Assessing the Impact of the Jepara Furniture Value Chain Project

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ABSTRACT

This thesis assesses the impact of the Jepara Furniture Value Chain (FVC) project, which was conducted by the Center for International Forestry Research (CIFOR) to address challenges faced by small-scale furniture producers in Jepara, Indonesia. This assessment focuses on the effect of membership in the APKJ, a producer association started as part of the project. The propensity score for association membership was estimated using unchanging firm and owner characteristics, as well as information recalled about firm operations in 2009 (before the association was formed). Propensity score matching was used to compare outcome variables of association members and non-members. Results suggest that membership in the APKJ does not have a significant effect on profit levels. Using differenced current and recalled marketing and production behaviors as outcome variables with propensity score matching indicates that members have improved their bargaining position and marketing behaviors more than non-members since 2009. Additionally, APKJ members are more likely to have obtained certificates of timber legality

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Chapter 1: Introduction

1.1 Problem Statement and Objectives

The wooden furniture industry of Jepara, Indonesia is central to the District's economy. Teak and mahogany carving has been culturally and economically important to the region for hundreds of years. The industry grew between 1997 and 2005, but declined after the financial crisis of 2008 (Loebis and Schmitz, 2005, Achdiawan and Purnomo, 2010, Purnomo et al., 2014).Today, it contributes an estimated 26% to Jepara's GDP (Melati et al., 2013). In 2010, the industry was composed of 11, 357 business units, the vast majority of which were small in scale (Achdiawan and Purnomo, 2010, Melati et al., 2013). The industry as a whole is confronted by increasing scarcity of timber, international pressures for assurance of timber legality, and increased international competition (Loebis and Schmitz, 2005). Small-scale producers are particularly vulnerable to industry pressures. In addition, small-scale producers suffer from limited bargaining power, inadequate access to credit, restricted market access, and insufficient knowledge infusion (Purnomo et al., 2013a).

The Jepara Furniture Value Chain (FVC) project, conducted by the Center for International Forestry Research (CIFOR) from 2008 to 2013, sought to address challenges faced by small-scale furniture producers in Jepara. The objectives of the project were: "(i). to enhance the structure and function of the furniture industry for the benefit of small-scale furniture producers; (ii). To improve marketing by small-scale furniture producers and their industry associations, and (iii). to monitor changes regarding the effects and early acceptance of innovations from objectives 1 and 2 and revise and/or reinforce project strategies accordingly" (Purnomo et al., 2013b).

These objectives were pursued based on the value chain upgrading approach, which harnesses value chain analysis to develop a strategy for market system change (Herr and Muzira,

2009). Value chain analysis methodically evaluates the system that is comprised of the full range of activities that carries a product or service from conception to the final consumer (Herr and Muzira, 2009). By characterizing the relationships, incentives, and capacities of actors within the value chain, the analysis brings about an understanding of systemic constraints. Identification of these constraints allows for policy-makers and project-implementers to facilitate upgrading, which consists of changes in the industry that improve firms' competitiveness by improving the efficiency of their current operations or adopting new production activities (Humphrey and Schmitz, 2002).

Researchers in the Jepara Furniture Value Chain project initiated four such strategies for upgrading in the Jepara Furniture Value Chain, or 'upgrading scenarios,' in Jepara: moving up, collaborating down, green certification, and producer association. The last scenario, formation of the Jepara Small-Scale Furniture Producer Association, or APKJ, facilitated implementation of the three other upgrading scenarios by bringing together stakeholders for collective bargaining power, improved marketing, and human resource development (Purnomo et al., 2013b). Producer association members, of which there are currently 125, were the primary project participants.

Although CIFOR's direct involvement ceased in 2013, the APKJ still exists, and policy developments promoted by the project are in the process of being formalized into law. Project stakeholders desire information about its impact: donors desire objective information on the effects of the project, and project implementers seek feedback in order to guide the formation of future projects. Researchers at CIFOR are hoping to implement a similar project in another furniture cluster, making the results of the impact assessment immediately relevant (personal communication with Herry Purnomo May 29, 2015). Determining the impacts of the APKJ will indicate what impacts can be expected from policy implementation and from future projects.

The overarching objective of this research is to determine the impact of membership in the APKJ. Sub-objectives which will contribute to fulfilling this objective are:

1. Quantify the livelihood impact of the project by comparing firm profits of APKJ members against a counterfactual
2. Determine the extent of the uptake of upgrading behaviors promoted by the four upgrading scenarios of the Jepara FVC project
3. Measure the effect of specific upgrading behaviors on revenues and profits

1.2 Methods and Hypotheses

The purpose of this research is to evaluate the impact of the Jepara FVC project, providing feedback on the value of research investment and guiding the formation of future projects. Impact assessment examines long-term sustainable changes that have been produced by the project (Herr et al. 2006). Unlike other forms of monitoring and evaluation, impact assessment hinges on accurately attributing results to project interventions. This requires comparing outcome measures of project participants to what these measures would have been absent project interventions (Khandker et al., 2010). Since it is impossible to know the outcome at a given period of time for an individual in both the treated and untreated states, a valid counterfactual must be created through thoughtful data collection and statistical analysis. For this study, propensity score matching (PSM) will be used. PSM statistically constructs a valid control group by first determining the probability of treatment for every treated and non-treated individual (Khandker et al., 2010).

Calculation of the propensity score involves regressing pre-intervention or inherent (time-invariant) characteristics of individuals (from both the treated and non-treated groups) on a binary dependent variable representing treatment (in this case, membership in the producer group). Data on outcome variables and matching characteristics were gathered in a 2015 firm

survey with 600 respondents. Both inherent and pre-intervention characteristics will be used to calculate the propensity score. In order to achieve this, the survey questionnaire gathered information on firm operations in 2009. These pre-treatment characteristics will be used as variables to calculate the propensity score. To test hypotheses, APKJ members will be matched with non-members with a similar propensity score. The propensity score will be calculated using characteristics of the firm owner, firm characteristics, and firm operations in 2009. Hypotheses will be tested by comparing levels of outcome variables for member and control units that have been matched based on their propensity score.

Hypothesis 1: APKJ members realize higher profits than non-members with similar attributes

Benefits from any upgrading undertaken by a firm is predicted to be captured by an increase in profit. Therefore, profit is used as the primary outcome of interest. The survey instrument focused on capturing information about costs and revenues in order to estimate firm profit. Further detail about profit estimation is provided in chapter three.

Hypothesis 2: APKJ members have a higher probability than non-members with similar attributes of increasing the sophistication of their marketing methods since 2009.

This hypothesis will be tested by comparing marketing methods in 2009 with marketing methods in 2015. If a firm has increased the sophistication of its marketing activities then it will have added new approaches to the marketing strategy. In particular, using an online marketing platform and meeting buyers through exhibitions represent more sophisticated marketing methods. Current marketing methods will be compared against recalled 2009 marketing methods. This examines the effectiveness of the moving-up scenario.

Hypothesis 3: APKJ members are more likely than non-members with similar attributes to have upgraded their production activities since 2009.

Firms can upgrade their production by creating a higher-value product through finishing furniture, and improving their position in the value chain or by integrating high-returns upstream activities such as marketing and brokering and shifting from being subcontracted to selling directly to buyers. Recall and current data will be used to compare changes in matched units and in total treatment and control groups. This measures the effectiveness of the moving-up scenario and the green certification scenario.

Hypothesis 4: APKJ members are more likely than non-members to have good business management practices.

Good management practices include keeping business records, obtaining SVLK certification and having formally registered firms. This hypothesis will be tested by comparing current levels of these practices of matched APKJ members and control units.

1.3 Overview of thesis

Chapter two of this thesis will provide detailed background information on the Jepara furniture industry, value chain upgrading, and the Jepara Furniture Value Chain Project. Examining the ways in which the Jepara Furniture Value Chain Project attempted to promote value chain upgrading informed selection of outcome variables. The background provided in chapter two provides context for understanding hypotheses and interpreting results. Chapter three transitions to the details of this study. Propensity score matching is explained in further detail in the conceptual framework and empirical methods section. A description of data collection includes information on both sample selection and the survey instrument. Chapter three also describes the covariates included in propensity score estimation as well as the outcome variables used in the analysis. Following this, chapter four provides further detail about implementing the empirical methods, and reports results of testing the hypotheses listed above. Chapter five discusses the findings and implications of this study.

Chapter 2: Background

This chapter provides background information to contextualize the current study. First, an overview of the Jepara Furniture Value Chain Project is provided. Next, details are provided on the Jepara furniture value chain, informed by research conducted as part of the Jepara Furniture Value Chain Project. Following this, the actions that the project took to improve the livelihoods and market position of producers are described.

2.1 The Jepara Furniture Value Chain Project

This study evaluates the impact of the Jepara Furniture Value Chain Project. The project began in August 2008 as a collaboration between the Center for International Forestry Research, the Forestry Research and Development Agency of the Indonesian Ministry of Forestry, and the Faculty of Forestry of Bogor Agricultural University. It built upon an EU-funded project titled "Levelling the Playing Field", which was conducted 2003–2007. Value chain analysis and other research conducted as part of this project informed the Jepara FVC Project, the objectives of which were: "(i). to enhance the structure and function of the furniture industry for the benefit of small-scale furniture producers; (ii). to improve marketing by small-scale furniture producers and their industry associations, and (iii). to monitor changes regarding the effects and early acceptance of innovations from objectives 1 and 2 and revise and/or reinforce project strategies accordingly" (Purnomo et al., 2013).

The project began by conducting value chain analysis (VCA) and participatory action research (PAR) in order to first identify stakeholders and constraints, and then involve stakeholders in an iterative process of addressing constraints. PAR is implemented in a reflection-planning-action-monitoring loop with the aim of harnessing collective thinking. The 'reflection' stage utilized VCA. Value chains are comprised of a network of related firms/producers that perform the full range of activities needed to bring a product or service to

the final consumer (Herr and Muzira, 2009, Trienekens, 2011). VCA provides a framework for evaluating the distribution of benefits, governance, and power relations along the value chain. VCA was used in this project to evaluate the context and identify constraints that could be addressed by the project. Data collection included surveys, interviews, and workshops. With the information collected, researchers were able to describe the paths that wood takes as it moves from unprocessed timber to final product, and characterize relationships between actors along these paths. These findings, which came from research for both the Jepara FVC project and the Levelling the Playing Field Project, provide much of the information for the discussion of Jepara's furniture value chain below.

2.2 The Jepara Furniture Value Chain

The wooden furniture industry of Jepara, Indonesia is comprised of a culturally and economically important value chain. The district of Jepara is located in Central Java, in Indonesia. Its population, which slightly exceeded 1 million in 2008, is spread over 16 administrative sub-districts called Kecamatan (see figure 1) (Melati et al., 2013). The furniture industry is central to the District's economy. Teak and mahogany carving has been culturally and economically important to the region for hundreds of years, though the strength of the industry has fluctuated with economic changes. The industry is estimated to employ 120,000 workers and contribute 26% to Jepara's GDP (Melati et al., 2013, Purnomo et al., 2014). In 2010, there were 11,357 log parks, sawmills, ironmongeries, workshops, showrooms and warehouses in Jepara, down from 16,290 in 2005 (Roda et al., 2007, Melati et al., 2013). One reason for the decline is increased competition from other countries in the international and domestic furniture markets. China mass-produces low-price, high-quality furniture, and Vietnam's furniture industry is growing rapidly. The ASEAN-China free trade agreement of 2012 reduced trade barriers,

allowing furniture from China and Vietnam to flood the Indonesian market (Purnomo et al., 2014).

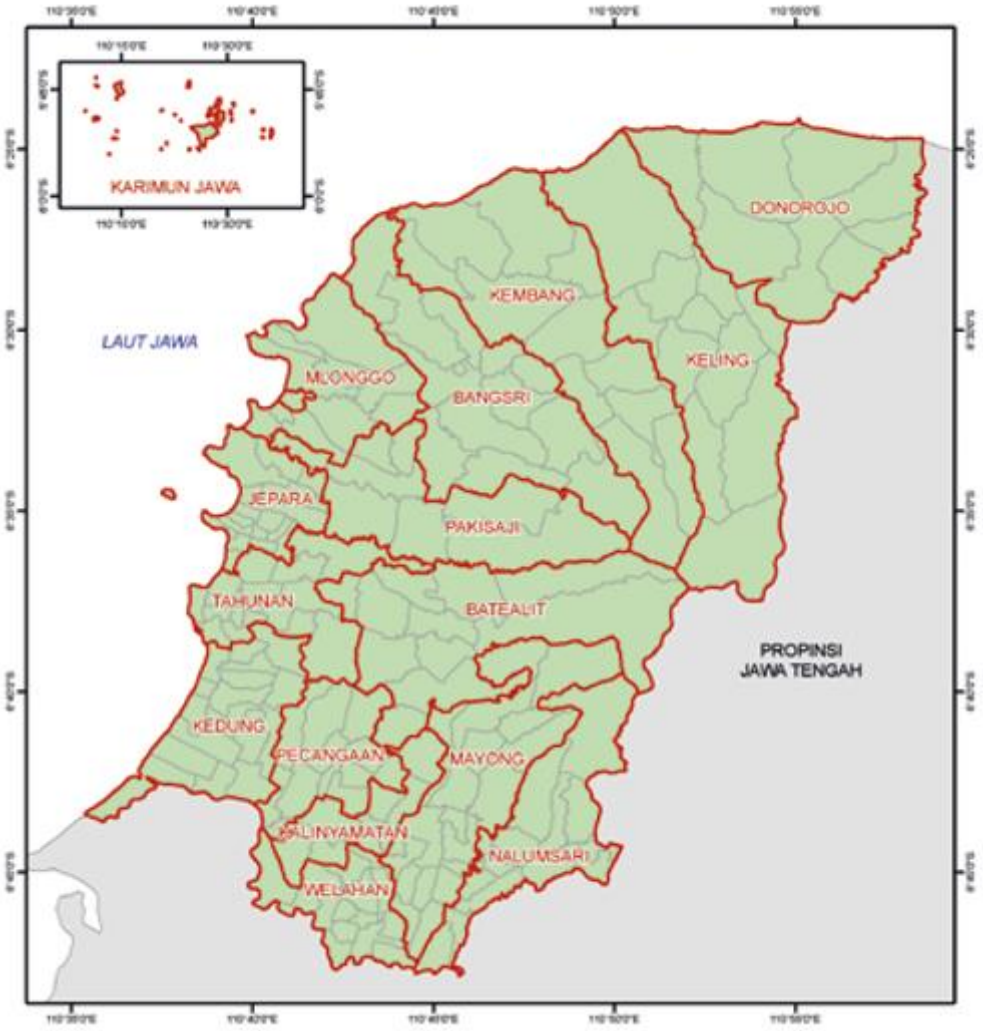

Figure 1: Map of Jepara
Source: Melati et al. (2013)

Figure 2, from Purnomo et al. (2014), depicts the Jepara furniture value chain, characterizing the relationships between agents in the value chain based on four categories of value chain governance: market-based, balanced network, directed network, and hierarchy. Under market-based governance, there are many suppliers and buyers, many transactions occur and there is little information flow. In a balanced network, suppliers sell to various buyers,

market information flows between suppliers and buyers, and there is incentive to negotiate. A directed network is buyer-driven; a single buyer purchases at least 50% of one supplier's output, defines the product, monitors supplier performance and provides technical assistance. Hierarchy involves vertical integration, and allows the suppliers little autonomy (McCormick and Schmitz, 2001).

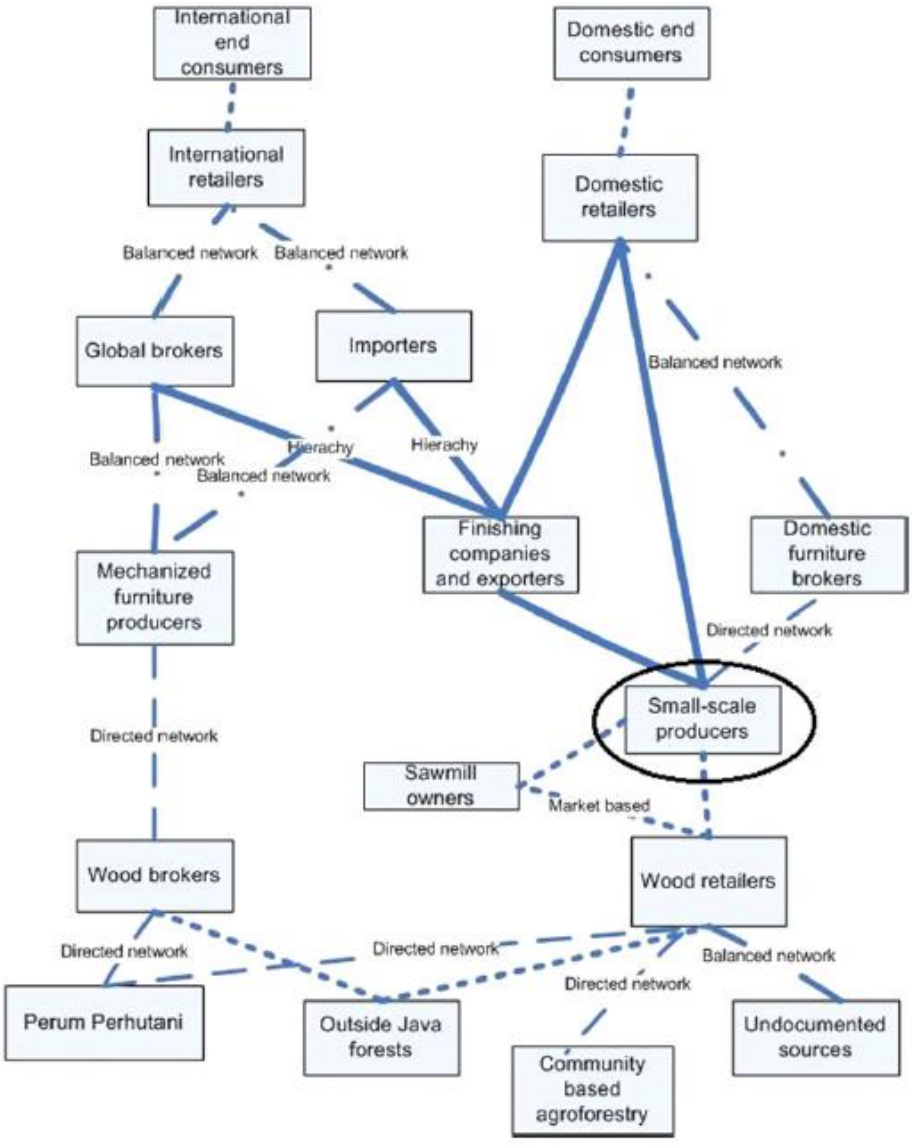

Figure 2: Jepara Furniture Value Chain

Source: Purnomo et al. (2014)

Value chain actors closer to end consumers capture a larger percent of the final product's value. Effendi and Parlinah (2009), as cited in Melati et al. (2013), found that retailers capture 52% of product value in the domestic market, and exporters capture 36% of the value in the international market. Purnomo (2006) evaluated the distribution of benefits among actors across the value chain. His findings support those of Effendi and Parlinah (2009), finding that international retailers take the largest share, 46.7%. The shares taken by downstream production activities are low: teak growers, log traders and sawmills take 5.6%, 0.9% and 0.6% respectively. Furniture producers and finishers receive 3.6% and 3.2%, while exporters, overseas exporters, and international wholesalers receive 11.4%, 6.1% and 21.9% respectively.

Timber is supplied by the state-owned timber supplier, Perum Perhutani, and by community forests in and around Jepara, as well as in other parts of Indonesia. Perum Perhutani can only supply 28-38% of Jepara's demand for timber (Yovi et al., 2009). Community forest plots supply teak and mahogany, as well as other timber varieties such as mindi and sonokoling. However, these often do not practice sustainable methods for maintaining the timber stock, felling trees before they have reached maturity. Meanwhile, timber scarcity and price pressures have facilitated development of a large illegal timber trade. Illegal timber harvesting diminishes Perum Perhutani's timber stocks, leads to forest degradation, and jeopardizes industry sustainability. Despite this, purchasing illegal timber is an appealing alternative for producers, as it can reduce timber procurement costs by 60% (Loebis and Schmitz, 2005, Yovi et al., 2009). Rising prices and limited supplies of timber present constraints to small-scale furniture producers.

To address international concern about the issue of illegal timber harvesting, the Indonesian government introduced the *Sistem Verifikas Legalis Kayu* (SVLK) in 2009 as a

mechanism to certify that timber products are legal. It was created as part of a Voluntary Partnership Agreement with the European Union in accordance with the EU's regulations against the importation of illegally-sourced timber products. Under the SVLK regulation, all exporters of timber products must have SVLK certification, indicating that all timber was obtained in compliance with Indonesian law (Fishman and Obidzinski, 2013). The requirements for legality certificates vary by operation type. Timber from state-owned forests is legal if the harvester is authorized to operate in the area, and harvest laws are followed. The only legality requirement for timber produced on private land is proof of ownership of the land. A clearing operation must have proof of authorization for clearing. Perhaps most complicated is the requirement for timber processors, who must have proof that they are authorized to operate, and be able to trace the source of all the timber used in their production (Fishman and Obidzinski, 2013). For furniture producers, this requires maintaining records of purchased timber, a challenge for small and micro-scale producers without training in record-keeping. Additionally, certification requires the business to be formally registered and pay taxes, which can discourage small-scale producers from obtaining certification.

Timber travels among various value chain agents before reaching the end consumer. Wood traders sell wood to furniture producers, also called workshops, which make up 79% of furniture business units in Jepara. Ninety-six percent of workshops are small in scale, with fewer than 20 workers (Roda et al., 2007). Small firms hold little market power, and are often subcontracted by larger workshops, showrooms, and brokers. In this directed network relationship, the buyer avoids risk as the contractor is responsible for any problems that might occur in producing the quantity and quality set by the buyer.

Irawati et al. (2010) examine three furniture value chain pathways in Jepara. In the first type of chain, producers sell to exporters who also act as finishing companies and warehouses.

The relationship between producers and the exporter fits what Gereffi et al. (2005) describe as a captive value chain, in which suppliers face large switching costs, becoming dependent on buyers, which are often lead firms that tightly control and monitor the production activities of the supplier. Small producers in Jepara in this position are price-takers who must deal with limited working capital when the exporter pays in small deposits or delays payment (Irawati et al., 2010). In such a relationship, the information that flows from the buyer to the producer is narrowly aimed at increasing the buyer's own competitiveness, not the competitiveness of the supplier. This limits the upgrading capacity of suppliers, for whom buyers are a key source of information (Van Geenhuizen et al., 2010).

The second type of value chain described by Irawati et al. (2010) involves market-based relationships between producers and domestic showrooms. While product specifications typically come from the showroom, they do not monitor the producers; their connection is based on market principles. As a result, producers are motivated to manufacture high-quality products. The wood that these producers purchase from wood traders tends to come from Perum Perhutani, the official state supplier of timber, as this is generally the best quality. A challenge for these producers is the rising cost of wood. In the third value chain type producers have a direct, market-based relationship with the end-consumers, allowing them to directly negotiate prices and product specifications. As buyers and producers begin to transact with each other more regularly, their relationship may move to that of a balanced network. In this situation, producers tend to use wood from community-based agroforestry because purchasing wood from Perum Perhutani is too expensive (Irawati et al., 2010).

In order for firms to adapt to the changing industry dynamics in Jepara, firms or groups of firms must improve the efficiency of their current operations or adopt new production

activities. Humphrey and Schmitz (2000) describe these shifts as upgrading, and identify three types of upgrading. Product upgrading refers to innovations in the product itself. In the course of upgrading, product quality, sophistication, and level of value-added increase. Process upgrading occurs through innovations in production processes such as improving efficiency, implementing quality control measures, or adopting standards. Functional upgrading occurs when firms integrate additional activities, including high-return upstream activities such as marketing, or cost-saving downstream activities such as (in the case of a furniture value chain) sawmill operation or timber production. Each type of upgrading develops production efficiency or adds value.

2.3: Project implementation

The Jepara FVC Project utilized value chain analysis and participatory action research to identify strategies to promote upgrading. VCA and PAR identified a need for an industry association to "increase market access, enhance design skills and product quality, and improve access to credit" (Purnomo et al., 2013b). To address the constraints identified, the Jepara FVC project implemented four integrated "upgrading scenarios": moving-up, collaborating down, green certification, and formation of a producer association. The fourth scenario consisted of the formation of the *Asosiasi Pengrajin Kecil Jepara* (APKJ), or small producer's association of Jepara. This was the lynchpin of the project, facilitating implementation of the other three scenarios by bringing together producers to participate in training, improve marketing, form credit cooperatives, and obtain group SVLK certification.

The moving-up scenario promoted functional and product upgrading. The former was stimulated by empowering producers to move into higher stages of the value chain, including finishing, marketing, and trading. These activities provide much higher returns than furniture

production, but require a greater degree of skill. Product upgrading was promoted by training producers in marketing and product quality, and facilitating use of more sophisticated marketing methods. The website www.javamebel.com was created to showcase and sell the products of APKJ members. Its webpage displays high-quality photos of beautiful pieces of furniture and carved decorations. The webpage facilitated transactions totaling around IDR 100 million (USD 7,857.04 at the exchange rate on June 28, 2015) from 2010 to 2013, but the retail aspect of the website has since been disabled (Purnomo et al., 2013b).

Participation in exhibitions was another tangible benefit to membership in the APKJ. During project implementation, participants attended a total of 14 trade shows and exhibitions, one of which was held in China, and another in India (Purnomo et al., 2013b). Successful upgrading will have resulted in workshops that sell high-quality, finished products and engage in sophisticated marketing mechanisms such as online marketing and participation in exhibitions. Differences in change in marketing channels and product sophistication for members was evaluated against a counterfactual, and results are discussed in chapter four.

The collaborating-down scenario, like the moving-up scenario, focuses on functional upgrading. This scenario, however, aimed at improving linkages between furniture producers and lower stages in the value chain. Producers were encouraged to collaborate with wood traders and to grow their own teak. During the project, 1,000 fast-growing teak seedlings were planted on the land of APKJ members (Purnomo et al., 2013b). Project implementers hoped that this would encourage more producers to plant teak, contributing to a future sustainable supply of teak. Upgrading by integration of these lower stages of the value chain will result in lower input costs for furniture producers. However, project implementers realized that the geographic spread of timber suppliers and the complexity of the value chain made this scenario difficult to bring to fruition, and decided to focus on the other three scenarios.

Product upgrading was also an aim of the green certification scenario. This scenario supported producers in obtaining SVLK certification by providing trainings in record-keeping and in the certification process. The APKJ facilitated the formation of groups to obtain group certification, which is free to producers (Purnomo et al., 2013b). Sustainable timber certification can add value to furniture, acting as a form of product differentiation (Ozanne and Vlosky, 1997, Veisten, 2007, Vlosky et al., 1999). It should allow producers to obtain higher prices for outputs while introducing new market opportunities abroad. The proportion of APKJ members with SVLK certification will be compared against a counterfactual.

The association scenario was essential for facilitation of the three other scenarios and promoted all three forms of upgrading. Trainings provided by the association contributed to the human capital of association members, covering topics such as financial management, entrepreneurship, quality control, finishing, and carving and design. The training on the formation of credit cooperatives stimulated the establishment of small credit cooperatives of APKJ members. Similarly, APKJ members formed groups to obtain SVLK certification following training on the certification system. All training sessions developed human capital and transferred knowledge, critical to inducing value chain upgrading (Van Geenhuizen et al., 2010).

The Jepara Furniture Value Chain Project also assisted in development of a Roadmap, or strategic plan to address the challenges of the furniture industry. To develop this Roadmap, four workshops were held with participants who depended on the furniture industry for their livelihood, had knowledge of furniture and business, held political power, or held power in policy-making processes. APKJ members, representing the interests of small-scale furniture makers, identified several actions for the district-level government to take in order to support small-scale producers: allocating a larger proportion of the government budget for small enterprise development; providing low-interest credit for small-scale producers; building

government-funded training centers; facilitating marketing of the products of small-scale producers, and establishing government-funded wood terminals to allow small-scale producers to obtain wood at an affordable price (Purnomo et al., 2016).

Stakeholders contributed to the roadmap, which was organized to include a detailed description of the industry's current state, a projection for the industry for the next ten years, the industry conditions that the stakeholders hope to realize, and programs to achieve the ideal conditions. Programs to achieve the ideal conditions included those identified by APKJ members. The Roadmap was made into district law as a PERDA, which ensured the allocation of an appropriate budget. The PERDA provides a regulatory foundation and government budget for supporting the development of small-scale furniture producers in marketing, production, legality certification and institutional strengthening (Purnomo et al., 2016). The PERDA influenced budget allocations in 2015 and actions are expected to be implemented in 2016. Thus, the impact of the Roadmap cannot yet be examined.

