Essays on public finance and environmental economics in Namibia

by

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Abstract

This thesis comprises two papers exploring aspects of public finance and environmental economics in Namibia.

Paper [I] estimates the shadow prices of capital, labour and foreign exchange for the Namibian economy. The results suggest that the shadow price of capital for Namibia is 8%. The economic costs of Namibian labour, as a share of financial costs, are 32% for urban semi- and unskilled labour, and 54% for rural semi- and unskilled labour. The economic cost of foreign labour as a share of financial costs is 59%. The estimated range for the shadow exchange rate factor is between 7% and 14% for the Namibian economy.

Paper [II] studies the determinants of property prices in the township areas of Windhoek, the capital of Namibia. The study reveals that properties located close to an environmental hazard, such as a garbage dump, sell at considerable discounts. On the other hand properties located near an environmentally favourable location, such as recreational open space, sell at a premium. These results provide evidence of the importance of environmental quality in lower income property markets in developing countries. It is therefore important for Namibian urban planners to incorporate environmental quality within the planning framework for lower income areas.
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Umeå, 19 April, 2007
Michael Nokokure Humavindu
This thesis comprises an introduction and the following two self-contained papers:


Introduction and Summary

1 Introduction

This thesis consists of two self-contained papers, analysing public finance and environmental economics aspects of Namibia. Paper [1] estimates shadow prices for the Namibian economy for use in social cost benefit analysis. Paper [2] analyses the determinants of property prices in a low-income area of Namibia’s capital, Windhoek. The focus is on the implicit valuation of environmental advantages and disadvantages in low-income property pricing markets. The common thread linking the two papers is that an application of comprehensive cost-benefit analysis in Namibian developmental projects would enhance decision-making. The application of consistent shadow pricing in Namibian projects would be a useful tool for national planners, even at an urban level.

Economic tools for project appraisal in developing countries have been well established since the early 1970s. The appropriate appraisal of public investment projects underlines the need to determine the social value of costs and benefits accruing from these investments. In developing countries especially, social values may diverge from market prices and values, depending on the level of distortions. These distortions may be caused by market imperfections as a result of both government interventions in product and factor markets, and structural disequilibria in labour markets. As a result of the distortions, market prices are unreliable indicators of the real net worth of goods and services (Adhikari, 1986). A case in point is the divergence from its true value of the official price of foreign exchange, due to government’s decision to devalue the currency. Official trade policy, such as the adoption of various tariff and non-tariff trade barriers, may also lead to a distorted market value of foreign exchange. The result is a distortion in the domestic price of all tradables, and also of non-tradables which use tradeables in their production. In labour markets, the equilibrium wage may be higher than the efficiency wage, as a result of minimum wage laws and union bargaining presence. In capital markets, the market interest rate may diverge from the marginal productivity of capital.
In project appraisal, modifications to market values are thus essential. A modification is determined by estimating a set of national parameters and conversion factors. These parameters are termed shadow prices. Conversion factors give the ratio between the price to be used in evaluating the project (the shadow price), and the price used to evaluate its cost (the market price). In the valuation of inputs used in production, the inherent assumption is that the price of any input should represent the opportunity cost of that input. The opportunity cost reflects the value of output forgone on one project when used on another. Shadow prices are thus useful when the market price for an input or output is unavailable. Labour, for example, is an important input in many investment projects, and should therefore be valued at its economic cost.

Shadow prices are a crucial link between the macro level and the project level of economic planning, and an important component of the overall process of development planning in developing countries. Only when the costs and benefits of all potential projects are valued at their shadow prices, may those projects that most efficiently use scarce resources be selected. Following this strategy would allow a developing country to maximise the potential net economic benefits accruing from its investments, thereby improving its potential to pursue broader social, political and other non-economic objectives (Saerbeck, 1989).

In general national parameters to be estimated for economic analysis are divided into five categories (Potts et al, 1998): primary factors, traded goods, non-traded goods, average estimates and the discount rate. Primary factors relate to different categories of labour, the value of domestic resources and foreign exchange.

Traded goods are goods for which the economic cost or benefit derived from their use is determined by their international prices. Shadow price estimation is essential where there is a significant difference between the border price and the local market price. Deriving the shadow price is also a necessity in situations where a benefit is likely to feature prominently as an input or output for a number of projects.

Non-traded goods are items that, by their nature, cannot be traded across borders, or may not be economically viable for trade. The estimation of a shadow price is prompted by a
situation where there is a significant difference between the local market price of a resource and its economic value, or where, as for traded goods, a benefit is likely to feature prominently as an input or output for a number of projects.

Average estimates relate to sectors where cost data do not allow further breakdown. The most important of such estimates, the standard conversion factor, describes the value of a unit of domestic resources in terms of a unit of foreign exchange. The standard conversion factor, in the case of average estimates, is derived indirectly through conversion factors for traded goods.

Discount rates quantify the effect of time on a project’s cost and benefit values.

Classical shadow pricing estimation would involve deriving a general equilibrium economic optimisation model with the following specific features (UNIDO, 2000):

- an objective function describing the effects of the use and generation of resources on a measure of economic value such as the gross domestic product (GDP)
- constraints on the use of resources (technological coefficients for each economic activity and a limit for the resource as a whole)
- non-zero constraints for the value of resources and non-negativity constraints for resources.

The shadow price is then the effect on the value of the objective function resulting from an increase or decrease by one unit in the availability of a scarce resource. However the estimation of shadow prices in this way is fraught with complexities and numerous constraints, and is infeasible in practice (Little & Mirrlees, 1974). This has led to the adoption of 'second best' approaches to shadow price estimations. These methods were developed in the late 1960s and early 1970s by the United National Industrial Development Organization (UNIDO, 1972, 1978, and 1980), and by Little & Mirrlees (1974) and Squire & van der Tak (1975). The departure point between these two approaches is the choice of unit of account.
In essence, the UNIDO approach uses a domestic resource as the unit of account and estimates the scarcity value of foreign exchange using a shadow exchange rate. This procedure is described as the use of a *domestic price numeraire* (Potts, 2002). The second approach, developed by Little & Mirrlees and Squire & van der Tak, uses the unit of foreign exchange (expressed in local currency units) as the numeraire. This method is described as the use of a *world price numeraire*.

A third approach is based on the premise that all shadow prices are interdependent because their value depends on the value of inputs from other sectors (Potts, 2002). These interdependencies are accounted for through conversion factors that are derived by solving a series of simultaneous equations using an input-output approach. This approach thus takes into account all the sectoral interrelationships; it is called the *semi-input-output analysis* (SIO), and is useful for non-traded sectors where the output from each sector may appear as inputs into others.

In estimating shadow prices, the choice of methodology is primarily determined by the nature and extent of available data. Readily available data was a constraining factor in this study, which therefore attempts initially to estimate the three primary factors, capital, labour and the exchange rate. Future extensions to this work would examine the possibility of employing the SIO analysis where data permits.

Despite the apparent importance of shadow pricing for a developing country such as Namibia, no set of official national parameters exists, nor has any attempt been made to estimate them. The country’s development path is guided by five-yearly development plans (National Development Plans). These national plans stress the importance of investment/development projects to alleviate chronic unemployment, low industrialisation, poverty and income inequality. Under such circumstances, it is vital that market signals provide an adequate guide for investment planning and project appraisal. There is an apparent need for a consistent set of prices which reflect the resource costs and social benefits of a proposed course of action. High unemployment (36%), uneven income distribution and an economy that exports most of its capital are all strong motivations for the estimation of a set of national parameters. Recently released national guidelines
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(‘Guidelines for Preparing the Third National Development Plan (NDP3): 2007/08-2011/12’) re-assert the importance of investment/development projects for Namibia’s economic development. In response, Paper [1] is the first formal attempt to estimate the shadow prices of capital, labour and foreign exchange for the Namibian economy. The estimation is based on data representing national averages.

Shadow prices based on national data averages have to be distinguished from sectoral, regional or project-specific parameters (Saerbeck, 1989). Project-specific parameters should be estimated for each individual project, because the opportunity costs of the resources used or produced may differ from project to project, due to the specific characteristics of each project. This can be applied, for example, to aspects of urban planning. The economic value of an urban housing project for lower income residents may be higher, if it is located near environmentally beneficial features (such as parks) and public amenities (such as schools, taxi ranks), than one located near environmental hazards, or far from public amenities.

Paper [2] is an application of the hedonic pricing methodology (Rosen, 1974) to study the determinants of property prices in a low income area of Namibia’s capital, Windhoek. The methodology uses property prices to estimate buyers’ implicit valuation of a property’s attributes (such as access to public services, proximity to environmentally beneficial or detrimental features) when trading takes place.

Economic decisions are made every day with regard to the use of all types of resources. In allocative decisions, prices act as a signaling device. The use of some resources, however, does not fall under the ambit of the market. These are referred to as non-marketed resources; they are not bought and sold in the market place, and are consequently unpriced. The missing market phenomenon therefore creates economic development biases against decisions that benefit the environment, and in favor of decisions that harm the environment.

The valuation of environmental assets and services would underline their economic importance and make a case for their conservation. The incorporation of environmental costs and benefits falls within the ambit of non-market valuation in the environmental...
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economics discipline. Non-market valuation is a measure of the willingness to pay for the value of unpriced environmental goods and services.

Generally, for non-marketable items (those that cannot be sold or bought), two groups of valuation methods are employed. ¹ The first method is the revealed preference approach, in which consumer behaviour towards environmental goods is analysed and values are inferred. Peoples’ preferences are revealed by their choices. There are two widely used revealed preference methods. The first is the travel cost method, in which the costs of travel are used as the substitute for what people would be willing to pay for the opportunity of using a public environmental benefit such as a park or open area. The travel cost method is used to estimate the value of recreational benefits generated by ecosystems. It assumes that the value of the site (or its recreational services) is reflected in the amount people are willing to pay to get there. It is referred to as a revealed preference method, because it uses actual behaviour and choices to infer values.

The application of the travel cost method has been extended into the random utility modelling methodology. The random utility approach is the most complicated of the travel cost approaches. It is also the approach of choice, because it allows for much flexibility in calculating benefits, making it the best approach for estimating the benefits of specific characteristics, or quality changes, of a site, rather than of the site as a whole. It is also the most appropriate approach when there are many substitute sites.

The second important revealed preference method is hedonic pricing, which postulates that the price of a commodity is related to its characteristics. Therefore, variations in demand for a commodity (such as a house) can be statistically related to its attributes (e.g. local air quality, amenities). The hedonic pricing method is used to estimate the value of environmental amenities that affect the prices of marketed goods. Most applications use residential housing prices to estimate the value of environmental amenities. The method is based on the assumption that people value the characteristics of a commodity, or the services it provides, rather than the commodity itself. Prices will thus reflect the value of a set of characteristics, including environmental characteristics, that people consider important when purchasing the commodity.

Revealed preference approaches are useful where consumers are making real decisions about environmental goods and services. However such approaches are of little assistance when consumer behaviour towards environmental goods cannot be observed. The solution then is to apply what is termed as the *stated preferences* approach. This is the second group of non-market valuation methodologies. The approach rests on the simple premise of putting hypothetical questions to consumers.

The most widely used method of hypothetical preference approaches is the *contingent valuation* technique, in which surveys are used to ask respondents how much they would be willing to pay to ensure a given environmental improvement. The contingent valuation method (CVM) is used to estimate economic values for all kinds of ecosystems and environmental services. The method has great flexibility, allowing for the valuation of a wider variety of non-market goods and services than is possible with any other non-market valuation technique. It can be used to estimate both use and non-use values, and it is the most widely used method for estimating the latter. It is also the most controversial of the non-market valuation methods. The fact that contingent valuation is based on what people say they would do, as opposed to what people are observed to do, is the source of its greatest strength and its greatest weakness. Contingent valuation is one of the few ways to assign monetary values to non-use benefits attached to the environment.

Criticisms of environmental valuation are rooted in both technical and theoretical issues. Technical problems are related to data limitations and inherent biases in valuation techniques. Such problems might lead to inaccurate values. The second category of criticisms has to do with theoretical, philosophical and ethical objections to environmental valuation. Notable objections cite the issue of distribution across and between generations, the problem of using human preferences as the basis of environmental value, and the difficulty of arriving at values when the effects of environmental factors are irreversible or when environmental risks are unquantifiable.

