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The effects of national parks on local communities' wages and employment in Costa Rica

By

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DEDICATION

To all the people who try to find their own way, giving the best of themselves.

To the rural way of living.

To my family.

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SUMMARY

Despite of the clear global environmental benefits of increasing the amount of protected areas, how these conservation policies affect the well being of individuals in nearby localities is still under debate. Using household surveys with highly disaggregated geographic reference, this study explores how national parks have affected wages and unemployment in Costa Rica for the period 2000-2007. Costa Rica's vast and already well established conservation efforts provide a unique opportunity to evaluate these effects. Conditions in which the effects on local welfare can be positive or negative in different areas of the parks or even within social groups are shown. Also, field observations were conducted to validate the statistical analysis. It was found that wages close to parks are higher only when located close to tourists' entrances. Also, workers close to parks but far away from tourists' entrances earn similar wages than those workers far away from parks. Additionally, workers close to park entrances have fewer probabilities to be unemployed compared with other rural areas, meanwhile far from entrance the chances are the same. Results are robust to different econometric approaches (OLS and matching techniques) and supported by field observations. The parks' entrance location and the possibility of agricultural workers to switch to service activities can be important tools to take advantage of the economic benefits of parks.

RESUMEN

A pesar del evidente beneficio ambiental de aumentar la cantidad de áreas protegidas, continúa el debate de cómo esta política de conservación afecta el bienestar de los individuos en las comunidades cercanas. Mediante encuestas de hogares con alta desagregación espacial, este estudio explora como los parques nacionales han afectado los salarios y el empleo en Costa Rica para el período 2000-2007. Los vastos y bien establecidos esfuerzos de conservación de Costa Rica ofrecen una oportunidad única para evaluar sus efectos. Se muestran las condiciones bajo las cuales los efectos en el bienestar social pueden ser positivos o negativos en diferentes zonas del parque, o incluso entre grupos sociales. También se realizan observaciones de campo para validar el análisis estadístico. Se encontró que los salarios cerca de los parques aumentan únicamente para los trabajadores que viven cerca de las entradas al parque. Los trabajadores cerca de los parques pero lejos de las entradas ganan salarios similares a aquellos trabajadores lejos de los parques. Adicionalmente, los trabajadores cerca de las entradas a los parques tienen menores probabilidades de estar desempleados, en comparación con otras áreas rurales; mientras que para los trabajadores lejos de las entradas las probabilidades son iguales. Los resultados son robustos a diferentes métodos econométricos (MCO y Matching), y son respaldadas por las observaciones de campo. La ubicación de la entrada al parque y la posibilidad de que los trabajadores agrícolas se cambien a actividades de servicios pueden ser herramientas importantes para aprovechar los beneficios económicos de los parques.

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ABBREVIATIONS

CINPE: Centro Internacional de Política Económica para el Desarrollo Sostenible

EHPM: Encuestas de Hogares de Propósitos Múltiples

GDP: Gross Domestic Product

INEC: Instituto Nacional de Estadística y Censos

IUCN: International Union for Conservation of Nature

OLS: Ordinary Least Squares

REDD: Reduced Emissions from Deforestation and Degradation

UNA: Univerisdad Nacional

1 INTRODUCTION

In the last few decades, the number of protected areas around the world has significantly increased. At the global scale, terrestrial protected area coverage reaches 12.2 percent (Coad et al. 2008) and initiatives to expand the amount of protected land in developing countries are under way (e.g., REDD, the United Nations Collaborative Program on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries). However, the debate about how these efforts will affect local communities continues. Sorting the effects of protected areas on local communities will allow determining whether compensations mechanisms are needed for people who lose for these conservation efforts or whether promoting policies that contribute to both poverty and conservation is feasible.

On one hand, it has been argued that National Parks might have negative effects in nearby communities. Land-use restriction can lead to loss of employment, social differentiation, inequality and uncertainty over property rights (Fortin and Gagnon 1999; Pfeffer et al. 2001; Mukherjee and Borad 2004; Robalino 2007; and List et al. 2006). On the other hand, higher population growth rates in areas close to parks, found in some Latin American and African countries, can be seen as evidence of the presence of positive effect on welfare (Wittemyer et al. 2008). Also, explicit evidence exists that parks have, in some cases, actually alleviated poverty (Sims 2009 and Andam et al. 2009) and increased household income (Mullan et al. 2009).

However, a considerable amount of research has also found that welfare effects of parks are neutral or insignificant. There was no evidence that showed that federal land designated to conservation in the western United States had significant effect on population growth or on employment (Duffy-Deno 1998). Similar results were found for employment and wage growth in the Nothern Forest region in the United States (Lewis, Hunt and Plantinga 2002, 2003).

This research contributes to this discussion by demonstrating conditions in which the effects on local welfare can be positive, negative or insignificant for different areas of a park and for different social groups. The study is conducted in Costa Rica, which is a developing

country with vast and well-established conservation efforts and a tourism sector that plays an important role within its economy and in particular within rural development.

Effects are sorted on wages and unemployment due to the level of aggregation and the spatial reference of the data available. The analysis at the workers' level allows obtaining more precise and detailed conclusions, controlling for important individual characteristics. The spatial reference of the observations permits to identify people close to entrances, close to the parks but far from the entrance, and far away from the parks. Therefore, it can be identified the effects on wages and unemployment where most tourism activities take place and compare them with the effects in areas close to parks but without tourism.

One of the empirical challenges is the fact that parks (and park entrances) are endogenously located (Pfaff et al. 2009). This implies that characteristics of the groups living close to parks and close to entrance can differ significantly. To address this issue, it is used a large set of workers' and geographic characteristics, and also matching techniques are employed. This is done by comparing workers who live close to a national park with similar workers living away from parks in similar geographic areas.

Findings suggest that park's effects on wages and unemployment vary according to economic activity and proximity to the entrance of the Park. Average wages were around 8 percent higher close to tourists' entrances when compared to workers with similar characteristics. There were no significant wage effects for workers close to the parks-far from entrance. Also, the probability of being unemployed was 1 percent lower close to park entrance, compared with similar locations far from parks. Areas close to parks-far from entrances had no significant effect on unemployment likelihood.

It was also found that workers close to the entrance were employed in higher-paid activities. In these areas, fewer workers are engaged in natural resource-dependent activities (agricultural, hunting, forestry and fishing activities) and manufacturing activities, but significantly more worked in tourism related activities (restaurants and hotels) and other service activities. However, in adjacent park areas away from the entrance, the percentage of

workers in natural resource-dependent activities and service activities was not significantly different from rural areas far away from parks.

Then, the difference of the premiums close to the entrance by migrant status, nationality and gender were analyzed. Parks' effects were very important especially for woman. While both females and males received better wages close to park entrances, the premium for females was significantly larger, and so was the reduction in the probability of being unemployed .

It is concluded that there is no evidence to support that national parks have negative effects on wages or employment. Workers close to a park entrance significantly benefit, meanwhile workers who live near the park but far from the entrance will not benefit or even be negatively affected.

1.1 Objetives

1.1.1 General Objetive

To analyze the effects of the national parks on local communities' wages and unemployment in Costa Rica for years 2000-2007.

1.1.2 Specific Objectives

- To define the relevant area of influence of a national park over which wages and unemployment might be affected.
- To estimate the effects of national parks on wages and unemployment in the area of influence.
- To analyze if parks' effects vary by gender, nationality and time of living in the community.
- To analyze the mechanisms through which national parks have an impact on local communities' wages and employment.

1.2 Hypothesis

- The establishment of a national park has a positive effect on wages and employment in local communities.
- The positive effects of national parks on wages and unemployment are not equally distributed among all workers around parks.

2 FRAMEWORK

2.1 Theroretical perspective

To explain the effects of national parks on local communities' welfare from a theoretical perspective, previous studies have based on von Thünen's ideas (1826). This geographer was the first to formulate a regional land-use model in which land is devoted to the use that generates the highest rent. Rents are the result of the combinations of factors such as distance from markets, productions costs, transportation costs and market prices. For example, more perishable goods are to be cultivated close to markets (cities), since transportation costs are lower, meanwhile far away from markets no agricultural activity would take place, and other land uses such as forests are more plausible. Therefore, this model explains how agricultural landscape is formed around cities, and has also been used to explain territories' growth and development (Toral 2001, García 1975, Fujita and Thisse 2002, Fujita et al. 2002).

Following von Tünen's conception, Chomitz and Gray (1996) have formulated and estimated a spatial model useful for calculating the probabilities of alternative land-uses as a function of land characteristics (such as soil quality) and distance to market. According to this model, roads, distances to markets and land characteristics altogether determine rents. Therefore, an agricultural land use is expected to be related with lower distance to markets and with more productivity-enhancing land characteristics. The main results of an empiric estimation of this model in Belize conclude that, as expected, agriculture becomes less attractive as distance to markets increases and that land and soil characteristics strongly affect the probability of agricultural use. These characteristics include soil nitrogen, phosphorus, soil pH, wetness, flood hazard, rainfall and slope. In particular, higher nitrogen, higher phosphorus and very low or high pH levels boost the probabilities of both commercial and subsistence agricultural use. Meanwhile, steeper slopes, wetness or rainfall discourage commercial farming but encourages semisubsistence farming.

Other studies have found similar results for the relationship between biological and geographic characteristics and land use. In particular, lands with steep slopes are less prone to

be designated as crops since steeper slopes increase production costs. This is supported by evidence in different places such as Thailand (Cropper et al. 1999), Belize (Chomitz and Gray 1996) Southern Yucatan, Mexico (Vance and Geoghegan 2002), Brazilian Amazon (Pfaff et al. 2007) and Costa Rica (Sader and Joyce 1988, Pfaff et al. 2007a, Pfaff et al. 2009 and Andam et al. 2008). Precipitation level is also a key factor in determining agricultural development (Chomitz and Gray 1996, Laurance et al. 2002, Vance and Geoghegan 2002, Pfaff et al. 2005 and Pfaff et al. 2009.) In general, lands with very low or very high levels of precipitation are less prone to be used for agriculture activities.

According to Sims (2007), the model proposed by von Thünen will likely predict that the imposition of a protected area will have a negative effect on overall economic welfare, since it restricts the possibility of devote the land to its most productive use. As a result of this restriction, land use around the park is likely to change too, causing impacts on economic activities and hence in labor markets. Moreover, few studies have addressed formally the relationship between protected areas and social welfare.

Robinson, Albers and Williams (2005) propose a model to analyze the impacts on rural welfare of establishing a protected area when local communities depend on extraction activities to procure themselves some specific goods. To the purposes of this study, the most remarkable result of this model is that local communities are worse off when resources are limited since they incur in costs for substituting the resources. Exclusion imposes additional costs on villagers both for having to extract the good more intensely in non protected areas and for having to purchase the resources directly from the market. Also, remotely located villagers bear the highest costs of exclusion since transaction costs are higher.

Robalino (2007) also uses von Thünen's approach and subsequent literature to develop a theoretical model that explains how land conservation affects rents and real wages. According with this proposition, the establishment of a national park reduces the land available for other uses, in particular agriculture. This reduction in land for agriculture reduces aggregate rents. But at the same time, all else equal, less land for cultivation means less production of agricultural goods and therefore prices increase. This prices rise increases aggregate rents and reduce real wages. In sum, this model demonstrates that under some

assumptions, more land under protected areas would increase aggregate rents and decrease real wages. These results imply that there is a distribution effect where landowners benefit and agricultural workers are worse off.

Sims (2007) also uses von Thünen's model to argue that positive externalities and a new income-generating sector must be considered to better assess the total effects of protected areas on economic welfare. Externalities might include environmental services which might improve local agriculture or generate products for consumption or sale. Also, people might benefit from employment opportunities created out of new tourism activities and directly from parks. According to this author, these benefits might be considerable and could offset the negative impacts so both wages and rents can actually increase.

For the purposes of this study three main theoretical findings are relevant. First, geographic characteristics help to determine the land use. Also, restrictions over land use imposed by a protected area will also determine the economic activities around them. When a protected area is set, agriculture and extraction activities are limited, and other economic activities take place. This affects labor market dynamics around the protected areas, including the wages level and employment opportunities.

Second, parks' effects are likely to be uneven for all population around. In particular, agricultural workers and remotely located households might bear the highest costs of protection, meanwhile land owners and people with more flexible conditions, more access to markets, and higher opportunity costs of time, might be in equal conditions or even better off. Third, possible negative effects of parks on people's welfare might be compensated in the presence of some conditions such as tourism and ecosystems services.

2.2 Previous empiric Studies

The relationship between conservation and social well-being has been widely discussed (Adams et al. 2006, and Scherl et al. 2004). However, empiric studies addressing these interactions are not conclusive. Cernea and Schmidt-Soltau (2006) argue that biological

sciences are far more advanced in understanding the costs of loosing biodiversity and the need for land conservation, meanwhile in the social sciences the costs and/or benefits from protection are less clear.

Methodological challenges to properly estimate these effects have been discussed in Ferraro (2008), Wilkie et al. (2006) and Sims (2009). These authors argue that in order to find the change in the people's welfare produced by the parks' presence, it is necessary to establish a reference line to which compare the after-park situation. Most studies up to date lack this baseline and therefore the knowledge of protected areas and welfare is still very limited. Still, some empirical findings provide some insights of the possible social outcomes of conservation.

One possibility is that national parks have negative effects for communities around them. For instance, land use restriction might result in a loss of welfare for local people, due to loss of employment in the alternative activities, relocation (Fortin and Gagnon 1999), restrictions on cultural activities (Fortin and Gagnon 1999) or loss of land including traditional ownership rights (Bandyopadhyay and Tembo 2009).

But there might be also positive effects. For instance, people might benefit out of the environmental services that ecosystems provide (soil erosion protection, watershed protection, climate control, sediments reduction). Other benefits might include government and NGO subsidies, employment creation associated directly with the protected area and with new tourism activities, and capital attraction from international cooperation (Duffy-Deno 1998, Fortin and Gagnon 1999, Ferraro 2002, Sims 2009).

Some studies have found positive effects of protected areas for local communities. Sims (2009) found that protection actually was effective reducing land clearing without causing negative impacts on socioeconomic outcomes in Thailand. Wittemyer et al. (2008) found that for different countries in Latin America and Africa, the grow population rate is higher in regions close to national parks compared with rates far from them, suggesting that parks actually have a positive impact on welfare so people are attracted to them.

Other studies have identified negative effects of protected areas on local communities. Norton-Griffiths and Southey (1995) conclude that the biodiverstiy conservation benefits are lower than costs in Kenya. Shyamsundar and Kramer (1996) argue that households close to Mantadia National Park in Madagascar incur in considerable costs in the name of conservation and therefore they should be compensated. Ferraro (2002) concludes that the opportunity cost of conservation is significantly high for local communities around Ranomafana National Park in Madagascar.

Additionally, some other studies have found null impacts or mixed effects of conservation for local people. Duffy-Deno (1998) found no evidence that federal land designated to conservation in the western United States has significant effect on population grow or on employment. Lewis, Hunt and Plantinga (2002, 2003) did not find significant effects in employment grow nor in wages due to land under protection in the Northern Forest region in United States during 1990 to 1997. Fortin and Gagnon (1999) conducted a four year qualitative research in Quebec, Canada, where they looked at what changes had been produced in communities after the establishment of two national parks in Saguenay region. They found significant changes in aspects such as resources management, local economy, tourism industry and in the participation and involvement of actors and social organization of local communities. Some of these changes were positive and others negative, and the net effect varies among communities and actors involved.

