The Impact of National Park Establishment on Economic Activities of Rural Households in Indonesia

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List of Acronyms

ATE	Average Treatment Effect
ATT	Average Treatment Effect on the Treated
CBD	Convention on Biological Diversity
DD	Difference in Difference
GCNP	Gunung Ciremai National Park
GMNP	Gunung Merapi National Park
IFLS	Indonesian Family Live Survey
IUCN	International Union for Conservation of Nature
MoF	Ministry of Forestry
MoU	Memorandum of Understanding
NGO	Non-Government Organization
NP	National Park
OLS	Ordinary Least Square
PA	Protected Areas
PHBM	Pengelolaan Hutan Bersama Masyarakat (Forest Management with Communities)
PSM	Propensity Score Matching
Susenas	the National Socioeconomic Survey

Abstract

Notwithstanding the widespread effort to conserve the nature, there is still a long debate as to whether conservation areas, such as National Parks, have an impact on rural livelihood. This paper aims to fill this gap by estimating the impact of National Park (NP) establishment on economic activities of rural households in Indonesia. Two NPs which are Gunung Ciremai NP (GCNP) and Gunung Merapi NP (GMNP) have been selected since both shared comparable characteristics. Those two NPs are located in Java Island and are established in 2004.

The estimation approach to examine the impact of NPs to rural economic activities adopted a pre-post treatment-control analysis design. This analysis utilized two periods cross-section data, the first was collected in 2000, four years prior to the NPs establishment, and the second was followed-up data collected in 2007, three years after the NP establishment, both for treatment and control groups. I compare the use of OLS regression and propensity score matching methods, and incorporate the role of "common support." These predictions provide an estimation of the impact of NPs establishment on rural economics.

A combination of Difference-in-Difference (DD) analysis and matching estimator shows that NPs establishment does not significantly affect expenditures of local households, both for food and non-food spending. Proximity to the NPs has insignificant impact on local farming activities. Lower total household's expenditure in post-establishment period was probably caused by other factors such as higher spending on farming input through inflation, but still the changing was not considerably different. The risk for reduced households expenditures due to lose access to natural resources after the NPs establishment was inversely correlated with the household revenue from non-farm activities and human development. Human development was simply indicated by average hours of school attendance and a binary variable whether children are working during schooling period or not.

In general, we conclude that the current economic activities of local people at the edge of NPss are not significantly affected by NP establishment. Even though NPs establishment introduce strict rule to prohibit local people to enter and utilize resources in NPs, the NPs authorities do not have sufficient personnel and fund to implement the legislation. Furthermore, NPs play an important role to maintain biodiversity and landscape that are beneficial to ecotourism activities that in turn may improve the rural income from non-farming activities.

This paper also suggests that further research is needed to examine the long term impact of NPs on adjacent household.

Relevance to Development Studies

Management of common-pool resources in developing countries has become a fundamental part of sustainable development policies. Some evidence have been shown that centralized management of natural resources through command and control approach is able to conserve biodiversity, but failed to provide immediate incentives for local people. Therefore, it is increasingly claimed that self-organized community can play a better role to deal with many economic problems related to internalization of environment externalities, the provision of common goods, and access to the market by poor people (Molinas 1998:413).

Ellis (1998) had attempted to explain that changing income of rural households from year to year depend upon the outcome of farming activities and the profit gain from farm-production sales. However, his studied in Asian countries showed that due to the high incidence of landlessness; the rural households generated their income from "off-farm" and "non-farm" activities for survival.

Institutional change as well as policies transformation occurs when the state takes over forests which previously managed by a community or private sectors. The establishment of NPs has been most widely practiced by states in order to maintain environmental services. Perhaps it has a long term effect and has been seen as the best funded approach to achieve the goals in forest conservation. The government passes conservation law to restrict the accessibility for local people to the forest resources. The impacts of such law on local people and communities are less documented, but some evidences have shown that the law has negative consequences when people have been excluded from protected areas where they used to gather forest products for their livelihood (Schwarze et al. 2007, Godoy et al. 1997, Colchester 2004). There is a tendency of trade-off between economic development of rural households and environmental sustainability.

Forest resources in NPs which are under state ownership sometimes are disputed by indigenous groups and other rural community. Furthermore, forests resources which are under community or private property regimes are typically subject to some restrictions on timber extraction or land occupation prohibition. Therefore, this paper tries to seek the impact of NPs establishment in specific region in Indonesia on economic activities of local people. This paper will contribute to analyze a conservation policy implementation in Indonesia. In turn, state agency (Ministry of Forestry of Indonesia) could consider a better policy or appropriate property regimes to gain economic and environmental sustainability.

Keywords

National Park, rural households, economic activities, difference-in-difference estimation, propensity score matching, Indonesia

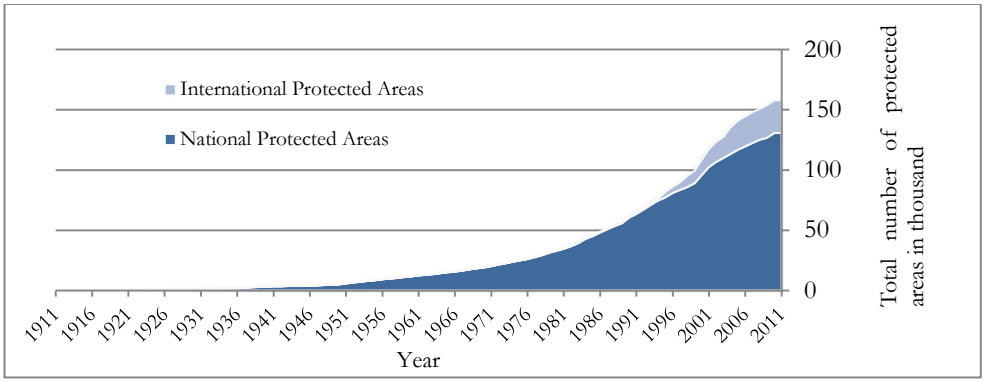
Chapter 1
Introduction

1.1. Background and Indication of Problem

National Parks (NPs) establishment is still considered as the best approach to maintain the pristine beauty and wilderness of nature, biodiversity and proportion of wildlife habitat (Brockington et al. 2008, Terborgh 2000). In twentieth century most environmentalists celebrate the remarkable development of conservation areas coverage and greater awareness to nature preservation (Naughton-Treves et al. 2005). However, according to the origin history of NPs, parks is not only containing wildlife and their habitat, but also including interaction between people and the nature (Colchester 2004, Brockington et al. 2008). Therefore, the mission of NPs and other Protected Areas (PAs) are not only to preserve the nature, but also expected to make a direct contribution to national development and strengthening local livelihood.

The broad goal of NPs establishment which is to achieve dual sustainability, nature sustainability and economic sustainability has been raising a great discourse in Development Studies. On the one hand, some studies presented the significant expansion of PAs during the twentieth century which reflected the remarkable effort of domestic and international agencies establishing PAs (Naughton-Treves et al. 2005, McNeely and Miller 1985). In addition, Naughton-Treves et al. (2005) revealed that during the past 25 years the terrestrial and aquatic areas which are under the legal protection have increased considerably. The graph below gives an overview regarding the growth of PAs worldwide[1][2]

Figure 1.Growth in number of nationally and internationally designated PAs (1911-2011)



Source: *IUCN and UNEP-WCMC (2012) The World Database on Protected Areas (WDPA): February 2012. Cambridge, UK: UNEP-WCMC < http://www.wdpa.org/Statistics.aspx>.*

[1] The graph illustrate cumulative number of nationally and internationally designated protected areas (both marine and terrestrial) from 1911-2011. The data have been included only protected areas that are designated and have a known year of establishment.

[2] The term "designated protected areas" is referring to those areas that are recognized, supported, and officially defined by national/international legislation and/or authorities.

On the other hand, the effectiveness of a NP in assisting local economic development is not easy to measure and still a big challenge to achieve. In fact, state agencies often undermined local incomes and jeopardize local livelihood when creating a PA. In Indonesia's cases, most part of conservation legislation is still inherited from colonial legislation which considers NPs as state-owned exclusive territories. Park authorities tend to create barrier between NP and people (Cribb 2007, Boomgaard 1999). Through the legislation, government believed that the proposed goal to maintain natural resources sustainability will be achieved by limiting the access to a NP. However, one thing that usually failed to be considered as the impact of the legislation is that limiting the access might reduce local people's ability to meet their basic needs (Agrawal 2001, Adams et al. 2004, Colchester 2004). Therefore, conservation approaches through NPs establishment is more likely cannot achieve dual sustainability.

Still, it is generally assumed that NPs establishment will impoverish the local household who live at the edge of NPs. This study will propose this assumption on two fronts. First, I ask whether changing on economic activities of households who live surrounding a forest are caused by the area to be designated as NP, or other factors. The main logical issue in drawing the conclusion is that the observed differences in outcome actually represent the causal effects of NPs establishment. Since the households as unit observations are systematically chosen on the basis of sub-district areas to be associated with household outcome, household characteristics in baseline survey are controlled to get appropriate estimation of NPs establishment.

The simplest set up to estimate the impact is assessing the different on outcome before and after the designation of the NP. In order to obtain more reliable estimation, this study examines the effectiveness of various regression analyses to match up it with estimated propensity scores. I use propensity score to reduce the bias on matching approach. Households who live in sub-district at the edge of NP and influenced by the NP intervention are matched to other households who live in neighboring sub-districts, and did not actually affected by the NP. Matching approach is clearly indicate the extent of similarity between the treated households and untreated households in term of the propensity score (Caliendo and Kopeinig 2008, Ravallion 2001). Finally, I estimate the impact of the NP on the treated group, rather than the average of the NP impact for the entire observation.

Empirical analysis in this study uses the IFLS longitudinal data set, a sample of 344 observations which are collected in two period of time. Each period of collection contains 132 controls and 40 treatment observations. This paper clearly estimates average treatment effects for the treated (ATT), and I present these estimates with respect to the region of common support.

1.2. Statement of the problems

The establishment of protected area such as NP is one of core global nature conservation strategy for protecting biodiversity. However, the Convention on Biological Diversity/CBD (2004) recognizes that the economic and socio-cultural cost and impacts arise from the establishment and maintenance of PAs, particularly for local communities.

Current Indonesia's conservation legislations are inherited from colonial legislation that often introduces restricted access to cultivatable lands, fishing grounds and forest. The legislation does not demand people who live surrounding a NP to be relocated to other areas but administratively restrict their access to utilize the NP's natural resources. As the result, the economic activities of local households will be change after the NP establishment.

The dilemma between the effort to improve local livelihood and to maintain nature conservation has to be the main consideration of central government in managing natural resources. National and International efforts have been made to overcome the problems of PAs that caused by local people. The most common underlying problems are related with property rights of the areas and the alienation of local people from PAs. Even though the legal procedures in designated protected areas have been completed, it does not automatically solve the fundamental issues of PAs. In fact, even demarcated PAs are often threatened by dependencies of local people on the resources inside.

1.3. Research objectives and questions

This paper aims to estimate the effect of NPs establishment on the rural household's economic behaviour in Indonesia. It can be done by investigating whether recent policy shifts (institutional change) towards NPs establishment have changed the economic activities of local households. Therefore, to attain the research objective, this paper is intended to answer a main question: 'whether NPs establishment have substantial impact on economic activities of rural households in Indonesia?'

Two sets of sub-questions are: how significant is the NP establishment change the economic activities of local households? Furthermore, are NP policies which prohibiting accessing and utilizing natural resources will affect every part of rural household economic activities? In this regards, the discussion will be linked with the local responses to the policy shift, and also the link between conservation policies and rural livelihood.

1.4. Hypothesis

The working hypotheses of the paper are: (1) Economic activities of local households considerably reduced by policies changing when NPs established, (2) Changing on household expenditure are significantly affected by changing on farm and non-farm activities, and also human development.

1.5. Scope and limitations

Nevertheless, our study has several limitations. A major weak point of this paper is data availability, because this paper relies on secondary data. This is problematic since the targeted scope of this study is looking at household's activities at village level in all NPs in Indonesia. Thus, the required data should be aggregated in village level, and cover many categories of household's farm and non-farm activities.

