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A survey of papers using Indonesian firm-level data: research questions and insights for novel policy-relevant research in economics

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Abstract

I review the existing literature in international trade that uses Indonesian firm-level data, particularly the Survei Tahunan Perusahaan Industri Pengolahan (Annual Manufacturing Survey) compiled by Badan Pusat Statistik (BPS-Statistics Indonesia). I identify the issues addressed and the scope for new issues and policy-relevant research questions. From a data availability approach, I provide insights into general data concerns and constraints faced by researchers. From a policy relevance approach, I find that the studies published in international refereed journals that use the data have analysed a limited number of topics and I identify overall trends. Finally, I discuss new topics and methods for a continuing policy-relevant research agenda.

Keywords: administrative micro-data, firms, Indonesia, international trade, investment, policy-relevant research

JEL classification: D22, F14, F23, L20

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1. INTRODUCTION

In the past decades, studies using novel data and methodological innovations have captured the attention of the major journals in economics (Hamermesh 2013). Therefore, it is worth exploring the potential offered by existing (micro-)data for carrying out research that meets the highest quality standards.

Because of the increasing availability of high-quality micro-data and the possibility of uncovering causal effects through the use of improved statistical and econometrics methods, trade and investment policymaking is set to undergo profound transformations in the coming years (in line with, e.g. Cernat 2016; Crato and Paruolo 2019). With this in mind, I write this survey to provide a guide to existing studies, together with insights to consider in further research using the data discussed. It provides an illustration of how researchers (particularly, “beginners”) can create their own long-term policy-relevant research agenda with potential for publication in the most esteemed journals.¹

The analysis of administrative firm-level data is of great interest to researchers. On the one hand, the availability of longitudinal data (for firms over time) allows researchers to exploit data variation and introduce methodological innovations into the literature. On the other hand, this type of analysis allows the study of a broad range of novel policy-relevant topics. For instance, it enables improvements to the understanding of the impact of economic phenomena on firms’ choices or the consequences of firms’ strategies for their performance (e.g. productivity, profits or market shares).

I focus on the field of international trade, which Cernat (2016) claims is in need of an upgraded “Trade Policy Analysis 2.0” that shifts its focus from analysing countries and sectors to studying individual firms, to contribute to trade policy priorities and to better

¹ “Policy-relevant research” is research whose findings have informative impacts on policy decision or policy evaluation.

understand how firms benefit from international trade. Previously, Wagner (2007, 2012) reviewed the (firm-level) empirical studies on international trade and several dimensions of firm performance. In these two surveys, one can observe a bias in the literature towards the study of firms in developed countries.

I therefore focus on an emerging market economy: Indonesia. More specifically, I survey papers using the Badan Pusat Statistik (BPS) annual firm-level data for medium and large manufacturing establishments (Survei Tahunan Perusahaan Industri Pengolahan, or SI).² One key characteristic of these data is that a panel dataset can be constructed from the annual surveys using the establishment's identity code. The annual surveys conducted are unusually information-rich and longitudinal in nature, helping to ensure they fulfil the conditions to be considered high-quality data.³

I review a number of policy-relevant economic issues explored in the context of manufacturing firms in Indonesia. Indeed, Indonesia's manufacturing sector is an attractive setting for firm-level research and a focus on manufacturing firms is of interest since manufacturing is a key sector contributing to growth in Indonesia (see, e.g. Rahardja et al. 2012).⁴ In this vein, Blalock and Gertler (2004) point out a number of reasons for the interest in this country's manufacturing industry:

² It is mandatory under Indonesian law for firms with more than 20 employees to complete this survey (see, e.g. Harrison and Scorse 2010). Note that, following the suggestion by three anonymous reviewers, I do not use the term "administrative data" or "census data" because, in the Indonesian context, the term *census* is usually associated with the *Statistik Industri* (SI) data derived from the census conducted every 10 years, in years ending in "6", e.g. 1996, 2006 and 2016.

³ The chapter by Rettore and Trivellato in Crato and Paruolo (2019) takes "high quality" to have two different meanings. On the one hand, high-quality data should provide information on the outcomes relevant for the evaluation of an intervention. On the other hand, high-quality data should allow the identification of a comparison group, made up of units not exposed to an intervention under evaluation and equivalent to the group of units exposed to the intervention, in all respects relevant to the outcomes considered in the evaluation.

⁴ The contribution of the manufacturing sector to the country's gross domestic product (GDP) is higher than the global average GDP contribution from the sector, i.e. 20.16% in 2017. According to the World Bank's WDI data, other countries whose manufacturing sectors contributed more than 20% to GDP in 2017 include China (28.11%), South Korea (26.95%), Japan (20.79%) and Germany (20.56%). In addition, manufacturing exports make up around 50% of Indonesian merchandise exports (see, e.g. Rodríguez-Pose et al. 2013).

“First, with the fourth largest population in the world and thousands of islands stretching over three time zones, the country has abundant labor and natural resources to support a large sample of manufacturing facilities in a wide variety of industries. Second, Indonesian government agencies employ a number of well-trained statisticians who have collected exceptionally rich manufacturing data for a developing country” (Blalock and Gertler 2004, page 400).

More than a decade ago, Aswicahyono (2009) provided a survey and evaluation of the academic literature on empirical micro-data analyses of Indonesian firms’ performance. This author surveyed research work on the export decision process, firms’ survival, foreign direct investment (FDI) spillovers, export spillovers, industrial demographics and productivity growth; overall, this author found evidence for a positive impact of globalising corporate activities and deepening economic integration on the performance of local firms.

My survey takes a broad perspective that goes beyond the strategy adopted by Aswicahyono (2009) of surveying existing papers on firms’ performance, as I review papers that have sought answers to policy-relevant questions by analysing Indonesian firm-level data from three perspectives: trade liberalisation, foreign ownership and firms’ performance; social issues; and other topics such as corruption and the environment.

Since Indonesia is a large, fast-growing developing country located in a dynamic emerging region, analysing the link between firms’ strategies and development, performance, wages and skills is not only useful in terms of creating new knowledge, but also helps policymakers to take informed decisions. Moreover, as an example of a country that became highly liberalised after the Asian crises (Pangestu et al. 2015), assessing the impact of different policy measures on domestic versus foreign firms is relevant. Besides, there is a long tradition of corruption in Indonesia (see, e.g. Vial and Hanoteau 2010); firm-level data

enables an estimation of the impacts of corruption on Indonesian firms' decisions and performance. Finally, Indonesia is a megadiverse country,⁵ and as such is strongly affected by environmental degradation and deforestation, so it can be instructive to examine firms' environmental footprint, particularly on rain forests, and the efficiency of the environmental measures taken.

Regarding trade and investment policy, the analysis of the latest data is promising because many new regulations that affect firms' outcomes and decisions, e.g. related to shipping or new trade barriers, have entered into force in recent years.⁶ The recent (global) phenomenon of increasing trade barriers and retrenching of global value chains (GVCs) and international interdependence in the face of increasing geopolitical tensions in a post-pandemic world is underexplored. Analyses of how firms face the challenge of "de-globalisation" is an underexplored issue in both developed and developing countries (see Witt 2019). The availability of longitudinal firm-level data in Indonesia and the introduction of protectionist trade and investment regulations make Indonesia a perfect case study for analysing the consequences of de-globalisation. Methodologically speaking, policy reforms and/or the introduction of new trade barriers provide a useful setting for causal inference with difference-in-differences.⁷ In addition, the combination of firm-level data with additional novel data that provide exogenous variation is a methodological innovation to identify causal relationships.

I find that, despite the availability of valid and reliable Indonesian micro-data for manufacturing firms, published studies in international refereed outlets have analysed a limited number of topics. Sound empirical applications using these data have mostly been

⁵ This term refers to any one of a group of nations that harbor the majority of Earth's species and high numbers of endemic species. For a review of biodiversity-related issues and challenges in Indonesia, see von Rintelen, Arida, and Häuser (2017).

⁶ See, e.g. Patunru and Rahardja (2015), for a list of protectionist trade laws, non-tariff barriers imposed, local content requirements and export measures taken by Indonesia since 2009.

⁷ Angrist and Pischke (2009) provide a detailed presentation of empirical frameworks for policy evaluation.

carried out using data from the 1990s and early-2000s. Therefore, there is a lack of studies analysing the situation in Indonesian firms in recent periods, and for longer time series covering, for example, the Asian financial crisis and the global financial crisis (GFC) or the (re-)introduction of trade and investment barriers.

