughout our analysis of trade data, we calculate the standard errors adjusted for two-way clustering by importer and product (Cameron et al., 2011). The coefficient γ is statistically significant at the 5% level for all but one specification. The estimate in Column (1), which is from a specification that includes only importer-year and product-year fixed effects, is significant at the 10% level, but is similar to other estimates in magnitude.

Our preferred estimate with a full set of fixed effects is in Column (3), which is a 38% increase, and with a sample restriction is in Column (6), which is a 45% increase. What does a 45% increase in Pakistan's exports of waived products to the EU imply for Pakistan's aggregate economy? In our data, waiver products accounted for 30.3% of Pakistan's exports to the EU in 2012. This means that Pakistan's total exports to the EU due to trade concessions increased by about 13.6%. As exports to the EU account for 21.2% of Pakistan's total exports, this indicates that Pakistan's total exports to the world due to EU trade concessions increased by about 2.9% in 2013. Given that Pakistan's exports as a percent of GDP were 12.4% in 2012, the impact on the aggregate economy of Pakistan due to EU trade concessions is equivalent to 0.36% of its GDP.[6] In terms of dollar values, it is approximately 804 million USD in total and 4.5 USD per capita.[7]

3.2. Extensive margin

As trade concessions were temporary, they were unlikely to induce firms' new entries to export to the EU market if the fixed costs of exporting were sufficiently large (e.g. Helpman et al., 2008). However,

[5] The implication for the intensive margins at the firm-level is, however, ambiguous. This is because the exports of existing firms in the market increase while the exports of less productive newly entered firms are smaller than those of incumbent firms before a fall in tariffs. Lawless (2010) shows that under the assumption of the Pareto distribution, a firm's intensive margin is independent of a change in variable costs. Therefore, it is an empirical question as to whether or not a decrease in tariff could increase the intensive margin of trade. As firm-level data are available only for limited countries, many studies that sought general empirical evidence of the implications of firm-heterogeneity trade models tend to use disaggregated product-level data. For instance, Dutt et al. (2013) and Baier et al. (2014) use HS 6 digit or SITC 4 digit product-level data to relate their findings to the model of Chaney (2008) and Helpman et al. (2008), respectively.

[6] Data source: World Development Indicators database of World Bank

[7] Pakistan's GDP per capita is about 1252 USD in 2012 (World Bank).

if the fixed costs were small enough, even a temporary drop in tariffs could lead firms into a new market by adding product lines or exporting to new destinations. This was most likely to happen in the case when, under very similar product categories, some products were waived and others not. For example, Dyed Fabrics *(Less* than 85% By Weight of Synthetic Filament, Mixed Cotton), was tariff-waived while the product category, Dyed Fabrics *(More* than 85% By Weight of Synthetic Filament, Mixed Cotton) was not, which suggests that a firm may be able to add one waiver product into an existing product line without paying substantial entry costs. Krautheim (2012) also argues that an increase in the number of exporting firms could even lower the fixed costs of exporting to the same destination, which could further induce more new entrants to the same market.

We use the same gravity model for the intensive margin as specified in Eq. (1), except that we replace the dependent variable with an indicator variable equal to one if positive trade flows take places for the product-destination-year observation and zero otherwise.

Overall, about 9% of product-destination-year observations record positive trade flows, i.e. they have a dependent variable equal to one. Among waiver products, however, about 70% of observations have a positive trade flow. Such difference confirms that waiver goods are important products for Pakistan's export trade and that they have penetrated into the EU markets.

Table 2 reports the fixed effects estimates for the coefficients that were not subsumed by fixed effects. Regardless of the specifications for fixed effects, the EU's tariff waivers increased the probability of Pakistan's exports to new destinations in the EU for tariff-waived goods by about 5%. The coefficient γ is statistically significant at 10% significance level for all specifications. The significant positive effects were quite surprising because there were only 30% of EU destinations that had no Pakistan exports at the end of 2012. Prior to 2012, out of 1782 potential destinations in the EU for waived products, Pakistan had zero exports to 500 destinations while, at the end of 2013, it had zero exports to only 473 destinations. On the other hand, out of 924 potential destinations in the non-EU countries for waiver products, only 273 markets were with no exports at the end of 2012. For non-EU countries, at the end of 2013 we find some withdrawals such that the number of markets there with zero trade increased to 286 for waiver products in the non-EU countries.

3.3. Potential spillover effects

We may underestimate or overestimate the trade creation effects with our triple-difference method if there exist positive or negative spillover effects. In particular, a recent literature documents evidence of destination spillover in exporting. For instance, Koenig et al. (2010) show positive destination spillover effects from transportation cost sharing using French firm data and Fernandes and Tang (2014) report positive destination spillover effects from learning, using Chinese firm data. With positive export spillover to non-EU countries, our triple-difference approach may underestimate trade creation effects of tariff concessions.

We examine whether tariff waivers from the EU for Pakistan had any spillover effects onto other destinations (non-EU importers) using the following difference-in-differences specification in a gravity framework:

$$\log(Export_{jkt}) = \alpha_0 + \alpha_1 Post_t + \alpha_2 Waiver_k + \delta(Waiver_k \times Post_t) + e_{jkt} \quad (2)$$

where $Export_{jkt}$ includes only positive flows and j indicates export destinations other than EU countries. $e_{jkt} = \mu_{jt} + \sigma_{jk} + \epsilon'_{jkt}$ is an error term including destination-year fixed effects μ_{jt}, product-destination fixed effects σ_{jk}, and an idiosyncratic term ϵ'_{jkt}. Other explanatory variables are similarly defined as before. δ thus captures the extent to which EU's waivers to Pakistan spillover to Pakistan's exports of these goods to other non-EU markets.

In Table 3, the first four columns report the fixed effects estimates for the coefficients that are not subsumed by the fixed effects. Regardless of sample restriction and fixed effects, we could not find any spillover effects. For our most preferred specification with the most exhaustive fixed effects, coefficient on spillover effects was virtually zero. Thus, we find no evidence of underestimation of trade creation effects on the intensive margin due to destination spillover effects. In the last two columns of Table 3, we estimate the destination spillover effects on the extensive margin. As on the intensive margin, we find no evidence of spillover effects on the extensive margin.

Potentially, the export expansion of waiver goods could spill over to other non-waiver products. If that is the case, we may overestimate the trade creation effects. We will discuss such a possibility in Section 4.3.

3.4. Heterogeneous effects by tariff reduction

The magnitude of tariff-cuts on 75 products varies from 4% to 12.8%. In this subsection, we study whether trade creation effects are driven by a few products, in particular within the high tariff-cuts sectors, or whether the effects appear in various sectors. In the estimation, we use the same gravity model and the DDD method, but we additionally include interaction terms to capture heterogeneous effects, depending upon the magnitude of tariff-cuts:

$$\begin{aligned}\log(Export_{jkt}) = {} & \alpha_0 + \alpha_1 Post_t + \alpha_2 Waiver_k + \alpha_3 EU_j + \beta_1(EU_j \times Post_t)\\ & + \beta_2(EU_j \times Waiver_k) + \beta_3(Waiver_k \times Post_t)\\ & + \gamma_1(EU_j \times Waiver_k \times Post_t)\\ & + \gamma_2[EU_j \times Waiver_k \times Post_t \times (TR_k - 8)] + u_{jkt}\end{aligned} \quad (3)$$

where TR_k is the percentage of tariff reduction due to the waivers so γ_1 captures the trade creation effect at $TR_k = 8$, which is the median of tariff reduction among the waiver goods.

Table 4 reports the estimation results allowing differential effects according to magnitude of tariff-cuts. The first two columns and the last two columns show the effects on the intensive margin and the extensive margin, respectively. Odd and even columns are different in terms of fixed effects to be accounted for and our preferred specification is even numbered columns. We find little evidence that the expansion of exports on the intensive margin depends on the size of tariff reduction. On the extensive margin, however, the probability of entering a new market decreases by about 1.7% as the tariff cut increases by 1 percentage.

Table 2
Tariff waivers and Pakistan's exports to the EU: extensive margin.

	(1)	(2)	(3)	(4)
EU×Waiver	0.012	0.012		
	(0.056)	(0.059)		
Waiver×Post	−0.003		−0.003	
	(0.025)		(0.027)	
EU×Waiver×Post	0.049*	0.049*	0.049*	0.049*
	(0.027)	(0.027)	(0.027)	(0.027)
Fixed Effects:				
Importer×Year	Y	Y	Y	Y
Product×Year		Y		Y
Product×Importer			Y	Y
No. of Observations	2,569,716	2,569,716	2,569,716	2,569,716
R^2	0.099	0.423	0.630	–

Notes: Standard errors in parentheses are adjusted for two-way clustering at the importer and product levels. The product, product-year, and product-importer fixed effects, are all at the HS-6 digit level. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$.

Table 3
Tariff waivers and Pakistan's exports to Non-EU Countries.

Dependent variable:	log(Export)				1(Export > 0)	
	(1)	(2)	(3)	(4)	(5)	(6)
Waiver	3.110***		2.630***		0.596***	
	(0.380)		(0.372)		(0.058)	
Waiver×Post	0.228	0.026	−0.001	0.0001	−0.004	−0.003
	(0.173)	(0.164)	(0.151)	(0.151)	(0.026)	(0.028)
Fixed Effects:						
Importer×Year	Y	Y	Y	Y	Y	Y
Product×Importer		Y		Y		Y
Initial sample			Y	Y		
No. of Observations	77,806	77,806	44,853	44,853	877,464	877,464
R^2	0.247	0.830	0.250	0.827	0.095	0.402

Notes: Standard errors in parentheses are adjusted for two-way clustering at the importer and product levels. The product, product-year, and product-importer fixed effects, are all at the HS-6 digit level. * $p < 0.10$; ** $p < 0.05$; ** $p < 0.01$.

Table 4
Tariff waivers and Pakistan's exports to the EU: heterogeneous effects by tariff reduction.

Dependent variable:	log(Export)		1(Export > 0)	
	(1)	(2)	(3)	(4)
EU×waiver×Post	0.219***	0.394***	0.035	0.051***
	(0.098)	(0.181)	(0.020)	(0.021)
EU×waiver×(tariff-cut-8)×Post	0.021	−0.035	0.001	−0.017***
	(0.030)	(0.031)	(0.005)	(0.007)
Fixed Effects:				
Importer×Year	Y	Y	Y	Y
Product×Importer	Y	Y	Y	Y
Product×Year		Y		Y
No. of Observations	197,038		1,054,080	

Notes: The median of tariff rate of waived products is 8%. Standard errors in parentheses are adjusted for two-way clustering by importer and product. The product, product-year, and product-importer fixed effects, are all at the HS-6 digit level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

3.5. The effects on competing countries: trade diversion

The initial trade concession package proposed by the EU had drawn objections from several WTO members, especially major textile and clothing exporting countries such as India and Bangladesh. To examine the validity of these objections, we quantify the effect of EU's tariff waivers to Pakistan on competing countries' exports to the EU. For each of the major textile and clothing exporting countries other than Pakistan, we re-estimate Eq. (1) using the same specifications as for Column (4) in Table 1, but replacing the dependent variable with exports from the major textile and clothing exporting countries. Similarly, for the extensive margin, we use Eq. (1), while replacing the dependent variable with the indicators of positive export flows from the major textile and clothing exporting countries. In both equations, the key variable of interest is "$EU \times Waiver \times Post$" and coefficients on this variable capture trade diversion effects for the countries competing with Pakistan for the EU imports.