It is clearly that certain variables are not available in the existing data sets. IFLS questionnaires do not cover depth discussion on environmental services and forest resources that are utilized by rural households. Therefore, the household's incomes and expenditures are generated by common rural economic activities, and the estimation of each variable easily affected by other factors. In the other words, the coefficient of each variable can be suffered from a bias.

Even though most of the literatures have been concerned with local people responses, this study focuses on household's economic interest. Some common responses of local people in Indonesia are migration and changing occupation. However, empirical test on these issues cannot be conducted due to lack of data.

Moreover, my propensity score model may not have included additional variables that affect rural household incomes and expenditures. Therefore, the results may be still influenced by omitted variable bias. Some environmental services and certain natural resources that might as well be priced and have contribution to the welfare of rural household were not formally referred, evaluated, and identified. In addition, estimation on NP establishment impact in this study is limited to certain period of time. Analyses through a longer time period may have produced different effects.

1.6. Structure of the Paper

This paper is divided into five chapters. Chapter 1 is introduction which contains background and indication of the problem, statement of the problems, research objective and questions, scope and limitations, and structure of the paper. Chapter 2 is an overview of NPs worldwide and in Indonesia specifically. This chapter provides the original concepts of NPs, history of NPs in Indonesia, discussion on property right in NPs, GCNP and GMNP. Chapter 3 discusses framework of analysis which contains methodological issues and data analysis. Section 4 reports the results obtained from econometric analysis. The final chapter is conclusion.

Chapter 2
An Overview of National Parks

This chapter examines the dominant idea behind the establishment of PAs and how this idea spreads worldwide. The examination is not only aimed to simply investigate the evolution of thought of PAs, but also to analyse that the idea may bring some more crucial impacts than its tangible consequences. Considerable amount of literature seek to describe the social and economic impact of PAs and how private, societies and state agencies overcome the negative externalities of the creation of PAs.

2.1. History of the Concept of National Park

It is commonly accepted that the term NP was introduced when the first NP, Yellowstone, established in the USA in 1872. According to this claim, the concept of NP was born from imagination of a romantic artist namely George Catlin who travelled throughout the West of America in the 1830s. He had imagined preserving a vast amount of land with its biodiversity and indigenous people. Afterward, he used 'National Park' for the first time to describe his imagination (Brockington et al. 2008, West 2006:8, Colchester 2004).

The idea about NPs was spreading around the world, but recently this concept has systematically changed. Indigenous or communal people that Catlin imagined as a part of the ecosystem have been systematically removed from the newly established NPs. Even the first NP also involved the denial of native people's rights since the very beginning of its establishment. Although the concept of NP has been severely flawed from its original idea, we consider the dominance of the Yellowstone creation as represent the force of mainstream conservation thought. This mainstream conservation has been promoting the NP initiative for a long time across the world.

The rapid growth of PAs before 1960 was also caused by the colonial rulers to set aside land before they lost the power. In India, the British government continued the previous traditional rules of hunting reserves, but these colonial-created rules was took place a large part of the colonial territories under the control of National Forest Department (Brockington et al. 2008). Elsewhere in the Tanzanian region, parks law changed due to shifting colonial power, from Germany to British colonist (Neumann 1995).

Since the PAs are considered fundamental to preserve the nature, IUCN has standardized the category of PAs designation[3]. This category clearly stated that NP is mainly to protect harmonious ecosystem services and to support environmental-friendly economic development, mostly through recreation and tourism (Colyvan et al. 1999). Nowadays, from economic perspective NPs often become identical with consumptive and tourism-oriented practises that are ambiguity in the conservation appraisal (Brockington et al. 2008:2).

[3] IUCN categories for PAs can be accessed from < http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/>

2.2. History of National Parks in Indonesia

Literally, the idea of conservation in Indonesia started in the late nineteenth century which was started by the recognition of the importance of birds in controlling agricultural insect pests. The colonial government of Netherlands East Indies was alarmed about the damaging social consequences of the presence of seasonal bird-of-paradise (*Paradisaea raggiana)* hunters in West Papua. The colonial agencies saw the indigenous peoples of the archipelago as the main offenders in environmental destruction, and this perception fuelled the assumption that the local people needed state control. In contrast, colonial government gave licences for member of the colonial to hunt. Colonial hunters increasingly advocated to create nature reserves in which could not be accessed by the indigenous people in order to reserve a sustainable wildlife population for their hunting activity (Cribb 2007:49-50).

Indonesia under the Dutch colonial government, was among the first countries that officially established PAs. The colonial government issued a set of PA legislation between 1916 and 1933. In 1921 the Netherlands Indies government established Ujung Kulon NP as the first NP in Indonesia. Ujung Kulon area at that time was part of a complicated system of game reserves, wildlife sanctuaries, NP and strict nature reserves to protect the Javan rhino (*Rhinoceros sondaicus*) (Jepson and Whittaker 2002). Subsequently, the new independent Indonesian government (New Order era under President Soeharto regimes, 1967–1998) adopted the colonial's science-based conservation principles and extended the protected area to nearly 10% of the terrestrial area in the form of NP, wildlife sanctuaries and nature reserves (Jepson et al. 2002).

The modern conservation movement in global politics also influenced the Indonesia's conservation policy. At that time, conflict between the conservation movement and human rights rising. The conflict was based on controversy about how environmental agencies determine areas which have been relatively untouched by development. In these areas, indigenous people often struggle to preserve their livelihood against external interventions. Likewise other cases around the world, the establishment of NPs and other type of PAs have excluded indigenous people from land that have been occupied and managed for centuries, and prohibited them to use and utilize natural resources for their livelihood (Colchester 2004, Brockington et al. 2008, Jepson and Whittaker 2002).

According to the recent Indonesia's legislation, NPs are categorized into Nature Conservation Area. NP literarily defined as "a nature conservation area which is managed through a zoning system that may consist of Core Zone, Utilization Zone, and other zones depending on the necessity"[4]. The main functions of NPs are for the purpose of research, science, education, culture, tourism and out-door recreation"[5]. Until 2011, the government of Indonesia have established 50 NP nationwide.

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[4] Article 32, Act of Republic of Indonesia Number 5/1990 about Conservation of Living Resources and Their Ecosystem

[5] Article 35, Government Regulation of The Republic of Indonesia Number 28/2011 regarding Management of Sanctuary Reserve and Nature Conservation Area

2.3. Natural Park, Property Right and Policies changing

In Garrett Hardin's (1968) classic essay 'The Tragedy of The Commons', he clearly revealed that:

> "The National Parks present another instance of the working out of the tragedy of the commons. At the present, they are open to all, without limit. The parks themselves are limited in extend – there is only one Yosemite Valley – whereas population seems to grow without limit. The visitors seek in the parks are steadily eroded. Plainly, we must soon cease to treat the parks as commons or they will be of no value to anyone."

He categorized NPs as open access resources, hence no restriction for potential users to utilize the resources. Since the numbers of people who potentially utilize the parks are grown rapidly, it seems the resources will be degraded as the population growth (Hardin 1968:1245). Theoretically, this situation can result in common problems. He assumed that communal people cannot attain self-organized system. For this reason, in order to prevent resources deprivation he suggested two options, firstly the resources are forced to be private property, and secondly to be governed by a strong authority such as the state (Hardin 1968:1245, Feeny et al. 1990:2).

NPs under state property regimes become popular fashion to conserve natural resources. However, a number of studies have found that state often unsuccessful to manage common-pool resources. In most cases, the state regulates NP by imposing many restrictions to prohibit local people from entering NPs and utilizing its natural resources. Ironically, the state agencies often have insufficient finance and personnel support to control and enforce the regulation effectively. Consequently, the common resources de facto are administered as state-owned property, but de jure are unregulated (Arnold and Campbell 1986:8, Ostrom et al. 1999:495). Another study in Bolivia, Honduras and Nicaragua, Pellegrini (2010) found that the forestry reform through implementing decentralization, participation management and changing regulation sometime fail to achieve policy objectives. In other words, he argued forestry reform through decentralization with participation is necessary to achieve policy objectives but it is not sufficient condition when the state agencies are powerless.

Naturally, rural people who live surrounding PAs absorb greatest impact from resource's property regimes transformation. Rural people highly depend upon forest resources to support their livelihood (Chomitz and Buys 2007:3, Pellegrini 2010). They recognize forests as a matter of inherent pleasure, hence nobody be able to prohibit them to utilize the forest resources. Without any restriction, the common resources will be depleted at the same time when the number of users increasing (Hardin 1968:1248). Nonetheless, the state regulation to preserve resources by limiting access will substantially change the livelihood of the poor substantially (Buscher and Whande 2007:5, Naughton-Treves et al. 2005).

In Indonesia, the increasing number of PAs under state property regimes also has a great impact on local communities especially for those who live surrounding buffer zones. It is mainly due to restricted access to the forest resource by conservation law. In order to maintain the biodiversity in the conservation areas, the government introduces legislation regarding biodiversity

and ecosystem conservation. State agency also classifies the PAs base on specific criteria and purposes. Accordingly, in some particular conservation areas which are mainly to conserve biodiversity, National Park for example, people are not allowed to do extraction activities.

Public participation plays an important role in policies making process. Participation can reduce the risk of future conflict; however, participation process is also able to change the main purposes of policy making. Pellegrini (2012) investigated different participation process in Bolivia and found that the policy making through participation process are more "legitimate" because it represents people's inspiration and is not produced by government agencies only. Lack of participation process in policies decision process also indicated that the government has no ability to manage resources in ways that supported by public.

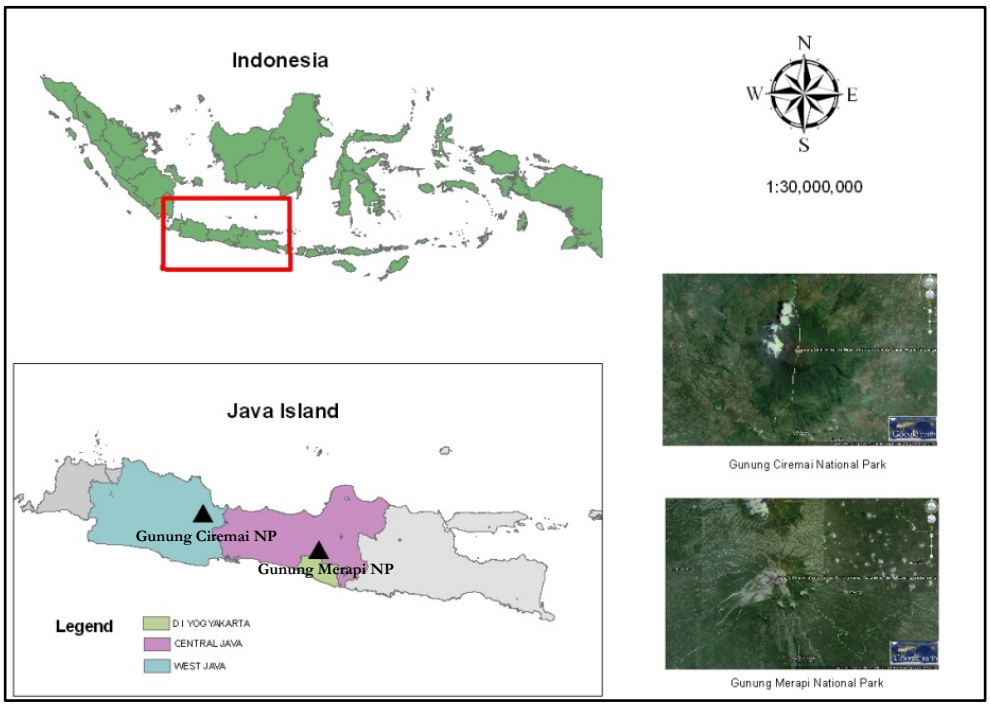
All in all, state agencies are able to control and manage the use of natural resources through NP designated. However, at the same time by imposing strict regulation to limit access for local people will affect their economic behaviour. This is such a common accepted argument; however, some studies also reveal that the relationship between property right regimes and economic behaviours of local households are uncertain (Baland and Platteau 1997, Reddy 1999, Adams et al. 2004).

