ASP Course on Microeconometric Methods (2021)
- Take Home Assignment -

Project A

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Section 1

We review three papers that provide a seamless synergy into our project that estimates the impact of foreign direct investment on firm performance by taking a wholistic approach to the literature. We first take a look at a paper by Borin and Mancini (2016) which displays the effects on firm performance in the firm's country of origin when they decide to invest abroad, thus becoming a multi-national enterprise. In an intermediate stage, we review a paper by Bajgar and Javorcik (2020) that investigates analyze spillover effects from FDI on domestic firm performance resulting from links along the supply chain. To conclude our review and introduce section 2, we review Chen (2011) studies the role of the origin of FDIs on target firm performance changes.

Borin and Mancini (2016) investigate the ex-post effects of foreign direct investment (FDI) on firm performance using data from the Bank of Italy's annual Survey of Industrial and Service Firms (the Invind survey) as well as balance sheet data from the Company Accounts Data Service (henceforth CADS). They extend the discussion from empirical and theoretical literature that shows how multinational firms (MNE) exhibit a competitive advantage before investing abroad, by conducting microeconomic data analysis to evaluate the policy implications of firm heterogeneity. The authors specify the best-case scenario to be the implementation of policy measures and internationalization strategies that are capable of enhancing both firm performance and employment. The ex-ante causal relationship (from performance to internationalization) in Borin and Mancini (2016)'s paper introduces a severe form of endogeneity, in that ex-post performance might reflect not only foreign investment, but also pre-existent advantages in terms of managerial ability, know-how and technology. To accurately evaluate the ex-post effects of FDI that take into account the inherent self-selection problem, the authors use a propensity score matching procedure to analyze the causal relationship between firm performance and foreign direct investment, looking in particular at the potential gains in terms of productivity and potential losses in terms of employment in the parent firm due to the acquisition of multinational status; as well as to evaluate whether these effects are evenly spread across new MNEs or concentrated among certain groups of investors. To implement the propensity matching estimation, the authors choose a company, ex-ante very similar to the first one, but that does not choose to invest abroad to act as a proxy of the unobservable counterfactual, enabling them to compare the evolution of new MNEs with the performance of the exact same company with no investment; since it is not possible to observe the same company in these two different scenarios. They find that firms investing abroad for the very first time, especially in advanced economies, show higher productivity and employment dynamics in the years following the investment: the average positive effect on TFP is driven by new multinationals operating in specialized and high-tech sectors, while the positive employment gains are explained by an increase of the white collar component. On average, the authors do not find a negative effects on the parent firm's blue collar component.

Bajgar and Javorcik (2020) analyze spillover effects from FDI on domestic firm performance resulting from links along the supply chain. More specifically, they investigate the relationship between quality upgrading by Romanian exporters and the presence of foreign affiliates in upstream and downstream industries, respectively. They use customs data merged with firm-level data for the years 2005 to 2011 and find a positive and robust link between the product quality of domestic exporters – proxied by two measures established in the literature, namely unit values and a measure proposed by Khandelwal et al. (2013) – and the presence of foreign-owned firms in upstream (i.e. input-supplying) industries. The results indicate that a one percentage point increase in FDI presence upstream is related to a roughly 0.5% increase in product quality of domestic exporters, on average and ceteris paribus. The positive relationship between export quality and the presence of foreign-owned firms in downstream industries is less robust. To estimate these effects, the authors employ OLS regressions with product quality as the dependent variable and a measure of FDI presence in upstream and downstream industries, respectively, as the main independent variable of interest. They control for firm-product-destination fixed effects, region-time fixed effects and linear time trends at the region-industry level. However, the authors acknowledge that reverse causality could be a problem, for example if foreign firms primarily invest in industries where high-quality domestic inputs become increasingly available, and these developments are not captured by the linear time trends. To mitigate these concerns, they lag their FDI variables by one year in all specifications. In addition, they perform a "strict exogeneity" test suggested by Wooldridge (2010), including also contemporaneous and lead FDI values into their model. They argue that if foreign firms enter Romania as a consequence of quality upgrading rather than the other way around, the coefficients on the lead values of FDI should also be statistically significant, which is not the case. They conclude that the increase in foreign presence in the upstream industries over the studied period corresponded to a circa 4% increase in the quality of exports by local firms.