Table 5 reports the results for trade diversion effects on both the intensive and extensive margins. At the intensive margin, we find no trade diversion effects that are statistically significant at the 10% significance level for any of the 15 countries.

Though statistically insignificant, the point estimates of diversion effects on the intensive margin for Thailand and Vietnam are close to 20%. For Thailand, a potential explanation is that Thailand's exports of waiver goods have a greater exposure to competition from Pakistan. In the first subplot of Fig. A1, we plot Thailand's market shares of each waiver good in EU's total imports against Pakistan's market shares of the waiver goods in total EU imports. Similarly, in each of the other subplots, we plot a competing country's market shares against Pakistan's market shares of waiver goods. Each bubble indicates one waiver good. If all bubbles are close to the vertical or horizontal axis, a competing country overlaps only slightly with Pakistan over the set of waiver goods exported to the EU. On the other hand, more bubbles in the interior of a subplot suggest a greater extent of competition with Pakistan in the EU market. Compared to other major textile- and leather- exporting countries with similar export volumes, such as Cambodia and Sri Lanka, Thailand has a relatively high number of waiver goods for which both Thailand and Pakistan have relatively large market shares. China, Turkey, and India also have a relatively large number of waiver goods located in the interiors of such scatter plots. However, these three countries have the largest market shares of waiver goods in the EU market (see Fig. A2). A majority of their waiver products have a market share greater than Pakistan's. These three countries may, therefore, be well positioned to guard their market shares against competition from Pakistan.

Vietnam's overlap with Pakistan over the product space is similar to other competing countries, such as Sri Lanka and Bangladesh, whose total values of waiver goods exported to the EU are close to that of Pakistan. From 2010 to 2013, the average annual growth rate of Vietnam's exports of waiver goods to non-EU OECD countries was very high—close to 20%—compared to a more steady and modest rate of 4% for exports to the EU. Vietnam's exports of waiver goods to the EU still grew by 5.6% in 2013. Therefore, it is likely that the estimated trade diversion effect instead reflects the lower growth of Vietnam's exports of waiver goods to the EU market related to Vietnam's export elsewhere.

Admittedly, we lack statistical power to rule out plausible trade diversion effects of waiver goods on major textile exporters. However, since the set of waiver goods only accounts for 2% of Thailand's and 8% of Vietnam's total exports to the EU, respectively, the overall trade diversion impact is unlikely to be considerable for either country. Unlike Pakistan, for which waiver goods accounted for more than 30% of its total export to EU, other countries' exports are substantially less concentrated in waiver goods. Among competing textile exporters, Cambodia's exports mostly concentrate in waiver goods, which still accounted for only 16% of its exports to the EU in 2012.

The t-statistics on the coefficients are very low for all countries except India on the extensive margin. For India, the probability of starting new exports decreased by 2.8% due to the EU's trade concessions policy to Pakistan. Given that India was one of the strongest opposers of the EU policy, it is worthwhile looking at India's exports more closely although trade diversion effects on the extensive margin were barely significant. Interestingly, India's estimated probability of new exports for the waiver products decreased not just in the EU, but also in other non-EU importers. The estimated

Table 5
Trade diversion effects on competing exporters.

	Intensive Margin: log(Export)							
	Bangladesh	Cambodia	China	Dom.Rep	Guatemala	Honduras	Indonesia	India
EU×Waiver×Post	−0.055 (0.136)	−0.051 (0.201)	0.093 (0.122)	0.428 (0.304)	−0.029 (0.370)	0.089 (0.220)	0.052 (0.190)	0.026 (0.134)
	Korea	Mexico	Philippines	Sri Lanka	Thailand	Turkey	Vietnam	
EU×Waiver×Post	0.037 (0.169)	0.092 (0.181)	−0.045 (0.263)	−0.041 (0.200)	−0.189 (0.160)	0.071 (0.139)	−0.225 (0.161)	
	Extensive Margin: $\mathbf{1}(\text{Export} > 0)$							
	Bangladesh	Cambodia	China	Dom.Rep	Guatemala	Honduras	Indonesia	India
EU×Waiver×Post	−0.027 (0.023)	0.011 (0.017)	0.011 (0.012)	0.004 (0.013)	0.015 (0.012)	0.002 (0.016)	−0.015 (0.028)	−0.028* (0.016)
	Korea	Mexico	Philippines	Sri Lanka	Thailand	Turkey	Vietnam	
EU×Waiver×Post	0.014 (0.019)	−0.008 (0.021)	−0.002 (0.015)	0.005 (0.023)	−0.018 (0.020)	−0.006 (0.024)	0.015 (0.018)	
Fixed Effects:								
Importer×Year	Y	Y	Y	Y	Y	Y	Y	Y
Product×Year	Y	Y	Y	Y	Y	Y	Y	Y
Product×Importer	Y	Y	Y	Y	Y	Y	Y	Y

Notes: Each observation is about the export of one product to one importer in one year. The dependent variable is the log value of exports for the regressions reported in the upper panel regressions, and an indicator variable indicating positive export value for the regressions reported in the lower panel. Standard errors in parentheses are clustered two-way at both importer and product levels. The product, product-year, and product-importer fixed effects, are all at the HS-6 digit level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

probability of new exports of the waiver products in non-EU countries decreased by 2.3%. Fig. A3 shows the proportion of India's export destinations with positive trade flows for the waiver and non-waiver products respectively. For the non-EU destinations, for both waiver and non-waiver products, time trends for the proportion of new destinations show very similar patterns. The proportion of non-EU destinations had been gradually increasing until 2012 and dropped slightly in 2013. On the other hand, for the EU destination, time trends for the proportion of new destinations were somewhat different between waiver and non-waiver products and especially in 2013. For non-waiver products, the proportion of new destinations had increased from 2009 to 2013. However, for waived products, there were huge drops in 2009 and 2013 while there were virtually no changes in trend from 2010 to 2012. Thus, we could not rule out that the withdrawal from the export markets in the EU in 2013 was due to trade diversion. From 2012 to 2013, India's waiver good withdrew from a total of 110 EU destinations and entered 92 EU destinations. Thus, net withdrawal from destinations was 18 for waiver products from 2012 to 2013. The total value of exports to the 92 new markets was $2.060 billion, while prior to the withdrawals, the total value of exports to 110 withdrawn destinations was $2.133 billion. India's total waived products exported to the EU in 2012 was $2885 billion. Thus, the decrease in export volume from net withdrawal is 0.07%, which is quite small economically. All in all, we find no significant trade diversion effects on competing exporters from the EU's tariff concession policy for Pakistan.

4. Timing of export boost

4.1. Too little, too late?

The results in Section 2 show that, despite their being temporary, EU's trade concessions boosted Pakistan's exports substantially on both the intensive and the extensive margins. However, opponents to using trade policies as the main means of aid, argue that trade concession as aid would be "too little, too late." Indeed, the EU tariff waivers were not effective until two and a half years after the floods. Most of the delays were due to political negotiations addressing the concerns of different EU and non-EU countries, who might have lost from the EU's trade concession to Pakistan.

There are several reasons why trade policy still merits consideration as an aid means for the future. First, as floods hit Pakistan, the international community, including the EU, provided emergent disaster relief. While trade concessions as a stand alone form of disaster relief may be too late, they could constitute an effective form of aid, well-complementing with conventional foreign aid of cash and in-kind transfers. Moreover, Baker and Bloom (2013) find that indirect effects from increased uncertainty after natural disasters hinder growth as much as the direct first moment effects of natural disasters. A promise or prospect of trade concession in the near future could be helpful in mitigating post-disaster uncertainty.

Second, while most forms of disaster relief could be subject to the same criticisms given to ODA, some of these criticisms may not be applicable to trade concessions as aid. For instance, under weak institutions, disaster relief aid may not be delivered to those in need. Possibly due to such concerns, the EU delivered its disaster relief aid mostly through non-profit organizations immediately following the floods. Moreover, while voter attention plays a significant role in the allocation of disaster relief (Eisensee and Strömberg, 2007), policies to foster economic recovery are likely to require a longer term perspective. In the context of Pakistan, insurgencies and political instability in the flood-hit areas afterward, remain as factors impeding growth. Since most forms of disaster relief are used in short term, trade concessions may provide a longer term aid to disaster-hit countries.

It but not least, the EU was the first major economy to propose using trade concession to aid the recovery of a disaster impacted country. Although the EU and the US as well as other major developed countries have long enforced their own preferential policies through Generalized Systems of Preferences to lower trade barriers for developing countries, and some positive effects on trade creation have been

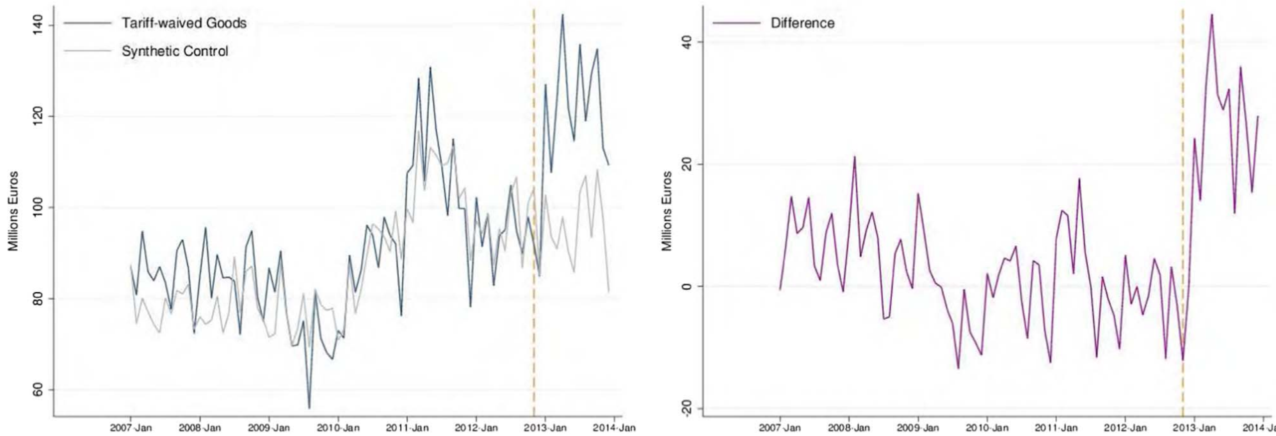

Fig. 3. Export volume of waived products and synthetic control.

reported (Rose, 2004; Frazer and van Biesebroeck, 2010), it was unclear how effective extra short term measures might be for developing economies suffering negative shocks. The results of the previous section suggest that the trade concession were certainly not too little for the flood-hit Pakistan, at least not in term of trade creation for the target recipient.

