About the Asian Development Bank
ADB aims to improve the welfare of the people in the Asia and Pacific region, particularly the nearly 1.9 billion who live on less than $2 a day. Despite many success stories, the region remains home to two thirds of the world’s poor. ADB is a multilateral development finance institution owned by 67 members, 48 from the region and 19 from other parts of the globe. ADB’s vision is a region free of poverty. Its mission is to help its developing member countries reduce poverty and improve their quality of life. ADB’s main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance. ADB’s annual lending volume is typically about $6 billion, with technical assistance usually totaling about $180 million a year.

ADB’s headquarters is in Manila. It has 26 offices around the world and more than 2,000 employees from over 50 countries.

About the Paper
H. M. Gunatilake, W.A.R. Wickramasinghe, and P. Abeygunawardena estimate individuals’ discount rate using a stated preference survey among peripheral villagers of a forest reserve in Sri Lanka. Results show that poverty is an important determinant of discount rates, and higher discount rates cause depletion of forest resources. The paper asserts that a long-term strategy for nature reserve protection would require poverty reduction in the peripheral communities, among other measures.

Time Preference and Natural Resource Use by Local Communities: The Case of Sinharaja Forest in Sri Lanka

H. M. Gunatilake, W.A.R. Wickramasinghe, and P. Abeygunawardena

August 2007
ERD Working Paper No. 100

TIME PREFERENCE AND NATURAL RESOURCE USE BY LOCAL COMMUNITIES: THE CASE OF SINHARAJA FOREST IN SRI LANKA

H. M. GUNATILAKE, W.A.R. WICKRAMASINGHE, AND P. ABEGUNAWARDENA

AUGUST 2007

H. M. Gunatilake is a Senior Economist at the Economic Analysis and Operations Support Division, Economics and Research Department, Asian Development Bank; W.A.R. Wickramasinghe is a Graduate Student at the Amsterdam Institute for Metropolitan and International Development Studies, University of Amsterdam, The Netherlands; and P. Abeygunawardena is a Principal Energy Economist at the South Asia Regional Department, Asian Development Bank.
FOREWORD

The ERD Working Paper Series is a forum for ongoing and recently completed research and policy studies undertaken in the Asian Development Bank or on its behalf. The Series is a quick-disseminating, informal publication meant to stimulate discussion and elicit feedback. Papers published under this Series could subsequently be revised for publication as articles in professional journals or chapters in books.
# CONTENTS

Abstract vii

I. INTRODUCTION 1

II. NONTIMBER FOREST PRODUCTS HARVESTING AND FOREST CONSERVATION 2

III. ESTIMATION OF INDIVIDUAL RATE OF TIME PREFERENCE 3

   A. Estimating the Individual Rate of Time Preference 4
   B. Elicitation Question 5

IV. HYPOTHESES AND MODEL SPECIFICATION 6

   A. Determinants of IRTP 6
   B. Socioeconomic Determinants of NTFP Harvesting 8

V. SAMPLING, DATA COLLECTION, AND MEASUREMENT OF VARIABLES 10

VI. RESULTS AND DISCUSSION 12

VII. CONCLUSIONS AND POLICY IMPLICATIONS 17

Appendix 1: Sample Distribution 18
Appendix 2: Data Used to Develop Market Incorporation Index 19
Appendix 3: Tests for Multicolinearity 20
Appendix 4: Test for Simultaneity and Contemporaneous Cross Correlation 21

References 22
ABSTRACT

Empirical studies on the impact of the individual rate of time preference (IRTP) on natural resource use are scarce. This paper investigates the impact of IRTP on forest resources harvesting from the Sinharaja Man and Biosphere Reserve in Sri Lanka. The impact of IRTP on the harvest rate of forest resources was tested using a simultaneous equation model. Analysis of the determinants of IRTP shows that the base value and age of the respondents negatively influence the IRTP while risk perception positively influences the IRTP. More importantly, low income induces a higher IRTP, indicating that poverty is an important determinant of the IRTP. Further, the results show that individuals with a higher rate of time preference harvest more forest resources. Overall, the results suggest that long-term strategies for management of nature reserves would require poverty alleviation in the peripheral communities, among other measures.
I. INTRODUCTION

An individual's preference for current over future consumption, called the rate of time preference or the rate of discount,\(^1\) is an important topic in economics. The generally held perception is that a higher rate of time preference typically accelerates natural resource harvesting and depresses investment for sustainable natural resource management. Higher discount rates\(^2\) also reduce the weights attached to the needs and desires of future generations. Therefore, a higher rate of time preference is viewed as a cause of depletion of natural resources and an obstacle to conservation. With this perception in mind, many environmentalists have suggested the use of lower discount rates for evaluation of natural resources and environmental projects.

This idea of using lower discount rates in natural resources and environmental projects is not new. Discussions on adjustment of the discount rate for conservation of the stock of natural capital, both in exhaustible and renewable resources, have persisted since the 1930s (Fisher and Krutilla 1995). Pigou (1932) may be the first to point out the need to use lower discount rates in the case of management of exhaustible resources (quoted in Fisher and Krutilla 1995). Early writings in natural resource economics consistently showed that a higher rate of discount leads to excessive use of natural resources. For example, see discussions by Hotelling (1931) for exhaustible resources and Clark (1973) for renewable resources. In recent times, there has been renewed interest in the argument for using a lower discount rate. For example, Weitzman (1994) argues for lower and declining discount rates for long-term benefit-cost analysis, for a variety of economic reasons. He further argues (Weitzman 1998) for the lowest possible discount rate for discounting the distant future. More recently, the use of a low discount rate in the Stern Report (Stern 2006) to estimate the cost of climate change has stimulated a heated debate on the impact of discounting on natural resources and the environment.

Despite its persistence for a long time, the claim that a lower discount rate is desirable for natural resource conservation has not been universally accepted by economists. For example, Fisher and Krutilla (1995) argue that an arbitrary reduction of the social discount rate is likely to result in more rapid extraction and wasteful use of natural resources. The mass balance principle, described by Ayres and Kneese (1969), also shows that high discount rates discourage more natural resources use than low discount rates do. Farzin (1984) shows that the discount rate has an ambiguous effect on the depletion period of an exhaustible resource under two situations: (i) backstop price is a function of the rate of time preference; and (ii) production is capital-intensive. Bulte and van Soest (1996) explain that under the circumstance of restricted supply (due to existence of timber concession contracts), depleting the primary stock of forests implies building a stock of secondary

---

1. Time preference is defined as the marginal rate of substitution between current and future consumption (Becker and Mulligan 1997). We use the terms “rate of time preference” and “discount rate” interchangeably, as did Poulos and Whittington (2000), Godoy et al. (1998), Becker and Mulligan (1997), and Olson and Bailey (1981).

2. In day-to-day decisions, people apply their time preference. In order to reflect this practice of use of time preference, future costs and benefits are discounted in project analysis. The social discount rate is also influenced by the opportunity cost of capital. See Zhuang et al. (2007) for a good discussion on the theory and practice of discounting.
forests. When this happens, as they argue, the impact of the rate of time preference on the primary forest stock is ambiguous. Price (1991) also claims that lowering the discount rate may actually promote short-term exploitation of forests.

Most of the above claims on the impact of time preference on natural resource use are based on theoretical models/arguments. When theory does not show clear direction of a relationship, empirical work may play an important role. However, empirical work that verifies the relationship between time preference and rate of natural resources use is limited. This lack of empirical tests on the impact of the rate of time preference on natural resource harvesting is more significant in developing countries where some of the important resources such as tropical rain forests are found. It is also important to note that most of the people living near such resources are either poor or extremely poor. Their survival often depends on continuous availability of such resources. In this study, we examine the relationship between individual rate of time preference (IRTP) and the harvest of forest resources by local communities.

Among the few empirical studies that attempted to estimate IRTP in developing countries, Poulos and Whittington (2000) use data on mortality reduction in Africa, Eastern Europe, and Asia. Holden et al. (1998) measure IRTP in Indonesia, Zambia, and Ethiopia using a stated preference survey. Reddy (1995) estimates IRTP using durable energy carrier choices in urban Indian households. Pender (1996) estimates the IRTP of rural villagers in southern India and relates this to credit markets. While these studies have estimated IRTP for various purposes in developing countries, the work of Godoy et al. (1998) is the only study that we know of that has estimated IRTP in developing countries in relation to forest resource use. Godoy et al. estimate the IRTP of peripheral villagers of Bolivian rainforests and relate it to the clearance of old growth forests. Their findings suggest that a higher IRTP is associated with less deforestation, which is contrary to common perception. Against this background, the objective of the present study is to test whether an individual with a higher rate of time preference harvests more forest resources, specifically, nontimber forest products (NTFP). Our findings show that individuals with a higher rate of time preference harvest more forest resources.

The rest of the paper is organized as follows. The second section discusses the importance of NTFP in managing protected rain forests and their contributions to poverty reduction. The third section describes the use of the survey method in eliciting the IRTP in the case study area of the Sinharaja forest. The fourth section presents the details of model specification and hypotheses of the study. The fifth section describes the study area, sampling, and data collection. Section six discusses the results of the study, and the final section presents conclusions and policy implications.

II. NONTIMBER FOREST PRODUCTS HARVESTING AND FOREST CONSERVATION

Nontimber forest products include a variety of products such as food (fruits, vegetables, yams, green leaves); game animals; medicinal plants; and raw materials for cottage industries (such as bamboo, rattan, resins, sugary saps). In the past, forest managers focused only on managing timber resources and, in effect, ignored the other forest products used by local communities. Work by Peters et al. (1989), de Beer and McDermott (1989), Panayotou and Ashton (1992), Godoy et al. (1993), and Gunatilake (1995), among other studies, showed the significance of NTFP in sustaining rural livelihoods and their potential role in the protection/destruction of biological diversity.
Loss of biodiversity is a cause for global concern. The major policy response of developing countries to this growing concern has been to designate more lands as protected areas (Ghimire 1994). There are more than 8,500 protected areas in the world today, which cover about 800 million hectares of land. A large portion of these protected areas is located in developing countries. Although developing countries have allocated forest land for protection, often due to various pressures from local and international interest groups, management of these sites has not been successful. One of the major problems faced in the management of protected areas in developing countries is resource use by local communities (Gunatilake 1998). For example, resource use by local communities is a major cause of the loss of closed canopy forests in Asia, rather than the commercial extraction of timber, as traditionally perceived (World Bank 1993).

Forest land clearance for agriculture by local communities accounts for part of the destruction of natural forests. Once the boundary of a protected forest is well established, forest clearing for agriculture becomes less feasible while NTFP extraction may continue (Gunatilake and Chakravorty 2002). Forest resource use by local communities is important due to a number of reasons. First, local communities have the closest physical contact with forests and have been using forest resources for generations. Second, local communities are adversely affected by resource use restrictions imposed by conservation projects (Gunatilake et al. 1993, Wells 1992, Panayotou 1994, Gunatilake 1995 and 1998, Shyamsundar and Kramer 1996). Third, local communities extract most of the NTFPs for their survival rather than for commercial uses. Fourth, there is a mismatch between what is considered as benefits from conservation by local communities and by conservationists. Finally, local communities may have little or no incentive for conservation because the benefits of rainforest conservation largely flow to national and global levels due to associated externalities (Tisdell 1995). Therefore, better understanding of the interactions between protected forests and rural communities living around them is crucial for the successful implementation of conservation projects.

Harvesting forest resources by local communities, as generally perceived, may be ecologically less destructive compared to clear felling of a forest for timber. However, there is continuing debate on the conditions necessary for sustainable harvest of nontimber forest resources and the extent to which such NTFP use affects conservation (Wells 1992, Homma 1992, Hanson 1992, Browder 1992, Godoy et al. 1995, Simpson 1995). Most of the assertions on the impact of forest resource use by local communities on biological diversity in the present debate are derived from logical arguments and historical reviews. Gunatilake (1998) argues for reduction of the dependency on NTFP as a conservation strategy. Given scientific uncertainties, practical difficulties, and the high cost of ecological monitoring required to ensure the sustainable use of NTFP by local communities, he proposes the reduction of dependency through rural development activities. This is seen as a more pragmatic and cost-effective approach to forest protection.

