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Optimization of Bilateral Cooperation at the Local Level: Vocational Schooling Program and Firm Productivity in Central Java[1]

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Abstract:

In 2011 the Indonesian and the German government initiated the Sustainable Economic Development through Technical and Vocational Education and Training Program (SED-TVET). Within the diplomacy realm, this kind of bilateral strategy has often been utilized to strengthen a country's specific needs. Following the program, Provincial Government in Central Java responds distinctively to the initiative by emphasizing link and match program to promote skilled-labor employment. This paper aims to investigate the effect of these national and local policies on firms' productivity. Our identification of treatment year is critical as this precedes wider implementation of TVET program at the national level in 2016. To capture the precise treatment effect of the program, we deploy difference-in-difference strategy using the province's neighbors as the control group. We find that firms in Central Java employed nearly 20% higher share of skilled labor relative to its controls. This correlates with significantly higher productivity and export performance at around 1.8%. The results highlight the benefit of well-coordinated bilateral cooperation while also stressing the important role of local leadership in optimizing the impact of the program.

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Introduction

The importance of vocational education in promoting skilled-labor and employment has been acknowledged in many studies, as it is expected to resolve development issues at once (Pavlova, 2014; Tabbron & Yang, 1997). Along this line, countries have also allocated larger educational budgets focusing on vocational schooling, also known as TVET. Consequently, the number of pupils in this sector has been constantly increasing in the first decade of 2000s. However, result varies from country to country, especially the developing ones, with some disappointments and successes (Eichhorst et al., 2015; see also Comyn, 2007).

Indonesia was not an exception to this TVET trend. Following the 1997 Asian Crisis, the country has grown steadily under the Yudhoyono administration (2004 - 2014) with around 6% annual growth. However his government was baffled with unemployment and low labor participation, particularly in skilled areas. His response to this issue came with the initiation of bilateral cooperation between Indonesia and Germany focusing, among others, on the development of vocational education at the end of 2009. This diplomatic effort became operational in the year after, and particularly in 2011 following the signing of Memorandum of Understanding between Indonesia and Germany.

The bilateral cooperation is later formally known as the Sustainable Economic Development through Technical and Vocational Education and Training (SED-TVET). It was an expansion of a previously limited implementation of vocational school development known as the Indonesian-German-Institute Alliance (IGI) which ran from 2001 to 2010. Based on information derived from the Ministry of Finance (2022), SED-TVET loan disbursement of 21 million EUR (2 million of which was in the form of grant) was started in June 2012, involving 23 vocational schools (SMK, BLK, and polytechnic institutions). Central Java is one of three initial provinces in Java Island that was exposed to the program, the other being West Java, and Yogyakarta, while its neighbor East Java was absent at this initial stage (GIZ, 2013).

Table 1. Number of vocational students in provinces exposed to SED-TVET program

No.	Province	Number of vocational high school students (in thousand)				Annual change (%)		
		2012	2013	2014	2015	12/13	13/14	14/15
	Exposed to the program:							
1.	Central Java	652.6	662.0	687.1	706.8	1.4	3.8	2.8
2.	West Java	811.5	836.0	858.7	903.3	3.0	2.7	5.2

No.	Province	Number of vocational high school students (in thousand)				Annual change (%)		
		2012	**2013**	**2014**	**2015**	**12/13**	**13/14**	**14/15**
	Not exposed or limited exposure to the program:							
3.	East Java	649.8	658.1	656.4	661.2	1.28	-0.26	0.73
4.	Yogyakarta	83.3	81.9	81.7	81.3	0.7	-0.2	-0.49

Source: Kementerian Pendidikan dan Kebudayaan

Since the full implementation of SED-TVET was around 2011, we expect that it would bring substantial effect starting in 2012 and beyond. The immediate one is in the increasing number of vocational students in the targeted provinces, and consequently a rise in the number of skilled labor supply by 2014. Table 1 presents the number of vocational high school students in Central Java and its surrounding provinces. We used earliest available data from 2012 provided by the Ministry of Education and Culture. We can see that the two provinces that were exposed to this program after 2012 experienced a positive increase at around 3% for Central Java, and nearly 4% in West Java on average. Meanwhile for the other provinces, the growth is quite uncertain. Initially, the number of vocational high school students in East Java is comparable in size with Central Java at around 650 thousand. However, by 2015 the province did not record significant growth and was lagging behind its neighbor by around 45 thousand students. Its average growth between 2013 and 2015 is also lower than its previous years. Same situation applies to Yogyakarta where the province recorded negative growth in terms of the number of vocational high school students.