4.2. Synthetic control analysis

For proponents of trade concessions becoming a standard part of disaster relief, a question remains that, if the political process for granting trade concessions could be expedited, how long would it take for tariff waivers to start boosting exports? To answer this question, we use monthly data of EU imports from Pakistan between 2007 and 2013. To estimate a causal impact of the tariff waivers, we compare the aggregate monthly Pakistan-to-EU exports of the waiver products to a synthetic control (Abadie and Gardeazabal, 2003; Abadie et al., 2010). The synthetic control is a weighted sum of Pakistan-to-EU export volume of 21 HS sections, excluding the waiver products:

$$\hat{Y}_t = \sum_{j\in C} w_j Y_{jt} \tag{4}$$

where $\hat{Y}_t$ is the synthetic control for aggregate Pakistan-to-EU exports for waiver products in period (month) t; Y_{jt} is the period t's total Pakistan-to-EU exports of HS Section j products, excluding the waiver products; w_j is the weight assigned to Section j; and C is a set of all HS sections, constituting the “donor pool” for the construction of synthetic control. The weights could be chosen by minimizing the mean squared errors of predicting the export of waiver products with the synthetic control in the pre-waiver period from January 2007 to October 2012:

$$\{w_j\}_{j\in C} = \arg\min_{\{w_j\}_{j\in C}} \left\{ \sum_{t=1}^{t=T_0} \left(Y_t^* - \sum_{j\in C} w_j Y_{jt} \right)^2 \right\} \text{s. t.} \sum_{j\in C} w_j = 1 \quad \text{and } w_j \geq 0, \quad \forall\, j \in C \tag{5}$$

where Y_t^* is the Pakistan-to-EU exports of products whose tariffs were to be waived from November 15, 2012; T_0 is the last period before the tariff waivers became effective, i.e. October 2012; t=1 is the first sample period, i.e. January 2007; and as before Y_{jt} is the period t total Pakistan-to-EU exports of HS section j products, excluding the waiver products.

Let $Y^* = (Y_1^*, \ldots, Y_{T_0}^*)'$ be a T_0 vector of stacked outcome variables Y_t^* for the treatment products. Let $\hat{Y}_t = \sum_{j\in C} w_j Y_{jt}$ so that $\hat{Y} = (\hat{Y}_1, \ldots, \hat{Y}_{T_0})'$ is a T_0 vector of stacked outcome variables $\hat{Y}_t$ of the synthetic control. Eq. (5) above could be rewritten as:

$$\{w_j\}_{j\in C} = \arg\min_{\{w_j\}_{j\in C}} \{(Y^* - \hat{Y})' V (Y^* - \hat{Y})\} \text{s. t.} \sum_{j\in C} w_j = 1 \quad \text{and } w_j \geq 0, \quad \forall\, j \in C \tag{6}$$

where V is a $T_0 \times T_0$ identity matrix. The identity matrix V essentially weights every pre-intervention period equally. Instead of using an identity matrix for V, Abadie and Gardeazabal (2003) and Abadie et al. (2010) propose a data-driven procedure to optimally select V, which gives a synthetic control that minimizes the expected mean square error of the synthetic control estimator.

Since proposed by Abadie and Gardeazabal (2003), the synthetic control analysis has proven to be a powerful tool in comparative case studies (Abadie et al., 2015). Our use of the synthetic control method to analyze the monthly Pakistan exports to the EU is motivated by two considerations. Firstly, the synthetic control analysis provides a visual examination of how large the waivers' impacts are on the aggregate export volume of all waived products and of how quickly such impacts show up in the data. Estimates from an unweighted regression capture the average treatment effect of tariff waivers across the 75 waived products. But because different products are traded at different volumes, such average treatment effect may deviate from the waiver's impact on aggregate export volume of the waived products, in particular when the impacts on different products vary with the average trading volume. While one could weight the products by their per-waiver or average trading volume, the synthetic control provides a more transparent way of visualizing the impact of waivers on the aggregate export of the waived products.

Secondly, the synthetic control method does not rely on the assumption that product-specific trends among waived products and non-waived products should be common to EU and non-EU countries, which is assumed in a triple-difference approach. Since we only have monthly data for trades with the EU and the tariff waivers applied to a group of products that Pakistan exports in large value to the EU, one might be concerned that the waived products to the EU might not have shared a common trend with those to non-EU countries or that the time effect within the group of waived products might have been different from the time effects within the group of non-waived products (Athey and Imbens, 2006). Moreover, the synthetic control analysis serves as a robustness check on our triple-difference analysis.

In Fig. 3, we plot the monthly exports of Pakistani products with tariffs to be waived starting November 15, 2012. In the same subplot spanning from January 2007 to December 2013, we also plot the export volume of our synthetic control as described above. As shown in Fig. 3, the time series of the synthetic control matched with the total export value of waiver products fairly well before November 2012. Moreover, after the tariff waivers became effective, exports of products with tariff waivers co-moved in similar directions as non-waived products. Strikingly, in less than two months after the waivers became

Table 6
Tariff waivers and Pakistan's exports to the EU: spillover across products.

Dependent variable:	log(Export)				**1**(Export > 0)	
	(1)	(2)	(3)	(4)	(5)	(6)
EU×Waiver(neighbor)	0.328***			0.007		
	(0.120)			(0.042)		
Waiver(neighbor)×Post		−0.109			0.015	
		(0.108)			(0.018)	
EU×Waiver(neighbor)×Post	0.091	−0.024	0.005	−0.004	−0.004	−0.004
	(0.114)	(0.111)	(0.114)	(0.021)	(0.021)	(0.021)
Fixed Effects:						
Importer×Year	Y	Y	Y	Y	Y	Y
Product×Year	Y		Y	Y		Y
Product×Importer		Y	Y		Y	Y
No. of Observations	187,698	187,698	187,698	2,537,244	2,537,244	2,537,244

Notes: Standard errors in parentheses are adjusted for two-way clustering at importer and product levels. The product, product-year, and product-importer fixed effects, are all at the HS-6 digit level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

effective, exports of tariff-waived products increased dramatically and persisted at a much higher level throughout the remainder of 2013. In Fig. 3, we also plotted the difference between exports of waived products and the synthetic control. The export hike plotted in Fig. 3 is similar in magnitude to what we find in Table 1, suggesting that our previous results reported in Table 1 were not due to outlying products with small trading volumes but large responses. The synthetic control results also addressed the concerns that our waived products exported to the EU followed a trend different from that of the waiver products exported to non-EU OECD countries or that of the non-waived products exported to the EU, which constitutes a maintained identification assumption underlying our triple-difference approach. Table A1 shows the weights assigned to the EU-bound export volume of each HS sections excluding the waived products. These weights were obtained by minimizing the weighted mean squared errors specified in Eq. (6) using monthly data from January 2007 to October 2012. We would have obtained similar results if we had constructed our weights using time series of trade volumes before July 2010, when the flood took place.

4.3. Spillover across products

The donors for our construction of synthetic control are monthly to-EU exports aggregated to the level of HS sections, excluding goods with tariffs to be waived. We use HS section aggregates instead of more disaggregate products as donors because waiver goods account for a large share of total Pakistan exports to the EU and a synthetic control is by construction a convex combination of donors' outcomes. Because the aggregate export of waiver goods is larger than the export value of the largest HS4 product excluding the waiver goods, using individual products would not be able to produce a synthetic control similar to the aggregate export of waiver goods in magnitude.

Table A1 reports the weights assigned to each of 21 HS sections for the synthetic control shown in Fig. 3. Perhaps not surprisingly, Section 11, Textile and Textile Articles, has the largest weights among all donors. The tariff waivers make exporting waiver goods less costly than similar textile articles. If the costs of switching products are sufficiently low, one may be concerned that the export of textile products similar to the waiver goods may drop. Then, the inclusion of these products in the donors would overstate the trade creation effects of the tariff-waivers.

To examine this possibility, we perform a placebo test using the triple-difference framework in the previous section. We define the HS6 placebo products as those with the same HS4 classifications as the waiver goods – but themselves do not have waivers. We drop the waiver goods and treat the placebo products as if they have waivers in regressions with a triple-difference specification as in Table 1.

Table 6 reports the results of the placebo tests. If product switching does happen, we would expect a negative and significant coefficient for the triple interaction term. However, the coefficient estimates are insignificant, often positive and small.

Moreover, for the nine waiver products with the higher export volumes in our sample period, we carry out a synthetic control analysis for each of them individually. These nine products collectively account for about half of the waiver products exported to the EU by Pakistan in our sample period. To construct the synthetic control for each waiver product at HS6 level, we exclude all the products in the same chapter (HS2) from the donor pool.[8] The monthly export volume of the nine products and their synthetic controls are plotted in Fig. 4. For most products, there were visible increases of exports related to their synthetic controls once the tariff waivers became effective.

In principle, we could similarly construct a synthetic control for the aggregate export volume of waiver goods using export volumes of HS sections excluding chapters with any waiver goods. We could also conduct a placebo test by performing a synthetic control analysis on the aggregate export volume of goods without tariff waivers but similar to waiver goods. We carry out such exercises and plot the results in Fig. A4, whose format is similar to that of Fig. 3. While we still find an export increase in waiver goods and no apparent decrease in non-waiver but otherwise textile goods, the synthetic controls poorly assemble the movements of the outcome variables of their associated treatment groups in the pre-intervention period. After excluding related HS chapters from the donor pool, the remaining products account for a relatively small share of Pakistan exports and appear to be not quite the same as the waiver goods. Alternatively, we could also perform synthetic control for each waiver product and aggregate all the synthetic controls to another synthetic control for the aggregate export of waiver goods. However, the resultant two-step synthetic control is a poor fit to the target it tries to predict. The two-step synthetic control is volatile since it does not account for the positive correlation induced by the repeated use of individual donors. After aggregation, a number of donor products end up with a weight much higher than one.

5. Labor market impacts

Whether the trade concessions aided the recovery following the 2010 floods depends on the extent to which the export boom created labor market opportunities for flood-affected population. In this

[8] There are 96 HS chapters and 11 of them contain at least one waiver good.