Despite these criticisms, valuation methods have, in recent decades, reached a considerable degree of sophistication, and there has also been notable consensus on their use (Secretariat of the Convention on Biological Diversity, 2007). The only differences that remain on these
valuation methods are on the level of terminology and of classification. As a result, valuation methods are increasingly applied, not only in developed countries, but also in developing countries.

Rietbergen-McCracken & Abaza (2000) explained that:

“[U]p to recently, there was considerable skepticism, particularly among international development organizations and developing country governments (as end users of the valuation results) about the possibilities of using valuation methods outside the relatively resource-rich and data-rich environments of developed countries. It was generally felt that developing countries and countries with economies in transition presented too many difficulties (including a scarcity of statistical information; the presence of price distortions or undeveloped markets; and in some cases largely illiterate communities) to allow valuation methods to produce meaningful results. However, over the last five to ten years a growing body of evidence has emerged to refute these claims.”

Rietbergen-McCracken & Abaza (2000) provided a number of case studies of valuation studies in Africa, Asia, Latin America and Central and Eastern Europe. Some of these case studies also dealt with biodiversity resources and functions as the related ecosystem services. IUCN (1998) guidelines for protected areas managers on economic values of protected areas provided summaries on a few valuation studies in developing countries. FAO (2001) conducted a survey on the use of contingent valuation studies in developing countries. In Namibia the work by Humavindu & Masirembu (2001) and Humavindu (2002) were two pioneering examples.

Humavindu & Masirembu (2001) estimated the direct value of Windhoek’s recreational assets using contingent valuation and travel cost methods. The study found that recreational assets were perceived as important by Windhoek’s inhabitants and that they wished to have them preserved. Humavindu (2002) presented an analysis of valuation studies addressing nature-based tourism, and established that tourists were willing to pay more to visit and preserve Namibia’s tourism assets.
2 Summary of the papers


In the first paper of this thesis, shadow prices of capital, labour and foreign exchange for the Namibian economy are estimated. Although the use of shadow prices is essential for sound developmental planning, the application of shadow pricing in Namibia has been limited or virtually non-existent. The interest in deriving Namibian shadow prices arises from both practical and academic points of views.

In practical terms, the recognition of the need for large scale investments to drive economic growth prompts the need to apply shadow prices, so as to ensure optimal allocation of scarce resources. From an academic point of view, the Namibian economy exhibits special features that support the need to estimate national parameters. A highly uneven income distribution, a large informal economy, and minimum wages in certain sectors all validate the necessity of estimating shadow wage rates. Unlike most other developing countries, Namibia is a net capital exporter. Although the economy has high domestic savings, the lack of domestic investment opportunities leads to capital outflow amounting to 10% of GDP annually. The shadow price of capital can then be reasonably expected to be low. Finally, Namibia’s membership of the Southern African Customs Union (SACU) and the Common Monetary Area (CMA) might affect the estimation of the shadow price of foreign exchange in Namibia. SACU groups together Botswana, Lesotho, Namibia, Swaziland (better known as BLNS countries) and South Africa, and applies a common external tariff. The SACU Agreement has recently been renegotiated, with key elements revised and given a new focus, in the light of the need to allow BLNS countries greater say in the determination and administration of SACU tariffs. The CMA comprises SACU countries, excluding Botswana, and is a monetary area with a centralised monetary policy aimed at achieving greater financial stability for the region. The monetary policy is controlled by South Africa, and all other CMA currencies are pegged to the South African Rand.

In principle there should be two Shadow Exchange Rates (SERs): one for convertible currency external to the Common Monetary Area, and one for Rand based currencies, which
would have a shadow exchange rate of 1, since there are no trade restrictions between the CMA countries. The SER calculated in this paper is applicable to transactions with countries outside the CMA, but not to the foreign content of goods purchased from South Africa.

The results suggest that the economic opportunity cost of capital is 8% in Namibia. The economic costs of Namibian labour, as a share of financial costs, are 32% for urban semi- and unskilled labour, and 54% for rural semi- and unskilled labour. The economic cost of foreign labour, as a share of financial costs, is 59%. The estimated shadow exchange rate factor lies between 7% and 14% for the Namibian economy.

**Paper [2] Hedonic pricing in Windhoek townships**

The second paper attempts to determine whether property prices in several townships of Namibia’s capital, Windhoek, are affected either by positive or by negative attributes, and applies the hedonic pricing method. Hedonic pricing, as previously stated, involves the implicit price of attributes or characteristics of a commodity rather than the price of the commodity itself. Hedonic pricing models are used to infer the demand for attributes of environmental quality, through the analysis of marketed goods whose value depends, in part, on these attributes. The methodology is generally applied for the valuation of environmental goods, property and water, and the implicit price of attributes and characteristics of the marketed goods. The general assumptions of such a model are that all the goods or services brought to the market must be clearly visible, and that property values and the implicit price of attributes or characteristics should be treated as a single market. Under these assumptions, the price of any residence can be described as a function of the environmental, structural, and neighborhood characteristics of the residence location. The Hedonic model gives a realistic estimation of environmental benefits and values, as model estimates are based on market information.

In this paper, we use property sales data obtained from the City of Windhoek Municipality, and apply the hedonic pricing model. Our findings are that, apart from housing quality, access to the central business district, access to marketplaces, and access to transportation, environmental quality also has a large impact on property prices. Properties located close to
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a garbage dump sell at considerable discounts, while properties located close to a combined conservation and recreation area sell at premium prices. The results thus suggest that the hedonic pricing method can be usefully applied when studying townships in developing countries, and that this can clarify and emphasise the importance of environmental factors, which are otherwise frequently neglected in town planning for township settlements.

References


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ESTIMATING NATIONAL ECONOMIC PARAMETERS FOR NAMIBIA

by

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ABSTRACT

This paper estimates the national economic parameters to be used for project appraisal in Namibia. The shadow prices of capital, labour and foreign exchange are derived. The results suggest that the economic opportunity cost of capital is 8%. The economic costs of Namibian labour, calculated as a share of financial costs, are 32% for urban, and 54% for rural semi- and unskilled labour. The economic cost of foreign labour, calculated as a share of financial costs, is 59%. The estimated shadow exchange rate factor lies between 7% and 14% for the Namibian economy.

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1. INTRODUCTION

In this paper I estimate the shadow prices of capital, labour and foreign exchange for the Namibian economy. Shadow prices are defined as the opportunity costs of inputs and outputs consumed or produced by a project (Potts, 2002). The value that a resource could have generated elsewhere in the economy is lost if that resource is moved to a particular project. Shadow prices are therefore calculated to take into account the true opportunity costs of resources, inputs and any external factors resulting from a developing programme or project.

In many markets, especially in developing countries, financial or market values differ from their real economic values due to distortions brought about by imperfect or underdeveloped markets, government protection policies and other external factors (Behrman, 1986). The greatest distortions are associated with unskilled labour, the cost of foreign exchange, and the cost of financial capital.

Shadow pricing is then used to correct for these distortions and value resources, and to approximate their actual value. The use of unadjusted market prices for labour and capital could lead to an underestimation of the real costs of capital intensive projects, promoting these at the expense of the socially less costly labour intensive projects. High levels of effective tariff protection, together with import quotas and over-valued exchange rates, discriminate against the agricultural sector in favour of the import-substituting manufacturing sector. Such distorted domestic product prices not only reflect inaccurately the real terms of trade between, for example, agriculture and industry, but also tend to favour upper income groups disproportionately in relation to lower income groups.

It is thus essential to estimate shadow prices when evaluating a project in terms of an economic analysis. Project evaluation aims to induce allocation efficiency in the use of a country’s resources by applying cost-benefit analysis (Campbell & Brown, 2003).

Despite its crucial role in sound developmental planning, the application of shadow pricing in Namibia has been limited or virtually non-existent. This is unfortunate, as Namibia's
development strategy, encapsulated in the five-yearly National Development Plans and in Vision 2030, underpins the importance of development/investment programmes in addressing the challenges of poverty, high unemployment, inequality and low industrialisation. The launch of a national development bank in 2004, to fund long-term infrastructure projects, further emphasises the importance of understanding the economic costs and benefits of the projects it supports. Potential large scale projects, such as the development of Kudu Gas Fields, Transfrontier Tourism Parks and other infrastructure projects, would need to be assessed on both financial and economic grounds. Practically applied in the economic analyses of Namibia's development projects, shadow pricing has the potential both to ensure the optimal allocation of the country’s scarce resources, and to help the country to attain the targets set out in its development strategy.

Estimating shadow prices for the Namibian economy is also interesting from an academic point of view. Namibia has special features that are not commonly found among other developing countries. Namibia's Gross Domestic Product (GDP) per capita at market exchange rates (2005) of US$ 3,100 is relatively high for a developing country. However, according to the World Bank's World Development Indicators 2006, Namibia has the world's highest Gini index (74.3, compared to South Africa's 57.8 and Botswana’s 63). This implies an uneven income distribution, which provides further incentives for estimating shadow wage rates.

The economy has an unusually large service sector for a developing country (around 58.7% of GDP). Independence in 1990 brought considerable changes to the economy's external and internal migration patterns, especially in relation to the labour market. According to Frayne & Pendleton (2001) internal migration and urbanisation in Namibia is growing rapidly, driven to a large extent by employment opportunities in urban centres. The population of Windhoek, the capital city, grew on average at an annual rate of 5.4% in the 1990s. No substantial research has been carried out in Namibia on either the scale or the

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2 Shadow prices are consistently used in the Ministry of Environment and Tourism (MET), but these are based on educated guesswork rather than real estimates. This framework assume the economic opportunity cost of capital at 8%, an adjustment (up by 6%) to the value of tradable goods to reflect excess demand for foreign exchange, and an adjustment (down by 65%) to unskilled labour costs, to reflect unemployment (Barnes, 1994).

3 The Gini index is a measure of the degree of income inequality.
possible consequences of skills emigration, but both skilled and unskilled Namibian migratory labour, deployed to South Africa (SA) and to other neighbouring countries, is very limited, according to preliminary analyses by Frayne & Pendleton (2001, 2002) and the ‘Migration Dialogue for Southern Africa’ (MIDSA, 2006). Namibia’s net migration rate is estimated at 0.47 for every 1000 persons.

In addition, unlike other developing countries, Namibia is a net capital exporter. The economy has high domestic savings, but these flow out in the most part to SA, in search of higher returns. The lack of domestic investment opportunities is cited as one reason for the persistent capital outflows (Fitch Ratings, 2005), which amount to 10% of GDP annually, and continue unabated.

The linkages to SA are not only restricted to Namibia's capital outflows. The two economies are members of regional groupings such as the Southern African Customs Union (SACU), the Southern African Development Community (SADC) and the Common Monetary Area (CMA). Namibia's currency is pegged to the South African Rand; 82% of the country’s total imports are from SA, and around 26% of the country’s total exports are to SA. The South African economy, the regional economic powerhouse, is some 30 times the size of the Namibian economy.

Recent calculations by Harberger et al (2003), Kuo et al (2003) and Bicak et al (2004) produced estimates of shadow prices for labour, capital and foreign exchange in the South African Economy. Since South Africa and Namibia share similar historical and political ties and a current close economic relationship, it would be interesting to compare the results of this work with those from the South African studies. However given Namibia's special features, atypical for a developing economy, it can reasonably be expected that the national parameter estimates for the two economies will be different.

This study is the first formal attempt to estimate shadow prices for the Namibian economy. The paper is structured as follows. Section 2 (following) discusses economic features pertinent to the estimation of Namibian shadow prices. Section 3 is a treatment of approaches to shadow pricing as well as the methodology employed. Section 4 describes the
data employed in the analysis and the assumptions underlying each estimate. Section 5 presents the results and Section 6 concludes.