### III. ESTIMATION OF INDIVIDUAL RATE OF TIME PREFERENCE

In this paper, we estimate the IRTP using a stated preference survey among the peripheral villagers of the Sinharaja Man and Biosphere Reserve in Sri Lanka. We use a simple discounted utility model that is commonly used as the theoretical framework in estimating the IRTP. This model is adopted from Olson and Bailey (1981) and Poulos and Whittington (2000) and modified slightly to represent the study context.
A. Estimating the Individual Rate of Time Preference

Consider a representative villager living in the periphery of a protected forest. Assume that the individual’s utility function has one argument, which represents a composite commodity $C_t$.

$$U = \sum_{t=0}^{T} w_t U(C_t)$$  \hspace{1cm} (1)

where $T$ is the planning horizon of the individual, $w_t$ is the discount factor, and $C_t$ is the consumption at time $t$. We assume that utility is increasing at a decreasing rate with $C$, lifetime utility is additively separable, and the utility function is stable over time. The discount factor is a function of pure time preference $r$ and time $t$.

$$w_t = f(r, t)$$ \hspace{1cm} (2)

Consider two distinct time periods, 0 and T. Assume that the consumption level for all the periods except for time 0 and T are constant. At the individual’s point of indifference between marginal changes in consumption on the periods 0 and T

$$dU = U'(C_t)dC_t + f(r, T)U'(C_0)dC_0 = 0$$ \hspace{1cm} (3)

The right hand side of equation (4) shows how the individual trades off current and future consumptions in order to keep his/her utility constant. The rate at which future and current utilities are traded is equal to the discount factor. The discount factor is a function of the pure rate of time preference, $r$, and the intertemporal marginal rate of substitution. The second component represents diminishing marginal utility of future consumption arising due to future income increases (Olson and Bailey 1981).

Define:

$$\frac{1}{1+r^T} = -f(r, T) \cdot \frac{U'(C_t)}{U'(C_0)}$$ \hspace{1cm} (4)

In order to adapt the above general case to NTFP harvesting, assume that the utility function only has the NTFP income as an argument. Assume a villager is faced with a choice of NTFP income in two time periods, 0 and T. We can rewrite the utility function more precisely as,

$$U = U(I_0, I_T)$$ \hspace{1cm} (5)

If the individual is indifferent between NTFP income levels $I_0$ and $I_T$, the choice can be represented as:

$$U(I_0, 0) = f(r, T) \cdot U(0, I_T)$$ \hspace{1cm} (6)

Total differentiation of (7) provides:

$$U'(I_0) \cdot I_0 + f(r, T) \cdot U'(I_T) \cdot I_T = 0$$ \hspace{1cm} (7)

Rearranging the above results in:
Using the results of (5) and solving equation (9) for $r$ provides:

$$
\frac{I_0}{I_T} = -f(r,T) \cdot \frac{U'(I_T)}{U'(I_0)}
$$

Equation (10) shows that the IRTP can be estimated, if one can find the future income level ($I_T$) and current income ($I_0$) that can keep the individual's utility constant. Stated preference survey questions can be designed to elicit the indifference between a given current level of income and a future level of income.

### B. Elicitation Question

Loewenstein and Prelec (1992) identify four anomalies that commonly occur in eliciting the IRTP using stated preference questions: common difference effect, absolute magnitude effect, gain-loss asymmetry, and delay speed-up asymmetry. Preference between the two consumption adjustments should depend on the absolute time interval separating them. This is known as the stationarity property. Violation of the stationarity property is known as the common difference effect. Empirical studies on IRTP show that large money values suffer less proportional discounting than do small amounts. This effect is known as the absolute magnitude effect. Another behavior observed in previous studies is that losses are discounted at a lower rate than gains. This anomaly is known as the gain-loss asymmetry. Finally, the preferences of the intertemporal choices are asymmetric for speed-up or delaying consumption. When framing an elicitation question for IRTP, one needs to consider the above four anomalies.

In our study, we first conducted a survey on NTFP harvesting by household. While the survey was going on, the quantities of NTFP harvested were input into an Excel spreadsheet, which is programmed to provide the total value of NTFP. Then we asked the following elicitation question from the respondent:

The Forest Department (FD) has decided to completely stop NTFP collection in the Sinharaja forest for one year to allow recovery of the forest. FD will make a payment to each household in order to compensate for lost NTFP income during this year. The payment is equal to last-year’s value of NTFP. Your last-year NTFP income is $I_0$ and you will receive this amount from FD for not collecting NTFP from Sinharaja during the next year. However, due to administrative problems, the payment may be delayed. How much do you want the FD to pay you if the payment is made exactly after one year from the due date? $I_T$.

The question was repeated with different delaying times (years 1, 2, 3, 5, 10, and 15).

With this elicitation format, every individual gets a question with a different base value since NTFP income varies across households. These different base values allow us to isolate the impact of

---

3 Delaying consumption from year 1 to 5 should have the same impact as year 5 to 10. However the empirical studies show different time preferences in these types of cases despite the fact that absolute differences are the same.
absolute magnitude effect by incorporating the base value as an explanatory variable in the equation for determinants of IRTP. Varying time delays are used in the elicitation format to account for the common difference effect. We estimated the IRTP for each individual for the above six different time delays and took the average value as the IRTP of that individual in our analysis on the impact of IRTP on NTFP harvesting. However, the other two anomalies identified by Loewenstein and Prelec (1992) were not addressed by our eliciting format.

One reason for our inability to account for gain-loss asymmetry is the difficulty involved in interpreting the above format as a gain or loss. Collection of NTFP is always subjected to some uncertainty and involves laborious work. Therefore, villagers may consider that payment made by the FD, equivalent to NTFP value, as a gain. On the other hand, people collect a variety of products from the forest and this variety adds diversity to their lives. Certain NTFP may not have substitutes in the market. In that case, the above format may be interpreted as a loss, rather than a gain. Moreover, the next year may provide more NTFP due to natural fluctuations. In that case, income based on this year’s NTFP value may imply a loss. Despite this difficulty to interpret whether the above eliciting format represents a gain or a loss, we attempted a different format to represent a loss. In that format, the eliciting question was framed stating that the household should pay the value of collected NTFP to the FD to represent a loss. In the pre-testing stage we understood that the question was too sensitive and people did not accept the scenario that they should pay for the resources, which they have been using for generations. Pretesting indicated a large proportion of scenario rejection. Therefore, the elicitation format developed to represent loss of income was dropped.

Accounting for the speed/delay anomaly was also tried. However, it was felt that too many of these questions confuse the rural households. Respondent fatigue was observed during the pretesting with different formats in a sequence with the same respondent. Based on the focus group discussions and experience of pretesting, the above format was selected as the best eliciting format. One potential problem with our elicitation format is the hypothetical nature of the question. Many researchers such as Pender (1996), Holden et al. (1998), and Poulos and Whittington (2000) have estimated IRTP values in developing countries with hypothetical questions. In order to avoid the “hypothetical nature” problem, actual payments were made by some researchers (for example, Godoy et al. 1998, and Gunatilake and Chakravorty 2002). We did not attempt to use actual payments because our budget was inadequate to make such payments. Moreover, in actual payment studies, time delays will have to be limited to a few days or weeks, for practical reasons. If time delays are limited to a few days or weeks, the researcher would not be able to account for the common difference effect.

IV. HYPOTHESES AND MODEL SPECIFICATION

A. Determinants of IRTP

In this study we test two sets of hypotheses. The first set of hypotheses analyzes the determinants of IRTP. Table 1 presents the variables included in the IRTP equation and the expected relationships.
Table 1

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>EXPECTED RELATIONSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base value (X₁)</td>
<td>Negative</td>
</tr>
<tr>
<td>Respondent’s education (X₂)</td>
<td>Negative</td>
</tr>
<tr>
<td>Total household income (X₃)</td>
<td>Negative</td>
</tr>
<tr>
<td>Respondent’s age (X₄)</td>
<td>Negative</td>
</tr>
<tr>
<td>Risk perception (X₅)</td>
<td>Positive</td>
</tr>
</tbody>
</table>

(i) **Base Value.** As mentioned earlier, base value is included as an explanatory variable in order to account for the absolute magnitude effect. There is a tendency to discount future incomes at lower rates when the sums involved are large (Loewenstein and Prelec 1992). The study by Benzion et al. (1989) also shows that the IRTP is inversely related with the base value. Therefore, we assume that the rate of time preference is negatively related with the base value.

(ii) **Level of Education.** Education facilitates people to imagine the future vividly. Educated people have a better appreciation of future utility or benefits. Moreover, the level of education is assumed to increase income and consequently reduce poverty. Therefore, education reduces impatience, leading to lower rates of time preference (Becker and Mulligan 1997). It is hypothesized that IRTP is negatively related to the level of education.

(iii) **Household Income.** It is claimed that people who have higher income levels possess a lower rate of time preference than those with lower income levels (Becker and Mulligan 1997). Low-income groups are expected to be more impatient due to the great need for providing for current consumption as well as due to lack of self-control and foresight. Hausman (1979), Reddy (1995), and Holden et al. (1998) show consistent empirical evidence on the negative relationship between income and IRTP. The Poulos and Whittington (2000) study, however, does not show a strong relationship between IRTP and income. In this study we hypothesize income to be inversely related to IRTP.

(iv) **Age.** The effect of age on the rate of time preference is ambiguous. It is argued that older people have a lower rate of time preference than younger people due to the impatience of the young. Counter arguments suggest that older people tend to consume more at present than in the future due to the uncertainty of living longer. However, the need for leaving bequests prevents the aged from possessing extremely high IRTP (Boardman et al. 1996). According to Becker and Mulligan (1997), the younger and the older have similar rates of time preference. In this study, we assume that the rate of time preference is inversely related with the age of the respondent.

(v) **Risk Perception.** When the people’s existence, prevalence of similar preference for consumption in the future, and availability of benefits in the future are uncertain, people perceive that they would not be able to consume in the future. As a result, they tend to have a higher IRTP. According to Olson and Bailey (1981), uncertainty can affect positively or negatively the IRTP and it is to a large extent an empirical matter. They argue that risk aversion and absence of insurance markets for most goods may play a role in the...
determination of IRTP. Holden et al.’s results (1998) show that risk-averse people tend to have lower discount rates. In this study we assume that individuals’ perception on risk and IRTP are directly related.

B. Socioeconomic Determinants of NTFP Harvesting

The second set of hypotheses analyzes the socioeconomic determinants of NTFP harvesting in which the IRTP is one argument. Gunatilake (1998) and Gunatilake and Chakravorty (2002) have studied the determinants of NTFP extraction previously in the same study area. Our main objective is to study the impact of IRTP on NTFP harvesting, rather than determinants of NTFP harvesting. However, analysis on the determinants of NTFP harvesting is repeated in this study in order to avoid specification errors due to omitted variables in the second equation. Table 2 provides a summary of the variables and anticipated relationships.

Table 2

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>EXPECTED RELATIONSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of time preference ($Y_1$)</td>
<td>Positive</td>
</tr>
<tr>
<td>Level of education ($X_2$)</td>
<td>Negative</td>
</tr>
<tr>
<td>Agricultural income ($X_6$)</td>
<td>Negative</td>
</tr>
<tr>
<td>Other income ($X_7$)</td>
<td>Negative</td>
</tr>
<tr>
<td>Family size ($X_9$)</td>
<td>Positive</td>
</tr>
<tr>
<td>Distance to forest ($X_{10}$)</td>
<td>Negative</td>
</tr>
<tr>
<td>Male–female ratio ($X_{11}$)</td>
<td>Positive</td>
</tr>
<tr>
<td>Index for market incorporation ($X_{12}$)</td>
<td>Positive</td>
</tr>
</tbody>
</table>

(i) **IRTP.** It is claimed that the greater the rate of time preference, the higher is the rate of resource use. Persons with high rates of time preference are more impatient compared to those with low rates of time preference. The more impatient persons extract more resources at present relative to less impatient persons. Gunatilake and Chakravorty (2002) show, using a theoretical model, that villagers with a higher time preference harvest more NTFP. In this study, we assume a positive relationship between IRTP and quantity of NTFP harvested.