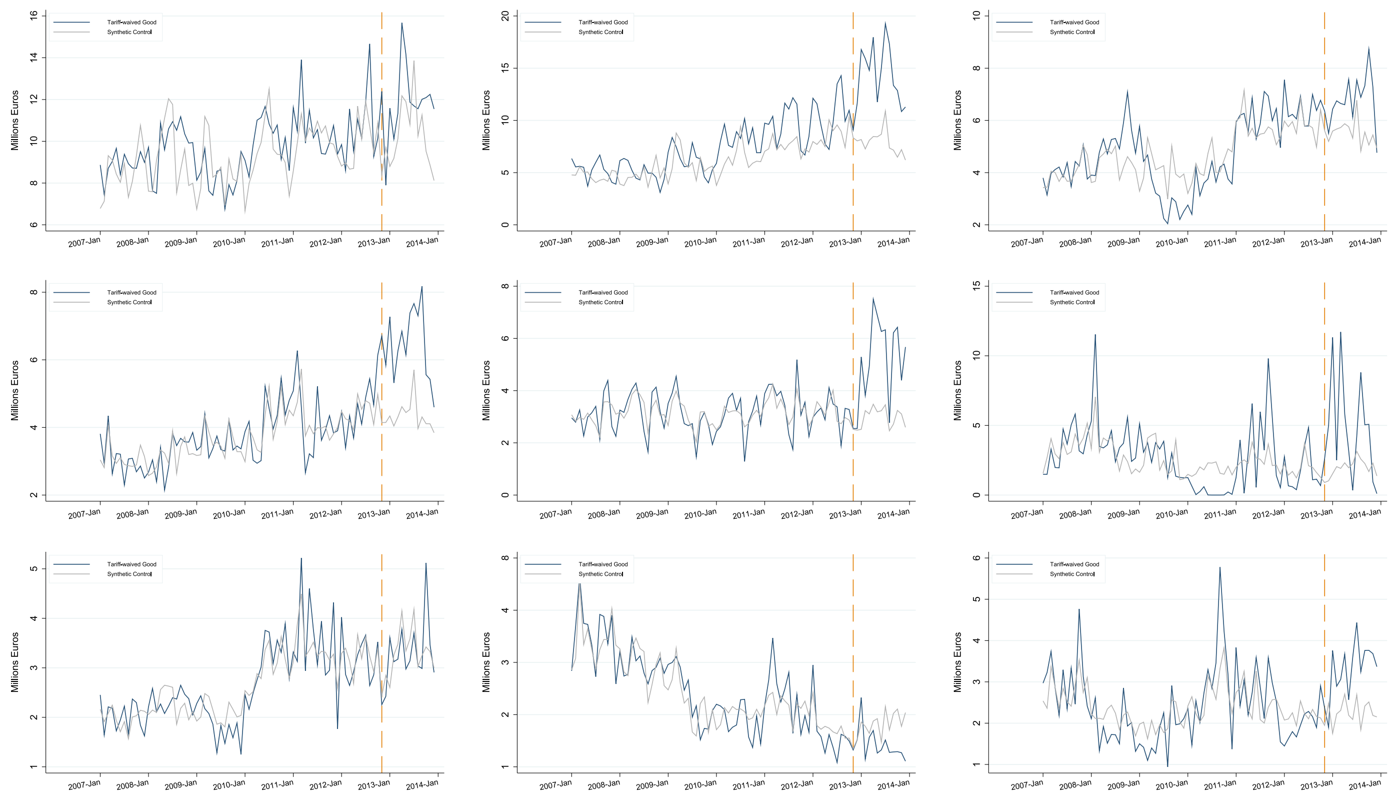

Fig. 4. Synthetic control analysis for each of the waiver goods with highest pre-waiver export volume.

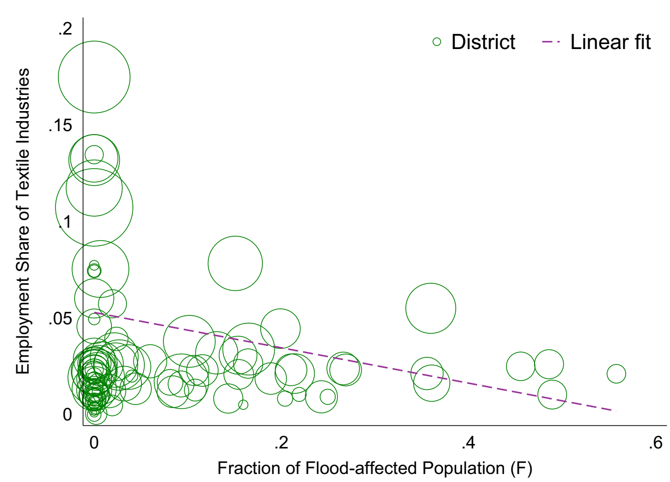

Fig. 5. Floods severity and employment share of textile, garment & leather industries.Notes: Each bubble is a district, whose population as of 2010 is indicated by the size of the bubble. The y-axis represents the employment share of textile industries. The x-axis represents the flood severity defined by Eq. (7).

section, we provide some descriptive analysis of the labor market impacts of the EU's trade concessions.

5.1. Data

The data used in this section consists mainly of the Pakistan Social and Living Standards Measurement Surveys (PSLMs). PSLMs are national household surveys conducted annually by the Pakistan Bureau of Statistics. PSLM samples are representative over the four provinces of Pakistan as well as the Islamabad Capital Territory. PSLM samples exclude Gilgit-Baltistan, and Azad Jammu and Kashmir, which are autonomous self-governing regions referred as Pakistan-administrated Kashimir by the United Nations (UN). PSLM samples also exclude the Federally administrated Tribal Areas bordering Afghanistan.

The latest wave of PSLMs available is the 2013-2014 wave. Interviews for this wave were conducted from late 2013 to early 2014. Hereafter, we refer this wave as the 2013 wave and use similar references for prior waves. For basic information such as demographics and labor market activities, the same set of questions is asked across waves. In odd numbered years, a larger set of questions, including consumption expenditure, is asked. In even numbered years a larger sample is collected. We obtained PSLMs from 2006 to 2013. Due to administrative difficulties, however, the 2009 survey was deferred to 2010 and conducted in conjunction with the 2010 survey. Combining seven survey years in our sample, we have 369,283 households and 2,478,650 individuals. Our sample mainly consists of survey years 2007 and 2010 to 2013, because surveys in 2006 and 2008 contain no information about the industry classification of subjects' employment.

The four provinces of Pakistan are further divided into districts. There are 106 districts as of 2010, with minor changes to the number of districts in our sample period. Since Pakistan has not conducted a census since 1998, we obtain district level population estimates as of mid-2010, prior to the floods, from the Demodatabase of the U.S. Census Bureau. Districts are further divided into sub-districts, known as *telsil* in Pakistan, for administrative purposes. To construct district level flood severity, we obtain sub-district level population and percentage of flood-affected areas from the UN Office for the Coordination of Humanitarian Affairs (OCHA).

5.2. Earnings and employment

As mentioned before, the tariff waivers mainly benefit the textile industries. However, as shown in Fig. 5, areas most severely affected by floods in 2010 tend not to be areas where the textile industries employ the highest share of workers. As of 2010, there were 106 districts in the Pakistan's four provinces. Fig. 5 plots the employment share of textile industries in a district against the flood severity of the district in 2010,

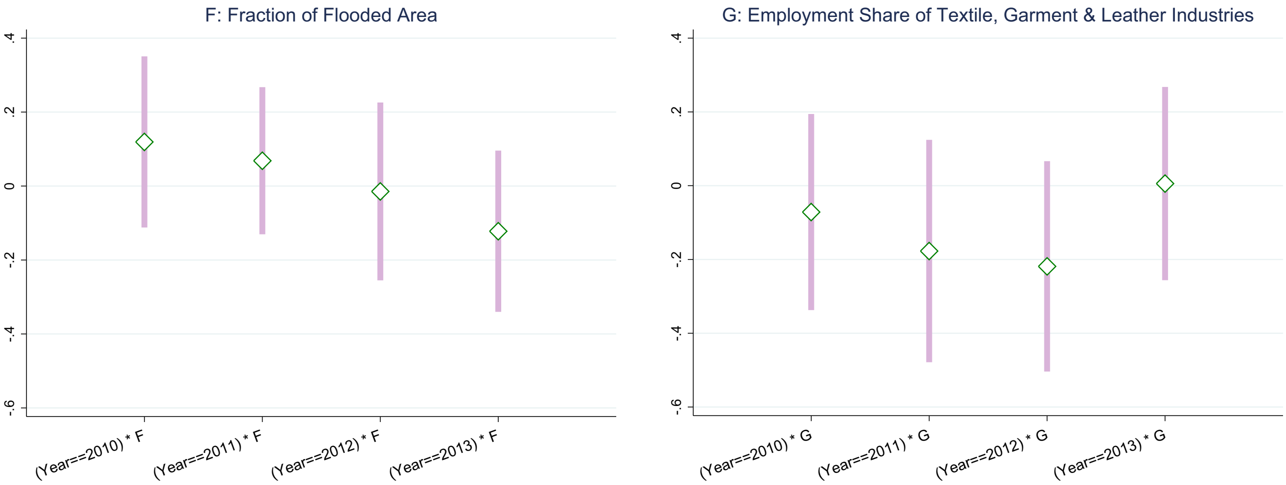

Fig. 6. Household earnings in flooded areas and areas with textile, garment & leather industries.Notes: The graphs above plot the coefficient estimates of the specification given by Eq. (8). The dependent variable is the log value of household earnings in the last year. The sample includes 198,961 households in PSLM waves 2007 and 2010–2013. The left subplot above contains the estimates of δ_t, which are the interaction terms between the fraction of flood-affected population and the indicator variables for year; The right subplot above contains the estimates of γ_t, which are the interaction terms between the local employment share of textile industries and the indicator variables for year. The bars indicated 95% confidence intervals. Standard errors are clustered at the district-urbanity level. The control variables include household characteristics, district-urbanity fixed effects, and year fixed effects.