2. FEATURES OF THE ECONOMY PERTINENT TO ESTIMATION OF SHADOW PRICES

(a) Dynamics of Capital Markets

The Namibian financial markets exhibit special features that affect the estimation of the shadow price of capital. Limited investment opportunities in domestic financial markets have led to sizable outflows of Namibian savings into the liquid and relatively developed South African markets. Membership of the CMA also allows for free capital outflows, and requires Namibia to conform to South African exchange control practices for countries outside the CMA. These outflows averaged around N$1.8 billion per year between 1990 and 1994, and have accelerated to about N$2.4 billion per year since 1995, driven by net outflows in both portfolio and other investments.

The Namibian economy is primarily resource-based, and thus has some investments that are highly profitable, fuelled by resource rents (economic profits obtained by utilising natural resources). These rents, existing because the natural resources are scarce, can be an important source of development finance; countries like Botswana and Malaysia have successfully leveraged natural resources this way. However, in sectors that do not have resource rents, the marginal product of capital appears to drop sharply, as many funds are invested outside of Namibia.

The Namibian authorities have followed a two-pronged strategy to stem capital outflows: regulatory controls, to restrict capital outflows, and development of domestic markets, to provide institutional investors with assets denominated in Namibian dollars. The latter strategy is still in its infancy. In the mid 1990s Namibian authorities raised regulatory requirements for both the pension fund and the insurance industries (Regulations 28 and 15 respectively), such that 35% of the assets under their management had to be domestic assets (up from an earlier 10%). This action did contribute to the growth of the Namibian Stock
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Exchange, due to an increase in dual listings of South African companies. However these investments in dual-listed companies were unable to contain capital outflows. As a result the government has proposed further changes to tighten the domestic assets requirements: among other new proposals, a 5% minimum for unlisted investments and a 10% maximum on dual listed shares.

The impact of the regulatory controls is significant. The total demand for Namibian investment instruments is estimated at N$ 23 billion whilst the total supply of Namibian investment instruments is estimated at N$ 17 billion. There is thus a N$ 6 billion excess supply of funds, which is currently channeled to dual-listed shares on the Namibian Stock Exchange.

(b) Labour Market Dynamics

The Namibian labour market is governed by a policy framework which includes a labour act, a social security act, an employment policy, an affirmative action bill and incentives for investment and training. On balance, however, unemployment and underemployment remain high. According to the latest Labour Force Survey of 2004, unemployment is estimated at 36%. According to the Bank of Namibia’s annual report (2004), an estimated 15% of the employed population are underemployed. Motinga & Tutilife (2006) indicate that Namibia created a mere 22,000 formal jobs between 1991 and 2001. Unemployment disproportionately affects the Namibian youth and the unskilled. The duration of unemployment is longer in rural areas, and varies between six months and 2 years.

There is also evidence of wage inequality between the skilled and the unskilled. Motinga & Mohammed (2002) calculated that an average unskilled person earns 3% of the wages and salaries of top management, and less than 50% of what an average skilled person earns. Westergaard-Nielsen et al (2003) confirm the huge wage differentials between skilled and unskilled labour. Although there is no formal minimum wage legislation, industry-specific wage agreements for the construction, agriculture and security industries do contain minimum wages. There is also a large informal economy employing at least 133,000 people,
64% of whom are young people. Remuneration in this sector is very low, and there are no benefits such as social security and medical aid.

The presence of a large informal economy and minimum wages lead to Namibian wages being set higher than the marginal productivity of labour. The case for such an economic adjustment is made by the imperfections in the labour markets. The informal economy, which consists of large numbers of small scale businesses, can reasonably be assumed to be a sector with market clearing wages. In the formal sector however, the presence of minimum wages, collective bargaining and potential efficiency wage issues, leads to wages above the market clearing levels found in the informal economy. Due to these distortions, a portion of the 36% unemployed would prefer formal jobs, but cannot get them.

(c) Issues in Estimation of Foreign Exchange Premium

Namibia’s participation in the Southern African Customs Union (SACU) raises the question of whether such participation affects the estimation of the shadow price of foreign exchange (SER). SACU groups Namibia, Botswana, Lesotho, Swaziland and SA together and applies a common external tariff. All customs and excise duties collected by the five members of SACU are pooled into a Common Revenue Pool (CRP), and re-distributed among them according to a Revenue Sharing Formula (RSF). The sharing of the revenue from customs duties is determined on the basis of each country's percentage share of total intra-SACU imports, excluding re-exports, and not on the basis of SACU imports from the rest of the world (Flatters & Stern, 2005 and Kirk & Stern 2005).

The majority of Namibian imports (82%) are from SA, which increases Namibia's share of the revenues from the SACU system (due to the RSF intra-SACU imports rule). Namibian imports from outside SACU (the remaining 18% of the country's total imports) are subject to SACU tariffs, but generate very little extra SACU revenue for Namibia because tariff revenues are paid into the SACU system, from which funds Namibia receives only a small portion. Most Namibian exports are to countries outside SACU, and therefore do not affect the country’s revenue share from SACU.
Thus since the Namibian SACU revenue is effectively independent of Namibian out-of-SACU imports, it can be argued that SACU receipts are not relevant to the determination of the shadow exchange rate, since they are essentially inter-governmental transfers, and do not directly affect the relationship between prices of traded goods at world prices and their domestic prices. Moreover the SACU revenue pool is now gradually declining due to continuing trade negotiations at the multilateral and regional levels.

In relation to the customs union, there is a question as to how to treat imports within the union. Namibia is part of the CMA, which includes Namibia, Swaziland, Lesotho and South Africa.\footnote{The CMA is described as an area of coordination of the monetary and exchange rate policies of its members under the Multilateral Monetary Agreement of 1992. Under the CMA, the Namibian currency is linked one-to-one to the South African rand, which is also legal tender. The CMA also guarantees free capital flows among member countries, as well as access for Namibian government and financial institutions to South Africa’s financial markets. See Tjirongo (1995) and Vollan (2000).} With the exception of Botswana, the CMA has more or less the same member countries as SACU; there should thus be two shadow exchange rates (SERs)—one for convertible currency external to the CMA, and one for Rand-based currencies which would have an exchange rate of 1, since there are no trade restrictions between the CMA countries. The SER to be calculated in this work is therefore applicable to transactions with countries outside of the CMA, but not to the foreign content of goods purchased from South Africa.

In principle one would expect the SER to be similar in relation to external economies for all members of the CMA, because they are all using the same tariff structure; however there might be some variation due to differences in the structure of imports.

3. ANALYTICAL FRAMEWORK (METHODOLOGY)

This section describes the analytical framework within which shadow prices in Namibia are estimated. Generally there are two approaches to shadow pricing, hinging on assumptions regarding the existence of market distortions (Medalla, 1982). The first approach may be generalised as an attempt to estimate shadow prices associated with a first-best optimum. If market and shadow prices diverge due to policy failures, then the appropriate shadow prices would be the equilibrium prices that would prevail if the distortions were removed. If, however, the divergence is caused by failures of market, rather than policy, then non-
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Optimality is in essence caused by the absence of first-best corrective measures. The studies by Tinbergen (1958) and Bacha & Taylor (1971) in the case of shadow pricing of foreign exchange are associated with this first approach, which, for primary factors such as capital and labour, is not yet feasible due to inadequate techniques and data (Medalla, 1982).

The second approach treats present distortions as given, and assumes that they might persist in the long term (Medalla, 1982). Shadow pricing is then a problem of deriving the dual solutions to the optimisation of welfare, while the distortions are treated as constraints. Under this approach the problem of optimisation is usually not formally specified, but rather forms the conceptual framework for shadow pricing rules. The resulting shadow prices are referred to as second-best shadow prices, representing the social costs and benefits of inputs at the second-best optimum. This approach is associated with the work of Little & Mirrlees (1969), Harberger (1972) and Dasgupta et al (1972).

In this paper we follow Harberger’s (1972) approach, for two reasons. Firstly, according to Khan (1979), this is the correct method of estimating the shadow discount rate where the marginal social value is not equal to the marginal social cost of funds at the market equilibrium, due to the presence of various distortions. Secondly, and more importantly, this approach will allow for the comparison of these results with those of Harberger et al (2003), Kuo et al (2003) and Bicak et al (2004) for South Africa.

(a) Economic Opportunity Cost of Capital (EOCK)

Harberger & Jenkins (2002) and Barreix (2003) mention four different approaches to the choice of a discount rate for use in economic cost benefit analysis. However, only one approach (the EOCK Approach) is suitable for a small open economy like that of Namibia. The other three approaches are marred by various constraints.\(^5\)

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\(^5\) It is not the purpose of this paper to delve into a lengthy exposition of the various approaches to defining the social rate of return. One approach suggests that both private and public investments should be discounted at a rate equal to the marginal productivity of capital in the private sector. A second approach recommends the use of an accounting rate of interest which is the estimated marginal return from public sector projects, given the fixed amount of investment funds available to the government. A third approach recommends that the benefits and costs of projects should be discounted by the social rate of time preference for consumption, but only after costs have been adjusted by the shadow price of investment to reflect the fact that forgone private investment has a higher social return than present consumption. The reader is advised to consult Barreix (2003), who provides an excellent summary.
The EOCK approach postulates that in a small open and developing economy, like Namibia, there are three alternative sources for public funds. The first source comes from individual savers, who take resources that would otherwise have been spent on private consumption, and instead contribute to an increase in domestic savings. The second source is from additional foreign capital inflows. The third source is from those resources that would otherwise have been invested in other investment activities that have been either displaced or postponed by the project’s extraction of funds from the capital market (Harberger & Jenkins, 2002). Based on these three alternative sources of public funds, the economic cost of capital can be estimated as a weighted average of the rate of time preference applicable to additional savings, the marginal cost of additional foreign capital inflows, and the rate of return on displaced or postponed investments. In general, various distortions are associated with each of these three alternative sources of funds.

Theoretically the social rate of return may be defined by applying national accounting principles. In an open economy, real income may differ from real product because of the servicing of national debt. Let us assume that \( s \) is the average interest rate on the stock of foreign debt (\( D \)). Then income \( Y \) is given by:

\[
Y = q - s \cdot D
\]  

(1)

where \( q \) is the real product. If we then consider a new public project:

\[
\Delta Y = \delta \Delta I_p + \rho \Delta I_p - i_f \Delta D
\]  

(2)

where \( \Delta q = \delta \Delta I_p + \rho \Delta I_p \), \( \Delta q \) is the permanent change in real product, \( \Delta I_p \) is the new public project, \( \delta \) is the rate of return of the project, \( \Delta I_p \) is the change in private investment caused by the new project (\( \Delta I_p < 0 \)), \( \rho \) is the marginal rate of return that the postponed investment would have generated, \( i_f \) is the marginal cost of additional foreign borrowing and \( \Delta D \) represents the change in the external debt stock.
The decision rule for accepting the project is that the discounted stream of extra income \((\Delta Y)\) must be higher than the consumption forgone now (change in savings \(\Delta S\)). Thus the project should be accepted if the following condition can be satisfied:

\[
\frac{\Delta Y}{r} \geq \Delta S \tag{3}
\]

This can then be rewritten as:

\[
\Delta Y \geq r \Delta S \tag{4}
\]

Substituting (2) into (4) gives us:

\[
\delta \Delta I_g + \delta \Delta I_p - i_f \Delta D \geq r \Delta S \tag{5}
\]

\[
\delta \Delta I_g \geq r \Delta S + i_f \Delta D - \rho \Delta I_p \tag{6}
\]

For the marginal public investment, we thus have:

\[
\delta = r \frac{\Delta S}{\Delta I_g} + i_f \frac{\Delta D}{\Delta I_g} - \rho \frac{\Delta I_p}{\Delta I_g} \tag{7}
\]

where \(\frac{\Delta S}{\Delta I_g}; \frac{\Delta D}{\Delta I_g}; \frac{\Delta I_p}{\Delta I_g}\) represents shares of funds sourced from different parts of the capital market. We can then solve:

\[
\Delta I_g = \Delta S + \Delta D - \Delta I_p = \left(\left(\frac{\partial S}{\partial r} + \frac{\partial D}{\partial r} - \frac{\partial I_p}{\partial r}\right)\frac{\partial r}{\partial I_g}\right) \Delta I_g
\]

\[
= \left(\frac{\partial S}{\partial r} + \frac{\partial D}{\partial r} - \frac{\partial I_p}{\partial r}\right) \frac{\partial r}{\partial I_g} \Delta I_g \tag{8}
\]
where \( \frac{\partial S}{\partial r}, \frac{\partial D}{\partial r}, \frac{\partial I_p}{\partial r} \) represent shares of funds.