It is important to note here that the SED-TVET program while it may have provided an important contribution to vocational education development in these provinces, was not the only program implemented nation-wide. Improving the quality of vocational school has been an objective of several manufacturing firms in Central Java, particularly Japanese automotive companies. Honda and Isuzu are the prime examples of this. They not only provide technical knowledge to their partner SMKs in the region, but also recruit the graduates to work at their factories (Kuswaraharja, 2015). The major difference with the SED-TVET is the scale of the program. While the latter is a major initiative involving multi-layer agencies from top-level policymakers down to local education service and schools, the Japanese firms are mostly engaged at local or regional level. Both programs, however, are applied around the same time with SED-TVET.

Table 2. Manufacturing* share to GRDP in Central Java and
its surrounding provinces (in percentage)

No.	Provinces	2011	2012	2013	2014	2015
1.	Central Java	28.3	29.1	29.6	30.5	30.2
2.	West Java	41.5	41.0	41.1	41.6	41.3
3.	East Java	29.0	29.1	28.7	28.9	29.3
4.	Yogyakarta	15.0	13.8	14.0	14.2	13.7

Note: Manufacturing refers to activities classified in ISIC Rev. 2 code 15-37 with the exception of mining (including oil and gas) related activities.

Source: Statistics Indonesia

Also around the same time with SED-TVET, the Indonesian government forged a similar cooperation project with Asian Development Bank (ADB) known as the Polytechnic Education Development Project (PEDP). This project, aimed at improving quality and relevance of polytechnic education, involves 34 polytechnic schools across different parts of Indonesia. However, as the project was approved by ADB in October 2012, financing did not become effective until February 2014. In addition, project implementation was slow between 2013 and 2014 (ADB, 2021). Therefore it is justified to assume that the project has not brought substantial effect around the same time of SED-TVET.

By 2015, six years after the implementation of the program, Central Java showed a different manufacturing growth trajectory compared to its neighbors (see Table 2). We can see that growth in Central Java has been the most consistent, starting at slightly over 28% in 2011 and ending up at more than 30% by 2015. Meanwhile both West Java, which is also exposed to the SED-TVET program, and East Java do not exhibit significant growth between the same period. Meanwhile, Yogyakarta shows steady decline in terms of manufacturing share between 2011 and 2015.

This paper investigates the impact of Indonesia-Germany SED-TVET cooperation on the development of skilled labor in Central Java, while acknowledging similar programs carried out by other entities. Specifically, the study is interested in the role of the provincial government in responding to the bilateral cooperation above. Under the administration of Ganjar Pranowo in 2013, Central Java has been very active in promoting link and match program that bridges between vocational institutions and industries (Kuswaraharja, 2015; Arifin, 2016; Jatengprov, 2017). Our findings suggest that different responses from the local government with regard to TVET programs affect differences in firms' labor structure, in which those in the treated group exhibit larger share of skilled-labor (nearly 20% higher) between 2009 and 2015 when compared to the control. In turn, this has made firms in

the treated group become more competitive as sales output is higher by 189 billion IDR. Our robustness test provides further support to our findings.

Studies on the effect of TVET on firm productivity result in positive relationships (Nilsson, 2010; CEDEFOP, 2011). Increasing skill is one of the mechanisms for that to happen, as revealed by Allais et. al (2020) who studied South African manufacturing firms. They also find that shortage of skill, in general, brings a negative effect on firms' growth except for the automotive sector where the effect is observed as small. While Nilsson (2010) also shared the same tendency in his study, he failed to establish further evidence linking TVET and overall economic growth. Sala and Silva (2013), meanwhile, managed to find conclusive evidence that TVET education has a positive impact on labor productivity in the case of European Countries.