(ii) **Level of Education.** As pointed out by Anderson (1992), NTFP harvesting requires low levels of capital and also brings low economic returns. There is evidence indicating that higher wages in the rural community result in less dependency on forest resources (Bluffstone 1995, Dufoumaud et al. 1995, Kerkvliet and Nebesky 1997, Gopalakrishnan et al. 2005). Higher education enables earning higher wages. Moreover, individuals with high opportunity costs of labor show less interest in forest extraction relative to those with low opportunity costs. Therefore, level of education is assumed to be inversely related to the quantity of NTFP harvested.

(iii) **Agricultural Income.** Gunatilake and Chakravorty (2002), using a model of competitive time allocation between forestry and agriculture, show that higher agricultural prices
lead to the harvesting of decreased quantities of NTFP. Agricultural income is a proxy for agricultural prices. Therefore, in this study we hypothesize that agricultural income is inversely related to NTFP harvesting.

(iv) Nonagricultural and Nonforest Income. Assume that a household allocates its total available time among forest-gathering activities, agriculture, and other economic activities. The more time it allocates for other economic activities leaves less time available for forest-resource harvesting and agriculture. In such a competitive time allocation framework, the dependency on the forest is assumed to decrease with the availability of income from other sources (Gunatilake and Gopalakrishnan 2002). As people become rich with higher levels of other income, they tend to veer away from subsistence economic activities such as gathering NTFP and shifting cultivation (Godoy and Bawa 1993, Gunatilake et al. 1993, Godoy et al. 1995). Moreover, working for nonagricultural and nonforest income occupies the people throughout the year, which leaves less or no time for forest-resource gathering activities (Gunatilake 1998). Therefore, it is hypothesized that income other than from agriculture and forestry is inversely related to NTFP harvesting.

(v) Extent of Homestead. Homestead is supposed to be an alternative source for forest products because it has the potential of providing forest products such as fuel wood, greens, spices and some vegetables, yams, etc. Therefore, it is hypothesized that NTFP harvesting is inversely related to the extent of homestead.

(vi) Family Size. If a family has more members, it needs extra income to support extra subsistence requirements. On the other hand, larger families may have more labor available for forest resource gathering. Hence, larger families can allocate more labor for NTFP harvesting in order to fulfill additional requirements (Gunatilake and Gopalakrishnan 2002). Accordingly, we hypothesize that NTFP harvesting is directly related to family size.

(vii) Distance to the Forest. Households residing close to the forest require less time to reach NTFP sources, compared to those residing far away. In previous studies, Gunatilake (1998) and Gunatilake and Chakravorty (2002) show a negative relationship between NTFP harvesting and distance to the forest. In this study, we also hypothesize that distance to the forest is inversely related to NTFP harvesting.

(viii) Male–Female Ratio. Composition of the NTFP varies from site to site. Depending on the tradition of division of labor and composition of NTFP, the male–female ratio can have a positive or negative relationship with NTFP gathering. In the Sinharaja area, males seem to be involved in many forest-based activities. Among the forest-based activities in the study area, males generally carry out Kithul tapping, trapping and hunting wild animals, collecting materials for weaving baskets, and collecting food items. Consequently, a family with more males is supposed to extract more forest products relative to a family with few males. Therefore, it is hypothesized that NTFP harvesting is directly related to the male–female ratio in a family.

(ix) Market Incorporation. Integration of remote villages with outside markets through better infrastructure may affect NTFP harvesting in different ways. One argument is that outside markets provide many opportunities for income-generating activities. Therefore, market incorporation reduces dependency on forest resources. Browder (1992) and Godoy and

\[4\] The flower of the Kithul palm tree is tapped for its sugary sap.
Bawa (1993) assert that people living far away from markets may deplete forest resources. A counter argument is that when rural communities are linked with outside markets, it provides avenues for harvesting NTFP for commercial purposes. Compared to subsistence uses, commercial uses may lead to the harvesting of more NTFP and lead to quicker forest resource depletion. In this study, we hypothesize that the rate of forest resource harvesting is directly related to the integration of rural communities with outside markets.

The above-described two sets of hypotheses were tested using two regression equations for IRTP and NTFP harvesting. The dependent variable in the IRTP equation is an independent variable in the NTFP equation. This may cause simultaneity bias if these equations are estimated as single equations. A closer look at the equations shows that they represent a recursive system. However, the simultaneity test (Hausman test) indicates the presence of simultaneous bias. Therefore, we estimated the equations as a system. We used order and rank conditions as described by Greene (2000) to identify the equation and our analysis shows that equations are overidentified. Therefore, we used two-stage least squares method to estimate the equations simultaneously.

V. SAMPLING, DATA COLLECTION, AND MEASUREMENT OF VARIABLES

The Sinharaja Man and Biosphere reserve is a lowland rainforest located in southern Sri Lanka. The biological richness of Sinharaja has drawn the attention of the national and international community. It was declared as a Man and Biosphere Reserve in 1978 by the United Nations Educational, Scientific and Children’s Organization, which also recognized the Sinharaja as a World Heritage Site in 1988. The Sinharaja is the only remaining relatively large (11,000 hectares) and less disturbed lowland tropical rainforest in Sri Lanka. Nine of the 15 floristic regions in the country are located in the Sinharaja. Ninety-five percent of the endemic birds and 70% of the endemic woody plants are said to exist in the Sinharaja (Gunatilleke and Gunatilleke 1980). There is a considerably large forest-dependent community living around the forest. McDermott et al. (1990) have identified 223 plant species, which are of some use to villagers. The biological richness and the long-lasting forestry–people interactions existing in the Sinharaja, thus make it an ideal site for empirical verification of the hypotheses described earlier in this paper.

The property right of a forest resource affects the IRTP of resource users. For example, Hardin’s “tragedy of the commons” (1968) occurs in an open-access situation and that the implied IRTP in this situation is infinite (Pender 1996). The government owns the Sinharaja forest and NTFP extraction was legally prohibited by early legislation. The Sri Lanka Forestry Sector Master Plan (Ministry of Forestry and Environment 1995) recommended allowing local communities to use NTFP from protected forests in Sri Lanka. Since then the FD adopted a lenient attitude toward NTFP use by local communities, though it does not actively promote the use of NTFP in the Sinharaja. The FD issues permits for tapping Kithul trees in the forest. There are a number of nongovernmental organizations working in the area promoting the marketing and processing of some NTFP and cottage industries using NTFP. Other projects involve enrichment planting of selected NTFP in the buffer zone of the forest with community participation. Given all these activities in the community, some form of community management regime for forest resources seems to be evolving. Therefore, a de facto open-access extractive reserve, often developed with government ownership, does not prevail in the Sinharaja forest.

The study was conducted in peripheral villages of five forest patches newly added to the Sinharaja protected area. They are Delwala and Walankanda forests in Ratnapura district, Runakanda
forest in Kalutara district, Dellawa forest in Galle district, and Diyadawa forest in Matara district. In selecting the sample, socioeconomic profiles were prepared for 17 Gramasevaka (GS) divisions (lowest administrative unit in Sri Lanka) adjoining the selected forest patches using rapid rural appraisal methods. The total number of forest-dependent households in these GS divisions was identified to be 1,909 in the 17 GS divisions. A sample of 180 forest-dependent households (9.4%) was selected from the population. The sample was stratified using the GS divisions. The number of households per GS division was determined by considering the proportion of forest-dependent families in the GS division. Random number tables were used to select the predetermined number from forest-dependent households of each GS division. Appendix 1 provides the details of the sample distribution.

A member of each household who is mainly responsible for household decisions was interviewed. The survey was conducted in May, July, and August 2000. The questionnaire was pretested and a number of focus group discussions were held before conducting the survey. The information collected included socioeconomic data such as age, education level of the respondent, total household income, number of family members, nontimber forest product extraction during the last year, and the respondent’s personal perception of risk for extraction of resources from the natural forest.

People extract different kinds of products from the forest. The NTFP harvesting equation for each product involves a large number of regression equations. Since the households collect different combinations of products, there are no adequate data points to estimate a regression equation for each product. This motivated us to aggregate different NTFP to a single quantity index. The quantity index for collected goods was prepared by using the following formula:

\[
Q_i = \frac{\sum_{j=1}^{k} p_j \cdot x_{ij}}{P}, \quad j=1,...,k
\]

(11)

where \(Q_i\) is the quantity index of NTFP for the ith household and \(P\) is the average price of the NTFP.

\[
P = \frac{\sum_{i=1}^{n} \sum_{j=1}^{k} p_{ij} \cdot x_{ij}}{\sum_{i=1}^{n} \sum_{j=1}^{k} x_{ij}}, \quad i=1,..,n, \quad j=1,...,k
\]

(12)

Calculation of the NTFP quantity index requires prices of all the forest species gathered by the villagers. Some NTFPs enter the market exchange process while other NTFPs never enter the market. The latter category is pure subsistence NTFP for which market prices do not exist. The presence of subsistence forest commodities poses a problem in their valuation. This study values NTFP using forest gate prices as the base following Godoy et al. (1993) and Gunatilake et al. (1993). When a product does not have a forest gate price, but does have a price at a nearby town, such prices were used to value NTFP after deducting the cost of transport and opportunity cost of time. If the product is transported manually, only the opportunity cost of time was deducted from the market price. When a product does not have a price both at the village and nearby town, the price of a close substitute was used as a proxy. Certain NTFPs have neither prices (in the villages or in nearby towns) nor close substitutes. In such cases, the contingent valuation method was used to value these NTFPs. Only few products fall into this category and an open-ended willingness-to-pay question was asked from randomly selected individuals to find the values.
The level of education of each household was also ranked according to attainment. The lowest rank (1) was for no schooling and the highest rank (7) was for people with university degrees. When the household income data were collected, the annual income of every family member (except separately living members) was included. This comprises agricultural income and nonagricultural income (wage labor, Kithul tapping in nonforest lands, cinnamon bark processing, brick making, carpentry, etc.). Risk perception was measured according to the respondent’s answer to the question “How long do you think you can collect NTFPs from the Sinharaja forest?” If the individual feels that he/she can harvest NTFPs for a long period in the future, risk perception was inferred to be low. Risk perception was ranked (1–6) according to the inverse of the length of time period. A market incorporation index was prepared based on the same approach used by Gunatilake (1998) in a previous study. The components of the index are distance to the nearest town; walking distance to get a bus; frequency of bus transport to the village and other facilities available in the village, such as cooperative shop, school, a subpost office, medical center, and rural bank (see Appendix 2). The information regarding availability of these facilities in each GS division was collected from the Grama Niladhari (Village Headman) of the division.

VI. RESULTS AND DISCUSSION

Out of 180 observations, 175 were included in the analysis. Five observations were excluded from the sample due to inconsistent answers to the IRTP elicitation question. The estimated IRTP values for different time periods are given in Table 3. According to the results, the villagers discount future consumption at an average rate of 24%. This is above the existing market rate of interest for bank loans (18.5%). This higher rate can be partly due to the existing poverty of the people engaged in forest products collection. Also, the ranges suggest that under each category of delay in consumption, there is a large variation. As shown in Figure 1, the IRTP values show a clear trend of decline with the increasing delayed time periods. This trend is due to the existence of the common difference effect. Horowitz (1988) and Benzion et al. (1989) have also found a similar pattern of declining IRTP with increasing delayed time periods.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>ESTIMATED RATES OF TIME PREFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Consumption Delay (years)</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Average</td>
<td>0.34</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.19</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.90</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.03</td>
</tr>
</tbody>
</table>

The behavior of the IRTP over different income groups is also depicted in Figure 1. During the first three years, the highest IRTP values are shown by the second lowest income group ($520–781), while the highest income group (> $1,823) holds the lowest IRTP over the years. Generally, the results indicate that IRTP declines when income increases. Every income group behaves almost similarly in valuing future benefits over time when consumption is delayed by different time periods. Further,
Figure 1 indicates that the gaps of IRTP among income groups become narrower when the delayed time period increases. The reason for this behavior may be the declining ability to imagine future benefits or costs when they occur in the far distant future (Becker and Mulligan 1997).