The weights of (8) can be written in terms of the aggregate elasticity of each source:

\[
\varepsilon_s = \frac{\partial S_r}{\partial r} \Rightarrow \frac{\partial S}{\partial r} = \frac{\varepsilon_s S}{r},
\]

(9)

and similarly for D and I\(_p\). We thus have:

\[
\frac{\partial S / \partial r}{\partial S / \partial r + \partial D / \partial r - \partial I_p / \partial r} = \frac{\varepsilon_s S / r}{\varepsilon_s S / r + \varepsilon_f D / r - \eta \frac{I_p}{r}} = \frac{\varepsilon_s S}{\varepsilon_s S + \varepsilon_f D - \eta I_p}
\]

(10)

which represents the share of increased savings (weight, \( f_s \)). Similarly the other two weights can be derived:

\[
\frac{\partial D / \partial r}{\partial S / \partial r + \partial D / \partial r - \partial I_p / \partial r} = \frac{\varepsilon_f D}{\varepsilon_s S + \varepsilon_f D - \eta I_p}
\]

(11)

which represents the share of increased foreign borrowing (weight, \( f_f \)), and finally,

\[
\frac{\partial I_p / \partial r}{\partial S / \partial r + \partial D / \partial r - \partial I_p / \partial r} = -\frac{\eta I_p}{\varepsilon_s S + \varepsilon_f D - \eta I_p}
\]

(12)

which represents the share of displaced private investment (weight \( f_i \)).

Thus, \( \varepsilon_s \) is the supply elasticity of household savings, \( \varepsilon_f \) is the supply elasticity of foreign funds and \( \eta \) is the elasticity of demand for domestic investment relative to changes in the interest rates. \( S \) is the total savings available in the economy, of which \( S_r \) is the contribution to the total savings by households, and \( S_f \) is the total contribution of net foreign capital inflows.
Barreix (2003) mentions that only this market-driven opportunity cost approach is sufficiently flexible to easily add a new source of financing to the analysis. This approach also has another important advantage: it can be defined as a single value. Thus no extra adjustment on investment expenditures is required, and no classification of benefits and costs are needed.

Barreix (2003) surveys the empirical literature on the estimation of the shadow price of capital and finds that most studies have used the EOCK approach, especially developing countries. The standard method for estimating the EOCK for developing countries is captured in the work of Jenkins & Kuo (1998), in which the (EOCK) is measured as a weighted average of the rate of time preference to savers ($\gamma$), the cost of additional foreign capital inflows ($MC_f$), and the rate of return on displaced investment ($\pi$). The weighted average of these three costs can be expressed as:

$$EOCK = f_1 \cdot \gamma + f_2 \cdot MC_f + f_3 \cdot \pi$$  \hspace{1cm} (13)

Where $\gamma$, $MC_f$ and $\pi$ equal the cost of the public sector funds obtained at the expense of current consumption, the cost of additional foreign capital inflow to the economy, and the cost of the public sector funds obtained at the expense of other domestic investment. The cost of foreign borrowing ($MC_d$) is valued at its marginal cost. The weights ($f_1$, $f_2$, and $f_3$) are the shares derived earlier, and are equal to the proportion of funds diverted or sourced from each sector.

If the weights are expressed in terms of elasticities of demand and supply of funds with respect to changes in interest rates, equation (13) can be rewritten as follows:

$$EOCK = \frac{\varepsilon_f (S_r / S_r) \cdot \gamma + \varepsilon_f (S_f / S_r) \cdot MC_f - \eta \cdot \pi}{\varepsilon_f (S_r / S_r) + \varepsilon_f (S_f / S_r) - \eta}$$  \hspace{1cm} (14)
Namibia’s special circumstances make it necessary to amend two things to the standard approach. Firstly, the savings analysis in (14) is different in Namibia from that in most developing countries, where total savings available are usually the sum of domestic savings and foreign investment. In Namibia, due to its net capital exporter status, total savings available in the economy are domestic savings minus investment abroad.

Secondly, the weighted average of the rate of return on displaced investment ($\pi$) is usually measured as the contribution of capital to GDP, which can be measured by the gross-of-tax return on capital (Kuo et al 2003). Most empirical work uses the average gross capital income as an approximation of marginal gross capital income (Jenkins & Kuo, 1998; Kuo et al 2003). The average gross-of-tax returns per invested unit of capital will usually give an acceptable approximation of the marginal gross-of-tax returns, but since Namibian average gross-of-tax returns include natural resource rents that are not available to the marginal investor, the average returns in Namibia are likely to be much higher than the marginal returns. This approach will therefore always tend to exaggerate the marginal income. Clearly a different approach is needed.

One approach would have been to use the standard approach, but only for capital invested in those sectors where no natural resource rents are involved. Such an approach is hardly feasible since those sectors are generally not well documented in the Namibian national accounts. A second, more feasible approach is based on the Namibian corporate tax code structure. The Namibian corporate tax code is very simple, and is equal for all sectors. The real net of tax return on capital can therefore be assumed to be equal to the interest rate (Barreix, 2003). The weighted average of the rate of return on displaced investment ($\pi$) is thus measured as:

$$\pi = \frac{(L_n - gP^d)}{(1 - T_c)(1 + gP^d)}$$

(15)

where $L_n$ is the Namibian lending rate, $gP^d$ is the domestic inflation, and $T_c$ is the Namibian corporate tax.
The rate of time preference to savers can be measured by the real net-of-tax rate of return on household savings. That is,

\[
\gamma = \frac{i_d(1-t_p) - gP_d}{1 + gP_d}
\]  

(16)

where \(i_d\) represents the nominal interest rates, \(gP_d\) represents the domestic inflation, and \(t_p\) represents the marginal personal income tax rate.

The economic cost of foreign borrowing is usually measured by the interest rate charged on loans for the projects, plus the marginal change in the cost of foreign borrowing, times the quantity of the stock of foreign debt, with variable interest rates that will be rolled over in the future periods. This can be calculated in the following way:

\[
MC_f = r_f \cdot (1 - t_f) \cdot \left[1 + k \cdot \left(\frac{1}{\epsilon_f}\right)\right]
\]  

(17)

where \(r_f\) is the prevailing market interest rate charged on the foreign loan, \(t_f\) is the withholding tax rate on foreign borrowing, \(k\) is the ratio of the total stock foreign borrowing, with a floating interest rate linked to the total stock of foreign capital inflows, and \(\epsilon_f\) is the supply elasticity of the stock of foreign funds. Although (17) is the formula normally applied for developing countries, not all parts of it are applicable to Namibia. In estimating (17), the \([1 + k \cdot (1/\epsilon_f)]\) part is rendered irrelevant for Namibia, since the country does not need to attract foreign funds, but rather to reduce the Namibian funds invested abroad by increasing government borrowing. Hence the correct thing to look at is the value of Namibian savings invested in South Africa.

The elasticities representing the sensitivity of domestic fixed investment to interest rates (\(\eta\)) was obtained from Humavindu (2001), who estimated a dynamic error-correction model for Namibian private investment. The work applies a Vector Autoregression (VAR) framework, which is an \(n\)-equation, \(n\)-variable linear model in which each variable is in turn explained by its own lagged values, plus current and past values of the remaining \(n - 1\) variables. In that
work the interest rate variable had a coefficient of -1.88. The output from the Humavindu (2001) regression is in appendix 1.

(b) Economic Opportunity Cost of Labour (EOCL)

The economic opportunity cost of labour (EOCL) reflects the value to the economy of the set of activities given up by the workers, including the non-market costs (or benefits) associated when they change employment from one project to another (Harberger & Jenkins, 2002). Two approaches are generally applied in estimating the EOCL: the value of marginal product of labour foregone, and the supply price of labour (Bicak et al, 2004).

Under the former approach (value of marginal product of labour forgone), the EOCL is estimated by starting with the gross-of-tax alternative wage earned in previous employment by the labour hired for the new project (marginal product foregone), and then adjusting for differences in other costs & benefits. Under the latter approach (supply price of labour), the EOCL is determined by starting with the gross-of-tax market wage (the supply price) required to attract sufficient workers to the project, and then adjusting for distortions such as taxes and subsidies. Theoretically these two approaches will produce the same result in estimating the EOCL, but they have different data requirements and levels of computational complexity, which affords them different degrees of operational usefulness (Bicak et al, 2004). The latter approach (supply price of labour) is straightforward and easier to use under a wide variety of conditions in the labour market.

Bicak et al (2004) use the supply price of labour approach, also employed in this paper. Special characteristics of the Namibian labour market are limited to the high wage inequality between skilled and unskilled labour and the large informal economy. There is little international migration, although inter-regional migration to urban areas is high. A new project is highly likely to attract workers from both the formal and the informal sectors, and foreign labour, where needed, but may also attract some skilled Namibians currently working in South Africa.
It appears that skilled labour is in scarce supply in Namibia with very little, if any, unemployment experienced in this sector (LARRI, 2005, 2006a; Marope, 2005). Managers and professionals earn annual remuneration of between N$250,000 and N$400,000. Unemployment stands at around 4% among those with a university education. In such cases, the opportunity cost of skilled labour is assumed to equal the domestic market wage (Potts, 2002). We therefore concentrate on the shadow price of unskilled labour and that of foreign labour.

The presence of a large informal economy presents an opportunity to determine the free market wage at which everyone could work. From LARRI (2006b), the free market wage can be estimated at N$ 175 per month. In Namibia there are some industries with minimum wages, and other wages are determined by collective bargaining agreements. In such markets, the wage rates are above their market clearing rates (Bicak et al, 2004). Because of the minimum wage rates, there is chronic unemployment in this segment of the labour market. The illustration in Figure 1 shows how the EOCL for protected jobs can be determined under the conditions of a linear supply curve and a perfectly elastic demand for labor in the informal economy.

Figure 1
Let $W_p$ be the protected sector wage and let the supply curve of labour for those who are not formally employed be given by $W_oS_i$. Let $L_i$ be the people who are willing to work at $W_i$ and $L_q$ be the quasi-unemployed, willing to work at $W_p$ but not at $W_i$. To simplify the analysis it is assumed that $W_i$ is the free market at which everyone could work if they wished. The intersection of this supply curve and the free market wage rate of $W_i$ determines the number of people willing to work at this wage, or $L_i$ in Fig. 1. In the Namibian case $W_i$ would be the informal market wage.

When a project creates a demand for protected workers, the demand will be met in part by those working in the free market (the informal economy, in our case) and partly by quasi-voluntarily unemployed workers (Bicak et al, 2004). If it is assumed that workers are recruited randomly from among all those willing to work for the protected sector wage, the economic cost of these jobs would be measured by the weighted average of the free market wage and the supply price of the quasi-voluntarily unemployed. The EOCL will then fall between the free market wage (the informal economy wage, in our case) and the protected wage rate. In the case of linear supply curves, the average supply price of the quasi-voluntarily unemployed is measured by $(W_i + W_p)/2$. If any tax adjustments are ignored, then the EOCL for protected sector jobs can be expressed as follows:

\[
\text{EOCL}_p = f_1 W_i + f_2 (W_i + W_p)/2
\]

where $f_1$ and $f_2$, respectively, represent the proportions of the project jobs being filled by those now working in the informal economy, and those filled by unemployed individuals who were waiting for new, protected project jobs to become available.

The EOCL for skilled foreign labour will be measured by the net-of-tax wage that the worker receives in Namibia, plus an adjustment for the foreign exchange premium (an additional cost on the share of wages remitted by the foreign worker). A second adjustment is related to the goods and services that the foreign worker consumes in Namibia. If the foreign worker pays any excise or value added taxes on purchased goods, these taxes should be deducted from the cost of foreign labour, as they do not represent a cost to the economy of Namibia. In some cases the temporary foreign worker might receive benefits such as
subsidised housing or subsidised health benefits. These should be added to the EOCL. Combining these factors, the economic opportunity cost of foreign workers (EOCL$f$) can be estimated as follows:

$$\text{EOCL}_f = W_f(1-t_f) + W_f(1-t_f)(E_e/E_m) - W_f(1-t_f)(1-R)t_{\text{VAT}}$$

where $W_f$ is the gross-of-tax wage of foreign labour, $t_f$ is the rate of personal income tax levied by the host country on foreign wages and salaries, $t_{\text{VAT}}$ is the average rate of value added tax paid, $R$ is the proportion of the net-of-tax income repatriated by foreign labour, $E_e$ is the economic exchange rate and $E_m$ is the market exchange rate.