The upgrading scenarios have been fully implemented, and their impacts are evaluated. Each upgrading scenario contributes to reducing producers' costs, increasing revenues, or empowering producers to expand. The presence and magnitude of these effects are measured by the profit levels of APKJ members. Additionally, the uptake of specific upgrading activities is examined. Chapter three describes the methods and data used to assess the effectiveness of the upgrading scenarios, and chapter four provides results of the assessment.

Chapter 3: Methods

This chapter presents the conceptual framework and empirical method, and describes the data used in the analysis. First, propensity score matching theory and corresponding assumptions are explained. Then, the data collection process is described, including details about the sample frame and survey instrument. Following this, the variables used in the model are defined, and the outcome variables of interest are explained.

3.1 Conceptual Framework and Empirical Model

Impact assessment seeks to isolate the effects of a program or policy (the treatment) from other factors that can affect outcome variables of interest. Conceptually, impact assessment compares the outcome variable for a treated unit (Y_1) with the outcome variable for the same unit had it not received treatment (Y_0). The true impact of an intervention is shown in equation 1 (Khandker et al., 2010, Smith and Todd, 2005).

(1) $\Delta = Y_1 - Y_0$

Since Y_0 cannot be known, because no observation is in the state Y_1 and Y_0 at the same time, impact assessment is essentially a problem of missing data (Heckman et al., 1997). In order to estimate the impact of an intervention, one must construct a valid counterfactual. When randomized control trials are not an option, evaluators risk the presence of selection bias, as characteristics that affect outcomes can also influence an individual's decision to participate in the project (Ichino et al., 2008). Propensity score matching (PSM) minimizes observable selection bias by matching treated and non-treated units on their probability of receiving treatment, and reduces dimensionality by allowing matching to occur with only one variable (the propensity score) (Rosenbaum and Rubin, 1983). The probability of treatment, called the propensity score, is shown in equation 2, where T represents the treated state (1 being treated and

0 being untreated), and X is a vector of characteristics which influence participation in the project (Ichino et al., 2008, Rosenbaum and Rubin, 1983).

(2) $\Pr(T=1|X)$

The propensity score is not known, but can be estimated by regressing observable pre-treatment and time-invariant characteristics on a binary dependent variable signifying treatment. In order to use the propensity score, two critical assumptions must be met. The first, conditional independence, is represented in equation 3. Conditional independence means that, conditional on the observables included in vector X, the treatment and the outcome are independent. This is a strong assumption, as X can only contain observable characteristics.

(3) $(Y_1, Y_0) \perp T|X$

This assumption is necessary for defining the average treatment effect (ATE). A slightly weaker assumption that can be relied upon when only seeking the average treatment effect on the treated (ATET) is shown in equation 4. This states that *not* participating in a program is completely explained by observable characteristics (variables contained in X) (Khandker et al., 2010, Ichino et al., 2008, Caliendo and Kopeinig, 2008). ATET focuses explicitly on effects of program participation on the actual participants in order to determine the impact of the program. This study will focus on estimation of the ATET in order to determine the impact of APKJ membership on members, which serves to evaluate the effectiveness of the Jepara FVC Project.

(4) $Y_0 \perp T|X$

The second critical assumption of PSM is the presence of common support: there must be sufficient overlap in the propensity scores of the treatment and control groups to run analysis that compares individuals with similar scores. Without common support, no comparisons between

groups could be made, and PSM could not be used. The common support requirement is shown in equation 5 (Caliendo and Kopeinig, 2008).

(5) $0<P(T=1|X)<1$

When PSM is used to evaluate the impacts of membership in a cooperative or association, the selection of characteristics to include in the vector X borrows heavily from the literature on the adoption of innovations. Models of innovation adoption are based on the economic theory of utility maximization: a decision-maker will adopt an innovation if doing so improves expected utility. Joining a cooperative or association is an example of adopting an institutional innovation. Propensity score estimation is limited to observable characteristics, though there may be unobservable characteristics that influence membership. APKJ membership was entirely voluntary, increasing the risk of selection bias from unobservable characteristics. Information about the APKJ was spread through an online description, radio segments, and word-of-mouth. Some covariates, such as owner characteristics, are included as indicators of internal motivation and openness to new innovations.

Studies that use PSM to evaluate impacts from membership in a cooperative or association follow the same logic as adoption studies when specifying the model to calculate the propensity score. Covariates typically include decision-maker age and education, location, asset ownership, labor utilization, type of operations (if heterogeneous within the sample) and some measure of operation size (Verhofstadt and Maertens, 2014, Wollni and Zeller, 2007, Ruben and Zuniga, 2010, Rodriguez et al., 2007). While most of these studies are evaluating agricultural cooperatives and associations, these categories of covariates also will predict furniture makers' participation in the APKJ. The selection of covariates is discussed further in section 3.3.

A linear probability model is not appropriate to estimate the propensity score. The linear probability model does not restrict the dependent variable to the range of 0 and 1, so that the

model can predict a probability greater than 1 or less than 0. Additionally, the probability of treatment is not linearly related to all independent variables. Rather, a 1 unit change might have a very different effect depending on where it falls in the distribution of the independent variable. (Aldrich and Nelson, 1995, Wooldridge, 2009). The logistic regression model (logit) overcomes these challenges by transforming the model. The log-odds, or logit, of the probability of treatment is calculated by taking the natural logarithm of the odds ratio. The logit of the probability can then be assumed to follow a linear model, which is estimated using maximum likelihood estimation (Rodríguez, 2007).

Various algorithms exist for using the estimated propensity score to match or weight units (Khandker et al., 2010, Ichino et al., 2008). Nearest neighbor matching is used in this study. Nearest neighbor matching compares a treated unit to a set number of control units with similar propensity scores to obtain the treatment effect. Matching will be implemented with replacement, allowing the same control unit to be matched to multiple treated units, will be used. Matching without replacement can cause bias by matching treated units to dissimilar control units, and requires a determination on the order in which treated units will be matched (Dehejia and Wahba, 2002). The treatment effects after matching without replacement, reported in appendix D, do not differ substantially from the treatment effects after matching with replacement. To avoid bias from matching without replacement, the results from matching with replacement are the focus of this study.

Once the propensity score has been estimated, it is necessary to check for common support and balance. Common support means that there are control units with propensity scores similar to treated units to match treated units to controls. The existence of common support is necessary for use of PSM. Oftentimes the lowest propensity score for the untreated units is lower than the lowest propensity score for the treated units, and the highest propensity score of the treated units

exceeds the maximum of the untreated units. Furthermore, there may be ranges within the range of common support where there are not neighbors that are close enough for good matches.

When implementing nearest neighbor matching, gaps in common support can be addressed by specifying a caliper, or maximum distance between the propensity scores of matched units. Austin (2011) advises using a caliper equal to 0.2 times the standard deviation of the logit model used to calculate the propensity score. Specifying a caliper addresses the issues of bad matches at the tails and within the range of common support when implementing nearest neighbor matching. A negative side effect of caliper matching is the reduction in sample size, however, these techniques can improve covariate balance.

In order for PSM to function as desired, the propensity score must balance covariates between treated and control groups, so that after conditioning on the propensity score, the outcome is independent of unit characteristics. This property is shown in equation 6, where X is a set of characteristics, p(X) is the propensity score, and D is the outcome variable. If balance has been achieved, differences in covariate means between treated and control groups should have been eliminated (Henrich, 2001). Standardized bias, t-tests, and variance ratios are useful for evaluating covariate balance after matching. These tests, and their application, are discussed in section 4.2

(6) $D \perp X \mid p(X)$

When using standard errors to interpret the ATET, the fact that the propensity score was estimated rather than known must be taken into account. When the propensity score is used for weighting, the standard errors can be adjusted with the bootstrap method. However, Abadie and Imbens (2008) showed that bootstrapping can over- or underestimate the asymptotic variance of matching estimators. Thus, bootstrapping does not provide asymptotically valid standard errors when the treatment effect is estimated through nearest-neighbor matching (Garrido et al., 2014).

Abadie and Imbens (2009) derived an adjustment to the large sample distribution of propensity score estimators that allows the standard errors of the treatment effect to account for the fact that the propensity score is estimated. Their method is applied automatically in Stata when using the "teffects psmatch" command for propensity score matching. This command was used for estimating treatment effects in this study (StataCorp, 2015, Garrido et al., 2014).

Here, the ATET will be calculated using profit as the outcome variable of interest. Firm profit was estimated using data on revenues and expenses obtained through the survey. Further details about profit estimation is provided in section 3.3.2. Other outcome variables of interest reflect uptake of upgrading activities. Current marketing practices and recalled 2009 information will be used to evaluate differences in changes in marketing and sales channels, brokering status, and finishing for APKJ members and a counterfactual. Current business practices of APKJ members such as keeping records and having SVLK certification will also be compared against a counterfactual. Section 3.2 describes the data for these analyses, and its collection.

3.2 Data Collection and the Survey Instrument

In order to estimate the treatment effect, it was necessary to obtain data from APKJ members and control units. A survey instrument was designed to collect information on outcome variables, including marketing initiatives, business practices, and profit. The largest portion and greatest effort in the survey was expended to obtain sufficient information to estimate profit as accurately as possible. In addition, the survey gathered data on firm and owner characteristics expected to influence participation in the APKJ. In order to be able to use information about a firm's operations as covariates, it was necessary to gather information about the firm's activities in 2009, before the APKJ was formed. The survey instrument, described in detail in section 3.2.1, was largely based on previous surveys that had been conducted as part of the Jepara FVC

chain project. Alterations were made in order to improve the accuracy of profit estimation and streamline the questionnaire.

A separate survey conducted in 2008 collected data on characteristics and operations of 263 furniture firms in Jepara (Prestvik, 2009). Respondents were randomly selected from a less-intensive survey conducted in 2005 that was considered to be representative of the population of furniture workshops in Jepara. The 2008 survey questionnaire contained nine parts: (i.) characteristics of workshop and owner; (ii.) production; (iii.) capital; (iv.) labor; (v.) inputs; (vi.) growth; (vii.) credit and support; (viii.) constraints, and (ix.) marketing. This 2008 questionnaire was the basis for development of the survey instrument used in the current study. The 2008 survey instrument was used again in 2012. APKJ members who were known to have participated in the 2008 survey were re-surveyed in 2012 (five), as well as a random sample of 46 producers surveyed in 2008 who had not become members. Thirty-six other APKJ members were also surveyed in 2012. These respondents consisted of APKJ members who could conveniently complete the interview, for a total of 87 respondents, seven of which had left the furniture industry since 2008.

A separate survey was conducted in 2010 using a census of the furniture industry from the same year as the sampling frame, and the data are considered to be representative of the population (Achdiawan and Purnomo, 2010). Data collected by the 2010 survey provides only basic information about producers, including start year, ownership of showroom, warehouse, sawmill, logpark, ironmongery, or kiln, participation in export and/or local sales channels, and an estimate of wood consumed. Location of respondents was given by GPS coordinates, village, and sub-district.

In the current study, data were collected from 598 furniture makers in Jepara, of which 121 were treated units (APKJ members). The survey collected data to be used as covariates for calculation of the propensity score, and outcome variables such as profit. Several rounds of piloting occurred in order to refine the questionnaire and train the enumerators. The first round of piloting occurred June 24-25, 2015, and provided useful feedback on the questionnaire. Two of the enumerators for this pilot survey returned to work on the survey in August. During July, the questionnaire was tested with furniture makers in Bogor, West Java (where CIFOR is headquartered), to guide further improvements. Eight additional enumerators, all of whom were university students or recent graduates, were recruited from Jepara. All enumerators were informed about the Jepara FVC project, the purpose of this study, and the questionnaire during training sessions. Two and a half days were spent conducting practice interviews, allowing enumerators to improve their interviewing skills. Feedback from these practice rounds prompted clarifications in some questions.

3.2.1 The Survey Instrument

The survey instrument contains ten sections. The first gathered basic information about the firm and owner, such as location, firm name, and firm owner name. While this information is important for organizing survey administration, unique identifiers will be used during data analysis to protect the identity of respondents. Section two collected data on the owner's age, gender, and education level. Section three focused on basic characteristics of the firm, including type of business unit, distance to the center of the administrative district, year started, and size. Sections four obtains information on the firms' product types, source and type of timber, marketing methods, sales channels, buyers, and labor use in 2009. Section five gathered information on current sales channels and marketing methods, which provide outcome variables to measure the uptake of upgrading activities.

Sections six through nine collected data to be used for estimation of the primary outcome variable of interest, profit. In section six, respondents were asked to describe each month of the year as either high, normal, or low season, and to estimate the number of products typically produced in that month. This section also asked respondents to estimate annual revenues for business units owned. Section seven consists of a table for information about furniture production, including furniture type, wood used, contracting out costs, and price received. Respondents were given the option of providing this information based on a year, month, or week, and were asked to specify the corresponding seasonality. Section eight, a table for wood inputs, was structured in a similar manner to section seven.

Section nine asked for information on credit, providing information on the effect of APKJ membership on being a member of a credit cooperative, as well as variables for a comparison of credit access among APKJ members and non-members. However, too few respondents answered these questions for any analysis to be conducted on credit access. Section ten garnered information on ownership of woodworking equipment and vehicles, including type, year acquired, purchase price, and year use was suspended (if applicable). Enumerators were also trained to ask about assets owned in 2009 that are not owned currently. The last section of the questionnaire asked respondents about participation in training sessions held by the Jepara FVC project to understand the degree of involvement.

3.2.2 Sample Selection

The APKJ is an association of small and medium scale furniture producers in Jepara, Indonesia. Of the 125 current association members, 121 were surveyed in 2015. In order to construct a valid counterfactual, a sample of untreated units that are comparable to association members was needed. Therefore, untreated units were selected to reflect the makeup of the APKJ. This facilitates maximization of the area of common support.

Four-hundred seventy five respondents were selected as control units. Of these, 191 were selected from the previously discussed 2008 survey (Prestvik, 2009) and 284 were selected from the previously-discussed less-intensive survey conducted in 2010 (Achdiawan and Purnomo, 2010). All small-scale producers interviewed in 2008 who were still in business in 2012 (if interviewed in 2012) were selected to be part of the control group in order to have a point of comparison.

Selection of respondents for the current survey from the 2010 sample frame was based on an attempt to maximize the area of common support using known characteristics of APKJ members. All APKJ members were small in scale when they joined the organization, but 2-3 producers (around 2% of members) are now medium in scale (personal communication with Ramadhani Achdiawan). A similar proportion of respondents in 2010 were medium-scale (around 2%). The sample was selected so that 2% of control respondents are medium-scale. APKJ administrative data from 2011 provided information on the categories of production activities that APKJ members are engaged in, such as outdoor furniture, indoor furniture, relief, or handicraft. Based on the administrative data, a much larger proportion of APKJ members produced outdoor furniture, relief, and handicrafts than non-member respondents in the 2010 and 2008 surveys. Sampling was adjusted accordingly in order for the percentage of each type of production in the control group to reflect the percentages in the APKJ. Sample selection is summarized in table 1. In the table, “outdoor” indicates that the firm produced outdoor furniture such as patio chairs, “indoor” denotes indoor furniture such as dining room sets, “relief” consists of flat panel of wood with a figure or object carved into it, and “handicraft” refers to production of other non-furniture carved wooden objects such as decorative items.

Table 1: Selection of Respondents Based on Wood Products and Firm Scale

Firm Scale	Type of Wood Products Produced	2010 Survey Respondents Selected for 2015 Survey	2008 Survey Respondents Selected for 2015 Survey	APKJ Members (Administrative Data)	
Small	Outdoor Furniture	98	27	31	**156**
Scale	Indoor Furniture	135	177	80	**392**
1-19 Workers	Relief	20	0	6	**26**
	Handicraft	7	0	8	**15**
Medium	Outdoor Furniture	4	0	0	**4**
Scale	Indoor Furniture	6	0	0	**6**
20-50 Workers	Relief	1	0	0	**1**
	Totals	**271**	**204**	**125**	**600**

The 2008 survey data contained addresses, while the 2010 survey data contained GPS coordinates. Enumerators put the coordinates in their smart phones or borrowed tablets in order to locate respondents from the 2010 survey. Once in the vicinity of a respondent, the enumerator would look for the name of the workshop or ask neighbors about the location of an individual with the name listed in the survey data. Frequently, enumerators were unable to find a respondent, often because the respondent had moved or died, or the GPS data from the 2010 survey was inaccurate. Rather than waste the time that had been spent looking for this respondent and waiting to get a replacement respondent, enumerators were given permission to replace respondents with another furniture producer in the vicinity. Questionnaires with replacement respondents were marked. If a specific reason for the replacement (for example, the owner died) was known, this was noted, and this information was entered with the other data. In some cases another potential respondent was not available, and a replacement was generated using Stata. These replacements were generated to be in one of the districts (Kecamatan) that had originally been assigned to that enumerator.

3.3 Data

3.3.1 Comparing recall responses with data from previous survey

The propensity score must be calculated using factors that would not have been influenced by participation in the APKJ. The APKJ was formed in December 2009. Therefore, respondents were asked to recall specifics about operations in 2009. To check the accuracy of respondent's recall, 2015 answers about the year 2009 were compared to responses from a similar survey conducted in 2008. One hundred and twenty-eight observations were interviewed in both the 2008 and 2015 surveys. However, only 8 of these were APKJ members, preventing panel data analysis. While comparing recall responses about 2009 to actual responses from 2008 provides some insight into the accuracy of recall, there is also the possibility that firms changed between 2008 and 2009, meaning that some variation in responses is due to actual change rather than poor memory.

Comparing this data shows mixed evidence for consistency between 2008 survey answers and recall answers for 2009. For responses about varieties of wood used by the firm, 82% of responses for each category were consistent between the 2008 data and the 2015 recall of conditions in 2009. Fifty-three percent, 63% and 98% of responses regarding doing nothing for marketing, marketing to warehouses, and marketing over the internet were consistent. Sixty-two percent of responses consistently reported produced chairs, 83% consistently reported producing tables, and 98% consistently reported producing ornamental decorations. Sixty-five percent consistently reported finishing products. To compare number of workers, the average number of workers in 2008 was subtracted from the average number of workers reported to be employed by the same firms in 2009 (based on recall from the 2015 survey). The mean of the absolute value of the deviations is 6.2. The absolute value of the deviations is greater than 2.5 for 63 cases, and greater than the absolute value of 10 for 16 cases. While these differences are not negligible,

some of the difference is likely attributable to differences between activities in 2008 and 2009. Overall, this comparison suggests that, while 2009 recall responses may not be entirely accurate, they are a reasonable approximation of activities in 2009, allowing for this information to serve as pre-treatment characteristics.

3.3.1 Covariates

The propensity score is estimated using a logit model. The covariates in vector X are described in table 2. The covariates are further discussed below. A brief justification for their inclusion in the propensity score estimation is also presented. Covariates that measure specifics about firm operations, such as sales channel or wood used, are 2009 recall values. Other covariates which are not expected to change over time, such as owner's level of education and the sub-district in which the firm is located, use current values. The covariates are categorized by woodworking equipment index, firm scale, wood used, sales channels, furniture types, sub-district, production processes, and owner characteristics.

Table 2: Descriptions of covariates in propensity score calculation

	Covariate Name	**Covariate Description**	**Mean** *Standard Deviation* **APKJ Members**	**Mean** *Standard Deviation* **Non-Members**	**Difference in Means**
wood use in 2009	_09_teak_pct	Percent of wood purchased in 2009 that was teak	61 *46*	76 *41*	-14.4
	_09_mahoni_pct	Percent of wood purchased in 2009 that was mahogany	25 *40*	18 *35*	7.2
	teak_tpk	teak was purchased from the state-owned timber supplier	0.43 *0.50*	0.44 *0.50*	-0.01
	mahoni_tpk	mahogany was purchased from the state-owned timber supplier	0.15 0.36	0.09 0.29	0.06
sub	batealit		0.14	0.11	0.04

	Covariate Name	Covariate Description	Mean *Standard Deviation* APKJ Members	 Non-Members	Difference in Means
		Equals 1 if the workshop was in that Kecamatan (city district)	*0.35*	*0.31*	
	jepara	Equals 1 if the workshop was in that Kecamatan (city district)	0.17 *0.37*	0.06 *0.24*	0.11***
	kedung	Equals 1 if the workshop was in that Kecamatan (city district)	0.10 *0.30*	0.08 *0.27*	0.02
	mlonggo	Equals 1 if the workshop was in that Kecamatan (city district)	0.18 *0.39*	0.14 *0.35*	0.04
	pakisaji	Equals 1 if the workshop was in that Kecamatan (city district)	0.14 *0.35*	0.10 *0.30*	0.04
	tahunan	Equals 1 if the workshop was in that Kecamatan (city district)	0.21 *0.41*	0.38 *0.49*	-0.16
Sales Channels	_09_cbn_otsh	Equals 1 if the firm sells furniture to/through a showroom with a different owner	0.45 *0.50*	0.42 *0.49*	0.03
	_09_cbn_dir	Equals 1 if the firm sells furniture directly to buyers	0.39 *0.49*	0.40 *0.49*	0.00
	_09_cbn_online	Equals 1 if the firm sells furniture online	0.05 *0.21*	0.01 *0.09*	0.04***
	_09_cbn_brok	Equals 1 if the firm sells furniture through a broker or trader	0.29 *0.45*	0.34 *0.47*	-0.05
	_09_cbn_exh		0.10	0.01	0.09***

	Covariate Name	Covariate Description	Mean *Standard Deviation* APKJ Members	 Non-Members	Difference in Means
		Equals 1 if the firm sells furniture through exhibitions	*0.30*	*0.09*	
	_09_cbn_exp	Equals 1 if the firm sells furniture to exporters	0.61 *0.49*	0.49 *0.50*	0.12**
	_09_cbn_sub	Equals 1 if the firm is subcontracted	0.39 *0.49*	0.33 *0.47*	0.06
Firm Scale	_09_worker_avg	Average workers in 2009	29 *22*	23 *26*	6.31***
	_09_totalm2 _workshop_sum	Total area of workshop(s) owned by firm	198 *237*	154 *231*	43.65
	_09_total _workshop	Showrooms owned by firm in 2009	0.99 *0.25*	1.00 *0.15*	-0.01
	_09_total_showroom	Workshops owned by firm in 2010	0.10 *0.30*	0.09 *0.28*	0.01
	_09_otherunits	Logparks, sawmills, hardware stores, warehouses, and large drying kilns owned by firm	0.19 *0.48*	0.05 *0.25*	0.14***
Owner Characteristics	(omitted)	Highest level of education achieved by firm owner: less than primary education	0.01 *0.11*	0.10 *0.30*	-0.09
	edu_sd	Highest level of education achieved by firm owner: Primary	0.18 *0.39*	0.44 *0.50*	-0.27***
	edu_smp	Highest level of education achieved by firm owner: SMP (junior secondary)	0.27 *0.45*	0.21 *0.41*	0.06
	edu_stmsmk	Highest level of education achieved by firm owner: STM/SMK	0.02	0.03	0.00

	Covariate Name	Covariate Description	Mean *Standard Deviation* APKJ Members	 Non-Members	Difference in Means
		(Upper secondary; technical track)	*0.15*	*0.16*	
	edu_sma	Highest level of education achieved by firm owner: SMA (Upper secondary; academic track)	0.29 *0.45*	0.21 *0.41*	0.08
	edu_high	Highest level of education achieved by firm owner: tertiary education (S1, S2, S3)	0.23 *0.42*	0.01 *0.10*	0.22***
	owner_age	Current age of firm owner in years	45 *9*	48 *9*	-2.31**
	_09_oth_org_total	Number of other organizations of which the owner is a member	0.05 *0.21*	0.01 *0.07*	0.04
Furniture types	im_ornamen _dekorasi	Equals 1 if the firm produces decorative ornaments	0.04 *0.20*	0.02 *0.12*	0.03*
	im_kerajinan_kaligrafi	Equals 1 if the firm produces carved calligraphy	0.14 *0.35*	0.01 *0.10*	0.13***
	im_sketsel	Equals 1 if the firm produces room dividers	0.08 *0.27*	0.03 *0.18*	0.04**
	im_relief	Equals 1 if the firm produces relief	0.05 *0.22*	0.01 *0.11*	0.04**
	im_parts_ komponen_mebel	Equals 1 if the firm produces furniture components	0.04 *0.20*	0.02 *0.12*	0.03**
	mebel_basic	Equals 1 if the firm produces basic furniture types: chairs and tables, beds, etc.	0.96 *0.20*	0.97 *0.17*	-0.01
Operations	finishing_1	The firm finished some or all furniture in 2009	0.29 *0.45*	0.17 *0.38*	0.11**
	contract_out_1	The firm contracted out some or all construction/assembly in 2009	0.06 *0.24*	0.07 *0.26*	-0.01

	Covariate Name	Covariate Description	Mean *Standard Deviation*		Difference in Means
			APKJ Members	**Non-Members**	
	_09_brokering	The firm engaged in brokering in 2009	0.02 *0.15*	0.01 *0.09*	0.02
	machinescore	First component from participatory componenet analysis of machines owned	-0.22 *2.01*	0.00 *1.66*	-0.21
Difference calculated as APKJ member mean minus Non-member mean Significance levels for two-sample t-test of means, null hypothesis: difference=0 * p<10% **p< 5% ***p<1%					

Source: 2015 Firm Survey

Woodworking Equipment Index

A woodworking equipment index (*machinescore*) was included as an indicator of firm size and sophistication. A larger firm is expected to have more equipment, and a more sophisticated firm is expected to have more sophisticated tools. An equipment asset index captures information about firm scale and sophistication, which are related to upgrading, and are expected to affect furniture producers' decision to participate in the APKJ. Principal Component Analysis (PCA) was used to create a woodworking equipment index. PCA creates factor weights for a set of covariates that are correlated across multiple dimensions (Fry et al., 2014). From the set of correlated variables, uncorrelated linear weighted combinations of variables (components) are created. The eigenvectors of the correlation matrix provide the factor weights for these principal components, and their variance is given by the eigenvalue of the corresponding eigenvector. The first principal component, which is used to create an index, explains the maximal overall variance, thereby maximizing discrimination between observations (Vyas and Kumaranayake, 2006, McKenzie, 2003). Factors weights are more positive for assets that indicate wealth in capital assets, and less positive (smaller positive numbers or negative numbers) if the asset indicates lack of wealth in capital assets. The factor weights for each piece

of woodworking equipment owned by a firm is summed to create woodworking equipment index (*machinescore*), which is inserted directly into the model.

Twelve woodworking equipment variables were included in the PCA. Each is a count of the number of pieces of equipment in a category. The categories are whipsaw, circle saw, chainsaw, router, hand drill, planer, grinder, sander, spindle, jointer, a category that includes drill presses and band saws, and another category for other woodworking equipment listed too few times to be included as separate variables. Drill presses and band saws were grouped together because of a lack of clarity in distinguishing between these two machines during survey administration, as the names of these items are similar in Bahasa Indonesia. Furthermore, the questionnaire contained an option for machine kit which included a few pieces of equipment. When this option was selected, it was assumed that all items for this machine kit were owned, but a distinction between drill press and band saw cannot be made. While these two pieces of equipment serve different functions, they both enable precise work, and are similar in size and price range. Since this is an integer rather than a binary variable, a firm that owns both a drill press and a band saw will score higher on the machine index than a firm that owns only a drill press, if all else is equal. Table 3 includes the descriptive statistics and factor weights for the variables used to construct the machine index.

Table 3: Variables used in creation of woodworking equipment index

Variable Description	Mean	Std. Dev.	Min	Max	Number of cases where x>=1	Factor Weight
Whipsaw	1.03	0.80	0	4	422	0.23
Circlesaw	0.29	0.47	0	3	163	0.37
Chainsaw	0.77	0.53	0	4	414	0.24
Router	0.01	0.12	0	1	8	-0.03
Hand drill	0.53	0.57	0	3	284	0.38
Planer	0.90	0.71	0	4	403	0.40
Grinder	0.72	0.69	0	3	331	0.31
Sander	0.61	0.56	0	4	332	0.41
Spindle	0.58	0.56	0	3	315	0.39
Jointer	0.05	0.23	0	2	29	0.15
Drill press and band saw	0.10	0.33	0	2	54	-0.06
Other	0.05	0.23	0	2	29	-0.07

Source: 2015 Firm Survey

Firm Scale

Several covariates provide information on the scale of the firm's operations. An average of the number of workers in the high, low and normal seasons during 2009 (recall data) was used as a measure of firm scale. Twenty-six cases (8 members and 18 non-members) were missing data on workers in 2009 due to enumerator error. In order to keep these cases in the analysis, the number of workers in 2009 was regressed on the number of workers in 2015, and the predicted values were used in place of missing 2009 information.

Total workshop area measured in meters *(_09_totalm2_workshop_sum*) also provided a measure of firm scale. When two workshops were owned by the same firm, their area was summed. Six cases (three members and three non-members) had missing data for workshop area.

