Economic impact of political ties in Vietnam: Evidence from northern rural households

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Economic impact of political ties in Vietnam: Evidence from northern rural households

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Abstract

This paper focuses on investigating the impacts of political connections on households' income and their agricultural investment in mountainous areas of Vietnam by employing several matching methodologies. Propensity score matching (PSM) is an increasingly well-known approach for evaluation studies in agricultural economics. Additionally, this study attempts to verify the significance of political connection in rural economics. To conduct the empirical approach, the article uses surveyed data of 550 households from three provinces in the north of Vietnam. The findings indicate that political connection has a significantly positive impact on households' total income and farming behaviour, but has a very negative impact on households' agricultural investment. The difference between the income of the connected and non-connected group of households is estimated at approximately 30 million VND (US$ 1,304) per year. However, the total income of the connected households is not heavily based on agricultural production, their non-agricultural activities account for a larger share of their total income. Another important outcome is to confirm the privileges of politically connected households in terms of receiving extension courses that substantially increase the inequality between rural households in survey areas because the distribution of government subsidy is distorted to target the necessities.

Keywords: Political connection; Propensity score matching; households' income, Vietnam

JEL Classification: G32, C21, Q12

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1 Introduction

As an agriculturally based country, Vietnam has always been seeking to develop agricultural production to eradicate poverty and ensure social welfare. With approximately 70% of labor forces participating in agricultural production, Vietnamese farming households generally attempt to diversify their income source to minimise risks of climatic changes or price volatility causing the reduction of their income (Fritzen, 2002 and Nguyen et al., 2015). Additionally, farming households are mainly located in rural areas in which the income of the occupants are significantly lower compared to that of urban residents. The importance of rural households' income is represented by their allowance for daily expenditure and saving capacity to reinvest into their farm. Besides, agricultural income, as well as investment for economic development, has received significant concerns in recent years due to the food price crises in 2007 (De Janvry and Sadoulet, 2008). Many papers have investigated the effects of land, credit, insurance, infrastructure, occupation of family members and other factors on rural income (Do and Iyer, 2008; Hornbeck, 2010 and Jacoby and Mansuri, 2008). In addition, investment in agriculture is similarly well defined and developed by global scholars. The most substantial function of agricultural investment stays on its productivity enhancement based on the capability of the farmers to purchase fertilisers, pesticide, seeds and farming equipment to cropping and improving cultivated lands (irrigations, ploughs, and bunds) in suitable climatic zones (Reardon et al., 1994; Hertz, 2009 and Viaggi et al., 2010). However, a fundamental influencing factor to the income of rural households or their capability to reinvest in their farming system that has been missing from the literature on rural households' income is political connection. A political connection was widely studied in the interrelationship between government and enterprises. Regarding the studies of Boubakri et al., 2008 and Adhikari et al., 2006, the literature on the political economy of local government has been also growing tremendously. The political connection has been demonstrated as a useful tool for firms or enterprises to successfully operate (Niessen and Ruenzi, 2010).

Before proceeding, we initially discuss the concept of political connection at the household level. The terminology practically implies that the existence of an implicit or explicit interrelationship between political systems and other subjects. The literature on that association between political systems and firms or enterprises is well developed. Generally, Faccio (2006) proposed the definition that a firm is considered to have a political connection if one of its large shareholders or top officers is: (i) a member of parliament, (ii) a minister or the head of state, or (iii) closely related to top officials. Similarly, a firm could be also defined

to be politically connected if at least one of its top officers (chief executive officer, chairman of the board, president, vice-president, or secretary of the board or a large shareholder) became a head of state (i.e., president, king, prime minister, a government minister or a member of the national parliament) (Faccio et al., 2006). On the other hand, Firth et al. (2011) proposed that a political connection would be formed when at least one of the board members, top management, or major stockholders has a relationship with someone in government. Regarding a study about firms in Malaysia, Adhikari et al. (2006) examined the relationship between political link and effective tax rates. The results implied that the political connection can cause a negative effect on tax rate. Independent variables included proxies or political connections, firm size, capital structure, asset mix, firm performance and growth prospects. The result suggested a significant negative effect on tax rate. Simultaneously, Charumilind and Wiwattanakantang (2006) investigated the influence of political ties on enterprises' loans in Thailand and pointed out that firms owning political connections could have more long-term loans with less collateral. Beside, Faccio et al. (2006) analysed the government bailouts of 450 politically connected firms from 35 countries for 1997-2002. The result confirmed that politically connected firms had much more opportunity to be bailed out when facing complications than unconnected firms. More importantly, the authors also found that political ties in countries with high levels of corruption generate a statistically significant cumulative abnormal return (CAR) of 4.32%, versus an insignificant CAR of 0.02% in countries with low levels of corruption. Besides, Leuz and Oberholzer-Gee (2006) employed data of 130 Indonesian firms to run a probit model to estimate the impacts of independent variables on a related or unrelated political connection for investigating the role of political relationships in a firm's financing. The variables indicated that strongly politically connected firms are less probable to have publicly traded foreign securities.

More recently, Li et al. (2008) examined the role of associating with Communist Partyin business activities of private firms in China. By estimating the profitability and using the return on assets and on equity as the dependent variables, the results pointed out that party membership, education variables had a significantly positive effect on dependent variables. Especially, management experience, former public firm manager, former cadre, PC (People's Congress) membership, CPPCC (Chinese People's Political Consultative Conference) membership were not statistically significant. Additionally, when Niessen and Ruenzi (2010) investigated politically connected firms in Germany, the authors figured out that firms with the political ties were received fewer risks, meanwhile, the market value was lower than firms without political connection. They also found that politically connected firms provide better

stock market performance. Specifically, politically connected firms have significantly higher returns on equity and returns on investments. Boubakri et al. (2012) found that firms with a political link have a lower cost of equity and are generally considered less risky than non-connected firms. To shed initial light on whether political link affected firm's equity financing costs, the authors used the cost of equity capital as the dependent variable and applied OLS to estimate coefficients and made comparison the impacts between with and without political connection groups. Researching the Chinese firms during 1999-2006, Wu et al. (2012) found that private politically connected firms have a higher value and obtain more government subsidies than others. Meanwhile, local state-owned firms owned a lower value. Similar to Denmark, Amore and Bennedsen (2013) indicated that connected firms significantly increased their performances when establishing a connection with local politicians. On the contrary, researching firms in Italy over period 1985-1997, Cingano and Pinotti (2013) pointed out that political connection might entail significant economic losses. The previous empirical studies had remarkably generated a positive outcome for political connected firms/enterprises in various aspects of their economic conditions. However, studying the interrelationship between political connection and its impacts in term of household income and their behaviour in agricultural production is significantly limited. Our research aims to fill the theoretical and practical gaps by investigating the role of political connection on households' income and their behaviour in agricultural production in rural areas Vietnam. Thereby, our study attempts to build up the clearest and most specific definition of political connection at the household level.

A decade ago, Goldstein and Udry (2008) argued that individuals who hold powerful positions in a local political hierarchy have more secure tenure rights and that as a consequence they invest more in land fertility and have substantially higher output. The intensity of investments on different plots cultivated by a given individual corresponds to that individual's security of tenure over those specific plots and, in turn, to the individual's position in the political hierarchy relevant to those specific plots. Moreover, some studies mentioned the important role of informal connections between government officials and private agents. In addition, Dalton et al. (2002) and Woodhouse (2006) also examined the patterns of social relations and social capital. They used some variables such as family, friends, works, religious, education, age, gender and income, but they only compared the interaction between these variables by several simple methodologies. But to what extent, local political position affect the households income as well as household's behaviour? By answering that question, we intentionally propose the analysis related to addressing the

economic effects of political connections (Fisman, 2001). Regarding the study of Markussen and Tarp (2014), the households in Vietnam are presently connected with public officials in three different types, but not mutually exclusive ways. Firstly, one or more household members may themselves be public officials. Secondly, a household may have relatives living outside the household who are public officials. The last type of connection is that friends or other non-family relations of the household may be officers. In fact, all three categories of the political relations in Vietnam are the main reason to cause the nepotism or favouritism in local government.

Markussen and Tarp (2014) explained particularly why their study focused on connections with initial relatives (rather than looking at the effects of officials in the household or connections with non-relatives). In a deeper explanation, if a household has invested heavily in the introduction of a new, high-value crop, the incentives for household members to seek employment as officials may be lower than those in other households. The returns from spending time on the farm are higher. A household planning to invest may actively nurture relationships with non-relatives in government in order to obtain approval or assistance for the investment project. Especially, households may confirm an official as a friend correctly because he or she assisted the household with participating in a development project. Connections with relatives outside the household are identified the same as connecting with friends who would reveal the information of the project and do not contribute to the household's income as family members. Beside development projects, the extension training program would be accordingly biased because of this association. Nguyen and Tuan (2020) argued that the occurrence of selection bias of trained farmers in rural areas in North Vietnam is popularised by local authorities especially environmental-related courses namely Integrated Pesticide Management, an extensive-based technique that consolidates practices for controlling harmful pests, insects economically. Therefore another assumption of political connection in rural areas of Vietnam has been formed by the question of farmers' behaviour in applying pesticide in their farms. Accordingly, our analysis initially managed to follow-up the idea of Markussen and Tarp (2014) for empirically investigating the support of the local political system and farmers. Secondly, the latent contribution of local authorities is demonstrated via households' income and their behaviour in agricultural production as their pesticide usage.

The remaining of this article is organised as follows. Section 2 presents the background and nature of political systems. Section 4 presents the data used in the analysis. Section 5

introduces the empirical framework and outlines the main findings. Section 6 concludes an outlook on the Vietnamese political connection.

2. Background and Nature of Political systems

In the past, Vietnam has experienced dramatical changes in economic and political system. Since North and South Vietnam reunited into one called the Socialist Republic of Vietnam in 1975, the Vietnamese Communist Party has continuously led the country. After 1986, Vietnam introduced a set of renovate (Doi Moi) policies that were extended by the National Constitution in 1992 (Turley and Selden, 1993). The reformation allowed commercial price to float in free-market; decentralised state enterprises by the involvement of non-governmental organisations; decollectivised farmlands; and liberalised foreign trade and investment. Consequently, a series of economic, political and legal renovations have followed by the marketisation of the economy. Gradually, Vietnam has either established or normalised trade relations with various foreign countries. Furthermore, the Vietnamese are also experiencing for improving living standards. Indeed, the World Bank reports impressive gains in the late 1990s in raising incomes and reducing poverty (Gillis et al., 2001). Yet this increment had also produced increases in income disparity between urban and rural areas that could not sustainably fulfil the national objective of poverty reduction (Fritzen, 2002).

By the 1950s, Communist party leaders in Vietnam considered axiomatically that large agricultural cooperatives represented for collectivism as the means of agricultural production to centralise farming lands, farming products, livestock, and irrigation facilities then divided farming activities into distinct tasks, each assigned task was done by teams of specialised workers. After 1986, decentralisation had been done to redistribute farming land to the individual household. Nonetheless, the scattered production without market orientation caused the occurrence of various constraints affecting the development of agricultural production in Vietnam such as difficulty in access of the farmers to output/input markets; low product's quality and safety; unknown legal framework and standards; bottlenecks in the distribution channel; limited access to market information; low quality and price of input materials, unknown transaction cost (Lapar et al., 2003). Recently, along with the decentralisation movement, supportive policies and economic priorities, the role of the government officials has raised leading to the effects of political economic on every angle of Vietnamese daily life. Especially, at the local level, nepotism or favouritism has even spread out more widely. In addition, the local government in Vietnam involved thoroughly and broadly in all aspects of rural economic activities (Markussen and Tarp, 2014). Firstly, all subsidised programs from the central government had been officially distributed and

implemented by local authorities to farmers. Most obviously, the state managed to open extension schemes or theoretically decided whoever belonging under poverty standard for receiving supports from poverty-alleviation programs. However, supportive policies are well propagandised or equally distributed depended on the decision of downstream authorities. Most of the formal lending institutions established in rural areas of Vietnam are directly managed by the local authority. Particularly, these organisations are in charge of screening applicants before getting approval from the bank including the non-collateral loans for farmers expanding their production scale or purchasing their inputs. Therefore, in case these vital supportive programs are asymmetrically acknowledged by rural households, no good policies can be fulfilled their objectives. Moreover, income of rural residents is mainly sourced from agricultural activities, especially in mountainous areas where all population has the same occupation as farmers (Nguyen et al., 2015). However, some of them expanded their livelihoods into other professions such as retails, handicrafts, hired employees...but their main income is still from agricultural activities. Consequently, rural households are the ones who always suffer significantly more disadvantages compared to those in urban areas and political connection is more likely to worsen their situation. Heley and Jones (2012) suggested that political network, one of substantial material of rural economic, should be reconsidered to comprehensively understand the continuation of change in rural areas. Moreover, Thereby, understanding whether the relationship between political connection and household income exists may help to increase the income of rural households as well as comprehend the intensity of linkage from local government to rural.