For South African labour coming to work in Namibia, the main source of skilled foreign labour, the equation (19) can be rewritten as (since $E_e/E_m=1$):

$$\text{EOCL}_{FS} = W_f(1-t_f) + W_{FS}(1-t_f)(1-R)t_{\text{VAT}}$$

Similarly for Namibian skilled labour attracted back home by the project from out of country employment, the EOCL will then have to adjust for loss of remittances:

$$\text{EOCL}_{\text{skilled Nam labour}} = W_N(1-t_{FS})R.$$  

(c) Economic Opportunity Cost of Foreign Exchange (EOCFE)

The wedge between the Shadow Exchange Rate (SER) and the Official Exchange Rate (OER) can be attributed to a combination of two factors: disequilibria in the balance-of-payments (BOP), and in the protection structure (Medalla & Powers, 1984). For the former, devaluation may be required up to the point where the level of foreign borrowing is deemed to be acceptable by a policy maker. The latter, however, calls for a reform in the protection structure, rather than devaluation. An SER higher than the OER reflects the premium placed on foreign exchange (used or produced), when evaluating projects in order to correct the distorted relative prices between traded and non-traded commodities. A higher SER does not indicate devaluation per se, but rather devaluation to the exact degree of the SER
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estimate. This distortion in relative prices arises from the protection system (and BOP disequilibrium), and not only affects price relationships among tradable goods, but also distorts the prices of tradables in general, relative to non-tradables. Among tradable commodities, relative price distortion may be corrected in project evaluation by using their relative border prices. However further correction is needed for the price distortion between tradables and non-tradables. This is in essence the role of the SER in project evaluation. It serves as the conversion factor for non-tradables, making their prices consistent with border prices of tradables. Ideally one would prefer to compute a specific conversion factor for each non-tradable rather than use a standard conversion factor such as the SER. However given the practicalities involved in decomposing non-tradables into their tradable and primary factor components, the SER is easier to compute.

Lagman-Martin (2004) mentions three alternative approaches to estimating the SER. These methods are generally based on converting the OER to the SER, through a conversion factor (the shadow exchange rate factor, or SERF). The first approach is applicable where the economy enjoys balanced trade. The formula applied then involves calculation of the SER based on the tariff-adjusted OER, weighted according to import-export shares. A second approach takes into account the sustainability of the country’s trade imbalance through an assessment of the Equilibrium Exchange Rate (EER). The use of the EER, rather than the OER, puts emphasis on the long-term stability of the exchange rate because of its significant effect on project performance. Finally in the third approach, when tariffs represent the only distortion to trade and there are no distortions in factor or commodity prices, the SERF can then be approximated by one plus the weighted average tariff rate. This approach is consistent with the accepted definition of the SER as the weighted average of the demand price for foreign exchange paid by importers, and the supply price of foreign exchange received by exporters.

This simple trade-weighted formula (Potts, 2002, and Lagman-Martin, 2004) can be represented as:
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\[ SERF = \frac{M(\text{cif}) + X(\text{fob})}{(M + M_t - M_s) + (X - X_t + X_s)} \]

\[ = \frac{TT}{TT - NT_t} \]

where \( M \) is the total value of imports (\textit{cif}-cost, insurance, freight), \( X \) is the total value of exports (\textit{fob}-free on board), \( M_t \) is total value of import taxes, \( X_t \) is the total value of export taxes, \( TT \) is the total value of trade, and \( NT_t \) is the total value of net trade taxes. \( M_s \) and \( X_s \) represent import and export subsidies.

Potts (2002) asserts that equation 22 above assumes that additional foreign exchange expenditure affects the level of imports and exports in proportion to their value in total trade. If it is assumed that a marginal change in foreign exchange availability primarily affects imports, then equation (22) can be simplified to:

\[ SERF_{\text{imports}} = \frac{(M + M_t - M_s)}{M} \]  \hspace{1cm} (23)

Equation (23) usually gives a higher SER value than (22) because in most countries, the average import duty is much higher than the rate of net export subsidy (Potts, 2002).

Other more complex formulae for the SER can be derived if data are available to indicate the types of imports or exports that change with a change in the availability of foreign exchange. Such formulae use the elasticity of demand for imports and exports with respect to changes in foreign exchange availability, to provide weights for different export and import categories. It is usually very difficult to obtain reliable information on these elasticities, and thus the simple weighted formulas are commonly used. Harberger et al (2003) employ a general equilibrium model to estimate the SER for South Africa. Their approach illustrates how the foreign exchange premium could be estimated in an economy in which the funds used to finance the purchase of tradable and non-tradable goods are obtained via the capital markets. This framework ensures that all repercussions in the economy due to the purchase of tradable goods for a project are taken into account in a consistent manner. Due to data limitations, this study employs the simple weighted trade
formulae presented above. Potts (2002) mentions that in estimating SERs empirically most studies yield values that lie between the two simple weighted trade formulae. Other methods include semi-input-output models using the weighted average of the conversion factors for traded goods. The question as to which formula to use is essentially an empirical one (Potts, 2002).

4. DATA

The data are derived from various sources. For the shadow price of capital estimates the data are derived from the Preliminary National Accounts 2005 (Central Bureau of Statistics), and the Bank of Namibia’s quarterly and annual reports. The personal income tax system in Namibia is progressive in nature, with five income tax brackets. The taxes range from nil to 35%; the maximum rate is reached when the taxable income exceeds N$200,000 (Ministry of Finance, 2003). We assume that the marginal personal income tax rate for savers is approximately 15%, the tax rate for those whose annual gross income falls between N$40,000 and N$60,000. The average inflation rate in Namibia since 2001 is 6.8% and the average nominal rate of return on savings in money markets for 2005 was 6%. Based on National Accounts data, the ratio of household savings to total savings ($S_r/S_t$) in Namibia is estimated at 1.5. The average lending rate in Namibia in 2005 was 10.5% whilst the Namibian corporate tax was 35%.

Following Jenkins & Kuo (1998) and Kuo et al (2003), the long term supply elasticity of the personal savings stock is set at 0.5, based on a number of international empirical studies. Similarly Kuo et al (2003) assume the supply elasticity of the stock of foreign funds (the $\varepsilon_f$ parameter) at 1.5. However since we argued in Section 3 (a) for the need to focus on Namibian savings to South Africa, the $\varepsilon_f$ parameter is likely to be higher for funds flowing between Namibia and South Africa than funds flowing between South Africa and the rest of the world. Thus in estimating the EOCK, we use three different values for $\varepsilon_f$ (2, 2.5 and 3).\(^6\)

Based on equation (13), the real net of tax rate of return on savings or time preference on

\(^6\)There are no empirical studies on the determinants of Namibian capital outflows to South Africa. The absence of such studies is due principally to data constraints.
foregone consumption is approximately -0.015%. Adjusting equation (14) yields a marginal cost of reduced investment abroad of -0.01%.

The labour estimates are derived using LARRI’s Actual Wage Rate Database, The Labour Force Surveys 2004 and the Namibia Informal Economy Survey 2001 (Ministry of Labour), and LARRI’s Study of the Informal Economy 2006. In terms of unskilled labour, we use the minimum wages as determined by LARRI (2005, 2006a) for the various economic sectors in Namibia. The database is derived from wage agreements entered between various trade unions and different corporate entities between 2000 and 2005. This database represents the urban semi- and unskilled labour. We will also look at special categories, such as farm workers and security guards who are formally paid a minimum wage as set out in legislation. LARRI (2006b) shows that on average the majority of informal workers are paid N$175 per month. The estimated number of people working in the informal sector is 133,000. Unfortunately, there are no disaggregated data available on rural and urban wages. Therefore the informal sector and farm workers are used as a proxy for rural semi- and unskilled labour. The Labour Force Survey of 2004 estimates that 108,119 people are unemployed. Using these data, we obtain \( f_1 \) at 0.55, \( f_2 \) at 0.45, and \( W_f \) at N$175, to estimate the EOCL equation. For urban semi- and unskilled labour, \( W_f \) is the LARRI's database average national wage, which is N$1475. For rural workers, \( W_p \) is the farm workers’ minimum wage of N$428. In estimating the EOCL for foreign labour, \( t^F \) is 35%, with \( t^{VAT} \) at 15%; \( \varepsilon/Em \) is the calculated SER derived from this study’s estimates. Finally we assume \( R \) (the proportion of the net-of-tax income repatriated by foreign labour) at 40%.

The Namibian trade statistics utilised to estimate the Forex premium were obtained directly from the Central Bureau of Statistics and from the Bank of Namibia’s publications.

5. RESULTS

(a) EOCK Estimates: Results

Using the three different values for \( \varepsilon_0 \), the EOCK estimates are given in Table 1.
Table 1: EOCK Estimates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>EOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\varepsilon_{f1}$</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>$\varepsilon_{f2}$</td>
<td>2.5</td>
<td>8%</td>
</tr>
<tr>
<td>$\varepsilon_{f3}$</td>
<td>3</td>
<td>10%</td>
</tr>
</tbody>
</table>

The EOCK is 8% on average. This estimate agrees with the informal estimate of 8% by Barnes (1994), and is lower than the result obtained by Kuo et al (2003), who estimate the South African EOCK at 11%.

(b) EOCL Estimates: Results

The results of the EOCL estimates are given in Tables 2 and 3.

Table 2: EOCL Estimations

<table>
<thead>
<tr>
<th>Namibian Minimum Wage by Sector</th>
<th>EOCL1</th>
<th>Economic Costs as share of Financial Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industry</strong></td>
<td>Three year average $W_i$ assumed at N$175 2003-2005</td>
<td>%</td>
</tr>
<tr>
<td>Agriculture, hunting, fishing, forestry</td>
<td>1256 417</td>
<td>33%</td>
</tr>
<tr>
<td>Community, social &amp; personal services</td>
<td>1676 511</td>
<td>31%</td>
</tr>
<tr>
<td>Construction</td>
<td>1415 452</td>
<td>32%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1366 441</td>
<td>32%</td>
</tr>
<tr>
<td>Mining &amp; quarrying</td>
<td>1812 542</td>
<td>30%</td>
</tr>
<tr>
<td>Transport &amp; storage</td>
<td>1693 515</td>
<td>30%</td>
</tr>
<tr>
<td>Wholesale &amp; retail trade</td>
<td>1104 383</td>
<td>35%</td>
</tr>
<tr>
<td><strong>National average</strong></td>
<td>1475 466</td>
<td>32%</td>
</tr>
</tbody>
</table>

Economic Costs as share of Financial Costs 32%
The EOCL estimations show that economic costs, as a share of financial costs, are 32% for Namibian urban semi- and unskilled labour, and around 54% for rural semi- and unskilled labour. The economic costs of foreign labour and Namibian expatriates comprise 59% and 28% of financial costs respectively. The informal estimate in Barnes (1994) was that the economic cost was 35% of the financial cost for all unskilled labour.

(c) EOCFE Estimates: Results

The results of the SERF estimates are given in Tables 4 and 5.