2.4. Gunung Ciremai and Gunung Merapi National Parks

GCNP and GMNP are located in Java Island and were established in 2004 (Kuswijayanti 2007, Ristiyanti 2008, Adirahmanta 2005, Yuniandra et al. 2007). Prior to 2004, both NPs were separated into three types of PAs, which are Protection Forest, Natural Recreation Areas, and Nature Reserves. The state agency - Ministry of Forestry (MoF) - argued that the main purpose of the changing of the protection classification of Gunung Merapi and Gunung Ciremai forest areas were to maintain forest function as water catchment areas, protection for life support systems, preservation of species diversity, and sustainable utilization of natural resources and their ecosystems. In addition, they also underlined that under NP management, it will be easier to obtain national and international conservation funds.

Some local activists and indigenous communities agree that the state agency plays an important role in preserving the nature through sustainability principles. However, they were afraid that the state intention on conservation funding will adjust the main conservation purposes. This conservation scheme will give the management a right to privatize the natural resources and displace the local people as many cases occurred in other NPs. Some fundamental questions are also raised and escalated into debates. First, whether NP scheme is the appropriate choices to preserve this area? Secondly, regard to property right problems and local people right violations in many NPs in Indonesia: is the same problems will take place in these newly designated NPs?

Map 1. Location of GCNP and GMNP



Map sources: Map of Indonesia (scale 1:30.000.000) and Java Island was taken from Land Use Map provided by National Land Agency of Indonesia (2009). The satellite images were taken from Google Earth (2013).

2.4.i. Gunung Merapi National Park

Even though these two NPs have similar characteristic, it is better to consider the chronology of the establishment of each NP. Firstly, Gunung Merapi National Park (GMNP), which is located in the centre of Java Island, precisely under the administration of Special Region of Yogyakarta and Central Java Province. The Merapi Mountain is one of the most active volcanoes in the world, and it peaks at an altitude of 3,968 above the sea level. The Merapi Mountain provides various environmental services such as water catchment area, erosion control, biodiversity ecosystem, wildlife habitat and sand supply from volcanically eruption. Forest area surrounds the Merapi Mountain also provides fire-wood, forest-fruits, forage and fertile land for indigenous people to cultivate vegetables (Adirahmanta 2005, Hidayat 2009, Kuswijayanti 2007).

In addition to environmental services, sustainable livelihoods of 396,294 people who live in ten district on the slopes of the Merapi Mountain are also depend upon economic services provided by the Merapi areas. In general, most people in the Merapi areas are farmers and cattlemen who highly rely on the fertility of the Merapi's soil. People in some villages such as Selo, Kinahrejo and Kaliurang also rely on ecotourism services, and a few of them are sand miners. Interaction between local people and their environment has established traditional practices in preserving the nature and also many traditional ceremonies such as plant and livestock rituals (Hidayat 2009).

In 2004, local people and civil society around Yogyakarta and Central Java paid attention on the MoF Decree Number 134/MENHUT-II/2004 which converted an area of 6,410 hectares on the Merapi Mountain into NP. Polemic regarding NP declaration emerged before the decree issued and still continue

after the enactment. Subsequently, a number of civil society and NGOs made a protest against NP establishment. The protestor claimed that NP legislation would prevent farmers to access forest resources and they would no longer be able to harvest forest product as what they have done so far (Hidayat 2009).

From property right perspective, chronology of the Merapi management shows the dynamic access of local people to natural resources. Originally, people have private property right on land in the Merapi area, then majority of private land converted into protected forest under the common property right regimes. It means, people as individual lose their right to determine what system is the best to manage their own land, whose have right to participate and utilize the natural resources on the land, and the right to trade the resources. After GMNP declaration, the state takes over all of the people rights as individual and also as a community. Local people only allowed entering NP area for collecting forage and twig as firewood. However, some farmer still continue to access the NP area to plant vegetable or to mine the sand, even though those have been considered as illegal activities (Kuswijayanti 2007).

Therefore, Adirahmanta (2005) and Kuswijayanti (2007) pointed out that GMTN establishment only bring advantages to local people who work in sand mining industry and ecotourism sector, but it gives an adverse effect for those who work as farmers and ranchers. They also identified that most conflicts between the government and NGOs are discourse conflict.

2.4.ii. Gunung Ciremai National Park

The second study site is the Gunung Ciremai National Park (GCNP) which is located in the West Java Province under two districts administrations, the Kuningan District and the Majelengka District. The initial condition of GCNP and GMNP are relatively similar. The Mount Ciremai is the highest mountain in the West Java Province, with the peak at 3,078 meters above sea level. Forest ecosystem in the Ciremai area is mostly covered by virgin forest that can be categorized as low-land forest, montana rainforest and sub-alpine forest. Ciremai Mountain contains high degree of biodiversity with numerous flora and fauna including several endangered species. Moreover, it has attractive landscape with several archaeological sites that potential for ecotourism, education, and research. This area also functions as a water catchment area and a source of fresh water for surrounding regions namely Kuningan, Majalengka and Cirebon[6].

Problem and challenges in the Mount Ciremai area before it declared as NP were illegal logging, forest fire, encroachment, sand mining and road construction across protection forest (Kuswijayanti 2007). However, the biggest challenge came when Perhutani (a state owned forest company) initiated a participatory programme in 1999. This programme namely Forest Management with Communities (Pengelolaan Hutan Bersama Masyarakat or PHBM) was introduced in the Ciremai forest when the area was classified as production forest and managed by Perhutani. PHBM elaborated collaborative management between local communities, local government, and Perhutani which aimed to encourage local people to participate in forest management. A Memorandum

[6] Gunung Ciremai National Park Agency, 2010

of Understanding between three parties gives a right for local people to plant certain plantations in forest ground. Overall, this programme gives local communities an opportunity to take a part on forest management and allow them to utilize the forest land under certain conditions (Isnaini 2006, Theresia 2008). Perhutani was still continuing this programme even after the status of the area was changed into protection forest (Kuswijayanti 2007).

In 2004 government changed the status of Mount Ceremai area from a production forest oriented to NP. This new status was formalized by MoF decree Number 424/Menhut-II/2004. The MoF was claimed that the NP management will give better conservation, preservation and protection practices, it will be able to maintain sustainability of biodiversity and the ecosystem, and also will improve community livelihoods. However, in practical way this institutional transformation creates a fundamental shift on farmer's right to use and utilize the forest. As a consequence, the NP declaration had raised objection from farmers and local communities surround GCNP.

Most of protestors complained about: 1) prohibition for local people to access resources in the NP which will affect their livelihood significantly; 2) the NP was declared without public hearings, thus local people cannot expressing their inspiration; 3) the NP management did not include collaborative process which were applied by the previous management system (PHBM); 4) there was no guarantee from MoF to involved collaborative management in the NP (Isnaini 2006:86).

After the establishment of the GCNP, the local people lost their rights to manage and to take part on forest planning, as well as rights to utilize the forest land. This new policies not only affects direct primary actors such as local people and Perhutani but also other indirect stakeholders such as the local government and community organizations (Isnaini 2006). In this case, property right and the stakeholders participation play an important role in PA management approach.

Chapter 3
Framework of Analysis

The main goal of this impact evaluation study is to determine the causal effect of NP establishment on economic activities of rural households. The issue on NP establishment is particularly salient in certain economic activities especially for rural households. The phenomenon is resulted by the fact that state agencies, that in charge of natural conservation, are under great pressure to promote programs that can reserve natural resources and fail to pay appropriate attention on rural people's livelihood. This study goes further than simply shows that outcomes have changed following the NP intervention; but also requires evidence that the changes in the outcomes are directly related with the intervention. In order to do this robustly I develop a logically counterfactual. In other words, I determine what the outcomes would have been if the NP intervention did not exist.

The challenge to the implementation of an impact evaluation method is that – for any observation – the counterfactual does not exist. There is no household that observed at the same time both with and without the NP intervention. Thus, basically, the impact evaluation method deals with missing data problem. However, some studies proposed methodology that can be used to generate an acceptable counterfactual in order to permit analysis of the causal effect of the NP intervention take place. Matching technique by using observation that have nearest characteristic is commonly used in this method.

This chapter briefly discusses the framework of analysis for the study which includes the methodology and data set which are used in this study.

3.1. Model Specification

Our NPs model attempt to find the difference between the actual total household expenditure of treated household and the rate of the same household if the NPs intervention had not exists. However, this model faces missing data problems that could result in great bias in the calculation. This bias appears when there is a difference in the mean of the total expenditure between treated and un-treated households. The best way to eliminate the bias is to set the NPs intervention randomly. In the other words, treated and un-treated households will gain the same expected NP's effect if the NPs were not established. However, in our case it is clear that NP effects cannot set randomly since the effects will be highly determined by the location where the household live.

Base on those missing data problems, it is obvious that there are two sources of bias in our data: the difference in the observable data and the difference in the unobservable data (selection bias). In order to obtain a better estimate of the NP's impact, it is important to reduce the bias by forming the comparison group. First attempt is to obtain baseline data for both treated and untreated observations, which was collected before the NPs were established. The main idea of this stage is to collect data on outcomes and it determinants both before and after the NPs were established, and to compile the data for an

untreated comparison household (control group) and also the household that exposed by the NP intervention (treatment group). The estimation can be conducted by subtracting the difference between treated and control group before and after the NPs were established. This model is called difference-in-difference (DD) estimation (Ravallion 2001:127). The second method to deal with the difference in observable data is propensity score matching (PSM). However, this method does not necessarily eliminate the bias. PSM also can be used to ensure that the control group is similar to the treatment group before we run DD estimation (Ravallion 2001:126, Khandker et al. 2010:79-80).

Numerous studies have attempted to explain the effectiveness of these methods in evaluate the impact of intervention. John Snow (1936) was the one who first time applying DD method to investigate cholera epidemic in Great Britain during the mid-nineteenth century. He compared mortality rates that caused by cholera in some districts where the people were consuming drinking water supplied by two water companies, namely Southwark and Vauxhall Company and Lambeth Water Company. In 1849 both companies used contaminated water from Thames River as their water sources, but in 1852 Lambeth Water Company decided to move water works upriver to areas that much cleaner. Based on these facts, Snow used data from 1849 as the baseline and 1852 as the follow-up data. Another comparison was also done to the districts that are served by those companies. He found that the mortality rates decreased dramatically in districts which are served by Lambeth Water Company. Therefore, he concluded that cholera transmission was highly correlated with the water supplies, and disputed prevailing theory which argued that cholera was carried by noxious air.

Another study on impact evaluation using the DD approach was carried out by Orley Ashenfelter and David Card in 1984. In this study, they use longitudinal structure of earnings for trainees and a comparison group to estimates the impact of a particular program to the participants of the programme. The complexities of this study were to found the appropriate control group that has identical characteristics with the treatment group in the baseline period. They used mean and standard deviation of each sample to determine which factors are more important and significantly affect the trainee's participants (Ashenfelter and Card 1984:650).

Several studies have showed that the DD approach can be combined by the PSM to obtain match samples between treatment and control groups (Ravallion 2001, Ravallion 2007, Wang et al. 2009, Mu and Van de Walle 2011). The impact evaluation assessment in this study is prepared by adapting similar procedure used by Ravalion (2007), Wang et al. (2009) and Sparrow et al. (2012). In general, this study use simple OLS to identify whether changes in such outcomes of different group households are affected by NP establishment itself, and not to some other reasons (Khandker et al. 2010:58). Afterward, I compare the OLS results using Difference-in-Differences (DD) evaluation to estimate the impact of NP on household economic activities. This study also applies Propensity Score Matching (PSM) approaches before estimates the DD impact to help match treatment groups with observationally similar control groups.

3.1.i. Notation of observations

This paper examines the impact of the NP establishment or intervention on an outcome *Y* over two groups of households. The two groups are indexed by NP intervention *T=0,1* where 0 denotes households who do not exposed by NP intervention, called 'control group', and 1 indicates households who affected by NP intervention, which called 'treatment group'. We collect data in two time periods *t=0,1* where 0 denotes a period before the treatment group receives intervention (year 2000), namely 'pre-intervention' and 1 after the treatment group receives intervention (year 2007), namely 'post-intervention'. Each household in our observation is indexes by *i =1,….,n.*

Each household in both treatment and control group will have two observations, first in pre-intervention and second in post-intervention (Y_t^T). To make it simple let Y_0^0 and Y_1^0 be the sample of mean outcome for the control group before and after intervention, respectively, and let Y_0^1 and Y_1^1 become the sample of average outcome for the treatment group in pre and post intervention respectively.