Figure 1: Political connections framework at households level

However, forming a theoretically consistent definition of political connection is likely to impossible because it depends on several social and cultural background in a specific nation or regions. Our hypothetical framework is synthesised to illustrate how political systems association with households in rural Vietnam. As can be seen from the framework, in Vietnam, at local authority's level, there are various substantial organisations such as Communal Agricultural Cooperative, Farmers' Association, Women' Association and Veteran's Association, Communist Party and People's Committee (Figure 1). These organisations are considered as solid components involving into the political system in Vietnam to manage. As a result, these organisations have strong links with the state and consequently, their membership may attain some advantages in business, looking for a job, education, promotion, etc. Henceforth, in this research, we define that a household will be considered as having a political connection if one or more members of the household, close friends and relatives involving into these institutions which had been interpreted by the study

of Faccio (2006) and Markussen and Tarp (2014). This definition will explicitly help to investigate the effect of political connection on household income in Vietnam rural areas.

3. Methodology

This study aims to estimate the Average Treatment Effect on the Treated (ATT) of having a political connection on the incomes of farming households and re-investment on agricultural production using propensity score matching (PSM) methodology with our data (Rosenbaum and Rubin, 1983). Matching method is a well-known approach to estimate causal treatment effects. It is widely applied in many empirical examples in very diverse fields of study, for example, estimation of the political connections to some aspects of rural development as the study of Mendola (2007) and Boubakri et al. (2012). Besides, matching or PSM techniques are the intermediate stages to estimate the true ATT of political connection to income, reinvestment in agriculture and farmer's behaviour in using chemical products. However, with PSM, King and Nielsen (2016) argued that since applying PSM, achieving the conditions of PSM more precisely, may increase imbalance as well. Matching method may be a better approach to perform ultimate results. Greedy matching is a tremendously well-known technique to estimate the ATT, meanwhile, Mahalanobis and Genetic which both uses Mahalanobis distance to match treated and control units are less likely popular. Propensity score (PS) is a statistical technique that has proven useful to evaluate treatment effects when using observational data and reduce the selection bias (Austin, 2011 and Rosenbaum and Rubin, 1983). One of the advantages associated with PS is the creation of adequate counterfactuals when random assignment is infeasible or unethical (Austin, 2011).

3.1 Analytical framework

Letting y is accumulated income of a household after one-year time treatment variable D is

$$D=\begin{cases} 1, \text{ treatment (at least one household's member participating in local authorities} \\ 0, \text{ control (no household's member belonging to any local political organizations} \end{cases}$$

Potential outcomes y^1 and y^0. y^1 is potential outcome with treatment (D = 1). y^0 is potential outcome without treatment (D = 0). Causal effect of the treatment for individual i is difference between potential outcomes $\delta_i = y_i^1 - y_i^0$. Since causal effect of D on y for individual i is defined as the difference in potential outcomes: $\delta_i = y_i^1 - y_i^0$. However, the observed outcome variable is

$$y_i = \begin{cases} y_i^1 \text{ if } D_i = 1 \\ y_i^0 \text{ if } D_i = 0. \end{cases},$$

In this paper, we focus more on average treatment effect on the treated to determine the impact of treatment on the income/reinvestment/households' behaviour of treated households. Fundamentally, Rosenbaum and Rubin (1983) proposed the algorithm of *ATT*:

$$ATT = E[y^1 - y^0|D = 1] = E[y^1|D = 1] - E[y^0|D = 1].$$

Nonetheless, to determine the average effect correctly, unbiased estimates of $E[y^0]$ and $E[y^1]$ are required. Importantly, the independence assumption $(y^0;y^1) \perp D$ is applied to ensure D is independent from y^0 and y^1, then we have $E[y^0] = E[y^0|D = 0]$ and $E[y^1] = E[y^1|D = 1]$.

3.2 Matching Algorithm

Our first matching methodology called Nearest neighbor that can be used either a greed algorithm in which each treated unit is searching for the control unit with the closest PS or more sophisticated optimal matching which is oppositely trying to minimize the distance between all treated and control matches. Typically, one treatment case can match several control cases. This oversampling form of matching also contains a trade-off between variance and bias. By using that, variance may be reduced, resulting from employing more information to establish the counter-factual for each participant, meanwhile, increasing bias from averagely poorer matches. However one-to-one matching is exclusively be preferred (Glazerman et al., 2003).

In this study, we employ the nearest-neighbour matching at ratio 1 : 1 to minimise bias because the matching algorithm simultaneously sought the smallest gap between two matching units Caliendo and Kopeinig (2008). On the other hand, caliper is another strategy to avoid poor matches by selecting exclusively the matches within caliper that possibly avoid poor matches. However, similar to replacement, this may lead to limitation in interpreting effects in the event that many treated units can not find a match (Rosenbaum and Rubin, 1985).

When the PS of the *i*th unit, $\pi(\rho_i)$, is estimated with logistic model. Given a treated unit *i*, the distance measure from the non-treated unit *j* to treated unit *i* will be determined $d_{ij} = |\pi(\rho_i)-\pi(\rho_j)|$. King and Nielsen (2016) argued that random pruning is supposed to be one of major problem in PSM due to its unnecessary reduction of the sample size (without changing) causing imbalance. Therefore, if using a matching algorithm such as nearestneighbour, as long as all ties are kept and observations are matched with replacement, random pruning is still be unavoidable. However, matching with replacement can maintain low bias at the cost of larger variance. To diminish these issues, we attempted to employ several pure matching methods using distance matrices between observations. The first matching method called Mahalanobis that was established based on matching measures the Mahalanobis distance

between the two observations x_i and x_j. Typically, the distance metric is able to map two covariates vectors into a single number. By the explanation of McLachlan (1999), the Mahalanobis distance of an observation $x\sim_i = (x_{i1},x_{i2},...,x_{in})$, $x\sim_j = (x_{j1},x_{j2},...,x_{jn})$ and covariance matrix S is defined as

$$d_M(\vec{x_i},\vec{x_j}) = [(\vec{x_i}-\vec{x_j})^\tau S^{-1}(\vec{x_i}-\vec{x_j})]^{\frac{1}{2}}.$$

where $(x\sim_i - x\sim_j)^\tau$ is transposed matrix of $(x\sim_i - x\sim_j)$ and S^{-1} is inverse variance-covariance matrix of x_i and x_j.

Additionally, Rosenbaum and Rubin (1985) proposed another way of matching with Mahalanobis distance on the PS, $\pi(\rho_i)$, to minimize the effects of sampling variation and non-exact matching which should match on individual covariates by minimizing the Mahalanobis distance of treated and control units to obtain balance on matching. In other words, PS is initially estimated then matching based on Mahalanobis distance within PS stratification. Applying the theory of Mahalanobis distance into PSM:

$$d_M[\pi(\rho_i),\pi(\rho_j)] = [(\pi(\rho_i)-\pi(\rho_j))^\tau S^{-1}(\pi(\rho_i)-\pi(\rho_j))]^{\frac{1}{2}},$$

$[\pi(\rho_i) - \pi(\rho_j)]^\tau$ denotes the related transpose of $[\pi(\rho_i) - \pi(\rho_j)]$.

Furthermore, Baltar et al. (2014) argued that a caliper c to set the boundary for maximum distance should be taken value at 0.2 of PS standard deviation:

$$d_M[\pi(\rho_i),\pi(\rho_j)] = [(\pi(\rho_i)-\pi(\rho_j))^\tau S^{-1}(\pi(\rho_i)-\pi(\rho_j))]^{\frac{1}{2}},$$

if $|\pi(\rho_i) - \pi(\rho_j)| \leq c$.

Nonetheless, Sekhon (2011) argued that using Mahalanobis distance as a distance metric might be biased in some certain circumstances. Instead, another balance metric is effortfully sought to induces the best balance in the data. Mahalanobis distance is augmented with a set of variable weights that call genetic matching. The procedure is to use a genetic search algorithm to find a set of weights for each covariate such that the a version of optimal balance is achieved after matching. The genetic algorithm is necessary because the optimisation problem is irregular. Basically, genetic match is conducted by minimising a generalised version of Mahalanobis distance that adds the parameter weight ω. Formally:

$$d(x_i,x_j,\omega) = [(x_i-x_j)^\tau (S^{-\frac{1}{2}})^\tau \omega (S^{-\frac{1}{2}})(x_i-x_j)]^{\frac{1}{2}},$$

where ω is a $k \times k$ diagonal positive definite weight matrix, and $(S^{-\frac{1}{2}}\_)$ is the Cholesky decomposition of S^{-1} (Diamond and Sekhon, 2013). The Cholesky decomposition is parameterised in genetic matching case such that $S = (S^{-\frac{1}{2}})(S^{-\frac{1}{2}})^\tau$ where $(S^{-\frac{1}{2}}\_)$ is a lower triangular matrix with real and positive diagonal entries, and $(S^{-\frac{1}{2}})^\tau\_$ denotes the conjugate

transpose of ($S^{-\frac{1}{2}}$). The component of ω are selected to simultaneously minimise the distributional difference and location difference of covariates between the treated and control groups relied on the Kolmogorov-Smirnov test and conventional t-test. Theoretically, the Kolmogorov-Smirnov statistic quantifies a distance between the empirical distribution function of the sample and the cumulative distribution function of the reference distribution. By combining the two tests, the covariates can be more accurately matched in either location or other properties of the distributions (Sekhon, 2011).

3.3 Endogeneity issue

In order to work, regression models need to meet some assumptions Draper and Smith (1998). One of them calls for independence between the independent variables in the model and the error term. Violations of this assumption are usually associated with omitted variables. That is, there is some other variable that is not included in the model which is correlated with both the dependent and the independent(s) variables. Omitted variables are one of the major problems in non-experimental (observational/quasi-experimental) studies, because if we do not take them into account, they will create abiased estimate of the effect. That is, our interpretation of the regression model will either under-estimate or over-estimate the relationship between the independent and dependent variables. Omitted variables represent a form of endogeneity which affects our ability to establish accurate causal relationships. However, similar to instrumental variable regression and Heckman selection correction, PSM or conventional matching algorithm are another way to control endogeneity issue.

3.4 Data

The data used in the analyses are part of a broader survey were collected in three provinces called Tuyen Quang, Phu Tho and Thai Nguyen in the north of Vietnam. Figure 2 indicates the geographical location of our surveyed areas in the provinces on the map northern Vietnam.[1]

[1] Data and the survey questionnaire are available from the authors upon request.

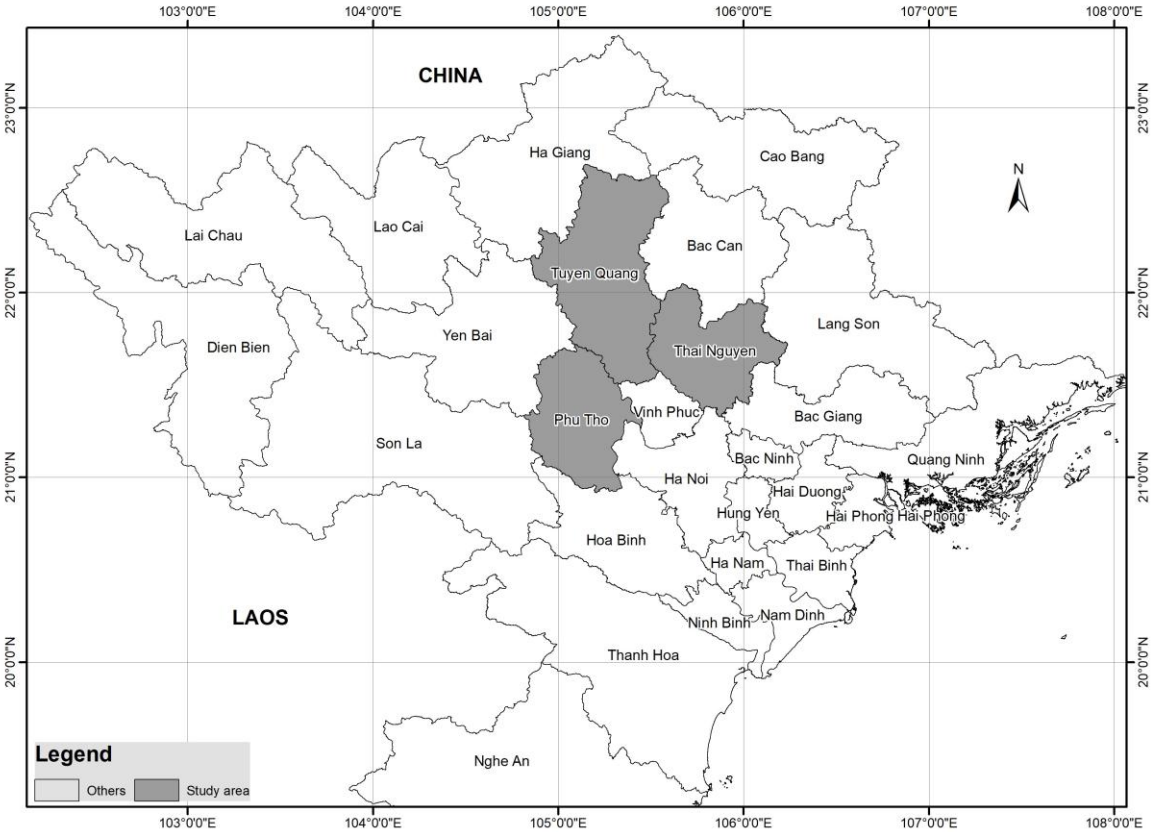


Figure 2: Geographical location of the survey

Our household-level cross-section data were collected from the rural areas of three provinces between December 2017 and January 2018. The data contained approximately 550 households in the surveyed areas. Households were selected using a two-stage proportional random sampling method: (1) Because the subsidizes programs were implemented nationwide so communes were chosen randomly in three provinces; (2) roughly 55 farming households were selected from each commune following the list of households received subsidies. The survey included questions to capture socio-demographic characteristics as well as investment on farmer production, factors affecting food choices, access to extension services. The survey respondent was the adult member of the household who was responsible for most of the decision in the household.