Table 4: SER Estimations: Export and Imports Formula

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports (CIF) N$ mill</td>
<td>18,226</td>
<td>17,816</td>
<td>18,671</td>
<td>16,996</td>
<td>14,226</td>
<td>12,119</td>
</tr>
<tr>
<td>Exports (FOB) N$ mill</td>
<td>18,556</td>
<td>17,050</td>
<td>17,396</td>
<td>16,320</td>
<td>12,446</td>
<td>10,811</td>
</tr>
<tr>
<td>Imports taxes (N$) mill</td>
<td>2,786</td>
<td>2,640</td>
<td>3,028</td>
<td>1,863</td>
<td>1,861</td>
<td>1,533</td>
</tr>
<tr>
<td>Exports taxes (N$) mill</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Net trade taxes (N$) mill</td>
<td>2,777</td>
<td>2,634</td>
<td>3,024</td>
<td>1,861</td>
<td>1,859</td>
<td>1,531</td>
</tr>
<tr>
<td>Total trade (N$) mill</td>
<td>36,782</td>
<td>34,866</td>
<td>36,067</td>
<td>33,316</td>
<td>26,672</td>
<td>22,930</td>
</tr>
<tr>
<td>SERF</td>
<td>1.08</td>
<td>1.08</td>
<td>1.08</td>
<td>1.06</td>
<td>1.07</td>
<td>1.07</td>
</tr>
<tr>
<td>SERF, six year average</td>
<td>1.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The SER estimates show a range that lies between the value of 1.07, using the imports and exports formula, and 1.14, using the imports only formula. A more general point is that the SER is not a precise figure, since it will be used in projections into an uncertain future. There are therefore grounds for using a central approximation (or best estimate) and doing some sensitivity tests around the central value. In appraising projects it is thus best to apply sensitivity analysis using a low value (7%) and a high value (14%). Harberger et al (2003) estimate a value of 6.2% for the South African economy, which is close to this study’s lower estimate. As previously stated, these estimates are for out-of-SACU-trades, as the SERF for SACU is 1.

6. CONCLUSIONS

This study represents the first formal attempt at estimating national economic parameters for the Namibian economy.

In terms of the EOCK, the lower value of 8%, as compared to South Africa’s 11%, clearly reflects the Namibian net saver position. The estimate is also in accordance with the Barnes (1994) estimate, in use for more than a decade. On the other hand, the EOCL estimate for farm workers, who are used as a proxy for semi- and unskilled rural labour, is much higher than that derived by Barnes (1994). Conversely, the EOCFE estimates are lower than the Barnes (1994) estimate, but are for out-of-SACU trades, which were not incorporated in his work.

These results are presented in the hope that they will represent a useful contribution to efficient and sustainable development planning in Namibia. Further extensions and
developments of this work should entail the estimation of shadow prices using input-output analysis, in order to estimate conversion factors for the different sectors of the Namibian economy.
APPENDIX 1. *Error-correction model for Namibia private fixed investment* (Humavindu, 2001)

The investment function is specified as

\[ L_{p_{inv}} = c + a_1 L_{gdp} + a_2 L_{rgiy} - a_3 L_{rexe} - a_4 L_{rr} - dum_{805} + dum_{85} + \epsilon \]

where \( L_{gdp} \) is Gross Domestic Product; \( L_{p_{inv}} \) is Namibian Private Fixed Investment, \( rr \) is Namibian Interest Rates, \( rgiy \) is Ratio of government investment to output, \( rexe \) is Real effective exchange rate, and dum_{805} and dum_{85} are dummy variables. Sample is from 1981 to 1998.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std.Error</th>
<th>t-value</th>
<th>t-prob</th>
<th>HCSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ( L_{p_{inv}} )_1</td>
<td>-0.26237</td>
<td>0.22942</td>
<td>-1.144</td>
<td>0.2823</td>
<td>0.24279</td>
</tr>
<tr>
<td>Δ( L_{gdp} )_1</td>
<td>-0.26932</td>
<td>0.31207</td>
<td>-0.863</td>
<td>0.4105</td>
<td>0.27681</td>
</tr>
<tr>
<td>Δ( L_{rr} )_1</td>
<td>-1.8820</td>
<td>1.6092</td>
<td>-1.170</td>
<td>0.2722</td>
<td>2.0426</td>
</tr>
<tr>
<td>Δ( L_{rgiy} )</td>
<td>-0.68671</td>
<td>0.41170</td>
<td>-1.668</td>
<td>0.1297</td>
<td>0.37817</td>
</tr>
<tr>
<td>Δ( L_{rgiy} )_1</td>
<td>-1.0228</td>
<td>0.42978</td>
<td>-2.380</td>
<td>0.0412</td>
<td>0.42465</td>
</tr>
<tr>
<td>Constant</td>
<td>0.050410</td>
<td>0.029303</td>
<td>1.720</td>
<td>0.1195</td>
<td>0.029770</td>
</tr>
<tr>
<td>ΔECM1_1</td>
<td>-0.078524</td>
<td>0.10838</td>
<td>-0.725</td>
<td>0.4872</td>
<td>0.098127</td>
</tr>
<tr>
<td>dum_{805}</td>
<td>-0.19062</td>
<td>0.070763</td>
<td>-2.694</td>
<td>0.0246</td>
<td>---</td>
</tr>
<tr>
<td>dum_{85}</td>
<td>0.062731</td>
<td>0.11596</td>
<td>0.541</td>
<td>0.6016</td>
<td>---</td>
</tr>
<tr>
<td>σ</td>
<td>0.0955125</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ \log \text{lik} = 285.23299 \log |\Omega| = -31.6926 \quad |\Omega| = 1.72226e-014 \quad T = 18 \]

LR test of over-identifying restrictions: \( \chi^2(4) = 0.0887259 \) [0.9990]
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Hedonic pricing in Windhoek townships

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ABSTRACT. This study applies the hedonic pricing model to property sales in the township areas in Windhoek, the capital city of Namibia, where municipal authorities have pursued a programme of selling plots of land to settlers in order to encourage them into a formalized economic situation. We find that, apart from house quality, access to the central business district, access to marketplaces and access to transportation, environmental quality also has a large impact on property prices. Properties located close to a garbage dump sell at considerable discounts, while properties located close to a combined conservation and recreation area sell at premium prices. The results thus suggest that the hedonic pricing method can be useful for studying townships in developing countries, and that this can help to clarify the importance of environmental factors which are otherwise frequently neglected in town planning for township settlements.

1. Introduction
The objective of this paper is to study whether property prices in the township areas in Windhoek, the capital city of Namibia, are influenced by attractive attributes in a similar fashion to prices in more developed property markets. This is analysed using the hedonic pricing method. This method has been applied in developing countries only rarely (see Malpezzi, 1999, for an overview), and hardly ever in township areas.

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It might seem obvious that households living in townships will spend what little money they have on goods which are crucial for their short-term survival, and are unlikely to be willing to pay extra for a property with, for instance, a pleasing view. It might also seem obvious that even if township dwellers are in fact willing to pay premia for slightly more attractive dwellings, they are unlikely to have the necessary overview of the property market to know when attractive properties are available and be able to bid for them. However, if attributes such as environmental quality do affect property prices, even among extremely poor households, it is important to town planners to be aware of this, as these preferences should be reflected in policy decisions.

Only a few hedonic pricing studies have been carried out in Africa, and these did not look at property markets in townships; in most of the informal and semi-formal settlements around large African cities the settlers do not have clear title to their land, and even when there are permanent or near-permanent property rights, trade in these properties is usually poorly documented.

In Windhoek, the municipality has pursued a policy of selling plots of land by instalments to low-income households and ultra low-income households – currently defined as households with monthly incomes of less than 1860 N$ (160 US$) and less than 500 N$ (45 US$), respectively – moving in from rural areas, in order to encourage them into a more formalized economic situation. Due to this policy, reliable information on property prices is more easily available for township areas in Windhoek than it is in most similar areas in developing countries. This means that Windhoek is one of the few places where the hedonic pricing method can be applied relatively easily to ultra low-income housing, in order to examine which factors are considered important by township inhabitants and what impact these factors have on property prices.

In the next section, the political and demographic background to the current township policies in Windhoek is presented. This is followed by a section which explains the theoretical framework for the study and discusses property attributes which might affect prices. The next section describes the econometric model and the data set used, followed by a section describing the results of the analysis. The concluding section discusses implications of the results.

2. The Windhoek townships
Windhoek lies in central Namibia. It was the colonial capital of what was then called South West Africa during the German colonial period, and subsequently during South African rule, which ended in 1990. The city is now the capital of independent Namibia and serves as the administrative, legislative, and judicial centre of the country.

The first of the present-day township areas in Windhoek was established during the South African apartheid system. Before the 1960s, the black population of Windhoek lived in the Old Location, a site west of the central business district. Residential blocks were rented from the municipality and

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1 Asabere, 1981a, 1981b; Megbolugbe, 1989; Arimah, 1992; Akpom, 1996.
inhabitants built their own houses. During the late 1950s through to the 1970s, the expansion of the ‘white section’ of Windhoek towards the Old Location led to the forcible relocation of black residents to a site north-west of the city centre. The new site was called Katutura, which means ‘the place where we do not stay’ in one of the local languages.

The South African authorities adopted new housing policies as well, in order to minimize the construction of urban dwellings and to focus more on the provision of ‘temporary’ accommodation. Katutura initially consisted of 4,000 rental houses, a barrack-like single quarters area and a walled compound to accommodate migrant labour. The rental units were divided into ethnic group sections and were uniform in appearance, quality, and size. There were also general regulations to stem the influx of blacks into Windhoek (Pendleton, 1974).

The 1970s and 1980s witnessed a liberalization of the regulations governing black residents of Windhoek and other urban centres (Haines and Tapscott, 1991). From the 1980s, plots of land – called ‘erwen’ in Namibia – and houses could be privately owned in Katutura. New areas west of the established townships were also opened for settlement (Pendleton, 1994).

As a result of the liberalized laws, urbanization increased dramatically. The population of Windhoek grew from approximately 100,000 in 1985 to approximately 145,000 at independence in 1990 (Windhoek City Council, 1996). Squatter settlements sprang up on the outskirts of Katutura and the other township areas.

Windhoek’s population has continued growing after independence and is now believed to be roughly 250,000. Most of the urban expansion has taken place in the township areas to the north and north-west of Windhoek. Before the apartheid regulations were relaxed, the entire black settlement was limited to an area of about 400 hectares located between 4.5 and 7 km from the city centre; currently, the furthest township settlements are over 12 km from the city centre, and the entire township area covers well over 2,300 hectares.

The average monthly household income in the townships is estimated (Windhoek City Council, 1996) to be about N$850 (approximately 75US$). These very low incomes seriously limit the level of services that can be provided at cost to the inhabitants of these areas. Many city governments in Africa faced similar problems with low-income settlers in the 1960s and 1970s. These local governments often attempted to provide subsidized full-service housing for city residents who could not afford cost-recovery tariffs, and limit migration to the city in order to keep down the costs of subsidies to low-income areas. However, the result has frequently been that these cities have ended up both with costly subsidies to the formally recognized low-income areas, and also (since the city governments cannot afford to provide subsidized full-service housing for all settlers) with large informal settlements where residents have no access to any municipal services and no legal rights whatsoever. The uncertainty of tenure and constant threat of eviction in the informal settlements have led to low levels of community involvement; these settlements are often characterized by high crime rates and other problems.
The local government in Windhoek, which faced the problem of rapid urbanization later than local governments elsewhere in Africa, has attempted to learn from these experiences. The municipal township policies aim both towards being financially viable and towards integrating settlers in the formal economy.

Rather than provide subsidized full-service housing, the municipality permits settlers to lease or purchase unused municipal land. Land purchases can be paid either in cash or through loans from the municipality at market interest rates, with the purchased property as collateral. Once the municipality has sold a property there are no restrictions on the resale price, provided that any remaining debt to the municipality is paid in full. Municipal services, such as water and electricity, are optional, but are available at cost-recovery prices for those who choose to make use of them.

Refuse collection is the only municipal service which is compulsory for all erven; each erf has its own refuse bin which is emptied once a week either by municipal trucks (in the older townships) or by private contractors. Illegal garbage dumping in open areas was becoming a major problem throughout the city in the early 1990s, but after municipal authorities improved refuse collection, converting some of the illegal dumps into officially recognized dumping sites in the process, nearly all garbage is now collected and dumped in the officially recognized locations. Unlike many township areas in developing countries, Windhoek’s townships therefore do not have any widespread sanitation problems related to uncollected refuse at present.