![Figure 1](image)

As discussed earlier, the impact of time preference on NTFP extraction was investigated by means of a simultaneous equation model. The descriptive statistics of the variables of these two equations are presented in Table 4. IRTP values in the table are the averages of each individual’s IRTP over different delayed time periods.

In this study, it was hypothesized that the extent of homestead affects NTFP extraction. Home gardens in the study area, however, do not represent agro-forestry systems as perceived. People in the study area cultivate tea, cinnamon, pepper, coconut, and other perennial agricultural crops mainly as monocultures. In the study area, therefore, homesteads do not produce substitutes for forest products. Because of this reason, the extent of homestead was excluded from the NTFP harvesting model. Correlation matrices obtained from two ordinary least squares regression models were used to check for multicollinearity. The correlation matrices of the variables of the two models presented in Appendix 3 shows that there is no strong correlation among variables. Both equations were specified as log linear models. A number of diagnostic tests indicated the presence of heteroscedasticity. Since the two-stage least square procedure does not have the built-in capacity to run for heteroscedastic models, the data were first corrected for heteroscedasticity using the weighted least squares method.
Table 4

Descriptive Statistics of the Variables Used in Regression Analysis

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>AVERAGE</th>
<th>STANDARD DEVIATION</th>
<th>MAXIMUM</th>
<th>MINIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y2 - Quantity index of NTFP (kg)</td>
<td>4889.48</td>
<td>6942.43</td>
<td>37992.61</td>
<td>88.97</td>
</tr>
<tr>
<td>Y1 - Average IRTP</td>
<td>0.24</td>
<td>0.12</td>
<td>0.70</td>
<td>0.03</td>
</tr>
<tr>
<td>X1 - Base value ($)</td>
<td>306.00</td>
<td>475.00</td>
<td>3125.00</td>
<td>5.00</td>
</tr>
<tr>
<td>X2 - Education</td>
<td>2.55</td>
<td>1.03</td>
<td>6.00</td>
<td>1.00</td>
</tr>
<tr>
<td>X3 - Total income ($)</td>
<td>1175.00</td>
<td>864.00</td>
<td>5675.00</td>
<td>0.00</td>
</tr>
<tr>
<td>X4 - Age of respondent (year)</td>
<td>45.45</td>
<td>11.70</td>
<td>87.00</td>
<td>18.00</td>
</tr>
<tr>
<td>X5 - Risk perception</td>
<td>3.43</td>
<td>1.51</td>
<td>6.00</td>
<td>1.00</td>
</tr>
<tr>
<td>X6 - Agric. Income ($)</td>
<td>683.00</td>
<td>761.00</td>
<td>4413.00</td>
<td>0.00</td>
</tr>
<tr>
<td>X7 - Other income ($)</td>
<td>492.00</td>
<td>553.00</td>
<td>3250.00</td>
<td>0.00</td>
</tr>
<tr>
<td>X8 - Homestead extent (ha)</td>
<td>0.26</td>
<td>0.27</td>
<td>1.60</td>
<td>0.00</td>
</tr>
<tr>
<td>X9 - No. of family members</td>
<td>4.71</td>
<td>1.73</td>
<td>10.00</td>
<td>1.00</td>
</tr>
<tr>
<td>X10 - Distance to forest (km)</td>
<td>0.77</td>
<td>0.93</td>
<td>4.80</td>
<td>0.002</td>
</tr>
<tr>
<td>X11 - Male-female ratio</td>
<td>1.37</td>
<td>0.87</td>
<td>5.00</td>
<td>0.00</td>
</tr>
<tr>
<td>X12 - Market incorporation index</td>
<td>23.53</td>
<td>9.00</td>
<td>50.30</td>
<td>12.25</td>
</tr>
</tbody>
</table>

As mentioned earlier, the simultaneity hypothesis was tested using the Hausman test (Greene 2000). As equations were unidirectional, time preference equation was used to find the estimated residuals and estimated rate of time preference. Then, the ordinary least squares method was used to estimate NTFP harvesting after substituting the estimated values in the equation. T-statistics for the estimated residual indicates that the residual is significant at 0.01 level. Thus, the simultaneity assumption was not rejected. Moreover, the models were checked to determine whether their residuals are contemporaneously correlated. For this, the residual of each model was estimated and they were regressed using the ordinary least squares method. The residuals’ correlated matrix indicates that errors are not correlated (see Appendix 4). As the residuals of the models are not correlated, models are not contemporaneously correlated in disturbances. Therefore, a seemingly unrelated regression model is not appropriate for this analysis.

The estimated model for determinants of time preference is presented in Table 5. The coefficient of determination ($R^2$) of the model is 0.7859. Adjusted $R^2$ is 0.7828. The small difference between two $R^2$ values indicates that there are an adequate number of observations in the model given the number of dependent variables. The model explains 78.28% of the variation of the individual rate of time preference in the peripheral community of the Sinharaja forest.
### Table 5
**Determinants of IRTP**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>COEFFICIENT</th>
<th>STANDARD ERROR</th>
<th>T-RATIO</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base value</td>
<td>-5.87E-02</td>
<td>2.11E-02</td>
<td>-2.775</td>
<td>0.006**</td>
</tr>
<tr>
<td>Education level</td>
<td>-9.06E-02</td>
<td>7.74E-02</td>
<td>-1.170</td>
<td>0.242</td>
</tr>
<tr>
<td>Total income</td>
<td>-2.90E-02</td>
<td>1.57E-02</td>
<td>-1.847</td>
<td>0.065*</td>
</tr>
<tr>
<td>Age</td>
<td>-0.22354</td>
<td>6.95E-02</td>
<td>-3.218</td>
<td>0.001**</td>
</tr>
<tr>
<td>Risk perception</td>
<td>0.21191</td>
<td>5.84E-02</td>
<td>3.630</td>
<td>0.000**</td>
</tr>
<tr>
<td>Intercept</td>
<td>-1.76E-04</td>
<td>3.12E-02</td>
<td>-5.65E-03</td>
<td>0.995</td>
</tr>
</tbody>
</table>

**Significant at 0.05 level.
*Significant at 0.1 level.

The results indicate that the impact of the base value on time preference is negative and statistically significant at 0.05 level. The education-level variable in the estimated model indicates an inverse relationship with rate of time preference as expected. But, it does not show a statistically significant relationship. This result may be due to the inadequate variation of the education variable in the sample. According to the survey results, majority (53.3%) of the respondents have attended grades 1 to 5. About 81.5% of the respondents belong to three categories (ranks 1, 2, 3) according to the rank assigned for different education levels.

The regression results show that age is positively related to IRTP and it is statistically significant at 0.05 level. Risk perception of individuals shows a positive relationship to IRTP as hypothesized and it is statistically significant at 0.05 level. A noteworthy finding on the determinants of IRTP is the statistically significant negative impact of income. This result reflects that the poor individuals have high rate of time preference, confirming previous findings by Hausman (1979), Reddy (1995), and Holden et al. (1998). The overall results of the determinants of IRTP analysis show that our IRTP estimation is reliable; and hence is suitable for examining our main hypothesis—positive relationship between IRTP and rate of NTFP harvesting.

The results of the estimated NTFP extraction model are presented in Table 6. The R² of this model is 0.8469. Adjusted R² is 0.8433. The two R² values show a small difference indicating the adequacy of the sample size, given the number of dependent variables. The model explains 84.33% of variation of the NTFP harvesting by the peripheral community of the Sinharaja forest.
Table 6
RESULTS OF NTFP HARVESTING MODEL

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>COEFFICIENT</th>
<th>STANDARD ERROR</th>
<th>T-RATIO</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of time preference</td>
<td>2.7121</td>
<td>0.590</td>
<td>4.597</td>
<td>0.000**</td>
</tr>
<tr>
<td>Education level</td>
<td>2.65E-02</td>
<td>0.297</td>
<td>8.94E-02</td>
<td>0.929</td>
</tr>
<tr>
<td>Agricultural income</td>
<td>-2.75E-02</td>
<td>3.15E-02</td>
<td>-0.8747</td>
<td>0.382</td>
</tr>
<tr>
<td>Other income</td>
<td>-7.88E-02</td>
<td>2.48E-02</td>
<td>-3.179</td>
<td>0.001**</td>
</tr>
<tr>
<td>Family size</td>
<td>0.51842</td>
<td>0.285</td>
<td>1.819</td>
<td>0.069*</td>
</tr>
<tr>
<td>Distance to forest</td>
<td>-0.14825</td>
<td>6.58E-02</td>
<td>-2.252</td>
<td>0.024**</td>
</tr>
<tr>
<td>Male-female ratio</td>
<td>0.38726</td>
<td>0.2057</td>
<td>1.883</td>
<td>0.060*</td>
</tr>
<tr>
<td>Market incorporation index</td>
<td>0.98778</td>
<td>0.2917</td>
<td>3.386</td>
<td>0.001**</td>
</tr>
<tr>
<td>Intercept</td>
<td>4.2662</td>
<td>0.8838</td>
<td>4.827</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

**Significant at 0.05 level.
*Significant at 0.1 level.

The most important finding in the NTFP harvesting model is that the rate of time preference positively affects forest resource harvesting. The relationship is statistically significant at 0.05 level. This result agrees with the theoretical expectations regarding time preference and resource extraction. Our finding is, however, different from that of Godoy et al. (1998), owing to different contexts. Our study examines the relationship between IRTP and harvesting nontimber forest products (NTFP) from a protected forest whereas Godoy et al. focus on forest land clearance. In the case of forest land clearance, impatient individuals clear secondary forests, which does less harm to virgin forests. Godoy et al. cast doubt on the positive relationship between IRTP and forest resource depletion. Availability of two types of forests for clearance and the differential impacts of clearance of these two types make their case quite different from ours. Therefore, our results do not directly contradict Godoy et al.’s findings.

The other results in this model have been shown earlier (see for example, Gunatilake 1998; Gunatilake and Chakravorty 2002). Except for a few variables, the results confirm previous findings. Therefore, we briefly discuss the rest of the results of the NTFP harvesting model. Nonagricultural and nonforest income shows the expected relationship to NTFP harvesting with statistical significance. Family size and male–female ratio show the expected positive relationship to NTFP harvesting (at 0.1 significance level) as hypothesized. These results indicate that forest extraction activities are male-dominant and larger families extract more NTFP in the study area. Distance to the forest also shows the negative impact on NTFP harvesting as expected.

Education does not show any statistically significant relationship to NTFP harvesting. As mentioned earlier, this result may be due to inadequate variation found in the education variable. Agricultural income also does not show the expected relationship to NTFP harvesting. In this case, the expected negative relationship arises due to competitive time allocation between agriculture and forest resource extraction. However, if forest resource harvesting occurs during the off-season of agriculture, this relationship may not hold. Our data do not show such a pattern of time allocation and hence this is a matter that needs further investigation. Market incorporation shows a positive
relationship to NTFP harvesting. In a previous study, Gunatilake and Gopalakrishnan (2002) show a negative relationship between these variables. Theory tells us that this relationship can be positive or negative. The available empirical evidence is also inconclusive. Therefore, further empirical research on this aspect is warranted.

VII. CONCLUSIONS AND POLICY IMPLICATIONS

We estimated the IRTP of the peripheral villagers of the Sinharaja Forest Reserve in order to examine the impact of IRTP on NTFP harvesting. A stated preference survey question was used to estimate IRTP and special attention was paid to account for the possible anomalies occurring in such studies. Average IRTP was estimated at 24%, which is higher than the existing market rate of borrowing at the time of investigation. Determinants of the IRTP were assessed using a regression model. Results show that family income and base value are negatively related to IRTP while risk perception and age are positively related to the IRTP. IRTP declines as the time delay in consumption increases for all income groups. This has been observed in many previous researches on IRTP.