Chen (2011) studies the role of the origin of FDIs on target firm performance changes. It uses data on acquisitions of U.S firms between 1979 and 2006, comparing firm level performance indicators before and after acquisition, focusing on the difference between firms acquired by domestic firms (USFs), firms from industrialized countries (ICFs) and firms from developing countries (DCFs). The identification strategy is based on a diff-in-diff analysis which gives rise to a twofold selection problem. The empirical set up defines a control group which is domestically acquired firms and two treatment groups. As trans-boundary firm acquisition is more challenging than domestic acquisitions (Helpman et al 2004), firms that engage in the former are likely to be different from those that invest domestically, which might translate into "more skillful" target firm selection on part of foreign acquirers. Hence, the firms chosen for foreign investments are likely to structurally differ pre-treatment from those firms that are chosen for domestic acquisitions. Secondly, selection criteria for target firms might also differ based on the origin of the acquiring firm. The author argues that systematic differences can be expected in the aimed at restructuring process depending on the origin of the acquirer, due to structural differences between these groups in technological progress and relative input costs between target and acquirer. Consequently, selection bias might be found in the comparison of control and the treatment groups, as well as in the comparison of the two treatment groups. To solve this issue the author implements a propoensity score matching procedure. The scoring is achieved through a multinomial logit model estimation of observables available to acquires before the acquisition that provide information on present and potential future target firm performance, as well as year, industry

and state fixed effects. The matching is done using a kernel matching procedure. This step allows to impose pre-treatment homogeneity in firm performance across comparison groups and thus to interpret any difference in performance between matched pairs to result from the difference in treatment. The results of this estimation show that firms acquired by ICFs show 13% higher improvements in terms of labour productivity, a 10% higher profit increase and a 19% higher increase in sales in the five years post acquisition relative to the year before the acquisition, compared to firms acquired by USFs. Between those two groups no difference in overall employment changes was found. For firms acquired by DCFs the author finds that labour productivity gains and changes in sales and employment are 1% lower than those of domestic acquisitions, albeit higher profit gains. Comparing firm-level effects of FDIs originating from industrialized countries to those from developing countries, gains in sales, labour productivity and employment are significantly higher for target firms acquired by ICFs.

In Section 2, we will provide a discussion of the most important features of the data we will be working with, including some interesting patterns and correlations that we have discovered in the data. We also provide some summary statistics and graphs of the variables of interest.

Section 2

(Saskia) *Provide a discussion of the most important features of the data; describe any interesting patterns or correlations in the data and provide some summary statistics/graphs of the variables of interest. If you have performed any data cleaning exercises (e.g. you have excluded some observations) or carried out any data transformations (e.g. "unlogging" the wage variables).*

- full sample description:
  - dataset on firm level performance indicators for the years 2015 and 2017 for 11.323 firms
  - roughly one third each low tech and medium high tech industries, and one sixth each medium low tech and high tech industries
  - 40% independent firms, 30% state owned firms, roughly 20% subsidiaries and a minority of 8% listed companies.
- treatment var: FDI received in 2016 yes or no and which type of FDI
  - 39% of firms in the dataset did receive FDIs
  - 8% of all firms in the dataset received export oriented FDIs, 14% technology intensive FDIs and 17% domestic market seeking ones

Section 3

(Susann) *Explain very briefly your econometric approach to evaluate the casual effects of FDI on the outcome variables of choice (you can assume that the readers know the basic principles of propensity score-based estimators). You are encouraged to estimate more than one model and probe the sensitivity of your findings to alternative model specifications. Write a report*

on your main findings, indicating which of the estimators, if any, you would you prefer most in the context of this exercise, and why?