3.1.ii. Outcome model

Suppose the total expenditures of the i^{th} households in period *t* are expressed by Y_{it}, and then follow a simple OLS estimation:

$$Y_{it} = \alpha_i + d_t X_{it} + \beta NP_{it} + \varepsilon_{it} \quad \text{...(1)}$$

where α_i is the parameter (intercepts), X_{it} represents a bunch of controlling variables that include all the observed economic activities proxies, NP_{it} is a dummy variable for NP intervention, β represent the impact of NP. Obviously, there will also be some purely random error term that influences the impact of NP on the economic activities. These serially uncorrelated transitory components of economic activities are not in our observation, and also end up in this ε term. Therefore, a simple difference between control and treatment groups will estimate the impact of NP which is β.

In order to explain the households total expenditure (*lthhexp)* as dependent variable, I use seven economic indicators listed in Table 2 as independent variables. Therefore the OLS estimation can be modified as:

$$\begin{aligned} Y_{it} = \alpha_i &+ d_1 lfitfarm_{it} + d_2 lprodfarm_{it} + d_3 lxfarm_{it} + \\ &d_4 lxasset_{it} + d_5 lrevhhbus_{it} + d_6 lhrschool_{it} + \\ &d_7 schwork_{it} + \beta NP_{it} + \varepsilon_{it} \end{aligned} \quad \text{...(2)}$$

To capture the difference between pre and post intervention and treatment and control group, we adjusted the outcome model Y_{it} in equation 1 by following equation:

$$Y_i = \alpha + \delta T_i + \gamma t_i + \beta (T_i . t_i) + \varepsilon_i \quad \text{...(3)}$$

where the coefficient $\alpha, \delta, \gamma, \beta$ are all unknow parameters, and ε_i is randomly unobserved error term. To make it clear, by inspecting equation 3 above the interpretation of each parameter are: α is a constant parameter, δ is the coefficient for permanent difference between treatment and control groups, γ is coefficient for time trend differences, and β is the true effect of treatment group in post-intervention period. In the other words, our model basically compares treatment and control groups in term of outcome changes relative to the outcomes monitored for a pre-intervention baseline. This estimator will considered biased as long as $\delta, \gamma \neq 0$.

3.1.iii. Assumption for unbiased estimator

In order to get accurate interpretation on DD estimator, some assumptions have to be followed: first, the equation model of outcome have to specified properly; second, the average of error term is equal to zero $E(\varepsilon_i) = 0$; third, the error term in the model equation is uncorrelated with the other variables (Khandker et al. 2010:73).

$$Cov(\varepsilon_{it}, T_{i1}) = 0$$
$$Cov(\varepsilon_{it}, t) = 0$$
$$Cov(\varepsilon_{it}, T_{i1}t) = 0$$

Considering these assumptions I can calculate separately the interaction between pre-post periods and treatment-control groups to get the average DD effects of NP establishment. Therefore, considering the equation 3 above I can determine the expected values of the outcome as given by:

$$E[Y_0^0] = \alpha$$
$$E[Y_1^0] = \alpha + \gamma$$
$$E[Y_0^1] = \alpha + \delta$$
$$E[Y_1^1] = \alpha + \delta + \gamma + \beta$$

3.1.iv. Difference in Differences

In general the DD method uses the control group to identify the counterfactual that what would happen if NPs were not established. The DD looks at the change in outcome before and after the intervention to the treatment group and compares it to the change in outcome pre and post the intervention to the control group. This can help improve the simple comparison because it can potentially remove the constant effect that unobservable characteristics have on the outcome (Khandker et al. 2010, Ravallion 2001).

Consider the first difference estimator $\widehat{(d_1)}$ is based on comparison between the average differences on outcome Y_i in pre and post intervention for the treatment group. The first difference estimator can be written as:

$$\widehat{(d_1)} = \overline{Y_1^1} - \overline{Y_0^1} \qquad \text{...(4)}$$

The estimation using OLS will be obtained by a regression equation on the treatment group only:

$$Y_i = \alpha_i + d_1 T_i + \varepsilon_i \quad \text{...(5)}$$

The coefficient of first difference estimator:

$$\begin{aligned} E\widehat{(d_1)} &= (\overline{Y_1^1}) - \overline{(Y_0^1)} \quad \text{...(6)} \\ &= (\alpha + \delta + \gamma + \beta) - (\alpha + \delta) \\ &= \gamma + \beta \end{aligned}$$

The second difference estimator $\widehat{(d_2)}$ is based on comparison of mean outcome (Y_i) between treatment and control group in post-intervention period. The second difference estimator can be written as:

$$\widehat{(d_2)} = \overline{Y_1^1} - \overline{Y_1^0} \quad \text{...(7)}$$

This can be estimated using OLS by a form of regression equation:

$$Y_i = \alpha_i + d_2 t_i + \varepsilon_i \quad \text{...(8)}$$

The coefficient of second difference estimator:

$$\begin{aligned} E\widehat{(d_2)} &= (\overline{Y_1^1}) - \overline{(Y_1^0)} \quad \text{...(9)} \\ &= (\alpha + \delta + \gamma + \beta) - (\alpha + \gamma) \\ &= \delta + \beta \end{aligned}$$

Finally, the DD estimator can be calculated by take the difference between the average outcome of treatment group in pre and post intervention minus the average outcome of control group in pre and post intervention period.

$$DD = E(Y_1^1 - Y_0^1 | T_1 = 1) - E(Y_1^0 - Y_0^0 | T_1 = 0) \quad \text{...(10)}$$

The coefficient of DD estimation will be:

$$\begin{aligned} DD &= E(Y_1^1 | T_1 = 1) - E(Y_0^1 | T_1 = 1) - \\ &\quad E(Y_1^0 | T_1 = 0) - E(Y_0^0 | T_1 = 0) \quad \text{...(11)} \\ &= ((\alpha + \delta + \gamma + \beta) - (\alpha + \delta)) - ((\alpha + \gamma) - \alpha) \\ &= (\gamma + \beta) - \gamma \\ &= \beta \end{aligned}$$

3.1.v. DD combine with PSM

In this paper I try combine a DD method with PSM. This combination approach is taken because I face a common fundamental problem in impact evaluation study. First problem appears since I seek to estimate the difference outcome of household with and without the NP intervention. Clearly, I cannot observe the outcomes of each household both with and without treatment at the same time. Rosenbaum and Rubin (1983) identified the unobservable outcome as counterfactual outcome (problem).

Table 1.Counterfactual interpretation

NP intervention	Y^1	Y^0
Treatment (T=1)	observable	(counterfactual)
Control (T=0)	(counterfactual)	observable

Furthermore, taking the mean outcomes of treated and un-treated household to estimate average treatment effect (ATE) is not appropriate, because treatment and control household usually have different outcomes even in the absence of NP intervention. The assumption behind ATE is that the effect of the NP intervention is the same for all observations.

Causal effect of observation *i*: $Y_i = Y_i^1 - Y_i^0$ ...(12)

ATE: $E(Y) = E(Y_i^1 - Y_i^0) = E(Y_i^1 - Y_i^0)$ ...(13)

The combination of the DD and the PSM approach is one possible solution to reduce such bias. These approaches are assuming that unobserved heterogeneity affect households economic activities but those factors are time invariant. The DD and the PSM combination adjust this bias by matching household units in the common support (LaLonde 1986, Dehejia and Wahba 1999, Dehejia and Wahba 2002, Ravallion 2001). In other words, the PSM can be used to match treatment and control group in the post-intervention period, and the impact of the NP establishment is calculated across treatment and matched control group within common support. Therefore the average treatment effect on the treatment group (ATT) can be calculated as follow:

$$ATT = E(Y_i^1 - Y_i^0 | T = 1) = E(Y_i^1 | T = 1) - E(Y_i^0 | T = 1) \quad ...(14)$$

Forming control group using the PSM is based on the assumption that the counterfactual outcome for a household in the treatment group can be assessed by examining the outcome of household that most closely similar in control group. Household in the treatment group are matched to household in the control group based on unobservable characteristics, thus a household counterfactual is developed for each household in the control group.

Furthermore, when constructing a PSM model we need to adopt some assumptions. Base on Rosenbaum and Rubin (1983), conditional independence and presence of common support are two necessary assumptions to identify of the intervention effects. Conditional independence is also called 'unconfoundedness' (Rosenbaum and Rubin 1983:44-45). It indicates that the implication of the intervention is based solely on observed attributes. Treatment observations will therefore have no so much different with non-treatment observations in term of observed characteristic uninfluenced by NP intervention. If unobserved characteristics influence intervention implication, conditional independence will be violated, thus PSM is no longer appropriate. This is a strong assumption and has been justified by the quality of data and selected chosen variables. For the rest of the paper I assume that this assumption is hold. The second assumption deals with comparison observation and it require a condition that treatment observations can be compared with control observations in the propensity score distribution (Khandker et al. 2010: 56).

In this study we employ logit model to estimate the outcomes or PSM approach. Even though the result of logit and probit model is not much different in binary treatment case, the logit distribution has more density mass in the overlap observation (Hirano et al. 2003). In addition, logit model will assume that the error term in the outcome equation has a logistic distribution and estimate that the parameter consistent with the assumption by the maximum likelihood approach (Ravallion 2001:125)

The Nearest Neighbour (NN) Matching and Kernel Matching are proposed as matching estimators in this study. NN Matching will choose the observation from control group for treated observation that is closest in term of the propensity score. In order to reduce the usage of number of distinct control used when created the counterfactual outcome, we allow the NN Matching to use a control observation more than once as a match (with replacement). By using this method the average quality of matching will increase and the bias are reduced. However, it also will increases the variance of estimator (Hirano et al. 2003, Caliendo and Kopeinig 2008).

Another matching technique is Kernel Matching which is considered as 'non-parametric' matching estimator. In order to construct counterfactual outcomes, this technique use weighted averages of all individuals as match. Since this approach uses more information to obtain counterfactual observation, it will have lower variance. However, this technique also possibly used bad match observations, and less effective to reduce bias.

Finally, our DD estimations are then generated by comparing the pre and post the NP establishment change in outcome measures for the treatment group with those for the matched control group. The basic idea is we use the pre-intervention data to deal with those counterfactual problems. Since the i^{th} household in pre-intervention is same with j^{th} household in the post-intervention we can take the difference between pre and post intervention.

$$Y_{i1} - Y_{i0} = \alpha_i + dX_i + \beta(NP_{i1} - NP_{i0}) + (\varepsilon_{i1} - \varepsilon_{i0}) \quad \ldots(15)$$

Afterward, I can adjust propensity score in the DD regression to estimate the impact of the NP on the household economic activities with match observation.

$$DD_i = (Y_{i1}^1 - Y_{i0}^1) - \sum_{j=0} \omega(i,j)(Y_{j1}^0 - Y_{j0}^0) \quad \ldots(16)$$

Where $\omega(i,j)$ is the weight (calculated using PSM approach) given to the j^{th} households in control group, and matched with households in treatment group i^{th} *(Khandker et al. 2010:80).*

According to Hirano, Imbens, and Ridder (2003) a weighted least square regression using the PSM to matching control group observation will generate an efficient estimator. Another paper by Mu and Van de Walle (2011) used DD and PSM combination to controll time invariant unobserved variations and potential time-varying selection bias in initial observable characteristic. They also compared between the short-term and long-term impacts using different stage periods, and they found that each factor have different impacts in every stage of periods.

3.2. Data collection method

In 2004 the government of Indonesia designated nine NPs countrywide[7]. Two of those newly NP located in the Java Island, the most dense population island in Indonesia. The NP establishment was mainly due to national and international effort to conserve the nature[8]. Nevertheless, the rural well-being was not considered the main concern when the state was creating new NP. For that reason, this study adopted impact evaluation method to estimate the actual effect of this conservation strategy on economic activities of rural households[9].