For these cases, the predicted values from a linear regression of workshop area on total number of workers in 2009 were used. Workshop area was left as zero if the firm did not own any workshops in 2009. The number of total workshops owned in 2009 was also included as a variable, *_09_total_workshop*, as was the total number of showrooms owned in 2009, *_09_total_showroom*. Other business units related to the furniture industry were owned by some firms, including showrooms, sawmills, kilns, and hardware stores. The variable *_09_otherunits* measured the total number of furniture business units other than workshops and showrooms. Business unit ownership is shown in table 4.

Table 4: Business unit ownership of APKJ members and control respondents before matching

Unit type	**Percent owning at least 1 of unit type in 2009**	
	APKJ Members	**APKJ Non-Members**
Workshop	93%	97%
Showroom	7%	9%
Sawmill	1%	0%
Large (Room-Sized) Oven	12%	4%
Logpark	0%	1%
Warehouse	2%	1%
Ironmongery (Hardware Shop)	1%	0%

Source: 2015 Jepara Firm Survey

Wood Used

Types of wood used for furniture production in 2009 recalled by the survey respondents included teak, mahogany, mango, coconut, jackfruit, trembesi, sonokeling, and others. Teak and mahogany were used most extensively. The percent of total wood used by the firm composed of teak and mahogany (respectively) were used as variables in the model. Binary variables indicate

whether the teak/mahogany was sourced from Perum Perhutani, the offical state supplier of timber (*teak_tpk/mahoni_tpk*).

Sales Channels

Three modules of the questionnaire used in 2015 gathered information about the way that products were sold. These sections were: sales channels, buyers, and marketing. Information from these three modules was combined to generate variables used in the model, as an approximation of the sophistication of the firm's sales strategy and buyers. Firms may have sold products to other showrooms (*_09_cbn_otsh*); online, whether through their own website, a group website, or through social media (*_09_cbn_online*); through a broker or trader (*_09_cbn_brok*), to another workshop as part of a subcontracting arrangement (*_09_cbn_sub*); to an exporter (*_09_cbn_exp*); directly to foreign and domestic buyers (*_09_cbn_dir*); or through exhibitions (*_09_cbn_exh*). If a firm owns its own showroom, it is expected that products are also sold through this channel. This effect is captured by including the variable *_09_total_showroom*, which measures the number of showrooms owned by the firm. Since a firm can sell through multiple channels, these variables are not mutually exclusive and do not sum to one.

Furniture Types

Binary variables indicate what broad categories of furniture were produced by the respondents in 2009. In order to not over-specify the model, basic furniture types were placed in one general category (*mebel_basic*) that included vanity tables, beds, cabinets/wardrobes, chairs and tables (both indoor and outdoor) and the catchall "other furniture types". Separate, specific binary variables were included for the production of wooden ornaments (*im_ornamen_dekorasi*), calligraphy pieces (*im_kerajinan_kaligrafi*), room dividers (*im_sketsel*), and relief (*im_relief*), the production of which suggest some level of specialization. A separate variable

(*im_parts_komponen_mebel*) was included for production of furniture components (such as chair and table legs); this production suggests a lower level of upgrading than a firm that produces whole furniture pieces. As noted in table 2, more APKJ members than sampled non-members produced furniture pieces. When data on furniture produced in 2009 was missing, it was assumed that furniture production in 2009 was the same as production in 2015. Four percent of sampled non-members who were operating in 2015 were missing data for furniture types in 2009, and 3% of APKJ members who were operating in 2015 were missing data for furniture types in 2009.

Sub-District (Kecamatan)

Kecamatan are the sub-district level of administration in Indonesia (Guggenheim et al. 2004). In the Kabupaten (district) of Jepara, where this survey was conducted, there are 15 Kecamatan. Binary variables were included in the model for all Kecamatan that contained at least 5% of the sampling frame. Thus, the base group are cases located in Kecamatan with low density of furniture businesses. Table 5 displays the percent of the sampling frame, treated units, and non-treated units located in each Kecamatan. Those Kecamatan that were included as variables in the model are highlighted in grey.

Table 5: Sub-district representation in current and past surveys

	Total Sample		**APKJ Members**		**Control Units**		**2010 frame**	
Name of Kecamatan	**Count**	**Percent**	**Count**	**Percent**	**Count**	**Percent**	**Count**	**Percent**
Batealit	65	11%	14	12%	51	11%	186	14%
Jepara	45	8%	22	18%	23	5%	69	5%
Kedung	52	9%	10	8%	42	9%	166	13%
Mlonggo	101	18%	23	19%	78	17%	78	6%
Pakis Aji	60	11%	16	13%	44	10%	103	8%
Tahunan	195	34%	25	21%	170	38%	557	42%
Bangsri	1	0%	0	0%	1	0%	48	4%
Donorojo	4	1%	0	0%	4	1%	4	0%
Kalinyamatan	3	1%	1	1%	2	0%	7	1%
Keling	2	0%	0	0%	2	0%	1	0%
Kembang	10	2%	0	0%	10	2%	15	1%
Mayong	4	1%	0	0%	4	1%	14	1%
Nalumsari	0	0%	0	0%	0	0%	5	0%
Pecangaan	27	5%	8	7%	19	4%	57	4%
Welahan	2	0%	0	0%	2	0%	8	1%
Totals:	**571**	**100%**	**119**	**100%**	**452**	**100%**	**1318**	**100%**

Source: 2015 Firm Survey

Production Processes

Variables about production processes capture information about the firm's level of upgrading and its position of power within the value chain. Finishing furniture is a high value-added activity. Respondents were asked to estimate the percent of production that was finished in house, the percent that was contracted out to be finished, and the percent that was sold unfinished. If a firm is contracting out work to another firm, it holds a position of relative power over the firm that it has contracted to do the work. The final model included a binary variable, which is equal to 1 if the firm sold finished pieces in 2009 (*finishing_1*). Including information on finishing in this form was found to be best for balancing covariates. Another binary variable was included which is equal to one when some percent of the construction and assembly was contracted out to other workshops (*contract_out_1*). The questionnaire did not ask directly if firms acted as brokers in 2009. However, it was presumed that a firm engaged in brokering in

2009 if it engaged in brokering in 2015, and reported contracting out in 2009, and the variable *_09_brokering* was generated and used in estimating the propensity score.

Owner Characteristics

Since individual characteristics of the owner can influence the decision to participate in an association, the owner's age and education were also included as variables. When the owner's age in years was missing and the wife or child had responded, the owner's age was estimated using the sample median difference in age between husbands and wives or between a child and a father (the median is equal to the rounded mean). The owner's education was included as a categorical variable. The questionnaire asked the respondents about their highest level of education achieved. Degrees which require the same number of years of education were grouped together. The categories are (i.) less than primary; (ii.) primary; (iii) SMP (middle school level); (iv.) STM/SMK high school (technical track); (v.) SMA high school (academic track); (vi.) tertiary education. A variable, *_09_other_org_total*, is a count of the other organizations of which the owner is a member.

3.3.2 Outcome Variables

Testing each hypothesis requires different outcome variables. The first hypothesis, APKJ members realize higher profits than non-members with similar attributes, required estimation of firm profit based on information on costs and revenues collected during interviews. Respondents could choose to record costs and revenues for a week, a month, or a year. Costs and revenues were summed according to the time frame, and then scaled to year level to approximate firm profit for the year as a whole. Costs that were accounted for in profit estimation are: wood inputs, labor expenses, contracting-out costs, and other inputs and expenses such as transportation, fuel, electricity, and oil/wax finishes.

Depreciation costs for woodworking equipment owned were not included in profit calculation. Many observations are missing data on year acquired and/or price of purchase. Furthermore, woodworking equipment used by small-scale producers is often makeshift in nature, defying standard depreciation schedules. A woodworking equipment index similar to the one described above, but using equipment owned in 2015 has a correlation coefficient with firm profit of 0.076. While the correlation is significant at the 10% level, it is low enough that any bias from excluding equipment depreciation costs can be expected to be minimal.

Revenues and expenses were scaled up from monthly/weekly to yearly using the seasonality table in section six of the survey instrument, shown here in table 6. This table categorizes each month of the year as part of low, normal, or high season, and includes an estimate of production quantity for each month. These estimates were used to calculate average monthly production during normal, high, and low seasons. The average for the seasonal level that corresponds to that of the production and revenues table was then divided into the estimated production quantity for each month. This created multipliers that could convert recorded costs and revenues to costs and revenues for each month of the year according to seasonal variations. The sample average for the appropriate multiplier (low to high, normal to low, etc.) was imputed for cases that had seasonality information but were missing production averages (six cases). Production was assumed to be constant for cases that lacked seasonality information and monthly production estimates (five cases). Seasonality information that was specific to labor was used to scale up labor costs. Respondents were asked the number of workers in low, normal and high season, and multipliers were created from this information in a similar manner to what is described above.

Table 6: Seasonality table from 2015 firm survey questionnaire

Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul	
Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products
Season code: 1=Low season 2=Normal season 3=High Season												Unit code: 1= pieces 2 = set 3 = container, 20ft 4= container, 40ft 5= container, 40HC											

Source: 2015 Firm Questionnaire

This manner of accounting for firm profits is subject to limitations. The time frame of inputs and outputs may not have always lined up properly, seasonality adjustments were estimated, and there are variations in production and prices that were not captured by the survey instrument. However, the information provided by the survey instrument delivers a rough approximation of firm's profits that can be used to assess the effect of APKJ membership on profit levels. Prior to analysis, observations with very high or very low levels of profit were re-examined. Fifteen observations were dropped because their profit estimations were unrealistically high or low, or they were missing critical data. For some cases, the amount of wood purchased did not appear to correspond with the amount of production in the given time period. This is not surprising, as a firm may have purchased wood inputs that will be used for production for more than one month, or had wood purchases left over from the previous month. For two cases, the questionnaires specified that this was the case. In 25 other cases, examination of wood input/furniture output ratios, along with consideration of the size of the piece that the suggested by the price, indicated that wood inputs did not line up with furniture production for

that time period. For these twenty-seven observations, alternate wood quantities were used for cost calculations based on an estimation of wood input per type of furniture output. Profit was also calculated without the imputed levels of wood to compare. Treatment effects are also estimated with the original wood costs to ascertain the impact of using alternate wood quantity estimations.

The second hypothesis, that APKJ members have a higher probability than non-members with similar attributes of increasing the sophistication of their marketing methods since 2009, is evaluated by examining whether firms have picked up or dropped certain marketing and sales channels between 2009 and 2015. These categories of marketing/sales channels were discussed in section 3.3.1 as the 2009 values of these binary variables were used in calculating the propensity score. Here, categorical variables comparing marketing and sales channel in 2015 and 2009 was used. These variables take on four values: 1 if the firm used the marketing method in 2009 and did not in 2015; 2 if the firm did not use the marketing method in either year, 3 if the firm used the marketing method both years, and 4 if the firm used the marketing method in 2015 and not in 2009. Binary variables were also created to focus on adding or abandoning marketing behaviors.

The third hypothesis, that APKJ members are more likely than non-members to have upgraded their production activities since 2009, evaluates the difference in brokering and finishing in 2009 and 2015. The variable indicating that the firm engaged in brokering in 2009, discussed in the previous section, was compared with a variable indicating that the firm engaged in brokering in 2015. Variables indicating whether the firm sold finished furniture in 2009 and 2015 were compared. Since it was not always clear whether the firm finished products in-house or contracted out the finishing before selling the products, this outcome variable simply

compares whether furniture was finished upon leaving the firm, not whether the firm finishes furniture. For brokering and finishing, categorical variables with categories analogous to those described for marketing were generated. Binary versions of these variables were also created for the analysis.

The fourth hypothesis, that APKJ members are more likely than non-members with similar attributes to have good business management practices, was evaluated by comparing 2015 levels of good business practices by APKJ members and non-members. The practices evaluated are record-keeping (*records*), having a registered business (*registered*) and being SVLK certified (*svlk*).

This chapter described how propensity score matching is used to evaluate the outcome variables of interest, explained the data collection process, and described the variables used in the analysis. The next chapter discusses application of these methods, and results.

Chapter 4: Analysis and Results

This chapter discusses implementation of the methods described in chapter three, and the results obtained from application these methods. First, details of the empirical method are discussed, including the commands used, decisions about caliper matching, and use of propensity score matching with ordinal and categorical outcome variables. Next, the propensity score will be evaluated based on common support and covariate balance criteria. Then, results from propensity score matching are used to address each of the hypotheses listed in chapter one. For the first hypothesis, profit differences between treated and control firms are evaluated as the outcome variable. The second, third, and fourth hypotheses evaluate differences in sales channels, marketing methods and production processes, as well as current business practices. Following this, the effect of APKJ membership on businesses staying open, and the influence of different factors on revenues and profit will be examined. Implications of the results reported in this chapter are further addressed in chapter 5.

4.1: Implementing Empirical Methods

Propensity score matching was implemented in Stata® using the command "teffects psmatch" (StataCorp, 2015). This command automatically calculates asymptotically unbiased standard errors following the method put forward by Abadie and Imbens (2006). A disadvantage of "teffects psmatch" is its inflexibility when restricting matches to a caliper. While the program allows for a caliper to be specified, it exits with an error if a match for a unit is not found within the specified caliper. Once the unmatched units are dropped, the user must run the command again, and the propensity score will be re-calculated with the restricted sample. There is a lack of clear guidance about whether the propensity score should be re-estimated after excluding units for whom there are not matches within the caliper (Takeshima et al., 2016). Since the propensity score that is estimated after dropping unmatched units will be different from the original

propensity score, distances between matches may be greater than in the original round. Observations that were matched in the first iteration might not have matches within the caliper in this second iteration. An older, user-written command, "psmatch2," will drop the observations without matches in their caliper from estimation of the treatment effect, and complete PSM (Leuven and Sianesi, 2003b). However, "psmatch2" cannot calculate Abadie-Imbens standard errors for propensity score matching (Leuven and Sianesi, 2003a).

When matching with a caliper, "teffects psmatch" was used with a caliper equal to 0.2 times the standard error of the logit model used to estimate the propensity. When matching to one nearest neighbor with replacement (to calculate ATET) 13 unmatched APKJ members were dropped from the dataset. Running "teffects psmatch" on this reduced dataset re-estimates the propensity score. If a caliper equal to 0.2 standard deviations of the newly estimated propensity score is required, 11 observations will not have matches within the caliper. The same is true if the caliper is restricted to be less than 0.2 times the standard deviation of the original propensity score. This pattern repeated itself for several iterations, resulting in an unjustifiably high loss of treated units from the sample. To avoid this, "teffects psmatch" was implemented without a caliper in the dataset from which the original 13 unmatched units were excluded. Since the propensity score is re-estimated excluding the dropped units, this may lead to matches that are different than in the original model (before dropping the units without matches within the caliper).

In order to conduct detailed analysis with binary and categorical outcome variables, datasets were created based on propensity score matches that allowed for the treated group to be directly compared to the matched sample. The manipulated dataset that is based on the original propensity score estimation consists of 84 APKJ members and the 84 nearest neighbor control

units. The differences in outcome means (proportions) of the binary outcome variables in the manipulated dataset are equal to the treatment effects reported by the propensity score matching commands in Stata.

Within the manipulated datasets, Fisher's exact tests were used to examine whether there is a significant relationship between the categorical outcome levels and APKJ membership. The tabulated data allow for a clear comparison in the proportions of members and non-members who added or abandoned different marketing/sales channels. Then, the binary versions of the outcome variables were used to calculate risk ratios, and as the outcome variable for "teffects psmatch." Risk ratios are the cumulative incidence of the exposed units divided by the cumulative incidence of the unexposed units. While statistical significance tests are not used with risk ratios, if the confidence interval does not contain 1 then the risk ratio is considered significant at the confidence level used by the confidence interval.

4.2: Checking Common Support and Covariate Balance Assumptions

The ATET is only defined within the region of common support. Visually examining the graphed propensity score densities after matching intuitively displays the overlap. Figure 3 displays the propensity score density graphs for the treated and untreated groups when one nearest neighbor (no caliper) is used to calculate the average treatment effect on the treated. These graphs indicate sufficient common support to sustain propensity score matching; the density graphs for treated and untreated units overlap substantially. However, the figure also shows that the highest propensity scores belong to APKJ members exclusively. The region of common support can be examined more precisely by comparing the highest and lowest propensity scores in the treated and untreated groups. The lowest four propensity scores of the untreated units all fall below 0.0001, while the lowest four propensity scores of the treated units fall between 0.019 and 0.034. This disparity does not cause problems; when estimating the

ATET untreated units are matched to each treated unit, but treated units are not matched to each untreated units. The highest four propensity scores of the untreated units are 0.739, 0.759, 0.775 and 0.919, considerably lower than the highest four propensity scores of APKJ members, 0.994, 0.996, 0.997 and 0.997. Furthermore, there may be spans within the range of common support where there are not untreated units with similar propensity scores to treated units, leading to poor matches.

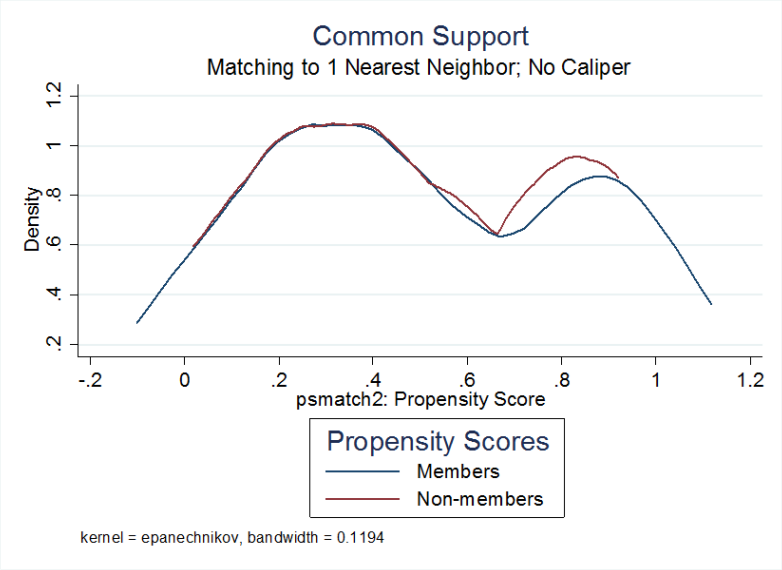

Figure 3: Common support when matching to one nearest neighbor without a caliper
Source: 2015 Firm Survey

Common support and covariate balance were considered when choosing a matching method. Caliper matching to one nearest neighbor was found to be the best option for improving common support and covariate balance. Specifying a caliper requires the propensity scores of matched units to be within a certain range. The caliper was specified as 0.05, or 0.2 times the standard deviation from the logit model which calculated the propensity score. Thirteen treated units did not have matches within the caliper, and were dropped from the estimation of the treatment effect. The observations with the eight highest propensity scores were dropped, as well as five observations with propensity scores between 0.82 and 0.85.

Percent standardized biases, t-tests of covariate means, and variance ratios were used to evaluate balance after matching. T-tests for equality of means is conducted by the command "pstest," used after implementing propensity score matching with the command "psmatch2" (Leuven and Sianesi, 2003b). The t-tests compare the covariate means of the treated and untreated groups in the matched sample. Non-significant differences in covariates means suggest relatively good covariate balance. Percent standardized bias, which standardizes the differences in covariate means of two groups in order to be compared, is calculated using the formula below:

$$(1)\ \mathrm{SB} = \frac{100*(\overline{x_t}-\overline{x_{c)}}}{\sqrt{\frac{s_{t+}^2 s_c^2}{2}}}$$

Where $\overline{x_t}$ ($\overline{x_c}$) and s_t (s_c) are the mean and variance of the treated (control) groups. Low standardized biases reflect good covariate balance. However, there is little formal guidance or consensus on what constitutes an acceptable percent standardized bias. Normand et al. (2001) implies that standardized biases lower than 10% are satisfactory, while Rosenbaum and Rubin (1985) suggest that higher than 20% is concerning. Percent Standardized bias was obtained using the command "teffects summarize" after propensity score matching with "teffects psmatch" Variance ratios, the mean ratios of a covariates' variance in the treated and untreated groups, allow the researcher to evaluate the similarity of the distributions of covariates in for treated and untreated groups after matching (Austin, 2009). The closer that variance ratios are to unity, the more similar the distributions of covariates in treated and untreated groups. Variance ratios were obtained through the "teffects summarize" command.

After matching to one nearest neighbor within a caliper, 20 out of 39 covariates has a standardized bias equal to or higher than 10%, including 7 with standardized biases of 20% or higher. The mean bias is 11.09% and the median bias is 9.74%. Two-sided t-tests found that 4

covariates were significantly different for matched treated and control groups. While some covariates are not well-balanced after matching, this is not surprising given the large number of covariates included.

Covariates are less balanced when matching to one nearest neighbor without a caliper, when 5 covariate means are significantly different[1], the mean bias is 15.44%, the median bias is 12.78%, and 27 covariates have a standardized bias of 10% or higher, 14 of which have standardized biases of 20% or higher. When matching to five nearest neighbors specifying a caliper is not feasible because it results in many treated units (39) being dropped from the treatment effect estimation. Despite this, matching to five nearest neighbors without a caliper produces slightly better balance between covariates than matching to one nearest neighbor within a caliper. After matching to five nearest neighbors, only two covariates are significantly different (at the 10% level), and seventeen covariates having a standardized bias of 10% or greater, seven of which have a standardized bias of 20% or greater. Matching to one nearest neighbor within a caliper is used primarily for the analysis, as it addresses both the concern of covariate balance and of common support. Furthermore, matching to only one nearest neighbor is best for the dataset manipulation performed for the evaluation of the outcome variables assessed for the second, third and fourth hypotheses. A summary table comparing balance tests for three matching methods is provided in Appendix B.

Matching to one nearest neighbor within a caliper is the most reliable method based on covariate balance and common support. Conclusions about the impact of APKJ membership will

[1] After matching to one nearest neighbor without a caliper, 3 covariate means are significantly different at the 10% critical value and 2 covariate means are significantly different at the 5% critical value.

be drawn based on the treatment effects from this matching method. Results from matching to one and five nearest neighbors without a caliper will also be presented as a point of comparison.

4.3: Hypotheses and Results

4.3.1: Hypothesis 1: APKJ members realize higher profits than non-members with similar attributes

Benefits from any upgrading undertaken by a firm are predicted to be reflected as an increase in profit. Since many factors influence profit, estimated profit serves as a comprehensive but imprecise measure of the impact of the APKJ. Furthermore, profit is being estimated based on information obtained through a survey, which may have incomplete data on costs or revenues, or make imprecise assumptions about scaling up to a year.

There is a large range in estimated profit levels in both treated and untreated groups before and after matching: figure 4 displays the kernel density graphs for estimated profit of treated and untreated groups before matching, and figure 5 displays the kernel density graphs for estimated profit of treated and untreated groups after matching. Summary statistics of firm profit for APKJ members and non-members in the raw and matched datasets are provided in table 8. A two-sample t-test of means shows that there is a significant difference in the profit levels of members and non-members before matching on the propensity score. After matching, there is not a significant difference in the profit levels of APKJ members and the counterfactual. The difference for the matched dataset is equal to the treatment effect estimated by propensity score matching. However, the sample standard deviations reported in table 7 do not account for the propensity score having been estimated. Abadie-Imbens standard errors, which do account for estimation of the propensity score, allow for reliable significance tests. Treatment effects from propensity score matching, along with Abadie-Imbens standard errors, are reported in table 8.

Table 7: Descriptive statistics of estimated profit in treatment and control groups

Sample	Treatment Group	Observations	Estimated Profit					
			Smallest	Median	Largest	Mean	*Standard Deviation*	Difference in Means
Raw (Unmatched)	APKJ Members	98	-18,782	15,669	323,700	33,388	*54,438*	15,576**
	Non-Members	385	-19,063	7,404	345,333	17,812	*35,548*	
Matched to 1 Nearest Neighbor (with caliper)	APKJ Members	71	-14,083	13,547	323,700	31,967	*54,646*	2,572
	Matched Non-members	71	-7,871	17,997	345,333	29,395	*60,824*	

Significance levels for two-sample t-test of means, null hypothesis: difference=0
* p<10% **p< 5% ***p<1%

Source: 2015 Firm Survey

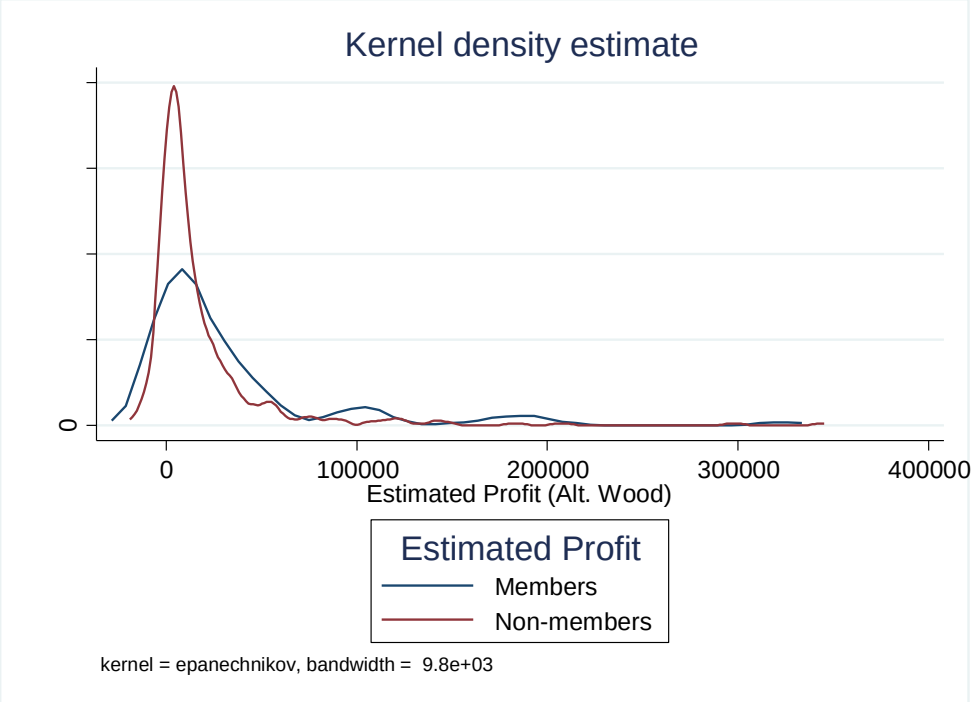

Figure 4: Kernel density of estimated profit for members and non-members before matching
Source: 2015 Firm Survey
Observations: 142

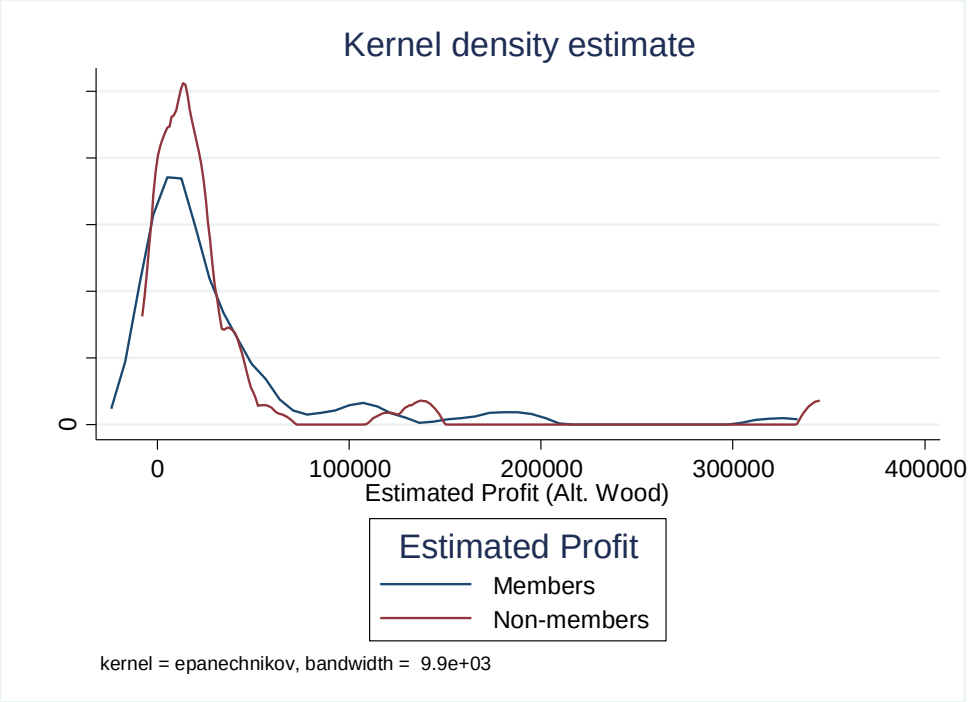

Figure 5: Kernel density of estimated profit after caliper matching to one nearest neighbor
Source: 2015 Firm Survey
Observations: 142

The treatment effects are positive but non-significant for matching to one nearest neighbor within a caliper, indicating that APKJ membership does not have an effect on profits (table 9). The treatment effect is also positive and non-significant after matching to five nearest neighbors without a caliper. The difference is significant when matching to one nearest neighbor without a caliper, but this does not provide sufficient evidence to conclude that there is a significant difference in profit levels.