My expectation is that new research on Indonesia will benefit hugely from using longitudinal micro-data on firms. New research will include both historical and the most recent Indonesian data, enabling researchers to capture, for example, how Indonesian firms and their performance are affected by the dynamics of trade and investment policy-making.

The remainder of the paper is structured as follows: Focussing on the available data in the survey, the second section discusses both the information contained and issues to consider when using the SI BPS firm-level data (hereafter referred to as “the data”), including their limitations. The third section focuses on a policy relevance approach and identifies overall trends in research that uses the data. In the fourth section, I present a framework for a policy-relevant research agenda with potential for publication in high-ranked economics journals, so researchers (particularly early-career researchers) can draw on this information when carrying out empirical analyses using the data. On the one hand, arising from sections 2 and 3, it establishes four steps to consider. On the other hand, it highlights new issues (topics and methodological advances and tools) to address for Indonesia. The last section concludes.

2. THE INFORMATION CONTAINED IN THE DATA

2.1. Overview and issues to consider

The SI data was conceived as an annual census of all manufacturing establishments with 20 or more employees from 1975 onwards. The survey consists of a questionnaire to be filled out by manufacturing firms. Depending on the year, the SI covers industrial classification, ownership (public, private, foreign), exports, status of incorporation, assets, asset changes, use of electricity and fuels, income, output, expenses, capital stock, labour (head count,

education, wages), raw material use, machinery and other specialised questions (see, e.g. Blalock and Gertler 2004). BPS has field agents who visit each non-respondent to encourage either compliance or to confirm that the establishment has ceased operations (see, Blalock and Gertler 2004; Blalock and Roy 2007). Although some firms may have more than one factory (establishment or plant), I use these terms interchangeably in a more general sense to refer to firms.⁸

It is worth discussing data limitations. For some variables, especially those that are mostly used in a typical firm-level study, information is likely to be consistent, valid and reliable over time. However, for other variables, even though the questions are included in the questionnaires, the information actually collected may be limited. This is the case, for example, for information concerning capital stocks, research and development (R&D) or expenses on gifts, charity and donations. Researchers have to consider these data limitations in order to tackle them in their analysis. For example, because capital values are not reported in 1996 or 2006, Kasahara, Liang, and Rodrigue (2016) used the capital values reported in 1994, 1995 and 1997 to construct the 1996 capital value, and similarly, the reported values in 2004, 2005 and 2007 to construct the 2006 capital value. Another example of how to handle the data limitation that not all variables are available for each year is illustrated by Blalock and Gertler (2009). These authors chose to start their analysis from 1988 because this was the first year for which data on fixed assets were available; similarly, Rho and Rodrigue (2016) decided to stop following their sample of firms in 1995 because the Indonesian manufacturing survey does not report physical investment in 1996.

Additional limitations include sectors not surveyed in certain years, missing data, inconsistency of variable definitions across years, typographical errors and outliers (Suyanto, Salim, and Bloch 2009). There is also a high level of non-reporting and erroneous responses

⁸ This is in line with previous analyses that suggest that fewer than 5% of Indonesian factories belong to multi-factory firms. It is worth noting that BPS also submits a different questionnaire to the head office of every firm with more than one factory (see Blalock and Gertler 2004).

to many of the survey questions. For example, according to Blalock and Gertler (2004), several BPS officials declared that some plants intentionally misreport financial information out of concern that tax authorities or competitors may gain access to the data.

Researchers need to tackle the issue of measurement error and attrition when using the data. For example, Rho and Rodrigue (2016) delved deeper to examine measurement error because they use annual estimates of firms' holdings of capital stock, determined by asking firm managers for the estimated replacement value of existing capital. Accordingly, Amiti and Konings (2007) suggested checking the consistency of the data across the sample period considered to increase confidence in their reliability. Luckily, the data are longitudinal in nature and the use of new methodologies and tools in causal approaches to isolate impacts allows researchers to obtain unbiased results.⁹

An additional data limitation is that the number of firms covered in the data varies every year. Although the annual surveys are based on the same BPS directory of establishments, the number of firms recorded in census years is usually higher than the number in non-census years. In addition, there is a decreasing trend in the response rate (RR) of the survey, which may reduce the accuracy of the data over time:¹⁰ if BPS leaves the non-responding data as missing values, then the data will be less representative of the population. Previous research has identified a general decrease in the level of survey RR over time and suggests providing supplemental analyses to confirm that the respondents are representative of the population (Baruch and Holtom 2008).

Researchers should go through the survey questionnaires to obtain consistent variable definitions throughout the analysed periods. In addition, they should consider the economic instability that characterises emerging countries and that there may be dissimilarities

⁹ Provided that each factory consistently misreports over time. However, even if the degree of misreporting for a factory varies over time, the results are unbiased provided the misreporting is not correlated with other factory attributes in the right-hand side of a regression analysis.

¹⁰ An anonymous reviewer mentioned this issue regarding the data. This reviewer also specified that the response rate was 73.53% in 2004, 63.32% in 2011, and 46.63% in 2017.

according to the period under consideration. For example, special attention should be paid when the analysis includes Indonesian firms before and after the Asian financial crisis or the GFC. As an additional concern, in 1985, BPS changed its field procedures and further improved them in 1988 and 1990. Therefore, any analysis that covers a period pre and post 1985 may be misleading (Aswicahyono 2009).

Another complication with the data is the changes in industrial classification codes. For example, in 2000, BPS changed the industrial classification (Aswicahyono 2009). Also, a more recent study mentions that BPS changed its industrial classification codes in 2010 (Negara and Hutchinson 2020). The industrial classification codes are required to merge the data with other BPS data, e.g. wholesale price indices (WPI) or input-output (IO) tables.¹¹ Researchers should also consider the harmonisation and consistency of industry codes when merging the data with datasets from other sources. For example, a number of studies have connected the data with trade or tariffs (e.g. Amiti and Konings 2007). In this case, concordances are required. Because codes change over time, the time series before and after any change in the industrial classification codes should be homogenised to ensure comparability.

A second group of codes used in the data refers to geographical location. The geographical information of each plant is useful when merging the data with other datasets in order to examine policy-relevant questions for the geographically diverse economy. In the data for earlier years, information on provinsi (province), kabupaten (regency), kecamatan (district) and desa (village) was available. However, the data for recent years include less detailed geographical information. It is worth mentioning that since the early 2000s some territories

¹¹ Complications include the fact that the base year used for WPI changes over time. BPS provides concordances to be able to match the industry codes in the different datasets. However, the concordances provided may differ from year to year. In this regard, one anonymous reviewer pointed out that BPS provided the concordance between the industry code used in IO tables and ISIC, but that in the latest version of the Indonesian IO tables for 2010, the concordance with 5-digit commodity codes, *Klasifikasi Baku Komoditas Indonesia* --KBKI, is provided.

have been merged or consolidated in Indonesia. Therefore, there is also a need to check the consistency of the geographical codes. It is worth mentioning that this external variation may represent an opportunity for researchers. Methodologically speaking, it is possible to exploit variation in the number of political jurisdictions as an identification strategy in causal econometric analyses. For example, Burgess et al. (2012) took advantage of the increase in the number of Indonesia's administrative divisions in 2000 and 2008. Specifically, these authors exploited the differential timing of district splits and found that subdividing a province increases the overall deforestation rate in that province. Researchers should think carefully about the identification strategy and the data required (e.g. variables, years, provinces, industries, or other data, from BPS or from other sources) to perform any causal analysis using the data.

2.2. Information about plants' features

2.2.1. Product-level and production data

The survey provides the industrial classification, which makes it easy to target an industrial sector.¹² It gives information on establishments' intermediate inputs (materials) and outputs, and is available disaggregated by product for some years.¹³ Data are available for quantity and value of materials used. Researchers can also access the value and quantity of goods produced, as well as the share of outputs exported and the main, but not all, export destinations. In the related literature, for example, Hayakawa, Matsuura, and Takii (2017) examined the detailed intermediate inputs and outputs data.

There are also indicators regarding the technology and production process used. For example, in the case of the textile industry, Hayakawa et al. (2017) differentiated between knitted

¹² 5-digit *Klasifikasi Baku Lapangan Usaha Indonesia* (KBLI). One version of KBLI (or *Klasifikasi Lapangan Usaha Indonesia*, KLUI for data before 1998) is based on a specific version of ISIC.