Hence, to compute personal relations with officials, we focus on the effects of having political relations. Our data set contains information on the presence of public officials as a household's member or relative and on whether household members have friends who are officials. Therefore, at most two connections can be inscribed. By avoiding the confusion between connections to officials and being an official, because the decision to work as local officers is potentially endogenous, these respondents are excluded from the analysis. In other

words, our study concentrated mainly on investigating the political connections captured by all the relations of the families with local officers. Additionally, a number of explanatory variables are included to estimate the propensity score. First, extension is included to reflect the reality that the local government is in charge of gathering farmers and operating the extension schemes. So the frequency of extension classes participation may correlate to the acquaintance of that farmer to local officials. Second, household characteristics such as the amount of land, age, experience years are employed in the models as our expectation of contributing to household's income and re-investment in agriculture. Similar to the study of Markussen et al. (2011), our cultivation land areas are in logs. Consequently, Ethnic is expected to determine the favouritism from majority groups compared to minority (ethnical) groups. To determine the impact of political connection on re-investment in agriculture, the components of main crops in the households are listed out. Interestingly, selling agricultural products is not solely income from the surveyed households since some substantial crops such as rice, maize is mainly self-consumed and the existence of non-agricultural income. Intuitively, our hypothetical relationship between political connections and the re-investment into agriculture is possibly to be insignificant.

Moreover, our most important variable, income, is defined as total earning of a household in a financial year including agricultural income and reinvestment in agricultural production of rural households. Cultivation land is represented for the total land used for cropping. Consequently, when Markussen et al. (2011) studied on property rights of land, real farm gate rice price was employed as an explanatory variable. Therefore, we managed to use real average farm gate prices of all marketable agricultural products to observe both the income from agricultural activities and re-investment into the agriculture of studied households. The price is calculated as the median farm gate prices of the products to avoid the outliers. Lastly, difficulty in access to credit variable has been included to potentially contemplate the ease of access to finance of households, because most of the formal lending institutions in rural regions of Vietnam are particularly operated by the local state. This implicitly implies that whether the capability of borrowing is related to political connections.

4. Results and discusion

4.1 Matching analyses

Descriptive analysis

To estimate the PS, we basically run a logistic model to with dependent variable as our treatment variable (being connected to local authorities). Initially, summary statistics of the variables are a good way to observe the distance before proceeding to the matching section

which is reported in Table 1. In this paper, total income and agricultural income are measured in million VND[1], while cultivation land is measured in hectare (ha). We observe that the mean total income of the treated households is about 135.67 million VND per year, meanwhile, the average income of control households group is 13.13 million VND less than the treated ones. Additionally, the standard deviation of total income of the treated group is greatly high at 143.34 million VND which indicates the large variability in total income among the treated households. Similarly, mean farm gate saleable agricultural product prices observes the same situation when treated group owns 18.87 thousand VND per ton greater price compared to the control group. This indicates that with higher income, the treated households re-invest into their farm to acquire higher products quality for a better price. Apart from our predicted variables, most of the household characteristics such as experience, age and ethnicity of the household's head of either treated or control group. Generally, before matching we observe the indifference in total income, usage of eco-friendly pesticide, experience, age, accessible ability to micro-credit loans of both connected and non-connected rural households. The remaining variables witness distinguished distance between the two groups.

Table 1: Descriptive statistics the characteristic for the households before matching

Variable	Mean Treated	Std.Dev.	Mean Control	Std. Dev.	p-value
Total income	135.67	143.34	122.54	73.29	0.365
Investment	93.90	119.11	102.22	123.09	0.069
Eco-friendly pesticide	0.99	0.09	0.99	0.09	0.975
lnLand	1.11	0.98	1.49	1.05	0.004
Experience	30.12	13.08	29.68	14.60	0.806
Age	47.94	9.99	48.02	9.87	0.953
Agricultural prices	106.21	67.46	87.34	59.62	0.021
Difficult to credit	0.66	0.48	0.70	0.46	0.501
Extension	0.92	0.28	0.77	0.42	0.002
Output	3.39	4.56	7.31	10.42	0.001

Table 2 is the summary of logistic model used for PS estimation. In this research, logistic model is principally employed to estimate the PS, thus we mainly focus on the sign of explanatory variables rather than their magnitude. The political connection of rural households in surveyed areas was designed as being connected at value 1 and being non-

connected at value 0. The insignificant impacts of cultivated farming areas, experience, age of household heads implicitly signified that there was no significant difference between connected and non-connected rural households to political system. On the contrary, extension, one of the governmental subsidy, was remarkably skewed to connected households. This indicated the ambiguous existence of nepotism in selecting participators of training courses. Lastly, measurement of total commercial agricultural products suggested that non-connected households produced more output than connected household, however, the mean farm-gate price was insignificant that leads to the question is whether more output resulted in higher income.

Table 2: Summary of the logistic model

Variable	Coefficient	Std.Error	z-value
Intercept	-0.927	0.905	-1.025
lnLand	-0.119	0.171	-0.700
Experience	-0.004	0.012	-0.336
Age	0.007	0.0167	0.456
Mean farm gate price	0.002	0.002	0.802
Difficult to credit	-0.349	0.299	-1.167
Extension	1.4331***	0.242	3.330
Output	-0.062**	0.308	-2.019

Notes: *z*-statistics in parentheses.

*, ** and *** mean for significance at 10%, 5% and 1% level, respectively.

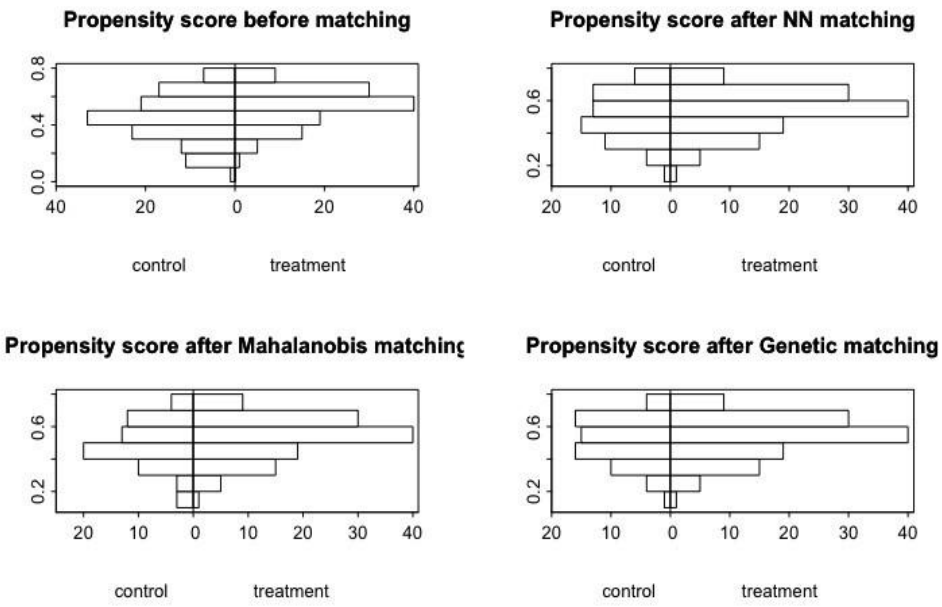
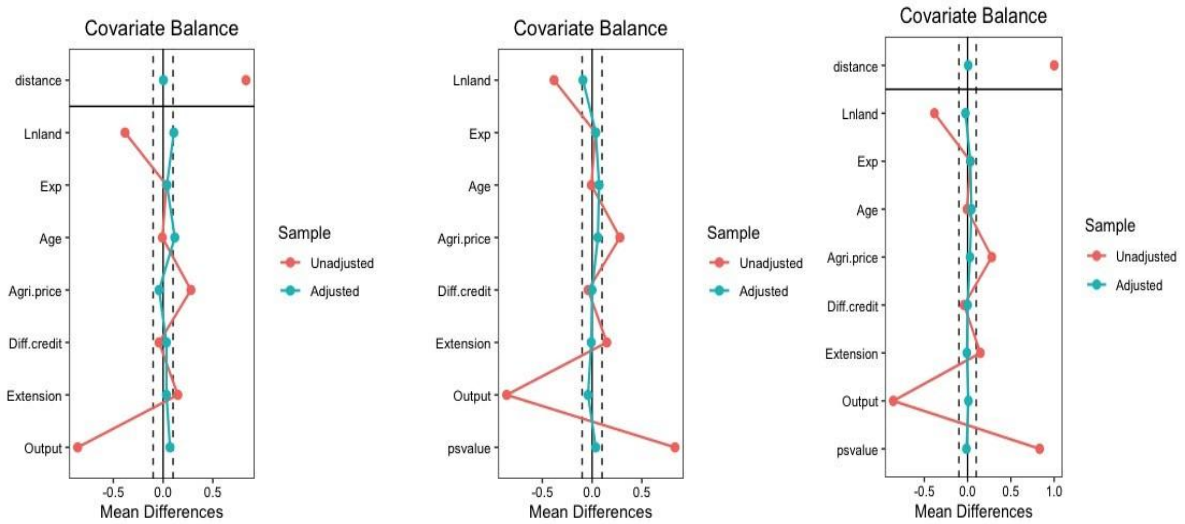


Figure 3: Before and After matching

Figure 3 illustrated the improvement in matching treated and control group using PS. It is clearly stated that the improvement is plausible to observe intuitively, however, there is a significant change in matching from 0.1 to 0.5 score. Genetic matching is likely to perform better matches above 0.6 score, meanwhile, both Nearest-Neighbor and Mahalanobis do not proceed any alteration in matching with above 0.6 PS. Nonetheless, compared to PS before matching, there is still a significant improvement after using matching methods especially Genetic matching.

Table 3 illustrates the change in control groups since we apply three different types of matching mentioned in third section. At the first glance, there is a significant improvement in attempting to find the best matches of all matching algorithm compared to the unmatched results in Table 1. Generally, Genetic matching is likely to produce the best matches when the average value of both treatment and control variables are the closest among three matching methods.

Imbalance checking



(a) NN (b) Mahalanobis (c) Genetic

Figure 4: Improvement after Nearest-Neighbour, Mahalanobis and Genetic matching

Importantly, checking imbalance after matching is applied to determine that all matched groups are balanced, thus eliminating (or substantially decreasing) the initial selection bias. Chi-square test is employed to figure out the imbalance. In Table 3, the difference displays between no matching and three matching methodologies indicated that there were several variables with a larger difference such as cultivated land, mean farm gate price, extension and output are substantially improved. Consequently, this explicitly signifies that our matching algorithms help to create better matches. However, variables namely age, experience

increases their standardised difference. That is similar to the study of Austin et al. (2007) which suggests that when balance in the selection model cannot be achieved on all the variables, those variables where balance was not achieved, and that may also be associated with the dependent variable could be included in the outcome model as covariates. Lastly, after matching, the outcome of chi-square test demonstrates no significance that suggests equivalence between treatment and control groups.

Table 3: Balance checking before and after matching

Variables	Treated	Control			
		No Matching	NN	Mahalanobis	Genetic
lnLand	1.112	1.490	1.006	1.239	1.127
Experience	30.117	29.679	29.613	29.747	29.664
Age	47.941	48.011	46.764	47.479	47.764
Mean farm gate price	106.210	87.339	108.941	100.479	105.768
Difficult to credit	0.655	0.769	0.622	0.655	0.655
Extension	0.916	0.770	0.882	0.924	0.916
Output	3.392	7.391	3.075	3.851	3.295
$\chi 2$		25.7	4.02	4.04	3.94

Besides, a more in-depth investigation of the all covariates distributions can be alternatively illustrated the deviations between treated and control groups by Quantile-Quantile plots (QQplot). As described in Figures 5, 6, 7 in Appendix, matching produces an improvement in covariate balance. Additionally, Genetic matching is still the best balance producer among three proposed matchings. Alternatively, Figure 4 is a summary plot of covariate balance before and after conditioning popularised more visually. These plots shows that balance substantially improved on all variables after adjustment. Similarly, Genetic matching is the best matching, however, unlike above graphs, we have our threshold of 0.1 for absolute mean differences that implies with any matching point below the threshold is a good match (Ahmed et al., 2007). Based on that we are clearly to state that our balance assumption is satisfied to proceed.