Confounding factors that moderate the effect of TVET on growth and development are firm size, sectors, and institutional setting (CEDEFOP, 2011). And with regard to firm size, it is also expected that the positive effect of TVET is continuously progressing overtime. The important role of institutions is echoed by Yamada and Otchia (2020), who studied garment industries in Ethiopia. They found mismatches between vocational institutions and factories, which necessitates intervention from policymakers. In the case of Germany, matching between the dual system of vocational schooling and industrial apprenticeship is shown to affect higher income at 139 DM per month (Witte & Kalleberg, 1995). Both of these studies emphasize the importance of link and matching programs to follow the TVET strategy.

The rest of the paper is structured as follows. Section 2 details our use of data and research methodology, while section 3 presents our results which is substantiated with a discussion section. Lastly, section 4 concludes this study.

Data and methodology

This section firstly describes data collection strategy and number of observation breakdown. This then followed with a detailed elaboration on how we identify our treatment variables and control group. Lastly, we laid out our difference-in-difference (DID) estimation strategy using simple differencing with a treatment matrix table, followed by an econometric model using OLS to test the robustness of our result under the presence of various control variables.

1. Data

We utilize panel data provided by the World Bank Enterprise Survey (WBES) as our main source. The survey was conducted twice in 2009 and 2015, before and after the implementation of the SED-TVET program. The total number of observations in each round of surveys totaled more than 1000 firms from eight provinces. However this study

concerns only the treated province of Central Java, with its surrounding provinces as the control group. Thus we eliminate samples from non-concerning provinces such as Jakarta, South Sulawesi, and Banten. As mentioned earlier, the main reason for choosing this province is due to its strong support for the development of vocational education in line with the national policy.

Yogyakarta was dropped from the observation for two main reasons. First, the province did not receive the SED-TVET program at the same scale of the other provinces, with only two schools receiving assistance. Secondly, the WBES data only includes a couple of Yogyakartan firms, which we deem insufficient for estimation. Additionally, Yogyakarta has strikingly different characteristics with the other provinces i.e. area size, economic structure, institution, rendering it unsuitable as a control group.

The sample collection in the survey followed a stratified randomized method using firm size, industry sector, and firm location as the cluster groups (WBES, 2015). This was done in order to minimize sampling bias. WBES sample frame comes from Statistics Indonesia, along with firms' contact information. In doing the survey, based on the prior contact information the survey team established a prior inquiry primarily using telephone which then used to set up an interview date. For the first round in 2009, field interviews lasted between August 2009 to January 2010, while for the second one, the interview was carried out from April to September 2015.

Finally, we ended up with a total number 213 firms for each year of observations, or 426 in total. Although the total number of firms in the sample is actually larger than 213, we dropped firms that were surveyed in 2009 but did not provide sufficient information for the 2015 round. In the treated group, the number of firms included in the observation in each round of survey is 32, while for the control it is 149.

2. Methodology

To measure the precise effect of the program, we deploy double difference estimation strategy similar to Card (1992), Card and Krueger (Card & Krueger, 1994), and Duflo (2001) among others. We start by selecting the treatment period; SED-TVET program implementation year plus one, 2013, is chosen as the treated period. We assume that the program has not yet been effective at year zero, thus the year after is selected. Difference in province leadership related to the program is our next variable of interest. In this case, the Central Java's link and match program under Governor Ganjar's first term (2013-2018) serves as an additional treatment policy. One of the main stressing points during his governorship campaign was improving educational quality and employment, which later manifested as the link and match program following his election win in 2013. It is

embedded within Central Java's Five Year Development Plan (RPJMN) 2013 – 2018. Similar program was not found in the neighboring provinces of West and East Java.

Furthermore, this program also precedes the national refocusing initiative on TVET education in 2016 promoted by the Joko Widodo administration at the national level. This initiative was spearheaded by the Ministry of Education. This was a major intervention that most likely will affect our estimation result, thus by selecting 2015 as the treatment year we omit this problem.