Several public sector agents have been involved in the provision of affordable housing in the township areas after independence. The government’s Build Together Programme was designed shortly after independence to provide credit for building and building improvements to ultra low-income households. The programme also provided technical assistance to the program beneficiaries. Poor repayment levels, and high subsidies from government, characterized the programme. The state-owned National Housing Enterprise (NHE) was also set up in order to provide low-cost housing. However, due to profitability problems, the NHE moved away from catering for the ultra low-income groups and began targeting slightly higher-income groups. The NHE is currently reorganizing and plans to start building houses for the lowest-income categories once more, but at present most construction in the township areas is thus done either by residents or by other private agents.

There are few employment opportunities in the township areas; only about 10 per cent of the township population are estimated to work there. Those township residents who are formally employed primarily work in the central areas of the city in the central business district or in the nearby (no longer very aptly named) Windhoek North area, while unemployed gather in the open areas in the central parts of the city in the hope of being picked up by households or small businesses which need to hire labour for short-term jobs. Nearly all work-related travel in the township areas is therefore to and from the central business district, either on foot or by car. There is a considerable number of relatively cheap, privately operated taxis which carry large numbers of passengers at a time; rates are fixed by
a central association so that travellers from the townships pay the same rates for a specific destination regardless of where in the township areas they are picked up. In principle, these taxis are only permitted to pick up passengers at specially designated taxi ranks throughout the city, but this rule is only enforced intermittently; however, while taxis are permitted to drop off passengers anywhere, they charge less for delivering passengers to a designated taxi rank than they do for delivering passengers elsewhere. Since Windhoek is still a fairly small city, many people with steady jobs are picked up by their employers, while people without steady jobs may walk into town to search for employment (Windhoek City Council, 1996).

Although there are few employment opportunities in the township areas, there is a great deal of other activity going on. Schools are available throughout the area. The municipality has also established a number of market places, where commodities are traded and where cultural activities take place. A large area around the Goreangab dam, where water is stored for the dry season, was set aside as a combined conservation and recreation area in the late 1960s. Although the townships have since expanded and now almost surround it, the area has been preserved and is one of the largest open areas in Windhoek. It has considerable scenic appeal and is used for activities such as barbecues, hiking, boating, and picnicking.

3. Hedonic pricing

Real estate characteristics such as the area of the plot or the distance to the nearest school are not themselves traded in any markets; they are tied to the individual property being sold and are only traded as parts of the bundle of characteristics constituting that particular property. However, by examining the prices paid for different bundles of characteristics, it is possible to estimate the value attached to a specific characteristic. This is the basis for the hedonic pricing model (Rosen, 1974; Sheppard, 1999).

A property is characterized by a vector of attributes, $H = h_1, h_2, \ldots, h_k$, and the hedonic pricing method attempts to establish the relationship between housing expenditure $P(H)$ and the levels of the various attributes, $P(H) = f(h_1, h_2, \ldots, h_k)$. If the price relationship is correctly specified, and if property markets are functioning efficiently, it becomes possible to determine households’ implicit marginal valuation of each attribute, $P_i = \frac{\partial P(H)}{\partial h_i}$. Attributes which have been studied in hedonic studies fall into two major groups; structural attributes of the property, such as the plot size, the size of the house, the number of rooms, and the building materials used; and location-specific property attributes, such as the distance to the city centre, access to transport, and environmental and socio-economic characteristics of the neighbourhood.

The few empirical studies which have been made of housing markets in African countries have all indicated that access variables are important in determining property prices. Asabere (1981a, 1981b) found that nearness to the city centre and quality of nearby roads had an impact on property prices in two Ghanaian cities. Megbolugbe (1989), Arimah (1992), and Akpom (1996), in their studies of different Nigerian cities, similarly found that a number of variables, measuring access to labour markets and/or
access to services, were important. The coverage of structural attributes in these analyses varied considerably, from studies which only looked at the sizes of the traded plots to studies which had access to detailed information on building materials as well as on the number and type of rooms of each house. Most studies, however, ignored the issue of environmental quality. The two studies by Asabere did include variables measuring environmental quality (and found these to have significant impacts on property prices in the two cities studied), but the later studies did not take such factors into account.

There are generally two stages to a hedonic pricing study; the first stage is the estimation of implicit prices for various attributes, while the second stage is the estimation of the implicit demand functions determining these prices. The implicit prices of different attributes in a property market, which reflect the marginal valuation of these attributes, can be estimated using sales prices of properties and data on the attributes involved. However, these implicit prices are in turn determined by the equilibria of implicit supply and demand functions, which are affected by a large number of factors. The market clearing implicit prices will be set through a bargaining process between the agents in the property market and will be affected by factors specific to the households buying and selling properties – household sizes, income levels, income distribution, and so on.

It is only possible to estimate the underlying implicit demand functions for different attributes by including data, not only on the traded properties, but also on the households involved in the property market at hand. Of the African studies cited above, only Arimah (1992) had this type of household information and was able to proceed beyond estimating implicit prices to estimating the implicit demand functions. In Windhoek’s township areas, there is no detailed household-level information available on variables, such as income, employment, or household size. At the moment, there are in fact not even reliable figures available on the total number of inhabitants in the different township areas, let alone inhabitants in individual households, and the only data on income levels are estimated average figures which are not sufficient for any detailed analysis. This analysis is therefore limited to estimating the implicit prices, rather than the implicit demand functions, for different property attributes.

Although formal segregation has been abolished for over a decade, it is still unthinkable for white or coloured households in Windhoek to move into the township areas in the northern and north-western parts of town, regardless of household income or house price. Likewise, although the former white neighbourhoods have seen an influx of black families in the past years, there is still considerable reluctance on the part of white homeowners to sell their houses to blacks. This means that there are, effectively, two separate housing markets in Windhoek, making it problematic to apply one single hedonic model for the entire area.

Frequently, hedonic studies have attempted to capture market segmentation between different areas by using switching regressions; the area being studied is divided into discrete segments, the model is estimated for each segment separately, and the results for different segments are then compared to see whether the differences are significant. However, there
are problems with using this approach on spatial data such as property prices, since the delineation of the areas becomes crucial for the results. Variation within the studied areas will produce misleading results, and where there are significant differences between different market segments the model will predict unrealistically large price differences between neighbouring plots at the borders between those segments (Can, 1992). The same problems occur when dummy variables are used for different market segments, an approach used in many hedonic pricing studies (including several of the African applications discussed earlier). In this study, rather than attempting to model the precise relationships between pricing of attributes in different sections of the city, we have chosen to limit the analysis to the township area. Moreover, since the township areas are all located in close proximity to each other rather than spread around the city – the latter frequently being the case with townships in other cities – we have also chosen not to subdivide the area by introducing neighbourhood dummies, in order to avoid the delineation problems noted above.

For the individual properties being traded, information on the sizes of the relevant erven is readily available. Unfortunately, detailed information on the structural attributes of individual houses, which could also be expected to affect prices, is not. However, when a house has been built, the municipality makes a valuation of the replacement cost of that house. Any changes made to the house have to be reported to the municipality, which then makes a new valuation. This means that the municipal replacement cost valuation can be used as a measure of overall house quality. Still, experiences from other hedonic pricing studies indicate that factors such as house size, number of rooms and building materials are very important in determining property prices, and, although a measure of plot size and a proxy measure of overall house quality are considerably better than nothing, it would definitely have been preferable to have more specific information on the buildings.

A number of access variables might be expected to be of importance in determining property prices in townships. Namibian roads are of high quality compared to those in other African countries and, unlike several of the studies cited earlier, we have therefore not included any measure of road quality. However, other access variables which are more likely to play a role in determining property prices are the distances to the central business district and to the nearest major market. Factors such as the access to taxi ranks, and the walking distance to the nearest school, might also play an important role in determining real estate prices in townships, where few households own their own car (Blauw et al., 1998).

While economic valuation of public goods has not been a major part of urban planning in Windhoek or elsewhere in Namibia, a recent survey (Humavindu and Masirembu, 2001) indicated that the Goreangab dam recreation area was perceived as important by township inhabitants and that they wished to have it preserved. It is of interest to see whether this stated preference for the site is also reflected in actual market behaviour, in which case properties with easy access to the area should be regarded as attractive and might be expected to sell at premium prices. Alternatively, the municipal garbage dumps which are located throughout the city are
probably not appreciated by their neighbours. If this lack of appreciation for the dumps is reflected in property prices, one would expect a downward pressure on property prices in the vicinity of a dump.

4. Econometric specification and data

Economic theory provides no a priori reason to prefer one functional form for the hedonic price function over others, and hedonic pricing studies have frequently used Box–Cox transformations to find the functional form that fits the data best. However, several authors (Cassel and Mendelsohn, 1985; Cropper, Deck, and McConnell, 1988; Sheppard, 1999) have argued that it is problematic to use Box–Cox transformations in hedonic pricing studies, both because the resulting parameter estimates tend to be highly sensitive to small variations in the data and also because those parameter estimates are frequently difficult to interpret. These authors have suggested using simpler functional forms which produce more stable parameter estimates.

The use of a simple functional form is especially recommended in situations such as the one studied here, where some potentially important attributes (such as house size or number of rooms) are not included due to limitations in the data set. Rather than using polynomial expressions or Box–Cox transformations, we have therefore chosen to test the following, quite simple, model for the price of property $i$

$$P_i = \alpha + \beta_1 \text{Size}_i + \beta_2 RCH_i + \beta_3 dCBD_i + \beta_4 dMarket_i + \beta_5 dSchool_i + \beta_6 dRank_i + \beta_7 \text{Garbage}_i + \beta_8 \text{Gorean}_i + \beta_9 dGori_i + \epsilon_i$$

$\text{Size}$ is erf size in square meters and $RCH$ is the official municipal valuation in N$ of the replacement cost of the house. $dCBD$ is the distance to the central business district where most of the township inhabitants find employment (if any), $dMarket$ is the distance to the nearest major marketplace where they are likely to make most of their purchases, $dSchool$ is the distance to the nearest school, and $dRank$ is the distance to the nearest taxi rank; all these distances are measured in meters. It is assumed here that the Euclidean distance is a reasonable approximation of the actual travel distance, which is usually the case for dense road networks (Puu, 1997) such as those in Windhoek’s township areas.

In order to study whether environmental quality has an impact on property prices, two dummy variables and one continuous variable are used. $\text{Garbage}$ is a dummy variable for proximity to garbage dumps, which takes the value 1 for plots which are less than 250 m from a garbage dump and 0 for plots which are not. The reason for using a dummy rather than the continuous Euclidean distance is that the perceived aesthetic difference between a plot adjacent to a garbage dump and one 500 m away is likely to be considerably greater than the perceived aesthetic difference between a plot 1 km away from a dump and one 1.5 km away. While this type of consideration might alternatively have been captured by using both linear and quadratic forms of the distances, this would have increased the risk discussed earlier of making the estimates highly sensitive to small variations in the data and estimating parameters incorrectly, because of the missing variable problem caused by the lack of structural information on houses.
The reason for choosing 250 m as a cutoff distance is that this captures properties in housing blocks adjacent to a garbage dump, while excluding properties located in housing blocks further off. Similarly, Gorean is a dummy variable which takes the value 1 for plots which are less than 250 m from the Goreangab dam recreational area and 0 for plots which are not; this variable is intended to capture the value of living directly adjacent to the recreational area, with an attractive view and extreme ease of access to the area. $d_{Gor}$, finally, is the distance to the recreational area, and is intended to capture the ease of access to the area for those plots which are located further off.\(^2\)

Windhoek municipality registers sales prices, official property valuation, and erf area when individual erven are traded, and also if the property is being sold by the municipality or by a close relative of the buyer. The full data set (Windhoek City Council, 2001) consisted of 551 recorded sales of residential erven in the northern and north-western suburbs (Goreangab, Hakahana, Katutura, Okuryangava, and Wanaheda) during 1999. Of these, 72 were sales either by the municipality or by a close relative of the buyer and were excluded from the sample, leaving a total of 479 sales in the reduced data set. Combining detailed maps of Windhoek (Windhoek City Council, 2001) with GIS software, it has been possible to calculate the distances from the centre point of each traded erf to the centre points of, respectively, the central business district, the nearest major marketplace, the nearest school, and the nearest taxi rank, as well as to the nearest garbage dump and to the Goreangab dam recreation area.