Similar results were found by Asquith et al. (2002) in Bolivia, i.e., although parks might have positive effects on local communities, certain sections of these communities might be worse off. This study emphasizes that the effects depend on how the conservation project is implemented and on other institutional circumstances such as property rights. Bandyopadhyay and Tembo (2009) concluded that having less strict protected regimes in areas close to national parks might benefit local communities. They compared consumption between communities living close to national parks where controlled hunting is permitted and communities close to parks where this activity is restricted. They found that having people coexisting with nature as well as community based natural resource management have a positive but unevenly distributed effect on communities' welfare, where non-poor households obtain the gains.

Previous empiric studies in Costa Rica have quantified how much do national parks contribute to socioeconomic development at three different levels: local, regional and national. Fürst et al. (2004) conducted a cluster analysis in Chirripó, Poás Volcano, and Cahuita national parks, and Naranjo (2007) did the same in Braulio Carrillo National Park. Fürst et al. found that the main impacts at local level are the income generation in the tourism activities, the benefits caused by the watershed protection, the increase in the land price, and the appearance of new activities related to tourism such as guides, handcrafts and local products sales. At the regional level, the positive impacts also are related to the tourism activities and watershed protection as well as the taxes revenues for the local government. Finally, at a national level, the main impacts are related to profits by the entrance fee, which are re-invested in the national conservation system.

Other similar study cases are being currently conducted by CINPE at National University of Costa Rica (UNA) using this cluster methodology for other national parks[1]. Moreover, one limitation of this type of studies is that they do not use a base line to compare the additional changes produced by the parks' presence and therefore the net effect of parks is hardly captured.

2.3 Costa Rica's context

Costa Rica is a relatively small country with 51.100 km^2 and around 4.5 million people, 41 percent of whom live in the rural area. This Latin American country has a long tradition conserving its natural resources. Nearly 26 percent of its land and a 17 percent of its coastal waters are under conservation regimes (SINAC 2007) as shown in Table 1. Half of this land protected area and almost all of marine areas are designated national parks —one of the most strict protection policies according to IUCN classification (IUCN 1994).

[1] Rincón de la Vieja Volcano National Park, Palo Verde National Park and Corcovoado National Park.

Table 1. Protected Areas in Costa Rica: main characteristics

Costa Rica's Management Category	IUCN Management Category		Number of protected areas	Continental Area (ha)	% of national continental area
Biological Reserves	I	Strict Nature Reserve/Wilderness Area	8	22 036	0.43
National Park	II	National Park	28	628 992	12.31
Natural Absolute Reserve	I	Strict Nature Reserve/Wilderness Area	2	1 639	0.03
National Monument	II	National Park	1		
National Monument	III	Natural Monument	1		
Wilderness Life National Refugee	IV	Habitat/Species Management Area	71	236 759	4.63
Wetlands	IV	Habitat/Species Management Area	15	63 723	1.25
Protected Area	VI	Managed Resource Protected Area	31	157 715	3.09
Forestry Reserve	VI	Managed Resource Protected Area	9	216 261	4.23
		Total	166	1 327 125	25.97

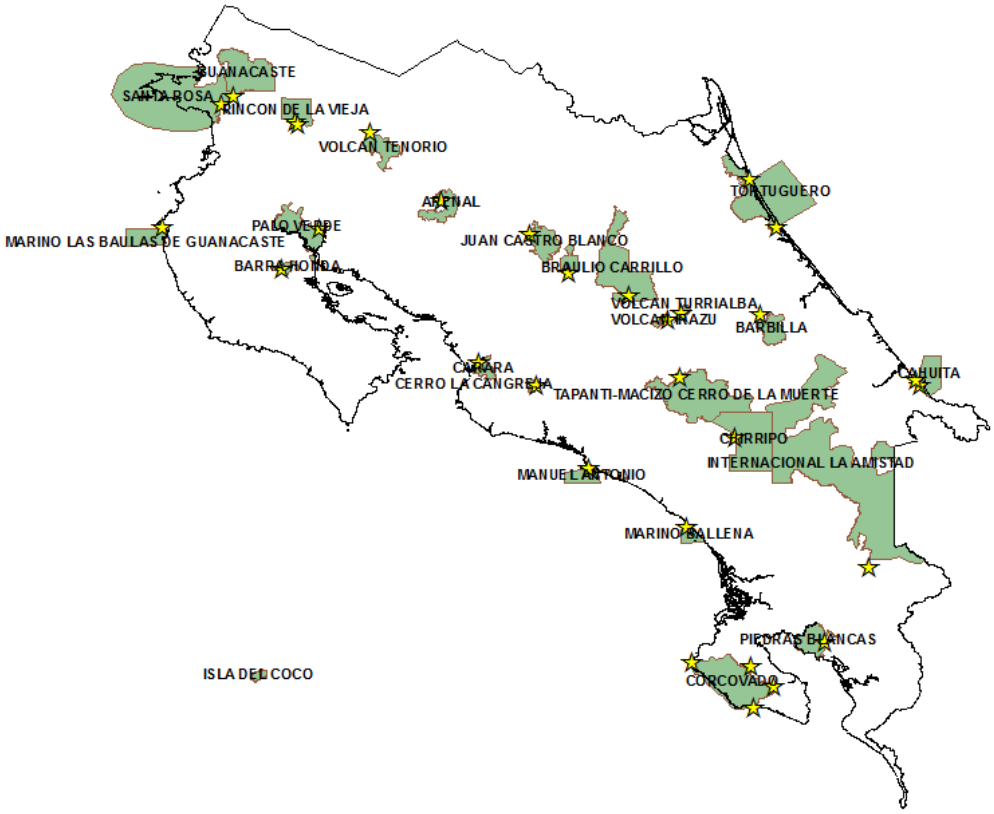
Source: SINAC, 2007

At present, Costa Rica has 28 national parks distributed all around the country. Parks vary in establishment date and in area. These characteristics for all parks considered in this study are presented in Table 2 and a map showing the distribution along the country is illustrated in Figure 1. The first national parks were established in 1955, but most were created in the 1970s and only three have been set up since year 2000. Average size of land area of national parks is 24100 ha, where La Amistad is the biggest with almost 200000 ha, and Las Baulas the smallest with 110 ha. The main objective of the Costa Rican national parks is to preserve natural resources in situ; as a result, human settlement is not allow within a park's borders (SINAC 2006).

Table 2. National Parks in Costa Rica: year of establishment and area

#	National Park	Establishment year	Area (ha)	#	National Park	Establishment year	Area (ha)
1	Irazú	1955	2 000	15	La Amistad	1982	199 147
2	Turrialba	1955	1 257	16	Marino Ballena	1989	110
3	Cahuita	1970	1 106	17	Arenal	1991	12 124
4	Poás	1971	6 506	18	Guanacaste	1991	34 651
5	Santa Rosa	1971	38 674	19	Juan Castro Blanco	1992	14 453
6	Manuel Antonio	1972	1 983	20	Piedras Blancas	1994	330
7	Rincón de la Vieja	1973	14 161	21	Baulas	1995	11 594
8	Barra Honda	1974	2 297	22	Tenorio	1995	12 872
9	Corcovado	1975	42 469	23	Barbilla	1998	11 944
10	Chirripó	1975	50 849	24	Carara	1998	5 242
11	Tortuguero	1975	31 187	25	Tapantí	1999	58 323
12	Braulio Carrillo	1978	47 583	26	La Cangreja	2002	1 861
13	Isla del Coco	1978	2 310	27	Diriá	2005	5 426
14	Palo Verde	1982	18 418	28	Quetzales	2006	5 021

Source: Gerencia de Áreas Silvestres Protegidas del SINAC



Source: Protected areas map from the ITCR (entrances were sketched by the author, using secondary information to approximate the location)

Figure 1. Map of National Parks in Costa Rica and their entrances

Agriculture and tourism-related activities are important to Costa Rica's economy. In 2007, agriculture production was 7 percent of GDP (gross domestic product) and employed 13 percent of the labor force (BCCR 2009, and INEC 2009); by contrast, hotels and restaurants were 4 percent of GDP and employed 6 percent of the labor force (BCCR 2009 and INEC 2009). Ecotourism, specifically related to protected areas, plays a central role within the tourism industry. In the last five years, tourists made more than 1 million visits to the protected areas in Costa Rica, which generated revenues from entrance fees exceeding US$ 5 million in 2005 and employed around 500 people (SINAC 2006).

Almost 70 percent of the visits to protected areas is concentrated in five national parks[2] (see Table 3). Around 54 percent of all foreign tourists in Costa Rica in 2007 visited a protected area and the average expenditure per each foreign tourist is estimated at US$ 1,345 (ICT 2007). Indirect benefits from protected areas, however, are harder to estimate.

Table 3. National Parks in Costa Rica: number of visits in year 2007

			Composition by nationality	
National Park	Total Visitation	% of Total Visitation	National	Foreigners
PNV Poás	307 002	25	48	52
PN Ml. Antonio	241 193	19	28	72
PNV Irazú	141 531	11	71	29
PN Tortuguero	117 626	9	21	79
PN Cahuita	98 268	8	42	58
PNV Ballena	73 904	6	88	12
PNM Arenal	58 829	5	21	79
PNV Rincón de la Vieja	44 597	4	24	76
PN Sta. Rosa	30 231	2	77	23
PN Carara	21 469	2	20	80
SUBTOTAL	1 134 650	91	44	56
Other NP (18)	105 878	9	64	36
TOTAL	1 240 528	100	46	54

Source: Gerencia de Áreas Silvestres Protegidas del SINAC

Costa Rica is an excellent place to study the effects of national parks on local communities' welfare because it is a developing country where tourism and agriculture activities are central to the rural development. Additionally, Costa Rica's vast and well-established conservation efforts offer a unique opportunity to evaluate their effects. Finally,

[2] The five parks most visited in 2007 were Poás Volcano National Park, Manuel Antonio National Park, Irazú Volcano National Park, Torguero National Park, and Cahuita National Park.

the availability of data at individual level and small spatial scales is an advantage for quantitative analysis.

2.4 Estimating causal effects in observational studies

In social sciences, it is usually of interest to draw cause and effect conclusions to explain different phenomena. Dehejia and Wahba (2002) define a *cause* as the manipulation or treatment that brings about a change in the variable of interest, compared to some base line called the *control*. Therefore, a treatment is administered to a unit of analysis and the scientific' interest is to measure the change in the response variable (*outcome*), maintaining everything else equal so the treatment effect can be detected. This means that, for assessing this treatment effect, the examiner must know the outcome before (*control*) and after the treatment.

The difficulty is that in many circumstances only one of the outcomes is observable. For instance, when studying the effect of high school education in an individual's wage, for a given individual it can only be observed the earnings with high school education or without it, but not both. The part that is not observed is called *counterfactual*. In the previous example, the counterfactual is the wage that the person would have had if she would not have finished high school when she actually did, or alternately, the wage that she would have had if she would have finished high school when she actually did not finish it.

One possibility to estimate the counterfactual is to look at the outcome of the people who did not were treated. Therefore, the effect of the treatment on the outcome would be the average outcome of the treated group minus the average outcome of the untreated. In the example, the average wage of the people who did not finish high school could be used as counterfactual. Unfortunately, the *maintaining everything else* equal condition would be violated, since there are many characteristics on both groups that can also produce variations in the wages. For instance, the group that finished high school might be more skilled than the people who did not attend high school, and so it might be this characteristic, and not the education level, what explains the difference in wages. When the observed difference in the

outcomes of untreated differs systematically from what the outcomes of treated would have been without the program, a *selection bias* is included into the estimated impacts (Heckman et al. 1998). In other words, there is a selection bias if the difference in the wages between the treated and the untreated can not be attributed only to the park effect but also to other characteristics.

Random assignment of treatments among the subjects usually solves the selection problem. In *randomized experiments*, the outcomes of the treated might be directly compared with the untreated results, since their characteristics are expected to be similar (Rosenbaum and Rubin 1983). Moreover, randomized trials are not very common in social science. Most studies in this area so far are *observational* i.e., studies of treatment effects when random assignment of treatments to subjects is not feasible.

To address causality in observational studies, two main tools have been widely developed, discussed and applied by econometricians. The first is the instrumental variables methods (Angrist et al. 1996, Abadie et al. 2002, Abadie 2003, among many others). The second approach tries to find an estimation of the counterfactual. Strategies such as matching, developed extensively by Rubin (1974) and Rosenbaum and Rubin (1983, 1984), and differences in differences (Meyer 1995) belong to this second approach.

3 MATERIALS AND METHODS

3.1 Data

Two types of data were used: socio demographic variables for individuals in rural areas and geographic variables for census tracks.

Socioeconomic data was obtained from the Encuestas de Hogares de Propósitos Múltiples (EHPM), which are household surveys conducted annually by the Instituto Nacional de Estadística y Censos (INEC). The period of analysis was from 2000 to 2007. Each household is in a census tract (around 60 households per tract). From the INEC, it was obtained the geographic location of each of these census tracts and focused only on rural census tracts, where the national parks are located. Therefore, the sample comprised the economically active population in rural areas from year 2000 to 2007, which correspond to 81397 observations.

The EHPM surveys include information about individual's wages, employment status and other individuals' characteristics. For estimating the parks' effects on wages the sample was limited only to those workers in the private sector (42907 observations). It is used the logarithm of hourly real wages as dependent variable as in (von Wacher and Schmieder 2009). Hourly real wages were obtained by deflating nominal monthly wages using Consumer's Price Index calculated by the Costa Rica's Central Bank (July 2006=100), and dividing by the number of hours worked per month. The average real wage of the full sample was 690 colones per hour[3].

Also, unemployment was used as another dependent variable. The unemployment sample included all the economically active population. According to the INEC, the unemployed comprise all persons above 12 years old who during the week of reference were without work and that could not find a job even if they had taken specific steps during five weeks before to seek paid employment or self employment (INEC 2004). The unemployed

[3] CRC = Costa Rican colones; CRC 557.4 = US$ 1 (Nov 2009)

represent a 5.78 percent of the total observations of the economically active population in the rural area for years 2000 to 2007.

Other socioeconomic variables that also affect wages were obtained from the EHPH, including education level, gender, age, marital status and full-year employment. It was also obtained information about migration by asking the people whether they resided in the census tract two years before the survey, as well as their nationality. Information about economic activity and occupation was also available.

Protected areas as well as all other geographic characteristics were mapped by the Geographic Information System Laboratory at the Instituto Tecnológico de Costa Rica. Using the protected areas map, it was identified the group of tracts located close to a national park (treated) and far from a national park (untreated). For calculating the linear distance from each tract's centroid[4] to each national park, it was used the Distance Matrix v.2.1 Tool for ESRI ArcView GIS 3.2a software.

The distance by roads from each segment's centroid to each park's entrance was also calculated. This allowed splitting the treatment group into those observations that are located close to a park's entrance and those observations that are located close to parks-far from the entrance. Entrances to national parks were sketched manually over the protected areas map using secondary information to approximate the location. Figure 1 presents parks entrances spatial distribution. Distance by roads from each tract's centroid to each park entrance was calculated using the Network Analyst Tool for ESRI ArcMAP software.