¹³ Product-level data for production and intermediate inputs have been published by BPS since 1998. However, the datasets providing the information at an establishment-product level are separated from the SI data. The product code for these data was in 9-digit *Klasifikasi Komoditi Indonesia* (KKI). In recent years, 10-digit *Klasifikasi Baku Komoditas Indonesia* (KBKI) has been used.

clothes, crocheted clothes and whether the batik method is used. The BPS survey provides information on R&D expenditure though it is not available every year (Suyanto and Bloch 2009). Information is also available on electricity, fuels and lubricant usage as well as expenses related to building and machinery. Related literature has used available information on energy. For example, Irawan, Hartono, and Achsani (2010) defined energy intensity as total energy consumption per output. More recently, Roy and Yasar (2015) defined fuel (electricity) intensity as the ratio of the value of fuels and lubricants (electricity) used to value added. Furthermore, the data provide information about expenditure on environmental abatement for some years (Rodrigue and Soumonni 2014).

2.2.2. Accounting data

The data cover a wide range of firm-level accounting information, including some basic information (year of starting production, location), ownership, production (gross output, stocks, capacity utilisation, share of output exported), material costs and other expenses, labour (head-count, salary and wages) and capital stock (Narjoko 2009). Regarding data about ownership, shares of foreign, domestic and (central and local) government ownership are recorded for each firm. This enables an assessment of, for example, the effect of FDI on firm performance. However, as highlighted in the data overview subsection, there are limitations affecting accounting data.¹⁴ An additional limitation concerns data on firms' debt and financial leverage. For example, researchers using BPS data lacked information on the currency in which the debt is denominated, the nature of the financial institution from which funds were borrowed and whether the borrowings were hedged (Narjoko and Hill 2007).¹⁵

Researchers can obtain information on indirect taxes, but not on income and personal taxes. Also, information about "gifts, charity, donations" in the survey can be used as an indication

¹⁴ For example, as clarified by one anonymous reviewer, data for capital stock are not available in the census years 1996, 2006 and 2016.

¹⁵ Indeed, these authors use the raw data from the unpublished establishment-level data tapes (period 1993-2000).

of plant-level corruption; however, information about commissions or contract shares are missing (Vial and Hanoteau 2010).

The total cost of firms' capital depreciation and interest paid by the firm is provided (Margono and Sharma 2006). The data include annual observations of the estimated value of fixed capital, new investment and capital sales across five types of capital: land, buildings, vehicles, machinery and equipment and the type "other". Rho and Rodrigue (2015) stated that this information is available for every year in their sample (1990-2000), except 1996.

Researchers can find detailed quantitative information such as short form income statements and balance sheets, which previous studies have complemented with alternative surveys for Indonesia. For example, Hyndman and Serio (2010) used a 1998 firm-level survey in Indonesia sponsored by the World Bank, which includes information regarding the percentage of goods sold on credit and the average number of days before payment is due.

2.2.3. Labour force data

The information on establishments' employees contains the head count, wages and education levels (Blalock and Roy 2007). In particular, the surveys record the distribution of academic achievement in two distinct occupation categories (production and other workers) in each plant; the number of workers with primary, secondary and post-secondary education are provided in some years. For example, Amiti and Cameron (2012) pointed out that "the SI collected information on the number of workers by educational category for a subsample of years, 1995 to 1997" (page 282). In the same vein, Kasahara et al. (2016) explained that they "use the data recorded in the census years 1996 and 2006 because, in these two years, the Indonesian manufacturing survey records the distribution of academic achievement in two distinct occupation categories (non-production and production) in each plant. Specifically, in each plant we observe the number of workers with primary, secondary and post-secondary education" (page 246). However, wages are not disaggregated by educational categories and

so researchers cannot explore the skill wage premium (i.e. the portion of worker wages that can be attributed to workers' skills) in more depth, unless they augment the manufacturing survey data with other Indonesian data, such as household surveys. Other variables of interest in this category that have been used in related research include the total plant-level expenditure on worker training (Kasahara et al. 2016). Workers' gender is likewise provided (see, for example, Roy and Yasar 2015).

2.2.4. Other relevant information

It is worth making a distinction between information from inside and outside of the SI datasets because many of the studies using the data rely on other variables, some of them built by BPS. The data contain establishments' industrial sector, making it possible to merge the data with additional industry-level information. For example, Suyanto and Salim (2011) used the average WPI and the WPI for machinery as deflators for monetary values of output and capital, respectively.¹⁶ Also, Blalock and Gertler (2008) used IO tables published by BPS in 1990 and 1995, which show the value added of goods and services produced by industry and how this value is distributed to other industries. In addition, there are studies that used information from other data sources. For example, Amiti and Konings (2007), Hayakawa et al. (2017) and Pane and Patunru (2020a) used import tariffs. Pane and Patunru (2020a) and Putra and Narjoko (2019) used exchange rates. Other researchers used industry market shares, which allows them to distinguish between concentrated and competitive industries (Amity and Konings 2007). Because the data also contain establishments' location, it is possible to retrieve additional geographical information from the outside; for example, Hyndman and Serio (2010) used data on firms' competitors operating in the same geographical area.

¹⁶ Amity and Konings (2007) also use the industry WPI to deflate plant-level sales revenue. Other studies that use BPS price deflators data include Blalock and Gertler (2004), Rodrigue and Soumonni (2014) and Rho and Rodrigue (2016). These deflators are published in the Buletin Statistik Bulanan Indikator Ekonomi of BPS, the Monthly Statistical Bulletin of Economic Indicators. More detailed information is available from the Wholesale Price Indices of Indonesia.

3. ECONOMIC ISSUES ADDRESSED WITH THE DATA

This section focuses on a policy relevance approach and introduces findings of trade and investment policy-relevant research relying on the data. In the context of this research, the relationship between a research finding and a related policy is that, to set appropriate policy goals, policymakers need to know and to understand the reality of firms.¹⁷

In Table 1, I provide a list of 33 published papers (in chronological, then alphabetical order), together with a summary of the contribution and main results of each of these studies. Because most of the policy-relevant questions can be answered by analysing panel data, I also add a column indicating whether the study implements a panel data analysis for firms. In addition, it is sometimes necessary to merge the data with information from the outside to conduct innovative research. Therefore, I include a column noting whether the selected studies are merged with data at higher levels of aggregation, e.g. the data are merged with industry- or national-level data, or at a lower level of aggregation, e.g. the data are merged with household-level data. In addition, this column specifies whether the data are merged with information from BPS or non-BPS datasets. It is worth mentioning that this list includes research papers in English only, published in refereed journals and relevant to trade and/or investment policy. This list is not intended as an exhaustive review of the literature, but rather a useful compilation of trade and investment policy-relevant studies that have used the data. This compilation allows researchers to group the selected studies according to different perspectives. Specifically, I group these perspectives into three blocks: 1) trade liberalisation, foreign ownership and firms' performance; 2) social issues, including employment, poverty, skills and wages; and 3) other issues, such as corruption and environment.

¹⁷ An anonymous reviewer pointed out that potential young readers may be interested in how to find a research theme with high policy relevance. They may want, for example, to participate in policy-oriented activities related to their field of research (Márquez-Ramos 2020). Also, potential young readers may want to know not only what questions have been answered but how informative the answers are for policymakers. Policymaking is not easy because uncertainties abound and data are limited (Walker 2000). In fact, research evidence is only one potential input in complex policy processes (Moat et al. 2013). This topic is beyond the scope of this paper and is left for future research.

3.1. Trade liberalisation, foreign ownership and firms' performance

Trade reforms and liberalisation opened up the Indonesian market to foreign investors, reduced the price of goods traded and brought new technologies into the country. This had effects on plants' organisation and on firms' performance. Given the richness of the data, this topic has been widely studied.

To the best of my knowledge, the first trade-related study using the data was that by Sjöholm (1999), who examined whether participation in international trade affects establishments' productivity in the cross-section. According to his findings, import and/or export participation correlate positively with productivity. The relationship among imports, exports and productivity is complex (see, for example, Bernard et al. 2018) and the trend in this vein of the literature has demonstrated the importance of panel data analysis to identify causal relationships.

Another early study that used BPS data was that by Aswicahyono and Hill (2002), who analysed how changes in total demand, decomposed into domestic demand expansion, export expansion, and import substitution, correlated with inter-industry variations in total factor productivity (TFP) growth. In this study, the trade regime and domestic competition was found to be correlated with TFP. However, the analysis was carried out at industry-level, with the authors highlighting the potential relevance of a higher level of disaggregation. Specifically, they pointed out that "ideally these industry studies need to be supplemented by firm-level analysis – not simply firm observations from industrial survey data, but longitudinal case-studies of firms over the course of a reform period" (page 159, Aswicahyono and Hill 2002). This has important policy implications and is in line with Cernat (2016), who points out that specialists analysing firm-level data formulate better-informed policy advice and policy responses to particular problems.