PSM was also applied to restricted samples. First, PSM was applied to a sample that excluded firms whose 2015 operations included brokering. The effect was positive and significant when matching to one nearest neighbor with and without a caliper (USD 14,014; 16,462). When the dataset excluded firms that engaged in brokering or owned a showroom in 2015, the treatment effects from all three matching methods were not significant. Next, extreme profit levels were excluded. Examining the graphed kernel density of profit levels for the full

sample (see figure 6) suggested that $80,000 would serve as a sensible cutoff point, and the dataset was restricted to observations with profit levels below that point. Caliper matching could not be implemented, as there were perfect predictors of membership after dropping units without matches within the caliper. The treatment effects calculated with this restricted sample were not significant. Additionally, the treatment effect was estimated using a profit calculation that included original costs for the 27 cases that had alternate wood quantity estimates. The treatment effects in this case are smaller than when alternate wood quantities are used, and none of the matching methods produces a significant effect.

Table 8: Average treatment effect on the treated for estimated firm profit (matching with replacement)

Sample Restrictions/ Difference in Outcome Variable Measure	Number of Neighbors	Caliper	Treatment Effect, USD	Std. Err.	P-Value	Number of Matched Observations
None	1	Yes	2,572	*11,397*	0.82	142
	1		10,828	*5,770*	0.06	168
	5		3,498	*6,189*	0.57	168
Exclude cases that broker in 2015	1	Yes	14,014	*7,191*	0.05	134
	1		16,462	*8,558*	0.05	154
	5		(5,655)	*20,450*	0.78	154
Exclude cases that broker in or own showrooms in 2015	1	Yes	(26)	*11,309*	0.99	114
	1		(6,024)	*13,091*	0.65	134
	5		(8,201)	*25,395*	0.75	134
Exclude Profit above USD 80,000	*Propensity score cannot be estimated (perfect predictors)*					
	1		(5,230)	*5,497*	0.34	148
	5		888	*4,674*	0.85	148
Use original wood costs in profit calculation (not alternate estimates)	1	Yes	734	*11,785*	0.95	142
	1		7,486	*6,727*	0.27	168
	5		661	*6,586*	0.92	168

Source: 2015 Firm Survey

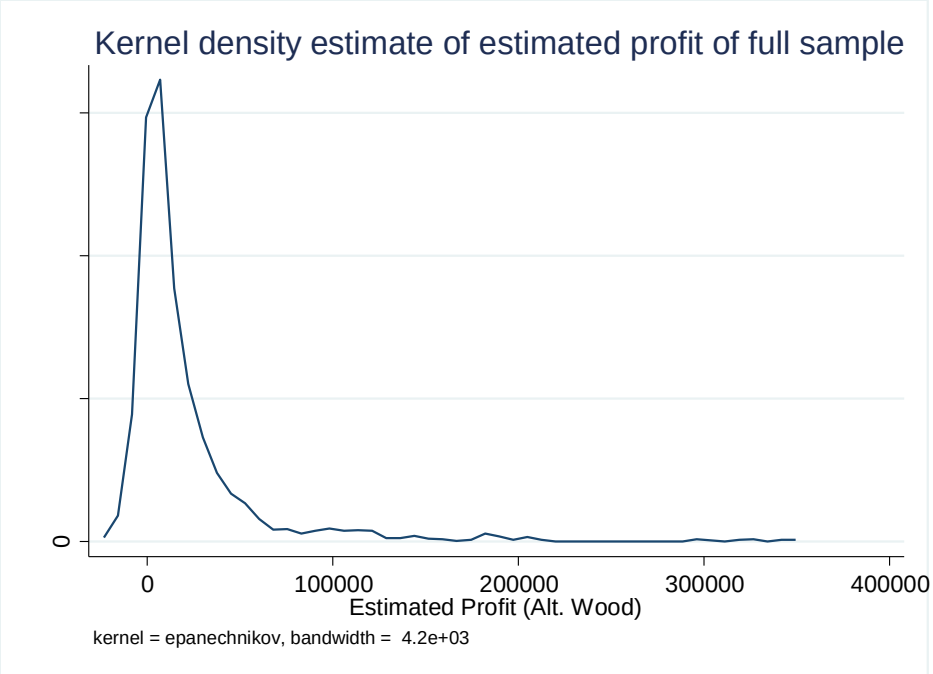

Figure 6: Kernel density of estimated profit of full sample
Source: 2015 Firm Survey
Observations: 483

Firm revenue was also examined as an outcome variable. There is expected to be less error in the revenues estimate than in the estimate of profit. Reporting sales information is more straightforward than reporting cost information, and misalignment of costs and revenues does not affect revenues. However, revenues are more reflective of the scale of a firm's operations than of livelihood effects, as high cost of inputs may erode most or all firm revenue. Still, firm revenue is an informative outcome variable that indicates a firm's level of success. Figure 7 compares revenues for members and non-members after matching to one nearest neighbor with a caliper. Like estimated profit, there is a very large range in estimated revenue levels.

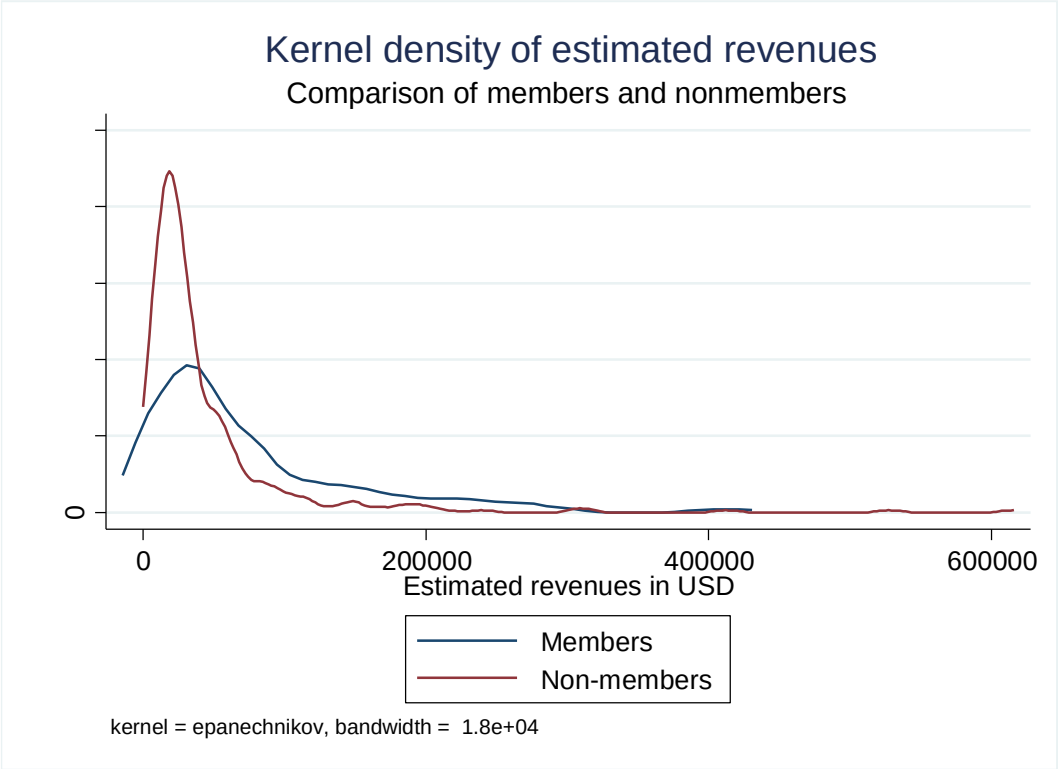

Figure 7: Kernel density of estimated revenues after caliper matching to one nearest neighbor
Source: 2015 Firm Survey
Observations: 142

The treatment effects for firm revenues, reported in table 9, reflect those for profit. As with the profit outcome variable, the treatment effects are positive and significant when matching to one nearest neighbor without a caliper when there are no dataset restrictions, and when matching to one nearest with or without a caliper after excluding firms that broker. Other matching methods yield non-significant results. These results further suggest but do not confirm the possibility of a livelihood impact of membership.

Table 9:Average treatment effect on the treated for estimated firm profit (matching with replacement)

Sample Restrictions/ Difference in Outcome Variable Measure	Number of Neighbors	Caliper	Treatment Effect, USD	Std. Err.	z	P-Value	Number of Matched Observations
None	1	Yes	-1,126	19,113	-0.06	0.95	142
	1		17,849	6,961	2.56	0.01	168
	5		8,863	9,276	0.96	0.34	168
Exclude cases that broker in 2015	1	Yes	22,488	4,236	5	0.00	134
	1		34,045	11,700	3	0.00	154
	5		-6,586	36,258	0	0.86	154
Exclude cases that broker in or own showrooms in 2015	1	Yes	8,394	18,946	0	0.66	114
	1		-12,193	22,507	-1	0.59	134
	5		-13,538	44,270	0	0.76	134

Source: 2015 Firm Survey

4.3.2: Hypothesis 2: APKJ members have a higher probability than non-members of increasing the sophistication of their marketing methods between 2009 and 2015

To evaluate this hypothesis, categorical variables were created to compare marketing/sales channels in 2009 and 2015. This categorical variable took on four values: 1 if the firm utilized a sales channel in 2009 that it did not utilize in 2015; 2 if the firm did not a sales channel in 2009 and 2015; 3 if the firm utilized a sales channel in 2009 and 2015, and 4 if the firm utilized a sales channel in 2015 that it did not in 2009. Either adding or abandoning a sales channel can be seen as upgrading, depending on the sophistication and power of the channel in question. The categorical variables compare changes in selling through other showrooms (*chg_cbn_otsh*), selling directly to buyers (*diff_cbn_dir*), selling through a broker (*diff_cbn_brok*), selling through exhibitions (*diff_cbn_exh*), selling through an exporter (*diff_cbn_exp*), being subcontracted (*diff_cbn_sub*), and selling online (*diff_cbn_online*).

Additional binary variables were created to focus on firms that added or abandoned a marketing/sales channel between 2009 and 2015. The variables focusing on adding a

marketing/sales channel (*pc_diff_cbn_[marketing/sales channel]*) equal 1 if the firm added that sales channel between 2009 and 2015, and equal 0 otherwise. The variables focusing on abandoning a marketing/sales channel (nc_diff_cbn_[marketing/sales channel]) equal 1 if the firm abandoned that sales channel between 2009 and 2015, and equal 0 otherwise. Variables on marketing/sales channels were excluded from calculation of the propensity score used to match units for the analysis of these outcome variables. Caliper matching with one nearest neighbor was used.

There is a significant relationship between the addition of exhibition attendance and APKJ membership (table 9). Twelve percent more APKJ members than the matched counterfactual adopted selling through exhibitions. The addition of exhibition attendance as a sales and marketing channel represents increased sophistication of marketing. The significant effect of membership on attendance validates the efforts of the Jepara FVC Project's moving up scenario to support exhibition attendance. While the treatment effect for abandoning selling through exhibitions is also positive and significant, this may be because APKJ members confused exhibitions attended in 2010 with 2009 exhibitions.

Table 10: Tabulated data, treatment effects, and risk ratios for changes in the practice of marketing through exhibitions (2009-2015)

Outcome variable	Measure		Values	
			% Non-members	% Members
Changes in practice of marketing through exhibitions, 2009-2015 (*chg_cbn_exh*)	Abandoned	1	0%	3%
	Neither year	2	95%	82%
	Both years	3	5%	4%
	Added	4	0%	12%
	P-value from Fishers Exact Test		0.00	
	Matched Observations (total)		152	

Binary variable indicating the firm added marketing through exhibitions between 2009 and 2015: *pc_diff_cbn_exh* (1 if added ; 0 otherwise)	risk ratio[2] P-value	N/A[3]
	Treatment Effect AI Standard Error P-value	0.12 0.04 0.00
Binary variable indicating the firm abandoned marketing through exhibitions between 2009 and 2015: *nc_diff_cbn_exh* (1 if abandoned ; 0 otherwise)	risk ratio p-value	N/A
	Treatment Effect AI Standard Error P-value	0.03 0.01 0.03
After matching to one nearest neighbor within a caliper; ATET		

Source: 2015 Survey data, which included recall questions on operations in 2009

The relationship between APKJ membership and change in whether a firm sells directly to buyers is significant at the 1% level (table 10). Thirteen percent of the matched sample of APKJ members began selling directly to buyers between 2009 and 2015, contrasting with only 4% of the counterfactual group. However, more producers in the APKJ than in the matched control group also stopped selling directly to buyers in the same time span. The treatment effects for both adding and abandoning selling directly to buyers are positive and significant. Since producers who engage in market-based interaction directly with buyers have bargaining power and are able to negotiate prices and product specifications, these results show that APKJ members are more likely to either improve their bargaining power by beginning to sell directly to buyers, or to decrease their bargaining power by abandoning selling directly to buyers.

[2] Risk ratios are calculated as the cumulative incidence of the exposed units divided by the cumulative incidence of the unexposed units. While statistical significance tests are not used with risk ratios, if the confidence interval does not contain 1 then the risk ratio is considered significant at the significance level used by the confidence interval.
[3] Risk ratios cannot be calculated when any value is zero

Table 11: Tabulated data, treatment effects, and risk ratios for changes in practice of selling directly to buyers (2009-2015)

Outcome Variable	Measure		Values	
			% Non-members	% Members
Changes in practice of selling directly to buyers, 2009-2015 (*chg_cbn_dir*)	Abandoned	1	1%	9%
	Neither year	2	74%	47%
	Both years	3	21%	30%
	Added	4	4%	13%
	P-value from Fishers Exact Test		0.00	
	Matched Observations (total)		152	
Binary variable indicating addition of selling directly to buyers between 2009 to 2015: *pc_diff_cbn_dir* (1 if added ; 0 otherwise)	risk ratio		3.33	
	P-value		<0.10	
	Treatment Effect		0.09	
	AI Standard Error		0.04	
	P-value		0.01	
Binary variable indicating abandoning selling directly to buyers 2009 - 2015: *nc_diff_cbn_dir* (1 if abandoned ; 0 otherwise)	risk ratio		7.00	
	P-value		<0.10	
	Treatment Effect		0.08	
	AI Standard Error		0.03	
	P-value		0.01	
After matching to one nearest neighbor within a caliper; ATET				

Source: 2015 Survey data, which included recall questions on operations in 2009

There is not a significant relationship between APKJ membership and adoption of online marketing (table 11), although a goal of The Jepara FVC Project was fostering the use of online marketing and sales channels by discussing online marketing in training sessions and launching a marketing website (www.javamebel.com) for members to use.

Table 12: Tabulated data, treatment effects, and risk ratios for changes in use of practice of online marketing (2009-2015)

Outcome Variable	Measure		Values	
			% Non-members	% Members
Changes in practice of marketing online, 2009-2015 (*chg_cbn_online*)	Abandon	1	1%	1%
	Neither year	2	43%	53%
	Both years	3	7%	1%
	Add	4	49%	45%
	P-value from Fishers Exact Test		0.31	
	Matched Observations (total)		152	

Binary variable indicating addition of marketing online between 2009 to 2015: *pc_diff_cbn_online* (1 if added ; 0 otherwise)	risk ratio P-value	0.91 ≥0.10
	Treatment Effect AI Standard Error P-value	-0.04 0.07 0.57
Binary variable indicating abandoning selling through another showroom from 2009 to 2015: *nc_diff_cbn_online* (1 if abandoned ; 0 otherwise)	risk ratio P-value	1.00 ≥0.10
	Treatment Effect AI Standard Error P-value	0.00 0.02 1.00
After matching to one nearest neighbor within a caliper; ATET		

Source: 2015 Survey data, which included recall questions on operations in 2009

The relationship between APKJ membership and change in selling through an exporter is significant at 1% (table 12). APKJ membership has a significant, positive effect on adding and abandoning selling through an exporter. Selling furniture through an exporter suggests that a firm is capable of adhering to international standards, but involves directed networks in which exporters, not producers, have bargaining power. Therefore it is unclear which change would be considered upgrading.

Table 13: Tabulated data, treatment effects, and risk ratios for changes in practice of exporting furniture (2009-2015)

Outcome Variable	Measure		Values	
Changes in practice of exporting furniture, 2009-2015 (*chg_cbn_exp*)			% Non-members	% Members
	Abandon	1	1%	11%
	Neither year	2	17%	22%
	Both years	3	74%	50%
	Add	4	8%	17%
	P-value from Fishers Exact Test		0.01	
	Matched Observations (total)		152	
Binary variable indicating addition of exporting from 2009 to 2015: *pc_diff_cbn_exp* (1 if added ; 0 otherwise)	risk ratio		2.67	
	P-value		≤0.10	
	Treatment Effect		0.09	
	AI Standard Error		0.05	
	P-value		0.08	
Binary variable indicating abandoning exporting from 2009 to 2015: *nc_diff_cbn_exp* (1 if abandoned ; 0 otherwise)	risk ratio		8.00	
	P-value		≤0.05	
	Treatment Effect		0.09	
	AI Standard Error		0.04	
	P-value		0.01	
After matching to one nearest neighbor within a caliper; ATET				

Source: 2015 Survey data, which included recall questions on operations in 2009

The relationship between APKJ membership and change in selling through other showrooms is not significant (table 13). Either adding or abandoning selling through domestic showrooms could be seen as upgrading. While producers who sell to other showrooms are not able to negotiate directly with end-users, the relationship between producers and domestic showrooms is based on market principles, encouraging producers to maintain high quality, and there is a possibility of moving to a balanced network, which encourages upgrading (Irawati et al., 2010).

Table 14: Tabulated data, treatment effects, and risk ratios for changes in practice of selling through other showrooms (2009-2015)

Outcome Variables	Measure		Values	
Changes in practice of selling through other showrooms, 2009-2015 (*chg_cbn_otsh*)			% Non-members	% Members
	Abandon	1	7%	9%
	Neither year	2	57%	51%
	Both years	3	29%	34%
	Add	4	8%	5%
	P-value from Fishers Exact Test		0.75	
	Matched Observations (total)		152	
Binary variable indicating addition of selling through another showroom from 2009 to 2015: *pc_diff_cbn_otsh* (1 if added ; 0 otherwise)	risk ratio		0.67	
	P-value		≥0.10	
	Treatment Effect		-0.03	
	AI Standard Error		0.04	
	P-value		0.56	
Binary variable indicating abandoning selling through another showroom from 2009 to 2015: *nc_diff_cbn*_otsh (1 if added ; 0 otherwise)	risk ratio		1.40	
	P-value		≥0.10	
	Treatment Effect		0.03	
	AI Standard Error		0.03	
	P-value		0.39	
After matching to one nearest neighbor within a caliper; ATET				

Source: 2015 Survey data, which included recall questions on operations in 2009

Membership in the APKJ does not have a significant effect on change in selling to brokers (table 14), or on being subcontracted by other firms (table 15). Selling to a broker and being subcontracted both represent positions of very low bargaining power, where the buyer defines the product and the price. A larger percent of APKJ members than matched non-members started being subcontracted between 2009 and 2015, and fewer members abandoned being subcontracted than in the counterfactual group.

Table 15: Tabulated data, treatment effects, and risk ratios for changes in practice of selling through (to) brokers (2009-2015)

Outcome Variables	Measure		Values	
Changes in practice of selling through (to) brokers, 2009-2015 (*chg_cbn_brok)*			% Non-members	% Members
	Abandon	1	4%	7%
	Neither year	2	50%	43%
	Both years	3	5%	20%
	Add	4	41%	30%
	P-value from Fishers Exact Test		0.04	
	Matched Observations (total)		152	
Binary variable indicating addition of selling through (to) brokers from 2009 to 2015: *pc_diff_cbn_brok* (1 if added ; 0 otherwise)	risk ratio		0.77	
	P-value		≥0.10	
	Treatment Effect		-0.11	
	AI Standard Error		0.09	
	P-value		0.25	
Binary variable indicating abandoning selling through (to) brokers from 2009 to 2015: *nc_diff_cbn_brok* (1 if added ; 0 otherwise)	risk ratio		1.67	
	P-value		≥0.10	
	Treatment Effect		0.03	
	AI Standard Error		0.04	
	P-value		0.45	
After matching to one nearest neighbor within a caliper; ATET				

Source: 2015 Survey data, which included recall questions on operations in 2009

Table 16: Tabulated data, treatment effects, and risk ratios for changes in practice of being subcontracted (2009-2015)

Outcome Variable	Measure		Values	
Changes in practice of being subcontracted, 2009-2015 (*chg_cbn_sub*)			% Non-members	% Members
	Abandon	1	33%	32%
	Neither year	2	43%	39%
	Both years	3	8%	9%
	Add	4	16%	20%
	P-value from Fishers Exact Test		0.92	
	Matched Observations (total)		152	
Binary variable indicating addition of being subcontracted between 2009 to 2015: *pc_diff_cbn_sub* (1 if added ; 0 otherwise)	risk ratio		1.25	
	P-value		≥0.10	
	Treatment Effect		0.04	
	AI Standard Error		0.07	
	P-value		0.58	

Binary variable indicating abandoning being subcontracted between 2009 to 2015: *nc_diff_cbn_sub* (1 if abandoned; 0 otherwise)	risk ratio P-value	0.96 ≥0.10
	Treatment Effect AI Standard Error P-value	-0.01 0.13 0.92
After matching to one nearest neighbor within a caliper; ATET		

Source: 2015 Survey data, which included recall questions on operations in 2009

These findings demonstrate varying levels of success of the Jepara FVC Project's efforts to improve small scale producers' marketing practices and bargaining power. Producers are more likely to abandon selling through brokers and begin selling directly to buyers and at exhibitions if they are members of the APKJ than if they did not join the association. Yet at the same, members are more likely to abandon selling directly to buyers and are no more likely to abandon being subcontracted or add online marketing than if they had not joined. It appears that the Jepara FVC met with the most success when the APKJ facilitated a specific behavior such as exhibition attendance.

4.3.3: Hypothesis 3: APKJ members are more likely than non-members to have upgraded their production activities since 2009

There is a significant relationship between APKJ membership and changing from not brokering in 2009 to brokering in 2015 (table 16). Brokering is a position with substantial bargaining power, which allows brokers to receive a larger portion of the final price than is received by someone who functions only as a wood carver. Brokering requires business acumen that APKJ training workshops sought to impart.

Table 17: Tabulated data, treatment effects, and risk ratios for changes in brokering status 2009-2015

Outcome Variable	Measure		Values	
Changes in brokering status, 2009-2015 (categorical variable *chg_brokering*)			% Non-members	% Members
	Neither year	2	99%	92%
	Both years	3	1%	2%
	Add	4	0%	6%
	P-value from Fishers Exact Test		0.04	
	Matched Observations (total)		166	
Changes in brokering status, 2009-2015 (binary variable *diff_brokering*)	Treatment Effect		0.06	
	AI Standard Error		0.03	
	P-value		0.02	
After matching to one nearest neighbor within a caliper; ATET				

Source: 2015 Survey data, which included recall questions on operations in 2009

More APKJ members than matched non-members stopped selling finished furniture between 2009 and 2015, and more matched non-members than non-members began selling finished furniture in the same time period (table 17). Like brokering, finishing is an 'upgraded' production activity. It allows firms to attain a larger portion of the final price than they would through carving, and requires skills and knowledge that were taught in APKJ training workshops. However, these workshops have not had a significant effect on adding production of finished products.

Table 18: Tabulated data, treatment effects, and risk ratios for changes in selling finished products 2009-2015

Outcome Variable	Measure		Values	
Changes in practice of finishing products, 2009-2015 (*chg_finished*)			% Non-members	% Members
	Abandon	1	1%	8%
	Neither year	2	61%	67%
	Both years	3	17%	13%
	Add	4	20%	11%
	P-value from Fishers Exact Test		0.06	
	Matched Observations (total)		166	

Binary variable indicating addition of selling finished products between 2009 to 2015: *pc_diff_finsihed* (1 if added ; 0 otherwise)	risk ratio P-value	0.53 ≤0.10
	Treatment Effect AI Standard Error P-value	-0.10 0.04 0.01
Binary variable indicating abandoning selling finished products between 2009 to 2015: *nc_diff_finished* (1 if added ; 0 otherwise)	risk ratio P-value	7 ≤0.10
	Treatment Effect AI Standard Error P-value	0.07 0.03 0.01
After matching to one nearest neighbor within a caliper; ATET		

Source: 2015 Survey data, which included recall questions on operations in 2009

These results present a mixed picture of the influence of the APKJ on upgrading production activities. More APKJ members than the counterfactual began brokering since the formation of the APKJ, indicating a shift to a position with bargaining power that takes a large portion of the final product's value. On the other hand, significantly more APKJ members than non-members stopped selling finished products. These results suggest that the Jepara FVC Project was more successful in facilitating functional upgrading that involves marketing and bargaining power (brokering) rather than production processes (finishing).

4.3.4: Hypothesis 4: APKJ members are more likely than non-members to have good business management practices

Training workshops conducted as part of the Jepara Furniture Value Chain Project encouraged application of good business management practices such as record-keeping and officially registering the business. The Jepara FVC project also encouraged obtaining SVLK certification by providing training workshops on the process, and facilitating the formation of groups to obtain group certification. The results for business registration and SVLK certification show that APKJ members are more likely than non-members to have good business management practices, though members are no more likely than non-members to keep business records.

Ten percent of APKJ members in the matched sample have SVLK certification, as opposed to 6% of matched non-members (table 18). The treatment effect is significant at the 1%

level. Empowering small-scale producers to obtain SVLK certification was a key focus of the Jepara Furniture Value Chain Project. While only a modest number of APKJ members have obtained certification, the treatment effect shows that the influence of membership on obtaining certification is positive and significant.

Table 19: Tabulated data, treatment effects, and risk ratios for SVLK certification

Outcome Variable	Measure		Values	
SVLK certification in 2015 (*svlk*): 1 certified; 0 if not certified			% Non-members	% Members
	Not Certified	0	94%	90%
	Certified	1	6%	10%
	P-value from Fishers Exact Test		0.53	
	Matched Observations (total)		142	
	risk ratio		1.75	
	P-value		≥0.10	
	Treatment Effect		0.04	
	AI Standard Error		0.00	
	P-value		0.00	
After matching to one nearest neighbor within a caliper; ATET				

Source: 2015 Survey data

There is not a significant relationship between APKJ membership and keeping records or having a registered business (tables 19 and 20)[4]. However, this is a cross-sectional comparison rather than a differenced outcome variable.

[4] Propensity score matching with the outcome variable records, unlike the other upgrading outcome variables, was conducted without a caliper. When a caliper was used with the records outcome variable, the covariate _09_brokering predicted APKJ membership perfectly, so the propensity score could not be estimated.

Table 20: Tabulated data, treatment effects, and risk ratios for record-keeping

Outcome Variable	Measure		Values	
Record-keeping in 2015 (*records*): 1 if firms keeps records; 0 if does not keep records			% Non-members	% Members
	Records	0	63%	71%
	No Records	1	37%	29%
	P-value from Fishers Exact Test		0.40	
	Matched Observations (total)		156	
	risk ratio		0.79	
	P-value		≥0.10	
	Treatment Effect		-0.08	
	AI Standard Error		0.19	
	P-value		0.69	
After matching to one nearest neighbor within a caliper; ATET				

Source: 2015 Survey data, which included recall questions on operations in 2009

Table 21: Tabulated data, treatment effects, and risk ratios for business registration

Outcome Variable	Measure		Values	
Registered business in 2015 (*registered*): 1 if firm is registered; 0 if not registered			% Non-members	% Members
	Not Registered	0	77%	64%
	Registered	1	23%	36%
	P-value from Fishers Exact Test		0.15	
	Matched Observations (total)		146	
	risk ratio		1.53	
	P-value		≥0.10	
	Treatment Effect		0.12	
	AI Standard Error		0.09	
	P-value		0.16	
After matching to one nearest neighbor within a caliper; ATET				

Source: 2015 Survey data

4.3.5: Revenue Predictors and Staying Open versus Shutting Down

The third objective of this study is to measure the impact of specific upgrading behaviors on revenues and profits. To do so, business practices and characteristics were used as independent variables in an ordinary least square regression, with profit or revenues as the dependent variable. In order to take the natural log of estimated profit, it was first adjusted so that all values were positive. When the natural log of adjusted estimated profit was used as the dependent variable, the only independent variable with a significant effect was the average

number of workers; the addition of one worker generates a 2% increase in profit, all else held constant.