Therefore, there are two different treatment groups: 1) individuals within a 5-km buffer around the park that are also within a 20-km distance by road to a park's entrance, and 2) individuals that are within the 5-km buffer around the park, but more than 20 km from the park entrance by road. In the untreated group, it was placed workers located more than 15 km away from any national park. The number of observations for each group and for both samples: wages and unemployment, are shown in Table 4.

[4] To estimate all distances it was used the centroid designated by the INEC which corresponds to the most populated area in the segment.

These distances were chosen as appropriate buffers taking as main criteria the availability of data and field observations. First, an analysis using 2 linear km and 5 km by road was conducted, but unfortunately there were not enough observations in the treated sample to conduct an adequate statistical analysis. Higher distances are also inconvenient since in a small country like Costa Rica, landscape might change abruptly between communities that have completely different characteristics. Therefore, labor dynamics of farther locations are hardly arguable to be related to the park.

In defining the close to entrance and the far from entrance samples, the 20 km by road to the park entrance was combined with the 5 km-in straight line criteria. For example, if a person was located 16 km by road from a park entrance, but at more than 6 km in straight line from the park boundaries, it was not included in the treated sample. If a person is within the 5-linear km and farther than 20 km by road, it was considered a "close to park-far from entrance" observation. Also, a distance of 15 km in straight line was chosen as criteria to consider an observation as untreated, in order to allow enough space to ensure that there was no park influence on labor market dynamics. Therefore, people located between 5-linear km and 15 km were excluded from both the treated and untreated groups, since their relationship with the park in terms of wages and employment can be either null or strong.

Table 4. Number observations by sample

	Wages sample[1]	Unemployment sample[2]
Close to parks (Treated) and		
T1 Close to the entrance	2 041	4 490
T2 Far from the entrance	983	2 437
Far from parks (Untreated)	23 209	53 668
Untreated/T1	11	12
Untreated/T2	24	22

[1]Includes only workers in the private sector of rural areas

[2]Includes all people in the economically active population

Close to parks: observations 5km or less from a Park

Far from parks: observations more than 15km away from a Park

T1: obs close to parks and 20km or less by roads from a park entrance

T2: obs close to parks and more than 20km away from an entrance

There are other protected areas besides national parks but this study focused on parks for two reasons: parks are one of the most restricted protected areas (IUCN 1994) and they receive visitors.

It was also used geographic variables at the census-tract level. It was calculated average slope, average precipitation, and average elevation per census tract using geographic information systems. It was also possible to calculate distances from the census tract to San José, and to the closest health and education center. The density of different types of roads was also calculated per census tract. As discussed in chapter 2, these geographic variables are closely related to land use, infrastructure accessibility, and access to markets and basic services; therefore they are important variables in determining the possible economic activities, which in turn help to explain wages level.

3.2 Empirical Approach

As discussed in the framework, randomly located parks and randomly located entrances of the parks would eliminate many of the possible bias of estimating their effects. If this was the case, it would be enough to compare wages of workers close to parks (or close to the entrance) with wages of workers who live far from parks. Workers characteristics would be equal in expectation and the only reason for difference in wages would be the effect of parks on the labor market.

However, policies are rarely applied randomly and national parks and land-conservation policies are no exception (Pfaff and Robalino 2008, Pfaff et al. 2009). Workers can endogenously choose their location according to their own characteristics. These issues create selection bias. This is what it is found in this particular data.

In Table 5, for the wages sample[5], the average of socio demographic variables for the three groups of workers is compared: those located far from parks, those located close to park's entrance, and those located close to parks-far from entrances. There are statistically

[5] The values for the unemployment sample are very similar to what is presented fot the wages sample. The corresponding table for unemployment is presented in Annex 1.

significant differences for many of these variables (see T-tests). There is, on average, more female participation in the labor force, higher education levels, lower proportion of male-headed households, higher immigration, fewer married people, and more people with full-time jobs in areas close to the entrance of the parks than in rural areas far away from the parks. Additionally, on average, workers close to the parks-far from the entrances are younger and less educated than workers in rural areas away from Parks. There are also less foreign workers, more workers employed full time; moreover, these workers tend to belong to larger households.

There are also geographic differences. There is a higher density of primary and local roads close to park entrances. Also, it can be seen that people close to parks are located in areas with steeper slopes, greater distances to education and health centers, and less distance to San José, compared with average "far from parks" values.

Consequently, economic activities and occupation are also different among these groups. Workers close to park entrances hold positions that demand a higher level of education, namely, professional, technical, and administrative. The fraction of workers in occupations associated with natural resources, such as farming, fishing, hunting, and logging, is high in all three groups. However, this fraction is higher in areas far from parks than in areas close to parks, but is lower when compared to areas close to parks-far from the entrances. Additionally, the fraction of service workers is quite similar between rural areas far from the parks and close to the parks-far from the entrance, but significantly higher in areas close to park entrances. Meanwhile, the fraction of workers in agricultural-related occupations is larger close to the parks-far from the entrances.

Economic activities close to park entrances are mostly concentrated in wholesale and retail trade, and restaurants and hotels (32.8 percent). However, for both the "far from parks" group and the "close to parks-far from entrances" group, the most important category is agriculture, hunting, forestry, and fishing activities (41.3 percent and 55.8 percent, respectively). The fraction of workers in community, social, and personal services is larger close to park entrances than in the other groups.

Table 5. Differences in the socioeconomic and geographic characteristics by groups.

Variable	Far from national parks (FP)	Close to national parks and			
		Close to entrance (CE)	T-stat (FP vs CE)	Far from entrance (FE)	T-stat (FP vs FE)
Number of observations	23 209	2 041		983	
Workers' Characteristics					
Male participation (%)	82.6	75.5	-7.7	81.8	-0.6
Age	32.8	32.6	-0.6	31.7	-2.8
People that finished High School (%)	14.8	22.5	9.0	11.4	-2.9
People with more than 2 years college (%)	3.9	10.7	13.9	2.3	-2.6
Male headed household (%)	49.8	41.4	-7.0	47.9	-1.2
Costa Rican (%)	74.8	73.5	-1.2	70.5	-3.0
People living in the same place for at least 2 yrs (%)	95.3	93.0	-4.6	94.3	-1.5
People married or living with someone (%)	57.6	53.1	-3.8	56.6	-0.6
Full year employed people (%)	83.9	88.8	5.7	87.8	3.1
Household size	4.7	4.6	-1.1	4.9	3.4
Geographic Characteristics					
Density of primary roads (km/km2)	0.1	0.2	5.2	0.1	-1.8
Density of secondary roads (km/km2)	0.4	0.3	-3.2	0.2	-4.8
Density of local roads (km/km2)	3.1	3.5	3.1	2.5	-4.4
Slope	9.6	12.4	11.5	11.3	4.8
Precipitation (mm)	3 120	2 915	-8.3	4 420	37.6
Distance to the nearest basic school (km)	1 122	1 525	19.3	1 444	10.7
Distance to the nearest highschool (km)	3 643	4 996	17.4	4 728	10.5
Distance to nearest health centre (km)	4 948	6 572	14.6	7 120	13.8
Distance to San Jose (km)	72 880	69 336	-2.6	67 824	-2.8
Workers' Occupation %					
Professional, Technical and Related Workers	3.3	7.5	9.4	2.5	-1.3
Directors and Managers Workers	1.0	2.1	4.9	1.1	0.4
Administrative Workers	6.1	8.6	4.4	4.5	-1.9
Sales Workers	8.2	9.3	1.7	7.0	-1.2
Farmers, Fishermen, Hunters, Loggers and Related	36.4	26.0	-9.1	44.8	5.3
Workers in Transport	3.9	2.5	-3.2	3.6	-0.6
Craftsmen, Production-Process Workers 1	17.6	14.8	-3.0	11.9	-4.5
Craftsmen, Production-Process Workers 2	4.8	4.3	-1.0	2.9	-2.9
Packers, Labellers and Related Workers	7.9	4.5	-5.3	10.4	2.7
Service Workers	10.8	20.4	12.6	11.6	0.7
Economic Activity %					
Agriculture, Hunting, Forestry and Fishing	41.3	23.2	-6.4	55.8	1.9
Mining and Quarrying	0.0	0.0	.	0.1	-2.1
Manufacturing	16.7	12.6	-4.7	8.8	-6.4
Electricity, Gas and Water	0.5	1.0	3.0	1.1	2.6
Construction	9.3	10.0	1.0	5.7	-3.7
Wholesale & Retail Trade & Restaurants & Hotels	17.2	32.8	22.3	16.1	-0.1
Transport, Storage and Communication	4.4	3.8	-1.2	3.7	-1.0
Financing, Insurance, Real Estate & Business Serv	3.9	4.0	0.2	2.6	-1.9
Community, Social and Personal Services	6.5	12.8	10.4	5.9	-0.6
Log wage (colones per hour)	6.4	6.5	10.4	6.3	-3.3

Differences are, of course, also found in wages (see tests results). Workers living close to park entrances receive higher wages than workers living far from parks. Also, workers living close to the park-far from the entrances have lower wages than workers far from parks. However, as discussed, wages of these groups may be different not only due to the effects of parks, but also due to differences in individual and geographic characteristics.

All these significant differences illustrate why parks effects can not be estimated by simply comparing outcomes close and far from entrances. These groups are clearly different in observable characteristics, and therefore differences in wages or unemployment can not be attributed exclusively to the presence of the park.

3.2.1 Addressing the selection bias problem: matching

The selection bias was addressed by using propensity score matching, which is useful for estimating treatment effects in observational studies when the dimensionality of the observable characteristics is high (Rosenbaum and Rubin 1983; Dehejia and Wahba 2001). The goal is to find an adequate untreated control group that is similar to the treated group in all relevant pretreatment characteristics. In this method, similarity is defined in terms of the propensity score, which is the conditional probability of assignment to a particular treatment, given a vector of observed covariates (Rosenbaum and Rubin 1983).

The advantage of using propensity score matching is that it is possible to determine how well the treatment and control groups overlap, and therefore estimations are less sensitive to the choice of functional form in the model (Rosenbaum and Rubin 1983; Dehejia and Wahba 2001). Another advantage is that the variance of the estimate of the average treatment effect will be lower in matched samples, compared with random samples, because the distributions of the covariates in the treated and control groups are more similar in matched than in random samples (Rosenbaum and Rubin 1983). A third advantage is that, unlike standard techniques, matching avoids extrapolation to portions of covariates space where there is no data.

However, as with all approaches, matching requires certain conditions for the identification of the effect. There must not be unobservable factors that affect the outcome and that are simultaneously correlated to the presence of treatment. Also, with matching, there can be a decrease in the number of observations because unmatched observations are dropped. In this study, the rich set of available data is expected to minimize the possibility of unobservable bias and the sample size (approximately 7.7 controls per treatment) is large enough to permit this loss of observations and degrees of freedom.

When using Matching, a probit regression might be used to estimate the conditional probability of assignment to the treatment (propensity scores) where the dependent variable is a dichotomous variable indicating if the individual was treated or not, and the independent variables are all the variables that influence simultaneously both the probability of being treated and the outcome (Caliendo and Kopeining 2005).

In Matching, there are many different methods to select the control group once propensity scores are estimated. One possibility is to choose as a match of a treated individual the observation that is closest in terms of its propensity score value. This method is called nearest neighbor matching (see Caliendo and Kopeining 2005 or Dehejia and Wahba 2002 for an explanation of different matching algorithms). Also, more than one neighbor can be chosen as matches for a treated observation, but the quality of the matches might decrease since more dissimilar observations may be included. This can be avoided if a level of tolerance is imposed, so only control observations that are within the tolerance limits and that are closer in terms of the propensity score is used as a match (radius matching).

To avoid bad matches when using propensity score to define similarity, this study used caliper matching (Cochran and Rubin 1973), which is a combination of radius matching and nearest neighbor matching. It was imposed a tolerance level on the maximum propensity score distance of 0.001 and allowed for up to 4 matches inside this radius per treatment. This method has the advantage that it uses only as many comparison units as are available within calipers, which allows more good matches if available and also avoids bad matches (Dehejia and Wahba 2002). Also, caliper matching allows for replacement, which means that an untreated individual can be used more than once as a match for different treatments. This approach has proved to be better than matching without replacement methods when there are few control observations (Dehejia and Wahba 2002).

In Matching, once treated and matched controls are found, it is necessary to check the *overlap* and the region of *common support* between the groups. Common support condition guarantees that every treated observation has a possible counterpart among the controls (Morgan and Winship 2007). This is necessary to ensure that any combination of

characteristics observed in the treated group can also be observed in the control group (Bryson et al. 2002). The most straightforward way to check for overlap is by looking at the density distribution of the propensity score in both the treated and the matched control groups (Dehejia and Wahba 2002). Observations that are off the support must be dropped out of the analysis and the resulting estimates of the average treatment effect are a narrower treatment effect that applies only for observations on common support (Heckman et al. 1997). Therefore, if the off support observations are considerable it can be useful to analyze their characteristics in order to better understand in what cases the treatment effect is accurate (Heckman et al. 1997).

After the control group was properly chosen, a linear regression can be run using only the observations in treated group and in the matched controls. This regression finds the treatment effects, using as dependent variable the outcome variable, and as regressors the treatment and variables that might explain the outcome.

3.2.2 Field work

Field observations were conducted in order to validate the results obtained through the statistical analysis as well as to understand better the mechanisms through which national parks affect wages and employment. In choosing the parks to be visited some criteria was taken into account: national park's date of establishment, location, visitation level, type of visitors, economic activities around, and secondary information available. The objective was to find a group of interesting case studies with different characteristics to cover a broad set of type of interactions between parks and communities.

Cahuita, Irazú and Tenorio national parks were selected under these criteria. Irazú was one of the first national parks established (1955), Cahuita is middle-age (1978) and Tenorio is more recent (1995). The first two parks receive high visitation, but for Irazú visitation is mostly national meanwhile Cahuita receives numerous foreigners. On the contrary, Tenorio is a park that receives a low but increasing visitation. Cahuita's main economic activity is tourism; meanwhile lands close to Irazú are devoted to agriculture. In Tenorio, agriculture is also important but economic activities are beginning to respond to tourism opportunities which is reflected by the several new accommodation infrastructure and food services.

In the three cases, social organizations have been established to lead community's development and to take advantage of tourism. In Irazú, a small group of 10 young people is organized to provide the national park with tourism guides. In Tenorio, the association leads and supports private business development oriented to tourism activities. In Cahuita, the community is in charge of the management of the fees that visitors voluntarily donate for entering in the park. With this income, new services and infrastructure for the community are supported.

Interviewees were selected using the technique known as snowball sampling (Vogt, 1999) where the first interviewed person provides the reference of another person(s) who might be a good informant and this second interviewed gives the name of another person and so on. Also, community leaders were chosen as key informants. In field work, around 7 interviews with people of local communities were conducted in each park. Informants included local tourism guides, business people, park rangers, restaurants employees, farm employees, community leaders and foreigners. Interviews were conducted both in the communities that are closest from the park entrance, and in those farther away.