One key study to mention in this branch of the literature is that by Amiti and Konings (2007), who found that the increase in firm productivity resulting from a reduction in input tariffs is much higher than that from a reduction in output tariffs. Besides, importing firms enjoy the highest productivity gains and those gains are the same in both concentrated and competitive industries. A related recent study is that by Hayakawa et al. (2017). These authors examined the effect of tariff reductions on product quality upgrading in the apparel industry. They showed that the reduction in output tariffs does not boost quality upgrading by producers of the output in question, but that reducing input tariffs enhances quality upgrading in both non-importers and importers, albeit with a larger effect for importers. These findings point to the importance of trade liberalisation policies that focus on the “inward” side of internationalisation and GVCs in developing countries.

The analysis of the consequences of FDI spillovers has received particular attention in this branch of the literature. Blomström and Sjöholm (1999) were the first to use the data to examine the effects on technology transfer and spillovers deriving from the ownership share of foreign multinational affiliates. These authors found that foreign firms have higher labour productivity than domestic firms. In addition, they showed that domestic establishments benefit from FDI spillovers. More recently, Blalock and Gertler (2008) distinguished between horizontal and downstream FDI.¹⁸ They found that, in a number of industries, the productivity gain derived from FDI is more than 2%. In addition, their findings suggest several positive effects; namely, benefits for consumers in terms of lower prices and for firms in the form of greater profitability, which are transmitted both up and down the supply chain through the adoption of technology brought with FDI. These findings have implications for policy in countries that try to frame the environment in which multinational firms operate (e.g. with a local partner requirement).

¹⁸ Horizontal FDI is measured as the share of an industry’s output in a particular market that is produced by foreign-owned firms, whereas downstream FDI is measured as the share of the total output of an industry and region that is sold to downstream foreign buyers across all industries.

A number of studies have focused on specific industries. For Indonesian chemical and pharmaceutical firms, Suyanto et al. (2009) analysed whether FDI spillovers affect productivity growth. These authors showed that intra-industry productivity spillovers exist and that competition facilitates spillovers from a foreign presence in the industry. Moreover, they found that firms with R&D expenditure benefit more than those without. This result is in line with other studies for different sub-samples, such as that by Negara and Adam (2012), who found that FDI entails a positive impact on a local firm's productivity. For the Indonesian pharmaceutical sector, Suyanto and Salim (2011) estimated the effect of FDI spillovers on technical efficiency. These authors found that foreign firms are more efficient than domestic firms and that there are positive FDI spillovers on technical efficiencies of domestic suppliers. Previously, Okamoto and Sjöholm (2000) examined the role that multinational enterprises played in the development of the automotive industry. They found that foreign firms seem to have contributed to the introduction of modern technology and management methods in Indonesia, and to upgrade the quality of products. Overall, these findings validate that FDI spillovers provide a justification to encourage foreign investment in different industries.

A number of studies have focused on the determinants of firms' exports as well as their co-evolution with other factors such as investment. In this vein, Blalock and Roy (2007) found that "better" firms, as proxied by foreign ownership, productivity, involvement in R&D and investment in training, were more likely to continue exporting after the Asian crisis. Narjoko and Hill (2007) noted that foreign ownership and prior export orientation were significant determinants of survival and recovery after the crisis. These findings have implications for policy when dealing with external shocks.

Related literature has recommended policy measures that encourage firms to devote more efforts on R&D. Regarding the interrelation of R&D, productivity and exports, Yang and

Chen (2012) found that R&D contributes positively to productivity and exports. In a related study examining the determinants of Indonesian manufacturing firms' exports, Rodríguez-Pose et al. (2013) found that export propensity is driven by past export experience, the share of foreign ownership, TFP, capital intensity and age of the firm. In addition, the conditions of the provinces where the firm is located and those of their neighbours' influence exports. Rho and Rodrigue (2016) evaluated the impact of investment on exporting over time, finding that new exporters invest heavily in new capital as they enter and grow into export markets. Their model also revealed a strong degree of complementarity between investment and exporting, particularly in capital-intensive industries. Although the direction of causality between exports and investment is not clear, some efforts have been made in the existing literature to gain a better understanding of this relationship. For example, Rho and Rodrigue (2015) found that exporting has a large impact on firm-level investment. Firm-level investment increases by 37% in the first year of entry into the export market and firm-level capital stocks continue to adjust to exporting for at least three years after entry.

A trend seen in this branch of the literature is the use of both detailed panel data from different sources as well as new empirical tools and methods that allow causal identification. An emerging line of policy-relevant research also uses panel data to analyse the impact of recent trade policy on firms' performance. In this vein, Pane and Patunru (2019, 2020b) focus on the importance of learning-by-exporting for firms' productivity; Pane and Patunru (2020a) focus on the role of imported inputs in firms' productivity and exports; and Putra and Narjoko (2019) focus on the impact of the exchange rate on firms' export.

3.2. Analysis of social issues: employment, poverty, skills and wages

Two trade and investment-related topics about effects on the local labour market have been extensively analysed using the data. Specifically, the impact of both trade liberalisation and

foreign ownership on the labour market have received special attention. Findings in this branch of the literature have implications for policy dealing with income inequality.

Regarding the consequences of trade liberalisation for the labour market, Kasahara et al. (2016) studied how starting to import affects the demand for highly-educated workers within and across production and non-production occupation categories at the plant level. They found that importing increases the demand for educated workers among Indonesian importers within each of the occupation categories. Previously, Amiti and Cameron (2012) analysed the effect on the skill wage premium of reducing import tariffs on intermediate inputs and final goods.¹⁹ They highlighted that a reduction in input tariffs reduces the skill wage premium for importers while changes in final goods tariffs have a non-significant effect.

Related research has shown that trade liberalisation affects poverty too. In this branch of the literature on local labour market effects, Kis-Katos and Sparrow (2015) assessed the effects of trade liberalisation on (regional) poverty levels. According to their results, input trade liberalisation in Indonesia has contributed to a reduction in poverty by increasing the incomes of the poorest people.

Regarding effects of foreign ownership on wages in Indonesia, Takii (2009) found positive wage spillovers in the districts where foreign-owned plants tend to be concentrated. More recently, in an analysis of the effects of foreign ownership on wages, employment and worker turnover rates (not only in Indonesia but also in Brazil, Germany, the United Kingdom and Portugal), Hijzen et al. (2013) found that foreign-owned firms pay higher wages than domestic firms. In addition, the foreign-wage premium is higher in developing countries (Brazil, Indonesia) than in developed countries. Finally, there are positive effects of foreign

¹⁹ Note that these authors also used the Indonesian Labor Force Survey (*Sakernas*), an annual nationally-representative household survey, which covers approximately 250,000 individuals across all of Indonesia's provinces.

ownership on employment.²⁰ A related paper that has a bearing on this literature is that by Harrison and Scorse (2010), who analysed the effect of anti-sweatshop campaigns in Indonesia on wages and employment. To that end, they compared the wage growth of workers in foreign-owned and exporting firms in targeted regions or sectors before and after the initiation of anti-sweatshop campaigns. Although campaigns led to wage increases for targeted enterprises, the authors failed to find significant effects on employment.

It is worth mentioning that trade liberalisation and fragmentation of production (offshoring or GVCs) are closely linked (see, e.g. Márquez-Ramos 2018). Hummels, Munch, and Xiang (2018) surveyed the empirical literature on the effects of offshoring on wages and distinguished four waves of studies: those using industry-level data; those using firm-level data; those using worker-level data; and those using matched worker-firm data. The trend in this branch of the literature is the use of innovative methods and tools to address the endogeneity of the independent variables used in the analysis, as well as the use of rich data sources allowing, for example, firm-level data to be merged with worker-level data.

3.3. Other topics and overall trends

Other topics that are relevant for policymakers and have been studied using the data include corruption and environmental issues. Vial and Hanoteau (2010) assessed the impact of plant-level corruption on output and productivity growth during the Suharto era. They found that corruption had a positive and statistically significant effect on plant growth.²¹ Rodrigue and Soumonni (2014) found that firm-level environmental investment increases growth in export demand, while Roy and Yasar (2015) analysed the impact of exporting on firms' energy efficiency, finding that exporting reduces the use of fuels.

²⁰ Note that this study uses firm-level and linked worker-firm data. However, linked worker-firm data were not available for Indonesia, and therefore Indonesia could only be included in the firm-level analysis.

²¹ There are analyses of corruption in Indonesian firms that use other data sources. For example, Kuncoro (2004) examined the extent of corruption at district level in 2001 and 2002. To do so, the author used data produced by the Special Survey on Governance, which covered different aspects of the cost of doing business, such as the payment of bribes, taxation, infrastructure provision, local regulation and labour and land disputes.