When the natural log of yearly revenues, rather than profit, was used as the outcome variable, more independent variables had a statistically significant effect. The output from this model is shown in table 21. This model showed that an additional worker increased revenues by 4.5%, and an additional square meter increased revenues by 0.1%. The interaction term for these two variables was not significant. Despite project implementers' high hopes for the effect of SVLK certification, this model did not show certification to have a significant effect on revenues. Brokering has a dramatic impact on revenues; firms that broker are shown to have 60.3% higher profit than firms that do not broker. Surprisingly, selling directly to buyers had a significant negative effect, decreasing revenues by 14.5%. Online marketing, conversely, has a positive effect of 23.5%. Selling at exhibitions increases revenues by 44.8. Selling to exporters also increases revenues by 19.6%.

Table 22: Ordinary least square estimates for predictors of firm revenues

Variables	**Variable Description**	**Coefficient**	***Standard Error***
_15_worker_avg	Average number of workers	0.04***	*0.01*
_15_totalm2 _workshop_sum	Total meters squared of workshop space	0.00***	*0.00*
worker_m2	Interaction term for workers and workshop space	0.00	*0.00*
brokering	Equals 1 if the firm engaged in brokering	0.60***	*0.21*
svlk_or_skema	Equals 1 if the firm had SVLK certification	-0.14	*0.21*
_15_finished	Equals 1 if the firm sold finished products	0.03	*0.12*
_15_total_showroom	The number of showrooms owned by the firm	0.09	*0.14*

Variables	Variable Description	Coefficient	*Standard Error*
_15_cbn_otsh	Equals 1 if the firm sold furniture to/through a showroom with a different owner	0.00	*0.11*
_15_cbn_dir	Equals 1 if the firm sold furniture directly to buyers	-0.14*	*0.09*
_15_cbn_online	Equals 1 if the firm sold furniture online	0.24**	*0.09*
_15_cbn_brok	Equals 1 if the firm sold furniture through a broker or trader	0.11	*0.09*
_15_cbn_exh	Equals 1 if the firm sold furniture through exhibitions	0.45**	*0.19*
_15_cbn_exp	Equals 1 if the firm sold furniture to exporters	0.20**	*0.10*
_15_cbn_sub	Equals 1 if the firm was subcontracted	-0.03	*0.11*
Constant		19.14	*0.11*
F(14, 468)=11.80 Prob > F=0 R-squared=0.26 Adjusted R-squared=0.24			

Source: 2015 Firm Survey

While surveying, it was found that some firms had closed down, including seventeen APKJ members. Fourteen APKJ members had shut down their businesses as a result of business-related problems, while three had shut down because of death or illness. With the intent of determining whether APKJ membership helped businesses to stay afloat, data on operations in 2009 were collected from firms that had closed down. As table 23 shows, APKJ members are 0.47 times as likely as non-members to shut down. This analysis was conducted without complete data, as many non-members that were originally selected from the sampling frame to

be respondents were not interviewed because they could not be found or had moved away. It is likely that many of these potential cases did shut down.

Table 23: Tabulated data, treatment effects, and risk ratios for businesses closing

Outcome Variable	Measure		Values	
Closed (The firm closed between 2009 and 2015 for business reasons)			% Non-members	% Members
	Open	0	78%	90%
	Closed	1	22%	10%
	P-value from Fishers Exact Test		0.06	
	Matched Observations (total)		176	
	risk ratio		0.47	
	P-value		<0.05	
	Treatment Effect		-0.11	
	AI Standard Error		0.05	
	P-value		0.02	

4.4: Qualitative Survey Responses

The survey conducted in summer 2015 asked respondents about the benefits of APKJ membership. Training, improved access to credit, improved market access, increased access to raw materials, and help with means of production were provided as potential answers for the enumerators to mark. A blank space was also provided in the questionnaire for any other opinion of members. Aggregated responses are provided in table 23. Ninety members (67%) listed training as a benefit. Eight (7%) listed improved credit access, 15 (13%) listed improved market access, 12 (10%) listed increased access to raw materials, and 10 (8%) listed help with means of production.

Several members added a comment about the APKJ. Forty-two members said that they had gained insight, knowledge, market access, experience or opportunities, and 11 emphasized the opportunity to build relationships that the APKJ had created. Additionally, two members reported borrowing woodworking equipment from the APKJ as a benefit of membership.

However, fifteen members added a comment indicating that they had not experienced any benefit from the association. Two of these members had joined late, in 2013, missing the training sessions that had been provided through CIFOR.

Table 24: Member-identified benefits of the APKJ

	Benefits of Membership	Number of APKJ Members
Suggested responses	Training	90
	Credit	8
	Market	15
	Raw Materials	12
	Production	10
Free response	No benefits	15
	Knowledge	34
	Improved production quality	2
	Gained Friends/Colleagues	12
	Experience	8
	marketing/market access/exhibition/opportunities	4
	Borrowed woodworking equipment	2

4.5: Conclusion and Limitations

These findings indicate that there is a limited, positive impact of APKJ membership. Profit and revenue treatment effects provide some evidence of a positive effect of membership, and other outcome variables indicate that membership does have some influence on members' marketing, production, and business practices. However, the conclusion of each hypothesis is unclear, as there is some evidence supporting each conclusion and some evidence against it. Through the APKJ, the Jepara FVC project influenced members to upgrade by participating in exhibitions, selling directly to buyers, beginning to sell finished products, obtaining SVLK certification, and moving towards becoming brokers. However, APKJ members are also more likely to abandon selling directly to buyers and stop selling finished products, and no more likely to being marketing online or stop selling through brokers. The implications of these results are

further discussed in the next chapter. This discussion will aid in understanding what this evaluation means for future projects.

The treatment effects for upgrading outcomes indicate that APKJ members changed more (for better and for worse) than the control units matched to them. These bimodal outcomes for members may be indicative of the APKJ attracting two different types of furniture producers: one type whose business is not doing well that joins the APKJ in hopes of improvement, and another type who is particularly motivated and views the APKJ as an opportunity to be developed in order to improve their business. It appears that the APKJ did not succeed in improving the firms of the first type of members, but that the members of the second type were able to leverage the opportunities and resources of the APKJ to improve their businesses.

Several factors limited the study. First, the study uses data on what a respondent could recall about their operations six years prior to survey administration. The recall data are included in estimation of the propensity score, which is relied upon for the results reported in this chapter, as well as for a baseline in the calculation of outcome variables. Additionally, the estimation of profit is based on survey responses. These responses do not include costs such as rent or a mortgage, depreciation expenses or debt expenses. Production and input time spans are not uniform so information for costs and revenues may not correspond, and assumptions about seasonality and consistency were used when scaling up costs and revenues to a year. Furthermore, the likelihood of getting significant results with the profit outcome variable is limited by the small sample size for treated units and the large variance in estimated profit. Propensity score matching was implemented in order to minimize selection bias. However, membership and outcome variables may have been influenced by unobservable characteristics that were not account for when estimating the propensity score.

Chapter 5: Discussion

The focus of this study was to determine the impact of membership in the APKJ. This was achieved by using propensity score matching to quantify the livelihood impact of the project by comparing firm profits of APKJ members against a counterfactual (sub-objective 1), and determine the extent of the uptake of upgrading behaviors promoted by the four upgrading scenarios of the Jepara FVC project (sub-objective 2). Two additional models, using profit and revenues as outcome variables, achieved the third objective of measuring the impact of specific upgrading behaviors on revenues and profits. The purpose in pursuing these objectives was to evaluate the Jepara Furniture Value Chain Project, the objectives of which were "(i). to enhance the structure and function of the furniture industry for the benefit of small-scale furniture producers; (ii). to improve marketing by small-scale furniture producers and their industry associations, and (iii). to monitor changes regarding the effects and early acceptance of innovations from objectives 1 and 2 and revise and/or reinforce project strategies accordingly" (Purnomo et al., 2013).

The first objective of the Jepara FVC Project requires the influence of the project to affect the entire furniture industry of Jepara. The policy roadmap works towards the achievement of this objective, but its efficacy cannot yet be evaluated. An assessment report being drafted by CIFOR about the Jepara FVC notes the important role of CIFOR in passing the legislation, and is optimistic about the capacity of the policy to improve the structure and function of the Jepara furniture value chain. Portions of local budgets have been allocated to implement this policy. CIFOR should follow up on the implementation of this policy by examining how the allocated budget is spent, and determining how many producers benefit from implementation of the policy.

Evaluating the APKJ in 2015, before the policy was fully implemented, provides an opportunity to examine the impact of changes that the policy hoped to achieve in the value chain

as a whole. While the APKJ did not alter the structure and function of the entire furniture value chain for the benefit of small-scale producers, participation in the APKJ improved bargaining power of some members. A significantly higher percentage of APKJ members than matched control units (the counterfactual) abandoned selling to a broker, which affords little power for negotiation in product specification or pricing. Additionally, a significantly higher percentage of APKJ members than non-members began brokering, a position with substantial market power that claims a large portion of the product's final value. More APKJ members than non-members also obtained SVLK certification, providing more opportunities to sell to buyers in Europe. Additionally, there is some evidence that membership in the APKJ membership improves livelihoods, suggesting that members are better able to function within the current structure of the value chain.

The second objective, as far as it relates to APKJ members, has been specifically addressed in this study. The proportions of members and non-members that adopted online marketing were similar. More APKJ members than non-members began marketing through exhibitions, which affords them the opportunity to interact directly with buyers and develop their own brand. More APKJ members than non-members also began selling directly to buyers from 2009 to 2015. However, more APKJ members than non-members also stopped selling directly to buyers in the same time span.

The third objective relates to the research method employed by the project, and the manner in which policy recommendations were synthesized. The knowledge generated by the project allowed researchers to pinpoint inefficiencies in the value chain. However, translating research findings into tangible outcomes is not always possible. Addressing many of the challenges identified by the value chain analysis, such as timber scarcity, lack of access to credit,

low bargaining power, and international competition are beyond the scope of a single project or policy. Furthermore, allocating fewer resources to defining challenges, and more resources to providing outreach to participants, will likely lead to better outcomes.

The project's design relied on several assumptions which should be further examined. Upgrading was seen as a means to improve all producers' livelihoods. While some upgrading activities such as obtaining SVLK certification and improving product quality add value to current production, the project also promoted moving up in the value chain. Shifting to or incorporating a higher stage in the value chain, such as finishing furniture or brokering, has potential to allow an individual to realize a larger portion of the final value of a product. However, uniformly encouraging producers to move up to higher stages of the value chain ignores the economic principal of comparative advantage, and disregards the interdependence of value chain actors. Since actors are needed at all levels of the value chain, unvaryingly encouraging actors to move up in the value chain does not represent a sustainable solution to the challenges faced by the industry. Furthermore, the anticipated impacts of the project relied on expectations that APKJ members would share knowledge, and that the APKJ would grow and become independent were not realized. The project directly engaged only with APKJ members and other attendees of training sessions, a very small portion of the furniture producers in Jepara: APKJ membership totals 125, while there are over 11,000 business units in Jepara's furniture industry. Project designers must be wary of basing expected impacts on assumptions such as independent growth of the APKJ.

Conclusions can be made from this project that can guide the design of future projects to increase impact. First, project designers should carefully consider investment in knowledge-generating activities, such as conducting value-chain analysis, over outreach activities, such as training sessions. Second, assumptions about the way in which improvements are achieved (such

as upgrading) must be carefully evaluated to determine if they hold in the context of the project. Third, evaluation of expectations for knowledge diffusion should ensure that the expectations are realistic and viable.

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Appendix A: Survey Questionnaire

Survey for Impact Study of the Jepara Furniture Value Chain Project

I. Control Information

		A	B	C
	Task	**Name**	**Date** **DD/MM/Year**	**Status OK? If not, comment**
1	Interview			
2	Check Questionnaire			
3	Enter data			

I. Identification

1. Sample ID: _____
2. Name of workshop/Furniture business (if none leave blank) _____
3. Address: Street_____ No.____ RT_____ RW_____
   Dusun _____ Desa_____ Kecamatan_____
4. Respondent name_____
5. Owner name _____
6. GPS reference of workshop location (UTM format):
   a. slide__ __ grid __ __ ordinal__ __
   b. Lattitude_____ Longitude_____ (Titik GPS)
7. APKJ member? Yes _____ No_____
8. APKJ champion? Yes_____ No_____

II. Owner Characteristics

A. Respondent

1. Age _____years
2. Gender: Male □ Female □
3. Highest level of education achieved by respondent: ____
   1. Did not graduate SD/ Did not attend formal school
   2. SD or equivalent
   3. SMP or equivalent
   4. STM/ SMK
   5. SMK Ukir
   6. SMA or equivalent
   7. Akademi/ Diploma
   8. S1
   9. S2 or higher
4. Is the respondent the workshop owner? Yes_____ No____ *If yes, proceed to section IV. If not, please answer the following questions*
5. Role of respondent: Manager____ Worker/ craftsman_____ Other_____
6. Do you receive salary/ wages □ or profit/income □ from the business's operations?
7. If so, what is the daily rate ? Rp_____/ hari
8. Age of workshop owner _____years
9. Gender of workshop owner : Male □ Female □
10. Highest level of education achieved by workshop owner:

1. Did not graduate SD/ Did not attend formal school
2. SD or equivalent
3. SMP or equivalent
4. STM/ SMK
5. SMK Ukir
6. SMA or equivalent
7. Akademi/ Diploma
8. S1
9. S2 or higher

Business Unit

Table IV.1: Current Business units (*all units owned since 2009*)

	A	B	C	D	E	F	G	H	I	J	K
	Type of business units 1=Workshop 2=Showroom 3=Sawmill 4=Large Drying Oven 5=Logpark 6=Warehouse 7=Ironmoger	Business Unit Name	Year Opened	Check if still open	How many years has the business been closed	If closed, why did it close?	The number of similar business units in the same RT (administrative unit)	The distance to the center of the Kecamatan		Located with the owner's home?	Size of business unit in square meters
								Kilometers	Minutes walking		
1								Km			M^2
2								Km			M^2
3								Km			M^2
4								Km			M^2
5								Km			M^2
6								Km			M^2
7								Km			M^2
8								Km			M^2
9								Km			M^2
10								Km			M^2

A. Other current characteristics of business

1. Is it a family-owned business? Yes_____ No_____
2. What percent (%) of the family's income comes from furniture production _____%
3. Does the business have a record of revenues and expenditures? Yes ____ No_____
4. Number of workers during:

   High Season _____ Low Season_____ Normal or average _____
5. Is the business formally registered? Yes_____ No_____
6. If yes, what type of registration?
   i. IRT (Industri Rumah Tangga/Domestic Industry), village or RT license
   ii. UD (Usaha Dagang/trading business)
   iii. CV
   iv. PT
   v. Other, write-in _____

Table IV.2: Certification

	A	B	C	D	E	F
	Certification	Does the business unit have any certification? *Mark if yes*	Has the business unit had this certification before? *Mark if yes*	Is this part of a group certification?	How many members are in the group?	How many members of the group are APKJ members?
1	SVLK					
2	Skema SVLK					
2	FSC					
3	LEI					
4	SGS					
5	Other					

Table IV.3 : Industry/Trade Organizations

What industry/trade organizations is the business unit owner a member of?

	A	B	C	D	E	F	G
	Organization 1=APKJ | 2=ASMINDO 3=Komunitas Pengrajin Mebel Nasional (KPMN) 4= AMKRI 5 = KADIN 6=other (please specify)	Year Joined	Still a member?	If left the organization, why did the owner leave?	How active in the organization? 1=Very active, attended all meetings/events 2=Somewhat active, attending meetings/events sometimes 3=Not too active – attended several meetings/events 4=Not active – never attend meetings/events	What kind of support have you received from the organization? 1=Training 2=Increase access to credit 3=Increase market access 4= Improved access to raw materials 5=Assistance with the tools for production	What are the main advantages of being a member ?
1							
2							
3							
4							
5							
6							
7							

V. State of the furniture business in 2009 (Refer to the 2009 elections for recall)

A. This business unit had been established by 2009 (If so, please check, if not go to section **VI**) _____

1. Did you have a record of expenditures and revenues for your business in 2009? Yes_____ No_____
2. If records were kept in 2009, please record revenues from that year _____
3. If records were kept in 2009, please record wood costs from that year_____
4. Number of employees

   High season (max) _____ Low season (Min)_____ Normal or average_____

Table V.1: Furniture type produced in 2009
Please check if produced in 2009

		A
	Furniture type	**Check if yes**
1	Outdoor chair	
2	outdoor table	
3	Outdoor table and chair set	
4	Chair indoor	
5	Indoor table	
6	Indoor chair and table set	
7	Vanity table	
8	Patio umbrella	
9	Wardrobe/cabinet	
10	Bed	
11	Carved crafts and calligraphy	
12	Simple crafts	
13	Ornaments, decoration	
14	Room divider	

15	Relief	
16	TV table	
17	Parts/furniture parts	
18	Other (please specify)	

Table V.2: Sales Channel

Please write the percent of sales that occurs through each channel

		A	B
	Jalur	**Check if Yes**	**Percent**
1	Firm Website		%
2	Group Website		%
3	Firm's own Showroom		%
4	Other showroom		%
5	Subcontracted by another firm		%
6	Facebook/other social media		%
7	Direct sales to buyers at exhibitions		%
8	Direct sales to buyers through personal		%
9	Direct sales to other types of buyers		%
10	Sold to exporter		%
11	Sold to traders/brokers		%
12	Sold directly to ther buyers/other buyers from abroad		%

Table V.3: Marketing

Marketing methods used in 2009. Check if used the marketing method in 2009 and rank by importance to the firm.

		A	B
	Marketing method	**Check if Yes**	**Rank (1=The most important)**
1	Not doing anything		
2	The buyer comes to the workshop/warehouse (buyer orders)		
3	Newspaper		
4	Make brochure		
5	Look for buyers in a place with a lot of people (tourist attractions, restaurants, etc.)		
6	Own marketing website		
7	www.javamebel.com		
8	Group marketing website		
9	Participate in exhibitions		
10	Facebook/Other social media		

Table V.4: Buyers*: Please fill in the following information about buyers in 2009*

		A	B	C
		Check if yes	Where/from where? (Location Code)	Where does the buyer sell it? (Location code)
1	Were there buyers from other workshops in 2009?			
2	Buyers from other showrooms in 2009?			
3	Was the business selling to an exporter in 2009?			
4	Did you sell to a broker/trader in 2009? (Y/N)			
5	Are the products sold directly to the consumer? (Y/N)			

Location Code
1=Jepara 2=Somewhere else in Indonesia 3=Europe 4=China/ Hong Kong 5=India 6= Somewhere else 7=Not known

Table V. 5: Production process coordination 2009				
A	B	C	D	E
What percentage of the construction of furniture is contracted out to other artisans? (0 if none)	What percentage (%) of product assembly furniture craftsmen contracted out to other artisans? (0 if never)	Columns C, D, and E should total 100%		
		What percent of products is sold unfinished?	What is the percent of product of products that are finished in the workshop?	What percent of the products are contracted out to other artisans for finishing?
%	%	%	%	%

Table.V.6 Wood used in 2009

No	**Type of Wood**	**Check if yes**	**Percent (%)**	**C. Sourcce of Wood** Please provide the percent of *each timber source* that wood inputs were composed of in 2009					**D. Timber source (location)** *In 2009, where did the business unit source wood from? List percent from each location*							
				Perhutani/ TPK	Community teak	Private Estates	Disediakan pembeli	Import	Jepara	West Java	East Java	Central Java	Sulawesi	Import	Other	Not known
1	Teah															
2	Mahogany															
3	Mango															
4	Coconut															
5	Durian															
6	Trembesi															
7	Sonokeling															
8	Old teak (*from dismantled structures*)															
9	Oak															
10	Other, specify ___															

VI. Current Marketing

Table VI.1: Sales Channels
tolong tunjukan berapa prosentase dari penjulan di workshop/ brak dan showroom/ toko mebel setiap jalurnya sampai saat ini

		A	B
	Jalur/sumber	Check if Yes	Percent Sold Through Channel
1	Own Marketing Website		%
2	www.javamebel.com (APKJ website)		%
3	Group Marketing Website		%
4	Own Showroom		%
5	Sell to other showroom		%
6	Receives orders from a large workshop		%
7	Facebook/other social media		%
8	Sell directly to buyers at exhibitions		%
9	Sell to buyers that are known personally		%
10	Sell directly to buyers (other)		%
11	Sell to exporter		%
12	Sell to broker		%
13	Sell directly to buyers		%

Table VI.2: Current Marketing
Rank marketing according to importance

		A	B
	Marketing Method	**Check if Yes**	**Rank**
1	Not doing anything		
2	The buyer comes to the workshop/warehouse (buyer orders)		
3	Newspaper		
4	Make brochure		
5	Look for buyers in a place with a lot of people (tourist attractions, restaurants, etc.)		
6	Own marketing website		
7	www.javamebel.com		
8	Group marketing website		
9	Participate in exhibitions		
10	Facebook/Other social media		

Question VI.1: How is the selling price determined?

1. Decide for self
2. Decided by buyer
3. Negotiated with buyer
4. Other, specify

Table V1.3: Buyers: *Please fill in the following information about buyers in 2009*

		A	B	C
		Check if yes	Where/from where? (Location Code)	Where does the buyer sell it? (Location code)
1	Were there buyers from other workshops in 2009?			
2	Buyers from other showrooms in 2009?			
3	Was the business selling to an exporter in 2009?			
4	Did you sell to a broker/trader in 2009? (Y/N)			
5	Are the products sold directly to the consumer? (Y/N)			

Location Code
1=Jepara 2=Somewhere else in Indonesia 3=Europe 4=China/ Hong Kong 5=India 6= Somewhere else 7=Not known

Table VI.4: Exhibits attended in last year
Record the exhibitions were attended by representatives of the firm in the last year (Juli2014-Juni 2015)

		A	B	C	D	E
	Exhibition:	Jepara	Semarang	Jakarta	Somewhere else in Indonesia	Another country
1	Total exhibition attended					
2	State where:					

VII. Production and sales

Table VII.1 Production during the year July 2014-June 2015
Time period: _____Week _____Month _____Year Season: _____Low _____Normal _____High

	A	B	C															D	E	F	G	H	I	J	K	L	M
	Production Unit	Which production processes are performed by your business? 1=Making furniture components 2=Merakit 3=Finishing 4= Everything 5=Component and assembly (unfinished) 6=Assembly and finishing 7 = Components & finishing 8= brokering/ trading/ marketing	Check furniture types															Wood (see code)			If part of the construction is contracted to other artisans, at what cost? Rp	If part of the assembly is contracted to other artisans, at what cost? Rp	Is the product finished when sold? (Y/T)	If finishing is contracted to other artisans, at what cost? Rp	Total production in time period	Price per unit (Rp/ Unit)	Total (Rp)
	1= pieces 2= set 3=Furniture components 4= Container 20ft 5= Container 40ft 6= Container 40HC 7= Truck 8 = Pickup		i. Outdoor Chair	ii. Outdoor Table	iii. Indoor Chair	iv. Indoor Table	v. Patio Umbrella	vi. Wardrobe/Cabinet	vii. Bed	viii. Carved crafts & calligraphy	ix. Decoration/ornament	x. Vanity table	xi. Room divider	xii. Relief	xiii. Fumiture parts	xiv. Other furniture	xv. other (specify)	Type of wood	Wood Source	Wood Source (location)							
1																											
2																											
3																											
4																											
5																											
6																											
7																											

A. Type of wood		B. Wood source	C. Wood source (location)	
1. Teak	6. Sonokoling	1. Perhutani/TPK	1.Jepara	6. East Java
2. Durian	7. Mango	2. Community forestry	2.Central Java	7. Import
3. Old teak (*disassembled*)	8. Oak wood	3. Private estates	3. Other	
4. Trembesi	9. Coconut	4. From buyer	4. West Java	
5. Mahogany	10. Other, specify	5. Import	5. Sulawesi	

Table VII.2 Product seasonality: *Write the number of products manufactured each month and whether the month was low, high, or normal season*

August		September		October		November		December		January		February		March		April		May		June		July		Unit
Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	Season	Number of Products	1= piece 2 = set 3 = container 20ft 4= container 40ft 5= container 40HC

Season:
1= Low Season
2= Normal/ average
3= High season

Other revenues July 2014-June 2015

1. Revenues workshop Rp _____
2. Revenues showroom/ Toko Mebel Rp _____
3. Oms Revenues et logpark/ TPK Rp _____
4. Revenues Oven/ Pengeringan Rp _____
5. Revenues penggergajian Rp _____

VIII. Inputs

Table VIII.1Wood purchase time frame week____, month_____ or year____)

	A	B	C	D	E	F	G	H	I	J		K	
	Type of wood (see code)	Source of raw materials?	Source of raw materials (location)?	Are the raw materials SVLK certified?	Quantity	Unit 1= m^3 2= truck 3= pick up 4 =bilah 5=volume 6 = Other	Price per unit	Bentuk kayu 1=plank/ kayu gergajian 2=kayu bulat 3=borongan 4= lainnya, sebutkan	Total spent (Rp)	If purchased in the form of log/timber, what are sawmill costs? What is an estimate of these costs if they saw in-house Rp	Mark if sawmill in-house	Cost of drying kiln if dried before assembly (if own kiln what is an estimate of the cost)?	Check if firm has own drying kiln
1													
2													
3													

4													
5													

A. Type of wood		B. Wood source	C. Wood source (location)	
1. Teak	6. Sonokoling	6. Perhutani/TPK	1.Jepara	6. East Java
2. Durian	7. Mango	7. Community forestry	2.Central Java	7. Import
3. Old teak (*disassembled*)	8. Oak wood	8. Private estates	3. Other	
4. Trembesi	9. Coconut	9. From buyer	4. West Java	
5. Mahogany	10. Other, specify	10. Import	5. Sulawesi	

See table VIII.1

Table VIII.2 Workers

	Number of Workers	Number of female workers	Number of male workers	Amount paid to female workers	Number of workers with SMK Carving degree	Number of workers with SMK/SMT or SMA (high school level) degrees
During May 2015						
During the year						

Table VIII.3: Other inputs in May

		A	B	C	D	E
		Jumlah yang digunakan berdasarkan dalam bulan Mei 2015	Dicatat pada bulan Mei 2015	Unit	Harga per unit (Rp/ Unit)	Total (Rp)
1	Fuel					
2	Diesel Fuel					
3	Electricity					
4	Transportation (for transporting wood purchased, finished products, product showroom, etc.)					
5	Paint/finish/melamine					
6	Other					

Total cost of product sold in **the firm's showroom** that are not produced in the firm's own workshop Rp_____

IX. Loans and Credit

Table IX. Loans taken out over the last 6 years

	A	B	C	D	E	F	G	H
	Source of loan	Year	Purpose	Interest	Interest 1=Monthly 2=Yearly	The amount borrowed (Rp)	Total paid (Rp)	Amount for each installment (Rp)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

(A) Loan source

1. Bank
2. APKJ cooperation
3. Other cooperation
4. Credit Card
5. Business micro-credit
6. Input loan from suppliers
7. Loan from Buyer
8. Private moneylenders
9. Family/friends
10. Pawnshop
11. Other source

(C) Purpose of loan

1. Family/private
2. Capital for business
3. Transportation
4. Machines
5. Building

X. Capital Assets

Table X.1: Machines currently owned (and those owned in 2009 not currently owned)

	A	B	C	D	E
	Machines category	Year of acquisition/purchase	Price (Rp)	Still owned? Check if yes	If not owned currently, how was the machine

					discarded of (sold, thrown out, given away)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Table **Kategori mesin: (1)** Gergaji Selendang; (2) Amplas mesin/ (3) Gerinda; (4) Bor; (5) Spindel; (6) Bengkok + kikir; (7) circle saw/ gergaji piringan; (8) Mesin 1 paket (bobok, pasah, bor, cerke, gergaji bengkok); (9) Profil; (10) Kompresor; (11); gergaji tangan; (12) Planner; (13) lainnya

	A	B	C	D	E
1	Transportation category (see code)	Year of acquisition/purchase	Price (Rp)	Still owned? Check if yes	If not owned currently, how was the mode of transport discarded of (sold, thrown out, given away)
2					
3					
4					
5					
6					
7					
8					
9					
10					

(A) Code

1. Pick up
2. Truck
3. Motor bike
4. Car
5. Other

XI. Participation in Training Sessions

Table XI.1: Training Sessions

		A	B	C
1	Pelatihan	Please mark if a representative of the business participated	Did you apply what you learned in this training session? *Mark if yes*	What, if anything, did you gain from this training session?
2	Quality control: (a) quality standards, (b) wood-drying techniques, (c) making simple drying kilns (8 April 2010)			
3	Financial management: (a) accessing and managing bank loans, (b) calculating costs, (c) managing financial matters (9 April 2010)			
4	Chain of custody certification (27–29 July 2010)			
5	Exhibition management (28 September 2010)			
6	Management and motivation training for small-scale furniture producers (3–4 October 2010)			
7	Furniture finishing and entrepreneurialism (11–12 May 2011)			
8	Training on design development			

	(18–22 July 2011)			
9	Training on exhibition preparation (October 2011)			
10	Entrepreneurialism for women (15–16 November 2011)			
11	Marketing assistance for SMEs in Jepara and financial management and funding (26 November, 17 December 2011)			
12	Carving and design training for women (28 February, 1 March 2012)			
13	Wood preservation training (8–9 March 2012)			
14	Image editing (18 April 2012)			
15	SVLK training (19–20 February 2012, 27–29 April, May 2012)			
16	Training on production: Tools (JIG) for spindle moulder and circular saw (30 June–1 July 2012)			
17	Improving performance of the furniture and timber industry in Central Java (19 July 2012)			
18	Training in kilns and drying (24 September 2012)			
19	Furniture design training (17–29 October 2012)			

Table XI.2: Other training sessions

Describe any training sessions attended in the last 6 years

	A	B	C	D
	Date	Topic	Sponsor	Location
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Appendix B: Balance Tests

T-tests for equality of means is conducted by the command "pstest," which is used after implementing propensity score matching with the command "psmatch2" (Leuven and Sianesi, 2003b). The t-tests compare the covariate means in the matched sample.