Questions were designed to obtain information about characteristics of the community in terms of population, health, education, infrastructure, basic services access, employment, wages, environmental quality, migration, among others. Also, it was asked information about the past history of the area to elucidate the main changes in the last years and their relationship with the park establishment. Additionally, more detail information about economic activities, sources of income, average wages, general prices and income distribution was requested. Finally, it was examined people's perception about how the park benefits or has a negative impact on their communities and other zones around (see Annex 1 for the full interview questionnaire). These interviews were conducted to better understand the relationships between parks' presence and communities' welfare and are not statistical representative.

4 RESULTS

In this section, results on wages, employment and field work are presented. For the wages analysis, first the OLS regressions results are presented as a first attempt to estimate the effects. Then, the matching analysis is showed, including the verification steps commented in section 2.6.1. After that, an analysis of the economic activities' structure and average wages by area is presented, in order to explore where the difference in wages come from. Finally, the national parks' effects are estimated for different social groups.

For the employment results, first an analysis of the unemployment incidence by social groups and areas is presented, followed by the estimation of the effects using OLS and matching. Finally, effects on employment by social groups are presented.

4.1 National Parks' effects on wages

4.1.1 A first approximation

As a first approach to the analysis, three OLS regressions were estimated disregarding the selection bias problem, which results were compared to the matching estimation. The log of hourly real wages was used as dependent variable as in Wacher and Schmieder (2009). Therefore, the coefficients are interpreted as the percentage change in the hourly wage caused by the treatment.

As a first approximation to the parks' effects on wages, a naïve regression was estimated (Morgan and Winship 2007). This regression is basically a mean comparison between treated and controls controlling by fixed effects on years.

$$\ln W_i = \beta_0 + \beta_1 * T_i + \sum_{j=2001}^{2007} \beta_j * y_{ji} + \varepsilon_i \qquad (1)$$

Where $\ln W_i$ is the logarithm of the wage in colones per hour for individual i, T_i takes the value 1 for treated observations (workers close to parks) and 0 otherwise, y_j is the vector

of dummies for years with j from 2001 to 2007. The error term is represented by ε_i, and β_1 is the effect of parks on wages i.e., $\beta_0 + \beta_1$ is the average wage when the observation has been treated, meanwhile β_0 is the average wage for untreated observations.

Results are presented in Table 6. The coefficients indicate that wages close to park's entrances were 13.5 percent higher than wages far from parks. Also, the difference in wage for workers close to parks-far from entrances, and workers far from parks was negative and significant (around 6 percent). These differences can be the result of differences in workers' characteristics, differences in local market characteristics and differences due to the effects of the treatment (the presence of parks). Then, as a second step, the following OLS regression was estimated.

$$\ln W_i = \beta_0 + \beta_1 * T_i + \sum_{j=2001}^{2007} \beta_j * y_{ji} + \beta_k * S_k + \varepsilon_i \qquad (2)$$

Model (2) is the same as model (1) but also includes a vector of relevant socioeconomic worker's characteristics S_k (gender, age, education level, marital status, household size, immigration and full-time employment).

Results from OLS estimations are also presented in Table 6. Once socioeconomic characteristics were incorporated, the effect decreased in both groups: close to parks, and close to parks-far from entrance. This suggests that, as expected, part of the difference in wages is explained by workers' characteristics. Close to the entrance the wage differential was still positive and significant (about 8 percent higher). Close to park-far from the entrance, the wage differential was still negative and significant (3.5 percent lower).

However, without controlling for geographic characteristics that affect labor markets, it is hard to conclude that the previous results are due to the presence of parks. Therefore, geographic variables that affect production were incorporated into the model (density of roads; slope; precipitation; and distance to education, health centers, and Costa Rica's capital city).

$$\ln W_i = \beta_0 + \beta_1 * T_i + \sum_{j=2001}^{2007} \beta_j * y_{ji} + \beta_k * S_k + \beta_m * G_m + \varepsilon_i \qquad (3)$$

Model (3) is model (2) plus geographic variables G_m (density of roads, slope, precipitation, and distance to education and health centers and to Costa Rica's capital city).

It was found that, for the close to entrances group, differences in wage remain about 8 percent higher, meanwhile for close to parks-far from entrances group the effects becomes null. This means that workers located close to parks-far from the entrance receive, in average, the same wage as workers located far from parks.

Table 6. A first approximation of parks' effects on wages. Mean comparison and OLS regressions including the full sample.

Model Dependent variable: log wage	Far from park vs Close to entrance	Far from park vs Close to parks-far from entrance
Mean comparison		
(1) Effect	**0.1349*** **	**-0.0597*** **
Standard Error	[0.0130]	[0.0181]
	23	22
No. Obs	782	789
R-squared	0.006	0.0022
OLS estimates using the full sample		
(2) Workers' characteristics		
Effect	**0.0765*** **	**-0.0351** **
Standard Error	[0.0114]	[0.0160]
	23	22
No. Obs	752	761
R-squared	0.2364	0.2159
(3) (2) + Geographic characteristics		
Effect	**0.0785*** **	**0.0254**
Standard Error	[0.0113]	[0.0163]
	23	22
No. Obs	752	761
R-squared	0.2754	0.2599

*** p<0.01, ** p<0.05, * p<0.1. No asterisk means no significance

Note: Workers's characteristics specification includes: gender, age, finish high school dummy, college for at least 2 years dummy, male headed household dummy, Costa Rican dummy, lived in the same place 2 years before dummy, married dummy, full year work dummy and household size

Geographic specification includes all the workers' characteristics and density of primary, secondary and terciary roads, slope, precipitation, log of distances to: schools, high schools, clinics and San José

Next step was to estimate parks effects on wages using matching. First, a probit regression was run in order to find the treated and the matched untreated groups.

4.1.2 Determinants of being under treatment (Propensity scores)

As discussed in section 3.2.1 a probit regression was estimated in order to obtain the conditional probability of assignment to each treatment groups: close and far from parks' entrance. In the probit specification both the worker's characteristics and the geographic variables were included. Results are presented in Table 7. The model was statistically significant as a whole (p-value of 0.000).

The average individual's probability of locating close to a national park entrance is correlated with being a female, some college education, a female head of households, immigration to the area, full-time employment, and less family members. On the other hand, for an average individual the probability of locating close to a national park-far from the entrance is correlated with being female, younger age, male head of household, immigration to the area, a full-year of employment, and more family members.

Geographic characteristics also played an important role on the assignment of a treatment. The probability of being close to a national park is correlated with steeper slopes and more precipitation, and greater distance from high schools and less distance to Costa Rica's capital city. Furthermore, land close to entrances is also correlated with fewer secondary roads, more local roads, and greater distance to basic school and health centers. Far from entrances is also related to more main roads and fewer local roads, and less distance to basic school and health centers.

Table 7. Determinants of the probability of being treated.

Variable Dependent variable: Treatment dummy	Close to entrance	Close to parks-far from entrance
Male population	-0.121***	-0.113**
Age	0.005	-0.029***
Age*age	0.000	0.000***
People that finished High School	0.034	0.082
People with more than 2 years college	0.479***	-0.061
Male headed household	-0.145***	0.116**
Costa Rican	-0.081**	-0.147***
Lived in the same place for at least 2 yrs	-0.193***	-0.200**
People married or living with someone	-0.049	-0.039
Full year employed people	0.186***	0.211***
Household size	-0.011*	0.040***
Density of primary roads	0.044**	0.324***
Density of secondary roads	-0.056***	0.015
Density of local roads	0.013***	-0.018**
Slope	0.010***	0.036***
Precipitation	0.000***	0.003***
Precipitation*precipitation	0.000***	0.000***
Distance to the nearest basic school	0.156***	-0.154***
Distance to the nearest highschool	0.082***	0.394***
Distance to nearest health centre	0.193***	-0.225***
Distance to San Jose	-0.206***	-0.166***
Number of obs	23752	22 761
Log likelihood	-6196.52	-2782.81
LR chi2(44)	926.85	2 172.84
Prob > chi2	0.000	0.000

Note: Controlled by year dummies

*** p<0.01, ** p<0.05, * p<0.1. No asterisk means no significance

4.1.3 Evidence of comparable groups

Two strategies were used to check if groups are comparable. First, it was checked whether there was enough overlap between the treated and the control group before and after matching. This was first inspected through a visual analysis of the density distribution of the propensity score in both groups, and also the percentage of treated observations on support is included in the results tables in section 4.1.6.

To check for overlap it was plotted the histograms of the propensity scores of the treated and untreated groups before matching, and treated and matched groups after matching. It is done both for the "close to entrance" and "close to parks-far from entrance" analysis.

For the close to entrances analysis it was found that the distribution of the treated and untreated groups significantly different before matching. However, after matching the distributions are more similar (see figure 2). The difference between before and after matching is more striking when looking close to parks-far from entrance (see figure 3). There are even some intervals where there are not enough matches such that we could not consider into the analysis. For these intervals there is not empirical evidence to properly estimate the treatment effects.

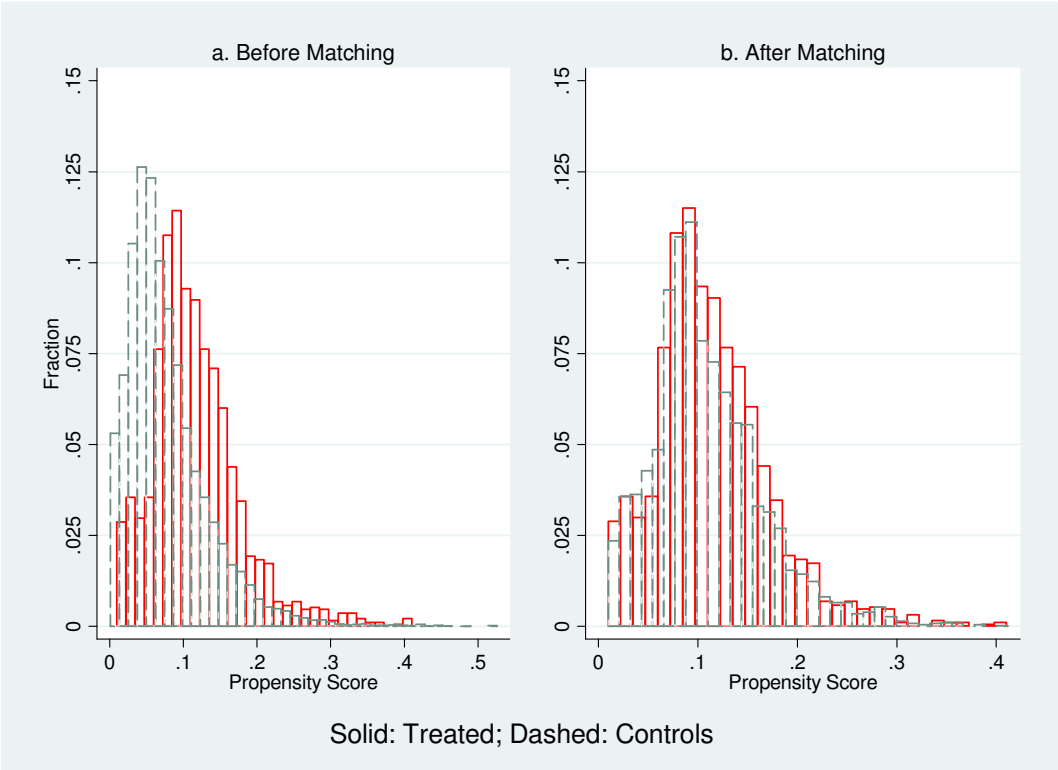


Figure 2. Common support test for wages sample. Histogram of propensity scores before and after the matching for close to entrances.

Figure 3. Common support test for wages sample. Histogram of propensity scores before and after the matching for far from entrances.

This visual test is supported by the high proportion of treated observations on the support (see Table 9, section 3.1.5). Close to entrances, once geographic controls are included, treated observations in common support are almost 100 percent. Far from entrances there are some geographic conditions that make difficult for some treated observations to find a similar observation far from parks.

4.1.4 Assessing the matching quality

Differences in the means of the variables between the treated and the controls were tested after the matching. For every variable these different were significantly lower (see T-tests in Table 8). Even for variables where differences are still statistically significant, the matched controls were clearly more similar to the treated compared with the full untreated sample. This shows that with matching it was possible to find a very similar, although not perfect, control group.

Table 8. Test on the matching effectiveness in finding comparable groups. Differences in mean values before and after matching for the wages sample

Variable	Close to park's entrance vs far from parks		Far from park's entrance vs far from parks	
	Difference	T-stat	Difference	T-stat
Workers' Characteristics				
Male participation	-0.003	-0.230	0.007	0.420
Age	-0.055	-0.160	0.255	0.490
Age*age	-5.934	-0.240	6.456	0.160
People that finished High School	0.026	2.270	0.000	0.020
People with more than 2 years college	0.031	3.790	0.001	0.220
Male headed household	0.008	0.540	0.020	0.910
Costa Rican	-0.003	-0.240	-0.003	-0.130
Lived in the same place for at least 2 yrs	-0.006	-0.920	0.000	0.010
People married or living with someone	0.004	0.260	0.017	0.760
Full year employed people	0.006	0.720	0.002	0.130
Household size	0.012	0.210	-0.108	-1.110
Geographic Characteristics				
Density of primary roads (km/km2)	-0.018	-0.980	0.008	0.610
Density of secondary roads (km/km2)	0.015	0.630	0.025	0.750
Density of local roads (km/km2)	0.160	1.320	-0.131	-0.920
Slope	-1.045	-3.880	-1.546	-3.070
Precipitation (mm)	-11.741	-0.480	59.826	1.670
Precipitation*precipitation	-36064.14	-0.230	253720.24	0.900
Log distance to the nearest basic school (km)	-0.052	-1.940	-0.116	-3.200
Log distance to the nearest highschool (km)	-0.031	-1.040	-0.229	-7.330
Log distance to nearest health centre (km)	-0.017	-0.640	-0.073	-1.460
Log distance to San Jose (km)	-0.031	-1.080	-0.042	-1.850
Log wage (colones per hour)	0.134	10.330	-0.060	-3.310

4.1.5 Effects of national parks on wages

Once the treated and the matched untreated groups were found, a linear regression was run in order to estimate parks' effects on wages. This regression was estimated using only the observations far from parks that are more similar to respective the treated group. Again, two specifications were run separately, one including only workers' characteristics as controls and then geographic variables were also incorporated. Results are presented in Table 9.

When controlling for workers' characteristics, the parks effects on wages were positive and significant for people living close to entrances. Workers living in this areas received 7.8 percent higher wage than similar workers far from parks. Once controlling for geographic variables as well, the effect for close to entrances group was slightly higher. This suggests that

the geographic characteristics of the land close to parks entrances are correlated with lower wages. Far from entrances wages were equal to far from parks average.

It is concluded that in average workers receive 8.3 percent higher wages close to the entrance, but workers close to parks-far from entrances receive equal wages than similar workers living in similar places far from parks, i.e., in this area there was no effect of parks on wages.

Table 9. Parks' effects on wages. OLS estimations restricting the sample to the most similar treated and untreated groups (matching).