As reported in Table 1, currently, all studies use panel data to answer policy-relevant research questions. Additionally, I confirm the trend mentioned by Hamermesh (2013) of a shift towards the publication of empirical studies based on data collected by the researchers. For example, Harrison and Scorse (2010) relied on a list of vendors for Nike, Adidas and Reebok, and used the names of enterprises described in newspaper accounts of sweatshops.

Concerning the policy debate trend in trade and investment research in Indonesia, there has been an increase in studies that go beyond firms' performance. For example, researchers have started to investigate the relationship between trade liberalisation and wages (e.g. Amiti and Cameron 2012; Amiti and Davis 2011). The analysis of social issues is now more likely to be explored with the use of both employer (i.e. firms) and employee (i.e. workers) data, as in the analysis of the relationship between minimum wages and employment (Alatas and Cameron 2008) or of the relationship between trade liberalisation and the wage skill premium within firms (Amiti and Cameron 2012).

Another trend worth noting is that of using additional data not only from the same source as the main dataset (i.e. BPS in this case), but also from other sources. In this vein, Hyndman and Serio (2010) combined a firm-level survey in Indonesia sponsored by the World Bank with the data to analyse the relationship between credit provision and competition. This trend is accompanied by a shift towards combining multiple data sources at different levels of aggregation (see, column "Additional data" in Table 1, e.g. Kasahara et al. 2016 or Kis-Katos and Sparrow 2015).

4. STEPS TO CONSIDER AND SCOPE FOR NEW ISSUES AND METHODS

Figure 1 provides a guide for researchers that want to use the data and may be particularly useful for those starting out on their research career in economics. It builds on Section 2 and Section 3 and takes into account overall trends identified for policy-relevant research published in esteemed journals. Specifically, it presents four steps to consider when using the

data: 1) to identify a (relevant and innovative) research question; 2) general data issues; 3) choice and management of variables over time and 4) the use of additional data. Related existing literature provides the researcher with useful information. In addition, Figure 1 includes new topics and methodological advances and tools that may help researchers to identify relevant and innovative research questions.

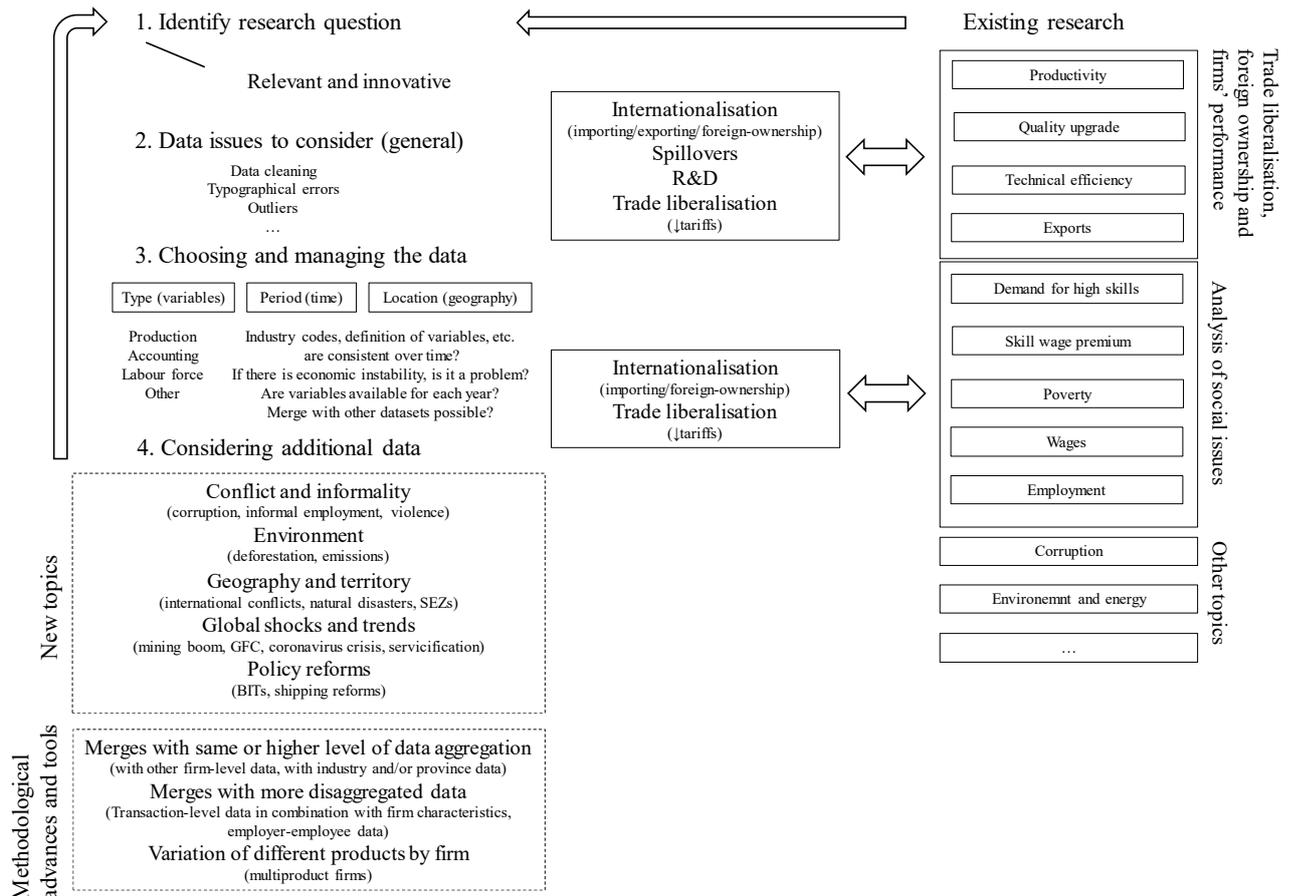


Figure 1. Steps to consider when carrying out empirical analyses using the data and scope for new issues and methods. Two-way arrows indicate correlation between variables.

One research area to be explored relates to territorial issues. They could analyse, for example, consequences for firms due to the dispute between China and several Southeast Asian countries that have overlapping territorial claims in the South China Sea, including

Indonesia.²² In this vein, Schultz (2015) discussed causal pathways between borders, conflict and trade. Comerford, Myers, and Rodríguez Mora (2014), relying on a firm heterogeneity model, analysed the consequences of the hypothetical independence of the Catalonian region from the rest of Spain, which would increase trade costs. These authors found that greater commercial distortions would lead to lower productivity of Catalonian firms. Along these lines, a researcher could study the feasibility of resolving disputes, which may affect trade costs, and its consequences for Indonesian firms under different scenarios.

Also regarding the importance of geography and territory, researchers who are interested in special economic zones (SEZs), regions' exports and firm-level activity will be able to use the data to obtain insights into trade and investment for Indonesia.²³ This type of analysis is highly policy relevant because the number of SEZs in Indonesia has increased significantly in recent years. Interestingly, the studies surveyed that use the most recent data analyse associations between SEZ status and firms' characteristics (Aritenang and Chandramidi 2020; Negara and Hutchinson 2020).

Availability of recent data enables analysis of the impacts of global shocks and trends. For instance, the global mining boom between 2003 and 2013 caused a frenzy of mineral extraction across Indonesia's resource-rich regions that led, firstly, to a law requiring mining companies to add domestic value to their mineral ores and, secondly, to a ban on the export of minerals (Patunru et al. 2018). Although the SI data only covers firms whose main products are manufactured goods, a researcher might exploit sectoral and/or geographical variation to analyse, for example, whether spillovers affect the performance or behaviour of manufacturing firms. To exploit such variation, the researcher may focus on manufacturing

²² Although China does not claim any of Indonesia's landmass, in 2009 it asserted its *historic* rights over waters that lie within Indonesia's exclusive economic zone in Natuna, a remote group of islands in the southern part of the South China Sea (Patunru et al. 2018).

²³ For example, two research papers in this field are Wang (2013) and Defever and Riaño (2017), who focused on SEZs in China. Grant (2020) provided evidence that SEZs are more economically important than was previously understood, and contributed a new dataset covering the universe of SEZs in the United States.

firms that, e.g. produce or import a derivative of raw mineral products (i.e. exploiting sectoral variation), or located in Indonesia's major mining regions (i.e. exploiting geographical variation).