Table 3. Policy treatment matrix

Group	Policy intervention: SED-TVET (2013)		Program effect
	2009 (pre)	**2015 (post)**	
(1)	(2)	(3)	(4)
Treated (Central Java)			SED-TVET + link and match program
Control provinces			No treat. (East Java) Partial treat. (West Java)
			Net-difference (Treated - Control)

Pre-treatment period

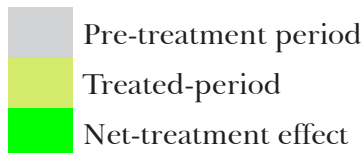Treated-period

Net-treatment effect

Table 3 presents the policy treatment matrix that illustrates our estimation strategy. Grey box (Column 2) indicates the pre-treatment period which is the year 2009, while the light green box (Column 3) indicates the treatment period (the implementation of SED-TVET program). Column 4 explains the program effect in which the treated group received an additional treatment unique to the province's characteristic that was not applicable in the control group. Finally, the green box shows the net-treatment effect where we take the net differences between the treated group and the control group.

To support our finding, we carry out the simple differencing strategy above under fixed-effect OLS model. The benefit of using OLS is that we may add control variables that may affect our target output, thus checking the robustness of our initial findings. To control for the locational difference that is not changing overtime such as local language, cultural

and natural traits, country fixed-effect is added in the model. This helps in controlling omitted variable bias as it purges the error term from being correlated with the variable of interest.

Equation (1) describes our econometric strategy with β0 marks the intercept of our model. β1 is the coefficient for SED-TVET policy, a binary variable given to its implementation year plus one (2013). β2 denotes our other exogenous treatment variable estimate that signifies the link and match policy of Central Java. We assign numerical value 1 for the province, and 0 otherwise. β3 serves as the net-treatment effect, essentially our DID treatment coefficient. X is a vector of control variables that includes labor cost, firm age, ownership structure, experience of top manager, usage of IT, and legal status of firms. c and d are firm and industry fixed-effects, respectively, while e is an error term assumed to be uncorrelated with the independent variables.

$$y_{it} = \beta_0 + \beta_1 post_{it} + \beta_2 cjava_{it} + \beta_3 post * cjava_{it} + \beta_4 X + c_i + d_t + e \ ...(1)$$

We propose 2SLS to show the combination effect of the SED-TVET program on skilled labor and firms' sales output, thus we propose the following specification

$$skill_{it} = \beta_0 + \beta_1 post_{it} + \beta_2 cjava_{it} + \beta_3 post * cjava_{it} + \beta_4 X + c_i + d_t + e ...(2)$$

in the above specification we use the vocational program as an instrumental variable to create predicted $skill_{it}$ and plug it into the equation (1) to create the following specification

$$y_{it} = \beta_0 + \beta_1 skill_{it} + \beta_2 X + c_i + d_t + e ...(3)$$

Results and discussion

This part is divided into three parts. The first one provides the basic result unconditional to the effect of different control variables in the equation. We look at the change in three main measurements; skilled labor, sales output, and export performance. On the second part, robustness check, we apply OLS estimation applying different control variables to see how much the result from the first one deviates when several conditionality are factored into the equation. In the third part, we provide some discussion about the result.

1. Results

Table 4 presents our first result comparing the differences in terms of share of skilled workers. to put more perspective, we first compare the difference in the mean number of workers. Despite both groups showing positive expansion of workers, those in the treated group experienced lesser change. When we compare the change between groups, we see that actually those in the treated one lagged by around 73 workers (see Column 4). This first result illustrates the quantitative change, but not so much on the qualitative one.

Changes in the number of skilled labor reflects more on the qualitative side. In this case, we can observe in Table 4 Column 5 that both groups show a similar share of skilled labor in the pre-treatment period, where it is around 63% in the treated group and around 62% in the control. However by 2015 (Column 6) we see a larger difference with the share of skilled labor in treated firms being 20% higher, or 19.38% if we also count the difference in time periods (2009 and 2015). Interestingly, partially treated control (West Java) did not suffer as bad as the non-treated one (East Java).