Model Dependent variable: log wage	Far from park vs Close to entrance	Far from park vs Close to park-far from entrance
Probit estimates using restricted sample (matching)		
(4) Worker's characteristics		
Effect	**0.0789*** **	**-0.0273**
Standard Error	[0.0139]	[0.0194]
No. Obs	7 093	925
No obs. Treat on common support	1 902	3 912
% treated obs on support	99	100
(5) (4) + Geographic characteristics		
Effect	**0.0832*** **	**0.0281**
Standard Error	[0.0137]	[0.0224]
No. Obs	6 843	2 873
No obs. Treat on common support	1 904	826
% treated obs on support	99	89

*** p<0.01, ** p<0.05, * p<0.1. No asterisk means no significance

Note: Workers's characteristics specification includes: gender, age, finish high school dummy, college for at least 2 years dummy, male headed household dummy, Costa Rican dummy, lived in the same place 2 years before dummy, married dummy, full year work dummy and household size

Geographic specification includes all the workers' characteristics and density of primary, secondary and terciary roads, slope, precipitation, log of distances to: schools, high schools, clinics and San José

4.1.6 National parks with treated observations and economic activities

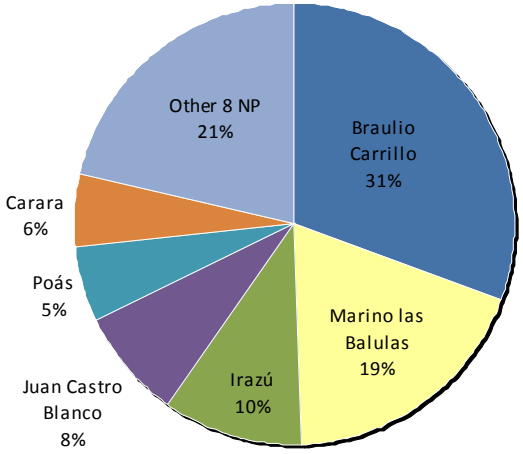
To have a better idea of where the differences in wages come from, Figures 4 and 5 present the structure of national parks for which treated observations are included into the analysis. Observing which and how many parks are within the sample allows to have an idea of how representative the results are for the whole country, and for which type of parks there is not enough evidence to conclude.

Also, in Figure 6 it is presented the composition of the economic activities around the parks, and in Figure 7 the average wage of each economic activity is showed. This is useful for exploring if the differences in wages are due to shifts in the activities and/or higher payments for the same activities. These graphs are complemented with a regression analysis that compares the probabilities of being employed in every activity, close and far from entrances (Table 10).

It was found that all the observations close to entrances are distributed around 14 national parks, 6 of which comprise a 70 percent of all observations. Close to parks-far from entrances, observations are dispersed in 11 national parks 2 of which comprise 68 percent of the total sample. These results indicate that this study cannot conclude for parks with low density of people around since there are not observations available to include in the sample. For this type of parks additional research has to be done to understand the parks effects on people. It is also important to state that as the household surveys are representative for the country, the close and far from entrances subsamples are also representative of each particular group. Moreover, it can not be concluded on particular parks since the sample is not representative at that scale.

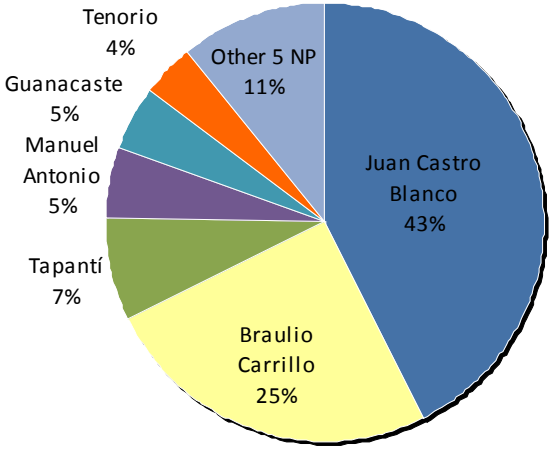
When economic activities structure was compared between each subsample, close to entrances' composition was very different than far from parks'. In the former, less workers are employed in agricultural activities and more employees work in service activities such as wholesale and retail trade, and restaurants and hotels. This might suggest that close to parks entrances workers are shifting from agricultural activities to better-paid jobs in services (see Figure 7 for average wages by activity).

Economic activities structure far from parks was more similar to close to park-far from entrances i.e., agriculture is the most important activity with a participation of 35 percent or higher. This economic activity structure might help to explain why wages far from parks' entrances were equal to far from parks.



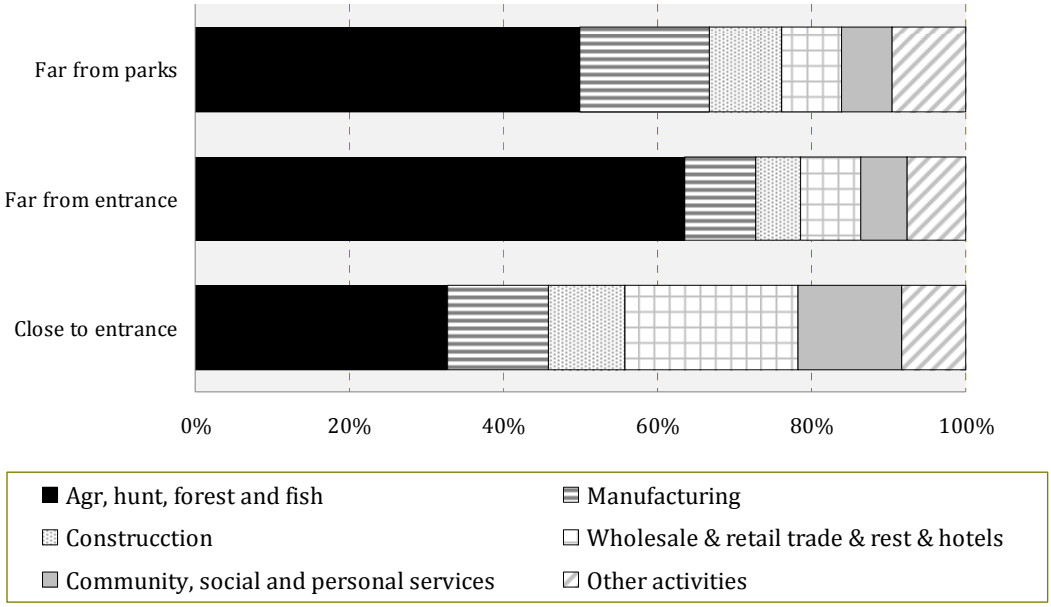
Note: Other 8 parks are: La Amistad, Arenal, Cahuita, Chirripó, Corcovado, Marino Ballena, Tapantí and Turrialba. Source: EHPM from INEC years 2000-2007.

Figure 4. National Parks for which there are observations close to the entrance



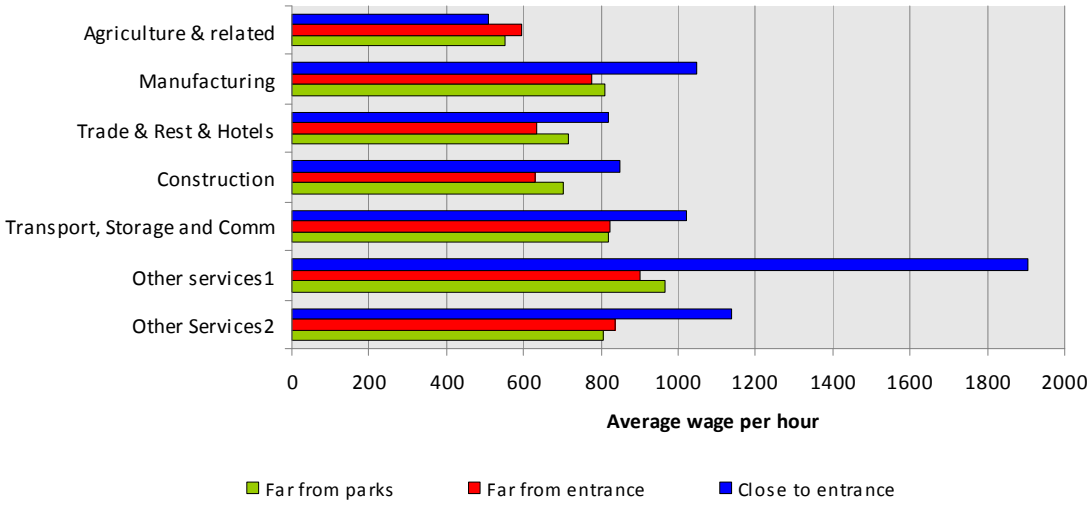
Note: Other 5 parks include: La Amistad, Chirripó, Corcovado, Piedras Blancas and Poás. Source: EHPM from INEC years 2000-2007

Figure 5. National Parks for which there are observations far from the entrance



Note: Other activities include: mining and quarrying; electricity, gas and water; transport, storage and communication; financing, insurance, real state and business services. Source: EHPM from INEC years 2000-2007

Figure 6. Economic activities' structure by studied groups.



Note: Other services 1 include Financing, Insurance, Real Estate & Business Services; other services 2 are: Community, Social and Personal Services. Source: EHPM from INEC years 2000-2007.

Figure 7. Average wages in colones per hour by economic activities for each studied group.

Table 10 presents the effect of location on the probability of being employed in a particular activity estimated with a probit regression[6]. Close to parks' entrances, the probability of being employed in agriculture is 37 percent lower compared to far from parks, i.e., it is less likely for a worker to be employed in agriculture activities when living close to a park entrance, than when located far from a park.

Also, the probability of being employed in hotels and restaurants activity was higher close to parks. Close parks-far from entrances the probability of being employed in wholesale and retail trade was significantly lower than far from parks, but it was similar for agriculture activities. These results support the idea that differences in wages close to entrances are due to shifts in economic activities towards better-paid jobs.

Table 10. Probability of being employed in particular activities.

Dependent variable: dummy indicating if the individual is employed in each activity

	Close to entrance			Far from entrance		
	Agriculture	Hotels & Restaurants	Wholesale and retail trade	Agriculture	Hotels & Restaurants	Wholesale and retail trade
PSMatching						
Effect	**-0.3749*** **	**0.6716*** **	**-0.0244**	**0.0341**	**0.2052***	**-0.3140*** **
Standard Error	[0.0441]	[0.0534]	[0.0488]	[0.0643]	[0.1105]	[0.0885]
Number obs	6291	6291	6291	2602	2602	2602
Obs treat on support	1746	1746	1746	744	744	744

*** p<0.01, ** p<0.05, * p<0.1. No asterisk means no significance

4.1.7 Effects of national parks on wages by social groups

Then it was analyzed the parks' effects by migrant status, nationality and gender (Table 11). For close to entrances it was found that while both females and males receive better wages close to parks entrances, the premium for females is significantly larger. Also, those workers that arrive within 2 years of our analysis do not receive significantly better wages that

[6] see Annex 4 to 9 for complete probit regressions

those that arrive to other rural areas. It is also found that foreign workers receive higher wages close to parks entrances than those foreign workers that live in rural areas away from parks.

Far from entrances males receive higher wages compared with males far from parks; meanwhile there is no difference for women. For all other groups, the significance was very low or the number of observations is not enough to conclude.

Table 11. Parks' effects on wages by gender, migration and nationality

(Dependent variable: log wage)	Close to parks' entrances	Far from parks' entrances
Males	0.0748***	0.0513**
Standard Error	[0.0153]	[0.0237]
No. Obs	5254	2477
Treated obs on support	1446	694
% treated obs on support	100	92
Females	0.1351***	0.0015
Standard Error	[0.0284]	[0.0566]
No. Obs	1493	373
Treated obs on support	443	118
% treated obs on support	94	70
Migrants[1]	Not enough observations	
Non migrants	0.0741***	0.0426*
Standard Error	[0.0137]	[0.0233]
No. Obs	6439	2803
Treated obs on support	1779	790
% treated obs on support	100	91
Costa Ricans	0.1007***	0.0453*
Standard Error	[0.0159]	[0.0248]
No. Obs	5104	2278
Treated obs on support	1404	612
% treated obs on support	100	94
Foreigners	0.0458*	0.0517
Standard Error	[0.0245]	[0.0553]
No. Obs	1735	495
Treated obs on support	481	171
% treated obs on support	95	63

[1]People who arrived in the last two years to the place

*** p<0.01, ** p<0.05, * p<0.1. No asterisk means no significance

It is noticeable that percentage of treated observations on support was very high in all subgroups estimations, except for migrants which have a bad performance due to the lack of observations. Therefore, it can be concluded that matching approach was able to obtain accurate estimations.

4.2 National Parks' effects on unemployment

4.2.1 Unemployment incidence by social groups

The rural areas in Costa Rica present higher unemployment rates, less participation in the labor force, and more workers employed in agricultural activities compared with urban areas. Moreover, even within rural areas there are differences in labor market dynamics. Table 12 presents the incidence of unemployment by different subgroups. Females and migrants in general present higher unemployment rates, meanwhile males and workers who finished the high school have lower rates. Also, workers living far from parks are worse off compared with workers close to parks, since they show higher unemployment rates for all subgroups. Even close to parks differences are noticeable. Except for migrants, for all subgroups the unemployment rate is lower close to parks-far from entrances compared with close to parks.

Table 12. Unemployment rates in rural areas by subgroups. Percentages

	Close to parks and Close to entrances	Close to parks-far from entrance	Far from parks
Full sample	4.70	4.43	6.30
Male	3.81	3.64	4.81
Female	6.59	6.47	9.70
Migrant	7.00	11.66	9.33
Non migrant	4.55	4.05	6.02
Finished high school	3.74	2.96	5.40
Not finished highschool	5.01	4.73	6.34

Moreover, based on these differences it is hard to conclude on the effects of parks over unemployment, since workers can be very different within the groups, as discussed before. For instance, it might be true that unemployment in areas close to entrances would be even higher than far from entrances if the park would not have been established, or that far from entrances employment would be even lower without the presence of the park. In order to address this

matter, the same models that were estimated for wages analysis are presented for unemployment.

4.2.2 Effects of national parks on unemployment

In this case, since the dependent variable is a dummy instead of a continuous variable, probit regressions were run instead of OLS. As a first approximation, a naïve regression was estimated. Then, other two regressions were estimated, one including workers' characteristics, and the other with geographic variables as well. Finally, matching was run for the same two specifications, and a probit regression was run once the matched treated and controls were found. This last regression finds the effects of parks on the probability of unemployment. The coefficients of the naïve, simple probit, and matching are presented in Table 13. For matching results the probit and the marginal effects are presented.

The naïve probit regression resulted in negative and significant effects both for close and far from entrances groups. The probability of a worker living close to a national park entrance to be unemployed is 1.6 percent less than for a worker living far from the parks. Very similar results were obtained when additional socioeconomic and geographic variables were included into the model, and probit regressions were run i.e., the probability of unemployment close to national parks was around 1 percent less than far from parks.

Using matching it was also found that the parks' effect on the probability of unemployment was negative for close to entrances group, but now the effect for close to park-far from entrances becomes non significant. This result is important since emphasizes the relevance of using matching. Once similar groups were compared, results that were not observable using simple probit regression were revealed.

Table 13. Parks' effects on unemployment. Mean comparison, probit estimates including all observations and probit estimates with restricted sample (matching).