Percent standardized bias, which standardizes the differences in covariate means of two groups in order to be compared, is calculated using the formula below:

$$(1)\ \mathrm{SB} = \frac{100*(\overline{x_t}-\overline{x_c})}{\sqrt{\frac{s_t^2+s_c^2}{2}}}$$

Where $\overline{x_t}$ ($\overline{x_c}$) and s_t (s_c) are the mean and variance of the treated (control) groups. Low standardized biases reflect good covariate balance. However, there is little formal guidance or consensus on what constitutes an acceptable percent standardized bias. Normand et al. (2001) implies that standardized biases lower than 10% are satisfactory, while Rosenbaum and Rubin (1985) suggest that higher than 20% is concerning. Percent Standardized bias was obtained using the command "teffects summarize" after propensity score matching with "teffects psmatch."

Variance ratios, the mean ratios of a covariates' variance in the treated and untreated groups, allow the researcher to evaluate the similarity of the distributions of covariates in for treated and untreated groups after matching (Austin, 2009). The closer that variance ratios are to unity, the more similar the distributions of covariates in treated and untreated groups. Variance ratios were obtained through the "teffects summarize" command

Table B1: Comparison of balance measures of three matching methods

	Nearest Neighbor Matching								
	1 Nearest Neighbor						5 Nearest Neighbors		
	Caliper			No Caliper			No Caliper		
Covariate Name	p>|t|	% Bias	Variance Ratio	p>|t|	Percent Bias	Variance Ratio	p>|t|	Percent Bias	Variance Ratio
_09_oth_org_total	1.00	0%	1.00	1.00	0%	1.00	0.41	13%	1.95
machinescore	0.26	-19%	1.14	0.16	-23%	1.17	0.99	0%	1.27
_09_brokering	0.16	24%	.	0.16	19%	.	0.16	22%	.
finishing_1	0.06	33%	1.71	0.00	43%	2.13	0.56	9%	1.10
contract_out_1	0.04	34%	.	0.25	15%	2.41	0.59	-8%	0.75

Table B1: Comparison of balance measures of three matching methods

	Nearest Neighbor Matching								
	1 Nearest Neighbor						5 Nearest Neighbors		
	Caliper			No Caliper			No Caliper		
_09_teak_pct	0.54	-10%	1.03	0.48	12%	0.99	0.08	-28%	1.32
teak_tpk	1.00	0%	1.00	0.21	19%	1.10	0.48	-11%	0.98
_09_mahoni_pct	0.56	10%	1.14	0.17	-23%	0.89	0.33	15%	1.48
mahoni_tpk	0.02	38%	3.24	0.16	22%	1.71	0.66	7%	1.15
im_ornamen_dekorasi	0.16	24%	.	0.41	14%	1.95	0.45	-12%	0.64
im_kerajinan_kaligrafi	0.52	11%	1.46	0.50	13%	1.25	0.93	1%	1.03
im_sketsel	0.41	14%	1.94	0.55	10%	1.36	0.64	-7%	0.81
im_relief	0.08	29%	.	0.41	14%	1.95	0.45	-12%	0.64
im_parts_komponen_mebel	1.00	0%	1.00	0.41	14%	1.95	0.35	-14%	0.59
mebel_basic	0.56	10%	0.51	0.31	-13%	2.93	0.20	-20%	4.86
batealit	0.67	-7%	0.89	0.02	-43%	0.60	0.59	-8%	0.85
jepara	0.48	12%	1.27	0.84	-4%	0.95	0.52	10%	1.22
kedung	0.77	-5%	0.87	0.12	21%	2.50	0.21	20%	2.01
mlonggo	0.84	-3%	0.95	0.28	16%	1.40	0.68	6%	1.12
pakisaji	1.00	0%	1.00	0.23	18%	1.60	0.10	26%	2.04
tahunan	0.83	-4%	0.94	0.71	-5%	0.93	0.56	-9%	0.89
_09_cbn_otsh	0.74	6%	1.02	0.76	-5%	0.99	0.74	-5%	0.99
_09_cbn_dir	0.22	21%	1.15	0.53	10%	1.06	0.62	-8%	0.97
_09_cbn_online	1.00	0%	1.00	0.18	22%	3.86	0.08	27%	9.57
_09_cbn_brok	0.30	17%	1.30	0.07	26%	1.47	0.29	16%	1.21
_09_cbn_exh	1.00	0%	1.00	0.05	33%	3.71	0.92	-2%	0.96
_09_cbn_exp	0.61	-9%	1.04	0.64	-7%	1.04	0.93	1%	0.99
_09_cbn_sub	0.87	3%	1.01	0.35	-15%	0.96	0.35	-14%	0.96
_09_worker_avg	0.85	3%	0.49	0.91	-2%	0.47	0.81	-4%	0.49

Table B1: Comparison of balance measures of three matching methods

	Nearest Neighbor Matching								
	1 Nearest Neighbor						5 Nearest Neighbors		
	Caliper			No Caliper			No Caliper		
_09_totalm2_workshop _sum	0.90	-2%	0.64	0.42	-14%	0.69	0.99	0%	0.81
_09_total_workshop	0.32	-17%	1.03	0.66	-6%	.	0.73	-5%	25.00
_09_total _showroom	0.25	19%	2.39	0.05	25%	3.71	0.06	29%	3.38
_09_otherunits	0.55	10%	1.20	0.21	22%	1.57	0.35	15%	1.39
edu_sd	0.53	11%	1.19	0.56	-8%	0.87	0.70	-6%	0.91
edu_smp	0.72	6%	1.06	0.48	11%	1.14	0.55	9%	1.11
edu_stmsmk	1.00	0%	1.00	1.00	0%	1.00	0.92	-1%	0.92
edu_sma	0.48	-12%	0.91	0.73	6%	1.06	0.69	-6%	0.95
edu_high	0.65	-8%	0.86	0.86	-4%	0.96	0.71	6%	1.08
owner_age	0.92	2%	0.80	0.06	-30%	0.86	0.96	1%	0.88
Mean Bias	11.09%			15.40%			10.31%		
Median Bias	9.74%			12.78%			8.44%		

Source: 2015 Firm Survey

Appendix C: Stata Code

Section 1 : Profit Estimation

Production (revenues)

```
*Avgprice*
	egen avgprice1=rowmean(harganya_normal_01 harganya_low_01 harganya_high_01 harganya_4_01 harganya_5_01 harganya_6_01)
	forvalues i=02/04{
	egen avgprice`i'=rowmean(harganya_normal_0`i' harganya_low_0`i' harganya_high_0`i')
	}
```

```
	egen avgprice5=rowmean(harganya_normal_05 harganya_low_05 harganya_high_05 harganya_4_05)
	egen avgprice6=rowmean(harganya_normal_06 harganya_low_06 harganya_high_06)
	forvalues i=07/09{
	gen avgprice`i'=harganya_normal_0`i'
	}
	forvalues i=10/15{
	gen avgprice`i'=harganya_normal_`i'
	}
	//exceptions
	replace avgprice1=( harganya_low_01 + harganya_high_01)/2 if count_id==504
*Avgjumlah, total_rec, comp_prod
	egen avg_jumlah_prod_01=rowmean(jumlah_produksi_01 jum_prod_high jum_prod_low)
	egen avgprice_all=rowmean(avgprice*)
	*gen total_jumlah_no_dist (depends on case; should only exist for cases where distribution is not known)

	*replace compare_prod=total_rec-avg_prod_l if seasonality_tabel_produksi==1
	*replace compare_prod=total_rec-avg_prod_h if seasonality_tabel_produksi==3
	egen total_rec=rowtotal(avg_jumlah_prod_01 jumlah_produksi_02 jumlah_produksi_03 jumlah_produksi_04
jumlah_produksi_05 jumlah_produksi_06 jumlah_produksi_07 jumlah_produksi_08 jumlah_produksi_09 jumlah_produksi_10
jumlah_produksi_11 jumlah_produksi_12)

*avg_total_nijual_
	forvalues i=1/5{
	egen avg_total_nijual_0`i'=rowmean(total_nijual_0`i' total_nijual_low_0`i' total_nijual_high_0`i')
	}
*Roughrev_prod*
	gen roughrev_prod1=avgprice1*avg_jumlah_prod_01
	forvalues i=2/9{

	gen roughrev_prod`i'=avgprice`i'*jumlah_produksi_0`i'

	}

	forvalues i=10/11{
	gen roughrev_prod`i'=avgprice`i'*jumlah_produksi_`i'
```

```
        }
        gen roughrev_no_dist=total_jumlah_no_dist
        //exceptions
        replace roughrev_prod1 = avg_total_nijual_01 if roughrev_prod1==.
        replace roughrev_prod2 = avg_total_nijual_02 if roughrev_prod2==.
        replace roughrev_prod3 = avg_total_nijual_03 if roughrev_prod3==.
        replace roughrev_prod4 = avg_total_nijual_04 if roughrev_prod4==.
        replace roughrev_prod5 = avg_total_nijual_05 if roughrev_prod5==.
        replace roughrev_prod6 = total_nijual_06 if roughrev_prod6==.
        replace roughrev_prod7 = total_nijual_07 if roughrev_prod7==.
        replace roughrev_prod8 = total_nijual_08 if roughrev_prod8==.

        replace total_jumlah_no_dist=13 if count_id==459
        replace total_jumlah_no_dist=100 if count_id==332

        replace roughrev_no_dist=avgprice_all*total_jumlah_no_dist


*Roughrev_total
        egen roughrev_total=rowtotal(roughrev_prod* roughrev_no_dist)
        //exceptions
        replace roughrev_total=roughrev_prod1 if count_id==504
        replace roughrev_total=total_nijual_01 if count_id==554

*month_rev
        g month_rev=roughrev_total if time_frame_prod==2
        replace month_rev=roughrev_total*4 if time_frame_prod==1
        gen year_rev=roughrev_total if time_frame_prod==3
        label var year_rev "=roughrev_total if time_frame_prod==3"

        //exceptions
        replace month_rev=avg_total_nijual_01 if count_id==383
        replace month_rev=avg_total_nijual_01 if count_id==233
        replace month_rev= (avg_total_nijual_02 + roughrev_prod1)*4 if count_id==43
```

```
replace month_rev=avg_total_nijual_01 if count_id==383
```

Production costs

```
// construction costs
        *total
        forvalues i=1/7{
        gen biaya_kontruksi_total_0`i' = biaya_kontruksi_0`i' if total_2_0`i'==2
        }
        *per unit product 1
        replace biaya_kontruksi_total_01= biaya_kontruksi_01*avg_jumlah_prod_01  if total_2_01==1
        forvalues i=2/7{
        replace biaya_kontruksi_total_0`i' = biaya_kontruksi_0`i'*jumlah_produksi_0`i' if total_2_0`i'==1
        }
        *per unit
        forvalues i=2/7{
        replace biaya_kontruksi_total_0`i' = biaya_kontruksi_0`i'*jumlah_produksi_0`i' if total_2_0`i'==1
        }

//biaya_perakitan_total
        *total 1-9
        forvalues i=1/9{
        gen biaya_perakitan_total_0`i' = biaya_perakitan_0`i' if total_a_0`i'==2
        }
        *per unit product 1
        replace biaya_perakitan_01= biaya_perakitan_01*avg_jumlah_prod_01  if total_a_01==1
        *per unit 2-9
        forvalues i=2/9{
        replace biaya_perakitan_total_0`i' = biaya_perakitan_0`i'*jumlah_produksi_0`i' if total_a_0`i'==1
        }
        *total 10-12
        forvalues i=10/12{
        gen biaya_perakitan_total_`i' = biaya_perakitan_`i' if total_a_`i'==2
        }
```

```
        *Per unit 10-12
        forvalues i=10/12{
        replace biaya_perakitan_total_`i' = biaya_perakitan_`i'*jumlah_produksi_`i' if total_a_`i'==1
        }

//biaya_sanding_01
        *per unit product 1
        gen biaya_sanding_total_01= biaya_sanding_01*avg_jumlah_prod_01  if total_b_01==1
        *per unit product 2
        gen biaya_sanding_total_02= biaya_sanding_01*jumlah_produksi_02  if total_b_02==1
        *total product 1
        replace biaya_sanding_total_01= biaya_sanding_01 if total_a_01==2
        *total product 2
        replace biaya_sanding_total_02= biaya_sanding_01 if total_a_02==2

//biaya finishing
        *total products 1-4
        forvalues i=1/4{
        gen biaya_finishing_total_0`i' = biaya_finishing_dikontrakan_0`i' if total_c_0`i'==2
        }
        *per unit product 1
        replace biaya_finishing_total_01= biaya_finishing_dikontrakan_01*avg_jumlah_prod_01 if total_c_01==1
        *per unit products 2-4
        forvalues i=2/4{
        replace biaya_finishing_total_0`i' = biaya_finishing_dikontrakan_0`i'*jumlah_produksi_0`i' if total_c_0`i'==1
        }
        *total products 2-4
        forvalues i=2/4{
        replace biaya_finishing_total_0`i' = biaya_finishing_dikontrakan_0`i' if total_c_0`i'==2
        }
        //no biaya_finishing_dikontrakan_05
        *total products 6-7
        forvalues i=6/7{
```

```
gen biaya_finishing_total_0`i' = biaya_finishing_dikontrakan_0`i' if total_c_0`i'==2
}
*Per unit products 6-7
forvalues i=6/7{
replace biaya_finishing_total_0`i' = biaya_finishing_dikontrakan_0`i'*jumlah_produksi_0`i' if total_c_0`i'==1
}
*Per unit product 1

replace biaya_finishing_total_01= biaya_finishing_dikontrakan_01*avg_jumlah_prod_01 if total_c_01==1

*Total products 6-7

forvalues i=6/7{
replace biaya_finishing_total_0`i' = biaya_finishing_dikontrakan_0`i' if total_c_0`i'==2
}


//produksi_costs_0
*prod costs 1-2
forvalues i=1/2{
egen produksi_costs_0`i' = rowtotal(biaya_finishing_total_0`i' biaya_sanding_total_0`i' biaya_perakitan_total_0`i'
biaya_kontruksi_total_0`i')

}

*prod costs 3-4
forvalues i=3/4{
egen produksi_costs_0`i' = rowtotal(biaya_finishing_total_0`i' biaya_perakitan_total_0`i' biaya_kontruksi_total_0`i')
}
*prod costs 5
egen produksi_costs_05 = rowtotal( biaya_perakitan_total_05 biaya_kontruksi_total_05)
*prod costs 6-7
forvalues i=6/7{
egen produksi_costs_0`i' = rowtotal(biaya_finishing_total_0`i' biaya_perakitan_total_0`i' biaya_kontruksi_total_0`i')
}
*prod costs 8-9
forvalues i=8/9{
```

```
egen produksi_costs_0`i' = rowtotal( biaya_perakitan_total_0`i')
}
*prod costs 10-12
forvalues i=10/12{
egen produksi_costs_`i' = rowtotal (biaya_perakitan_total_`i' )
}

//Produksi costs no jumlah
//Produksi
forvalues i=1/7{
gen perunit_konstruksi_0`i'=biaya_kontruksi_0`i' if total_2_01==1
}
egen avg_perunit_konstruksi=rowmean ( perunit_konstruksi_0*)
gen total_konstruksi_nodist=total_jumlah_no_dist*avg_perunit_konstruksi

//perakitan
forvalues i=2/9{

gen perunit_biaya_perakitan_0`i' = biaya_perakitan_0`i' if total_a_0`i'==1

}

forvalues i=10/12{

gen perunit_biaya_perakitan_`i' = biaya_perakitan_`i' if total_a_`i'==1

}

egen avg_perunit_perakitan=rowmean ( perunit_biaya_perakitan_0*)

gen total_perakitan_nodist=total_jumlah_no_dist*avg_perunit_perakitan


//sanding

gen perunit_sanding_01= biaya_sanding_01 if total_b_01==1
gen perunit_sanding_02= biaya_sanding_02 if total_b_02==2
```

```
egen avg_perunit_sanding=rowmean ( biaya_sanding_0*)
gen total_sanding_nodist=total_jumlah_no_dist*avg_perunit_sanding

//finishing
forvalues i=1/4{
gen perunit_finishing_0`i' = biaya_finishing_dikontrakan_0`i' if total_c_0`i'==1
}
forvalues i=6/7{
gen perunit_finishing_0`i' = biaya_finishing_dikontrakan_0`i' if total_c_0`i'==1
}
egen avg_perunit_finishing=rowmean ( biaya_finishing_*)
gen total_finishing_nodist=total_jumlah_no_dist*avg_perunit_finishing

//produksi no distribution
egen total_produksi_no_dist= rowtotal(total_konstruksi_nodist total_perakitan_nodist total_sanding_nodist
total_finishing_nodist)

//Aggregate production costs
egen total_costs_prod=rowtotal(total_produksi_no_dist produksi_costs_* borongan)
gen total_costs_prod_mo= total_costs_prod if time_frame_prod==2
replace total_costs_prod_mo= total_costs_prod*4 if time_frame_prod==1
gen total_costs_prod_yr= total_costs_prod if time_frame_prod==3
replace total_costs_prod_yr= 76410714 if count_id==425
replace total_costs_prod_mo=. if count_id==425

**********************************************************************************
Wood Input Costs

//harga
egen avg_hargakayu_1= rowmean(harga_normal_1 harga_high_1 harga_low_1)
egen avg_hargakayu_2= rowmean(harga_normal_2 harga_high_2 harga_low_2)

//Kuantitas
```

```
egen avg_kuantitas_1= rowmean(kuantitas_normal_1 kuantitas_low_1 kuantitas_high_1)

//Oven
        *m3                     1
        *truck          2
        *pickup         3
        *bilah          4
        *borongan       5       (I considered it total)
        *piece          6
        *set            7
        *natural        8
        *other          9
        **********
        *m3                     1
        gen total_oven_1=biaya_oven_1*avg_kuantitas_1 if biaya_oven_unit_1==1
        gen total_oven_2=biaya_oven_2*kuantitas_normal_2 if biaya_oven_unit_2==1
        gen total_oven_3=biaya_oven_3*kuantitas_normal_3 if biaya_oven_unit_3==1
        *truck          2       made decision to assume total but IDK how much wood is in 1 truckload
        replace total_oven_1=biaya_oven_1 if biaya_oven_unit_1==2
        *borongan       5       (I considered it total)
        replace total_oven_1=biaya_oven_1 if biaya_oven_unit_1==5
        replace total_oven_3=biaya_oven_3 if biaya_oven_unit_3==5
        *piece          6
        replace total_oven_1=biaya_oven_1*jumlah_produksi_01 if biaya_oven_unit_1==6
        *other          9
        replace total_oven_1=biaya_oven_1*jumlah_produksi_01 if biaya_oven_unit_1==9
                *not sure why I made that decision
        //exceptions
```

```
replace total_oven_1=biaya_oven_1*avg_kuantitas_1 if count_id==509
replace total_oven_2=biaya_oven_2*kuantitas_normal_2 if count_id==509
replace total_oven_1=biaya_oven_1*avg_kuantitas_1 if count_id==578
replace total_oven_1=biaya_oven_1*avg_kuantitas_1 if count_id==509
replace total_oven_2=biaya_oven_2*kuantitas_normal_2 if count_id==509

//Sawmill 1
g total_bentuk_1=biaya_bentuk_log_1 if bentuk_log_unit_1==5
replace total_bentuk_1=biaya_bentuk_log_1*avg_kuantitas_1 if bentuk_log_unit_1==1

//exceptions
replace biaya_bentuk_log_1= 140000 if count_id==229
replace biaya_bentuk_log_1= 140000 if count_id==229
replace total_bentuk_1=biaya_bentuk_log_1 if count_id==229
replace total_bentuk_1=biaya_bentuk_log_1 if count_id==480|count_id==183|count_id==397
//Not sure about the pick up truck-how many pickup trucks is 7 m3 of wood?
//if the bed is 63 by 57.25 in. then there will be 12.6 m3 of room so I think I can assume that a truck bed is the total
replace total_bentuk_1=biaya_bentuk_log_1 if count_id==581
//I think for the 9's I can assume that id 480 it is per unit and for id 183 it is total
replace total_bentuk_1=biaya_bentuk_log_1 if count_id==183
replace total_bentuk_1=biaya_bentuk_log_1*kuantitas_normal_1 if count_id==581
replace total_bentuk_1=bentuk_log_unit_1*kuantitas_normal_1 if count_id==380


//*//*//*//*//*
replace avg_kuantitas_1=total_yang_dibayar_1/avg_hargakayu_1 if
count_id==531|count_id==167|count_id==50|count_id==334|count_id==385|count_id==525
//count_id=537 has quantity of 2-4
//*//*//*//*//*

//unit=9
replace total_bentuk_1=biaya_bentuk_log_1 if count_id==183
gen total_bentuk_2=biaya_bentuk_log_2 if count_id==183
replace total_bentuk_1=biaya_bentuk_log_1*avg_kuantitas_1 if count_id==397|count_id==480
```

```
		replace total_bentuk_1=biaya_bentuk_log_1 if count_id==298
		replace total_bentuk_2=biaya_bentuk_log_2 if count_id==480
	//Sawmill 2
		replace total_bentuk_2=biaya_bentuk_log_2*kuantitas_normal_2 if bentuk_log_unit_2==1
		replace total_bentuk_2=biaya_bentuk_log_2 if bentuk_log_unit_2==5
	//Sawmill 3
		gen total_bentuk_3=biaya_bentuk_log_3*kuantitas_normal_3 if bentuk_log_unit_3==1
		replace total_bentuk_3=biaya_bentuk_log_3 if bentuk_log_unit_3==5
	//Exceptions
		//476: bentuk unit is missing. I think it is per unit so I will multiply by kuantitas
		replace total_bentuk_2=biaya_bentuk_log_2*kuantitas_normal_2 if count_id==476
		//480 bentuk unit missing. Assume per unit.
		replace total_bentuk_2=biaya_bentuk_log_2*kuantitas_normal_2 if count_id==480
		//183 assume total
		replace total_bentuk_2=biaya_bentuk_log_2 if count_id==183
		//486 a challenge because there is harga per unit but quantity is missing
			//checked questionnaire	- 27 m3 must recalc avg_kuantitas forward

	//total_wood_cost 1-4
	gen total_wood_cost_1=avg_hargakayu_1*avg_kuantitas_1
	replace total_wood_cost_1= total_yang_dibayar_1 if total_wood_cost_1==.
	gen total_wood_cost_2= kuantitas_normal_2*avg_hargakayu_2
	replace total_wood_cost_2=total_yang_dibayar_2 if total_wood_cost_2==.
	gen total_wood_cost_3=kuantitas_normal_3*harga_normal_3
	replace total_wood_cost_3= total_yang_dibayar_3 if total_wood_cost_3==.
	gen total_wood_cost_4= kuantitas_normal_4*harga_normal_4
	replace total_wood_cost_4=total_yang_dibayar_4 if total_wood_cost_4==.

	// total wood costs all... by month... by year
	egen total_wood_costs_all= rowtotal(total_wood_cost_1 total_wood_cost_2 total_wood_cost_3 total_wood_cost_4
total_oven_1 total_oven_2 total_oven_3 total_bentuk_1 total_bentuk_2 total_bentuk_3)

	replace total_wood_costs_all=total_yang_dibayar_1 if count_id==237
```

```
replace total_wood_costs_all=total_yang_dibayar_1 + total_oven_1 + total_bentuk_1 if count_id==51

gen total_wood_costs_mo=total_wood_costs_all if time_frame_kayu==2
replace total_wood_costs_mo=total_wood_costs_all*4 if time_frame_kayu==1
gen total_wood_costs_yr=total_wood_costs_all if time_frame_kayu==3

//exceptions
replace total_wood_costs_yr=total_yang_dibayar_1 if count_id==574
```

Other Input Costs

```
*Bensin
gen avg_total_bensin=total_bensin
replace avg_total_bensin=jumlah_bensin*hpu_bensin_nor if total_bensin==.

gen month_bensin=avg_total_bensin if time_period_bensin==2
replace month_bensin=avg_total_bensin*4 if time_period_bensin==1
gen year_bensin=avg_total_bensin if time_period_bensin==3

*Solar
egen avg_total_solar= rowmean(total_solar total_solar_higi total_solar_low)
replace avg_total_solar=hpu_solar_normal*jumlah_solar if avg_total_solar==.

gen month_solar=avg_total_solar if time_period_solar==2
replace month_solar=avg_total_solar*4 if time_period_solar==1
gen year_solar=avg_total_solar if time_period_solar==3


*Listrik
gen calc_total_listrik_high=hpu_listrik_high*jumlah_listrik if total_listrik_high==.
gen calc_total_listrik=hpu_listrik_normal*jumlah_listrik if total_listrik==.
gen calc_total_listrik_low=hpu_listrik_low*jumlah_listrik if total_listrik_low==.
egen avg_total_listrik= rowmean(total_listrik total_listrik_high total_listrik_low calc_total_listrik_low calc_total_listrik
calc_total_listrik_high)
```

```
gen month_listrik=avg_total_listrik if time_period_listrik==2
replace month_listrik=avg_total_listrik*4 if time_period_listrik==1
gen year_listrik=avg_total_listrik if time_period_listrik==3

*Transportation
egen avg_total_trans=rowmean(total_transportasi total_trans_high total_trans_low)
replace avg_total_trans=hpu_transportasi_normal*jumlah_transportasi if avg_total_trans==.

gen month_trans=avg_total_trans if time_period_trans==2
replace month_trans=avg_total_trans*4 if time_period_trans==1
gen year_trans=avg_total_trans if time_period_trans==3

*Finish
gen avg_total_finish=total_finish
replace avg_total_finish=harga_per_uniy*jumlah_finishing if total_finish==.

gen  month_finish=avg_total_finish if time_period_finish==2
replace month_finish=avg_total_finish*4 if time_period_finish==1
gen year_finish=avg_total_finish if time_period_finish==3


//Aggregate other costs
egen total_costs_other= rowtotal(month_trans month_listrik month_solar month_bensin month_finish)
egen total_costs_other_yr= rowtotal(year_trans year_listrik year_solar year_finish)
```

Labor Input Costs

```
//Women
        egen avg_wage_f= rowmean (wage_f_normal_1 wage_f_high_1 wage_f_low_1)
        //by week per person
        gen month_wage_f=avg_wage_f*4 if dibayaran_per_1==2 & per_or_total_1==1
        //by week total jumlah
        replace month_wage_f=(avg_wage_f/jumlah_perempuan_1)*4 if dibayaran_per_1==2 & per_or_total_1==2
```

```
		//by day total jumlah
		replace month_wage_f=(avg_wage_f/jumlah_perempuan_1)*24 if dibayaran_per_1==1 & per_or_total_1==2
		//by day per person
		replace month_wage_f=(avg_wage_f)*24 if dibayaran_per_1==1 & per_or_total_1==1
		//by month total jumlah
		replace month_wage_f=avg_wage_f/jumlah_perempuan_1 if dibayaran_per_1==3 & per_or_total_1==2
		//by month per person
		replace month_wage_f=avg_wage_f if dibayaran_per_1==3 & per_or_total_1==1

	//MEN
		egen avg_wage_m= rowmean (wage_m_normal_1 wage_m_high_1 wage_m_low_1)

		//by week per person
		gen month_wage_m=avg_wage_m*4 if dibayaran_per_1==2 & per_or_total_1==1
		//by week total jumlah
		replace month_wage_m=(avg_wage_m/jumlah_laki_laki_1)*4 if dibayaran_per_1==2 & per_or_total_1==2
		//by day total jumlah
		replace month_wage_m=(avg_wage_m/jumlah_laki_laki_1)*24 if dibayaran_per_1==1 & per_or_total_1==2
		//by day per person
		replace month_wage_m=(avg_wage_m)*24 if dibayaran_per_1==1 & per_or_total_1==1
		//by month total jumlah
replace month_wage_m=avg_wage_m/jumlah_laki_laki_1 if dibayaran_per_1==3 & per_or_total_1==2
		//by month per person
	replace month_wage_m=avg_wage_m if dibayaran_per_1==3 & per_or_total_1==1

	//Neutral and production wages

gen prod_wage=total_rec*avg_wage_m if dibayaran_per_1==4 & avg_wage_m!=. & avg_wage_m!=0|dibayaran_per_1==5 &
avg_wage_m!=. & avg_wage_m!=0

replace prod_wage=avg_wage_m*(jumlah_laki_laki_1+jumlah_perempuan_1) if count_id==152

		gen prod_wage_mo=prod_wage if time_frame_prod==2

		replace prod_wage_mo=prod_wage*4 if time_frame_prod==1
```