4.2 Outcome analyses

The outcome analysis is conducted after assuring the balance of all three matching methods as illustrated in Table 4. Our results suggest that solely total income of rural households is significantly impacted by political connection at 29.687, 32.603 and 29.744 million VND per

year respectively in all matching approaches. This indicates that having a connection with local authorities in form of being a family member or friend, relative increase household's income by approximately 30 million VND per year (roughly US$ 1,304 per year) that is unlikely similar to the results of Jena et al. (2012). This depicted an overview picture of political connection having a significant impact on the earnings of rural households even when the connection is outside the household in form of relatives or friends and has no direct contribution to household's income. Importantly, the political connection significantly increases the income disparity between connected and non-connected households. The total income of rural households in survey areas is constructed via agricultural and non-agricultural earnings, meanwhile, agricultural income straightly affects the capacity of monetary investment into agricultural production of rural households yielding insignificant impact in all matching methodologies. Connected households resulted in insignificant but lower agricultural income than non-connected households. This signifies that non-agricultural income contributed remarkably into the total income of associated households. The analysis in the current section established that there are two reasons for such an insignificant effect of political connection. Specifically, treated households own more than one income source of agricultural production. At least one member of the family has a second job rather than solely agricultural production. Simultaneously, the family-labour is the main human force to work in agricultural production leading the production has been limited because hiring labour for agricultural activities in rural or especially mountainous areas of Vietnam presently is difficult due to the movement of seasonal movement from rural to urban regions seeking for better-paid jobs (De Brauw and Harigaya, 2007).

Along with a negative relationship of political connection and household's agricultural income, the non-connected households employed significantly less investment and labour used in agricultural production. Our empirical result indicated the significantly negative impact of being connected to the political system in agricultural reinvestment of studied households in Mahalanobis and Genetic matching with the reduction of 0.195 and 0.287 million VND (US$ 8,479 and 12,478) yearly. The gap between the two groups was slightly small, meanwhile, the negative sign suggested that the investment of non-connected households is larger than that of connected households. Similarly, total labour-hours used in agricultural activities of connected households are reported significantly smaller than that of non-connected households at roughly 40 labour-hours. These outcomes latently demonstrate an interesting story behind. Two fundamental components of agricultural income are an agricultural investment in farming equipment, inputs acquisitions and labour used for

agricultural farming activities are significantly different between the two households' groups, meanwhile, agricultural income is insignificantly distinguishable. However, the coefficient of treatment effect on the treated (connected) households suggested the same direction of response variables "investment" and "labour". In contrast, the household's behaviour of using eco-friendly pesticide indicated that connected households tend to use more of these products instead of chemical substances than referent households. The eco-friendly products of pesticides/herbicide/insecticides are mainly distributed by extension officers and the guidance of using these inventions are mostly instructed via extension training courses. The result practically pointed out the usefulness of extension courses in term of changing farmer's using chemical substance behaviour to produce their crops. The pro-environment action of rural households is necessarily conducted to guide them hot to develop their farming production sustainably (Khanh et al., 2006; Ha, 2014 and Tu et al., 2018). However, the amount of connected households having opportunity to participate into extension training courses is 92 percent in Table 1, the sign and magnitude of extension in Table 2 indicate the practically positive relationship between participation to extension class and households' connection to the local political system. More importantly, our previous outcome indicates that non-connected households concern more about their farming production compared to connect households, meanwhile, the practical effect of extension course on significant changing households' behaviour in using eco-friendly products. Therefore, the privileges of connected households in term of receiving extension courses are more likely to increase the inequality between rural households in survey areas because the distribution of government subsidy is distorted to target the necessities

Table 4: Estimation of the ATT from three matching methods

Variables	Nearest-neighbour	Mahalanobis	Genetic
Total income	29.871**	32.603**	29.744**
Agricultural income	-3.316	-4.590	-4.201
Investment	-0.061	-0.195*	-0.287**
Labour	-33.399	-37.539**	-38.566***
Eco-friendly pesticide	0.025	0.033*	0.042**

Notes: *, ** and *** mean for significance at 10%, 5% and 1% level, respectively.

4.3 Sensitivity analysis

Estimates of treatment effects based on matching are unbiased unless all possible confounders are observed or all potential covariates have been comprised in the matching models. Thus,

the question is whether our adjustment through matching fail or succeed to account for all relevant covariates (Keele, 2010). Fortunately, a sensitivity analysis is designed to provide a quantitative increase in uncertainty when a key assumption is relaxed. Rosenbaum's method of sensitivity analysis is based on the sensitivity parameter that measures the degree of departure from random assignment of treatment Rosenbaum (2002). In this study, the sensitivity analysis relies on Wilcoxon sign rank test and test for Hodges-Lehmann Point Estimate.

The output in Table 4 is reported similarly to standard matching analysis. Although the estimated results suggests that the coefficients of dependent variables relatively close to the experimental benchmark, none of them are statistically significant at conventional levels based on the Abadie-Imbens standard. Additionally, this analysis outcome presumes that matching conducted by logistic PS is not depended on all relevant characteristics and unobserved confounder latently existed that possibly accounts for this difference across the connected and non-connected groups. This bias directly caused the insignificant impact of political connection in nearest-neighbour matching, meanwhile, mahalanobis matching using caliper and genetic matching reported to be more precise (Rosenbaum and Rubin, 1985, Baltar et al., 2014). In table 5, the value of Γ is basically interpreted as the odds of treatment assignment hidden bias. In other words, a change in the odds of lower or upper bounds from significant to non-significant (or otherwise) implicitly indicates by how much the odds need to change before the statical significance of the outcome alters. In our analysis, the maximum value for Γ is set from 1.0 to 1.5 with increments of 0.1. Γ is 1.0 means no hidden bias occurred in our analysis. Here, the lower bound estimate of rural households's total income shifts from non-significant (0.0685) to significant (0.0247) when Γ value is 1.1. This signifies that a change of 0.1 in the odds will result a change in the significance value. Rosenbaum (2002) defines a matching case as sensitive if value of Γ close to 1 that explicitly means larger change in the odds, the more robust to hidden bias. The remaining predicted variables such as Agricultural income and Investment have taken Γ value at 1.2, meanwhile, Γ value of total labour and eco-friendly use of pesticide is 1.3. The output of Rosenbaum Sensitivity Test for Hodges-Lehmann Point Estimate demonstrated a homogenous story to Wilcoxon Sign Rank Test. Since Γ value is at 1.3, total income of connected households higher than that of non-connected household from 1.3801 to 22.7801. Nonetheless, when Γ value increases to 1.4, the result is less robust because total income of connected households possibly turns to be lower than that of non-connected household (lower-bound is -1.5199). The general explanation accordingly is that while the political connection has a positive effect on treated group, the

outcome is sensitive to potential hidden bias caused by an unobserved confounder. Similarly, The behaviour of connected household in using eco-friendly pesticide is more sensitive since the Γ value alters from 1.0 to 1.1, the hidden bias is occurred.

5. Conclusions

This study empirically investigates the impacts of political ties on total income, agricultural investment and the behaviour of using eco-friendly products of rural households using data from a baseline survey at Northern Vietnam. By using PSM and pure matching methods, the selection bias is controlled. Since these matchings merely control for "selection on observables", at our last step, the analysis of sensitivities of our political connections impact results to bias due to unobservables indicates that the impact of political ties on total income would vanish if an unobserved covariate increased the odds of owning political connections by more than a factor of respective Γ of each predicted variables.

Political ties have been implicitly asserted to provide substantial benefits for related households (Markussen et al., 2011). In this article, after using three matching methodologies, the outcome suggests that political connection has a positive impact on total income and farming behaviour of households and negative effect on agricultural income and investment into agriculture. Furthermore, the impact of political connections on household's income is significantly large when we observe the difference between the income of the connected and non-connected groups of households (roughly 30 million VND per year), meanwhile, although having political connections is negatively affecting to agricultural production income and investment in agriculture. This finding implicitly implies less concern of politically tied households on these activities. Importantly, the total incomes of connected households are not based heavily on agricultural production, their nonagricultural activities account for a larger share in their total income.

Besides, in the logistic estimate for PS, extension is found to have a significant impact on the treatment variable. However, positive effect indicates that households in the treated group have more opportunities to attend extension class organized at their local regions, meanwhile, households in the control group who perform better in term of agricultural production income having fewer chances. This is a relatively obvious paradox when the needs are not being sufficiently and efficiently supported. Accordingly, our result is a potentially substantial case study for policymakers to either at least distribute the attending opportunity equally or concentrate on the proper objects because the extension is created toward aiding farmers for their production.

In addition, another outcome of the average treatment effect on the treated analysis indicates that the potential behaviour of treated households in term of developing their agricultural production eco-friendly and sustainably. Synthetically, this implies that households owning political connections is likely to transform the knowledge acquired from extension training courses provided by the local government to achieve better agriculture practice. Fortunately, unlike the farm-gate price of rice as the result of Markussen et al. (2011), the quality of the agri-related products is a dominant feature to set saleable products price that possibly reduces the effects of local authorities in causing asymmetric price between households. The government action is needed quickly to revise their subsidized policies' outcome for eliminating the abnormal phenomenon toward developing agricultural production in the Northern region of Vietnam.

Additionally, the study synthesises either advantages and disadvantages of using propensity in matching from that provides other matching methods to achieve better matching. Despite these contributions, our study still faces some limitations. Firstly, as a drawback of PSM, unobservable variables or effects can not be estimated in both sign and magnitude. Secondly, the hidden bias has occurred to restrict our robust outcome. Thirdly, there is a lot more approach that can be employed to examine political relations such as Instrument Variables, Doubly robust estimation of causal effects... In our study, we focus mainly on three advanced matching methods because after attempting to trial other matching methods namely optimal and full matching, their results suggest less applicable than our three matching methods. Lastly, the study fails to provide a significant explanation for agricultural production income owning political connections.

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Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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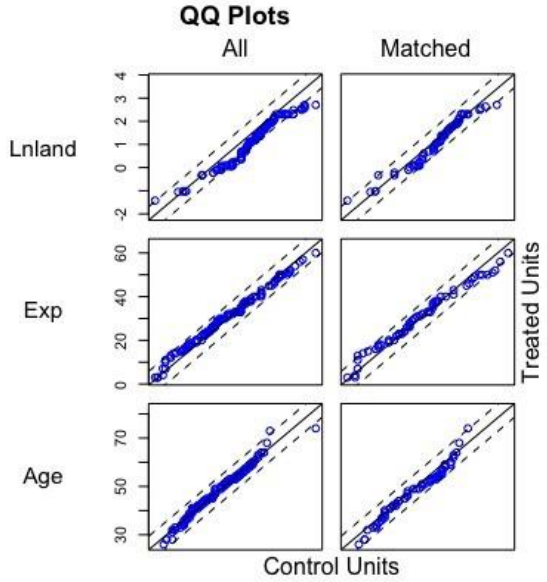
Appendix



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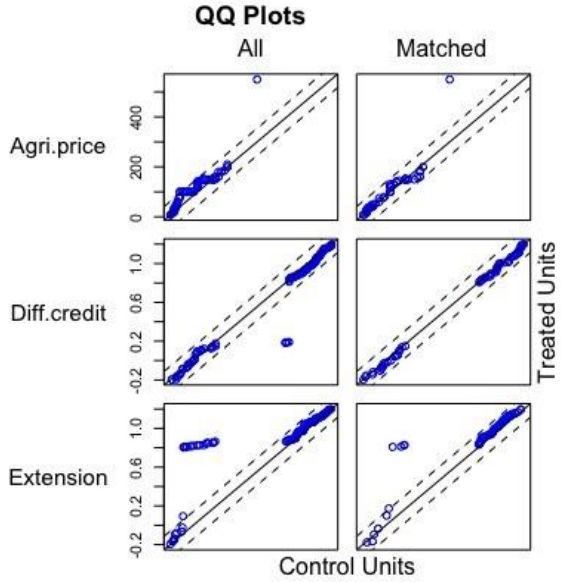