The realistic IRTP values and confirmation of their relationships to determinants with theoretical expectations show that our IRTP estimates are reliable. The average IRTP values over different time delays were incorporated in the NTFP harvesting model. Results show that people with higher IRTP extract more NTFP. Thus the paper shows, with rigorous analysis, that a higher rate of time preference of individuals causes depletion of forest resources.

The paper brings out a number of policy implications. The most significant is the importance of poverty reduction in local communities for effective forest conservation. As discussed earlier, NTFP extraction may become a serious problem in managing protected forests. It is more difficult to find policy tools for managing NTFP harvesting when poor people live near nature reserves and depend on forest resources for livelihood. Under such circumstances, the challenge is to find policy interventions that address both poverty reduction and nature conservation at the same time. Poor individuals have higher discount rates; they do not prefer to wait for long-term benefits of forest conservation. Increasing incomes and enhancing socioeconomic endowments in the short term, preferably through appropriate rural development activities, reduces the direct need to harvest NTFP. In the long run, poverty reduction will have its indirect impact on forest conservation through reduction of IRTP. Therefore, a long-term strategy for nature reserve protection (or conservation management) would require poverty reduction, among other measures.
## Appendix 1

**Sample Distribution**

<table>
<thead>
<tr>
<th>Forest Reserve</th>
<th>Gramasevaka Division</th>
<th>Number of Families</th>
<th>Number of Families Using Forest Resources</th>
<th>Number of Selected Families</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delwala</td>
<td>Delwala</td>
<td>1315</td>
<td>500</td>
<td>47</td>
</tr>
<tr>
<td>Walankanda</td>
<td>Rambuka</td>
<td>483</td>
<td>187</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Thanabela</td>
<td>261</td>
<td>220</td>
<td>21</td>
</tr>
<tr>
<td>Runakanda</td>
<td>Diganna</td>
<td>216</td>
<td>150</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Thiniyawala</td>
<td>634</td>
<td>75</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Batagodawila</td>
<td>275</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Kalukandawa</td>
<td>46</td>
<td>40</td>
<td>4</td>
</tr>
<tr>
<td>Dellawa</td>
<td>Pahalamillawa</td>
<td>292</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ihalamillawa</td>
<td>140</td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Happitiya</td>
<td>226</td>
<td>95</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Miyanawatura</td>
<td>105</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>Diyadawa</td>
<td>Kotapola-North</td>
<td>540</td>
<td>100</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Deniyaya-West</td>
<td>325</td>
<td>150</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Pallegama-South</td>
<td>538</td>
<td>72</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Pussawela</td>
<td>268</td>
<td>100</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Deniyaya</td>
<td>570</td>
<td>40</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Beliattakumbura</td>
<td>318</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1909</strong></td>
<td><strong>180</strong></td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX 2
### DATA USED TO DEVELOP MARKET INCORPORATION INDEX

<table>
<thead>
<tr>
<th>Gramasevaka Division</th>
<th>Distance to Nearest Town (km)</th>
<th>Walking Distance to Get a Bus (km)</th>
<th>Frequency of Bus Transport (Visit/Day)</th>
<th>Other Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Co-operative Shop</td>
</tr>
<tr>
<td>Delwala FR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delwala</td>
<td>12</td>
<td>2</td>
<td>12</td>
<td>A</td>
</tr>
<tr>
<td>Uda-delwala</td>
<td>14</td>
<td>2</td>
<td>7</td>
<td>A</td>
</tr>
<tr>
<td>Walankanda FR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rambukagama</td>
<td>13</td>
<td>0.75</td>
<td>20</td>
<td>A</td>
</tr>
<tr>
<td>Yatantenna</td>
<td>12.8</td>
<td>0.75</td>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>Kajugawatta</td>
<td>12.5</td>
<td>0.75</td>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>Kopikella</td>
<td>13</td>
<td>1.50</td>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>Pandeniya</td>
<td>12.3</td>
<td>0.75</td>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>Thanabela</td>
<td>25</td>
<td>3.5</td>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>Thebugala</td>
<td>25</td>
<td>1</td>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>Runakanda FR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diganna</td>
<td>11</td>
<td>3.5</td>
<td>25</td>
<td>NA</td>
</tr>
<tr>
<td>Thiniyawala</td>
<td>8</td>
<td>2</td>
<td>8</td>
<td>A</td>
</tr>
<tr>
<td>Batagodawila</td>
<td>12</td>
<td>1.6</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Kalukandawa</td>
<td>23</td>
<td>6.4</td>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>Dellawa FR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ihalamillawa</td>
<td>8</td>
<td>8</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Pahalamillawa</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>A</td>
</tr>
<tr>
<td>Happitiya</td>
<td>7</td>
<td>0.5</td>
<td>14</td>
<td>NA</td>
</tr>
<tr>
<td>Miyanawatrya</td>
<td>16</td>
<td>3</td>
<td>14</td>
<td>NA</td>
</tr>
<tr>
<td>Diyadawa FR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kotapola North</td>
<td>3</td>
<td>0.4</td>
<td>100</td>
<td>A</td>
</tr>
<tr>
<td>Deniyaya West</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td>A</td>
</tr>
<tr>
<td>Pallegama South</td>
<td>4</td>
<td>0.8</td>
<td>24</td>
<td>A</td>
</tr>
<tr>
<td>Pussawela</td>
<td>8</td>
<td>0.5</td>
<td>24</td>
<td>NA</td>
</tr>
<tr>
<td>Deniyaya</td>
<td>0.25</td>
<td>0.25</td>
<td>100</td>
<td>A</td>
</tr>
<tr>
<td>Beliattakumbura</td>
<td>9</td>
<td>1.6</td>
<td>24</td>
<td>NA</td>
</tr>
</tbody>
</table>

FR means forest reserve; NA means not available; A means available.

Note: Numbers within parenthesis indicate the highest grade available in the school.
APPENDIX 3
TESTS FOR MULTICOLLINEARITY

Table A3.1
CORRELATION MATRIX OF VARIABLES OF TIME PREFERENCE MODEL

<table>
<thead>
<tr>
<th></th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>Y1</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>-3.66E-02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2</td>
<td>-0.11493</td>
<td>-5.49E-02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X3</td>
<td>-9.12E-02</td>
<td>-5.34E-02</td>
<td>0.11374</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X4</td>
<td>-1.46E-02</td>
<td>-5.07E-02</td>
<td>-0.20386</td>
<td>-2.33E-02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X5</td>
<td>0.14932</td>
<td>4.95E-02</td>
<td>-5.82E-02</td>
<td>2.13E-02</td>
<td>0.10388</td>
<td></td>
</tr>
</tbody>
</table>

Table A3.2
CORRELATION MATRIX OF VARIABLES OF NTFP MODEL

<table>
<thead>
<tr>
<th></th>
<th>Y1</th>
<th>X2</th>
<th>X6</th>
<th>X7</th>
<th>X9</th>
<th>X10</th>
<th>X11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y1</td>
<td>9.93E-02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2</td>
<td>-1.52E-02</td>
<td>-0.11493</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6</td>
<td>-1.62E-02</td>
<td>-5.98E-02</td>
<td>6.12E-02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X7</td>
<td>-0.1728</td>
<td>-6.01E-02</td>
<td>9.35E-02</td>
<td>-0.16546</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X9</td>
<td>3.11E-02</td>
<td>0.15973</td>
<td>-0.13932</td>
<td>0.19058</td>
<td>0.19222</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X10</td>
<td>-0.11236</td>
<td>-1.09E-03</td>
<td>-4.46E-03</td>
<td>-7.51E-02</td>
<td>8.85E-02</td>
<td>0.1088</td>
<td></td>
</tr>
<tr>
<td>X11</td>
<td>4.38E-02</td>
<td>4.04E-02</td>
<td>-3.66E-02</td>
<td>0.10909</td>
<td>3.71E-02</td>
<td>0.10547</td>
<td>-1.29E-02</td>
</tr>
<tr>
<td>X12</td>
<td>-0.10017</td>
<td>0.11535</td>
<td>-2.16E-02</td>
<td>-0.15806</td>
<td>0.16612</td>
<td>2.05E-02</td>
<td>-6.12E-02</td>
</tr>
</tbody>
</table>

Y2   Y1   X2   X6   X7   X9   X10   X11
APPENDIX 4
TEST FOR SIMULTANEITY AND CONTEMPORANEOUS CROSS CORRELATION

APPENDIX Table 4.1
HAUSMAN TEST RESULTS

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>COEFFICIENT</th>
<th>STANDARD ERROR</th>
<th>T-ratio</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average IRTP</td>
<td>-86728.0000</td>
<td>8131.0000</td>
<td>-10.67</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual of time preference</td>
<td>8021.3000</td>
<td>787.5000</td>
<td>10.19</td>
<td>0.000</td>
</tr>
<tr>
<td>model</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td>-951.9700</td>
<td>149.4000</td>
<td>-6.37</td>
<td>0.000</td>
</tr>
<tr>
<td>Agricultural income</td>
<td>-0.01888</td>
<td>0.00225</td>
<td>-8.40</td>
<td>0.000</td>
</tr>
<tr>
<td>Other income</td>
<td>-0.03547</td>
<td>0.00281</td>
<td>-12.63</td>
<td>0.000</td>
</tr>
<tr>
<td>Number of family members</td>
<td>346.7700</td>
<td>86.4500</td>
<td>4.01</td>
<td>0.000</td>
</tr>
<tr>
<td>Distance to forest</td>
<td>-716.5500</td>
<td>81.3900</td>
<td>-8.80</td>
<td>0.000</td>
</tr>
<tr>
<td>Male–female ratio</td>
<td>239.5600</td>
<td>119.1000</td>
<td>2.01</td>
<td>0.044</td>
</tr>
<tr>
<td>Index to open market</td>
<td>-49.8480</td>
<td>8.3440</td>
<td>-5.97</td>
<td>0.000</td>
</tr>
<tr>
<td>Constant</td>
<td>31484.0000</td>
<td>2585.0000</td>
<td>12.18</td>
<td>0.000</td>
</tr>
</tbody>
</table>

IRTP means individual rate of time preference.

APPENDIX Table 4.2
RESIDUAL CORRELATION MATRIX

<table>
<thead>
<tr>
<th></th>
<th>E1</th>
<th>E2</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>3.78E-02</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: E1 is the residual of time preference model; E2 is the residual of nontimber forest products model.
REFERENCES