Model Dependent variable: Dummy indicating unemployment status (1= unemployed)	Probit Far from park vs		Marginal and Mean effects Far from park vs	
	Close to entrance	Far from entrance	Close to entrance	Far from entrance
Mean comparison				
(1) Effect	**-0.1444*** **	**-0.1723*** **	**-0.0160*** **	**-0.0186*** **
Standard Error	[0.0333]	[0.0453]	[0.0033]	[0.0043]
No. Obs	58 158	56 105	58 158	56 105
Probit estimates using the full sample				
(2) Workers' characteristics				
Effect	**-0.1536*** **	**-0.1873*** **	**-0.0137*** **	**-0.0163*** **
Standard Error	[0.0352]	[0.0480]	[0.0028]	[0.0036]
No. Obs	58 061	56 015	58 061	56 015
(3) (2) + Geographic characteristics				
Effect	**-0.1143*** **	**-0.1329*** **	**-0.0103*** **	**-0.0118*** **
Standard Error	[0.0356]	[0.0501]	[0.0030]	[0.0040]
No. Obs	58 061	56 015	58 061	56 015
Probit estimates using restricted sample (matching)				
(4) Worker's characteristics				
Effect	**-0.1199*** **	**-0.2122*** **	**-0.0103*** **	**-0.0181*** **
Standard Error	[0.0399]	[0.0533]	[0.0033]	[0.0042]
No. Obs	16 529	10 172	16 529	10 172
No obs. Treat on common support	4 480	2 435	4 480	2 435
% treated obs on support	100	100	100	100
(5) (4) + Geographic characteristics				
Effect	**-0.1177*** **	**-0.0452**	**-0.0100*** **	**-0.0037**
Standard Error	[0.0401]	[0.0632]	[0.0033]	[0.0051]
No. Obs	16 636	6 973	16 636	6 973
No obs. Treat on common support	4 481	1 927	4 481	1 927
% treated obs on support	100	79	100	79

*** p<0.01, ** p<0.05, * p<0.1. No asterisk means no significance

Note: Workers's characteristics specification includes: gender, age, finish high school dummy, college for at least 2 years dummy, male headed household dummy, Costa Rican dummy, lived in the same place 2 years before dummy, married dummy, full year work dummy and household size

Geographic specification includes all the workers' characteristics and density of primary, secondary and terciary roads, slope, precipitation, log of distances to: schools, high schools, clinics and San José

The determinants of being under treatment were very similar for unemployment sample and wages analysis. In particular, average workers' probability to locate close to a national park entrance is correlated with female participation in the labor force, some college education, a female head of households, immigration to the area, full-year employment and less family members. Also, average workers' probability to locate close to a national park-far from the entrance is correlated with female participation in the labor force, younger age, a

female head of household, immigration to the area, full -year employment, and more family members.

Additionally, the probability of being close to a national park is correlated with more primary roads, steeper slopes, more precipitation, greater distance to high schools, and less distance to Costa Rica's capital city. Furthermore, land close to entrances is also correlated with less secondary roads, more local roads, and greater distance to basic school and health centers. Probit coefficients for unemployment are presented in Annex 3.

Balances of confounder variables after matching are presented in Table 14. Similar to wages analysis, it was found that differences between groups decrease, even when for some variables a perfect balance is not achieved.

Table 14. Test on the matching effectiveness in finding comparable groups. Differences in mean values before and after matching for the unemployment sample

Variable	Close to park's entrance vs far from parks		Far from park entrance vs far from parks	
	Difference	T-stat	Difference	T-stat
Workers' Characteristics				
Male participation	-0.010	-1.140	0.039	2.940
Age	0.018	0.070	0.156	0.390
Age*age	-3.731	-0.190	15.645	0.480
People that finished High School	0.020	2.540	-0.051	-5.090
People with more than 2 years college	0.022	3.710	-0.023	-3.850
Male headed household	-0.002	-0.180	0.022	1.500
Costa Rican	-0.003	-0.370	0.031	2.390
Lived in the same place for at least 2 yrs	-0.012	-2.770	0.011	1.590
People married or living with someone	0.009	1.020	0.015	1.060
Household size	-0.017	-0.450	0.034	0.580
Geographic Characteristics				
Density of primary roads (km/km2)	0.032	2.790	-0.125	-9.850
Density of secondary roads (km/km2)	0.019	1.140	0.024	1.610
Density of local roads (km/km2)	0.240	3.010	-0.836	-11.990
Slope	-0.399	-2.320	0.422	1.210
Precipitation (mm)	14.865	0.970	-18.963	-0.720
Precipitation*precipitation	148 210	1.480	-477 209	-2.360
Log distance to the nearest basic school (km)	-0.029	-1.600	0.022	0.870
Log distance to the nearest highschool (km)	-0.019	-0.990	-0.012	-0.540
Log distance to nearest health centre (km)	-0.017	-0.960	0.070	2.340
Log distance to San Jose (km)	0.007	0.390	-0.045	-2.500

Overlap of the propensity scores density distribution is checked in Figure 8 (close to entrances) and Figure 9 (close to parks-far from entrance). In both cases, it was found that after matching the distributions are more similar than before matching.

Figure 8. Common support test for unemployment sample. Histogram of propensity scores before and after matching for close to entrances.

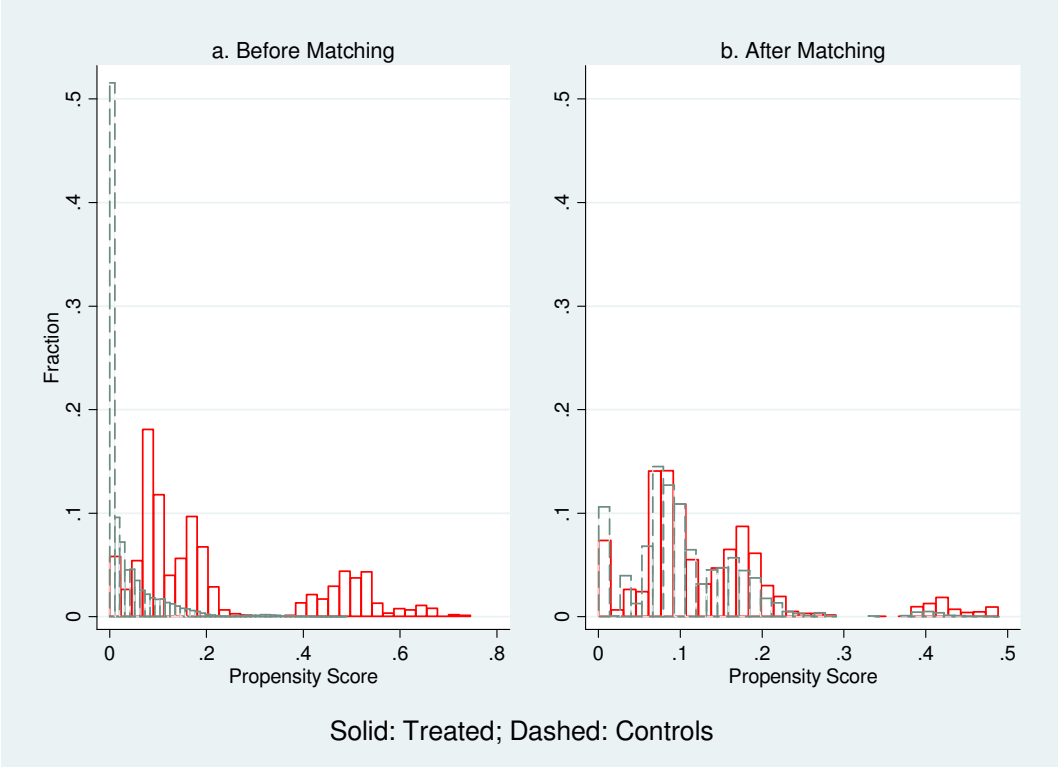


Figure 9. Common support test for unemployment sample. Histogram of propensity scores before and after matching for far from entrances.

4.2.3 Effects of national parks on unemployment by social groups

Parks' effects on unemployment for different subgroups are presented in Table 15. Parks reduced the probability of unemployment in around 2 percent for women, 1.1 percent for non migrants and 1.3 percent for people who did not finished high school. These results are remarkable, since those workers are typically the less advantaged groups in the labor markets, as shown in section 4.2.1.

Table 15. Parks' effects on unemployment by gender, migration and education level.

Dependent variable: Dummy for unemployment	Probit		Marginal Effects	
	Close to parks' entrances	Far from parks' entrances	Close to parks' entrances	Far from parks' entrances
Males	-0.0070	-0.0928	-0.0005	-0.0062
Standard Error	[0.0545]	[0.0826]	[0.0036]	[0.0054]
No. Obs	10676	4756	10676	4756
Treated obs on support	3058	1478	3058	1478
Females	-0.1898***	-0.2547**	-0.0209***	-0.0300**
Standard Error	[0.0659]	[0.1088]	[0.0070]	[0.0124]
No. Obs	4969	1873	4969	1873
Treated obs on support	1423	494	1423	494
Migrants[1]	-0.0660	-0.3935	-0.0054	-0.0233
Standard Error	[0.1595]	[0.3828]	[0.0129]	[0.0254]
No. Obs	785	136	785	136
Treated obs on support	261	57	261	57
Non migrants	-0.1357***	-0.1729***	-0.0114***	-0.0144***
Standard Error	[0.0430]	[0.0668]	[0.0035]	[0.0054]
No. Obs	14675	6100	14675	6100
Treated obs on support	4170	1800	4170	1800
Finished high school	-0.1025	-0.2062	-0.0056	-0.0185
Standard Error	[0.0917]	[0.1777]	[0.0050]	[0.0153]
No. Obs	3553	780	3553	780
Treated obs on support	1083	226	1083	226
Not finished High school	-0.1418***	-0.1337**	-0.0131***	-0.0113**
Standard Error	[0.0460]	[0.0680]	[0.0041]	[0.0057]
No. Obs	11949	5991	11949	5991
Treated obs on support	3390	1826	3390	1826

[1]People who arrived in the last two years to the place

*** p<0.01, ** p<0.05, * p<0.1. No asterisk means no significance

4.3 Field validation

So far results suggest that parks have a positive effect on wages, particularly for workers living close to the parks access. One possible explanation is that workers close to entrances are receiving higher payments for the same kind of jobs, or because there are more workers employed in better paid activities in this area. Evidence in this study suggests that both possibilities are plausible, since close to entrances average wage is higher in almost every activity, and also there is more diversification in the economic activities than far from parks. Also, parks reduce probability of being unemployed. This effect is more important for traditionally less-advantaged groups such as women and less-educated workers. These results suggest that labor market dynamic is different close to parks entrances compared with other rural areas far away.

In order to understand better these dynamics, field observations were conducted in three national parks: Irazú, Cahuita and Volcán Tenorio. Analysis of field interviews suggests that tourism has an important impact on economic activities around parks. As analyzed in previous sections, average lands close to parks are characterized by difficult geographical conditions for agriculture development e.g., steep slopes and high precipitation. According to the findings in Chomitz and Gray (1996) already discussed, this might discourage commercial farming but encourages semi-subsistence farming. When the protected area is attractive for tourism, new opportunities are presented, and households start to combine agriculture with service activities. This would lead to a diversification in households' income sources. From field verification, it was observed that in many of these new activities woman and young people have a very important role. This might explain why wages are higher, and the probability of unemployment is lower, for these groups compared with other rural areas. This type of dynamic was clearly observed in Tenorio.

Moreover, this income diversification is not likely to be the case when the park boundaries restrict almost all the possibilities for developing agriculture activities. According to the opinion of interviewed people in Cahuita, the most probable activity that would take place if the park would not have been established is agriculture. Since there is a land restriction, and the park has many attributes that are attractive to tourists, restaurants and hotels activity was the most plausible alternative activity. At present, this is the only income

source for many households. Informants also mentioned that people with the highest incomes in the community are landowners, since land value has risen significantly and they develop tourism activities such as hotels and restaurants. According to people interviewed, wages might be higher than in other rural areas because local people receive additional incomes from tourists' tips. Since they receive visitors virtually all year long (with around 7 highly visited months), and these tourists come from countries with high purchase power, tips play an important role in their monthly incomes.

Furthermore, according to interviewees, even when Irazú is highly visited, tourism interaction with the communities is limited. Tourists stay in the area around half a day, given that it is close to the capital city. Still, some households along the access road have combined their agriculture activities with services for the tourists. Even if these activities are secondary in the zone, people directly employed in them declared to be significantly better off than in their alternative occupations.

Finally, from the field work it is important to emphasize the role of social organizations, as well as government agencies in leading the economic and social development around the opportunities that the park may bring. Local organizations also help to reduce the possible negative impacts that tourism might bring. Also, their role is extensive to distribution issues.

Field observations support the results obtained with regressions analysis. In particular, people located close to parks' entrance declared that in their opinion the community is better off with the presence of the park than what they expected it to be in the alternative situation. Also, people far from entrances consider that the park has no effect on their general welfare. Besides higher wages and employment, people close to entrances stated that other benefits are received from the presence of the park e.g., environmental quality and aid from government and other institutions (including environmental education and infrastructure), and financial and training support for new entrepreneurships.

5 DISCUSSION AND CONCLUSIONS

This study estimated the effect of national park on local communities' wages and unemployment by comparing workers close to parks with similar workers living in similar areas far from parks.

It is concluded that in average workers receive 8.3 percent higher wages close to the entrance but workers far from parks' entrances receive equal wages than similar workers living in similar places far from parks, i.e., in this area there is no effect of parks on wages. Close to parks' entrances, results suggest that workers are shifting form agricultural activities to better paid jobs in services.

Also, it was found that effects are not equally distributed. Females living close to entrances receive higher a wage premium, meanwhile workers recently arrived to the community do not receive significantly better wages than those in the same situation far from parks. Also, foreigners do not capture all the benefits from this industry. Local people also achieve better incomes and employment opportunities.

It is also concluded that workers close to parks' entrances have a lower probability of being unemployed than the situation with no park. This probability is 1 percent lower compared with workers far from parks. Furthermore, workers far form entrances have the same unemployment rate than those with no park, once controlling for all the relevant characteristics and using matching techniques.

When parks' effects on unemployment were estimated for different social groups, it was found that women, migrants and low educated workers have an even lower probability of being unemployed in close to entrances zones. The magnitude is around 2 percent, 1.1 percent and 1.3 percent respectively.

In sum, it was found that workers close to the park's entrance obtain all the gains from park's establishment and that benefits are not distributed evenly. Results are robust to different

econometric approaches (OLS and matching techniques) and they support previous empiric findings that protected areas actually can have positive effects on local people welfare.

Field work supports the results obtained. Tourists' visitation activates the labor market, generating new opportunities for employment and higher wages, meanwhile the dynamics far from entrances is similar to other rural areas without parks. The main mechanisms through which parks affect wages and employment are new business opportunities created from visitors demands for goods and services, education for native people to attend these demands and support of local associations

The tourism role in determining economic activities and therefore wages depends on factors such as visitors' level and average time that tourists spend in the place, as well as their average expenditure. This is important to consider since means that parks that do not receive visitors would be equal or even worse off compared with other rural areas. Moreover this study finds that in average wages are higher and unemployment lower close to parks' entrances, including in the sample individuals close to low visited parks e.g Juan Castro Blanco, Braulio Carrillo and Las Baulas. This means that besides the tourism there are other factors related to the parks presence that might be explaining differences in wages and probability of being unemployed. More efforts should be made to analyze parks' effects on soil quality, infrastructure, health and education for example.