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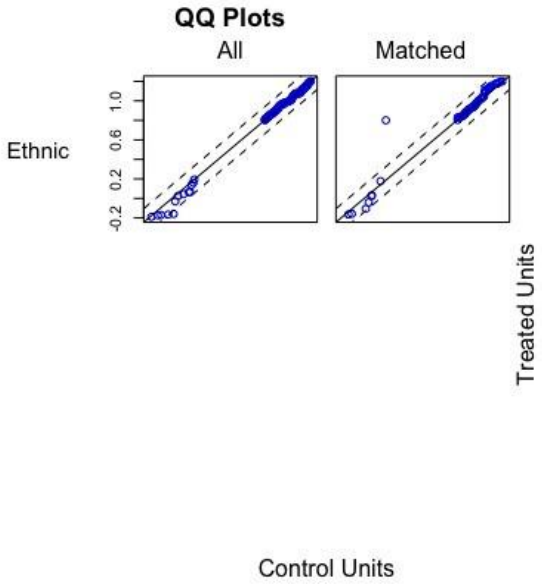
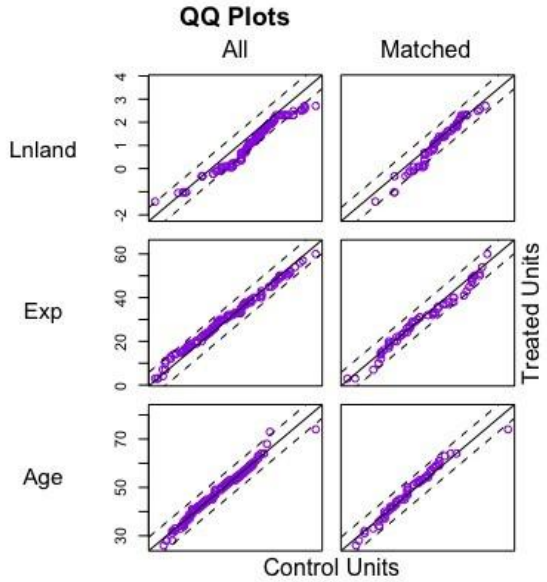
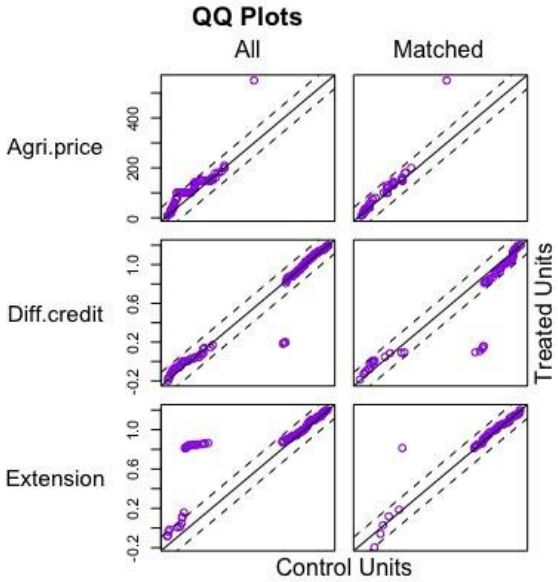


(c) Nearest3

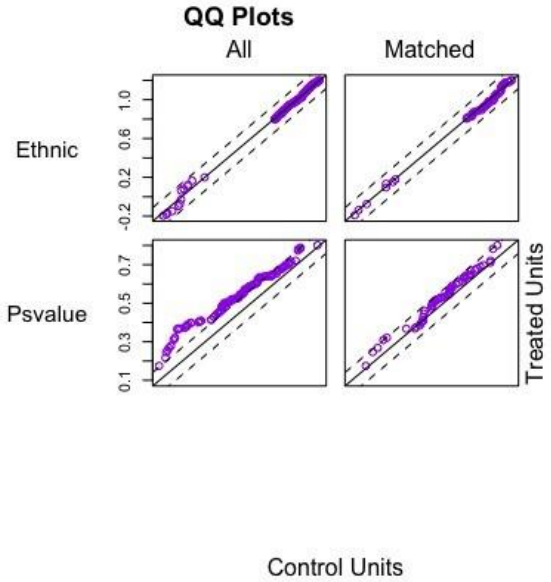
Figure 5: Distribution of propensity score using Nearest-Neighbour matching



(a) Mahalanobis1

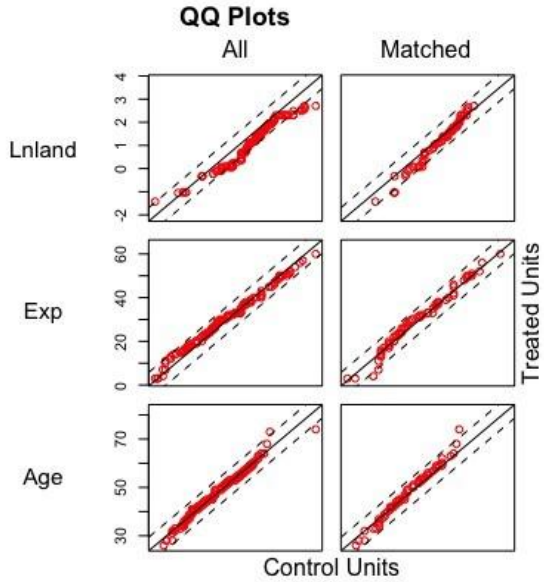


(b) Mahalanobis2

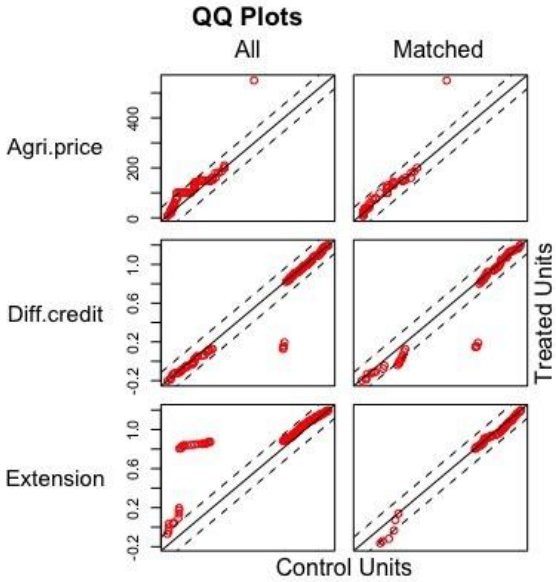


(c) Mahalanobis3

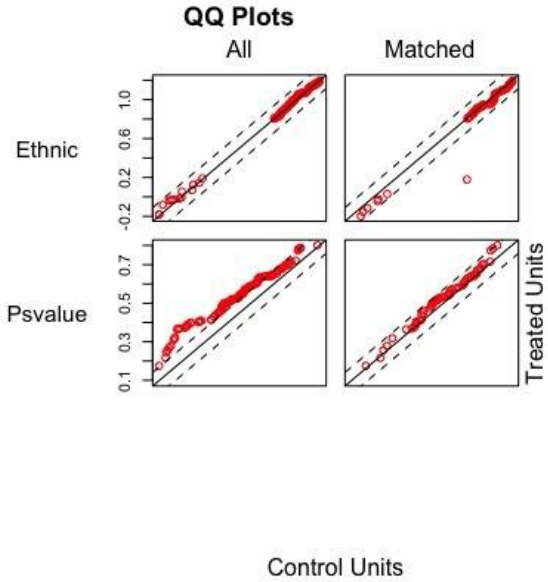
Figure 6: Distribution of propensity score using Mahalanobis matching



(a) Genetic1



(b) Genetic2



(c) Genetic3

Figure 7: Distribution of propensity score using Genetic matching

Table 5: Rosenbaum Sensitivity Test for Wilcoxon Signed Rank P-Value

Variables	Total income		Agricultural income		Investment		Labour		Eco-friendly pesticide	
Gamma	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
1.0	0.0685	0.0685	0.2160	0.2160	0.1679	0.1679	0.3158	0.3158	0.0899	0.0899
1.1	0.0247	0.1559	0.1305	0.3777	0.0749	0.3133.	0.1693	0.4988	0.0736	0.1081
1.2	0.0081	0.2811	0.0446	0.5481	0.0301	0.4789	0.0815	0.6671	0.0604	0.1265
1.3	0.0024	0.4273	0.0177	0.6981	0.0111	0.6352	0.0359	0.7975	0.0497	0.1448
1.4	0.0007	0.5728	0.0065	0.8127	0.0038	0.7628	0.0147	0.8859	0.0410	0.1629
1.5	0.0002	0.7003	0.0023	0.8912	0.0012	0.8555	0.0057	0.9398	0.0339	0.1807

Table 6: Rosenbaum Sensitivity Test for Hodges-Lehmann Point Estimate

Variables	Total income		Agricultural income		Investment		Labour		Eco-friendly pesticide	
Gamma	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
1.0	11.6800	11.6800	-3.5001	-3.5001	-7.4999	-7.4999	-0.0612	-0.0612	0.9999	0.9999
1.1	7.6801	15.6799	-5.4001	-1.3001	-11.6000	0.3133.	-0.16122	0.03879	-0.0009	1.0999
1.2	4.3801	19.1801	-7.2098	0.5994	-15.6000	-0.4999	-0.26122		-0.0009	1.0999
1.3	1.3801	22.7801	-9.0001	2.5999	-19.1000	2.7001	-0.26122	1.3878	-0.0009	1.0999
1.4	-1.5199	25.9798	-11.0000	4.5999	-22.6000	5.5001	-0.36122	2.3878	-0.0009	1.0999
1.5	-4.1199	28.3801	-13.0000	6.5999	-25.8000	8.2001	-0.36122	2.3878	-0.0009	1.0999

Figures

Figure 1

Political connections framework at households level

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Political connections framework at households level

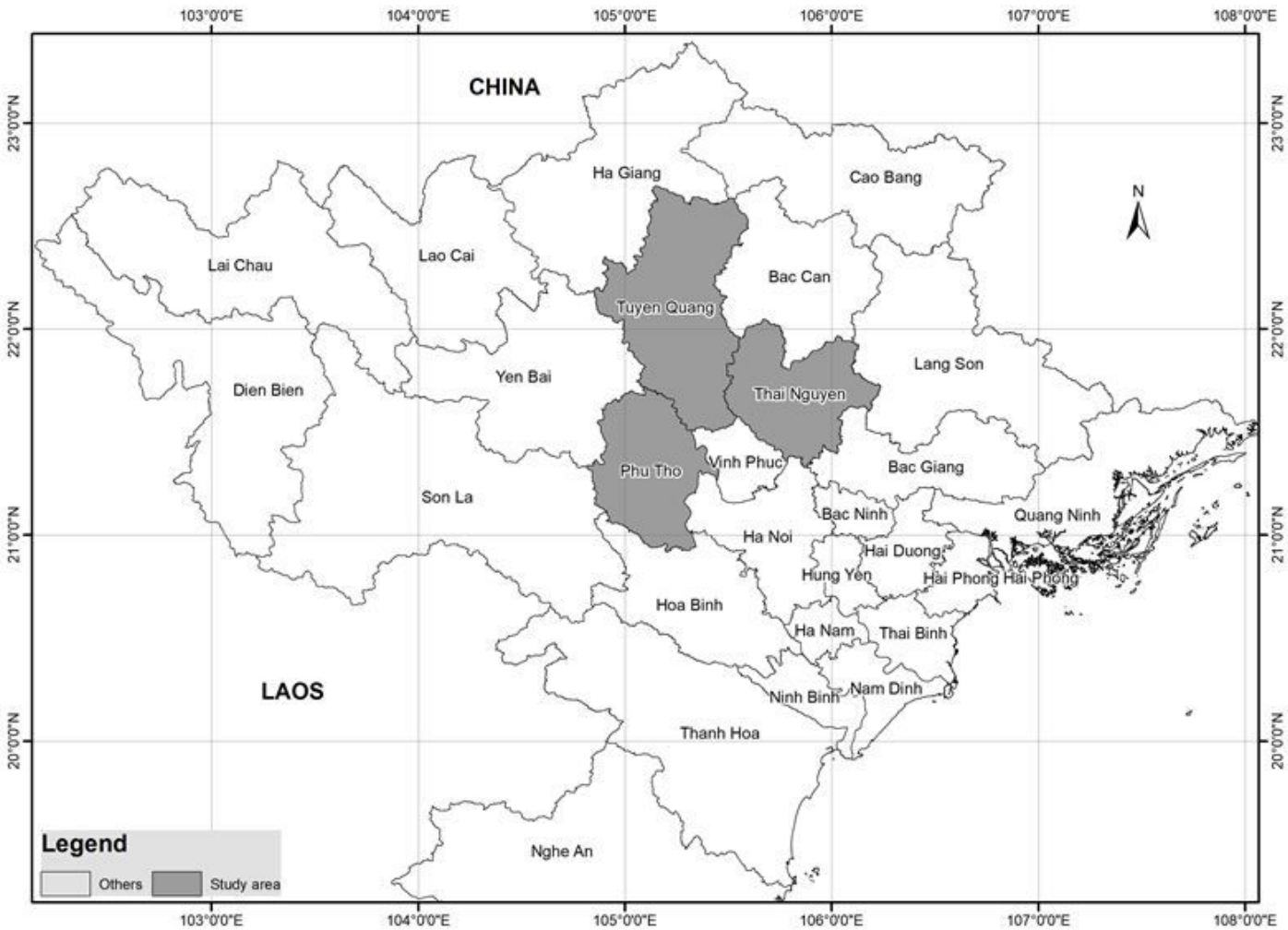
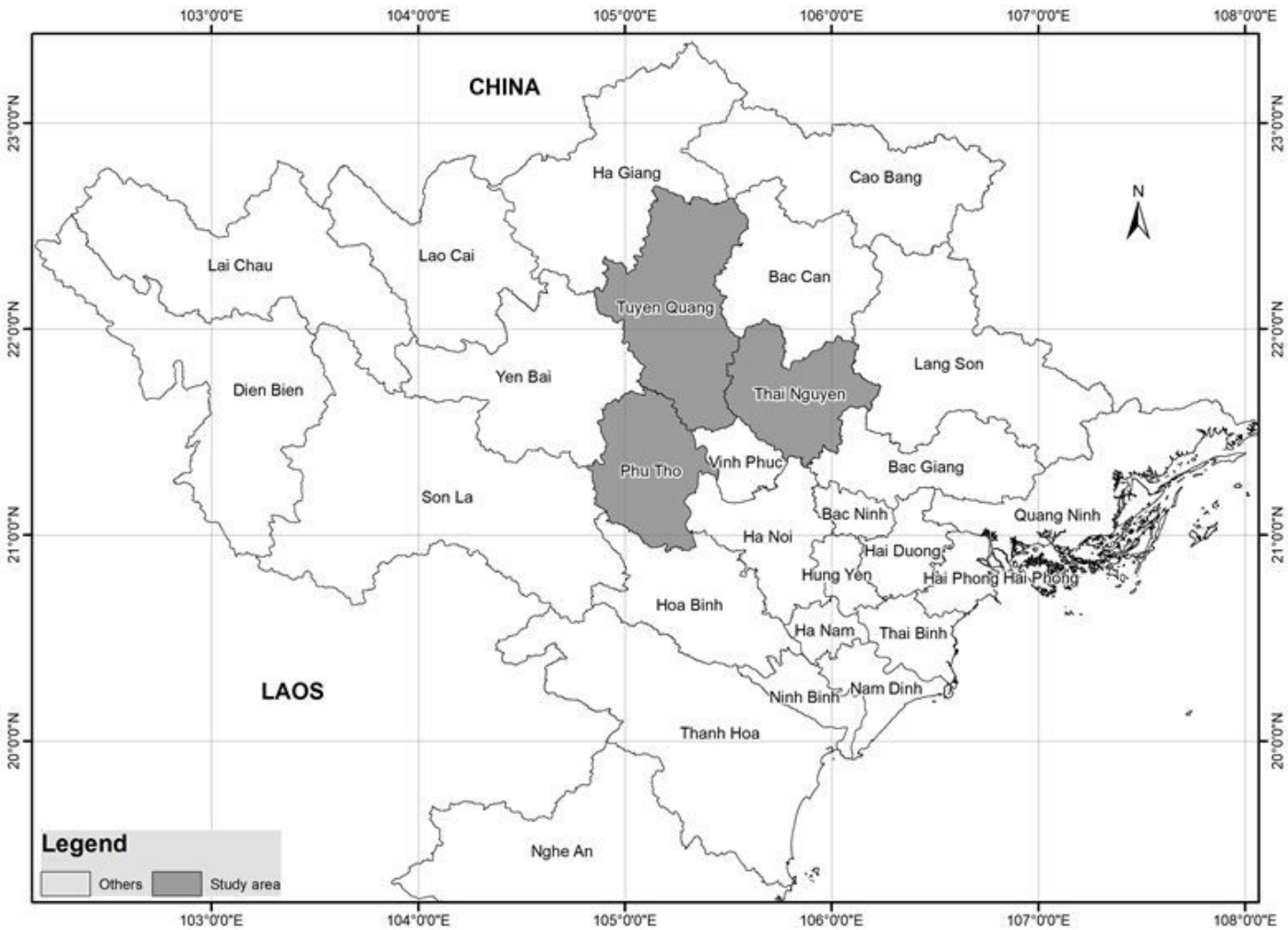