Table 4. Difference in number of workers 2009 and 2015

No.	Groups	Mean number of workers		Mean share of skilled workers	
		2009	2015	2009	2015
(1)	(2)	(3)	(4)	(5)	(6)
1.	Treated (Central Java)	181.5	243.0	62.97	79.40
2.	Control	236.6	371.4	61.95	59.00
	- West Java	159.8	309.7	54.71	52.98
	- East Java	76.8	61.7	69.92	65.63
3.	Group differences (2 - 1)	-55.1	-128.4	1.02	20.40
4.	Net difference (2015 - 2009)		-73.3		19.38

Note: (1) Skilled workers are workers engaged in skill-related production activities that require special knowledge or ability in their work. Numbers are reported as the percentage of total production workers. (2) Total number of observations are 128 and 298 for the treatment and control groups, respectively. (3) Net difference is between group differences over two time period (before and after SED-TVET implementation)

Source: WBES, 2015

We proceed our exercise by looking at the difference in terms of sales output. This refers to the overall revenue a firm received in one fiscal year. Their difference in labor structure, between skilled and non-skilled labor, should be correlated with differences in sales output. In this case, our estimation result suggests that there is a substantial difference between the groups. First, in the treated group we can see a dramatic change between 2009 and 2015 (see Column 5). Average firm share output rose from merely 38 billion IDR (lower than the control group) to more than 290 billion IDR, which is around nine folds of those in the control. This makes the difference between the period at 181 billion IDR.

Meanwhile, the change in the control group for the same measure is shown to be negative at 8 billion IDR, with firms in West Java recording the largest drop in sales output. All in all, the net differences between the two groups for the two periods stand at

189.23 billion IDR (see bottom row of Column 5). Furthermore, we expect that there is some upward bias in the result in favor of large firms, we therefore exclude the top 20% of samples based on sales output. We drop our observations based on years as well as provinces. Results are shown in the right part of Table 5. There we see the same substantial increase of sales output for the treated group at 103 billion IDR while for the control group it is down 13.88 billion IDR (Column 8). The net difference between the groups stands at 117.54 billion IDR. The result is smaller than the previous one, but it shows a consistent pattern that firms' performance in the treated group outperforms those in the control, attesting the robustness of our estimation strategy.

Table 5. Difference in firms' sales output (in IDR billion)

No.	Groups	All samples			Excluding top 20%		
		2009	**2015**	**Difference**	**2009**	**2015**	**Difference**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Treated (Central Java)	38.04	292.37	181.15	22.77	126.48	103.66
2.	Control	45.57	37.49	-8.08	56.05	42.17	-13.88
	- West Java	74.85	39.81		49.85	39.11	
	- East Java	11.75	4.36		6.20	3.06	
3.	Net difference (2 - 1)			**189.23**			**117.54**

Note: (1) Figure is reported in current IDR million, (2) Total number of observations are 128 and 298 for the treatment and control groups, respectively (3) Net difference is between group differences over two time period (before and after SED-TVET implementation)

Source: WBES, 2015

Finally, we look at firms' export performance. Positive change in skilled labor attainment that affects the change in sales output should also resonate with better export performance. This study defines export as both a direct and indirect component of firms' outward international transactions. Table 6 presents firms' share of export, where we can see substantial change for the treated group from 0.6% in 2009 to 3.4% in 2015. The same for the control group is shown to be much lower, growing from 2.3% in 2009 to just 2.4% in 2015. Its low performance is contributed by East Java which suffered a large drop (0.8 percent) between the periods. Meanwhile, the net differences between the two groups is 2.7 percent.