The consequences of the coronavirus crisis for Indonesian firms is a policy-relevant issue worth investigating when the data for 2020 become available.²⁴ Additionally, it seems that there is a trend towards trade protectionism in Indonesia since 2009. Most of the policies reflecting this trend are non-tariff measures, as tariffs are already very low (Patunru and Rahardja 2015). In fact, because the trend towards increasing globalisation and openness to international competition seems to be undergoing a global reversal, with growing scepticism about globalisation, I see the Indonesian experience as a harbinger of future events in other (emerging) countries. Analysing how the introduction of laws and protectionist measures affects firms in Indonesia can help policymakers to take informed decisions, in Indonesia and beyond.

Regarding investment policy, recent findings imply that evaluations of economic integration should consider investment regulation (Heid and Vozzo 2020). Indonesia announced the termination of its Bilateral Investment Treaties (BITs) in 2014.²⁵ This concerns existing and prospective investors, as the investment protections afforded by BITs play a significant part in the final decision to invest, particularly in developing countries such as Indonesia. In addition, impacts of other recent policy reforms can be analysed. For example, researchers may analyse impacts of shipping reforms related to ports in Indonesia, and whether these reforms affect firms' competitiveness.²⁶ There is existing research analysing how

²⁴ In this line, Kimura et al. (2020) explored policy responses to the coronavirus crisis on trade and value chains at a country level, while Guinea and Cernat (2020) proposed a firm-level approach to build an evidence-based monitoring platform of trade policy to assess shocks such as Covid-19.

²⁵ See Table 1 in Hamzah (2018) for a detail of BITs that have been terminated by consent, unilaterally denounced or replaced by a new treaty.

²⁶ Prior to 2008, the framework for port administration in Indonesia was established by Shipping Law 21/1992. Under this law, four port corporations were established to administer the main commercial ports. Each Indonesian port corporation (IPC) was given control of all commercial ports within a designated geographical region. The Shipping Law of 2008 introduced significant changes to the structure of port administration in

improvements to ports' strategic and operational effectiveness increase regions' competitiveness (e.g. Márquez-Ramos and Aparisi-Caudeli 2013); however, consequences of shipping reforms for firms are underexplored. Therefore, the trade consequences for firms of reforms in the port (or transport) system is a promising line of research. Especially when analysing innovative research questions that have not previously been studied for Indonesia, researchers should consider data limitations. For example, in the case of a potential study of foreign investors, the data do not report which firms received foreign investments from which countries. In addition, there is no information about firm-port relationships in the data. The development of new methodological tools and the combination of the data with additional datasets may help to take on board new research topics.

The data rely on a survey consisting of a questionnaire to be filled out by manufacturing firms. There is, however, a high importance of services in manufacturing and the “servicification” of manufacturing (purchases, production, sale and export of services) is increasing (see, e.g. Lodefalk 2015). The data allow the analysis of policy-relevant research questions in these aspects. Specifically, researchers can find expenditure on manufacturing services, revenue from manufacturing services and revenue from non-manufacturing services. The data provide information on revenue from manufacturing services distinguishing domestic *versus* foreign from 2014 onwards, as well as profits arising from non-manufacturing services, which are combined with profits from sales of unprocessed goods and of waste into one variable in the data.²⁷ Researchers could combine the data with, for example, IO data to perform a study that goes beyond the industry level of analysis by introducing intra-industry firm heterogeneity, as suggested by Fortanier et al. (2020).

Indonesia. The law separates the functions of port operator and regulator. It provides for new port authorities to be formed, which will take over a number of the functions previously performed by the IPCs. The Shipping Law of 2008 removes the IPC's legislated monopoly on commercial ports and in so doing opens the sector up to participation by other operators, including those from the private sector (OECD 2012).

²⁷ Note that, as a consequence, a researcher that uses the revenue from non-manufacturing services must separate it from a bundle variable (a combined value of the revenue from non-manufacturing services, sales of unprocessed goods and sales of waste).

However, researchers should still consider data limitations affecting the firm-level data, e.g. relating to expenditure on industrial services and income from services, and perform a variety of robustness checks.

In addition to servicification-related indicators, there is other useful information available in the data that, to the best of my knowledge, has not been used for research. For example, policy-relevant research questions about informal employment and natural disasters may be studied. Regarding informal employment, the informal economy is huge, especially in developing countries, but its productivity is lower than that of the formal economy (La Porta and Shleifer 2014). The data provide information on paid and unpaid workers. The unpaid workers are likely employed informally, i.e. without a written work contract or social security contribution.²⁸ Therefore, one could study the determinants of using informally-employed workers within formal firms, i.e. firms that pay taxes and are registered with the government. The analysis of informal employment within firms using firm-level data is a policy-relevant and innovative topic. In particular, the relationship between trade liberalisation and the level of informality is still unclear; see, e.g. Heid, Larch, and Riaño (2013) and Heid (2015). Regarding natural disasters, Felbermayr, Gröschl, and Heid (2019) exploited monthly variation in trade data to estimate the short-run productivity and expenditure effects of natural disasters using country-level data. The data provide information of months of production activities, meaning that a panel of monthly production data and data on natural disasters such as earthquakes, tsunamis, volcanic eruptions and floods could be merged to study the consequences of natural disasters on firms' production.²⁹

An additional promising avenue for research relates to the environment. As Cherniwchan, Copeland, and Taylor (2017) pointed out:

²⁸ It is worth noting that unpaid workers are not always informal workers, they might be, e.g. the owners or family of the owners working a few hours.

²⁹ Note that Indonesia is located on the Pacific Ring of Fire, an area with a high degree of tectonic activity.

A firm-level focus in answering trade and environment questions is very promising, but researchers have not yet fully exploited its potential. There are many new insights, but much remains poorly understood. Theories in which comparative advantage drives across-industry adjustment are often treated as competitors to theories based on within-industry adjustments, rather than as complements studying different units of analysis. As a result, there is little work that attempts to integrate empirical findings from the old and the new approaches. Moreover, there are several new and potentially important hypotheses that cry out for further study (Cherniwchan et al. 2017, page 60).

Indonesia is one of the top carbon-emitting countries and is notably affected by environmental damage. Some programmes have been launched in Indonesia, such as the Clean Development Mechanism (CDM)³⁰ and Reducing Emissions from Deforestation and Forest Degradation (REDD).³¹ Consequently, having data about plants' energy efficiency and firms' policy regarding environmental indicators is of great interest when it comes to assessing the impact of the measures already taken, targeting the points to be improved and advising policymakers on the implementation of new programmes.

One promising line of research would be to consider both firm-level characteristics and information on international transactions (obtained from Indonesian customs); for example, this would allow the researcher to identify multiproduct firms and find out the corresponding trading partners (exporters and importers), as well as ports of origin and destination. Information on different products produced by Indonesian firms, which may be included by BPS as an extension of the data, represents a good starting point for the analysis of multiproduct firms in emerging countries.

³⁰ A search of <https://cdm.unfccc.int/Projects/projsearch.html> found 152 projects hosted by Indonesia (search performed 13 May 2019). Note that via this webpage, the researcher can access useful data such as the date on which the CDM was registered, the title of the project, host parties, other parties involved and estimated emission reductions.

³¹ REDD projects in Indonesia are available at <http://forestcarbon.com/projects>.

There is huge potential for high-quality research using transaction-level data (customs data) in combination with firm characteristics. Given the quality of the existing Indonesian micro-data for firms, the possibility of data merges between firm- and transaction-level data potentially enables the type of research that would be very meaningful for policymaking and that would meet the highest academic standards. Crucially, Indonesia is missing from the tabular survey of empirical studies using transaction-level data on exports and imports by Wagner (2016).

Finally, there is a lot of potential for high-quality research when the data are combined with other existing (BPS and non-BPS) datasets. For example, Hyndman and Serio (2010) combined the data and a firm-level survey sponsored by the World Bank to assess the effect of the Asian financial crises on the manufacturing sector.³² Other relevant data that are available include the National Violence Monitoring System (NVMS),³³ which provides data regarding conflict and violence across all provinces in Indonesia. Recent research demonstrates that trade-induced job loss increases violence. For example, Dell, Feigenberg, and Teshima (2019) showed that Mexican manufacturing job loss induced by competition with China increases cocaine trafficking. For Indonesia, Kis-Katos and Sparrow (2011) showed that increased exposure to trade liberalisation is associated with a decrease in child work. Combining the data with external databases that provide details of conflict and violence, such as the NVMS, which provides information on elements such as location of incidents, incident date or type of violence, enables a better understanding of the complex interrelationships among conflict, economic integration, social issues, and firms' performance and behaviour.

The availability of additional data from external sources offers a significant opportunity.

Availability of integrated micro-data in many developed countries (e.g. employer-employee-

³² The countries included in this survey are Indonesia, the Republic of Korea, Malaysia, Philippines and Thailand. See Hallward-Driemeier (2001).