Figure 2

Geographical location of the survey. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.



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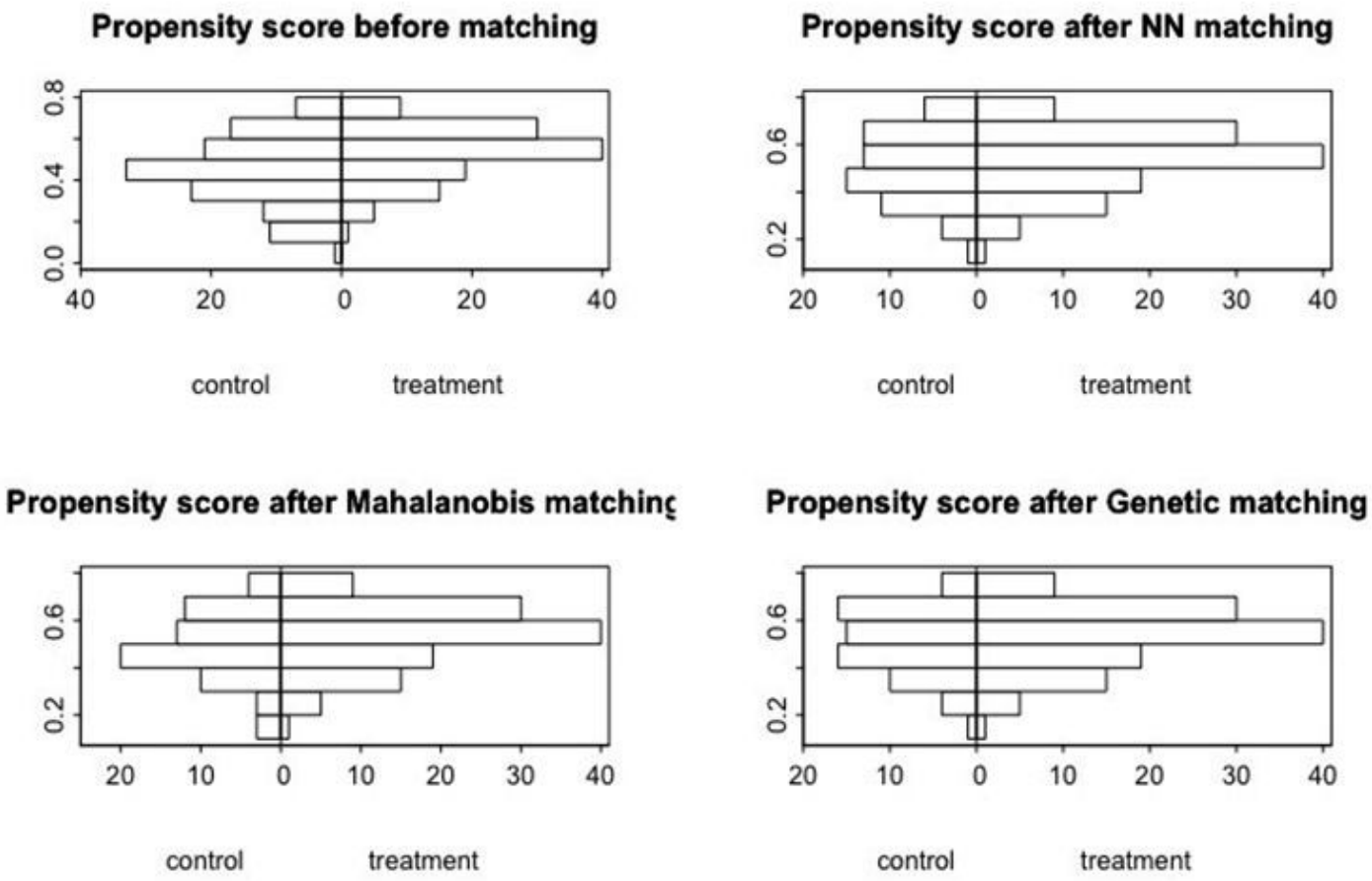