It can be argued that prices are high in places where tourism takes place in response to the high purchase power of many of the visitors. This might cause that local people have to pay higher prices compared with other similar rural areas and so, even if they earn higher wages, purchase power is similar. However, it can be also argued that in many touristic places, commerce applies a price differentiation for local and foreigner people as a strategy to maximize benefits. This would imply that for local people prices remain similar than in other rural places, and so there would not be an inflation effect on wages. From field observations, some people around the three consulted national parks commented that prices were relatively high, but the reasons rendered were the distance from urban area, the transportation costs and the national inflation. Therefore, this price effect is conceivable in areas where the next town

without tourism is far away or difficult to be accessed, so local people do not have many choices where to buy their consumption goods.

Besides the positive relationships between parks and people found in this study, many questions rise about other dimensions of people's welfare beyond wages and employment. Negative impacts associated with the presence of tourism in the communities are also considerable. For instance in Cahuita, a community leader declared that traditions and culture have changed substantially in recent years because of the presence of foreigners. Insecurity, drugs, alcoholism and prostitution have been associated as bad effects of tourism in Costa Rica.

It is important to state that this study's findings are average effects of parks on wages and unemployment. This means that, as many previous studies have stated, there are people that might be better off with the presence of the park, meanwhile other are the same or worse off. This investigation can not derive any conclusion about particular cases or parks. Also, it is important to note that this study can not conclude for parks with low density of people around since there are not observations available to include in the sample. For this type of parks additional research has to be done to understand the parks effects on people.

More detailed analysis is required to understand better national parks' effects on local communities' welfare. For instance, parks' effects on infrastructure, education, possibilities of self-employment and health outcomes are plausible next steps to take. Also, improvements in methodology can be achieved. In particular, panel data analysis might help to better estimate dynamic effects i.e., it could be compared outcomes for the same group of people before and after park' establishment.

Policy implications of these results are noteworthy. There is a chance to achieve both conservation and income and employment objectives. These goals are not mutually exclusive. In this grow target, tourism has a vital role as it activates the job market through new demand for goods and services. Moreover, policies have to be addressed to avoid high dependence in households' incomes to such a stationary activity as tourism. Diversification between

agriculture and service activities is an accurate approach for rural households close to national parks to improve welfare.

If a national park is to be created three key points have to be considered. First, there is no evidence to support that park establishment would have a negative effects on wages or employment. However, the effects found in this study are average numbers, i.e., some people might actually be worse off. Second, the location of the visitors' access matters. Depending where the entrances are placed, selected rural communities are to be benefited in terms of incomes and employment. Policies that promote tourism all around the park are necessary to improve local welfare. Third, policies that allow workers to switch to tourism activities might make a big difference on how local communities benefit from parks.

When a national park has already been established, efforts should be directed to integrate people far from visitors' access to close to entrances activities. This can be achieved through new infrastructure that facilitates the connection between those two areas. Also, a second tourists' access point might be considered to boost development in other rural areas around the park. Finally, trade between close and far from parks might be incentivized.

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7 ANNEX

Annex 1. Field work questionnaire

GUÍA DE ENTREVISTAS

sobre la relación comunidad-parque nacional y

delimitación del área de influencia

Presentación de la entrevistadora y del estudio

I. Información general

(A ser llenado por entrevistador):

Fecha _____

Comunidad _____

Distrito _____

Ubicación geográfica _____

Parque Nacional cercano _____

Fecha de creación del Parque Nacional _____

¿Cerca de la entrada? SI / NO

Comentarios_____

II. Datos sobre el informante

Persona entrevistada _____

¿Desde cuándo vive en la comunidad? _____

Organización (p.e Iglesia, Asociación de Desarrollo, etc) _____

Ocupación _____

Edad (rango) _____ años

Género _____

III. Temas clave y preguntas guía

1. Características actuales de la comunidad: población, salud, educación, infraestructura, acceso a servicios básicos, empleo, salarios, calidad ambiental, migración, religión, actividades de ocio, agrupaciones sociales, cooperación externa. ¿A qué se dedica en general las personas de la comunidad?

2. Origen e historia de la comunidad: cambios importantes en la comunidad (línea de tiempo). ¿qué los ha originado? ¿Tienen que ver con el Parque Nacional? ¿Recuerda algún cambio o transformación que haya tenido su comunidad en consecuencia del establecimiento del parque en el año _____, por ejemplo en términos de tipo de: empleo: cambios de actividad, nuevas actividades, múltiples actividades, ingresos, migración de personas, densidad de población, infraestructura, otros?

3. Mercado laboral y empleo: principales actividades económicas antes y ahora ¿están ligadas al Parque? ¿Si hay cambios, a qué se deben? ¿las personas han cambiado de actividad debido a la existencia del parque? ¿Hay particularmente mucha o poca demanda y oferta de trabajo?

4. Diversificación del empleo: ¿las familias en general tienen una o varias actividades? ¿las familias ligadas al turismo tienen otra actividad adicional? ¿hay dependencia del turismo?

5. Salarios: ¿qué explica el nivel salario? ¿Tiene el Parque alguna influencia sobre el nivel de salarios?

6. Costo de vida: ¿son los precios relativamente más altos que en otras zonas rurales similares? ¿Se debe a la influencia turística?

7. Distribución del ingreso: ¿Quiénes reciben salarios mayores/menores y por qué? (por ejemplo: nuevos residentes, sector servicios, gente joven, agricultores, comerciantes en servicios relacionados con turismo, extranjeros etc? ¿Tiene que ver con el Parque?

8. Inmigración y emigración: ¿Es frecuente que lleguen nuevas personas a vivir en esta comunidad? ¿Cuáles son los motivos de estas nuevas llegadas? ¿Es frecuente que personas de esta comunidad se vayan a vivir a otras partes? ¿Cuáles son los motivos para irse? ¿Qué papel tiene el parque en las decisiones de ubicación de las personas de la comunidad?

9. Infraestructura: ¿a partir de cuando y por qué se creó la infraestructura existente? ¿El Parque ha atraído infraestructura? ¿Nuevas industrias (cuáles) han sido atraídas por esta infraestructura?

10. Percepción respecto al Parque: ¿qué tipo de actividades han sido beneficiadas y cuales afectadas por la existencia del parque? Efectos positivos y negativos de la existencia parque nacional sobre:

    → el entrevistado y su familia

→ otras personas dentro de la comunidad: grupos específicos:mujeres, jóvenes, nuevos residentes, etc.?

→ la comunidad como un todo

→ otras comunidades cercanas (¿Cuáles?)

11. Si el parque no existiera:

a. La comunidad tendría en promedio ingresos (a los que percibe actualmente) Iguales Más altos Más bajos

b. La calida de vida en la comunidad sería: Igual Mejor Peor

c. La condición de salud sería: Igual Mejor Peor

d. La calidad ambiental en la comunidad sería: Igual Mejor Peor

e. La infraestructura en la comunidad sería: Igual Mejor Peor

f. El acceso a servicios sería (agua, electricidad, teléfono, comunicaciones, educación, centros de salud, transporte público) Igual Mejor Peor

g. Las personas de la comunidad trabajarían en el mismo lugar SI NO

h. Las actividades económicas serían Iguales Diferentes

i. La distribución del ingreso en la comunidad sería Igual Diferente

12. Delimitación de área de influencia: ¿Se puede diferenciar las características socioeconómicas a partir de cierta distancia? ¿Se puede diferenciar las características socioeconómicas entre cerca

y lejos de la entrada? ¿Hay diferencia en las variables anteriores para la gente que vive cerca de la entrada al parque respecto a quienes viven lejos?

13. Capital Social: ¿hay asociaciones comunales y a qué temas se dedican? ¿Las autoridades administrativas del parque tienen algún tipo de programa o forma de relacionarse o proyectarse con las comunidades?

14. Cacería y extracción de recursos del Parque Nacional: ¿es común? ¿qué se extrae?

Annex 2. Differences in the socioeconomic and geographic characteristics by groups

Variable	Far from national parks (FP)	Close to national parks			
		Close to entrance (CE)	T-stat (FP vs CE)	Far from entrance (FE)	T-stat (FP vs FE)
Number of observations	53.668	4.490		2.437	
Workers' Characteristics					
Male participation (%)	72,1	68,2	-5,5	72,1	0,0
Age	35,6	35,8	1,2	35,2	-1,2
People that finished High School (%)	17,8	24,3	10,9	16,6	-1,5
People with more than 2 years college (%)	7,0	12,5	13,4	6,7	-0,7
Male headed household (%)	51,8	48,4	-4,3	53,3	1,5
Costa Rican (%)	74,9	73,2	-2,5	73,4	-1,7
Lived in the same place for at least 2 yrs (%)	95,8	93,0	-8,7	95,0	-1,8
People married or living with someone (%)	58,5	56,9	-2,2	60,6	2,0
Full year employed people (%)					
Household size	4,6	4,5	-4,1	4,6	-0,6
Geographic Characteristics					
Density of primary roads (km/km2)	0,1	0,2	8,2	0,1	-2,4
Density of secondary roads (km/km2)	0,4	0,3	-3,6	0,1	-9,0
Density of local roads (km/km2)	3,1	3,6	7,5	3,1	0,0
Slope	10,2	12,7	14,9	13,6	15,1
Precipitation (mm)	3085,2	3011,5	-4,8	4306,2	59,4
Distance to the nearest basic school (km)	6,8	6,9	7,7	6,9	6,8
Distance to the nearest highschool (km)	7,8	7,9	8,6	8,3	22,9
Distance to nearest health centre (km)	8,1	8,4	15,1	8,0	-4,1
Distance to San Jose (km)	10,9	10,7	-11,7	11,1	10,3
Workers' Occupation %					
Professional, Technical and Related Workers	6,8	10,4	8,9	6,2	-1,3
Directors and Managers Workers	1,3	2,5	6,6	1,8	2,5
Administrative Workers	4,8	7,2	7,4	5,0	0,6
Sales Workers	10,4	10,2	-0,6	10,7	0,4
Farmers, Fishermen, Hunters, Loggers	32,3	23,6	-12,0	35,9	3,8
Workers in Transport	3,9	2,9	-3,3	4,6	1,8
Craftsmen, Production-Process Workers 1	13,9	13,3	-1,2	12,6	-1,8
Craftsmen, Production-Process Workers 2	3,7	4,5	2,8	1,8	-4,7
Packers, Labellers and Related Workers	4,5	2,5	-6,2	4,8	0,7
Service Workers	17,5	22,3	8,1	15,8	-2,1
Economic Activity %					
Agriculture, Hunting, Forestry and Fishing	21,7	34,5	-17,5	41,1	6,7
Mining and Quarrying	0,4	0,2	-1,6	0,0	-2,7
Manufacturing	11,2	10,0	-2,3	7,1	-6,3
Electricity, Gas and Water	0,9	1,7	5,5	3,0	10,7
Construction	7,1	8,4	3,2	5,1	-3,7
Wholesale & Retail Trade & Rest & Hotels	16,4	25,7	15,9	16,9	0,7
Transport, Storage and Communication	4,7	4,1	-1,9	4,6	-0,3
Financing, Insur, Real Estate & Business Serv	3,0	3,7	2,4	2,9	-0,4
Community, Social and Personal Services	20,2	22,9	4,4	17,9	-2,8
Unemployment rate	6,3	4,7	-4,3	4,4	-3,7

Annex 3. Determinants of the probability of being treated for unemployment sample. Dependent variable: Treatment dummy

Variable	Close to entrance	Far from entrance
Male population	-0.034*	-0.079***
Age	0.014***	0.001
Age^2	0.000***	0.000
People that finished High School	0.077***	0.048
People with more than 2 years college	0.245***	0.67
Male headed household	-0.083***	0.060*
Costa Rican	-0.102***	-0.108***
Lived in the same place for at least 2 yrs	-0.241***	-0.230***
People married or living with someone	-0.057***	0.005
Full year employed people	n/a	n/a
Household size	-0.016***	0.008
Density of primary roads	0.048***	0.306***
Density of secondary roads	-0.038***	-0.029
Density of local roads	0.020***	0.007*
Slope	0.009***	0.034***
Precipitation	0.001***	0.003***
$Precipitation^2$	0.000***	0.000***
Distance to the nearest basic school	0.136***	0.028
Distance to the nearest highschool	0.083***	0.000***
Distance to nearest health centre	0.117***	0.000***
Distance to San Jose	-0.188***	0.000***
Number of obs	58061	56015
Log likelihood	-15029.11	-7215.68
LR chi2(44)	1506.170	5601.95
Prob > chi2	0.000	0.000

[1] Note: Controlled by year dummies

*** p<0.01, ** p<0.05, * p<0.1. No asterisk means no significance

Annex 4. Probability of being employed in agriculture. Close from entrances

```
Probit regression                                 Number of obs   =      21133
                                                  LR chi2(27)     =     871.77
                                                  Prob > chi2     =     0.0000
Log likelihood = -5606.4145                       Pseudo R2       =     0.0721

------------------------------------------------------------------------------
Dummy_dis~20 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      gender |  -.1188178   .0349812    -3.40   0.001    -.1873798   -.0502559
         age |  -.0003264   .0063644    -0.05   0.959    -.0128004    .0121475
        age2 |   .0000438   .0000807     0.54   0.587    -.0001143    .0002019
    fin_hsch |   .0359688   .0422982     0.85   0.395    -.0469341    .1188717
college_2y~s |   .4844231   .0605704     8.00   0.000     .3657072     .603139
      D_jefe |  -.1356807   .0379912    -3.57   0.000    -.2101421   -.0612193
        D_cr |  -.0748502   .0348914    -2.15   0.032    -.1432362   -.0064642
D_mismo_c~2y |  -.2039784   .0556327    -3.67   0.000    -.3130165   -.0949402
live_with_~1 |  -.0490822   .0339968    -1.44   0.149    -.1157148    .0175504
  empl_anual |   .1887404   .0394888     4.78   0.000     .1113438     .266137
    tamhogar |  -.0077519   .0068457    -1.13   0.257    -.0211692    .0056654
       d_lpr |   .0511587    .022545     2.27   0.023     .0069714     .095346
       d_lsr |  -.0610083   .0133276    -4.58   0.000    -.0871298   -.0348868
      d_luvr |   .0128368   .0040404     3.18   0.001     .0049177    .0207559
   pendiente |   .0103325    .001346     7.68   0.000     .0076944    .0129707
  pp_promedi |   .0003626   .0001035     3.50   0.000     .0001598    .0005654
 pp_promedi2 |  -6.14e-08   1.54e-08    -3.99   0.000    -9.16e-08   -3.13e-08
     log_sch |   .1479534   .0206902     7.15   0.000     .1074013    .1885054
   log_coleg |   .0893962   .0225891     3.96   0.000     .0451223    .1336701
  log_clinic |   .2046567   .0201723    10.15   0.000     .1651198    .2441936
   log_saban |  -.2086537   .0197494   -10.57   0.000    -.2473619   -.1699456
         D_02 |   .0725702   .0531134     1.37   0.172    -.0315303    .1766706
         D_03 |   .0197546   .0550002     0.36   0.719    -.0880437    .1275529
         D_04 |   .0548304   .0550689     1.00   0.319    -.0531026    .1627634
         D_05 |   .0756309   .0536887     1.41   0.159     -.029597    .1808587
         D_06 |    .180805   .0522165     3.46   0.001     .0784625    .2831475
         D_07 |   .1575975   .0515768     3.06   0.002     .0565089    .2586861
       _cons |  -3.015072   .2766404   -10.90   0.000    -3.557277   -2.472867
```