H. M. Gunatilaka, W. A. R. Wickramasinghe, and P. Abeygunawardena

August 2007

22


No. 68 Local Currency Financing—The Next Frontier for MDBs?
   —Tobias C. Hoschka, April 2005
No. 69 Export or Domestic-Led Growth in Asia?
   —Jesus Felipe and Joseph Lim, May 2005
No. 70 Policy Reform in Viet Nam and the Asian Development Bank's State-owned Enterprise Reform and Corporate Governance Program Loan
   —George Abonyi, August 2005
No. 71 Policy Reform in Thailand and the Asian Development Bank's Agricultural Sector Program Loan
   —George Abonyi, September 2005
No. 72 Can the Poor Benefit from the Doha Agenda? The Case of Indonesia
   —Douglas H. Brooks and Guntur Sugiyarto, October 2005
No. 73 Impacts of the Doha Development Agenda on People's Republic of China: The Role of Complementary Education Reforms
   —Fan Zhai and Thomas Hertel, October 2005
No. 74 Growth and Trade Horizons for Asia: Long-term Forecasts for Regional Integration
   —David Roland-Holst, Jean-Pierre Verbiest, and Fan Zhai, November 2005
No. 75 Macroeconomic Impact of HIV/AIDS in the Asian and Pacific Region
   —Ajay Tandon, November 2005
No. 76 Policy Reform in Indonesia and the Asian Development Bank's Financial Sector Governance Reforms Program Loan
   —George Abonyi, December 2005
No. 77 Dynamics of Manufacturing Competitiveness in South Asia: Analysis through Export Data
   —Hans-Peter Brunner and Massimiliano Calli, December 2005
No. 78 Trade Facilitation
   —Teruo Ujiie, January 2006
No. 79 An Assessment of Cross-country Fiscal Consolidation
   —Bruno Carrasco and Seung Mo Choi, February 2006
No. 80 Central Asia: Mapping Future Prospects to 2015
   —Malcolm Dowling and Ganesan Wignaraja, April 2006
No. 81 A Small Macroeconomic Model of the People's Republic of China
   —Duo Qin, Marie Anne Cagas, Geoffrey Ducanes, Nedelyn Magtibay-Ramos, Filipinas Quising, Xin-Hua He, Rui Liu, and Shi-Guo Liu, June 2006
No. 82 Institutions and Policies for Growth and Poverty Reduction: The Role of Private Sector Development
   —Rana Hasan, Deveshch Mishra, and Mehmet Ulubasoglu, July 2006
No. 83 Preferential Trade Agreements in Asia: Alternative Scenarios of “Hub and Spoke”
   —Fan Zhai, October 2006
No. 84 Income Disparity and Economic Growth: Evidence from People's Republic of China
   —Duo Qin, Marie Anne Cagas, Geoffrey Ducanes, XinHua He, Rui Liu, and Shiguo Liu, October 2006
No. 85 Macroeconomic Effects of Fiscal Policies: Empirical Evidence from Bangladesh, People's Republic of China, Indonesia, and Philippines
   —Geoffrey Ducanes, Marie Anne Cagas, Duo Qin, Filipinas Quising, and Mohammad Abdur Razzak, November 2006
No. 86 Economic Growth, Technological Change, and Patterns of Food and Agricultural Trade in Asia
   —Thomas W. Hertel, Carlos E. Ludena, and Alla Golub, November 2006
No. 87 Expanding Access to Basic Services in Asia and the Pacific Region: Public–Private Partnerships for Poverty Reduction
   —Adrian T. Panggabean, November 2006
No. 88 Income Volatility and Social Protection in Developing Asia
   —Vandana Sipakimalani-Rao, November 2006
No. 89 Rules of Origin: Conceptual Explorations and Lessons from the Generalized System of Preferences
   —Teruo Ujiie, December 2006
No. 90 Asia's Imprint on Global Commodity Markets
   —Cyn-Young Park and Fan Zhai, December 2006
No. 91 Infrastructure as a Catalyst for Regional Integration, Growth, and Economic Convergence: Scenario Analysis for Asia
   —David Roland-Holst, December 2006
No. 92 Measuring Underemployment: Establishing the Cut-off Point
   —Guntur Sugiyarto, March 2007
No. 93 An Analysis of the Philippine Business Process Outsourcing Industry
   —Nedelyn Magtibay-Ramos, Gemma Estrada, and Jesus Felipe, March 2007
No. 94 Theory and Practice in the Choice of Social Discount Rate for Cost–Benefit Analysis: A Survey
   —Juzhong Zhuang, Zhihong Liang, Tun Lin, and Franklin De Guzman, May 2007
No. 95 Can East Asia Weather a US Slowdown?
   —Cyn-Young Park, June 2007
No. 96 Interrelationship between Growth, Inequality, and Poverty: the Asian Experience
   —Hyun H. Son, June 2007
No. 97 Inclusive Growth toward a Prosperous Asia: Policy Implications
   —Ifzal Ali and Juzhong Zhuang, July 2007
No. 98 Defining and Measuring Inclusive Growth: Application to the Philippines
   —Ifzal Ali and Hyun H. Son, July 2007
No. 99 Flood Insurance as a Flood Management Tool: An Economic Perspective
   —Tun Lin, Franklin D. De Guzman, and Maria Cita Cuevas, August 2007
No. 100 Time Preference and Natural Resource Use by Local Communities: The Case of Sinharaja Forest in Sri Lanka
   —H. M. Gunatilake, W.A.R. Wickramasinghe, and P. Abeygunawardena, August 2007
No. 43 Creating Better and More Jobs in Indonesia: A Blueprint for Policy Action  
—Guntur Sugiyarto, December 2005
No. 44 The Challenge of Job Creation in Asia  
—Jesus Felipe and Rana Hasan, April 2006
No. 45 International Payments Imbalances  
—Jesus Felipe, Frank Harrigan, and Aashish Mehta, April 2006
No. 46 Improving Primary Enrollment Rates among the Poor  
—Ajay Tandon, August 2006

—Ajay Tandon and Juzhong Zhuang, January 2007
No. 48 Pro-Poor to Inclusive Growth: Asian Prescriptions  
No. 49 Technology and Development in Asia  
—Frank Harrigan, June 2007

ERD TECHNICAL NOTE SERIES (TNS)  
(Published in-house; Available through ADB Department of External Relations; Free of Charge)

No. 1 Contingency Calculations for Environmental Impacts with Unknown Monetary Values  
—David Dole, February 2002
No. 2 Integrating Risk into ADB's Economic Analysis of Projects  
—Nigel Rayner, Anneli Lagman-Martin, and Keith Ward, June 2002
No. 3 Measuring Willingness to Pay for Electricity  
—Peter Choynowski, July 2002
No. 4 Economic Issues in the Design and Analysis of a Wastewater Treatment Project  
—David Dole, July 2002
No. 5 An Analysis and Case Study of the Role of Environmental Economics at the Asian Development Bank  
—David Dole and Piya Abeygunawardena, September 2002
No. 6 Economic Analysis of Health Projects: A Case Study in Cambodia  
—Erik Bloom and Peter Choynowski, May 2003
No. 7 Strengthening the Economic Analysis of Natural Resource Management Projects  
—Keith Ward, September 2003
No. 8 Testing Savings Product Innovations Using an Experimental Methodology  
—Nava Ashraf, Dean S. Karlan, and Wesley Yin, November 2003
No. 9 Setting User Charges for Public Services: Policies and Practice at the Asian Development Bank  
—David Dole, December 2003
No. 10 Beyond Cost Recovery: Setting User Charges for Financial, Economic, and Social Goals  
—David Dole and Ian Bartlett, January 2004
No. 11 Shadow Exchange Rates for Project Economic Analysis: Toward Improving Practice at the Asian Development Bank  
—Anneli Lagman-Martin, February 2004
No. 12 Improving the Relevance and Feasibility of Agriculture and Rural Development Operational Designs: How Economic Analyses Can Help  
—Richard Bolt, September 2005

No. 13 Assessing the Use of Project Distribution and Poverty Impact Analyses at the Asian Development Bank  
—Franklin D. De Guzman, October 2005
No. 14 Assessing Aid for a Sector Development Plan: Economic Analysis of a Sector Loan  
—David Dole, November 2005
No. 15 Debt Management Analysis of Nepal’s Public Debt  
—Sungsup Ra, Changyong Rhee, and Joos-Ho Hahn, December 2005
No. 16 Evaluating Microfinance Program Innovation with Randomized Control Trials: An Example from Group Versus Individual Lending  
—Xavier Gine, Tomoko Harigaya, Dean Karlan, and Binh T. Nguyen, March 2006
No. 17 Setting User Charges for Urban Water Supply: A Case Study of the Metropolitan Cebu Water District in the Philippines  
—David Dole and Edna Balucan, June 2006
No. 18 Forecasting Inflation and GDP Growth: Automatic Leading Indicator (ALI) Method versus Macro Econometric Structural Models (MESMs)  
—Marie Anne Cagas, Geoffrey Ducanes, Nedelyn Magtibay-Ramos, Duo Qin and Pilipinas Quising, July 2006
No. 19 Willingness-to-Pay and Design of Water Supply and Sanitation Projects: A Case Study  
—Herath Gunatilake, Jui-Chen Yang, Subhrendu Pattanayak, and Caroline van den Berg, December 2006
No. 20 Tourism for Pro-Poor and Sustainable Growth: Economic Analysis of ADB Tourism Projects  
—Tun Lin and Franklin D. De Guzman, January 2007
No. 21 Critical Issues of Fiscal Decentralization  
—Norio Usui, February 2007
No. 22 Pro-Poor Growth: Concepts and Measures  
—Hyun H. Son, June 2007
ERD OCCASIONAL STATISTICAL PAPER SERIES (OSP)
(Published in-house; Available through ADB Department of External Relations; Free of Charge)

No. 1 Developing an Interregional Input–Output Table for Cross-border Economies: An Application to Lao People’s Democratic Republic and Thailand
—Benson Sim, Francisco Secretario, and Eric Suan, July 2007

SERIALS
(Available commercially through ADB Office of External Relations)
1. Asian Development Outlook (ADO; annual) $36.00 (paperback)
2. Key Indicators of Developing Asian and Pacific Countries (KI; annual) $35.00 (paperback)
3. Asian Development Review (ADR; semiannual) $5.00 per issue; $10.00 per year (2 issues)

SPECIAL STUDIES, COMPLIMENTARY
(Available through ADB Department of External Relations)

1. Improving Domestic Resource Mobilization Through Financial Development: Overview September 1985
5. Financing Public Sector Development Expenditure in Selected Countries: Overview January 1988
7. Financing Public Sector Development Expenditure in Selected Countries: Bangladesh June 1988
8. Financing Public Sector Development Expenditure in Selected Countries: India June 1988
11. Financing Public Sector Development Expenditure in Selected Countries: Pakistan June 1988
12. Financing Public Sector Development Expenditure in Selected Countries: Philippines June 1988
13. Financing Public Sector Development Expenditure in Selected Countries: Thailand June 1988
17. Foreign Trade Barriers and Export Growth September 1988
18. The Role of Small and Medium-Scale Industries in the Industrial Development of the Philippines April 1989
19. The Role of Small and Medium-Scale Manufacturing Industries in Industrial Development: The Experience of Selected Asian Countries January 1990
23. Export Finance: Some Asian Examples September 1990
27. Investing in Asia 1997 (Co-published with OECD)
28. The Future of Asia in the World Economy 1998 (Co-published with OECD)
29. Financial Liberalisation in Asia: Analysis and Prospects 1999 (Co-published with OECD)
30. Sustainable Recovery in Asia: Mobilizing Resources for Development 2000 (Co-published with OECD)
31. Technology and Poverty Reduction in Asia and the Pacific 2001 (Co-published with OECD)
32. Asia and Europe 2002 (Co-published with OECD)
33. Economic Analysis: Retrospective 2003
34. Economic Analysis: Retrospective: 2003 Update 2004
36. Investment Climate and Productivity Studies 

Philippines: Moving Toward a Better Investment Climate 2005
The Road to Recovery: Improving the Investment Climate in Indonesia 2005
Sri Lanka: Improving the Rural and Urban Investment Climate 2005
Lao PDR Private Sector and Investment Climate Assessment: Reducing Investment Climate Constraints to Higher Growth 2006
OLDMONOGRAPH SERIES
(Available through ADB Department of External Relations; Free of charge)

EDRC REPORT SERIES (ER)

No. 1 ASEAN and the Asian Development Bank
—Seiji Naya, April 1982

No. 2 Development Issues for the Developing East and Southeast Asian Countries and International Cooperation
—Seiji Naya and Graham Abbott, April 1982

No. 3 Aid, Savings, and Growth in the Asian Region
—J. Malcolm Dowling and Ulrich Hiemenz, April 1982

No. 4 Development-oriented Foreign Investment and the Role of ADB
—Kiyoshi Kojima, April 1982

No. 5 The Multilateral Development Banks and the International Economy's Missing Public Sector
—John Lewis, June 1982

No. 6 Notes on External Debt of DMCs
—Evelyn Go, July 1982

No. 7 Grant Element in Bank Loans
—Dal Hyun Kim, July 1982

No. 8 Shadow Exchange Rates and Standard Conversion Factors in Project Evaluation
—Peter Warr, September 1982

No. 9 Small and Medium-Scale Manufacturing Establishments in ASEAN Countries: Perspectives and Policy Issues
—Mathais Bruch and Ulrich Hiemenz, January 1983

No. 10 A Note on the Third Ministerial Meeting of GATT
—Jungsoo Lee, January 1983

No. 11 Macroeconomic Forecasts for the Republic of China, Hong Kong, and Republic of Korea
—J.M. Dowling, January 1983

No. 12 ASEAN: Economic Situation and Prospects
—Seiji Naya, March 1983

No. 13 The Future Prospects for the Developing Countries of Asia
—Seiji Naya, March 1983