Table 6. Difference in firms' share of export (percent)

No.	Groups	2009	2015	Difference
(1)	(2)	(3)	(4)	(5)
1.	Treated (Central Java)	0.6	3.4	2.8
2.	Control	2.3	2.4	0.1
	- West Java	3.0	4.0	
	- East Java	1.5	0.7	
3.	Net differences (2 - 1)			2.7

Note: (1) Share of export constitutes direct and indirect components of export reported by firms (2) Number of observations are 128 and 298 for the treatment and control groups, respectively

Source: WBES, 2015

Using empirical data provided by the WBES, we have observed that there is a linear relationship between firms' labor structure and productivity. Higher share of skilled labor is correlated with higher sales output. This extends further to firms' increasing export performance, validating the positive change in their labor structure. However, we look to check the robustness of the previous result by applying DID using OLS regression. We apply the same strategy to measure the effect of change in skilled labor share on firms' productivity. We realize that this could lead to biased estimates as the relationship is potentially endogenous, where the more productive firms are those with higher chances of recruiting more skilled workers. To avoid this, we apply the 2SLS estimation following Duflo (2001).

Table 7 shows our OLS results. For the outcome variable across all specifications, we use logarithmic form (log). In Column 1 and 2 we can see the conditional result controlling for factors of production. The DID coefficient (Treat*Post) magnitudes are nearly identical at 0.52 and are statistically significant. In the rest of the specifications, we apply firm characteristics; legal status, age, etc. We find that our DID coefficients do not vary dramatically, and that the significance remains. Our model managed to explain around 83% of changes in the output, with significant F-test across all specifications.

Table 7. Output robustness under the presence of endogenous variables

	Dependent variable: Sales output (log IDR billion)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat	-1.06	-1.064	-1.063	-3.252*	-3.243*	-3.249*	-3.222*	-3.053
	(1.587)	(1.591)	(1.594)	(1.875)	(1.877)	(1.883)	(1.882)	(1.886)
Post	-0.213	-0.216	-0.22	-0.788***	-0.780***	-0.778**	-0.771**	-0.766**
	(0.141)	(0.141)	(0.142)	(0.298)	(0.299)	(0.300)	(0.300)	(0.300)
Treat*Post	0.528**	0.524**	0.547**	0.520**	0.543**	0.542**	0.536**	0.513*
	(0.257)	(0.258)	(0.263)	(0.261)	(0.263)	(0.263)	(0.263)	(0.264)
Labor cost (log)	0.750***	0.733***	0.737***	0.715***	0.693***	0.695***	0.711***	0.702***
	(0.116)	(0.129)	(0.130)	(0.129)	(0.132)	(0.133)	(0.134)	(0.134)
Constant	0.831	0.853	0.837	-2.955	-2.944	-2.979	-3.239	-3.281
	(1.413)	(1.418)	(1.422)	(2.249)	(2.251)	(2.271)	(2.283)	(2.281)
Add. Control	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	426	426	426	426	426	426	426	426
Degree of freedom	239	240	241	242	243	244	245	246
R-sq.	0.827	0.827	0.827	0.831	0.832	0.832	0.833	0.834
F-stat.	3.714***	3.681***	3.650***	3.727***	3.709***	3.673***	3.666***	3.662***

Note: * 0.1 ** 0.5 *** 0.01

Source: WBES, 2015

Investigating the relationship further between skill and productivity, our 2SLS results are shown in Table 8. For comparison, Column 1 presents the basic OLS result, showing that there is no significant relationship between skilled labor and firms' sales output. As previously argued, the result is potentially biased and in this case the magnitude is also potentially underestimated. Instrumenting our DID model, our first 2SLS result (Column 2) shows that there is a positive and significant relationship between skilled labor and

output of production. The specification suggests that for every percentage increase of skilled labor, change in the output is expected at around 1.8% higher. The impact is larger (see Column 4) when we compare the treated province against the exclusively non-treated one (East Java).

Table B. Effect of skilled workers on firms' output: OLS and 2SLS estimates

Variables	OLS	2SLS	2SLS	2SLS
	Dependent variable: Firm sales output (log IDR billion)			
	(1)	(2)	(3)	(4)
		(1st stage instrument: SED-TVET policy)		
Skilled labor	-0.001	0.018**	0.017*	0.022**
	(0.003)	(0.008)	(0.009)	(0.009)
Constant	0.273	-3.925*	-0.721	-4.005*
	(1.448)	(2.210)	(1.530)	(2.340)
Control variables	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Control province	All	All	West Java	East Java
Observations	426	426	284	270
Degree of freedom	241	241	163	162
R-sq.	0.824	0.776	0.788	0.743