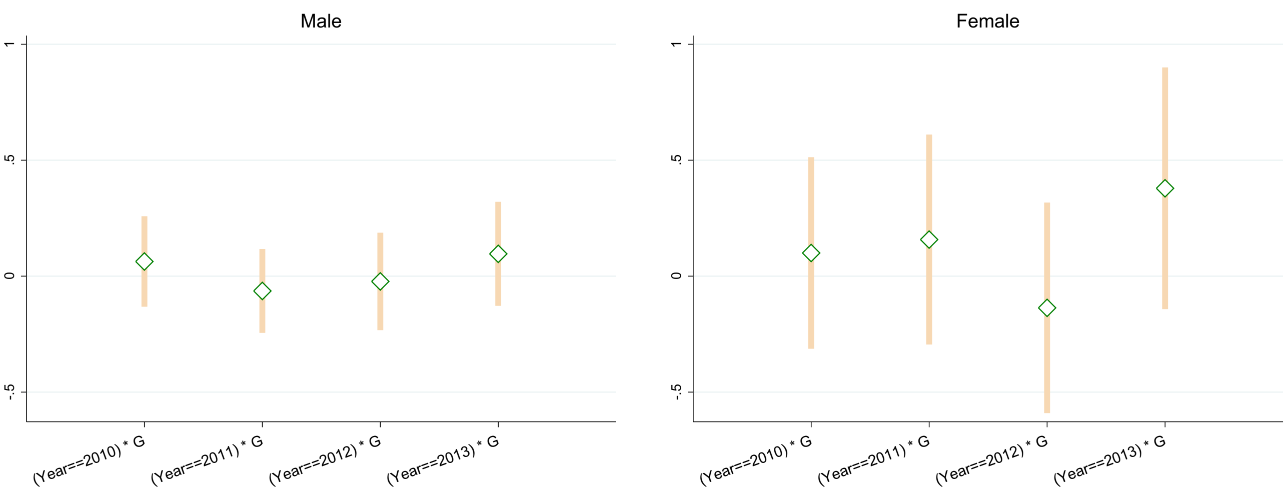

Fig. 7. Employment by gender in areas with textile, garment & leather industries.Notes: The graphs above plot the coefficient estimates of the specification given by Eq. (8). The dependent variable is an indicator variable equal to one if the individual is a paid employee and zero otherwise. The sample includes 377,212 working-age individuals in the labor force from PSLM waves 2007 and 2010–2013. Both subplots above contain the estimates of γ_t, which are the interaction terms between the local employment share of textile industries and indicator variables for year. The left subplot plots γ_t from the male sample; the right subplot plots γ_t from the female sample. The bars indicated 95% confidence intervals. Standard errors are clustered at the district-urbanity level. The control variables include individual characteristics, district-urbanity fixed effects, and year fixed effects.

Fig. 8. Employment share of textile, garment & leather industries.

where each bubble represents a district and the size of a bubble indicates the population size of the district as of 2010 prior to the floods. To measure the flood severity in a district, we measure the fraction of population in district d affected by floods using sub-district population and flooded areas:

$$F_d = \frac{\sum_{s \in S_d} f_s p_s}{\sum_{s \in S_d} p_s} \tag{7}$$

where s indexes sub-districts divisions; S_d is the set of sub-districts dividing district d; f_s is the fraction flooded areas in sub-district s in 2010; and p_s is the population of sub-district s.

Only a small number of districts with considerable textile employment were affected by the floods. Districts with the most concentrated textile employment tended to be unaffected by the 2010 floods. Such negative correlation and the fact that the floods mostly affected rural areas (Kirsch et al., 2012) may explain why the export volume of textile industries did not have significant drops.

To investigate the labor market impacts of the floods and the 2013 export boom in textile industries, we use data from the Pakistan Social

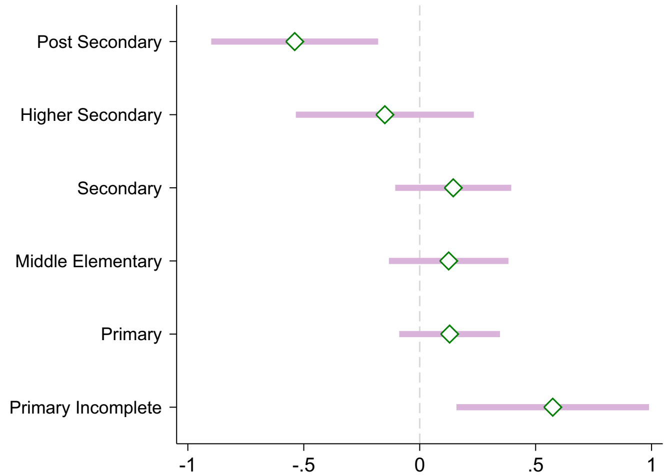

Fig. 9. 2013–2012 differences on how local textile employment share affects household earnings: by education attainment of the head of household.Notes: The graphs above plot the coefficient estimates of the specification given by Eq. (9). The dependent variable is the log value of household earnings in the last year. The sample includes 198,961 households in PSLM waves 2007 and 2010–2013. The graph above plots estimates of θ_t, which are the triple-interaction terms of the local employment share of textile industries, the indicator variables for year, and indicator variables of education attainments. The bars indicated 95% confidence intervals. Standard errors are clustered at the district-urbanity level. The control variables include household characteristics, district-urbanity fixed effects, and year fixed effects.

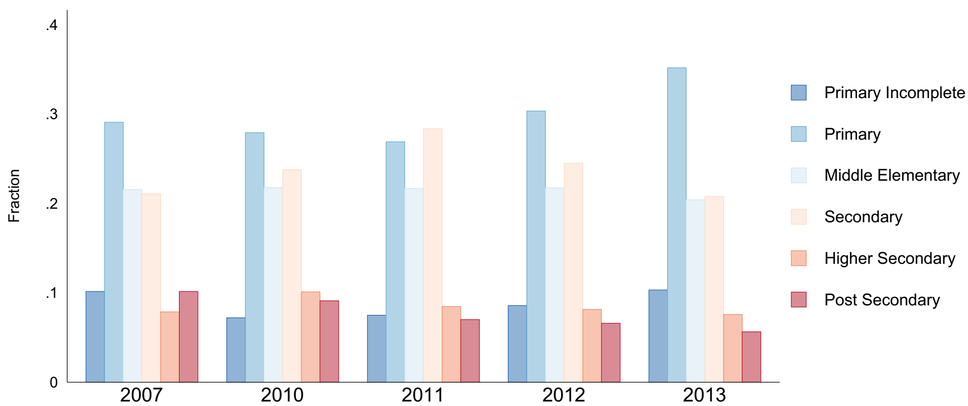

Fig. 10. Distribution of education attainment of textile workers.

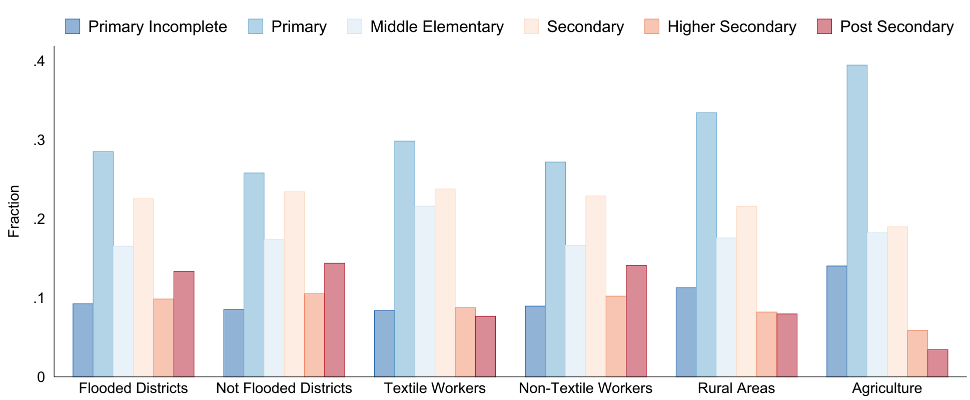

Fig. 11. Distribution of education attainment.

and Living Standard Surveys (PSLMs) to estimate the following model:

$$Y_{idt} = \sum_{\tau=2010}^{2013} \delta_t F_d \mathbf{1}(t=\tau) + \sum_{\tau=2010}^{2013} \gamma_t G_{idt} \mathbf{1}(t=\tau) + \gamma_0 G_{idt} + X_{idt}^{'}\beta + \mu_t + \lambda_d + \epsilon_{idt} \tag{8}$$

where i indexes households or individuals; d indexes districts; t indexes survey years; Y_{idt} is an outcome variable such as household earnings and employment; $\mathbf{1}(\cdot)$ is an indicator variable equal to one if the statement inside the parentheses is true and zero otherwise; F_d is flood severity as defined above in Eq. (7); G_{idt} is the local employment share of textile industries in the areas where the household/individual i resides; X_{it} is a vector of household or individual characteristics; μ_t is a year fixed effect; λ_d is a district-urbanity fixed effect; and ϵ_{idt} is an error term.

The local employment share of textile industries, G_{idt}, is defined over geographic units identified as primary sampling units by the Pakistan Bureau of Statistics. A primary sampling unit is typically a village in rural areas or an enumeration block in urban areas, and includes about 200 to 250 households. A typical households in Pakistan has about eight members. In our sample, each primary sample unit has about 95 observations.

We focus on primary sampling units for local exposure to the textile industries for two main reasons. First, as shown in Fig. 5, the employment share of textile industries in a typical district is fairly low, averaging about 4%. It is unlikely that the district level employment shares of textile industries could provide precise estimates on the labor market impacts we are interested in. Indeed, we do not find contemporary textile employment share at the district level predicts labor market outcomes in 2013. On the other hand, given that the labor demand in the textile industries might spill over to local labor markets and non-tradable goods sectors, a local measure of textile exposure might be better at capturing the impacts of textile employment than individual affiliation with the textile industries (Kovak, 2013). However, since primary sampling units are coded by the statistics bureau and are not linked longitudinally, one may be concerned about the simultaneity biases and omitted variables driving both local textile employment shares and the outcome variables. We will discuss some of

Fig. 12. Household dependent ratio in flood-hit areas and areas with textile, garment & leather industries.Notes: The graphs above plot the coefficient estimates of the specification given by Eq. (8). The dependent variable is the age dependent ratio. The sample includes 198,961 households in PSLM waves 2007 and 2010–2013. The left subplot above contains the estimates of δ_t, which are the interaction terms between the fraction of flood-affected population and the indicator variables for year; The right subplot above contains the estimates of γ_t, which are the interaction terms between the local employment share of textile industries and the indicator variables for year. The bars indicated 95% confidence intervals. Standard errors are clustered at the district-urbanity level. The control variables include household characteristics, district-urbanity fixed effects, and year fixed effects.