Annex 5. Probability of being employed in hotels and restaurants. Close from entrances

```
Probit regression                                 Number of obs   =      21133
                                                  LR chi2(27)     =     871.77
                                                  Prob > chi2     =     0.0000
Log likelihood = -5606.4145                       Pseudo R2       =     0.0721

------------------------------------------------------------------------------
Dummy_dis~20 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      gender |  -.1188178   .0349812    -3.40   0.001    -.1873798   -.0502559
         age |  -.0003264   .0063644    -0.05   0.959    -.0128004    .0121475
        age2 |   .0000438   .0000807     0.54   0.587    -.0001143    .0002019
    fin_hsch |   .0359688   .0422982     0.85   0.395    -.0469341    .1188717
college_2y~s |   .4844231   .0605704     8.00   0.000     .3657072     .603139
      D_jefe |  -.1356807   .0379912    -3.57   0.000    -.2101421   -.0612193
        D_cr |  -.0748502   .0348914    -2.15   0.032    -.1432362   -.0064642
D_mismo_c~2y |  -.2039784   .0556327    -3.67   0.000    -.3130165   -.0949402
live_with_~1 |  -.0490822   .0339968    -1.44   0.149    -.1157148    .0175504
  empl_anual |   .1887404   .0394888     4.78   0.000     .1113438     .266137
    tamhogar |  -.0077519   .0068457    -1.13   0.257    -.0211692    .0056654
       d_lpr |   .0511587    .022545     2.27   0.023     .0069714     .095346
       d_lsr |  -.0610083   .0133276    -4.58   0.000    -.0871298   -.0348868
      d_luvr |   .0128368   .0040404     3.18   0.001     .0049177    .0207559
   pendiente |   .0103325    .001346     7.68   0.000     .0076944    .0129707
  pp_promedi |   .0003626   .0001035     3.50   0.000     .0001598    .0005654
 pp_promedi2 |  -6.14e-08   1.54e-08    -3.99   0.000    -9.16e-08   -3.13e-08
     log_sch |   .1479534   .0206902     7.15   0.000     .1074013    .1885054
   log_coleg |   .0893962   .0225891     3.96   0.000     .0451223    .1336701
  log_clinic |   .2046567   .0201723    10.15   0.000     .1651198    .2441936
   log_saban |  -.2086537   .0197494   -10.57   0.000    -.2473619   -.1699456
        D_02 |   .0725702   .0531134     1.37   0.172    -.0315303    .1766706
        D_03 |   .0197546   .0550002     0.36   0.719    -.0880437    .1275529
        D_04 |   .0548304   .0550689     1.00   0.319    -.0531026    .1627634
        D_05 |   .0756309   .0536887     1.41   0.159     -.029597    .1808587
        D_06 |    .180805   .0522165     3.46   0.001     .0784625    .2831475
        D_07 |   .1575975   .0515768     3.06   0.002     .0565089    .2586861
       _cons |  -3.015072   .2766404   -10.90   0.000    -3.557277   -2.472867
```

Annex 6. Probability of being employed in wholesale and retail trade. Close from entrances

```
Probit regression                                 Number of obs   =      21133
                                                  LR chi2(27)     =     871.77
                                                  Prob > chi2     =     0.0000
Log likelihood = -5606.4145                       Pseudo R2       =     0.0721

------------------------------------------------------------------------------
Dummy_dis~20 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      gender |  -.1188178   .0349812    -3.40   0.001    -.1873798   -.0502559
         age |  -.0003264   .0063644    -0.05   0.959    -.0128004    .0121475
        age2 |   .0000438   .0000807     0.54   0.587    -.0001143    .0002019
    fin_hsch |   .0359688   .0422982     0.85   0.395    -.0469341    .1188717
college_2y~s |   .4844231   .0605704     8.00   0.000     .3657072     .603139
      D_jefe |  -.1356807   .0379912    -3.57   0.000    -.2101421   -.0612193
        D_cr |  -.0748502   .0348914    -2.15   0.032    -.1432362   -.0064642
D_mismo_c~2y |  -.2039784   .0556327    -3.67   0.000    -.3130165   -.0949402
live_with_~1 |  -.0490822   .0339968    -1.44   0.149    -.1157148    .0175504
  empl_anual |   .1887404   .0394888     4.78   0.000     .1113438     .266137
    tamhogar |  -.0077519   .0068457    -1.13   0.257    -.0211692    .0056654
       d_lpr |   .0511587    .022545     2.27   0.023     .0069714     .095346
       d_lsr |  -.0610083   .0133276    -4.58   0.000    -.0871298   -.0348868
      d_luvr |   .0128368   .0040404     3.18   0.001     .0049177    .0207559
   pendiente |   .0103325    .001346     7.68   0.000     .0076944    .0129707
  pp_promedi |   .0003626   .0001035     3.50   0.000     .0001598    .0005654
 pp_promedi2 |  -6.14e-08   1.54e-08    -3.99   0.000    -9.16e-08   -3.13e-08
     log_sch |   .1479534   .0206902     7.15   0.000     .1074013    .1885054
   log_coleg |   .0893962   .0225891     3.96   0.000     .0451223    .1336701
  log_clinic |   .2046567   .0201723    10.15   0.000     .1651198    .2441936
   log_saban |  -.2086537   .0197494   -10.57   0.000    -.2473619   -.1699456
         D_02 |   .0725702   .0531134     1.37   0.172    -.0315303    .1766706
         D_03 |   .0197546   .0550002     0.36   0.719    -.0880437    .1275529
         D_04 |   .0548304   .0550689     1.00   0.319    -.0531026    .1627634
         D_05 |   .0756309   .0536887     1.41   0.159     -.029597    .1808587
         D_06 |    .180805   .0522165     3.46   0.001     .0784625    .2831475
         D_07 |   .1575975   .0515768     3.06   0.002     .0565089    .2586861
        _cons |  -3.015072   .2766404   -10.90   0.000    -3.557277   -2.472867
------------------------------------------------------------------------------
```

Annex 7. Probability of being employed in agriculture. Far from entrances

```
Probit regression                                 Number of obs   =      20194
                                                  LR chi2(27)     =    1887.93
                                                  Prob > chi2     =     0.0000
Log likelihood = -2467.3041                       Pseudo R2       =     0.2767

------------------------------------------------------------------------------
Dummy_dis~05 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      gender |  -.0868403   .0552714    -1.57   0.116    -.1951703    .0214897
         age |  -.0296762   .0088989    -3.33   0.001    -.0471177   -.0122347
        age2 |   .0003531   .0001112     3.18   0.001     .0001352    .0005711
    fin_hsch |   .0620804   .0715521     0.87   0.386    -.0781591    .2023199
college_2y~s |  -.1809586   .1613228    -1.12   0.262    -.4971456    .1352283
      D_jefe |   .0799591    .058137     1.38   0.169    -.0339874    .1939056
        D_cr |  -.2145975   .0495763    -4.33   0.000    -.3117653   -.1174297
D_mismo_c~2y |  -.2853767   .0880878    -3.24   0.001    -.4580256   -.1127279
live_with_~1 |  -.0749797   .0516911    -1.45   0.147    -.1762923    .0263329
  empl_anual |   .2225867   .0571231     3.90   0.000     .1106274     .334546
    tamhogar |   .0326785   .0099689     3.28   0.001     .0131399    .0522172
       d_lpr |   .3162769   .0459359     6.89   0.000     .2262441    .4063097
       d_lsr |   .0165855   .0295428     0.56   0.575    -.0413174    .0744884
      d_luvr |  -.0167754   .0076878    -2.18   0.029    -.0318432   -.0017076
   pendiente |     .03631   .0019545    18.58   0.000     .0324793    .0401407
  pp_promedi |   .0028962   .0002045    14.16   0.000     .0024953     .003297
 pp_promedi2 |  -2.73e-07   2.56e-08   -10.65   0.000    -3.23e-07   -2.23e-07
     log_sch |  -.1464564   .0292859    -5.00   0.000    -.2038556   -.0890571
   log_coleg |   .3903629   .0326976    11.94   0.000     .3262769    .4544489
  log_clinic |  -.2179341   .0283193    -7.70   0.000    -.2734389   -.1624293
   log_saban |  -.1420789   .0407925    -3.48   0.000    -.2220306   -.0621271
        D_02 |    .071112   .0780195     0.91   0.362    -.0818035    .2240275
        D_03 |   .1388578   .0781287     1.78   0.076    -.0142716    .2919871
        D_04 |   .1469727   .0781183     1.88   0.060    -.0061363    .3000817
        D_05 |    .076001   .0768158     0.99   0.322    -.0745552    .2265572
        D_06 |   .0921707   .0772199     1.19   0.233    -.0591776    .2435189
        D_07 |   .0852134   .0755595     1.13   0.259    -.0628804    .2333072
       _cons |  -7.098406   .5939006   -11.95   0.000     -8.26243   -5.934382
------------------------------------------------------------------------------
```

Annex 8. Probability of being employed in hotels and restaurants. Far from entrances

```
Probit regression                                 Number of obs   =      20194
                                                  LR chi2(27)     =    1887.93
                                                  Prob > chi2     =     0.0000
Log likelihood = -2467.3041                       Pseudo R2       =     0.2767

------------------------------------------------------------------------------
Dummy_dis~05 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      gender |  -.0868403   .0552714    -1.57   0.116    -.1951703    .0214897
         age |  -.0296762   .0088989    -3.33   0.001    -.0471177   -.0122347
        age2 |   .0003531   .0001112     3.18   0.001     .0001352    .0005711
    fin_hsch |   .0620804   .0715521     0.87   0.386    -.0781591    .2023199
college_2y~s |  -.1809586   .1613228    -1.12   0.262    -.4971456    .1352283
      D_jefe |   .0799591    .058137     1.38   0.169    -.0339874    .1939056
        D_cr |  -.2145975   .0495763    -4.33   0.000    -.3117653   -.1174297
D_mismo_c~2y |  -.2853767   .0880878    -3.24   0.001    -.4580256   -.1127279
live_with_~1 |  -.0749797   .0516911    -1.45   0.147    -.1762923    .0263329
  empl_anual |   .2225867   .0571231     3.90   0.000     .1106274     .334546
    tamhogar |   .0326785   .0099689     3.28   0.001     .0131399    .0522172
       d_lpr |   .3162769   .0459359     6.89   0.000     .2262441    .4063097
       d_lsr |   .0165855   .0295428     0.56   0.575    -.0413174    .0744884
      d_luvr |  -.0167754   .0076878    -2.18   0.029    -.0318432   -.0017076
   pendiente |     .03631   .0019545    18.58   0.000     .0324793    .0401407
  pp_promedi |   .0028962   .0002045    14.16   0.000     .0024953     .003297
 pp_promedi2 |  -2.73e-07   2.56e-08   -10.65   0.000    -3.23e-07   -2.23e-07
     log_sch |  -.1464564   .0292859    -5.00   0.000    -.2038556   -.0890571
   log_coleg |   .3903629   .0326976    11.94   0.000     .3262769    .4544489
  log_clinic |  -.2179341   .0283193    -7.70   0.000    -.2734389   -.1624293
   log_saban |  -.1420789   .0407925    -3.48   0.000    -.2220306   -.0621271
        D_02 |    .071112   .0780195     0.91   0.362    -.0818035    .2240275
        D_03 |   .1388578   .0781287     1.78   0.076    -.0142716    .2919871
        D_04 |   .1469727   .0781183     1.88   0.060    -.0061363    .3000817
        D_05 |    .076001   .0768158     0.99   0.322    -.0745552    .2265572
        D_06 |   .0921707   .0772199     1.19   0.233    -.0591776    .2435189
        D_07 |   .0852134   .0755595     1.13   0.259    -.0628804    .2333072
       _cons |  -7.098406   .5939006   -11.95   0.000     -8.26243   -5.934382
------------------------------------------------------------------------------
```

Annex 9. Probability of being employed in wholesales and retail trade. Far from entrances

```
Probit regression                                 Number of obs   =      20194
                                                  LR chi2(27)     =    1887.93
                                                  Prob > chi2     =     0.0000
Log likelihood = -2467.3041                       Pseudo R2       =     0.2767

------------------------------------------------------------------------------
Dummy_dis~05 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      gender |  -.0868403   .0552714    -1.57   0.116    -.1951703    .0214897
         age |  -.0296762   .0088989    -3.33   0.001    -.0471177   -.0122347
        age2 |   .0003531   .0001112     3.18   0.001     .0001352    .0005711
    fin_hsch |   .0620804   .0715521     0.87   0.386    -.0781591    .2023199
college_2y~s |  -.1809586   .1613228    -1.12   0.262    -.4971456    .1352283
      D_jefe |   .0799591    .058137     1.38   0.169    -.0339874    .1939056
        D_cr |  -.2145975   .0495763    -4.33   0.000    -.3117653   -.1174297
D_mismo_c~2y |  -.2853767   .0880878    -3.24   0.001    -.4580256   -.1127279
live_with_~1 |  -.0749797   .0516911    -1.45   0.147    -.1762923    .0263329
  empl_anual |   .2225867   .0571231     3.90   0.000     .1106274     .334546
    tamhogar |   .0326785   .0099689     3.28   0.001     .0131399    .0522172
       d_lpr |   .3162769   .0459359     6.89   0.000     .2262441    .4063097
       d_lsr |   .0165855   .0295428     0.56   0.575    -.0413174    .0744884
      d_luvr |  -.0167754   .0076878    -2.18   0.029    -.0318432   -.0017076
   pendiente |     .03631   .0019545    18.58   0.000     .0324793    .0401407
  pp_promedi |   .0028962   .0002045    14.16   0.000     .0024953     .003297
 pp_promedi2 |  -2.73e-07   2.56e-08   -10.65   0.000    -3.23e-07   -2.23e-07
     log_sch |  -.1464564   .0292859    -5.00   0.000    -.2038556   -.0890571
   log_coleg |   .3903629   .0326976    11.94   0.000     .3262769    .4544489
  log_clinic |  -.2179341   .0283193    -7.70   0.000    -.2734389   -.1624293
   log_saban |  -.1420789   .0407925    -3.48   0.000    -.2220306   -.0621271
        D_02 |    .071112   .0780195     0.91   0.362    -.0818035    .2240275
        D_03 |   .1388578   .0781287     1.78   0.076    -.0142716    .2919871
        D_04 |   .1469727   .0781183     1.88   0.060    -.0061363    .3000817
        D_05 |    .076001   .0768158     0.99   0.322    -.0745552    .2265572
        D_06 |   .0921707   .0772199     1.19   0.233    -.0591776    .2435189
        D_07 |   .0852134   .0755595     1.13   0.259    -.0628804    .2333072
       _cons |  -7.098406   .5939006   -11.95   0.000     -8.26243   -5.934382
------------------------------------------------------------------------------
```