//Missing women's wages

replace prop_replace_f_wage=.5443311*month_wage_m if avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==1 |avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==2 |avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==3

replace mean_replace_f_wage=822654.2 if avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==1 |avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==2 |avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==3

replace prop_mode_replace_f_wage=.4761905 *month_wage_m if avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==1 |avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==2 |avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==3

replace total_wage_f_missing_propmean=prop_replace_f_wage*jumlah_perempuan_1

replace total_wage_f_missing_propmode=prop_mode_replace_f_wage*jumlah_perempuan_1

replace total_wage_f_missing_mean=745310.7*jumlah_perempuan_1 if avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==1 |avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==2 |avg_wage_f==. & jumlah_perempuan_1!=. & jumlah_perempuan_1!=0 & dibayaran_per_1==3

sum month_wage_f, detail

*IQR 266666.7

*Upper bound 1266666.75

*Lower bound -199999.95

sum month_wage_f if month_wage_f<1266666.75, detail

*mean: 745310.7

//Aggregate wages further

gen total_wage_f=month_wage_f*jumlah_perempuan_1

gen total_wage_m=month_wage_m*jumlah_laki_laki_1

egen total_labor_mo = rowtotal (total_dibayar_pekerja_1 prod_wage_mo total_wage_m total_wage_f total_wage_f_missing_mean)

//Total Costs

```
*drop total_costs_mo total_costs_yr

egen total_costs_mo=rowtotal( total_labor_mo  total_wood_costs_mo total_costs_other total_costs_prod_mo)

egen total_costs_yr=rowtotal(total_wood_costs_yr total_costs_other_yr total_costs_prod_yr)

egen total_costs_mo_nl_nw=rowtotal(total_costs_other total_costs_prod_mo)

//Seasonality

gen augprod_n=augprod if aug123==2
gen sepprod_n=sepprod if sep123==2
gen octprod_n=octprod if oct123==2
gen novprod_n=novprod if nov123==2
gen decprod_n=decprod if dec123==2
gen janprod_n=janprod if jan123==2
gen febprod_n=febprod if feb123==2
gen marprod_n=marprod if mar123==2
gen aprprod_n=aprprod if apr123==2
gen mayprod_n=mayprod if may123==2
gen junprod_n=junprod if jun123==2
gen julprod_n=julprod if jul123==2

replace augprod_l=augprod if aug123==1
replace sepprod_l=sepprod if sep123==1
replace octprod_l=octprod if oct123==1
replace novprod_l=novprod if nov123==1
replace decprod_l=decprod if dec123==1
replace janprod_l=janprod if jan123==1
replace febprod_l=febprod if feb123==1
replace marprod_l=marprod if mar123==1
replace aprprod_l=aprprod if apr123==1
replace mayprod_l=mayprod if may123==1
replace junprod_l=junprod if jun123==1
replace julprod_l=julprod if jul123==1
```

```
replace augprod_h=augprod if aug123==3
replace sepprod_h=sepprod if sep123==3
replace octprod_h=octprod if oct123==3
replace novprod_h=novprod if nov123==3
replace decprod_h=decprod if dec123==3
replace janprod_h=janprod if jan123==3
replace febprod_h=febprod if feb123==3
replace marprod_h=marprod if mar123==3
replace aprprod_h=aprprod if apr123==3
replace mayprod_h=mayprod if may123==3
replace junprod_h=junprod if jun123==3
replace julprod_h=julprod if jul123==3


egen avg_prod_h=rowmean(augprod_h-julprod_h)
egen avg_prod_l=rowmean(augprod_l-julprod_l)
egen avg_prod_n=rowmean(augprod_n-julprod_n)


*Monthly scale
gen aug_scale=augprod/avg_prod_n if seasonality_tabel_produksi==2
gen sep_scale=sepprod/avg_prod_n if seasonality_tabel_produksi==2
gen oct_scale=octprod/avg_prod_n if seasonality_tabel_produksi==2
gen nov_scale=novprod/avg_prod_n if seasonality_tabel_produksi==2
gen dec_scale=decprod/avg_prod_n if seasonality_tabel_produksi==2
gen jan_scale=janprod/avg_prod_n if seasonality_tabel_produksi==2
gen feb_scale=febprod/avg_prod_n if seasonality_tabel_produksi==2
gen mar_scale=marprod/avg_prod_n if seasonality_tabel_produksi==2
gen apr_scale=aprprod/avg_prod_n if seasonality_tabel_produksi==2
gen may_scale=mayprod/avg_prod_n if seasonality_tabel_produksi==2
gen jun_scale=junprod/avg_prod_n if seasonality_tabel_produksi==2
gen jul_scale=julprod/avg_prod_n if seasonality_tabel_produksi==2
```

```
replace aug_scale=augprod/avg_prod_h if seasonality_tabel_produksi==3
replace sep_scale=sepprod/avg_prod_h if seasonality_tabel_produksi==3
replace oct_scale=octprod/avg_prod_h if seasonality_tabel_produksi==3
replace nov_scale=novprod/avg_prod_h if seasonality_tabel_produksi==3
replace dec_scale=decprod/avg_prod_h if seasonality_tabel_produksi==3
replace jan_scale=janprod/avg_prod_h if seasonality_tabel_produksi==3
replace feb_scale=febprod/avg_prod_h if seasonality_tabel_produksi==3
replace mar_scale=marprod/avg_prod_h if seasonality_tabel_produksi==3
replace apr_scale=aprprod/avg_prod_h if seasonality_tabel_produksi==3
replace may_scale=mayprod/avg_prod_h if seasonality_tabel_produksi==3
replace jun_scale=junprod/avg_prod_h if seasonality_tabel_produksi==3
replace jul_scale=julprod/avg_prod_h if seasonality_tabel_produksi==3


replace aug_scale=augprod/avg_prod_l if seasonality_tabel_produksi==1
replace sep_scale=sepprod/avg_prod_l if seasonality_tabel_produksi==1
replace oct_scale=octprod/avg_prod_l if seasonality_tabel_produksi==1
replace nov_scale=novprod/avg_prod_l if seasonality_tabel_produksi==1
replace dec_scale=decprod/avg_prod_l if seasonality_tabel_produksi==1
replace jan_scale=janprod/avg_prod_l if seasonality_tabel_produksi==1
replace feb_scale=febprod/avg_prod_l if seasonality_tabel_produksi==1
replace mar_scale=marprod/avg_prod_l if seasonality_tabel_produksi==1
replace apr_scale=aprprod/avg_prod_l if seasonality_tabel_produksi==1
replace may_scale=mayprod/avg_prod_l if seasonality_tabel_produksi==1
replace jun_scale=junprod/avg_prod_l if seasonality_tabel_produksi==1
replace jul_scale=julprod/avg_prod_l if seasonality_tabel_produksi==1


replace sep_scale=0 if sepprod==0
replace oct_scale=0 if octprod==0
replace nov_scale=0 if novprod==0
replace dec_scale=0 if decprod==0
replace jan_scale=0 if janprod==0
replace feb_scale=0 if febprod==0
```

```
        replace mar_scale=0 if marprod==0
        replace apr_scale=0 if aprprod==0
        replace may_scale=0 if mayprod==0
        replace jun_scale=0 if junprod==0
        replace jul_scale=0 if julprod==0

//Labor Scale

replace seasonal_labor=1 if _15_worker_ramai!=_15_worker_normal & _15_worker_ramai!=. & _15_worker_normal!=.
|_15_worker_sepi!=_15_worker_normal & _15_worker_sepi!=. & _15_worker_normal!=.

replace seasonal_labor=0 if _15_worker_ramai==_15_worker_normal & _15_worker_normal==_15_worker_sepi
label var seasonal_labor_yn "Whether there are seasonal differences in labor; 1=yes"

egen total_workers=rowtotal(jumlah_tenaga_kerja_1 jumlah_tenaga_kerja_2)
replace season_labor_table = 1 if total_workers==_15_worker_sepi
replace season_labor_table = 2 if total_workers==_15_worker_normal
replace season_labor_table = 3 if total_workers==_15_worker_ramai
replace season_labor_table = 2 if total_workers==_15_worker_normal==_15_worker_sepi==_15_worker_ramai
        label var season_labor_table "The season that the worker table fits with based on _15_worker_normal _15_worker_sepi
_15_worker_ramai"

        replace season_labor_table = 2 if count_id==249
        replace season_labor_table = 2 if count_id==303
        replace season_labor_table = 2 if count_id==374
        replace season_labor_table = 2 if count_id==489
        replace season_labor_table = 2 if count_id==513
        replace season_labor_table = 2 if count_id==513
        replace season_labor_table = 3 if count_id==523
        replace season_labor_table = 2 if count_id==65
        replace season_labor_table = 2 if count_id==434
        replace season_labor_table = 2 if count_id==464

gen ltn=_15_worker_normal/_15_worker_sepi
```

```
gen lth=_15_worker_ramai/_15_worker_sepi

gen ntl=_15_worker_sepi/_15_worker_normal
gen nth=_15_worker_ramai/_15_worker_normal

gen htl=_15_worker_sepi/_15_worker_ramai
gen htn=_15_worker_normal/_15_worker_ramai

//August
gen aug_labor_scale=1 if season_labor_table==1 & aug123==1
replace aug_labor_scale=ntl if season_labor_table==2 & aug123==1
replace aug_labor_scale=htl if season_labor_table==3 & aug123==1

replace aug_labor_scale=ltn if season_labor_table==1 & aug123==2
replace aug_labor_scale=1 if season_labor_table==2 & aug123==2
replace aug_labor_scale=htn if season_labor_table==3 & aug123==2


replace aug_labor_scale=lth if season_labor_table==1 & aug123==3
replace aug_labor_scale=nth if season_labor_table==2 & aug123==3
replace aug_labor_scale=1 if season_labor_table==3 & aug123==3
**********
//September
gen sep_labor_scale=1 if season_labor_table==1 & sep123==1
replace sep_labor_scale=ntl if season_labor_table==2 & sep123==1
replace sep_labor_scale=htl if season_labor_table==3 & sep123==1


replace sep_labor_scale=ltn if season_labor_table==1 & sep123==2
replace sep_labor_scale=1 if season_labor_table==2 & sep123==2
replace sep_labor_scale=htn if season_labor_table==3 & sep123==2

replace sep_labor_scale=lth if season_labor_table==1 & sep123==3
replace sep_labor_scale=nth if season_labor_table==2 & sep123==3
```

```
replace sep_labor_scale=1 if season_labor_table==3 & sep123==3
************************
//October
gen oct_labor_scale=1 if season_labor_table==1 & oct123==1
replace oct_labor_scale=ntl if season_labor_table==2 & oct123==1
replace oct_labor_scale=htl if season_labor_table==3 & oct123==1

replace oct_labor_scale=ltn if season_labor_table==1 & oct123==2
replace oct_labor_scale=1 if season_labor_table==2 & oct123==2
replace oct_labor_scale=htn if season_labor_table==3 & oct123==2

replace oct_labor_scale=lth if season_labor_table==1 & oct123==3
replace oct_labor_scale=nth if season_labor_table==2 & oct123==3
replace oct_labor_scale=1 if season_labor_table==3 & oct123==3
*****************************
//November
gen nov_labor_scale=1 if season_labor_table==1 & nov123==1
replace nov_labor_scale=ntl if season_labor_table==2 & nov123==1
replace nov_labor_scale=htl if season_labor_table==3 & nov123==1

replace nov_labor_scale=ltn if season_labor_table==1 & nov123==2
replace nov_labor_scale=1 if season_labor_table==2 & nov123==2
replace nov_labor_scale=htn if season_labor_table==3 & nov123==2

replace nov_labor_scale=lth if season_labor_table==1 & nov123==3
replace nov_labor_scale=nth if season_labor_table==2 & nov123==3
replace nov_labor_scale=1 if season_labor_table==3 & nov123==3
*****************************
////December
gen dec_labor_scale=1 if season_labor_table==1 & dec123==1
replace dec_labor_scale=ntl if season_labor_table==2 & dec123==1
replace dec_labor_scale=htl if season_labor_table==3 & dec123==1
```

```
replace dec_labor_scale=ltn if season_labor_table==1 & dec123==2
replace dec_labor_scale=1 if season_labor_table==2 & dec123==2
replace dec_labor_scale=htn if season_labor_table==3 & dec123==2

replace dec_labor_scale=lth if season_labor_table==1 & dec123==3
replace dec_labor_scale=nth if season_labor_table==2 & dec123==3
replace dec_labor_scale=1 if season_labor_table==3 & dec123==3
**************************
////January
gen jan_labor_scale=1 if season_labor_table==1 & jan123==1
replace jan_labor_scale=ntl if season_labor_table==2 & jan123==1
replace jan_labor_scale=htl if season_labor_table==3 & jan123==1

replace jan_labor_scale=ltn if season_labor_table==1 & jan123==2
replace jan_labor_scale=1 if season_labor_table==2 & jan123==2
replace jan_labor_scale=htn if season_labor_table==3 & jan123==2

replace jan_labor_scale=lth if season_labor_table==1 & jan123==3
replace jan_labor_scale=nth if season_labor_table==2 & jan123==3
replace jan_labor_scale=1 if season_labor_table==3 & jan123==3

**************************
////February
gen feb_labor_scale=1 if season_labor_table==1 & feb123==1
replace feb_labor_scale=ntl if season_labor_table==2 & feb123==1
replace feb_labor_scale=htl if season_labor_table==3 & feb123==1

replace feb_labor_scale=ltn if season_labor_table==1 & feb123==2
replace feb_labor_scale=1 if season_labor_table==2 & feb123==2
replace feb_labor_scale=htn if season_labor_table==3 & feb123==2

replace feb_labor_scale=lth if season_labor_table==1 & feb123==3
replace feb_labor_scale=nth if season_labor_table==2 & feb123==3
```

```
replace feb_labor_scale=1 if season_labor_table==3 & feb123==3
**************************
//March
gen mar_labor_scale=1 if season_labor_table==1 & mar123==1
replace mar_labor_scale=ntl if season_labor_table==2 & mar123==1
replace mar_labor_scale=htl if season_labor_table==3 & mar123==1

replace mar_labor_scale=ltn if season_labor_table==1 & mar123==2
replace mar_labor_scale=1 if season_labor_table==2 & mar123==2
replace mar_labor_scale=htn if season_labor_table==3 & mar123==2

replace mar_labor_scale=lth if season_labor_table==1 & mar123==3
replace mar_labor_scale=nth if season_labor_table==2 & mar123==3
replace mar_labor_scale=1 if season_labor_table==3 & mar123==3
**************************
//April
gen apr_labor_scale=1 if season_labor_table==1 & apr123==1
replace apr_labor_scale=ntl if season_labor_table==2 & apr123==1
replace apr_labor_scale=htl if season_labor_table==3 & apr123==1

replace apr_labor_scale=ltn if season_labor_table==1 & apr123==2
replace apr_labor_scale=1 if season_labor_table==2 & apr123==2
replace apr_labor_scale=htn if season_labor_table==3 & apr123==2

replace apr_labor_scale=lth if season_labor_table==1 & apr123==3
replace apr_labor_scale=nth if season_labor_table==2 & apr123==3
replace apr_labor_scale=1 if season_labor_table==3 & apr123==3
**************************
//May
gen may_labor_scale=1 if season_labor_table==1 & may123==1
replace may_labor_scale=ntl if season_labor_table==2 & may123==1
replace may_labor_scale=htl if season_labor_table==3 & may123==1
```

```
replace may_labor_scale=ltn if season_labor_table==1 & may123==2
replace may_labor_scale=1 if season_labor_table==2 & may123==2
replace may_labor_scale=htn if season_labor_table==3 & may123==2

replace may_labor_scale=lth if season_labor_table==1 & may123==3
replace may_labor_scale=nth if season_labor_table==2 & may123==3
replace may_labor_scale=1 if season_labor_table==3 & may123==3
**************************
//June
gen jun_labor_scale=1 if season_labor_table==1 & jun123==1
replace jun_labor_scale=ntl if season_labor_table==2 & jun123==1
replace jun_labor_scale=htl if season_labor_table==3 & jun123==1

replace jun_labor_scale=ltn if season_labor_table==1 & jun123==2
replace jun_labor_scale=1 if season_labor_table==2 & jun123==2
replace jun_labor_scale=htn if season_labor_table==3 & jun123==2

replace jun_labor_scale=lth if season_labor_table==1 & jun123==3
replace jun_labor_scale=nth if season_labor_table==2 & jun123==3
replace jun_labor_scale=1 if season_labor_table==3 & jun123==3
**************************
//July
gen jul_labor_scale=1 if season_labor_table==1 & jul123==1
replace jul_labor_scale=ntl if season_labor_table==2 & jul123==1
replace jul_labor_scale=htl if season_labor_table==3 & jul123==1

replace jul_labor_scale=ltn if season_labor_table==1 & jul123==2
replace jul_labor_scale=1 if season_labor_table==2 & jul123==2
replace jul_labor_scale=htn if season_labor_table==3 & jul123==2

replace jul_labor_scale=lth if season_labor_table==1 & jul123==3
replace jul_labor_scale=nth if season_labor_table==2 & jul123==3
replace jul_labor_scale=1 if season_labor_table==3 & jul123==3
```

```
**************************
replace aug_labor=aug_labor_scale*total_labor
replace sep_labor=sep_labor_scale*total_labor
replace oct_labor=oct_labor_scale*total_labor
replace nov_labor=nov_labor_scale*total_labor
replace dec_labor=dec_labor_scale*total_labor
replace jan_labor=jan_labor_scale*total_labor
replace feb_labor=feb_labor_scale*total_labor
replace mar_labor=mar_labor_scale*total_labor
replace apr_labor=apr_labor_scale*total_labor
replace may_labor=may_labor_scale*total_labor
replace jun_labor=jun_labor_scale*total_labor
replace jul_labor=jul_labor_scale*total_labor

//Scale Exceptions
//531
        replace aug_scale=1 if count_id==531
        replace sep_scale=1 if count_id==531
        replace oct_scale=1 if count_id==531
        replace nov_scale=1 if count_id==531
        replace dec_scale=1 if count_id==531
        replace jan_scale=1 if count_id==531
        replace feb_scale=1 if count_id==531
        replace mar_scale=1 if count_id==531
        replace apr_scale=1 if count_id==531
        replace may_scale=1 if count_id==531
        replace jun_scale=1 if count_id==531
        replace jul_scale=1 if count_id==531
//464
replace aug_scale=1 if count_id==464
replace sep_scale=1 if count_id==464
replace oct_scale=1 if count_id==464
replace nov_scale=1 if count_id==464
```

```
replace dec_scale=1 if count_id==464
replace jan_scale=1 if count_id==464
replace feb_scale=1 if count_id==464
replace mar_scale=1 if count_id==464
replace apr_scale=1 if count_id==464
replace may_scale=1 if count_id==464
replace jun_scale=1 if count_id==464
replace jul_scale=1 if count_id==464


//449
replace aug_scale=1 if count_id==449
replace sep_scale=1 if count_id==449
replace oct_scale=1 if count_id==449
replace nov_scale=1 if count_id==449
replace dec_scale=1 if count_id==449
replace jan_scale=1 if count_id==449
replace feb_scale=1 if count_id==449
replace mar_scale=1 if count_id==449
replace apr_scale=1 if count_id==449
replace may_scale=1 if count_id==449
replace jun_scale=1 if count_id==449
replace jul_scale=1 if count_id==449

//523
replace aug_scale=1 if count_id==523
replace sep123=2 if count_id==523
replace sep_scale=1  if count_id==523
replace oct123 =2 if count_id==523
replace oct_scale =1 if count_id==523
replace nov123 =2 if count_id==523
replace nov_scale =1 if count_id==523
*******

replace dec123 =3 if count_id==523
```

```
replace dec_scale =1.5 if count_id==523
replace jan123 =3 if count_id==523
replace jan_scale =1.5 if count_id==523
replace feb123 =3 if count_id==523
replace feb_scale =1.5 if count_id==523
*********
replace mar123 =2 if count_id==523
replace mar_scale =1 if count_id==523
replace apr123 =2 if count_id==523
replace apr_scale =1 if count_id==523
replace may123 =2 if count_id==523
replace may_scale =1 if count_id==523
replace jun123 =2 if count_id==523
replace jun_scale=1 if count_id==523
replace jul123=2 if count_id==523
replace jul_scale=1 if count_id==523


//131
        replace sep_scale=1 if count_id==131
        replace oct_scale=1 if count_id==131
        replace nov_scale=1 if count_id==131
        replace dec_scale=1 if count_id==131
        replace jan_scale=1 if count_id==131
        replace feb_scale=1 if count_id==131
        replace mar_scale=1 if count_id==131
        replace apr_scale=1 if count_id==131
        replace may_scale=1 if count_id==131
        replace jun_scale=1 if count_id==131
        replace jul_scale=1 if count_id==131
//82
        replace aug_scale=1 if count_id==82
        replace sep_scale=1 if count_id==82
        replace oct_scale=1 if count_id==82
```

```
        replace nov_scale=1 if count_id==82
        replace dec_scale=1 if count_id==82
        replace jan_scale=1 if count_id==82
        replace feb_scale=1 if count_id==82
        replace mar_scale=1 if count_id==82
        replace apr_scale=1 if count_id==82
        replace may_scale=1 if count_id==82
        replace jun_scale=1 if count_id==82
        replace jul_scale=1 if count_id==82

//489
replace aug_scale=1 if count_id==489
replace sep123=2 if count_id==489
replace sep_scale=1  if count_id==489
replace oct123 =2 if count_id==489
replace oct_scale =1 if count_id==489
replace nov123 =2 if count_id==489
replace nov_scale =1 if count_id==489
replace dec123 =2 if count_id==489
replace dec_scale =1 if count_id==489
replace jan123 =2 if count_id==489
replace jan_scale =1 if count_id==489
replace feb123 =2 if count_id==489
replace feb_scale =1 if count_id==489
replace mar123 =2 if count_id==489
replace mar_scale =1 if count_id==489
replace apr123 =2 if count_id==489
replace apr_scale =1 if count_id==489
replace may123 =2 if count_id==489
replace may_scale =1 if count_id==489
replace jun123 =2 if count_id==489
replace jun_scale=1 if count_id==489
replace jul123=2 if count_id==489
```

replace jul_scale=1 if count_id==489

//504

replace aug_scale=1 if count_id==504
replace sep_scale=1 if count_id==504
replace oct_scale=1 if count_id==504
replace nov_scale=1 if count_id==504
replace dec_scale=1 if count_id==504
replace jan_scale=1 if count_id==504
replace feb_scale=1 if count_id==504
replace mar_scale=1 if count_id==504
replace apr_scale=1 if count_id==504
replace may_scale=1 if count_id==504
replace jun_scale=1 if count_id==504
replace jul_scale=1 if count_id==504

//538

replace aug_scale=1 if count_id==538
replace sep123=2 if count_id==538
replace sep_scale=1 if count_id==538
replace oct123 =2 if count_id==538
replace oct_scale =1 if count_id==538
replace nov123 =2 if count_id==538
replace nov_scale =1 if count_id==538
****
replace dec123 =3 if count_id==538
replace dec_scale =dec_labor_scale if count_id==538
replace jan123 =3 if count_id==538
replace jan_scale =jan_labor_scale if count_id==538
replace feb123 =3 if count_id==538
replace feb_scale =feb_labor_scale if count_id==538

****
replace mar123 =2 if count_id==538
replace mar_scale =1 if count_id==538
replace apr123 =2 if count_id==538
replace apr_scale =1 if count_id==538
replace may123 =2 if count_id==538
replace may_scale =1 if count_id==538
replace jun123 =2 if count_id==538
replace jun_scale=1 if count_id==538
replace jul123=2 if count_id==538
replace jul_scale=1 if count_id==538

//554

replace aug_scale=1 if count_id==554
replace sep_scale=1 if count_id==554
replace oct_scale=1 if count_id==554
replace nov_scale=1 if count_id==554
replace dec_scale=1 if count_id==554
replace jan_scale=1 if count_id==554
replace feb_scale=1 if count_id==554
replace mar_scale=1 if count_id==554
replace apr_scale=1 if count_id==554
replace may_scale=1 if count_id==554
replace jun_scale=1 if count_id==554
replace jul_scale=1 if count_id==554

//450

replace sep123=1 if count_id==450
replace sep_scale=sep_labor_scale if count_id==450
replace oct123 =1 if count_id==450
replace oct_scale=oct_labor_scale if count_id==450

****
replace nov123 =2 if count_id==450
replace novprod =40 if count_id==450
*****
replace dec123 =3 if count_id==450
replace dec_scale=dec_labor_scale if count_id==450
replace jan123 =3 if count_id==450
replace jan_scale=jan_labor_scale if count_id==450
replace feb123 =3 if count_id==450
replace feb_scale =feb_labor_scale if count_id==450
*****
replace mar123 =2 if count_id==450
replace marprod =40 if count_id==450
replace apr123 =2 if count_id==450
replace aprprod =40 if count_id==450
replace may123 =2 if count_id==450
replace mayprod =40 if count_id==450
replace jun123 =2 if count_id==450
replace junprod=40 if count_id==450
replace jul123=2 if count_id==450
replace julprod=40 if count_id==450

//461
replace aug_scale=.4 if count_id==461
replace sep_scale=.4 if count_id==461
replace oct_scale=.4 if count_id==461
replace nov_scale=.4 if count_id==461
replace dec_scale=.4 if count_id==461
replace jan_scale=.4 if count_id==461
replace feb_scale=1 if count_id==461
replace mar_scale=1 if count_id==461
replace apr_scale=.4 if count_id==461
replace may_scale=.67 if count_id==461

```
replace jun_scale=1 if count_id==461
replace jul_scale=1 if count_id==461


//51
replace aug_scale=1 if count_id==51
replace sep_scale=1 if count_id==51
replace oct_scale=1 if count_id==51
replace nov_scale=1 if count_id==51
replace dec_scale=dec_labor_scale if count_id==51
replace jan_scale=jan_labor_scale if count_id==51
replace feb_scale=feb_labor_scale if count_id==51
replace mar_scale=mar_labor_scale if count_id==51
replace apr_scale=apr_labor_scale if count_id==51
replace may_scale= may_labor_scale if count_id==51
replace jun_scale=jun_labor_scale if count_id==51
replace jul_scale=jul_labor_scale if count_id==51


//420
replace sep123=1 if count_id==420
replace sep_scale=sep_labor_scale if count_id==420
replace oct123 =1 if count_id==420
replace oct_scale=oct_labor_scale if count_id==420
*****
*****
replace dec123 =3 if count_id==420
replace dec_scale=dec_labor_scale if count_id==420
replace jan123 =3 if count_id==420
replace jan_scale=jan_labor_scale if count_id==420
replace feb123 =3 if count_id==420
replace feb_scale =feb_labor_scale if count_id==420

//17
```

```
replace aug_scale =1  if count_id==17
replace sep_scale =1  if count_id==17
replace oct_scale =1  if count_id==17
replace nov_scale =1  if count_id==17
replace dec_scale =1  if count_id==17
replace jan_scale =1  if count_id==17
replace feb_scale =1  if count_id==17
replace mar_scale =1  if count_id==17
replace apr_scale =1  if count_id==17
replace may_scale =1  if count_id==17
replace jun_scale =1  if count_id==17
replace jul_scale =1  if count_id==17

//Scale to year

        replace aug_costs=total_costs_mo*aug_scale
        replace sep_costs=total_costs_mo*sep_scale
        replace oct_costs=total_costs_mo*oct_scale
        replace nov_costs=total_costs_mo*nov_scale
        replace dec_costs=total_costs_mo*dec_scale
        replace jan_costs=total_costs_mo*jan_scale
        replace feb_costs=total_costs_mo*feb_scale
        replace mar_costs=total_costs_mo*mar_scale
        replace apr_costs=total_costs_mo*apr_scale
        replace may_costs=total_costs_mo*may_scale
        replace jun_costs=total_costs_mo*jun_scale
        replace jul_costs=total_costs_mo*jul_scale

        egen year_costs_original=rowtotal(total_costs_yr aug_costs sep_costs oct_costs nov_costs dec_costs jan_costs feb_costs
mar_costs apr_costs may_costs jun_costs jul_costs)

        replace aug_rev=month_rev*aug_scale
        replace sep_rev=month_rev*sep_scale
        replace oct_rev=month_rev*oct_scale
```

```
replace nov_rev=month_rev*nov_scale
replace dec_rev=month_rev*dec_scale
replace jan_rev=month_rev*jan_scale
replace feb_rev=month_rev*feb_scale
replace mar_rev=month_rev*mar_scale
replace apr_rev=month_rev*apr_scale
replace may_rev=month_rev*may_scale
replace jun_rev=month_rev*jun_scale
replace jul_rev=month_rev*jul_scale

egen year_rev_total=rowtotal(year_rev aug_rev sep_rev oct_rev nov_rev dec_rev jan_rev feb_rev mar_rev apr_rev may_rev jun_rev jul_rev)

note  year_rev_total:year_rev aug_rev sep_rev oct_rev nov_rev dec_rev jan_rev feb_rev mar_rev apr_rev may_rev jun_rev jul_rev

replace year_rev_total= 97250000 if count_id==425


//No labor no wood
replace aug_costs_nl_nw=total_costs_mo_nl_nw*aug_scale
replace sep_costs_nl_nw=total_costs_mo_nl_nw*sep_scale
replace oct_costs_nl_nw=total_costs_mo_nl_nw*oct_scale
replace nov_costs_nl_nw=total_costs_mo_nl_nw*nov_scale
replace dec_costs_nl_nw=total_costs_mo_nl_nw*dec_scale
replace jan_costs_nl_nw=total_costs_mo_nl_nw*jan_scale
replace feb_costs_nl_nw=total_costs_mo_nl_nw*feb_scale
replace mar_costs_nl_nw=total_costs_mo_nl_nw*mar_scale
replace apr_costs_nl_nw=total_costs_mo_nl_nw*apr_scale
replace may_costs_nl_nw=total_costs_mo_nl_nw*may_scale
replace jun_costs_nl_nw=total_costs_mo_nl_nw*jun_scale
replace jul_costs_nl_nw=total_costs_mo_nl_nw*jul_scale
```