Figure 3

Before and After matching

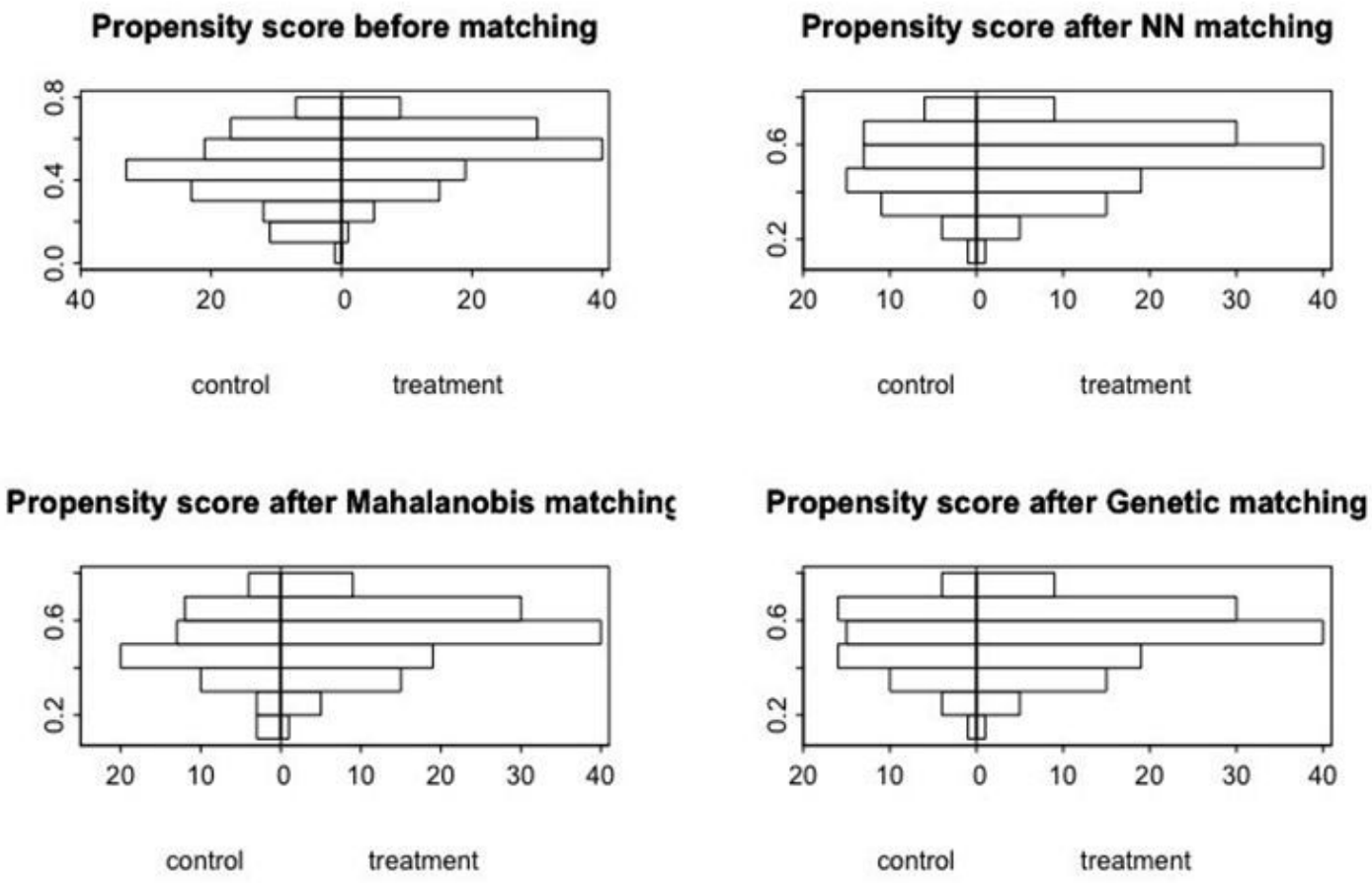


Figure 3

Before and After matching

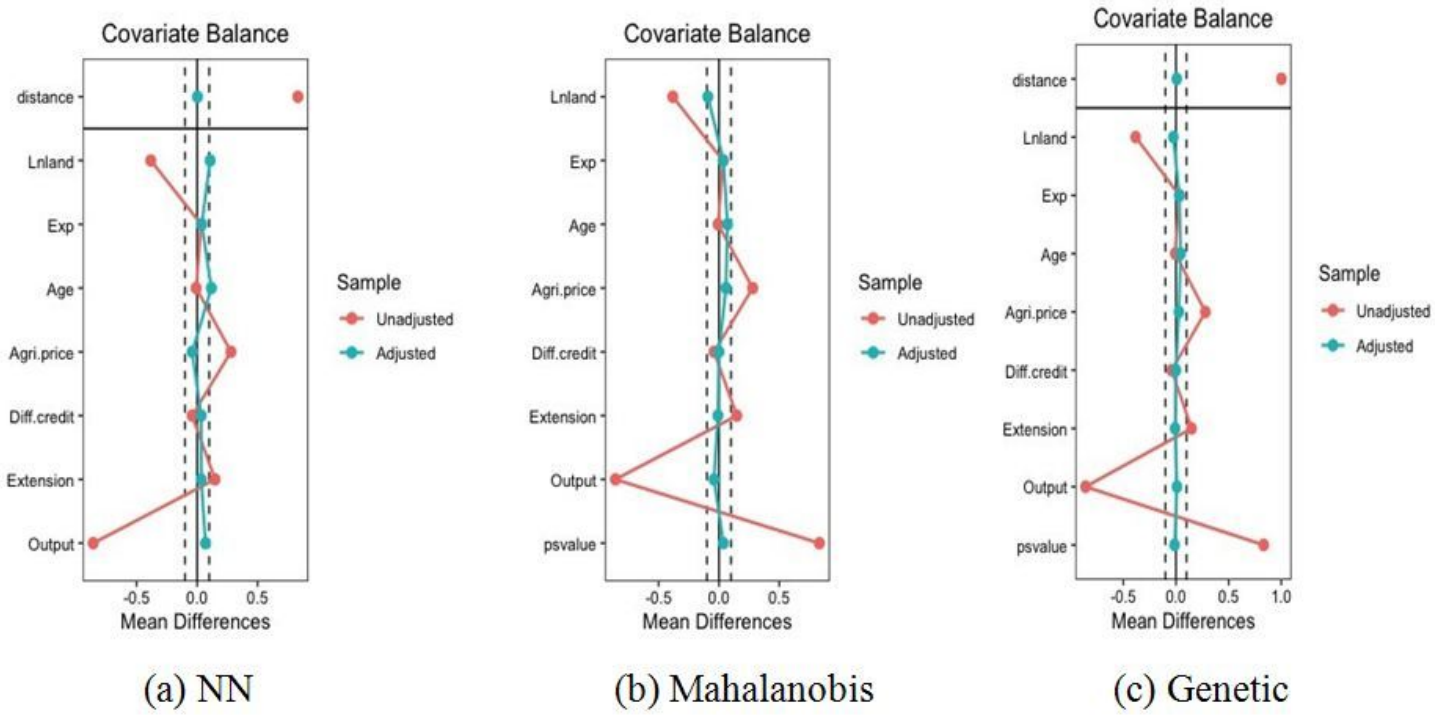
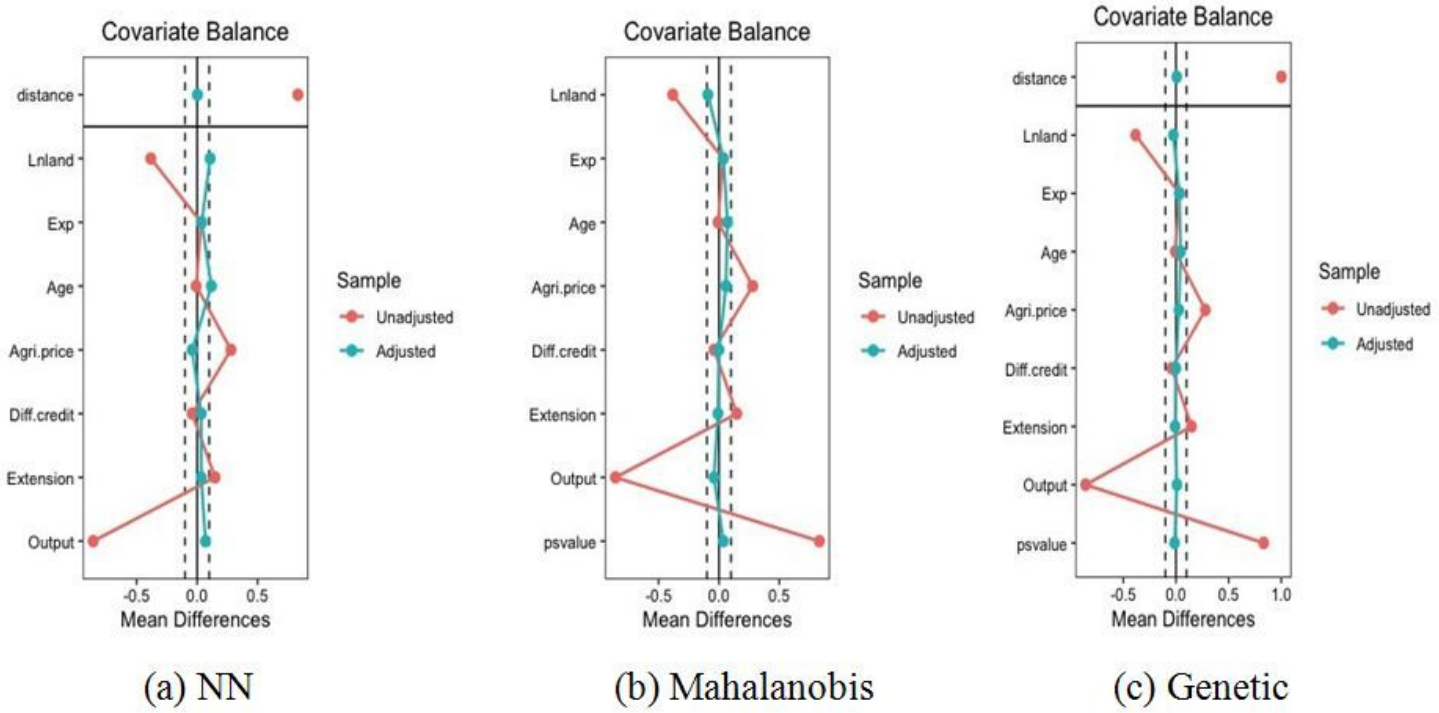


Figure 4

Improvement after Nearest-Neighbour, Mahalanobis and Genetic matching



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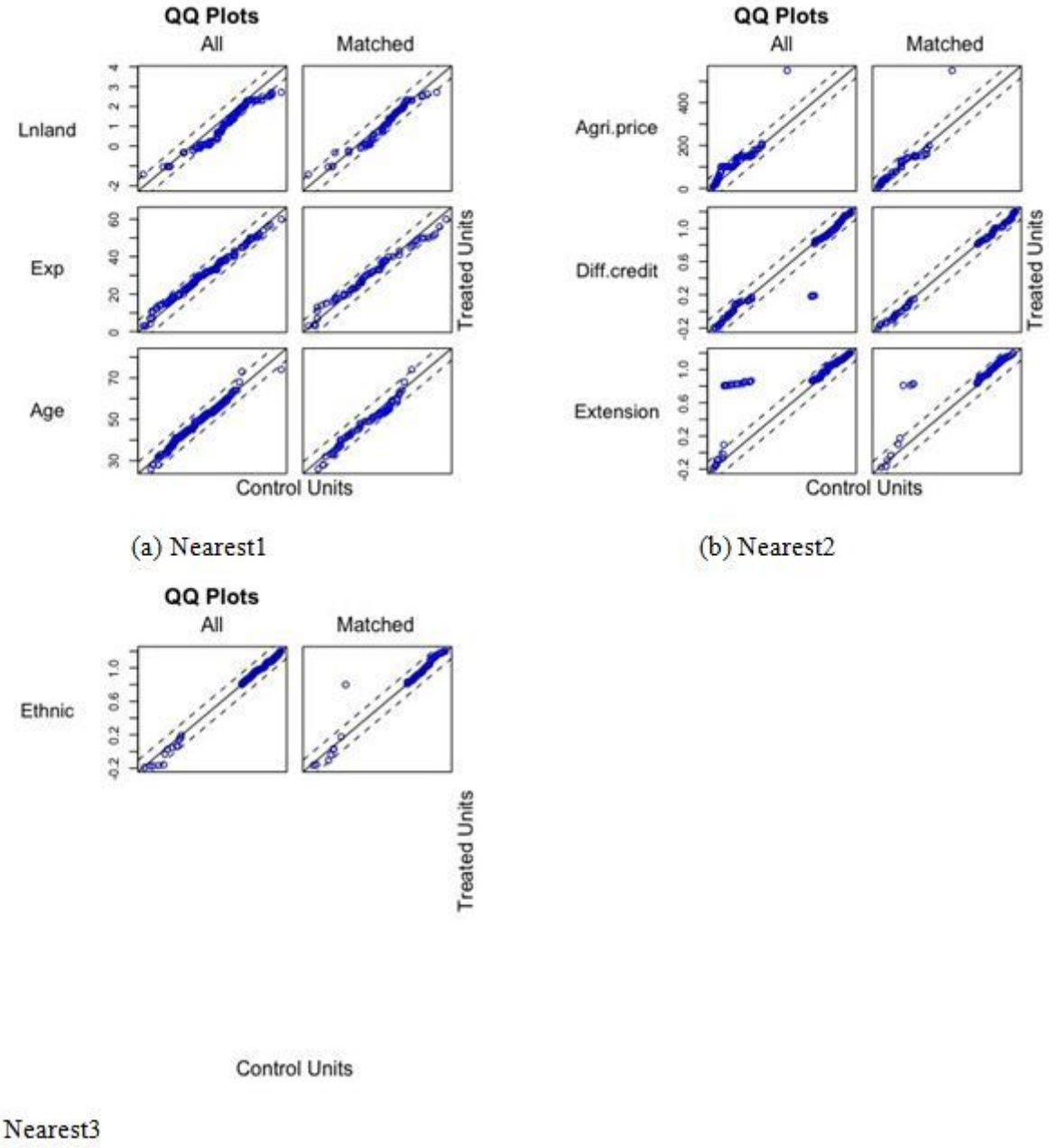
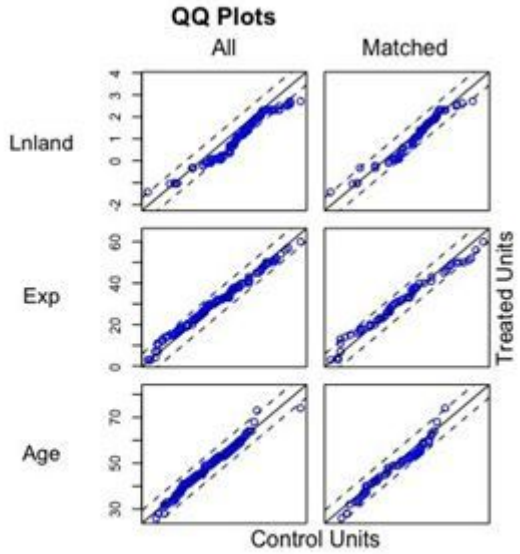
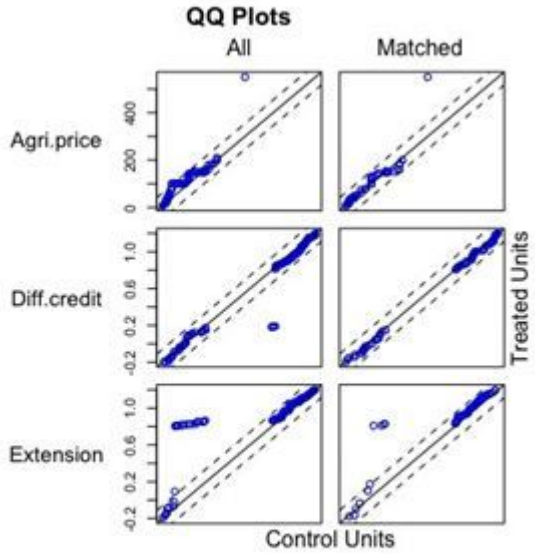


Figure 5

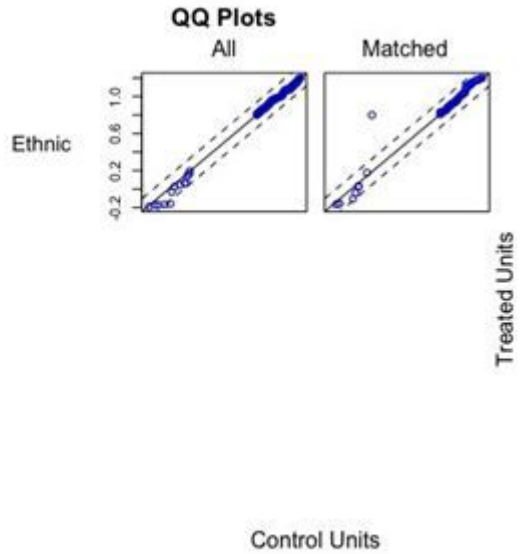
Distribution of propensity score using Nearest-Neighbour matching