- selection into treatment (likely) non-random, firms receiving FDIs likely chosen based on their (observable!) pre-treatment performance, which is thus correlated with treatment assignment as well as with post-treatment performance, by definition.
- compare balancedness of *2015 vars across treatment conditions. –> check for which/how many variables are unbalanced.
- regression output
  - unbalanced in wages, TFP, employment, export intensity and debt. R&D are not too different between treated and untreated
  - unbalanced in terms of firm kinds as well
  - → violation of CIA and curse of dimensionality
- compute propensity score measure using logit function/ probit function or varying the matching algorithm (number of neighbours, caliper), check for common support condition, compute ATE. Outcome variables of interest: employment and wages
- goal in this process is to achieve a propensity score measure that achieves balancedness in terms of relevant observables, on one hand and a good treatment overlap on the other. This is not trivial. Imagine a situation in which treatment is assigned according to one specific set of variables being high. If matching is performed based on this variable set then propensity scores will be high for firms with high values along this set of variables and matching of firms with similar propensity scores will produce very little differences in variables. Yet, this will produce a most certainly bad overlap. Opposed to that using a variable that is not related to treatment assignment for the propensity score matching will produce a high overlap as propensity scores calculated based on a unrelated variable will be similarly distributed within treatment and non-treatment groups, but it will be unlikely that this matching procedure will be able to balance the previously unbalanced variables. Consequently, a scoring function specification has to be found that involves all variables relevant for treatment assignment but in a way that produces high overlap.
  - mostly all 2015 observables show relevance for treatment assignment.
  - only including a subset of the relevant 2015 observables in the scoring function achieves the opposite: Improvements in overlap but non-convincing balancedness levels. (compare output d, e, f) argue
  - experimenting with linear and interacted (continous vars with categorial/binary vars) functional specifications, logit and probit estimations, different number of neighbors and varying caliper levels leads to improvements in balance but is insufficient to produce a convincing overlap to proceed with the propensity scoring approach at effects estimation. (compare output a, b, c)
  - Finally we found a specification that seems to balance across those two goals in the matching procedure. This specification makes use of a categorial export variable (..descrribe how.. taking out some info but not all info) such that it can be used as a type describing variable instead of as part of the continuous variables.

- **Employment effects:** ATE of 0.79
- **Wage effects:** ATE of 0.75

  –> using the models with best balancing still show bad overlap. This means that propensity scoring is difficult to apply to this data. Doubly robust can work with misspecified scoring functions use doubly robust accept some imbalance.

  Wage Effects

  - matching process will be the same as before if same variables used, thus use last condition including interaction effects
  - ATE 0.654 (p-value 0.046)
  - looking at figure 6 it can be seen that overall drop in wages from 2015 to 2017, which were however much lower treated firms.

Section 4

(Linda) *Try to answer the question whether your conclusions from Section 3 change if you re-estimate the casual effects of FDI by type of FDI? You are encouraged to consider alternative models to estimate the propensity scores, as well as experiment with different estimators.*

- effects of FDI on firm performance likely varying by FDI type as FDIs differ by the kind of restructuring goals they formulate, i.e. export or domestic market oriented, thus they are likely affect different outcome variables differently
- also firm selection criteria are likely to differ between FDI types, given these different restructuring goals
  - for example significant differences in RD in 2015 of firms target for export oriented, technology intensive and domestic market oriented FDIs
  - (Types quite balanced)
- redo by using multinomial logit model for propensity score matching and doubly robust propensity score estimator (task 5 of computer class 2)

  Employment Effects

  - try 1: logit scoring function, no interactions
    - imbalances in high tech industries, exports and a bit in employment
    - ATE 0.29/0.30 for all FDI types. how can that be?!
  - try 2: logit scoring function, interactions
    - –> ERROR for balancing table
    - ATE roughly the same slightly more spread around 0.30

  Wage Effects

  - try 1: no interactions –> ATE: 0.23 for all
  - try 2: interactions –> ATE: 0.23 more spread out

- check

When analysing the impact of FDI on wages and employment at the firm level, the motive of the foreign investor might also play a role. For example, investors trying to sell their products in the destination country of their investment may be particularly concerned about their reputation in the host country, potentially leading to higher wage payments. Our dataset also provides information on the type of FDI and distinguishes across four categories: exports-oriented FDI (1), technology-intensive FDI (2), and domestic market seeking FDI(3). Of the firms receiving FDI, 44% receive domestic-market seeking FDI, followed by 35% that receive technology-intensive FDI. The share of firms receiving export-oriented FDI is 21/%. Figure 1 provides a graphical illustration of the main variables by type of FDI, displaying the means of wages, employment, TFP, export intensity and R&D for 2015 and 2017, respectively and in addition, the graph displays the means for firms not receiving FDI (0). The corresponding Tables can be found in the Appendix (Tables 4 and 5). While the differences in means across the types of FDI are relatively small when it comes to wages, employment, export intensity and TFP both in 2015 and 2017, the differences across FDI types are large regarding R&D activities.