It deserves to be noted (table 1) that the average valuation of building investments in the traded properties is close to 47,000 N$, so many households clearly spend large amounts of time and/or money improving their dwellings once they have bought them. One of the goals of the settlement formalization programme has, of course, been to encourage people in the township areas to take greater responsibility for their surroundings, so this effect was to be expected, but similar behaviour has been observed in township areas in other developing countries where households only have semi-permanent squatter rights and do not actually own their properties (Jimenez, 1982). However, for some of the traded properties (28 of the properties which remained in the reduced data set) the official valuation of the replacement cost is zero, i.e. any existing structures are of such poor quality that the municipality believes that, if destroyed, they could be rebuilt at negligible cost. This means that the sample includes houses ranging from the extreme lower end of the market to fairly high-quality dwellings.

One may also note the considerable variation in the size of plots. Until 1997, the smallest erf size permitted by the Ministry of Regional and Local Government and Housing was, in principle, 300 m\(^2\), a minimum which has since been lowered to 200 m\(^2\), and well over half of the traded plots have sizes between 200 m\(^2\) and 400 m\(^2\). However, some plots have sizes which

\(^2\) An earlier version of this paper used only the dummy variable; we thank a referee for pointing out that this would only capture the ‘view’ aspect of the Goreangab area.
are less than the official minimum, while a few plots are far greater than the official minimum size.

The distance to the city centre varies by almost 5 km for the traded properties. As noted earlier the townships currently extend to a distance of approximately 12 km from the city centre, but many of the outermost settlements have been established relatively recently and the properties there have not yet been resold. Most properties are located relatively close to a school and a taxi rank, but the average distance to the nearest major market is considerably greater. The distance to the Goreangab reserve, finally, varies from dwellings located in blocks directly adjacent to it to dwellings located almost 5 km away.

5. Results

The model presented above was estimated using an ordinary least squares regression. As a White test indicated the presence of heteroscedasticity, the standard errors in the regression were corrected for heteroscedasticity using a White estimator (White, 1980). The results are presented in table 2. Results using semi-log and log formulations\(^3\) are shown for comparison in tables 3 and 4; the results in terms of significant variables are largely similar, but the linear form has greater explanatory power.

Some attributes which could potentially be important, such as individual attributes of houses, were not included in the available data,

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\(^3\) In the log formulation, we used zero rather than \(\ln(RCH)\) for those properties where the replacement cost was valued at 0.

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Table 1. The data set

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>N$</td>
<td>60,192</td>
<td>2,060</td>
<td>220,000</td>
</tr>
<tr>
<td>Size</td>
<td>m(^2)</td>
<td>337</td>
<td>131</td>
<td>1,191</td>
</tr>
<tr>
<td>RCH</td>
<td>N$</td>
<td>46,737</td>
<td>0</td>
<td>266,300</td>
</tr>
<tr>
<td>dCBD</td>
<td>m</td>
<td>6,862</td>
<td>4,587</td>
<td>9,323</td>
</tr>
<tr>
<td>dMarket</td>
<td>m</td>
<td>870</td>
<td>103</td>
<td>2,763</td>
</tr>
<tr>
<td>dSchool</td>
<td>m</td>
<td>435</td>
<td>57</td>
<td>1,468</td>
</tr>
<tr>
<td>dRank</td>
<td>m</td>
<td>344</td>
<td>41</td>
<td>2,223</td>
</tr>
<tr>
<td>Garbage</td>
<td>Dummy</td>
<td>0.06</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Gorean</td>
<td>Dummy</td>
<td>0.01</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>dGor</td>
<td>m</td>
<td>2,661</td>
<td>118</td>
<td>4,955</td>
</tr>
</tbody>
</table>

Notes: Price is the sales price of each property; Size is the plot size; RCH is the municipal valuation of the replacement cost of the house on the property; dCBD, dMarket, dSchool, and dRank are the Euclidean distances to the central business district, the nearest market, the nearest school, and the nearest taxi rank, respectively; Garbage is a dummy variable which is 1 for plots which are less than 250 m from a garbage dump and 0 for plots which are not, while Gorean is a dummy variable which is 1 for plots which are less than 250 m from the Goreangab dam recreation area and 0 for plots which are not; finally, dGor measures the Euclidean distance to the Goreangab dam recreation area.
Table 2. Estimation results for the linear form

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Robust SE</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>5.13</td>
<td>19.94</td>
</tr>
<tr>
<td>RCH</td>
<td>0.72</td>
<td>0.07</td>
</tr>
<tr>
<td>dCBD</td>
<td>−6.64</td>
<td>2.10</td>
</tr>
<tr>
<td>dMarket</td>
<td>−9.88</td>
<td>3.57</td>
</tr>
<tr>
<td>dSchool</td>
<td>6.42</td>
<td>8.42</td>
</tr>
<tr>
<td>dRank</td>
<td>−16.18</td>
<td>6.92</td>
</tr>
<tr>
<td>Garbage</td>
<td>−34706.26</td>
<td>4086.45</td>
</tr>
<tr>
<td>Gorean</td>
<td>21801.38</td>
<td>8032.49</td>
</tr>
<tr>
<td>dGor</td>
<td>−3.32</td>
<td>1.82</td>
</tr>
<tr>
<td>Constant</td>
<td>92367.02</td>
<td>19553.41</td>
</tr>
</tbody>
</table>

R² = 0.4520
F(9, 469) = 42.28

Notes: See table 1.

Table 3. Estimation results for the semi-log form

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Robust SE</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>0.000339</td>
<td>0.000379</td>
</tr>
<tr>
<td>RCH</td>
<td>0.000011</td>
<td>1.59E-06</td>
</tr>
<tr>
<td>dCBD</td>
<td>−0.000211</td>
<td>0.0000532</td>
</tr>
<tr>
<td>dMarket</td>
<td>−0.000344</td>
<td>0.0000963</td>
</tr>
<tr>
<td>dSchool</td>
<td>0.0000875</td>
<td>0.000209</td>
</tr>
<tr>
<td>dRank</td>
<td>−0.000582</td>
<td>0.000186</td>
</tr>
<tr>
<td>Garbage</td>
<td>−0.769</td>
<td>0.149</td>
</tr>
<tr>
<td>Gorean</td>
<td>0.740</td>
<td>0.286</td>
</tr>
<tr>
<td>dGor</td>
<td>−0.000051</td>
<td>0.000046</td>
</tr>
<tr>
<td>Constant</td>
<td>12.060</td>
<td>0.451</td>
</tr>
</tbody>
</table>

R² = 0.3720
F(9, 469) = 34.77

Notes: See table 1. The regression used the logarithm of the dependent price variable.

Table 4. Estimation results for the log form

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Robust SE</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>0.728</td>
<td>0.120</td>
</tr>
<tr>
<td>RCH</td>
<td>0.125</td>
<td>0.019</td>
</tr>
<tr>
<td>dCBD</td>
<td>−0.904</td>
<td>0.385</td>
</tr>
<tr>
<td>dMarket</td>
<td>−0.226</td>
<td>0.077</td>
</tr>
<tr>
<td>dSchool</td>
<td>−0.011</td>
<td>0.087</td>
</tr>
<tr>
<td>dRank</td>
<td>−0.172</td>
<td>0.081</td>
</tr>
<tr>
<td>Garbage</td>
<td>−0.886</td>
<td>0.144</td>
</tr>
<tr>
<td>Gorean</td>
<td>0.794</td>
<td>0.213</td>
</tr>
<tr>
<td>dGor</td>
<td>−0.033</td>
<td>0.102</td>
</tr>
<tr>
<td>Constant</td>
<td>15.961</td>
<td>4.150</td>
</tr>
</tbody>
</table>

R² = 0.3477
F(9, 469) = 67.27

Notes: See table 1. The regression used the logarithms of all variables except the two dummy variables; for the variable RCH, the value 0 rather than \ln(RCH) was used in the 28 cases when RCH took zero values.)
leading to a relatively low $R^2$ of 0.45 (the $R^2$'s for the other specifications were even lower). Even so, at a 5 per cent significance level the results support the hypothesis that several other attributes of the traded properties have an effect on property prices in the township areas. The $R^2$ is not much lower than those in several of the other hedonic pricing studies cited earlier, and the F statistic for the entire regression is 42.28, which is also significant at the 5 per cent level.

Erf size does not appear to have a significant impact on property prices, while housing quality and nearness to the city centre do have significant impacts. This suggests that the recent decrease in the statutory minimum erf size can potentially be welfare enhancing because it means that the municipality can open up for further densification of the older township areas, making it possible for people in recently established townships further out to move closer to the city centre. (Incidentally, the marginal valuation of an additional N$’s worth of building investments is lower than 1, which means that there are no arbitrage gains to be made by sellers through making additional investments before selling.)

Proximity to a school has no significant effect on property prices – the point estimate of the parameter even has the ‘wrong’ sign. This is presumably due to the fact that the distance to a school is fairly short for most properties in any case, so that an additional meter is not perceived as particularly important. Despite the limited enforcement of the rank system (which should mean that many commuters are able to catch a taxi wherever they want to anyway) the distance to the nearest taxi rank has a significant impact on property prices. Many people use commuter taxis to travel into town and back, and it appears that they attach considerable importance to having easy access to taxi transport. This indicates that the municipal policy of establishing taxi ranks and taxi services quickly in newly settled areas is likely to be appreciated by inhabitants and may play an important role for the municipality’s success in integrating new settlers into the local economy.

The distance to the nearest major market has a significant effect on property prices (the marginal valuation of an additional meter is actually higher for the distance to the nearest market than it is for the distance to the city centre), indicating that households attach considerable importance to having access to major marketplaces. Although one cannot say anything with confidence without having estimates of the underlying implicit demand functions as well, it is possible that the cost of establishing additional market places might be more than offset by the resulting increase in social welfare. This is, at any rate, something that deserves to be studied more closely.

The two dummy variables for environmental quality both had significant impacts on property prices. Proximity to a garbage dump is clearly viewed as unattractive; the mean effect is to reduce the value of a property by almost 35,000 N$. Close proximity to the Goreangab dam recreation area, on the other hand, raises the value of a property by almost 22,000 N$. The distance to the Goreangab area, on the other hand, does not appear to have a significant impact on property prices. Thus, having a pleasant view is valued highly while the ease of access does not have an impact on prices.
for plots further away.\(^4\) This finding is in line with an earlier study (Humavindu and Masirembu, 2001) which indicated that travel distance to Goreangab did not affect how frequently people living in the township areas visited the site. One possible explanation for this might be that many people go to Goreangab by taxi and thus pay a fixed rate regardless of where in the township area they start.

6. Conclusions
This paper has shown that property prices in Windhoek’s townships reflect attractive and unattractive location-specific characteristics, including proximity to environmental goods and bads. Public policy determines many of these location-specific attributes, and the results indicate that the hedonic pricing method can be useful for evaluating public policy not only in affluent neighbourhoods but also in townships. Keeping track of property sales in townships, in the way that municipal authorities have done in Windhoek, can thus provide urban authorities responsible for administering townships with a powerful additional tool for policy analysis.

Lack of reliable detailed information on household characteristics is likely to be a problem for township studies in other cities as well. The usefulness of the method could nonetheless be increased further by at least recording household characteristics at the time of sale/purchase of a property, even if it is likely be difficult for many municipal authorities to update this household-level information on a regular basis. Property market segmentation, and the welfare effects of this, also warrants further exploration, as this is likely to be a complicating factor in the analysis of property markets in many developing country cities.

An important finding in this study is the high value that inhabitants in the township areas clearly attach to environmental quality. Proximity to a conservation area or to garbage dumps have remarkably large impacts on property prices. Townships in other developing country cities have often been allowed to expand under less organized circumstances than in Windhoek, and the issues of maintaining refuse disposal and secluding garbage dumps from residential areas, as well as maintaining open spaces in township areas have frequently been neglected by urban authorities. Our results indicate that where this neglect has occurred it may have been a very serious omission.

References

\(^4\) Dropping one of the two ‘Goreangab’ variables does not affect the result for the other one, so it would appear that the two different aspects of the Goreangab area studied here are not closely related.


Windhoek City Council (2001), unpublished data.