No. 14 Energy and Structural Change in the Asia-Pacific Region, Summary of the Thirteenth Pacific Trade and Development Conference
—Seiji Naya, March 1983

No. 15 A Survey of Empirical Studies on Demand for Electricity with Special Emphasis on Price Elasticity of Demand
—Wisarn Pupphavesa, June 1983

No. 16 Determinants of Paddy Production in Indonesia: 1972-1981—A Simultaneous Equation Model Approach
—T.K. Jayaraman, June 1983

No. 17 The Philippine Economy: Economic Forecasts for 1983 and 1984
—J.M. Dowling, E. Go, and C.N. Castillo, June 1983

No. 18 Economic Forecast for Indonesia

No. 19 Relative External Debt Situation of Asian Developing Countries: An Application of Ranking Method
—Jungsoo Lee, June 1983

No. 20 New Evidence on Yields, Fertilizer Application, and Prices in Asian Rice Production
—William James and Teresita Ramirez, July 1983

No. 21 Inflationary Effects of Exchange Rate Changes in Nine Asian LDCs
—Pradumna B. Rana and J. Malcolm Dowling, Jr., December 1983

No. 22 Effects of External Shocks on the Balance of Payments, Policy Responses, and Debt Problems of Asian Developing Countries
—Seiji Naya, December 1983

No. 23 Changing Trade Patterns and Policy Issues: The Prospects for East and Southeast Asian Developing Countries
—Seiji Naya and Ulrich Hiemenz, February 1984

No. 24 Small-Scale Industries in Asian Economic Development: Problems and Prospects
—Seiji Naya, February 1984

No. 25 A Study on the External Debt Indicators Applying Logit Analysis
—Jungsoo Lee and Clarita Barretta, February 1984

No. 26 Alternatives to Institutional Credit Programs in the Agricultural Sector of Low-Income Countries
—Jennifer Soar, March 1984

No. 27 Economic Scene in Asia and Its Special Features
—Kedar N. Kohli, November 1984

No. 28 The Effect of Terms of Trade Changes on the Balance of Payments and Real National Income of Asian Developing Countries
—Jungsoo Lee and Lugarda Labios, January 1985

—Yoshihiro Iwasaki, February 1985

No. 30 Sources of Balance of Payments Problem in the 1970s: The Asian Experience
—Pradumna Rana, February 1985

No. 31 India's Manufactured Exports: An Analysis of Supply Sectors
—Ifzal Ali, February 1985

No. 32 Meeting Basic Human Needs in Asian Developing Countries
—Jungsoo Lee and Emma Banaria, March 1985

No. 33 The Impact of Foreign Capital Inflow on Investment and Economic Growth in Developing Asia
—Evelyn Go, May 1985

No. 34 The Climate for Energy Development in the Pacific and Asian Region: Priorities and Perspectives
—V.V. Desai, April 1986

No. 35 Impact of Appreciation of the Yen on Developing Member Countries of the Bank
—Jungsoo Lee, Pradumna Rana, and Ifzal Ali, May 1986

No. 36 Smuggling and Domestic Economic Policies in Developing Countries
—A.H.M.N. Choudhury, October 1986

No. 37 Public Investment Criteria: Economic Internal Rate of Return and Equalizing Discount Rate
—Ifzal Ali, November 1986

No. 38 Review of the Theory of Neoclassical Political Economy: An Application to Trade Policies
—M.G. Quibria, December 1986

No. 39 Factors Influencing the Choice of Location: Local and Foreign Firms in the Philippines
—E.M. Pernia and A.N. Herrin, February 1987

No. 40 A Demographic Perspective on Developing Asia and Its Relevance to the Bank
—E.M. Pernia, May 1987

31
ECONOMIC STAFF PAPERS (ES)

No. 1  International Reserves: Factors Determining Needs and Adequacy  
—Evelyn Go, May 1981

No. 2  Domestic Savings in Selected Developing Asian Countries  
—Basil Moore, assisted by A.H.M. Nuruddin Chowdhury, September 1981

No. 3  Changes in Consumption, Imports and Exports of Oil Since 1973: A Preliminary Survey of the Developing Member Countries of the Asian Development Bank  
—Dal Hyun Kim and Graham Abbott, September 1981

No. 4  By-Passed Areas, Regional Inequalities, and Development Policies in Selected Southeast Asian Countries  
—William James, October 1981

No. 5  Asian Agriculture and Economic Development  
—William James, March 1982

No. 6  Inflation in Developing Member Countries: An Analysis of Recent Trends  

No. 7  Industrial Growth and Employment in Developing Asian Countries: Issues and Perspectives for the Coming Decade  
—Ulrich Hiemenz, March 1982

—Burnham Campbell, April 1982

No. 9  Developing Asia: The Importance of Domestic Policies  
—Economics Office Staff under the direction of Seiji Naya, May 1982

No. 10  Financial Development and Household Savings: Issues in Domestic Resource Mobilization in Asian Developing Countries  
—Wan-Soon Kim, July 1982

No. 11  Industrial Development: Role of Specialized Financial Institutions  
—Kedar N. Kohli, August 1982

—Burnham Campbell, September 1982

No. 13  Credit Rationing, Rural Savings, and Financial Policy in Developing Countries  
—William James, September 1982

No. 55  Financial Sector and Economic Development: A Survey  
—Jungsoo Lee, September 1991

No. 56  A Framework for Justifying Bank-Assisted Education Projects in Asia: A Review of the Socioeconomic Analysis and Identification of Areas of Improvement  
—Etienne Van De Walle, February 1992

No. 57  Medium-term Growth-Stabilization Relationship in Asian Developing Countries and Some Policy Considerations  
—Yun-Hwan Kim, February 1993

No. 58  Urbanization, Population Distribution, and Economic Development in Asia  
—Ernesto M. Pernia, February 1993

No. 59  The Need for Fiscal Consolidation in Nepal: The Results of a Simulation  
—Filippo di Mauro and Ronald Antonio Batiang, July 1993

No. 60  A Computable General Equilibrium Model of Nepal  
—Timothy Bucher and Filippo di Mauro, October 1993

No. 61  The Role of Government in Export Expansion in the Republic of Korea: A Revisit  
—Yun-Hwan Kim, February 1994

No. 62  Rural Reforms, Structural Change, and Agricultural Growth in the People’s Republic of China  
—Bo Lin, August 1994

No. 63  Incentives and Regulation for Pollution Abatement with an Application to Waste Water Treatment  

No. 64  Saving Transitions in Southeast Asia  
—Frank Harrigan, February 1996

No. 65  Total Factor Productivity Growth in East Asia: A Critical Survey  
—Jesus Felipe, September 1997

No. 66  Foreign Direct Investment in Pakistan: Policy Issues and Operational Implications  
—Ashfaque H. Khan and Yun-Hwan Kim, July 1999

No. 67  Fiscal Policy, Income Distribution and Growth  
—Sailesh K. Jha, November 1999
No. 38 The Role of Fertilizer Subsidies in Agricultural Production: A Review of Select Issues
—Prabhakar B. Ghate, October 1987

No. 37 Determining Irrigation Charges: A Framework
—Prabhu Khare, October 1987

No. 36 Implications of Falling Primary Commodity Prices for Agricultural Strategy in the Philippines
—I. Ali, September 1987

No. 35 Agricultural Price Policy in Nepal
—Gerald C. Nelson, March 1987

No. 34 Changes in the Export Patterns of Asian and Pacific Developing Countries: An Empirical Overview
—Pradumna B. Rana, January 1987

No. 33 Satellite Remote Sensing in the Asian and Pacific Region
—Mohan Sundara Rajan, December 1986

No. 32 Science and Technology for Development: Role of the Bank
—Kedar N. Kohli and Ifzal Ali, November 1986

No. 31 Economic Analysis of the Environmental Impacts of Development Projects
—John A. Dixon et al., EAPI, East-West Center, August 1986

No. 30 Rice in Indonesia: Price Policy and Comparative Advantage
—I. Ali, January 1986

No. 29 Effects of Foreign Capital Inflows on Developing Countries of Asia
—Jungsoo Lee, Pradumna B. Rana, and Yoshihiro Iwasaki, April 1986

No. 28 Risk Analysis and Project Selection: A Review of Practical Issues
—J.K. Johnson, August 1985

No. 27 Industrial Technology Development: the Republic of Korea
—S.Y. Lo, July 1985

No. 26 Patterns of External Financing of DMCs
—E. Go, May 1985

No. 25 Exports and Economic Growth in the Asian Region
—Pradumna Rana, February 1985

No. 24 Economic Analysis of Power Projects
—Nitin Desai, January 1985

No. 23 ASEAN Economies and ASEAN Economic Cooperation
—Narongchai Akrasanee, November 1984

No. 22 Income Distribution and Poverty in Selected Asian Countries
—John Malcolm Dowling, Jr., November 1984

No. 21 The Significance of Off-Farm Employment and Incomes in Post-War East Asian Growth
—Harry T. Oshima, January 1984

No. 20 The Transition to an Industrial Economy in Monsoon Asia
—Harry T. Oshima, October 1983

No. 19 Asian Agriculture in Transition: Key Policy Issues
—William James, September 1983

No. 18 The Impact of the Current Exchange Rate System on Trade and Inflation of Selected Developing Member Countries
—Pradumna Rana, September 1983

No. 17 External Shocks, Energy Policy, and Macroeconomic Performance of Asian Developing Countries: A Policy Analysis
—William James, July 1983

No. 16 Long-Run Debt-Servicing Capacity of Asian Developing Countries: An Application of Critical Interest Rate Approach
—Jungsoo Lee, June 1983

No. 15 Income Distribution and Economic Growth in Developing Asian Countries
—I. Malcolm Dowling and David Soo, March 1983

No. 14 Small and Medium-Scale Manufacturing Establishments in ASEAN Countries: Perspectives and Policy Issues
—Mathias Bruch and Ulrich Hiemenz, March 1983

No. 13 The Role of Fertilizer Subsidies in Agricultural Production: A Review of Select Issues
—M.G. Quibria, October 1987

No. 12 Domestic Adjustment to External Shocks in Developing Asia
—Jungsoo Lee, October 1987

No. 11 Improving Domestic Resource Mobilization through Financial Development: Indonesia
—Philip Erquique, November 1987

No. 10 Recent Trends and Issues on Foreign Direct Investment in Asian and Pacific Developing Countries
—P.B. Rana, March 1988

No. 9 Manufactured Exports from the Philippines: A Sector Profile and an Agenda for Reform
—I. Ali, September 1988

No. 8 A Framework for Evaluating the Economic Benefits of Power Projects
—I. Ali, August 1989

No. 7 Promotion of Manufactured Exports in Pakistan
—Jungsoo Lee and Yoshihiro Iwasaki, September 1989

No. 6 Education and Labor Markets in Indonesia: A Sector Survey
—Ernesto M. Pernia and David N. Wilson, September 1989

No. 5 Designing Strategies and Policies for Managing Structural Change in Asia
—I. Ali, June 1990

No. 4 The Completion of the Single European Community Market in 1992: A Tentative Assessment of its Impact on Asian Developing Countries
—I.P. Verbist and Min Tang, June 1991

No. 3 Economic Analysis of Investment in Power Systems
—I. Ali, June 1991

No. 2 External Finance and the Role of Multilateral Financial Institutions in South Asia: Changing Patterns, Prospects, and Challenges
—I. Ali, November 1991

No. 1 The Gender and Poverty Nexus: Issues and Policies
—I. Ali, November 1993

No. 52 The Role of the State in Economic Development: Theory, the East Asian Experience, and the Malaysian Case
—Jason Brown, December 1993

No. 53 The Economic Benefits of Potable Water Supply Projects to Households in Developing Countries
—Dale Whittington and Venkateswarlu Swarna, January 1994

No. 54 Growth Triangles: Conceptual Issues and Operational Problems
—Min Tang and Myo Thant, February 1994

No. 55 The Emerging Global Trading Environment and Developing Asia
—Arvind Panagariya, M.G. Quibria, and Narhari Rao, July 1996