With this knowledge in mind, we re-estimate the causal effects of FDI by type to examine if there are any differences in comparison to our analysis in Section 3. We are particularly focused on using the weighted estimators, IPW and AIPW as we have concluded and shown earlier that these, particularly the AIPW, give us a consistent estimator if one of our models is incorrectly specified. As we have shown in Section 3, we suspect that our treatment model is probably incorrectly specified and so we rely on the AIPW estimates in this section as well. To be thorough, we also estimate the IPW estimator as a robustness exercise, as well as examine two cases of variable specifications: the model where we have interactions and the model where we do not have interaction terms. As is the case in section 3, the IPW estimator produces biased estimates, judging from the exceptionally large standard errors – an indication of possible misspecification in our treatment model. Because balance improves when we use interactions in our model, we only estimate the interacted model for our further analysis. We then estimate our treatment and outcome model using the double robust estimator.

Table **??** shows that for all the firm sectors, the average treatment effect is the same, thus – for firms which are export oriented and technology intensive, the average treatment effect for employment is estimated to be about 0.28 when compared to firms which do not have any FDI at all, with that for domestic market seeking firms a bit higher. The average treatment effect for employment is estimated to be 4.9 when no firms receive FDI at all. For wages, we observe the same trend as shown in Table **??**, with the ATE for export oriented, technology intensive firms and domestic market seeking firms being 0.2. We suspect that the ATEs are similar across FDI types because the differences in means across the types of FDI are relatively small for wages and employment, but would be different for other variables in the dataset. Furthermore, overlap significantly improves in our estimation of IPW and AIPW, but is still partial as we do not manage to get a good overlap on the control variables with propensity score values between 0 and 0.1.

Section 5

This is a summary and conclusion section where you should give an overall evaluation of your work including possible shortcomings.

Table 1: Causal effects of FDI (by type) on employment

	(1) ipw	(2) ipw (interactions)	(3) aipw (imteractions)
	b/se	b/se	b/se
ATE			
Export Oriented FDI	0.73***	0.25	0.27***
	(0.07)	(0.42)	(0.03)
Technology Intenstive FDI	0.87***	0.59	0.28***
	(0.08)	(0.42)	(0.03)
Domestic Market Seeking FDI	0.72***	0.21	0.27***
	(0.06)	(0.44)	(0.03)
Observations	11,323	11,318	11,318

* p<0.1, ** p<0.05, *** p<0.01

Table 2: Causal effects of FDI (by type) on wages

	(1) aipw (interactions)
	b/se
ATE	
Export Oriented FDI	0.21***
	(0.02)
Technology Intenstive FDI	0.22***
	(0.03)
Domestic Market Seeking FDI	0.23***
	(0.02)
Observations	11,318

* p<0.1, ** p<0.05, *** p<0.01

- severe shortcoming: overlap bad if we include all variables relevant in the logit specification, dropping variables

References

Bajgar, M. and B. Javorcik (2020). Climbing the rungs of the quality ladder: Fdi and domestic exporters in romania. *The Economic Journal 130*(628), 937–955.

Borin, A. and M. Mancini (2016). Foreign direct investment and firm performance: an empirical analysis of italian firms. *Review of World Economics 152*(4), 705–732.

Chen, W. (2011). The effect of investor origin on firm performance: Domestic and foreign direct investment in the united states. *Journal of international economics 83*(2), 219–228.

Khandelwal, A. K., P. K. Schott, and S.-J. Wei (2013). Trade liberalization and embedded institutional reform: Evidence from chinese exporters. *American Economic Review 103*(6), 2169–95.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.

Appendix

The output from Stata and the code you used in your study.