(a) Nearest1



(b) Nearest2



(c) Nearest3

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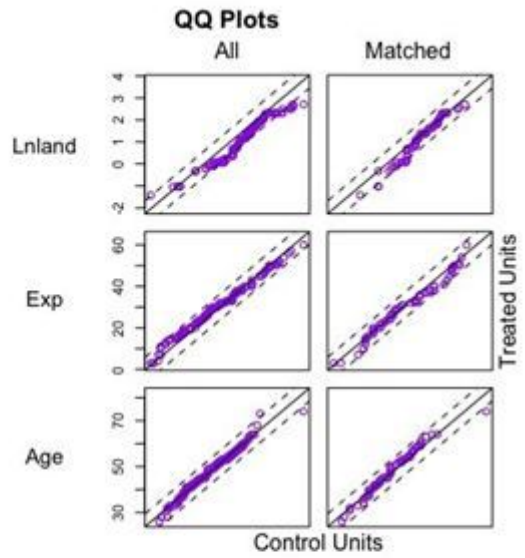
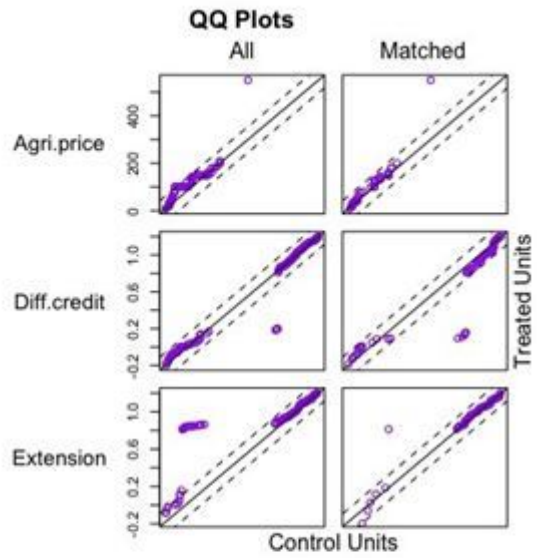
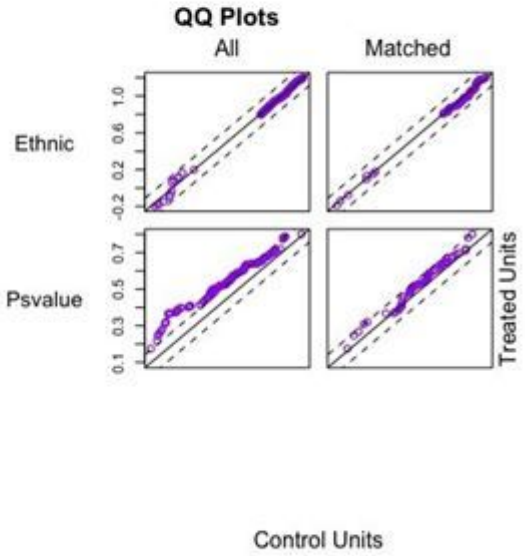
Distribution of propensity score using Nearest-Neighbour matching



(a) Mahalanobis1



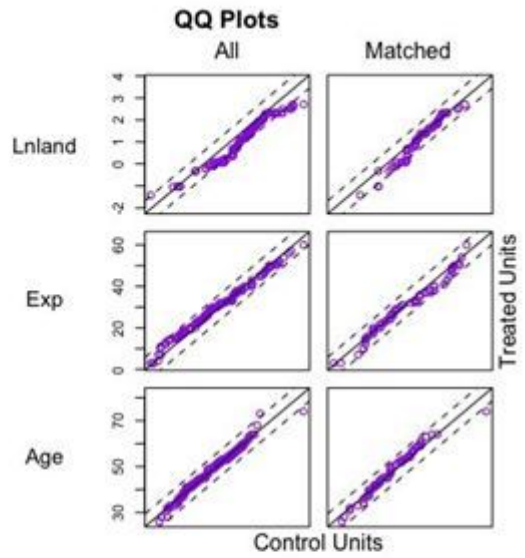
(b) Mahalanobis2



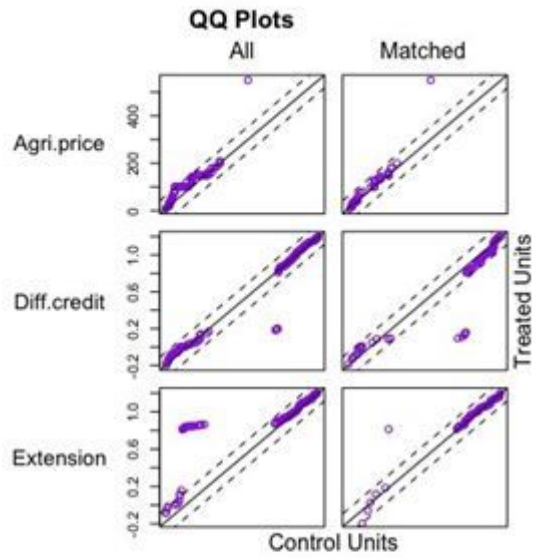
(c) Mahalanobis3

Figure 6

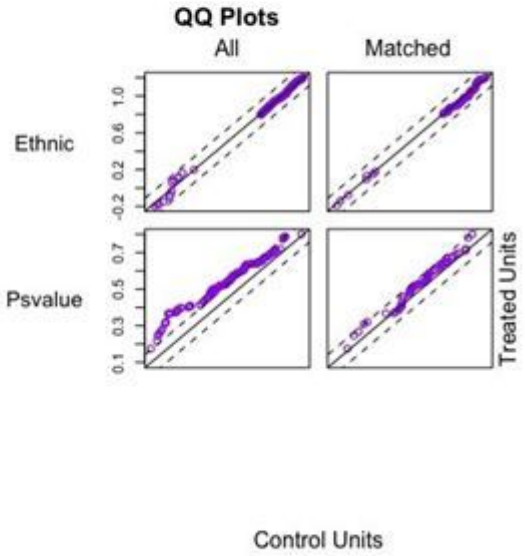
Distribution of propensity score using Mahalanobis matching



(a) Mahalanobis1



(b) Mahalanobis2



(c) Mahalanobis3

Figure 6

Distribution of propensity score using Mahalanobis matching

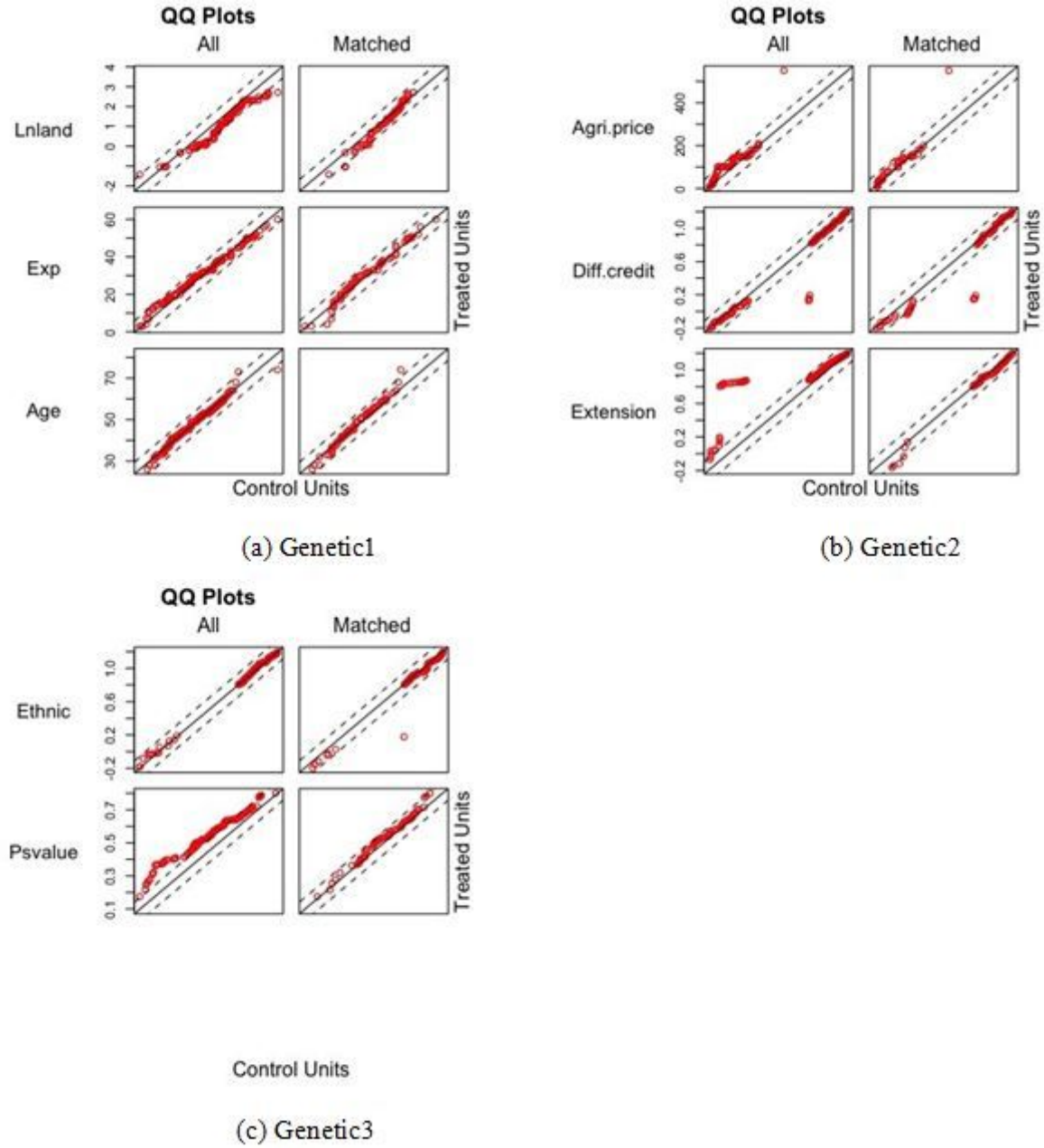


Figure 7

Distribution of propensity score using Genetic matching

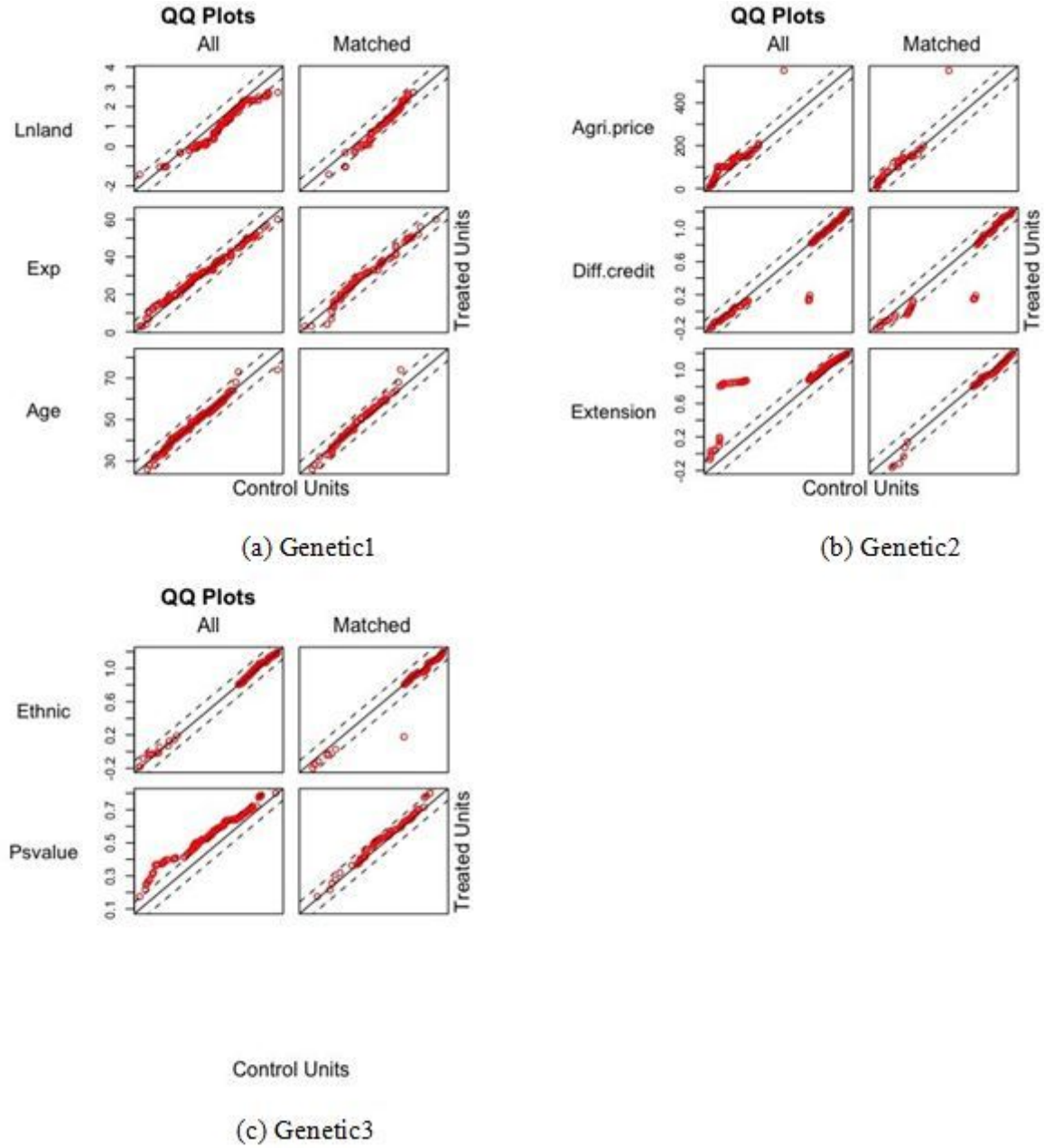


Figure 7

Distribution of propensity score using Genetic matching