No. 56 Aspects of Urban Water and Sanitation in the Context of Rapid Urbanization in Developing Asia
—Ernesto M. Pernia and Stella LF. Alabastro, September 1997

No. 57 Challenges for Asia's Trade and Environment

No. 58 Economic Analysis of Health Sector Projects—A Review of Issues, Methods, and Approaches
—Ramesh Adhikari, Paul Gertler, and Anneli Lagman, March 1999

No. 59 The Asian Crisis: An Alternate View
—Rajiv Kumar and Bibek Debroy, July 1999

No. 60 Social Consequences of the Financial Crisis in Asia
—James C. Knoules, Ernesto M. Pernia, and Mary Racelis, November 1999
OCCASIONAL PAPERS (OP)

No. 1  Poverty in the People's Republic of China: Recent Developments and Scope for Bank Assistance
—K.H. Moinuddin, November 1992

No. 2  The Eastern Islands of Indonesia: An Overview of Development Needs and Potential
—Brian K. Parkinson, January 1993

No. 3  Rural Institutional Finance in Bangladesh and Nepal: Review and Agenda for Reforms
—A.H.M.N. Chowdhury and Marcella C. Garcia, November 1993

No. 4  Fiscal Deficits and Current Account Imbalances of the South Pacific Countries: A Case Study of Vanuatu
—T.K. Jayaraman, December 1993

No. 5  Reforms in the Transitional Economies of Asia
—Pradumna B. Rana, December 1993

No. 6  Environmental Challenges in the People’s Republic of China and Scope for Bank Assistance
—Elisabetta Capannelli and Omkar L. Shrestha, December 1993

No. 7  Sustainable Development Environment and Poverty Nexus
—K.F. Jalal, December 1993

No. 8  Intermediate Services and Economic Development: The Malaysian Example
—Sutanu Behuria and Rahul Khullar, May 1994

No. 9  Interest Rate Deregulation: A Brief Survey of the Policy Issues and the Asian Experience
—Carlos J. Glower, July 1994

No. 10  A New Approach to Setting the Future Transport Agenda
—Roger Allport, Geoff Key, and Charles Melhuish, June 1998

No. 11  Some Aspects of Land Administration in Indonesia: Implications for Bank Operations
—Sultan Behuria, July 1994

No. 12  Demographic and Socioeconomic Determinants of Contraceptive Use among Urban Women in the Melanesian Countries in the South Pacific: A Case Study of Port Vila Town in Vanuatu
—T.K. Jayaraman, February 1995

No. 13  Managing Development through Institutional Building
—Hilton L. Root, October 1995

No. 14  Growth, Structural Change, and Optimal Poverty Interventions
—Shiladitya Chatterjee, November 1995

No. 15  Some Aspects of Land Administration in Indonesia: Implications for Multilateral Development Banks
—Pradumna B. Rana, December 1998

No. 16  The Rural-Urban Transition in Viet Nam: Some Selected Issues
—Sudipto Mundle and Brian Van Arkadie, October 1997

No. 17  Surges and Volatility of Private Capital Flows to Asian Developing Countries: Implications for Multilateral Development Banks
—Pradumna B. Rana, December 1998

No. 18  The Millennium Round and the Asian Economies: An Introduction
—Dilip K. Das, October 1999

No. 19  Tax Reforms in Viet Nam: A Selective Analysis
—Sudipto Mundle, December 1998

No. 20  Occupational Segregation and the Gender Earnings Gap
—Joseph E. Zveglich, Jr. and Yana van der Meulen Rodgers, December 1999

No. 21  The State of Agricultural Statistics in Southeast Asia
—Roger Allport, Geoff Key, and Charles Melhuish, 1999

No. 22  The Millennium Round and the Asian Economies: Some Selected Issues
—P. Hodgkinson, October 1996

STATISTICAL REPORT SERIES (SR)

No. 1  Estimates of the Total External Debt of the Developing Member Countries of ADB: 1981-1983
—I.P. David, September 1984

No. 2  Multivariate Statistical and Graphical Classification Techniques Applied to the Problem of Grouping Countries
—I.P. David and D.S. Maligalig, March 1985

No. 3  Gross National Product (GNP) Measurement Issues in South Pacific Developing Member Countries of ADB
—S.G. Tiwari, September 1985

No. 4  Estimates of Comparable Savings in Selected DMCs
—Hananto Sigit, December 1985

No. 5  Keeping Sample Survey Design and Analysis Simple
—I.P. David, December 1985

No. 6  External Debt Situation in Asian Developing Countries
—I.P. David and Jungsoo Lee, March 1986

No. 7  Study of GNP Measurement Issues in the South Pacific Developing Member Countries. Part I: Existing National Accounts of SPDMCs—Analysis of Methodology and Application of SNA Concepts
—P. Hodgkinson, October 1986

No. 8  Study of GNP Measurement Issues in the South Pacific Developing Member Countries. Part II: Factors Affecting Intercountry Comparability of Per Capita GNP
—P. Hodgkinson, October 1986

No. 9  Survey of the External Debt Situation in Asian Developing Countries, 1985
—Jungsoo Lee and I.P. David, April 1987

No. 10  A Survey of the External Debt Situation in Asian Developing Countries, 1986
—Jungsoo Lee and I.P. David, April 1988

No. 11  Changing Pattern of Financial Flows to Asian and Pacific Developing Countries
—Jungsoo Lee, March 1989

No. 12  The State of Agricultural Statistics in Southeast Asia
—I.P. David, March 1989

—Jungsoo Lee, May 1990

No. 14  A Survey of the External Debt Situation in Asian and Pacific Developing Countries: 1988-1989
—Jungsoo Lee, May 1990

No. 15  A Survey of the External Debt Situation in Asian and Pacific Developing Countries: 1989-1992
—Jungsoo Lee, May 1990
1. Rural Poverty in Developing Asia  
   *Edited by M.G. Quibria*  
   Vol. 1: Bangladesh, India, and Sri Lanka, 1994  
   $35.00 (paperback)  
   Vol. 2: Indonesia, Republic of Korea, Philippines, and Thailand, 1996  
   $35.00 (paperback)  
2. Gender Indicators of Developing Asian and Pacific Countries  
   *Asian Development Bank, 1993*  
   $25.00 (paperback)  
3. External Shocks and Policy Adjustments: Lessons from the Gulf Crisis  
   *Edited by Naved Hamid and Shahid N. Zahid, 1995*  
   $15.00 (paperback)  
4. Indonesia-Malaysia-Thailand Growth Triangle: Theory to Practice  
   *Edited by Myo Thant and Min Tang, 1996*  
   $15.00 (paperback)  
5. Emerging Asia: Changes and Challenges  
   *Asian Development Bank, 1997*  
   $30.00 (paperback)  
6. Asian Exports  
   *Edited by Dilip Dos, 1999*  
   $35.00 (paperback)  
   $55.00 (hardbound)  
7. Development of Environment Statistics in Developing Asian and Pacific Countries  
   *Asian Development Bank, 1999*  
   $30.00 (paperback)  
8. Mortgage-Backed Securities Markets in Asia  
   *Edited by S.Ghon Rhee & Yutaka Shimomoto, 1999*  
   $35.00 (paperback)  
9. Rising to the Challenge in Asia: A Study of Financial Markets  
   *Asian Development Bank*  
   Vol. 1: An Overview, 2000 $20.00 (paperback)  
   Vol. 2: Special Issues, 1999 $15.00 (paperback)  
   Vol. 3: Sound Practices, 2000 $25.00 (paperback)  
   Vol. 4: People's Republic of China, 1999 $20.00 (paperback)  
   Vol. 5: India, 1999 $30.00 (paperback)  
   Vol. 6: Indonesia, 1999 $30.00 (paperback)  
   Vol. 7: Republic of Korea, 1999 $30.00 (paperback)  
   Vol. 8: Malaysia, 1999 $20.00 (paperback)  
   Vol. 9: Pakistan, 1999 $30.00 (paperback)  
   Vol. 10: Philippines, 1999 $30.00 (paperback)  
   Vol. 11: Thailand, 1999 $30.00 (paperback)  
   Vol. 12: Socialist Republic of Viet Nam, 1999 $30.00 (paperback)  
10. Corporate Governance and Finance in East Asia: A Study of Indonesia, Republic of Korea, Malaysia, Philippines and Thailand  
    *J. Zhuang, David Edwards, D. Webb, & Ma. Virginita Capulong*  
    Vol. 1: A Consolidated Report, 2000 $10.00 (paperback)  
    Vol. 2: Country Studies, 2001 $15.00 (paperback)  
11. Financial Management and Governance Issues  
    *Asian Development Bank, 2000*  
    Cambodia $10.00 (paperback)  
    People's Republic of China $10.00 (paperback)  
    Mongolia $10.00 (paperback)  
    Pakistan $10.00 (paperback)  
    Papua New Guinea $10.00 (paperback)  
    Uzbekistan $10.00 (paperback)  
    Viet Nam $10.00 (paperback)  
    Selected Developing Member Countries $10.00 (paperback)  
12. Government Bond Market Development in Asia  
    *Edited by Yun-Hwan Kim, 2001*  
    $25.00 (paperback)  
13. Intergovernmental Fiscal Transfers in Asia: Current Practice and Challenges for the Future  
    *Edited by Paul Smoke and Yun-Hwan Kim, 2002*  
    $15.00 (paperback)  
14. Guidelines for the Economic Analysis of Projects  
    *Asian Development Bank, 1997*  
    $10.00 (paperback)  
15. Guidelines for the Economic Analysis of Telecommunications Projects  
    *Asian Development Bank, 1997*  
    $10.00 (paperback)  
    *Asian Development Bank, 1999*  
    $10.00 (hardbound)  
    *Asian Development Bank, 2000*  
    $10.00 (paperback)  
    *Asian Development Bank, 2001*  
    $10.00 (paperback)  
    *Asian Development Bank, 2002*  
    $10.00 (hardback)  
    *Asian Development Bank, 2002*  
    $10.00 (hardback)  
21. Defining an Agenda for Poverty Reduction, Volume 1  
    *Edited by Christopher Edmonds and Sara Medina, 2002*  
    $15.00 (paperback)  
22. Defining an Agenda for Poverty Reduction, Volume 2  
    *Edited by Isabel Ortiz, 2002*  
    $15.00 (paperback)  
23. Economic Analysis of Policy-based Operations: Key Dimensions  
    *Asian Development Bank, 2003*  
    $10.00 (paperback)
About the Paper
H. M. Gunatilake, W.A.R. Wickramasinghe, and P. Abeygunawardena estimate individuals’ discount rate using a stated preference survey among peripheral villagers of a forest reserve in Sri Lanka. Results show that poverty is an important determinant of discount rates, and higher discount rates cause depletion of forest resources. The paper asserts that a long-term strategy for nature reserve protection would require poverty reduction in the peripheral communities, among other measures.

About the Asian Development Bank
ADB aims to improve the welfare of the people in the Asia and Pacific region, particularly the nearly 1.9 billion who live on less than $2 a day. Despite many success stories, the region remains home to two thirds of the world’s poor. ADB is a multilateral development finance institution owned by 67 members, 48 from the region and 19 from other parts of the globe.

ADB’s vision is a region free of poverty. Its mission is to help its developing member countries reduce poverty and improve their quality of life. ADB’s main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance. ADB’s annual lending volume is typically about $6 billion, with technical assistance usually totaling about $180 million a year.

ADB’s headquarters is in Manila. It has 26 offices around the world and more than 2,000 employees from over 50 countries.

Time Preference and Natural Resource Use by Local Communities: The Case of Sinharaja Forest in Sri Lanka
H. M. Gunatilake, W.A.R. Wickramasinghe, and P. Abeygunawardena

August 2007

Asian Development Bank

ERD Working Paper
ECONOMICS AND RESEARCH DEPARTMENT
SERIES No.100

Time Preference and Natural Resource Use by Local Communities: The Case of Sinharaja Forest in Sri Lanka

H. M. Gunatilake, W.A.R. Wickramasinghe, and P. Abeygunawardena

August 2007

Asian Development Bank