³³ Available at <http://snpk.kemenkopmk.go.id>.

linked longitudinal data) has opened the door to research on significant new topics and has contributed to generating greater demand for integration of data from different sources and over time (see, e.g. the chapter by Trivellato in Crato and Paruolo 2019). However, this integration of data across several sources of micro-data is still rarely used in the study of firms in developing countries.

There are challenges involved in merging SI data with external and/or supporting data, as the compatibility of SI data with supporting data can be an issue. Merging SI data with more aggregated data (e.g. industry level or province level) may be relatively easy to do, but it would pose a challenge to merge SI data with other firm-level data, customs data or individual-level data. A collaboration with BPS, which has the details on firm identity in SI data, or other data providers, may be needed in the process of data merging.³⁴

5. CONCLUSION

I explored a number of trade and investment studies that use Indonesian firm-level data from BPS surveys and confirmed that this statistics agency has provided unusually rich and accurate datasets over more than 40 years. This is particularly interesting considering Indonesia's socio-economic situation. A broad range of information is available, covering many different aspects of firms such as export and import market share, environmental investment, employees' skills and the production process used. The identification of industrial sectors makes it easy to match a dataset from BPS with other databases. Nevertheless, researchers should be prepared for problems of missing data and inconsistent values for some questions in some years. Furthermore, firms with fewer than 20 employees are not included in the data, which limits the assessment of firm-size effects.³⁵

³⁴ Examples of research performed after a collaboration with BPS are Pane (2019); Pane and Patunru (2020a); Putra and Narjoko (2019).

³⁵ For an application using data on Indonesian firms with fewer than 20 workers from alternative surveys, see Rothenberg et al. (2016), where the authors relied on another BPS survey: Survey of Micro and Small Enterprises (Survei Industri Mikro Dan Kecil, or IMK). The IMK Survey is an annual 1% sample of micro and small firms. The 2013 survey contained data on more than 40,000 micro and small firms, operating in nearly

Many researchers have already used the data to investigate different policy-relevant issues and there are many resulting publications out there in high-impact international journals. However, these data can be utilised further as they allow innovative research and provide answers to novel policy-relevant research questions. Of the topics identified here, “Trade liberalisation, foreign ownership and firms’ performance” is the most extensively studied topic. In particular, effects on productivity have received special attention. The paper by Amiti and Konings published in the *American Economic Review* in 2007 has been cited more than 2,000 times, while the study by Blomström and Sjöholm (1999) has been cited more than 1,500 times.³⁶ The effect of trade liberalisation on employment, poverty and development has been examined quite often. Some studies have addressed the ecological impact of trade, but there are still many aspects to analyse given the extent of environmental issues, from the clearing of rainforests to the decline of biodiversity. The issue of corruption still calls for further investigation, given the political history of Indonesia and the past availability of data. A promising strand of the literature is that using merged firm- and transaction-level data.

There exists a great potential for fruitful and relevant research due to two major factors, as pointed out by Crato and Paruolo (2019): “the increasing availability and quality of data and the existence of modern econometric methods that allow for a causal impact evaluation of policies. These two fairly new factors mean that policy-making can and should be increasingly supported by evidence” (page 2). To place Indonesian micro-data at the forefront of economic research in developing countries, facilitating the combination of the data with additional data seems a reasonable way to incentivise the use of the data by both early career researchers just starting out as well as senior scholars. They are excellent for those who aim

450 different industries and sampled from all of Indonesia’s 33 provinces (see Rothenberg et al. 2016). In other sectors, there are BPS surveys for agricultural households, mining (oil and natural gas, and non-oil and non-natural gas), and several service sectors. I do not survey papers that use these datasets as they are beyond the scope of this paper.

³⁶ According to Google Scholar (August 2020).

at publishing in top economics journals. Given the high number of policy-relevant research questions that can be answered by analysing the Indonesian BPS firm-level data, as well as the potential for application of innovative methodological advances and tools when exploring them, we are likely to see a growing number of papers dealing with Indonesia in the most esteemed journals in the years to come.

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Table 1: List of trade and investment-related studies using the Indonesian manufacturing firm-level data by BPS

#	Study	Years covered	Panel data	Additional data	Contribution/Purpose	Main findings
1	Blomström and Sjöholm 1999	1991	No		Examines the effect on technology transfer and spillovers deriving from the ownership share of foreign multinational affiliates.	Labour productivity is higher in establishments with foreign equity than in domestically-owned firms. Domestic establishments benefit from FDI spillovers.
2	Sjöholm 1999	1980 and 1991	No		Examines whether participation in international trade affects establishments' productivity.	Finds a positive effect on productivity from exports and imports. Indonesian establishments engaged in imports as well as exports have high productivity levels.
3	Okamoto and Sjöholm 2000	1990 and 1995	No		Examines productivity performance in the Indonesian automotive industries.	The automotive industry shows negative productivity growth after 30 years of protection and government support.
4	Blalock and Gertler 2004	1990-1996	Yes	BPS, aggregated data: price indices and deflators.	Analyses whether firms become more productive by learning through exporting.	Firms experience a jump in productivity of about 2% to 5% following the initiation of exporting.
5	Takii 2005	1990–1995	Yes	BPS, firm-level data: backcast datasets.	Examines spillovers from foreign affiliates of MNCs to local plants.	Finds a positive productivity spillover effect. The magnitude of spillovers changes by industry.
6	Amiti and Konings 2007	1991-2001	Yes	BPS and non-BPS, aggregated data: price indices and tariffs.	Estimates the effects of reducing input and output tariffs on firm productivity.	A 10 percentage point fall in input tariffs leads to a productivity gain of 12% for firms that import their inputs, an effect that is much higher than the productivity gains obtained from reducing output tariffs.
7	Blalock and Roy 2007	1990-2000	Yes	BPS, aggregated and firm-level data: price indices and information about reduced production after the Asian financial crisis.	Addresses two questions: 1) how did firm exporting behaviour change in response to the devaluation of the Indonesian rupiah? 2) if firms varied in their response to the devaluation, can firms' perceptions of constraints or managerial attributes predict the different responses?	The rate of entry into and exit from export markets increased dramatically following the devaluation. However, a large number of pre-crisis exporters quit exporting even in the presence of a much more advantageous exchange rate. Foreign firms, firms engaged in research and development, and firms investing in training were all more likely to continue to export post-crisis.
8	Narjoko and Hill 2007	1993-2000	Yes		Assesses the effect of Indonesia's 1997-1998 crisis.	Foreign ownership and prior export orientation are significant determinants of survival and recovery. Furthermore, the industry in which firms are located, in particular its factor proportions, is also found to be significant.

9	Blalock and Gertler 2008	1988-1996	Yes	BPS, aggregated data: IO tables and price indices.	Examines whether: 1) there were transfers of technology along the supply chain, 2) the technology transfer leads to increased competition 3) the increased competition generated welfare improvements in terms of lower prices, greater production, and higher profits in both the supply market and in industries downstream of the supply market.	The adoption of technology brought with FDI creates benefits for consumers in terms of lower prices, and for firms in the form of greater profitability, which are transmitted both up and down the supply chain.
10	Blalock, Gertler, and Levine 2008	1990-2000	Yes	BPS, aggregated data: price indices.	Analyses whether capital market imperfections limit investment in Indonesia following the 1997-1998 East Asian financial crisis.	Foreign-owned exporters increased capital during the crisis, but similar domestic-owned exporters did not. The liquidity constraints decreased capital by 21.8%, decreased employment by 26.5%, and decreased value added by 43.5% relative to foreign exporters.
11	Arnold and Javorcik 2009	1983–2001	Yes	BPS and non-BPS, aggregated data: price indices and depreciation rates.	Examines the relationship between foreign ownership and plant performance. Considers a number of outcomes that can be influenced by foreign owners: labour productivity, output, employment, wages, skill intensity and TFP.	Foreign ownership leads to significant and wide-ranging changes to plant operations and results in a higher total factor productivity (TFP) and a higher labour productivity. The improvement is about 13.5% for TFP and 63% for labour productivity.
12	Blalock and Gertler 2009	1988-1996	Yes	BPS, aggregated data: price indices.	Explores how firm capabilities affect the diffusion of technology brought with FDI.	Firms with investments in R&D and firms with highly-educated employees adopt more technology from foreign entrants than others. In contrast, firms that are close to the international best-practice frontier benefit less than firms with weak prior technical competency.
13	Narjoko 2009	1993-1996	Yes		Examines the impact of trade and investment reforms that took place in the 1980s and 1990s on plant entry.	Ambiguous results are found. Industries that produce textile and garments, wood products and paper products, for example, recorded some increase in the plant entry rates, while industries that produce machinery and transport equipment experienced lower plant entry rates over time.
14	Suyanto, Salim, and Bloch 2009	1988–2000	Yes	BPS, aggregated data: price indices.	Examines whether FDI spillovers contribute to productivity growth in Indonesian chemical and pharmaceutical firms.	Intra-industry productivity spillovers are present in the Indonesian chemical and pharmaceutical sectors. Competition facilitates spillovers from a foreign presence in the industry. Firms with R&D expenditure receive more productivity spillovers