This study implements the balanced panel data set based on households units located in sub-districts surrounding the GCNP and the GMNP. These NPs are located in 21 sub-districts within three provinces. These two NPs are chosen because it shares similar characteristics; both located in Java Island, and were established at the same period of time. The two rounds of panel data collected under the auspices of the Indonesia Family Life Survey (IFLS) by the RAND Corporation. These data set uses same code for location with The National Socioeconomic Survey (Susenas) performed by Statistics Indonesia. Some assumptions are employed to give specific indicators to measure rural household's expenditures and incomes in certain sub-district areas surrounding NPs.

Since those NP established in 2004, we used IFLS data wave 3 which was conducted in 2000, provide a baseline survey 4 years prior to the NP establishment, and IFLS wave 4 in 2007 as the follow-up survey or post-establishment data. Moreover, these data can be aggregated into sub-districts level. Since the study goal is to evaluating the impact of NP, it would be reasonable to create a control group based on untreated sub-district nearby. Hence, 21 sub-districts which adjacent to the NP are selected as treatment areas and 38 sub-districts next to the treatment areas are selected as control areas. In order to generate clear comparison between pre-post periods and treatment-control groups, I select 40 households for treatment group and 132 households for control group in both pre and post establishment periods. Therefore, it is clear that treatment and control observations do not represent a suitable random sample.

[7] The data is from Directorate of Forest Protection and Nature Conservation, Ministry of Forestry Republic of Indonesia.

[8] Base on the act of Republic of Indonesia No. 5 of 1990 concerning conservation of living resources and its ecosystems, the government of Indonesia consider that conservation efforts are necessary to promote the sustainable utilization of living resources and their ecosystems; therefore, living resources and its ecosystems are always maintained and be able to create a balance and be integrate in development. Besides that, IUCN asserts that protected areas establishment are widely considered as one of the most effective approach to preserve the biodiversity <http://www.iucn.org/about/work/programmes/gpap_home/gpap_biodiversity/>.

[9] The new policies on how resources managed are embedded with the newly forest property regimes.

Household level is chosen as a unit analysis of economic indicator due to some characteristics. Within household people share same risk, have strong family relationship, and inter-household transfers of labour, assets and goods reduce the importance of individual member of household as a unit of analysis (Campbell and Luckert. 2002:22-23). Most studies on rural livelihood or in more specific term economics activities also uses households as the unit of empirical analysis. It is mainly because households in developing countries considered as a single social group which is lived in the same house, share the same foods, and jointly make decision on income and assets distribution (Ellis 1998).

3.3. Descriptive Statistics of Household Economic Activities

To investigate the real impact of the NP establishment on household economic activities, basically I examine how policies changing due to NP establishment influenced the economics activities of local households. In general, economic activities of households which located closer to NP are much more dependent on forest resources and services for cash income such as utilizing forest-land to plant agricultural commodity, harvesting forest-fruits, and also collecting fire-woods and herbals (Rayamajhi et al. 2012, Mamo et al. 2007). As one moves farther from forest, households become slightly dependent on forest resources and services to meet subsistence needs and cash income. This description can be explained by reliance on access to forest resources and services (Chomitz and Buys 2007, Schwarze et al. 2007).

Household behavior to use and utilize the freely available forest service and products may be affected by a various factors. Some of these factors concern on household characteristics itself, while others are more contextual perspectives. From household characteristics side, larger household members will extract more forest resources because they have more labours and more mouths to feed (Godoy et al. 1997:983). In addition, a better asset endowment and human capacities allow households to take more advantage on forest resources through direct collection or by performing farming activities. Other reveals that land and livestock holdings, farming, and education exert a significant influence on appropriating benefits from the common resources (Godoy and Contreras 2001, Adhikari et al. 2004).

Moreover, in this study economic activities of rural household will be presented by the total amount of household expenditure on food and non-food items as a dependent variable (*thhexp*). This data is a sum from weekly total expenditure on food per capita times four (assuming a month has four weeks), and total expenditure for non-foods item per capita monthly. Food items in this data set consist of staple food (uncooked rice), vegetables, meat and fish, sugar, spices, drinking water and others. Whereas non-food items are defined by electricity, fuel, toiletries, recreation and transportation, clothing, medical cost, and taxes[10].

[10] The classification of food and non-food items are based on the IFLS questionnaire in Book I, section KS.

Prior summation, IFLS data are distinguished between food and non-food expenditures. It is because the nutritional well-being has become more important for households in most developing countries especially for those with low income (Strauss 1984:77). This situation affects household's decision on consumptions and expenses. They tend to have bigger portion of spending on food (Working 1943). When I compared the portion of food expenses on total expenditures, we found similar result with the previous studies. Household on average spends 71% of their income for food consumption. Table 2 below clearly shows the average portion of food expenditure by rural households, both treatment and control groups in pre-post intervention.

Table 2. Proportion of food expenses on total expenditures of rural households

	Control	Treatment
pre-intervention	72%	69%
post-intervention	70%	76%

In order to capture the real total expenditure, I weight the total expenditure by national poverty line in both periods. The National poverty line in 2000 and 2007 are Rp. 73,000.00 and Rp. 146,837.00 respectively[11]. To explain the households total expenditure, I elaborate some component of household's livelihoods. First, I use income that refers to the cash earnings of the households together with any payment that have market value (Ellis 1998). In this study, the cash earnings component of family's income divided into farm and non-farm business. The farm includes the approximately net profit from farm business in one year (*fitfarm*), total production from farm business (*prodfarm*), households expenditures from farm business (*xfarm*) (Barrett and Arcese 1998, Barrett 2001, Maertens et al. 2002, Schwarze and Zeller 2005).

Non-farm businesses are explained by the total revenue of previous year from rent or property income (revbs)(Ellis 1998). Additionally, in order to capture the impact of the establishment on human capital, we employ the average hours of school attendance each day in school (h*rschool*) and dummy variable (*schwork*) to identify whether households member working during school hours (Schwarze et al. 2007, Schwarze and Zeller 2005). Tabel 3 shows the description of each variable which is used in empirical analysis.

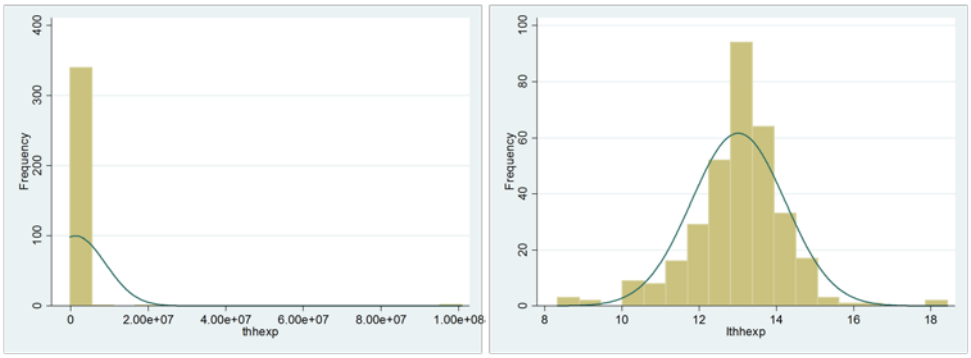
[11] The poverty line in 2000 referred to data from World Bank <http://www.worldbank.org/content/dam/Worldbank/ document/ EAP/Indonesia/IEQ-MARCH-2013-BHS.pdf>, and data in 2007 was taken from Statistics Indonesia <http://www.bps.go.id/ brs_file/kemiskinan-02juli07.pdf>.

Table 3. Variables descriptions

IFLS Code	Variables	Definition	Sources
-	intv	A dummy variable that represent National Parks invention (explanatory variable). The treatment group is for those households who live in sub district areas adjacent NP, and control group is households that live in sub districts that not adjacent NP but nearby the treatment's sub districts.	Sub district codes in IFLS and SUSENAS manual books.
-	year	A dummy variable that states time difference, which year 0 means the period before NP establishment (year 2000), and year 1 means the period after NP establishment (year 2007)	Two periods of survey, IFLS wave 3 conducted in year 2000, and IFLS wave 4 in 2007
ks02 and ks06	thhexp	Total expenditures by all household members for food and non-food items per capita per month	Own calculation using data from IFLS wave 3 and 4
nt09	fitfarm	The approximate amount in rupiah of net profit generated by the farm business during the past 12 months	Own calculation using data from IFLS wave 3 and 4
ut07	prodfarm	The approximate amount in rupiah of total production (revenue) by the household from the farm business (including produce for own consumption) during the past 12 months	Own calculation using data from IFLS wave 3 and 4
ut08	xfarm	The approximate amount in rupiah of total expenses spent by the household for the farm business during the past 12 months	Own calculation using data from IFLS wave 3 and 4
ut14	revhhbus	The total income from the rent/lease/profit-sharing of household business in the past 12 months	Own calculation using data from IFLS wave 3 and 4
dl16g	hrschool	The average hours of school attendance each day now/in last year in school.	Own calculation using data from IFLS wave 3 and 4
dl15	schwork	Dummy variable whether the member households do work while attending the school?	Own calculation using data from IFLS wave 3 and 4

In order to satisfy the normal distributed assumptions, I perform normality-test for both the dependent and the independent variables. Symmetry distribution of data is a necessary assumption before further analyses are conducted. Graphical analysis shows that data distribution of dependent variable before transformation is not equally distributed. However, after it is transformed into natural logarithm it is normally distributed.

Figure 2.Frequency distribution of total house-holds expenditure before and after transformation



before transformation after transformation into natural logarithm

In addition, normality test for independent variables using histograms and normal q-q plots are also conducted, and the result shows that data are normally distributed after transformed into natural logarithm. Furthermore, all data except of school-working variable are transformed into natural logarithm form. Data in natural logarithm is not only create normally distributed data, but also give direct interpretation on approximate percentage changes between samples.

In order to identify the preliminary conditions of household economics behaviour, the statistical summary of each variable in two periods and two different groups will become a necessary information. From the statistical summary below, it can be clearly seen that generally the mean of economic variables for treatment group in follow-up survey are slightly lower than the mean in baseline survey. Nevertheless, some economic activities such as total revenue from non-farming business and working during schooling period are increase slightly in the following survey.

Moreover, when assessing the differences between treatment and control group, we can see that during the pre-intervention period that the mean of economic activities of households who live nearest NPs are slightly lower than those household who live farther from NPs. The mean of non-farm revenue both for treatment and control group seems similar before and after NP intervention; however the mean of non-farm revenue increase after establishment. Furthermore, prior to the NPs establishment, both groups have similar mean in average hour of school attendance, but after establishment school attendance for the treatment group are slightly lower than control group.

Table 4.Statistical description of variables

	Pre-intervention				Post-intervention			
	Treatment		Control		Treatment		Control	
	(N=40)		(N=132)		(N=40)		(N=132)	
Variables	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
ln total household expenditure	12.84	0.61	12.92	0.82	12.85	0.61	12.93	0.83
ln profit from farming	12.00	0.85	12.46	1.40	9.80	0.93	12.02	1.27
ln production from farming business	13.60	0.80	13.71	1.12	13.32	0.76	13.34	1.18
ln total expenses for farming business	11.53	1.56	11.69	1.61	11.55	1.43	11.81	1.66
ln revenue from non-farm business	11.55	1.43	11.81	1.66	12.28	1.16	12.28	1.63
ln average hours school attendance	1.73	0.21	1.73	0.21	1.70	0.21	1.78	0.13
working in schooling hour	0.28	0.45	0.14	0.35	0.13	0.33	0.17	0.37

Figure 3. Mean and standard error of variables

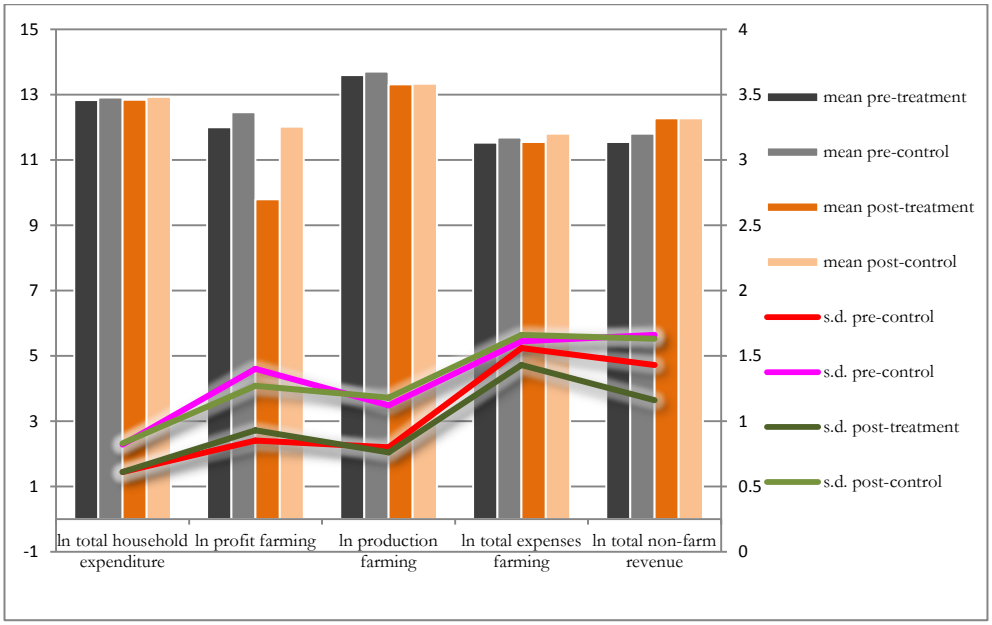


Figure 3 uses means and standard deviation from Table 4 to illustrate the change on means of each variable over times. The graph depicts that the change in average income and expenditure is not excessively large, yet in some variables it seems remain constant for both control-treatment and pre-post period.