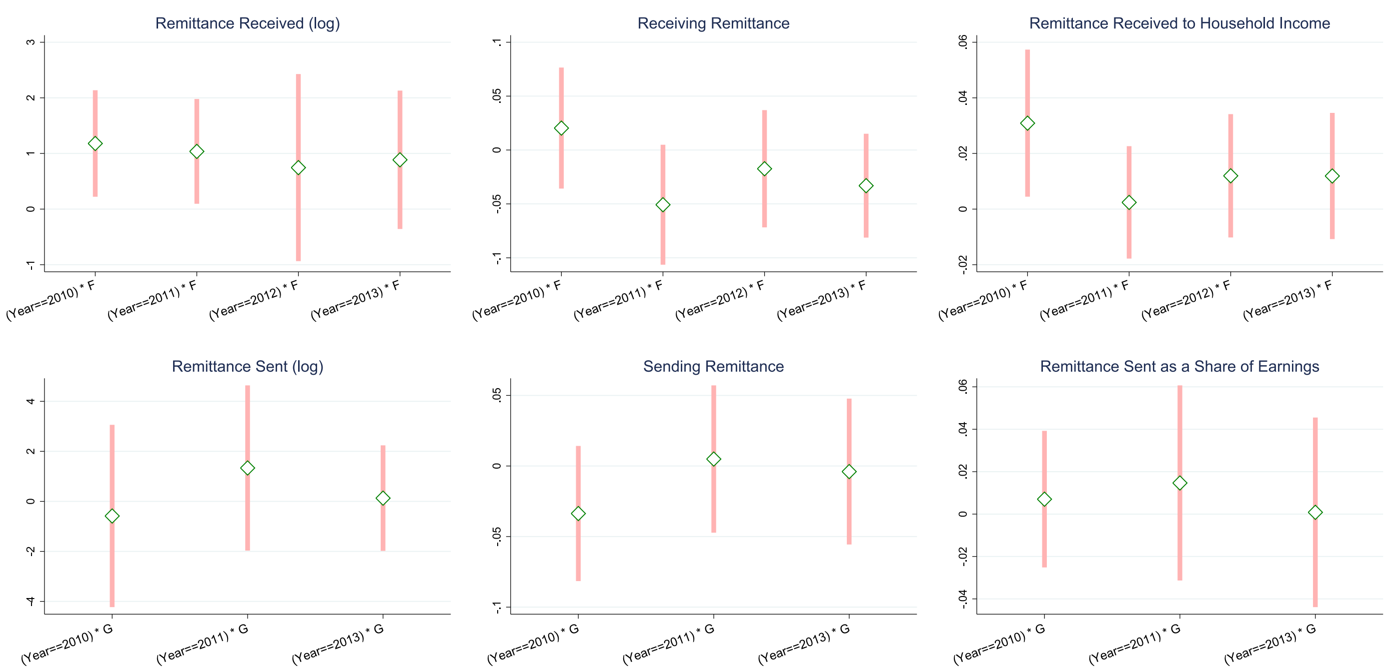

Fig. 13. Remittance received and sent.Notes: From left to right on the top row of subplots, the dependent variables are respectively log remittance received, an indicator variable indicating a positive amount of remittance received in the past year, and remittance received as a share of household income. From the left to right on the bottom row of subplots, the dependent variables are respectively log remittance sent, an indicator variable indicating any remittance sent in the past year, and remittance sent as a share of earnings. On the top row, the estimated coefficients of the flood severity measure (F) interacting with the indicator variables for year are plotted. On the bottom row, the estimated coefficients of the local textile employment share (G) interacting with the indicator variables for year are plotted. Questions on remittance sent out are not asked in the 2012 PSLM survey and hence 2012 was dropped in the bottom row regressions.

the issues but acknowledge that our estimates in this section may not have strong causal interpretations.

Since the most disaggregate geographic unit we could link longitudinally is district-urbanity, we include a district-urbanity fixed effect λ_d instead of a district fixed effect and an indicator variable indicating urban-rural division of a district in our baseline specification. However, using the later specification does not qualitatively change our results.

We first examine the log value of household labor market earnings in the past year as an outcome variable Y_{idt}. In this regression, the household characteristics we control for include a set of indicator variables indicating one of the six levels of education attainment of the head of the household; a quadratic term of age of the household head; an indicator variable indicating whether the household head is a woman; and indicator variables indicating the number of working household members and the size of the household. Estimates of δ_t and γ_t, for t = 2010, …, 2013, are plotted in Fig. 6.

As shown in the subplot on the left of Fig. 6, household earnings in more flood-affected districts have grown more slowly since year 2010. Although year-to-year changes are not statistically significant, the estimate of δ_{2013} is significantly lower than that of δ_{2010} (with a p-value of 0.028). This means that households in a district not affected by floods at all, on average have a 2013 income 2.6% higher than households in a district with 11% of its population affected by floods in 2010. About 25% of the population live in districts with at least 11%

areas affected by the 2010 floods. However, due to the repeated cross-sectional nature of our data sets, we are not able to distinguish whether existing households in flood-hit areas suffer chronical underperformance in income growth or if a composition effect drives our results. In the context of United States, Strobl (2011) finds that hurricane-prone counties experience low economic growth partially due to out-migration of richer individuals. The positive selection of out-migration may drive the lower average earnings of households in the flood affected areas. However, it is unclear whether the out-migrants after the 2010 floods were positively selected. Hornbeck and Naidu (2014) find that the Great Mississippi Floods of 1927 in the American South lead to the immediate and persistent out-migration of the low-waged black population.

On the right hand side of Fig. 6, estimates of γ_t also show a slightly weaker growth in earnings for households in high textile employment areas from 2010 to 2012. However, textile-intensive areas experienced a boost in 2013. The difference between γ_{2013} and γ_{2012} is statistically significant at the 5% level, which suggests that households earnings in neighborhoods without any textile employment, on average, grew 3% less in 2013 than households in neighborhoods with 13% of their employment in the textile industries.[9] About 10% of the population live in neighborhoods where 13% or more of the workers are employed in the textile industries.

The higher household earnings for households in textile intensive areas in 2013 is mainly driven by greater employment opportunities than higher wages. We estimate a linear probability model where the outcome variable equals to one if an individual is a wage/salary earner and zero otherwise, but in the labor force. The specification is similar to Eq. (8) but at the individual level. We run regressions separately for men and women. We also control for individual characteristics by including a quadratic term of age and a set of indicator variables indicating education attainment. Fig. 7 plots the key coefficient estimates of interests.

For men in textile-intensive areas, the employment growth in 2013 is small and significant at only the 10% level. On the other hand, women in textile-intensive areas were much more likely to be employed in 2013 than in 2012. The difference is significant at the 1% level and suggests that, compared to 2012, women in 2013 were 6.7 percentage points more likely to be employed in an area with 13% textile employment than women in areas with no textile employment. Given that only 42% of women in the labor force were wage/salary workers, as compared to 55% for men, the boom in the textile industries created more work opportunities for women. This is consistent with the fact that while only 3.8% of working men worked in the textile industries, 7.4% of working women worked in the textile industries.

Since we use contemporary employment shares of textile industries as an explanatory variable, one concern is that cross-sectional shocks might drive our estimated employment gains even in the absence of aggregate shocks. To examine whether this is the case, we plot the raw overall employment shares of textile industries over our sample years in Fig. 8. There was a large increase in the employment share of textile industries in 2013, which suggests that the higher employment rate in textile-intensive areas is not entirely driven by cross-sectional shocks. There also appeared to be an increase in the employment share by the textile industries in 2012. However, since the interviews of the 2012 wave were conducted in late 2012 and the first half of 2013, the higher employment share may have picked up an increase in textile employment in early 2013.

Moreover, the expansion of the textile industries seems to offer greater employment opportunities for women previously non-employed or underemployed. Women working in the textile industries on average reported working for 9.8 months in 2013, as compared to 11 months in 2012.

To investigate the distributive effects, we modify the specification described by Eq. (8) by interacting the term $\gamma_t G_{idt}$ with indicator variables indicating the education attainment of the heads of households. We create six indicator variables to indicate the six levels of education attainment in Pakistan: (i) less than primary school completion; (ii) primary school completed; (iii) middle school completed; (iv) secondary school completed; (v) higher secondary completed; (v) post secondary degree(s). We estimate the following specification:

$$Y_{idt} = \sum_{e=1}^{6}\sum_{\tau=2010}^{2013} \theta_t^e G_{idt}\mathbf{1}(t=\tau)D_{idt}^e + \gamma_0 G_{idt} + \sum_{\tau=2010}^{2013} \delta_t F_d \mathbf{1}(t=\tau) + X_{idt}^{'}\beta + \mu_t + \lambda_d + \epsilon_{idt} \tag{9}$$

where $e = 1, \ldots, 6$ indexes the six education attainment levels described above; D_{idt}^e is an indicator variable indicating education attainment of level e; and the remaining terms are the same as in Eq. (8). A set of indicator variables $D^e{}_{idt}$ now is also included in controls X_{idt}.

Let $\Delta\theta^e = \theta_{2013}^e - \theta_{2012}^e$. Then $\Delta\theta^e$ captures how the boom in the textile industries benefits different households with education attainment e. Fig. 9 plots the estimates of $\Delta\theta^e$ with their associated 95% confidence interval for different education attainments. The textile booms benefit households whose heads did not complete primary schools most. Compared to households without completing primary education in areas with no textile employment, households with similar education attainment but living in areas with 13% textile employment had earnings 7.5% higher in 2013. Such difference is significant at the 1% level. The increased labor demand in the textile industries seems to benefit low education households more. The estimated $\Delta\theta^e$ for primary, middle elementary and secondary are positive but insignificant. The estimated $\Delta\theta^e$ is negative for higher secondary and post secondary education, the later of which is significant at the 1% level. This finding is consistent with the factor that in 2013, textile industries employed more workers with primary education or less, as shown in Fig. 10, which plots textile workers' education attainment over the sample years.

Textile workers also have slightly lower education than non-textile workers. In Fig. 11, we plot the distribution of the education attainment of textile workers and non-textile workers. However, the stimulus to the textile industries may not have benefited the poorest households. In areas without any textile employment, median household earnings are 17% lower than those in areas with positive textile employment. Although education attainment highly correlates with income in Pakistan as in other countries, and flood-affected districts have a workforce with only slightly lower education (see Fig. 11), it is unclear whether the most poverty stricken populations benefit from the textile boom. Floods mostly affect rural areas, where the majority of households engage in agricultural production. In the following subsection, we discuss potential channels through which the textile industries may benefit this segment of the population.