Note: * 0.1 ** 0.5 *** 0.01

Souce: Authors

2. Discussion

The instrumental role of TVET program in the expansion of skilled labor supply in the case of Central Java reflects previous studies in the context of South African manufacturing firms done by Allais et. al (2020). To a larger extent, this study finds that increasing skilled labor is correlated with higher firms' output, implying that they are becoming more productive, including in terms of export performance. Our robustness test using 2SLS provides additional evidence on the significance of this relationship. While the finding in terms of growth is similar to Nilsson (2010), we do not yet have conclusive evidence that

the bumps on sales output is solely due to the increase in skilled labor, rather we argue that it is one of the major contributing factors.

We did, however, control for a possible confounding variable that is the PEDP program and the national policy aimed at vocational education reorientation. For the first one, this program started a few years after the SED-TVET and as the ADB report mentioned its slow implementation between 2013 and 2014, we assume that the effect was not significant at the time of this research in 2015. This is the same argument for the second confounding factor where the policy intervention was started in 2016.

While Central Java and West Java received the program at the same time, differences in local government response resulted in seemingly better firm performance in the earlier. Following province elections that led to the winning of Governor Ganjar Pranowo in 2013, the new provincial government quickly addressed the mismatch issue with their link and match program (known as DUDI in Indonesian, keterkaitan Dunia Usaha dan Dunia Industri) that bridges between vocational schooling and its employment in the industry sector. Essentially, this approach warrants the employability of vocational school graduates. The commitment was included in the province's Five Year Plan (RPJMD 2013 - 2018) and was monitored and evaluated in the next RPJMD document. Meanwhile, in the other provinces incumbent leaders managed to retain their seats, and we fail to see a similar aggressive approach in the industrial sector. Even though the mismatch issue was addressed in the RPJMD document of East Java Province (2014 - 2019), there was no clear evaluation assessment in the following planning document suggesting weak implementation of the program.

The SED-TVET program, which is based on Germany's dual system approach, resolves the matching issue more from the supply side through teacher trainings and curriculum advancing, among others. However to optimize the effect of the program, local government intervention and active response is needed. Setting up link-and-match program with the industries operating within a province as shown by the Central Java administration, is one of the example. In the end, our finding highlights the important role of institutions in reducing mismatch as suggested by Yamada and Otchia (2020), and confirms the study of Sala and Silva (2013) regarding the positive relationship between skill increase from vocational-based education trainings and the increase in labor productivity.

Conclusion

The Indonesia-German bilateral cooperation focusing on technical skill development through the SED-TVET program, initiated in 2011, has been implemented in some targeted provinces. We try to investigate the effect of such policy on firms' productivity with particular interest in Central Java, where its institutional respond to the policy is different

from its neighboring provinces. To capture the precise treatment effect of the program, we employed a simple difference-in-difference strategy followed with two robustness checks. To further avoid bias, we control for potential confounding factors that are the PEDP program and new national TVET policy in 2016.

Our findings revealed that firms in Central Java employed nearly 20% larger numbers of skilled labor relative to its controls. This correlates with higher productivity and better export performance. Our subsequent 2SLS exercise shows that for a percentage increase in skilled-labor share the effect on sales output is at 1.8%. We argue that differences in the provincial government's response contributes to the change, although we refuse to conclude that this is the only explanation. The new leadership in Central Java following the province's election in 2013 aggressively attempted to reduce mismatch through its link and match program, something that is not clearly established in the control group for the same period. These results highlight the benefit of well-coordinated bilateral cooperation while also stressing the important role of local leadership in optimizing the impact of the program.

We recommend the local governments, both at the province and district level, to implement the same strategy as the Central Java government in two ways. First is to allocate larger fiscal resources in supporting the quality of TVET education or its related programs as it is proven to boost firm growth in the long run. Second is to deepen the link and match program between school and firms through partnership scheme in the frontiers of automotive technologies such as development of electric or autonomous vehicle, not only to increase output and productivity but also to nurture advance knowledge.

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