In order to examine the significance of differences for those variables I perform two-sample test. Table 5 clearly gives an overview of differences between control and treatment group characteristic in pre and post intervention. During the pre- intervention period, treatment and control group show similar characteristic. The main differences between those two groups are the profit from farming activities and working in schooling period. This fact shows that

treatment group not only sold their crops but also use it for self-consumption. The proportions of crops that are utilized for self-consumption are sometime even larger than those that are sold (Ellis 1998). In addition, the number of household's members who working during schooling period for treatment group are greater than control household. Similar results are showed in post-intervention period, which profit from farming activities between those groups is significantly different.

Table 5. Impact of intervention for control and treatment group in pre and post intervention

Variable	Differences between control and treatment group			
	Pre-intervention		Post-intervention	
	Mean diff	Ha: diff!=0 Prob (|T| >|t|)	Mean diff	Ha: diff!=0 Prob (|T| >|t|)
ln total household expenditure	0.756	0.5946	0.739	0.5990
ln profit from farming	0.453	0.0548*	2.231	0.0000***
ln production from farming business	0.121	0.5153	0.165	0.9336
ln total expenses for farming business	0.162	0.5792	0.262	0.3681
ln revenue from non-farm business	0.001	0.9957	0.262	0.3681
ln average hours school attendance	0.004	0.9009	0.081	0.0046**
working in schooling hour	-0.131	0.0562*	0.041	0.5285

significant in 90%; ** significant in 95; * significant in 99%.*

Since the difference is calculated by mean(0)-mean(1), the sign (+) in mean difference column indicates lower economic activities of treated group in respect to control group.

Similar test is conducted to examine the changing of household business of control and treatment groups before and after the establishment of NPs. Table 6 shows that both groups have lower profit from farm activities after the NPs establishment. For control group it can be explained by considerable declining in farm production. Significant lower farm production generated considerable impact to reducing farm-profit. On the other hand, the revenue of control group has increased their revenue from farm business. In the same time, the average of schooling has increased.

Nevertheless, significant lower profit from farm business for treatment group seems to be caused by increasing proportion of farm production that are self-consumed. Lower profit from farming is also caused increasing number of household member who are working while schooling in order to generate additional income.

Table 6. Significance t-test in pre and post periods

Variable	Differences between pre and post establishment			
	Control group		Treatment group	
	Mean diff	Ha: diff!=0 Prob (|T| >|t|)	Mean diff	Ha: diff!=0 Prob (|T| >|t|)
ln total household expenditure	0.000	0.9946	-0.001	0.9897
ln profit from farming	0.437	0.0087***	2.213	0.0000***
ln production from farming business	0.372	0.0093***	0.264	0.1334
ln total expenses for farming business	-0.125	0.5338	-0.023	0.9442
ln revenue from non-farm business	-0.665	0.0007***	-0.367	0.1742
ln average hours school attendance	-0.04	0.0399**	0.03	0.5224
working in schooling hour	-0.023	0.6118	0.15	0.0958*

*Note: *significant in 90%; ** significant in 95; *** significant in 99%.*

Since the difference calculated by mean(0)-mean(1), the sign (+) in mean difference column indicates reduction in economic activities in those group after NP establishment.

The examination of the main explanatory variable is concluded by performing a one-way tabulation of the NPs intervention (intv) dummy variable. As indicated in Table 7, this permits for establishing the proportion of the sample identified as treatment group (intv=1) and control group (intv=0). In the view of the aforementioned, the panel contains 23.26% of observations relating to sample with highly intervened by the NP establishment and 76.74% are concerning not intervened by the NP establishment.

Table 7. Panel tabulation for the indicator variable *intv*

	Overall		Between		Within
intv	Freq.	Percent	Freq.	Percent	Percent
0	264	76.74	132	76.74	100
1	80	23.26	40	23.26	100
Total	344	100	172	100	100
			(n=172)		

Chapter 4
Result and Analyses

This chapter presents empirical findings of the relationship between household expenditure, NP intervention and other rural economic activities in two NPs. This chapter consist of four main parts. The first part discusses estimator description that will be used in analysis. The second part discusses the pre-regression analysis to test multicollinearity among variables. The third part will discuss impact evaluation from three different estimation techniques. Finally, in the last part we analyse the result from theoretical perspectives.

4.1. Estimator description

In order to estimate the significance impact of NP on household's economic performances between two periods, we arrange our observations as panel data set and run simple mean comparison test. In this study we employ total households expenditure per month as our main outcomes (Y_{it}^{T}). To explain the impact of NP intervention we use a binary variable that represent a period before NP establishment (intv=0) and after establishment (intv=1). Moreover, we operate five continuous variables and a dummy variable to control characteristic of our dependent variable.

To conduct the regression analysis some variables are manually generated. First we generate a variable that calculated by subtract the value of treatment group in pre and post intervention to conduct first difference estimation[12]. The second variable is used to run the second difference estimation, which is computed by subtract the value of control group from treatment group in post intervention[13]. Moreover, the DD outcomes are calculated from the change between treatment and control group in both periods[14]. In addition, to examine the average effect of NP intervention on treatment group we generate an interaction variable for treatment group in post-intervention only.

Before inspecting the regression results, we start the analysis with a brief description on development of the main response variables and the household's economic activities. The initial condition of observations provides a simple indication of impact of NP establishment. Table 4 above have shown statistic summary of each variable that used in this study. Table 5 and 6 give overviews regarding difference in mean outcomes with respect to two different groups and two periods. Overall, the mean outcomes of rural economic indicator were not significantly differ after NP established.

[12] The equation for first difference as shown in equation 4: $\widehat{(d_1)} = \overline{Y_1^1} - \overline{Y_0^1}$

[13] The equation for second difference as shown in equation 7: $\widehat{(d_2)} = \overline{Y_1^1} - \overline{Y_1^0}$

[14] Difference in difference variable are calculated as presented in equation 10: $DD = E(Y_1^1 - Y_0^1 | T_1 = 1) - E(Y_1^0 - Y_0^0 | T_1 = 0)$

4.2. Pre-regression

We arrange the pre-regression procedures by carrying out a diagnostic test in order to avoid miss-estimation of the model. Since the continuous variables are more likely contain similar information about the dependent variable, we need to examine multi-correlation problems. The result of multicollinearity test indicates that there are no correlations among variables.

Table 8. Multicollinearity test

	ltotalexp	lprofitfarm	lprodfarm	lexpensefarm	lrevnonfarm	lhrschool	schoolwork
ltotalexp	1.0000						
lprofitfarm	0.0283	1.0000					
lprodfarm	0.0132	0.5128	1.0000				
lexpensefarm	0.0362	-0.1149	0.0331	1.0000			
lrevnonfarm	0.0783	-0.1717	-0.0637	-0.1160	1.0000		
lhrschool	-0.0131	0.1239	-0.0091	-0.0341	0.0078	1.0000	
schoolwork	0.0435	0.0540	-0.0093	-0.0390	0.0783	-0.0803	1.0000

Variable	VIF	1/VIF
ln total household expenditure	1.72	0.861554
ln profit from farming	1.43	0.699506
ln production from farming business	1.03	0.957864
ln total expenses for farming business	1.02	0.977161
ln revenue from non-farm business	1.01	0.990886
ln average hours school attendance	1.01	0.992399

4.3. Empirical Findings

The impact of NP establishment on economic activities will be presented in two ways, first by comparing ATT from NN matching, Kernel matching and DD estimation and secondly using OLS regression with propensity score adjustment. The impact of NP establishment on total expenditure of rural households is presented in Table 9. The table shows impact estimations from various estimation techniques with respect to total household expenditure as dependent variable.

The general pattern of impact estimation is that NP establishment do not significantly affect the rural household's economic activities. In the presence of NP, total household expenditure was reduced by approximately 0.04%. NN matching estimates that NP intervention will reduce household expenditure by 0.021%, but this estimation have the highest bias. Kernel matching estimates the NP can reduce household expenditure approximately 0.052%. Kernel matching gives the highest estimation but produce lower standard error than NN Matching.

The third estimator, OLS combine with propensity score, give estimation about -0.046. This regression uses DD interaction variable as priority variable and all observation are weighted by propensity score. This estimation gives the lowest standard error because the treated observation matched with control observation in the range of common support. In other word, weighted OLS gives most effective estimation.

Table 9. Impact estimation of NP establishment on rural household economic activities using regression analysis

Estimation Method	Dependent variable: total household expenditure		
	Impact estimation	Std. Error	Sig.
Nearest Neighbour Matching	-0.021	0.195	-0.108
Kernel Matching	-0.052	0.192	-0.27
OLS with propensity score	-0.046	0.184	-0.25

Note: Average treatment effect of NP establishment on treated household are interpreted in percentage change. This regression is using total household expenditure as dependent variable and binary variable of NP-intervention as priority variable.

4.3.i. Evidence from Difference in Difference estimation

Table 10 present simple mean comparison between pre-post and treatment-control group. This mean comparison gives overviews about the different characteristic for each observation. As we can see, from first difference, the mean economic activities of rural people who live adjacent to NP were not significantly differ with another group. The second mean comparison attempt to comparing the mean between treatment and control groups in post-intervention (ignoring pre-intervention outcomes). Finally, the DD comparison that combines the first and second comparison take into account the permanent characteristic of different observations.

Table 10. Difference in difference estimation by comparing mean outcome

Economic activities of local households	First difference		Second difference		Difference in Difference	
	Comparison between pre and post intervention for treatment group only		Comparison between control and treatment group in post intervention period		Difference between treatment and control group in pre-post period	
	Mean diff	Sig.	Mean diff	Sig.	Mean diff	Sig.
ln total household expenditures	0.0017 (0.1370)	0.9897	0.0739 (0.1403)	0.5590	-0.0010 (0.3765)	0.9769
ln profit from farming	2.2139 (0.2004)	0.0000**	2.231 (0.2176)	0.0000**	1.7765 (0.1787)	0.0000**
ln production from farming business	0.2644 (0.1743)	0.1334	-0.0165 (0.1987)	0.9336	-0.1080 (0.1116)	0.3346
ln total expenses for farming business	0.0235 (0.3361)	0.9442	0.2626 (0.2910)	0.3681	0.1019 (0.2993)	0.7337
ln revenue from non-farm business	-0.3676 (0.2680)	0.1742	0.2626 (0.2919)	0.3681	0.2652 (0.4427)	0.5500
ln average hours school attendance	0.0306 (0.0477)	0.5224	0.0802 (0.0279)	0.0046**	0.0755 (0.0430)	0.0814*
dummy working in schooling time (1=working, 0=not working)	0.1500 (0.0890)	0.0958	2.2316 (0.2176)	0.0000**	0.1727 (0.0875)	0.0502*

*Note: Standard error in parentheses. * p<0.1; **p<0.05*
The difference was calculated by mean(0)-mean(1), the sign (+) in mean difference column indicates reduction in economic activities in those group after NP establishment or for treatment group.