5.3. Migration and remittance

Although the flood affected areas tend not to have the highest concentration of textile industries, migration and remittance may help improve the welfare of the flood-affected population. PSLMs do not track households over time, nor ask questions on the migratory history of the subjects. Due to these data limitations, we are not able to track households who move entirely out of the flooded areas or into areas with greater employment opportunities. However, if households send one or more of their members to work outside of their permanent residency, we may be able to detect some migration activities by examining the family structure. In particular, we consider household

[9] Although neither γ_{2012} nor γ_{2013} is significant at the 5% level, their difference is significantly different from zero at the 5% level because the estimated covariance between their estimates is large: $\widehat{\text{Var}}(\hat{\gamma}_{2013} - \hat{\gamma}_{2012}) = \widehat{\text{Var}}(\hat{\gamma}_{2013}) + \widehat{\text{Var}}(\hat{\gamma}_{2012}) - 2\,\widehat{\text{Cov}}(\hat{\gamma}_{2013}, \hat{\gamma}_{2012}) = 0.018 + 0.021 - 2 \times 0.014 = 0.011$. The standard error is associated with a t-statistic of 2.13 and a p-value of 0.034.

age dependency ratio as an outcome variable and estimate the impacts of the 2010 floods and the textile boom using the same specification described by Eq. (8). Following the same definition of age dependent ratio used by the World Bank at the country level, we define the age dependency ratio at the household level as the ratio of non-working-age members to working-age members, where working ages are 15–64.

Fig. 12 plots the main estimates as before. As compared to 2007 in the same areas, the household dependency ratios in more extensively flooded areas tend to be higher. The coefficients of the interaction between the flood severity measure and the indicator variables for year are not individually or jointly significant. Thus, no evidence suggests that flooded areas send more of their household members out to work. However, we note that our data may not be powerful enough to detect whether migration increases or decreases after natural disasters. Using household panel surveys, Gröger and Zylberberg (2016) find that households send out more members to work after a severe typhoon in Vietnam.

On the other hand, areas with higher textile employment shares had a significantly lower dependency ratio in 2013. Related to 2012, the dependency ratio was 0.03 lower in 2013 areas with 13% of their workers employed by the textile industries. For comparison, the mean, median and standard deviation of the dependency ratio are close to 1. This suggests that workers with fewer dependents move into areas with textile jobs in 2013.

Not only an important source of regular revenue, remittance is also insurance payments responding to income shocks in many developing countries such as Pakistan. Using a regression framework similar to the one used earlier, Fig. 13 shows that households in more extensively flooded districts receive more remittances. Each subplot of Fig. 13 represents coefficient estimates from one regression using the same framework as before. The top row of subplots has dependent variables about the remittance received by households. In the sample of households receiving a positive amount of remittance, households in a 13% flooded districts received about 15% more remittance in 2010 and 2011 than not flooded districts (see the top left subplot). There seems to be no evidence that more households received a positive amount of remittance (see first-row middle subplot, where the dependent variable is an indicator variable indicating received any remittance in the past year). This result is consistent with Gröger and Zylberberg (2016) findings in the context of Vietnam, where households with settled migrants before a severe typhoon received an increase in remittance. As a share of household income in 2010, remittance received by households in a 13% flooded districts increased by about 6% related to the mean remittance share in household income (see the right subplot on the first row of Fig. 13, where the dependent variable is about remittance received as a share of income).

However, households working in the textile industries do not seem to send out more remittance in 2010 or in 2013. The bottom row of Fig. 13 plots coefficients from regressions similar to those on the top row, except that the dependent variables are about remittance sent out by households and the coefficients reported are about local textile employment share interacting with indicator variables for year. From left to right, the dependent variables are respectively log remittance sent, indicator of sending any remittance, and remittance sent as a share of earnings. We do not find that local textile employment share predicts remittance sending behaviors in 2010 or in 2013.

Therefore, while households in flooded areas received remittance in the aftermath of floods, there is no evidence that the remittance is predominantly from textile workers; nor is there any evidence that households in flooded areas responded to greater employment opportunities in the textile industries, migrate and send back part of their earnings.

In sum, the hike in textile exports in 2013 brings greater labor market opportunities. The temporary trade concessions granted by the EU appear to stimulate Pakistan's exports and improve its labor market conditions. However, we find no evidence that households in the flooded areas benefit directly from the improved labor market conditions. We caution that, due to data limitation, our analysis linking flood-affected households and textile employment remain preliminary. Further work may shed more light on the effectiveness of EU's trade concession as a disaster relief. Moreover, there may be other channels through which the trade concessions benefit households in flooded areas indirectly. For example, the trade concession improves government finance in the affected areas, which allows for more resources to be directed to economic recovery.

6. Concluding remarks

This paper investigates trade concessions as a potential policy for aiding a disaster-hit country. Using a triple-difference method and a synthetic control method, we first examine how the temporary trade concessions affected Pakistan exports. The triple-difference approach allows us to fully control for product-destination differences, as well as destination-year and product-year shocks. Our synthetic control analysis supplements the triple-difference approach by providing a visualization of the tariff waivers' timing and aggregate impacts.

We find that the waivers increased Pakistan's exports of waiver goods greatly and rapidly, without substantially harming the exports of individual competing countries. The export boost to the textile industries brought greater labor market opportunities, particularly for women and people with little education. However, we do not find evidence that the expansion in textile industries was particularly beneficial to households most affected by the 2010 floods.

Though we note that our labor market analysis is preliminary due to data limitations, our findings suggest that trade policy may not be a substitute for traditional means of disaster relief, because it is unlikely to effectively target the populations most affected. Nevertheless, trade concessions may be a cost-effective policy when they complement more traditional types of aid, such as cash transfers. The EU's nominal loss of tariff revenue amounted to about 107 million euros, which is tiny compared to its spending on foreign aid; Germany alone spent 10 billion euros on ODA in 2012.

On the other hand, trade concessions to disaster-hit countries may facilitate their recovery and be conducive to long-term growth, for several reasons. First, trade concessions may mitigate macroeconomic uncertainty in the aftermath of natural disasters, which have been shown to impede growth (Baker and Bloom, 2013). Second, developing countries may lack state capacity to raise tax revenue in response to post-disaster fiscal needs. A favorable external environment for their formal tradable sector, which is relatively easy to tax, may assist the government in funding infrastructure rebuilding, providing disaster relief, and counteracting any political instability induced by the disaster. While dependency on foreign aid in the form of cash or in-kind transfers may dampen states' incentives to develop the legal and fiscal capacity to provide public goods, such as disaster relief (Besley and Persson, 2014), the more market-based approach through trade concessions may arguably be less likely to distort state incentives to invest in state capacity.

If weak institutions render ODA ineffective, foreign aid policies should be devised that take into consideration any institutional constraints; in particular, in countries with weak institutions, trade concessions may facilitate economic recovery and growth. Further studies may shed light on the conditions under which trade policy might be more or less potent. However, given the limitations and drawbacks of traditional ODA as the primary means of foreign aid, our findings suggest that there is considerable scope for trade policy to complement traditional means of foreign aid to assist developing countries in coping with natural disasters.

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Appendix A

See Figs. A1–A4 and Table A1.

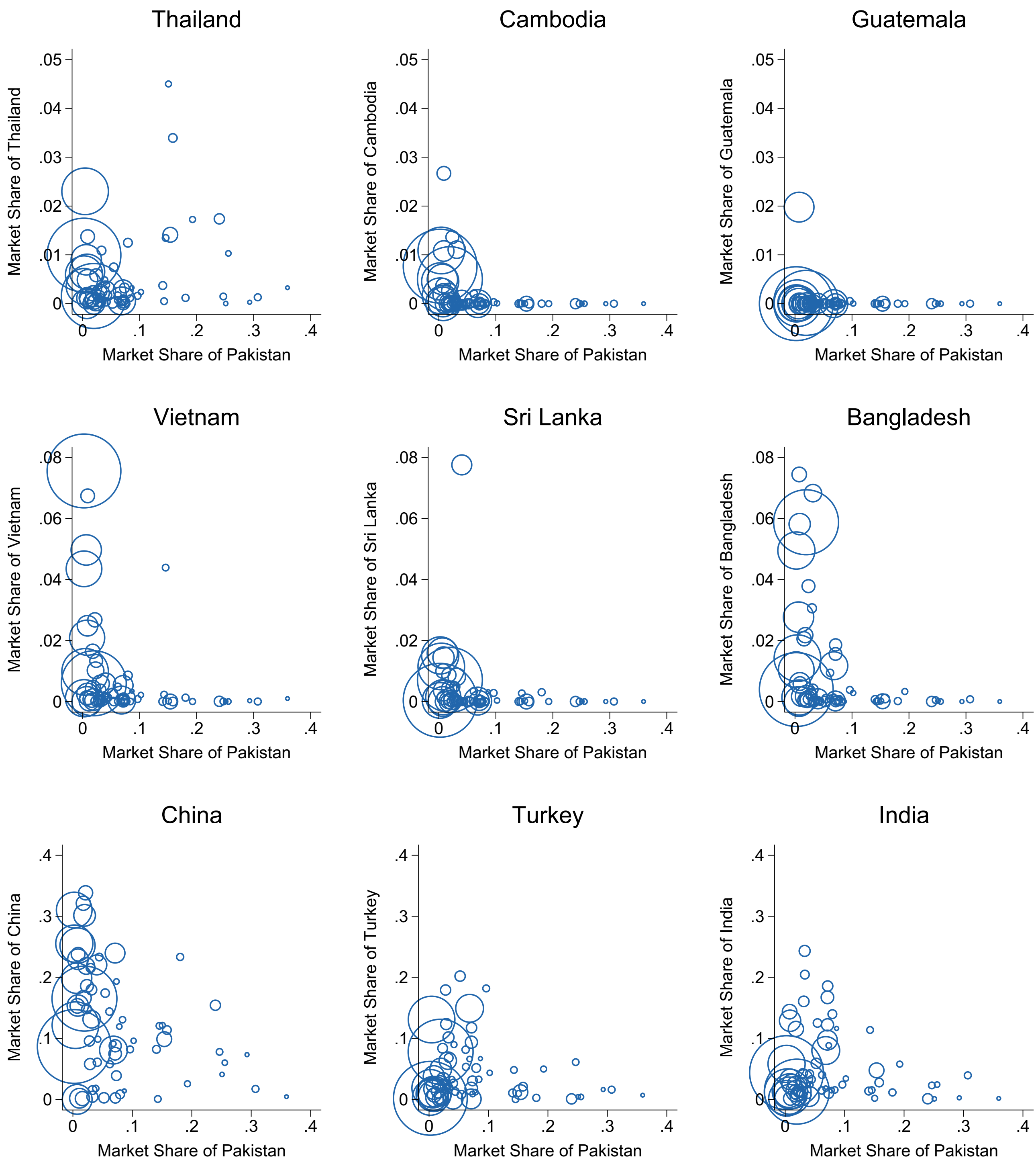

Fig. A1. Market shares of Pakistan and competing countries in EU's imports of waiver goods.Notes: In each subplot, the horizontal axis represents Pakistan's market share of a waiver good in EU's total import of the waiver goods; the vertical axis represents a competing country's market share of the same waiver good in EU's total import of the waiver goods. Each subplot represents a different competing country as indicated on the subplot titles. Each bubble represents a waiver product and the size of a bubble indicates EU's total import value of

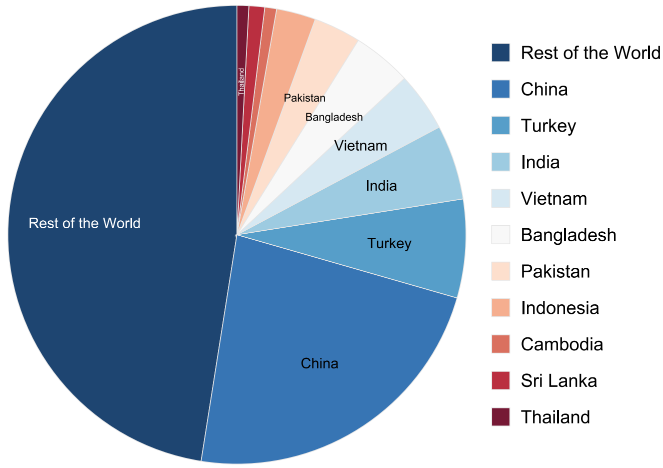

Fig. A2. Market shares of the largest exporters of waiver goods to the EU.Notes: The pie chart above shows 10 countries' market shares of waiver goods in EU's imports in 2012. The chart legend lists the 10 countries with the largest market shares in descending order.