						than those without R&D expenditure. Technological progress is the major driver of productivity growth.
15	Takii 2009	1990-1995	Yes		Compares the magnitude of productivity and wage spillovers derived from foreign presence to local firms in different locations.	The effects of foreign presence on the level and growth of productivity and wages in locally-owned plants are greater in regions where multinational corporation affiliates tend to have a higher concentration as compared to other regions in the same province.
16	Harrison and Scorse 2010	1990-1996	Yes	Non-BPS, disaggregated and firm-level data: vendors for Nike, Adidas and Reebok; names of enterprises described in newspaper accounts of sweatshops in Indonesia.	Analyses the impact of anti-sweatshop campaigns in Indonesia on wages and employment.	Identification is based on comparing the wage growth of workers in foreign-owned and exporting firms in targeted regions or sectors before and after the initiation of anti-sweatshop campaigns. Results reveal that the campaigns led to large real wage increases for targeted enterprises. The authors fail to find significant effects on employment.
17	Suyanto and Salim 2011	1990-1995	Yes	BPS, aggregated data: price indices.	Analyses FDI spillover effects on the technical efficiency of the Indonesian pharmaceutical sector.	Foreign firms are more efficient than domestic competitors, and the presence of the former increases the inefficiency of the latter. FDI has a negative and significant impact on technical efficiency changes in domestic competitors, but generates positive spillovers to domestic suppliers.
18	Amiti and Davis 2011	1991-2000	Yes	Non-BPS, aggregated data: tariffs.	Analyses how trade liberalisation affects wages. Distinguishes between the impact of final and intermediate input tariff cuts on workers' wages, and considers the global engagement of the firm.	Cuts in output tariffs reduce wages in firms oriented exclusively to the domestic market but raise wages in firms that export a sufficient share of their output. Cuts in input tariffs raise wages in firms that import inputs but have an insignificant effect on wages of workers at firms that do not import.
19	Amiti and Cameron 2012	1991-2000	Yes	BPS and non-BPS, aggregated and disaggregated data: labour force data and tariffs.	Analyses the effect of reducing import tariffs on intermediate inputs and final goods on the skill wage premium (wages of production workers relative to non-production workers) within firms in Indonesia.	While reducing input tariffs reduces the skill wage premium within firms that import intermediate inputs, reducing tariffs on final goods is not found to have significant effects on the skill wage premium within firms.
20	Negara and Adam 2012	1995-2005	Yes		Analyses the effects of FDI spillovers on local firms' productivity.	The presence of FDI has a positive impact on local firms' productivity.
21	Yang and Chen 2012	1998-2000	Yes		Examines the determinants of R&D activity and the interrelations of R&D, productivity and exports.	Exporting activity contributes positively to plants' R&D activity. R&D has a positive impact on both productivity and exports.

22	Hijzen et al. 2013	1997–2005, except 2001	Yes		Studies the effects of foreign ownership on wages and employment. The analysis is performed in a cross-country comparison that includes another developing country (Brazil) and three developed countries.	Foreign-owned firms offer higher average wages than their domestic counterparts do. The foreign-wage premium appears to be particularly important in emerging economies. In addition, foreign-owned firms employ many more workers than domestic firms.
23	Rodríguez-Pose et al. 2013	1990–2005	Yes	BPS and non-BPS, aggregated data: socioeconomic data on regions, value added and investment deflators; depreciation rates; distance between the capitals of regions.	Aims to answer the questions: 1) what makes Indonesian firms export? 2) are the factors behind firm export propensity and intensity inherent to the firm or external?	Both internal and external factors matter. The conditions of a firm's province and those of neighbouring provinces shape firm exports. Agglomeration effects, education, and transport infrastructure endowment play a particularly relevant role in Indonesian firms' export propensity, while export spillovers increase export intensity.
24	Narjoko 2014	1990–96 and 1999–2009	Yes		Examines whether there were differences in the characteristics of entrants to the Indonesian manufacturing sector before and after the 1997–98 Asian financial crisis.	Entrants after the crisis were larger and exported less. In addition, they were less dependent on credit than their predecessors were. Productivity levels were the same before and after the crisis.
25	Rodrigue and Soumonni 2014	1994–1997	Yes	BPS, aggregated data: price indices.	Studies the impact of firm-level actions taken to reduce deforestation in Indonesia on domestic and export performance.	Whereas environmental abatement has no appreciable impact on productivity, it encourages growth in export demand. Specifically, firm-level environmental investment may increase unobserved export demand growth by 1 to 5% among non-exporting firms and 2 to 14% among exporting firms.
26	Kis-Katos and Sparrow 2015	1993–2002	Yes	BPS and non-BPS, aggregated and disaggregated data: household and labour force data; information on the district level labour market structure; IO tables; tariffs.	Measures the effects of trade liberalisation on poverty levels.	Poverty reduced, especially in districts with a greater sector exposure to input tariff liberalisation.
27	Rho and Rodrigue 2015	1990–2000	Yes	BPS, aggregated data: price indices.	Documents the impact of exporting on capital accumulation across heterogeneous firms.	Entering export markets significantly increases investment behaviour during the year of initial entry and for as much as three years after entry. The results imply that the investment rate among new exporters is 37% higher than non-exporters in the

						year of entry and 14–26% higher in the three years after entry.
28	Roy and Yasar 2015	2001-2007	Yes	BPS and non-BPS, aggregated data: price indices and capital price deflators.	Examines the impact of exporting on firms' energy efficiency.	Exporting can be regarded as environmentally beneficial because exporting reduces the use of fuels relative to electricity (fuels are considered a more polluting form of energy).
29	Kasahara, Liang, and Rodrigue 2016	1994-1996 and 2004-2007	Yes	BPS and non-BPS, aggregated and disaggregated data: price indices; labour force data; transportation cost of the region in which the plant is located; tariffs; import heaviness and airshare; IO tables.	Examines whether starting to import contributes to skill upgrading in Indonesian plants.	Importing increases the relative demand for educated workers within each occupation. These authors define a skilled worker as one with high school education for production workers and one with college education for non-production workers.
30	Rho and Rodrigue 2016	1990-1996	Yes	BPS and non-BPS, aggregated data: price deflators; tariffs; industry-level export flows.	Characterises the complementarity between exporting and investment in physical capital, and evaluates the impact of investment on exporting over time.	New exporters invest heavily in new capital as they enter and grow into export markets. Firm-level investment and export decisions evolve endogenously with firm-specific productivity and export demand shocks.
31	Hayakawa, Matsuura, and Takii 2017	2001 and 2010	Yes	BPS and non-BPS, aggregated and disaggregated data: inputs and outputs; tariffs.	Examines how changes in output and input tariffs affect quality upgrading in the apparel industry.	A reduction in output tariffs does not affect product quality upgrading. However, a reduction in input tariffs boosts quality upgrading in general. In particular, this impact is greater for import plants.
32	Aritenang and Chandramidi 2020	2000-2003 and 2008-2014	Yes	Non-BPS, aggregated data: semi-structured interviews with the management of the industrial clusters.	Analyses whether agglomeration economies from the industrial parks in SEZ Batam affect firm productivity.	Inconclusive evidence that SEZ policies stimulate the productivity of firms.
33	Negara and Hutchinson 2020	2004-2015	Yes		Analyses whether Batam's Free Trade Zone (FTZ) status is related to improved levels of output, exports, employment and efficiency.	Positive association between FTZ status and the growth in output per worker, employment and efficiency. Access to imported raw materials has a positive relationship with firm performance. However, FTZ status has no significant association with export growth.

Note: this table is ordered first in chronological order and second in alphabetical order. This list only includes research papers in English, which have been published in refereed journals, and which are relevant to trade and/or investment policy. Column “Additional data” reports whether additional information was used to answer the main research question. If the study uses additional data, I detail whether it is from BPS or from external sources (non-BPS), as well as whether more “aggregated” (e.g. country, industry, region), more “disaggregated” (e.g. individual, household, transaction), or data at the same level of analysis (i.e. firms) are used.