Table 11.Regression of single difference estimator two cross-section data

Outcome	ln total household expenditures			
	Year=0		Year=1	
	Single different in the pre-intervention period		Single different in the post-intervention period	
	Coeff.	Sig.	Coeff.	Sig.
NP intervention	-0.07928 (0.145395)	0.586	0.182172 (0.191695)	0.343
ln profit from farming	0.04812 (0.057903)	0.407	0.125956 (0.060378)	0.039**
ln production from farming business	-0.08171 0.071195	0.253	-0.17124 (0.06531)	0.01**
ln total expenses for farming business	-0.04015 (0.039209)	0.307	0.000347 (0.037662)	0.993
ln revenue from non-farm business	0.031791 (0.039802)	0.426	0.042559 (0.042485)	0.318
ln average hours school attendance	0.093529 (0.287828)	0.746	-0.53466 (0.399347)	0.183
dummy working in schooling time	0.066637 (0.1612)	0.68	0.05722 (0.164693)	0.729
Constanta	13.35204 1.17498	-	14.0779 1.280144	-

*Note: Standard error in parentheses. * p<0.1; **p<0.05*

Table 11 shows the result of single difference regression using OLS base on difference characteristic of treatment and control group. This regression takes the expected estimation by subtracted outcome of control group from expected outcome of treatment group. In both pre and post intervention period NP had no significant impact on total household expenditure, but the direction was different. In pre-intervention period the presence of NP reduce household expenditure by 0.08%. In contrast, after establishment the NP increase household expenditure by 0.18%. Different outcome between pre and post period indicates the presence of permanent different characteristic between those two groups ($\gamma \neq 0$).

Table 12.Single difference estimator pre-post intervention

Outcome	ln total household expenditures			
	NP intervention=0		NP intervention=1	
	Single different in the absence of NP intervention		Single different in the presence of NP intervention	
	Coeff.	Sig.	Coeff.	Sig.
Year	-0.029 (0.10752)	0.786	0.195 (0.226651)	0.392
ln profit from farming	0.078 (0.048594)	0.108	0.111 (0.07922)	0.163
ln production from farming business	-0.130 (0.055814)	0.02**	-0.081 (0.093522)	0.388
ln total expenses for farming business	-0.046 (0.031883)	0.146	0.094 (0.048085)	0.052*
ln revenue from non-farm business	0.028 (0.033159)	0.384	0.076 (0.058877)	0.197
ln average hours school attendance	-0.143 (0.295213)	0.628	-0.108 (0.323798)	0.738

Outcome	ln total household expenditures			
	NP intervention=0		NP intervention=1	
	Single different in the absence of NP intervention		Single different in the presence of NP intervention	
	Coeff.	Sig.	Coeff.	Sig.
dummy working in schooling time	0.126 (0.140613)	0.368	0.009 (0.184846)	0.959
Constanta	14.160 (0.987784)	0	10.761 (1.954854)	0

*Note: Standard error in parentheses. * p<0.1; **p<0.05*

Table 12 provides the result from the second different regression. This regression captures the time-invariant characteristic. The result shows that the outcome of control group decreasing overtime (-0.029%). Conversely, the outcome of treatment group increasing by 0.19% overtime. This estimation also considered carried a bias that generated by permanent time trend ($\delta \neq 0$). Furthermore, the DD estimator that combines first and second estimation take into account those two sources of bias, and it can produce more reliable estimation.

Table 13. Difference-in-Difference estimation

Outcome	ln total household expenditures	
	DD estimation	
	Coeff.	Sig.
NP intervention	-0.013 (0.050391)	0.788
ln profit from farming	-0.002 (0.017086)	0.9
ln production from farming business	0.023 (0.027431)	0.396
ln total expenses for farming business	-0.005 (0.010744)	0.606
ln revenue from non-farm business	0.011 (0.007262)	0.12
ln average hours school attendance	-0.011 (0.069502)	0.947
dummy working in schooling time	-0.032 (0.03386)	0.337
Constanta	0.003 (0.022333)	0.884

*Note: Standard error in parentheses. * p<0.1; **p<0.05*

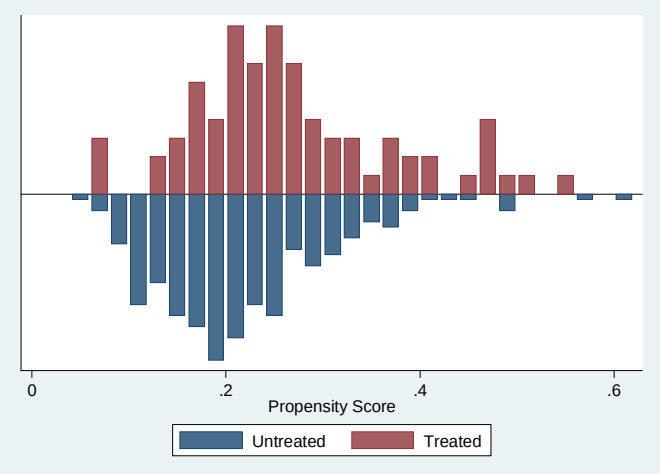
Table 13 shows the result from DD estimation. It is clearly shown that the NP intervention do not significantly affect the total household expenditure. Magnitude of NP impact constituted 0.013% reduces the household expenditure. However, to make the result robust we combine DD technique with propensity score that presented in Table 16.

4.3.ii. Propensity Score Matching

Randomly assigning observations that receives intervention or not is not possible because this model deal with a counterfactual problem. To reduce the bias we employ matching technique. This study uses 80 observations as the treatment group, and it is constituted 23% of total observation. On the other hand, the control group which is not affected by NP establishment are 264 observations (77%). This treatment-control proportion states that the number of control observation is adequate to perform probability model. However, our propensity score are restricted to capture baseline characteristic of each observation. Thus, only 40 and 132 of treatment and control observations respectively are used in probability calculation. In addition the overlap condition of treatment observations that have same characteristic with control observations is between 0.02902281 and 0.75880869. Therefore, the balancing property between treatment and control group is satisfied[15]. Since the propensity score result is a probability in the interval (0;1), the average probability to participate in the treatment for all observation is 99%.

To examine overlap and the region of common support we perform some diagnostics test. Main purposes of these assessments are to ensure that we have sufficient overlap observations between the treatment and control group in order to make reasonable comparisons. The first diagnostic is plot histogram for the propensity score of the treatment and control observations. Figure 4 shows a graph that illustrates the treated observation in red on top and the control observation in blue on bottom. It can be seen that there are enough overlap observations to match between control and treatment group. Another visual analysis using propensity histogram is showed in Figure 5. From this histogram, it is clear that there are sufficient numbers of control observation to be match with the treatment cases.

Figure 4. Common Support graph



[15] Propensity Score using Stata is provided in Appendix 4.

Figure 5. Propensity histogram

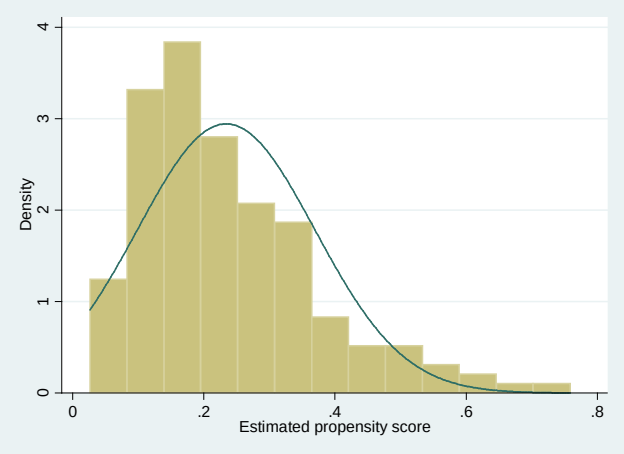


Table 14 clearly depicts that NN matching use less control observation to estimate ATT. Thus, it produces greater bias (0.065) than Kernel matching (0.004). In this case NN matching also have greater variance after bootstrapped standard error. Since Kernel matching can reduce greater bias, it is can be assumed that Kernel matching gives more appropriate estimation.

Table 14. Bias after matching

Matching method	ATT estimation		Bias	Boot-straped Std Error	Normal Std Error	Bias reduction
	n. treat	n. control				
NN matching	40	31	0.065	0.195	0.199	0.1344287
Kernel matching	40	99	0.004	0.192	-	0.1911083

Note: the numbers of treated and controls refer to actual observation matches in pre-intervention period.

4.3.iii. Evidence from OLS with propensity score

Finally we estimate the impact of NP establishment using OLS which adjusted by propensity score. Table 15 reports the regression output of the NP intervention model. The goodness of fit of the model as shown by Prob>F is significant in 0.10. It indicates that household total expenditure can be explained by explanatory variables. However, the model gives R^2 value of 0.1094. It means the variance of independent variable can explain 11% of variance of dependent variable, and the 89% are explained by other factors.

Among those economic activities, the revenue from non-farm business is the only variables that significantly affect the household expenditure. It can be said that 1% change in non-farming activities can increase household expenditure by 0.11%. However, the other income generators such as production and profit from farming activities reveal an inverse direction. Generally, an increase in farming activities will also increase household ability to spending, but our result shows opposite correlation. Even though the effect of farming business on household expenditure is not significant, we can assume that changing on household economic activities are (11%) caused by NP intervention.

Some evidence show that NP establishment increase the risk of food insecurity and landlessness for rural household (Cernea and Schmidt-Soltau 2006, Laudati 2010). Farming activities still considered the prominent activities of rural people. However, farming business faces risks when the shock is presence. NP establishment also considered be a shock in farming activities, especially for those who highly depend on forest resources.

Human development that represented by average hour of school attendance and probability of child worker are also have insignificant affect to the household expenditure. However we can examine the causality by analyzing the coefficient sign. One percent increase in school attendance will reduce household expenditure by 0.37%, but in the presence of child labour will increase household's expenditure ability by 0.04%. Child labour for rural household can make a significant contribution for rural household income especially from agricultural and informal sector. Schooling is probably the most effective method for combating child labour; however, there is trade-off between child labour and rural income (Admassie 2003).

Table 15. Changing on economic activities of treatment group caused by NP establishment (estimation using OLS weighted by propensity score)

Economic activities of rural household	Dependent variable: ln total household expenditures		
	Percentage change	T-test	P>|t|
NP intervention	-0.0463 (0.1848)	-0.25	0.800
ln profit from farming	-0.0156 (0.0799)	-0.20	0.844
ln production from farming business	-0.1142 (0.0891)	-1.14	0.258
ln total expenses for farming business	-0.0517 (0.0696)	-0.84	0.406
ln revenue from non-farm business	0.1104 (0.0485)	2.10**	0.040**
ln average hours school attendance	-0.3754 (0.4989)	-0.97	0.338
working in schooling hour	0.0488 (0.2161)	0.24	0.811
Constant	14.5388 (1.8350)	7.92***	0.000***
Number observation	72		
R-squared	0.1094		
Prob > F	0.0752		

Note: standard error in parenthesis
** significant in 1%, ** significant in 5%, ***significant in 10%.*

4.4. Analyses

The result shows that there is no supporting evidence for hypothesis of NP establishment that have significant impact on economic activities of rural households. The most important economic determinant that significantly can change households expenditure is revenue from non-farm activities. An increase in 1% change on non-farming activities can increase household expenditure by 0.11%. Non-farming activities considered play an important role for rural household in the presence of constraint in their main income generator (Barrett 2001). However other factors may influence household utilization of freely available natural resources and generating income from crop plantation.

In most rural area, agriculture sector is still considered the dominant activities to gain cash income; however, rural people often facing various risks to maintain their agriculture outcome. Any little shock in agriculture supporting factor will considerably change the farming outcome. Limiting access to resources and landlessness are such factors that can constraint their agriculture outcome (Adams et al. 2004).

Family characteristic also influence the household behavior in generating income from farm and natural resources. Larger family seem to have greater labour to extract natural resources, but they also demands more food for consumption. Gender proportion plays a crucial role in generating income. Larger number of male among family member seems more opportunity to gain income from natural extraction (Ellis 1998). Human capital gives more long term impact on household income. Educated household member may be in a better position to gain income from natural resources and generate long term income from labour market (Godoy et al. 1997). In addition, Barrett (2001) argued that better education is most crucial factor on income diversification.