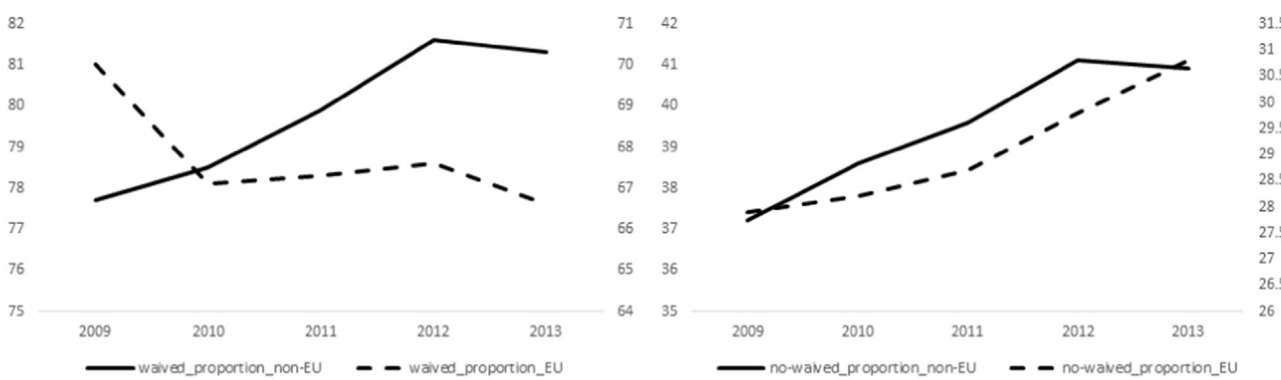

Fig. A3. Percentage of India's export destinations with positive export for waiver and non-waiver products.Notes: In both subplots, the vertical axis on the left represents the proportion of non-EU destinations to which India exports; the vertical axis on the right represent the proportion of EU destinations to which India exports.

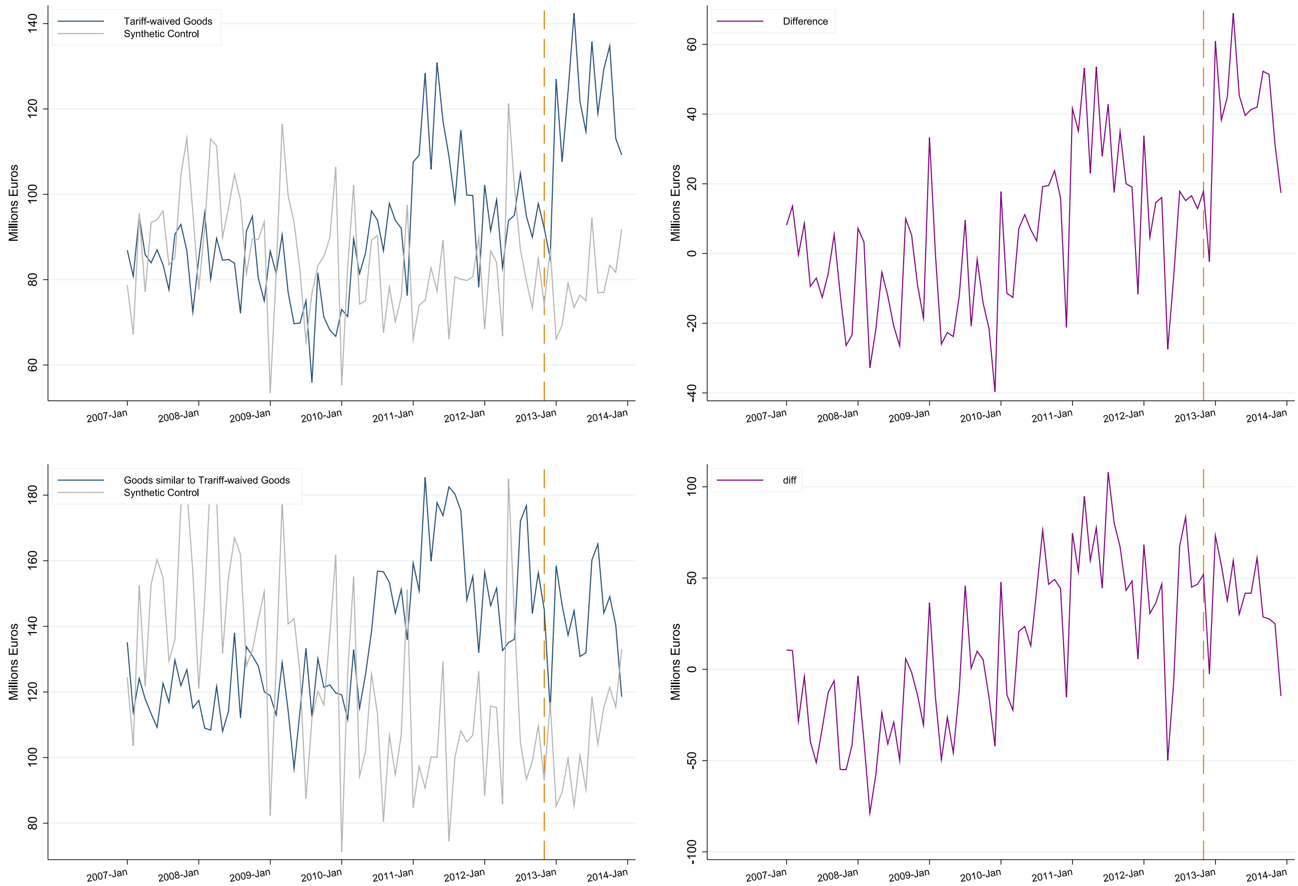

Fig. A4. Synthetic control analysis for aggregate Pakistan-to-EU export of waiver goods and similar non-waiver goods.

Table A1
Donor weights of synthetic controls.

HS Section (j)	Products	Weight (w_j)
1	LIVE ANIMALS; ANIMAL PRODUCTS	0.000
2	VEGETABLE PRODUCTS	0.083
3	ANIMAL OR VEGETABLE FATS AND OILS AND THEIR CLEAVAGE PRODUCTS; PREPARED EDIBLE FATS;ANIMAL OR VEGETABLE WAXES	0.000
4	PREPARED FOODSTUFFS; BEVERAGES, SPIRITS AND VINEGAR; TOBACCO AND MANUFACTURED TOBACCO SUBSTITUTES	0.124
5	MINERAL PRODUCTS	0.052
6	PRODUCTS OF THE CHEMICAL OR ALLIED INDUSTRIES	0.000
7	PLASTICS AND ARTICLES THEREOF; RUBBER AND ARTICLES THEREOF	0.000
8	RAW HIDES AND SKINS, LEATHER, FURSKINS AND ARTICLES THEREOF; SADDLERY AND HARNESS; TRAVEL GOODS, HANDBAGS AND SIMILAR CONTAINERS; ARTICLES OF ANIMAL GUT	0.023
9	WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL; CORK AND ARTICLES OF CORK; MANUFACTURES OF STRAW, OF ESPARTO OR OF OTHER PLAITING MATERIALS; BASKETWARE AND WICKERWORK	0.000
10	PULP OF WOOD OR OF OTHER FIBROUS CELLULOSIC MATERIAL; RECOVERED (WASTE AND SCRAP) PAPER OR PAPERBOARD; PAPER AND PAPERBOARD AND ARTICLES THEREOF	0.000
11	TEXTILES AND TEXTILE ARTICLES	0.524
12	FOOTWEAR, HEADGEAR, UMBRELLAS, SUN UMBRELLAS, WALKING-STICKS, SEAT-STICKS, WHIPS, RIDING-CROPS AND PARTS THEREOF; PREPARED FEATHERS AND ARTICLES MADE	0.000
13	THEREWITH; ARTIFICIAL FLOWERS; ARTICLES OF HUMAN HAIR	0.000
14	ARTICLES OF STONE, PLASTER, CEMENT, ASBESTOS, MICA OR SIMILAR MATERIALS; CERAMIC PRODUCTS; GLASS AND GLASSWARE	0.000
15	NATURAL OR CULTURED PEARLS, PRECIOUS OR SEMI-PRECIOUS STONES, PRECIOUS METALS, METALS CLAD WITH PRECIOUS METAL AND ARTICLES THEREOF; IMITATION JEWELLERY COIN;	0.000
16	METALS AND ARTICLES OF BASE METAL	0.042
17	MACHINERY AND MECHANICAL APPLIANCES; ELECTRICAL EQUIPMENT; PARTS THEREOF; SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND	

(continued on next page)

Table A1 *(continued)*

HS Section (j)	Products	Weight (w_j)
	RECORDERS AND REPRODUCERS, AND PARTS AND ACCESSORIES OF SUCH ARTICLES	0.000
18	VEHICLES, AIRCRAFT, VESSELS AND ASSOCIATED TRANSPORT EQUIPMENT	0.000
19	OPTICAL, PHOTOGRAPHIC, CINEMATOGRAPHIC, MEASURING, CHECKING, PRECISION, MEDICAL OR SURGICAL INSTRUMENTS AND APPARATUS; CLOCKS AND WATCHES; MUSICAL INSTRUMENTS; PARTS AND ACCESSORIES THEREOF	0.000
20	ARMS AND AMMUNITION; PARTS AND ACCESSORIES THEREOF	0.152
21	MISCELLANEOUS MANUFACTURED ARTICLES	0.000
Total		1

Notes: The weights listed about are obtained by solving Eq. (6). Each HS section exclude any HS6 products with any waiver goods.

Appendix B. Supplementary data

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.jdeveco.2016.10.005.

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