////Alternative wood quantity

```
g scale_down_1=alt_kuantitas_normal_1/avg_kuantitas_1
g scale_down_2=alt_kuantitas_normal_2/kuantitas_normal_2

g alt_total_oven_1=biaya_oven_1*alt_kuantitas_normal_1 if biaya_oven_unit_1==1 & alt_kuantitas_normal_1!=.
replace alt_total_oven_1=biaya_oven_1*scale_down_1 if biaya_oven_unit_1==5 & alt_kuantitas_normal_1!=.

g alt_total_oven_2=biaya_oven_2*alt_kuantitas_normal_1 if biaya_oven_unit_1==1 & alt_kuantitas_normal_1!=.
replace alt_total_oven_2=biaya_oven_2*scale_down_2 if biaya_oven_unit_2==5 & alt_kuantitas_normal_2!=.

g alt_total_bentuk_1=biaya_bentuk_log_1*scale_down_1 if bentuk_log_unit_1==5 & alt_kuantitas_normal_1!=.
replace alt_total_bentuk_1=biaya_bentuk_log_1*alt_kuantitas_normal_1 if bentuk_log_unit_1==1 &
alt_kuantitas_normal_1!=.

g alt_total_bentuk_2=biaya_bentuk_log_2*scale_down_2 if bentuk_log_unit_2==5 & alt_kuantitas_normal_2!=.
replace alt_total_bentuk_2=biaya_bentuk_log_2*alt_kuantitas_normal_2 if bentuk_log_unit_2==1 &
alt_kuantitas_normal_2!=.

g alt_total_wood_cost_1=avg_hargakayu_1*alt_kuantitas_normal_1
g alt_total_wood_cost_2=avg_hargakayu_2*alt_kuantitas_normal_2

egen alt_total_wood_costs_all= rowtotal(alt_total_wood_cost_1 alt_total_oven_1 alt_total_bentuk_1 alt_total_wood_cost_2
alt_total_oven_2 alt_total_bentuk_2)
replace alt_total_wood_costs_all=. if alt_kuantitas_normal_1==.

gen alt_total_wood_costs_mo=alt_total_wood_costs_all if time_frame_kayu==2 & alt_total_wood_costs_all!=.
replace alt_total_wood_costs_mo=alt_total_wood_costs_all*4 if time_frame_kayu==1 & alt_total_wood_costs_all!=.
gen alt_total_wood_costs_yr=alt_total_wood_costs_all if time_frame_kayu==3 & alt_total_wood_costs_all!=.

replace aug_alt_wood_costs=alt_total_wood_costs_mo*aug_scale if  alt_total_wood_costs_all!=.

replace sep_alt_wood_costs=alt_total_wood_costs_mo*sep_scale if  alt_total_wood_costs_all!=.

replace oct_alt_wood_costs=alt_total_wood_costs_mo*oct_scale if  alt_total_wood_costs_all!=.
```

```
        replace nov_alt_wood_costs=alt_total_wood_costs_mo*nov_scale if  alt_total_wood_costs_all!=.
        replace dec_alt_wood_costs=alt_total_wood_costs_mo*dec_scale if  alt_total_wood_costs_all!=.
        replace jan_alt_wood_costs=alt_total_wood_costs_mo*jan_scale if  alt_total_wood_costs_all!=.
        replace feb_alt_wood_costs=alt_total_wood_costs_mo*feb_scale if  alt_total_wood_costs_all!=.
        replace mar_alt_wood_costs=alt_total_wood_costs_mo*mar_scale if  alt_total_wood_costs_all!=.
        replace apr_alt_wood_costs=alt_total_wood_costs_mo*apr_scale if  alt_total_wood_costs_all!=.
        replace may_alt_wood_costs=alt_total_wood_costs_mo*may_scale if  alt_total_wood_costs_all!=.
        replace jun_alt_wood_costs=alt_total_wood_costs_mo*jun_scale if  alt_total_wood_costs_all!=.
        replace jul_alt_wood_costs=alt_total_wood_costs_mo*jul_scale if  alt_total_wood_costs_all!=.
drop year_alt_wood_costs
egen year_alt_wood_costs=rowtotal(alt_total_wood_costs_yr aug_alt_wood_costs sep_alt_wood_costs oct_alt_wood_costs
nov_alt_wood_costs dec_alt_wood_costs jan_alt_wood_costs feb_alt_wood_costs mar_alt_wood_costs jun_alt_wood_costs
jul_alt_wood_costs)
**********************************************************************
//Profit Calculations
        //Non-seasonal labor and without alternative wood
        drop year_profit_original year_profit_original_dollars
        gen year_profit_original=year_rev_total-year_costs_original
        replace year_profit_original=. if year_profit_original==0 & year_rev_total==0 & year_costs_original==0
        gen year_profit_original_dollars=year_profit_original/12500

        //Seasonal Labor without alternative wood
        egen total_costs_season_labor=rowtotal(aug_labor sep_labor oct_labor nov_labor dec_labor jan_labor feb_labor mar_labor
apr_labor may_labor jun_labor jul_labor)
        egen total_costs_mo_nolabor=rowtotal(total_wood_costs_mo total_costs_other total_costs_prod_mo )
```

```
egen total_costs_yr_nolabor=rowtotal(total_wood_costs_yr total_costs_other_yr total_costs_prod_yr )


replace aug_costs_nl=total_costs_mo_nolabor*aug_scale
replace sep_costs_nl=total_costs_mo_nolabor*sep_scale
replace oct_costs_nl=total_costs_mo_nolabor*oct_scale
replace nov_costs_nl=total_costs_mo_nolabor*nov_scale
replace dec_costs_nl=total_costs_mo_nolabor*dec_scale
replace jan_costs_nl=total_costs_mo_nolabor*jan_scale
replace feb_costs_nl=total_costs_mo_nolabor*feb_scale
replace mar_costs_nl=total_costs_mo_nolabor*mar_scale
replace apr_costs_nl=total_costs_mo_nolabor*apr_scale
replace may_costs_nl=total_costs_mo_nolabor*may_scale
replace jun_costs_nl=total_costs_mo_nolabor*jun_scale
replace jul_costs_nl=total_costs_mo_nolabor*jul_scale


egen year_costs_nolabor=rowtotal(total_costs_yr_nolabor aug_costs_nl sep_costs_nl oct_costs_nl nov_costs_nl dec_costs_nl
jan_costs_nl feb_costs_nl mar_costs_nl apr_costs_nl may_costs_nl jun_costs_nl jul_costs_nl)

egen year_costs_ls=rowtotal (year_costs_nolabor total_costs_season_labor)
gen sl_year_profit=year_rev_total-year_costs_ls
replace sl_year_profit=. if sl_year_profit==0 & year_rev_total==0 & year_costs_original==0

//Seasonal Labor and alternative wood

egen year_costs_nl_nw=rowtotal( aug_costs_nl_nw sep_costs_nl_nw oct_costs_nl_nw nov_costs_nl_nw dec_costs_nl_nw
jan_costs_nl_nw feb_costs_nl_nw mar_costs_nl_nw apr_costs_nl_nw may_costs_nl_nw jun_costs_nl_nw jul_costs_nl_nw)

gen slaw_year_profit=year_rev_total-(year_costs_nl_nw+total_costs_season_labor +year_alt_wood_costs)

replace slaw_year_profit= sl_year_profit if alt_kuantitas_normal_1==.
replace slaw_year_profit=. if sl_year_profit==0 & year_rev_total==0 & year_costs_original==0
        replace slaw_year_profit=. if count_id==137

//Alternative wood without seasonal labor
```

```
g or_aug_labor=aug_scale*total_labor
g or_sep_labor=sep_scale*total_labor
g or_oct_labor=oct_scale*total_labor
g or_nov_labor=nov_scale*total_labor
g or_dec_labor=dec_scale*total_labor
g or_jan_labor=jan_scale*total_labor
g or_feb_labor=feb_scale*total_labor
g or_mar_labor=mar_scale*total_labor
g or_apr_labor=apr_scale*total_labor
g or_may_labor=may_scale*total_labor
g or_jun_labor=jun_scale*total_labor
g or_jul_labor=jul_scale*total_labor
egen or_labor_yr=rowtotal(or_aug_labor or_sep_labor or_oct_labor or_nov_labor or_dec_labor or_jan_labor or_feb_labor or_mar_labor or_apr_labor or_may_labor or_jun_labor or_jul_labor)

gen aw_year_profit=year_rev_total-(year_costs_nl_nw+or_labor_yr +year_alt_wood_costs)

replace aw_year_profit=year_profit_original if alt_kuantitas_normal_1==.

replace aw_year_profit=. if aw_year_profit==0 & year_rev_total==0 & year_costs_original==0
g d_year_profit_original=year_profit_original/13641.78927
g d_sl_year_profit = sl_year_profit/13641.78927
g d_aw_year_profit = aw_year_profit/13641.78927
g d_slaw_year_profit=slaw_year_profit/13641.78927
```

Secction 2: Stata Code for Analysis

```
use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\PSM_Full_27june_drop_dontuse.dta"

PSM with original dataset (no restrictions)

////No Caliper

    //// Nearest Neighbor with replacement  k=1 ATET; No Caliper
```

teffects psmatch (d_slaw_year_profit) (anggota_apkj _09_oth_org_total machinescore _09_brokering finishing_1 contract_out_1 _09_teak_pct teak_tpk _09_mahoni_pct mahoni_tpk im_ornamen_dekorasi im_kerajinan_kaligrafi im_sketsel im_relief im_parts_komponen_mebel mebel_basic i.batealit i.jepara i.kedung i.mlonggo i.pakisaji i.tahunan i._09_cbn_otsh i._09_cbn_dir i._09_cbn_online i._09_cbn_brok i._09_cbn_exh i._09_cbn_exp i._09_cbn_sub _09_worker_avg _09_totalm2_workshop_sum _09_total_workshop _09_total_showroom _09_otherunits edu_sd edu_smp edu_stmsmk edu_sma edu_high owner_age), atet gen(nn1_nocal)

tebalance summarize

//// Nearest Neighbor with replacement k=1 ATET; No Caliper; Without alternate wood quantities

teffects psmatch (d_sl_year_profit) (anggota_apkj _09_oth_org_total machinescore _09_brokering finishing_1 contract_out_1 _09_teak_pct teak_tpk _09_mahoni_pct mahoni_tpk im_ornamen_dekorasi im_kerajinan_kaligrafi im_sketsel im_relief im_parts_komponen_mebel mebel_basic i.batealit i.jepara i.kedung i.mlonggo i.pakisaji i.tahunan i._09_cbn_otsh i._09_cbn_dir i._09_cbn_online i._09_cbn_brok i._09_cbn_exh i._09_cbn_exp i._09_cbn_sub _09_worker_avg _09_totalm2_workshop_sum _09_total_workshop _09_total_showroom _09_otherunits edu_sd edu_smp edu_stmsmk edu_sma edu_high owner_age), atet

///With Caliper

//// Nearest Neighbor with replacement k=1 ATET

teffects psmatch (d_slaw_year_profit) (anggota_apkj _09_oth_org_total machinescore _09_brokering finishing_1 contract_out_1 _09_teak_pct teak_tpk _09_mahoni_pct mahoni_tpk im_ornamen_dekorasi im_kerajinan_kaligrafi im_sketsel im_relief im_parts_komponen_mebel mebel_basic i.batealit i.jepara i.kedung i.mlonggo i.pakisaji i.tahunan i._09_cbn_otsh i._09_cbn_dir i._09_cbn_online i._09_cbn_brok i._09_cbn_exh i._09_cbn_exp i._09_cbn_sub _09_worker_avg _09_totalm2_workshop_sum _09_total_workshop _09_total_showroom _09_otherunits edu_sd edu_smp edu_stmsmk edu_sma edu_high owner_age), nneighbor(1) caliper(0.0485) osample(cal_20se) atet

*13 observations have no propensity-score matches within caliper .0485; they are identified in the osample() variable

drop if cal_20se==1

save "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\PSM_drop_dontuse_cal_20se.dta", replace

teffects psmatch (d_slaw_year_profit) (anggota_apkj _09_oth_org_total machinescore _09_brokering finishing_1 contract_out_1 _09_teak_pct teak_tpk _09_mahoni_pct mahoni_tpk im_ornamen_dekorasi im_kerajinan_kaligrafi im_sketsel im_relief im_parts_komponen_mebel mebel_basic i.batealit i.jepara i.kedung i.mlonggo i.pakisaji i.tahunan i._09_cbn_otsh i._09_cbn_dir i._09_cbn_online i._09_cbn_brok i._09_cbn_exh i._09_cbn_exp i._09_cbn_sub _09_worker_avg _09_totalm2_workshop_sum _09_total_workshop _09_total_showroom _09_otherunits edu_sd edu_smp edu_stmsmk edu_sma edu_high owner_age), atet

tebalance summarize

quietly psmatch2 (anggota_apkj _09_oth_org_total machinescore _09_brokering finishing_1 contract_out_1 _09_teak_pct teak_tpk _09_mahoni_pct mahoni_tpk im_ornamen_dekorasi im_kerajinan_kaligrafi im_sketsel im_relief im_parts_komponen_mebel mebel_basic batealit jepara kedung mlonggo pakisaji tahunan _09_cbn_otsh _09_cbn_dir _09_cbn_online _09_cbn_brok _09_cbn_exh _09_cbn_exp _09_cbn_sub _09_worker_avg _09_totalm2_workshop_sum _09_total_workshop _09_total_showroom _09_otherunits edu_sd edu_smp edu_stmsmk edu_sma edu_high owner_age), outcome(d_slaw) neighbor(1) logit ties

pstest

//Create datasets with matched samples for tabulating outcome variables

//ATET 1 Nearest Neighbor full model with Caliper

//Use model with the units that don't have a matche within the caliper remove

use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\PSM_drop_27june_PS_dontuse_caliper.dta"
drop obs_num
gen obs_num=_n
drop _1nncal_1
drop _pscore pc_pscore pc_pscore_2

//Run the model to get the observation numbers of matches (_1nncal) teffects psmatch (d_slaw_year_profit) (anggota_apkj _09_oth_org_total machinescore _09_brokering finishing_1 contract_out_1 _09_teak_pct teak_tpk _09_mahoni_pct mahoni_tpk im_ornamen_dekorasi im_kerajinan_kaligrafi im_sketsel im_relief im_parts_komponen_mebel mebel_basic i.batealit i.jepara i.kedung i.mlonggo i.pakisaji i.tahunan i._09_cbn_otsh i._09_cbn_dir i._09_cbn_online i._09_cbn_brok i._09_cbn_exh i._09_cbn_exp i._09_cbn_sub _09_worker_avg _09_totalm2_workshop_sum _09_total_workshop _09_total_showroom _09_otherunits edu_sd edu_smp edu_stmsmk edu_sma edu_high owner_age), atet gen(_1nncal_)

```
*2571.82
save "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\PSM_drop_27june_PS_dontuse_caliper.dta", replace
```
Keep observation number of matches and then merge with the other information from the original dataset
```
keep _1nncal_1
count /*446*/
rename _1nncal_1 obs_num
drop _merge
merge m:1 obs_num using
"C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\PSM_drop_27june_PS_dontuse_caliper.dta"
```
only keep matched non-members
```
drop if _merge==2
drop if anggota_apkj==1
count /*71*/
gen matched=1
save "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\nn1_atet_caliper.dta", replace
```
go back to original dataset to get information on matched members
```
use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\PSM_drop_27june_PS_dontuse_caliper.dta"
keep if anggota_apkj==1 & cal_20se!=1
count /*71*/
save "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\members_data_caliper.dta", replace
use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\nn1_atet_caliper.dta"
count /*71*/
append using "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\members_data_caliper.dta"
```
Check if difference in means is the same as when implementing PSM in the original dataset ztest d_slaw, by(anggota_apkj) /* 2571.82 */
```
save "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\nn1_atet_caliper.dta", replace
```
//Upgrading Outcome Variables

Marketing/Sales Channels
```
use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\nn1_atet_caliper_nocbn.dta"
```

//Other Showroom

(The analyses here were repeated for each outcome variable below)

Fisher's exact test:

tab chg_cbn_otsh anggota_apkj, exact

Risk ratios:

cs pc_diff_cbn_otsh anggota_apkj

cs nc_diff_cbn_otsh anggota_apkj

Treatment Effects:

use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\PSM_drop_PS_dontuse_no_cbn_caliper.dta" teffects psmatch (pc_diff_cbn_otsh) (anggota_apkj _09_oth_org_total machinescore _09_brokering finishing_1 contract_out_1 _09_teak_pct teak_tpk _09_mahoni_pct mahoni_tpk im_ornamen_dekorasi im_kerajinan_kaligrafi im_sketsel im_relief im_parts_komponen_mebel mebel_basic i.batealit i.jepara i.kedung i.mlonggo i.pakisaji i.tahunan _09_worker_avg _09_totalm2_workshop_sum _09_total_workshop _09_total_showroom _09_otherunits edu_sd edu_smp edu_stmsmk edu_sma edu_high owner_age), atet

teffects psmatch (nc_diff_cbn_otsh) (anggota_apkj _09_oth_org_total machinescore _09_brokering finishing_1 contract_out_1 _09_teak_pct teak_tpk _09_mahoni_pct mahoni_tpk im_ornamen_dekorasi im_kerajinan_kaligrafi im_sketsel im_relief im_parts_komponen_mebel mebel_basic i.batealit i.jepara i.kedung i.mlonggo i.pakisaji i.tahunan _09_worker_avg _09_totalm2_workshop_sum _09_total_workshop _09_total_showroom _09_otherunits edu_sd edu_smp edu_stmsmk edu_sma edu_high owner_age), atet

//Direct

Fisher's exact test:

tab chg_cbn_dir anggota_apkj, exact

Risk ratios:

cs pc_diff_cbn_otsh anggota_apkj

cs nc_diff_cbn_otsh anggota_apkj

Treatment Effects:

//Sell through Broker

Fisher's exact test:

tab chg_cbn_brok anggota_apkj, exact

Risk ratios:
cs pc_diff_cbn_brok anggota_apkj
cs nc_diff_cbn_brok anggota_apkj
//Exporter
Fisher's exact test:
tab chg_cbn_exp anggota_apkj, exact
Risk ratios:
cs pc_diff_cbn_exp anggota_apkj
cs nc_diff_cbn_exp anggota_apkj
//**Subcontract**
Fisher's exact test:
tab chg_cbn_sub anggota_apkj, exact
Risk ratios:
cs pc_diff_cbn_sub anggota_apkj
cs nc_diff_cbn_sub anggota_apkj
//Exhibitions
Fisher's exact test:
tab chg_cbn_exh anggota_apkj, exact
Risk ratios:
cs pc_diff_cbn_exh anggota_apkj
cs nc_diff_cbn_exh anggota_apkj
//Online
Fisher's exact test:
tab chg_cbn_online anggota_apkj, exact
Risk ratios:
cs pc_diff_cbn_online anggota_apkj
cs nc_diff_cbn_online anggota_apkj

Production Upgrading

use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\nn1_atet_caliper_no_op.dta"

//Brokering
Fisher's exact test:
tab chg_brokering anggota_apkj, exact
Risk ratios:

cs chg_brokering anggota_apkj

//Finishing

Fisher's exact test:

tab chg_finished anggota_apkj, exact

Risk ratios:

cs pc_diff_finished anggota_apkj

cs nc_diff_finished anggota_apkj

Business Practices

//svlk

Fisher's exact test:

tab svlk anggota_apkj, exact

cs svlk anggota_apkj

cs svlk anggota_apkj, level(90)

use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\PSM_Full_27june_drop_dontuse.dta"

use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\PSM_drop_dontuse_cal_20se.dta"

//Keeping records

use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\nn1_atet_caliper_records.dta"

use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\nn1_atet_records.dta"

Fisher's exact test:

tab records anggota_apkj, exact

cs records anggota_apkj

cs records anggota_apkj, level(90)

//registered

use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\nn1_atet_caliper_registered.dta"

use "C:\Users\Corinna\OneDrive\JeparaFVC\SurveyData\nn1_atet_caliper_records.dta"

Fisher's exact test:

tab registered anggota_apkj, exact

cs registered anggota_apkj

cs registered anggota_apkj, level(90)

Appendix D: Treatment Effects for Matching Without Replacement

The analysis in this thesis uses propensity score matching with replacement in order to minimize bias from poor matches. However, matching with replacement increases the variance of the estimator. Matching without replacement can result in higher bias due to bad matches, but can reduce variance. Here, results from propensity score matching without replacement are reported. Since observation order can affect matching when matching without replacement, a random sort order was used. The "teffects psmatch" command in Stata ® does not allow for matching without replacement, so the "psmatch2" command was used to match without replacement to one nearest neighbor. The command does not allow matching without replacement to more than one nearest neighbor. The standard errors reported by this command do not take into account that the propensity score was estimated, so they may be biased.

The average treatment effect on the treated for firm profit calculated without replacement is reported in table D1. When matching with a caliper in the original dataset, 32 members were dropped from the analysis, leaving only 52 members for matching. Twenty-five members were dropped when a caliper was used after excluding firms that broker, leaving 52 for matching. After excluding firms that broker and firms that have showrooms, specifying a caliper dropped 18 members, leaving 49 for matching. Thirty members did not have matches within the caliper after excluding cases that had profit above USD 80,000, only 44 were matched. P-values are from two-sided t tests.

Table D1: Average treatment effect on the treated for estimated firm profit (matching without replacement)

Sample Restrictions/ Difference in Outcome Variable Measure	Number of Neighbors	Caliper	Treatment Effects	Std. Err.	P-values	Number of Matched Observations
None	1	no caliper	7,371	*8,043*	0.36	168
	1	caliper	1,578	*9,200*	0.87	104
Exclude cases that broker in 2015	1	no caliper	9,723	*8,644*	0.27	154
	1	caliper	7,355	*9,151*	0.43	104
Exclude cases that broker in or own showrooms in 2015	1	no caliper	6,084	*8,936*	0.50	134
	1	caliper	10969	*10,565*	0.30	98
Exclude Profit above USD 80,000	1	no caliper	1,681	*3,052*	0.58	148
	1	caliper	-2,153	*4,032*	0.60	88

Source: 2015 Firm Survey

The treatment effect estimates for upgrading outcome variables, after matching without replacement (with a caliper), are not extremely different than the treatment effects when matching with replacement (table D2).

However, there are a few notable contrasts in the results when matching without or without replacement. When matching without replacement there is no significant effect of APKJ membership on exhibition attendance. Nineteen percent more APKJ members than non-members stopped being subcontracted, moving out of a position with low bargaining power. Seventeen percent more APKJ members than matched non-members also started using online marketing. While the treatment effects are different than those estimated when matching without replacement, these results are equally mixed as those from matching with replacement. APKJ membership is linked with some improvement, but the effect is limited.

Table D2: Upgrading Outcome variables when matching without replacement

Outcome Variable	Treatment Effect	Standard Error	p-value	Matched Observations
Binary variable indicating addition of selling through another showroom from 2009 to 2015: pc_diff_cbn_otsh (1 if added ; 0 otherwise)	-0.11	0.05	0.03	106
Binary variable indicating abandoning selling through another showroom from 2009 to 2015: *nc_diff_cbn*_otsh (1 if added ; 0 otherwise)	0.02	0.05	0.7	106
Binary variable indicating addition of selling directly to buyers between 2009 to 2015: pc_diff_cbn_dir (1 if added ; 0 otherwise)	0.09	0.05	0.05	108
Binary variable indicating abandoning selling directly to buyers 2009 - 2015: nc_diff_cbn_dir (1 if abandoned ; 0 otherwise)	0.07	0.04	0.04	108
Binary variable indicating addition of selling through (to) brokers from 2009 to 2015: *pc_diff_cbn_brok* (1 if added ; 0 otherwise)	-0.04	0.09	0.68	106
Binary variable indicating abandoning selling through (to) brokers from 2009 to 2015: nc_diff_cbn_brok (1 if added ; 0 otherwise)	0.02	0.04	0.65	106
Binary variable indicating the firm added marketing through exhibitions between 2009 and 2015: *pc_diff_cbn_exh* (1 if added ; 0 otherwise)	0	0.04	1	110

Outcome Variable	Treatment Effect	Standard Error	p-value	Matched Observations
Binary variable indicating the firm abandoned marketing through exhibitions between 2009 and 2015: nc_diff_cbn_exh (1 if abandoned ; 0 otherwise)	0	0.03	1	110
Binary variable indicating addition of exporting from 2009 to 2015: pc_diff_cbn_exp (1 if added ; 0 otherwise)	0.02	0.07	0.8	108
Binary variable indicating abandoning exporting from 2009 to 2015: nc_diff_cbn_exp (1 if abandoned ; 0 otherwise)	0.02	0.05	0.73	108
Binary variable indicating addition of being subcontracted between 2009 to 2015: pc_diff_cbn_sub (1 if added ; 0 otherwise)	-0.13	0.09	0.14	106
Binary variable indicating abandoning being subcontracted between 2009 to 2015: nc_diff_cbn_sub (1 if abandoned; 0 otherwise)	0.19	0.08	0.02	106
Binary variable indicating addition of marketing online between 2009 to 2015: pc_diff_cbn_online (1 if added ; 0 otherwise)	0.17	0.09	0.07	108
Binary variable indicating abandoning selling through another showroom from 2009 to 2015: nc_diff_cbn_online (1 if abandoned ; 0 otherwise)	0.02	0.02	0.32	108
Binary variable indicating addition of selling finished products between 2009 to 2015: pc_diff_finsihed (1 if added ; 0 otherwise)	0	0.06	1	110
Binary variable indicating abandoning selling finished products between 2009 to 2015: nc_diff_finished (1 if added ; 0 otherwise)	0.02	0.04	0.65	110
Changes in brokering status, 2009-2015 (binary variable diff_brokering)	0.02	0.02	0.32	110
SVLK certification in 2015 (*svlk*): 1 certified; 0 if not certified	0.04	0.04	0.25	134
Record-keeping in 2015 (*records*): 1 if firms keeps records; 0 if does not keep records	0.08	0.07	0.25	120
Registered business in 2015 (*registered*): 1 if firm is registered; 0 if not registered	0.08	0.08	0.31	118

Source: 2015 Firm Survey

Appendix E: Institutional Review Board Approval Letter

VirginiaTech

Office of Research Compliance
Institutional Review Board
North End Center, Suite 4120, Virginia Tech
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website http://www.irb.vt.edu

MEMORANDUM

DATE: April 13, 2016

TO: Jeffrey R Alwang, Corinna Jane Clements

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires January 29, 2021)

PROTOCOL TITLE: Jepara Furniture Value Chain Impact Assessment

IRB NUMBER: 15-487

Effective April 12, 2016, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the Continuing Review request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm
(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As:	**Expedited, under 45 CFR 46.110 category(ies) 5,7**
Protocol Approval Date:	**April 30, 2016**
Protocol Expiration Date:	**April 29, 2017**
Continuing Review Due Date*:	**April 15, 2017**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.