Some evidence shows that livelihood diversification is the prominent strategy for rural people to survive and improve their standard of living. The livelihood in this sense is not only referring to cash earning activities, but also encompasses institutional and social relationship, and property right to support and maintain standard of living. Social institution and property right regimes also critical to interpret the household constraint on income, access and asset (Ellis 1998).

The NP intervention was not significantly affect household economic decisions during three years after establishment, because NP legislation have not implemented properly yet. During transition period, NP authorities still allowed local people to do similar activities as they did before establishment (Kuswijayanti 2007). In addition, NP authorities also often face less staff and budget during this period; thus, implementation of NP regulation was still considered less effective[16]. Therefore this study only captures short-term NP establishment impact on rural household. NP probably have different long-term impact on rural livelihood.

In order to promote environmental protection while improving livelihood of local people, NP authority introduced zoning system. Ideally zoning system can balance between conservation purposes and economic development.

[16] GMNP authority in unpublished report (2008) states that law enforcement will be effective after five year after establishment.

However this policy suffered from lack of implementation. This circumstances can perpetuates ambiguity in PAs objectives. However, zoning system seems to be effective if it legitimated by local people and key stakeholders (Naughton-Treves et al. 2005).

It seems participation and collaborative management become a crucial factor to develop PAs harmonious with economic development. Evidence from Bolivia has shown that participation process can raise public legitimation. However inappropriate participatory process will lead to difficulty to implement the public policies (Pellegrini 2012). GCNP and GMNP were also established without participation and public hearing process. This situation can potentially rising conflict between NP authority and local people. Therefore, Kuswijayanti (2007) proposed that NP authority need to promote participation and collaborative approach in managing GMNP.

Chapter 5
Conclusion

National Parks are often blamed for reducing economic activities of local people. This assumption is rising because NP legislation prevents local people from accessing and utilizing the NPs resources. In the other hand, there is assumption contends that the establishment of a NP provides new opportunities to generate income (Ferraro 2002, Kuswijayanti 2007). Estimation of the contradictory assumptions is needed in order to construct a better conservation policy, because the goal of a conservation policy is not solely to protect the biodiversity and the environment, but also expected to increase the livelihood of people who live surrounding the PAs (Adams et al. 2004).

This paper attempts to fulfil the causality gap between those people and the NP by examining the economic activities of people surrounding two newly-established NPs in Indonesia. The study examines whether the NP establishment is a key factor of changing on household economic activities. In this study, 344 observations are taken from two period data survey. First set of data was collected in year 2000, 4 year before NPs were established, and second set of data was collected in year 2007, about two and half years after NPs establishment. From time-frame perspective, this study examines the sort-term impact of the NPs establishment.

A combination of regression analysis and matching estimator is an appropriate method to evaluate the impact of NP on household economic activities. Even though some observations are dropped to achieve the common support, the PSM increase the likelihood of reasonable comparison between treatment and control group. The Matching technique is potentially reducing the bias in this impact evaluation study. The result is robust if there is a large enough data on control group to draw matches.

A central empirical finding of this paper is that the NPs establishment is not significantly reduce the total expenditures of local people who live surrounding NPs. In the presence of the NP intervention, household expenditure as a proxy of household economic activities was decreasing about 0.046%. Even though most of farming activities were decreased after NP establishment, the result is not statistically significant. Therefore, the magnitude and significance of the result is not strong enough to support the hypothesis.

Another important finding is that decreasing in profit and farming production of farming is not affected by the NP establishment, but other factors. This finding is consistent with argument which claimed that household income is often found to have a non-linear relationship with forest resources utilization (Mamo et al. 2007:917). The characteristic of a poor household such as the number of family member, the gender and the age composition plays a more-important role in generating income from farm activities. Larger family may have greater labour to generate income, but at the same time it also demands more food to feed the entire family. Meanwhile, household composition namely the gender and the age structure are more important in affecting the household income (Adhikari et al. 2004)

Income generating from non-farm business was significantly increase household expenditure by approximately 0.11%. A central argument of this finding is that economic diversification plays an important role for rural people in the presence of agricultural constraint (Schwarze and Zeller 2005, Naughton-Treves et al. 2005). Even though the average gain from non-farm activities was lower than average farming profit, this source of income statistically significant affect total household expenditure.

Income diversification becomes a central issue when assessing rural household survival strategies in the absence of agricultural support. Ellis (1998) argued that income diversification in farm household is not only correlated with income sources but also with increased ability to deal with shocks. In other words, income diversification can reduce household vulnerability.

Another study in Lore Lindu NP explained that the common reason why rural household diversify their economic activities with non-farming activities is because their assets endowed in farming production are decrease in relation to the returns from using the same assets to non-farm activities. In the other words, the household ability to diversify their income sources also depends upon the access to different types of assets, for example human and physical capital. This condition can explain the fact that not all of households have the same opportunity to participate in non-farm activities (Schwarze and Zeller 2005).

Finally I have some suggestions for further research on evaluating the impact of NP on household livelihood. First, to capture real characteristic of rural household that live adjacent to NP, observation might be aggregated in village level. The reason for this is that household in communities often share same resources to generate their income. Thus, choosing control and treatment group base on village level are more appropriate. Second, to evaluate long-term impact of NPs, longer period of observation is needed, and it will be better if the future study involve all NPs in Indonesia to capture a more generalized findings.

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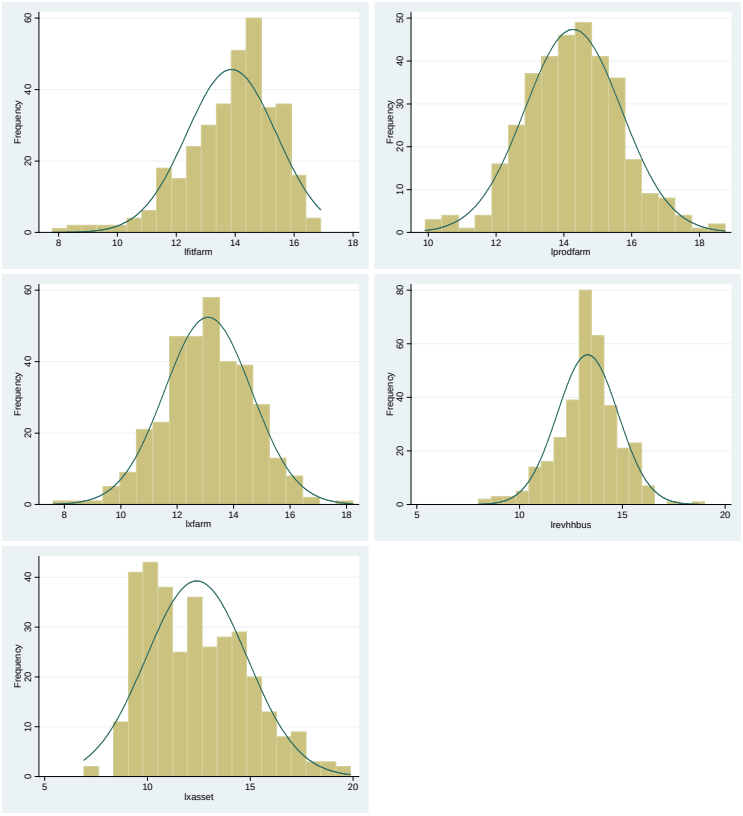
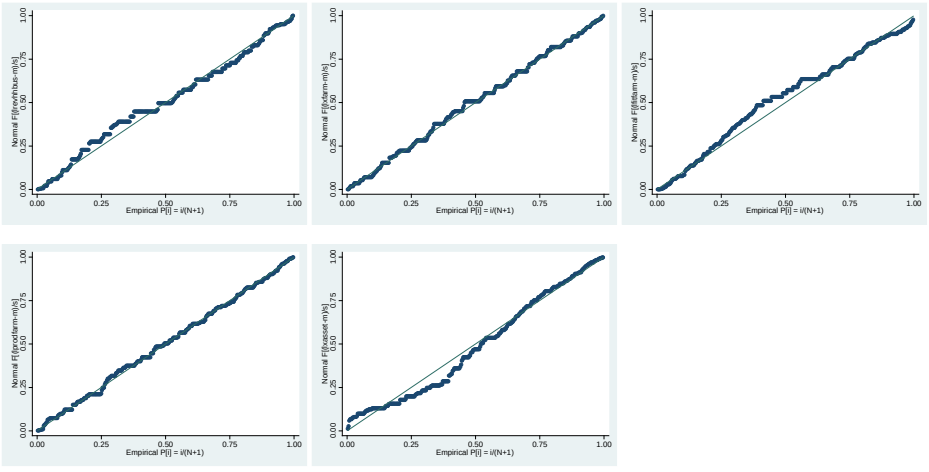
Appendix

Appendix 1. Normality test for five continuous independent variables using histogram



Appendix 2. Normality test for five continuous independent variables using normal probability plots



Appendix 3.Propensity Score with Common Support

```
The treatment is intv
```

intv	Freq.	Percent	Cum.
0	264	76.74	76.74
1	80	23.26	100.00
Total	344	100.00	

```
Estimation of the propensity score

Iteration 0:   log likelihood = -93.018441
Iteration 1:   log likelihood = -89.441167
Iteration 2:   log likelihood = -89.364079
Iteration 3:   log likelihood = -89.364057

Logistic regression                               Number of obs   =        171
                                                  LR chi2(6)      =       7.31
                                                  Prob > chi2     =     0.2932
Log likelihood = -89.364057                       Pseudo R2       =     0.0393
```

intv	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lprofitfarm0	-.3038421	.1730583	-1.76	0.079	-.6430301	.0353459
lprodfarm0	.0653371	.21135	0.31	0.757	-.3489014	.4795755
lexpensefa~0	-.0192516	.1180338	-0.16	0.870	-.2505935	.2120903
lrevnonfarm0	-.045748	.118526	-0.39	0.700	-.2780546	.1865586
lhourschool0	.0953123	.8384857	0.11	0.909	-1.548089	1.738714
schoolwork0	.7780672	.4433855	1.75	0.079	-.0909525	1.647087
_cons	2.103369	3.600037	0.58	0.559	-4.952574	9.159312

```
Note: the common support option has been selected
The region of common support is [.15278944, .49959232]

Description of the estimated propensity score
in region of common support
```

Estimated propensity score

Percentiles		Smallest		
1%	.1542143	.1527894		
5%	.1670712	.1542143		
10%	.1757075	.1612411	Obs	139
25%	.1956394	.1632368	Sum of Wgt.	139
50%	.2256		Mean	.2494512
		Largest	Std. Dev.	.0750863
75%	.2872087	.4240448		
90%	.3753861	.4317894	Variance	.005638
95%	.4096292	.4849494	Skewness	1.130999
99%	.4849494	.4995923	Kurtosis	3.678183

```
The final number of blocks is 3

This number of blocks ensures that the mean propensity score
is not different for treated and controls in each blocks
```

The balancing property is satisfied

This table shows the inferior bound, the number of treated
and the number of controls for each block

Inferior of block of pscore	intv 0	1	Total
.1527894	29	13	42
.2	67	22	89
.4	3	5	8
Total	99	40	139

Note: the common support option has been selected

Appendix 4. OLS estimation with adjusted propensity score

Linear regression

Number of obs = 72
F(7, 64) = 1.94
Prob > F = 0.0782
R-squared = 0.1060
Root MSE = .72139

ltotexp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
intv07	-.0463618	.1826116	-0.25	0.800	-.4111704	.3184468
lprofitfarm	-.0156264	.0789468	-0.20	0.844	-.1733408	.142088
lprodfarm	-.1142501	.1000383	-1.14	0.258	-.3140995	.0855993
lexpensefarm	-.051729	.0619012	-0.84	0.406	-.175391	.0719329
lrevnonfarm	.110486	.0525933	2.10	0.040	.0054189	.2155531
lhourschool	-.3754687	.3889733	-0.97	0.338	-1.152532	.4015948
schoolwork	-.0488419	.2029532	-0.24	0.811	-.4542875	.3566037
_cons	14.53889	1.835038	7.92	0.000	10.87298	18.2048