

DRIVING FORCES OF SMALL-SCALE GOLD MINING AMONG
THE NDJUKA MAROONS: A CROSS-SCALE SOCIOECONOMIC ANALYSIS
OF PARTICIPATION IN GOLD MINING IN SURINAME

By

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	ii
LIST OF TABLES	viii
LIST OF FIGURES	x
ABSTRACT	xii
CHAPTERS	
1 INTRODUCTION	1
Central Question	1
Relevance	2
My Approach	4
Predictions	6
2 SURINAME, THE NDJUKA MAROONS, AND SMALL-SCALE GOLD MINING	9
Study Site	9
Recent Political and Economic Developments	10
Ndjuka Territory and Sella Creek	13
Study Population: the Ndjuka Maroons	15
The Maroons	15
The Ndjuka	16
Gold Mining in Suriname	18
A Brief History of Gold Mining	18
Historic Mining Activity among the Ndjuka	19
Gold Mining in Suriname Today	19
Mining Technology and Production	20
Life in the Mining Area	21
The Economics of Small-Scale Gold Mining	22
Local Mining Rights	25

3 METHODS AND SAMPLE	34
Definitions	34
Small-Scale Gold Mining	34
Gold Miners	35
Sample	37
Sampling Methods	37
Sample Population	38
Sample Population: Gold Miners	40
Sample Population: Non-Miners	41
Methods	41
Ethnographic Methods	42
Quantitative Analysis	44
Archival Research	45
4 ZOOMING OUT: DISTANT FACTORS DRIVING THE SURINAME GOLD RUSH	51
Central Questions	51
Approach and Relevance	52
Competing Hypotheses	53
Econometric Model	54
Explanatory Variables	55
Price of Gold	55
Price of Fuel	56
Political Instability	56
Inflation and Consumer Prices	58
Unemployment	58
Dependent Variable	59
Econometric and Data Problems	62
Results	64
Discussion	65
International Commodity Markets	65
Political Instability	66
National Economic Instability	69
Conclusions	70
5 UNRAVELING THE CHOICES OF GOLD MINERS AND NON-MINERS ..	84
Central Question and Relevance	84
Methods	85
Seven Steps to Ethnographic Decision Tree Modeling	85
Sample	86
Results in Seven Steps	88
Step 1: Collecting Data	88

Steps 2 and 3: Extracting Criteria and Constructing Individual Decision Models	89
Step 4: Data Structuring Using Freelists	90
Steps 5, 6, and 7: Building, Testing, and Adjusting a Composite Model	92
Discussion: Gender and Risk in Gold Mining	93
Gender	94
Risk	96
The Outlier	98
Conclusions	99
6 HOW GENDER LIMITS THE PARTICIPATION OF WOMEN IN GOLD MINING	109
Central Question	110
Approach	111
Hypothesis	112
Gender in Ndjuka Society	113
Husbands and Wives	113
Unequal Education and Income	116
Men and Women in the Outside World	119
Menstrual Taboos	120
Econometric Model	121
Explanatory Variables	122
Control Variables	124
Econometric Specification	124
Results	125
Discussion	126
Women are Physically Too Weak to Be Miners	128
Female Miners Earn Less Money than Male Miners	128
Gold Mining is a Man's Job; Good Women Do Not Mine	129
Husbands Keep Women at Home	130
Menstrual Taboos Complicate Work in the Mining Area	131
Women Do Not Want To Be Gold Miners	132
Female Miners	132
Conclusions	134
7 IS RISK-TAKING AT THE ROOTS OF DECISIONS ABOUT MINING?	140
Central Question	140
Gold Miners are Adventurers	141
Gold Miners are Marginalized People	142
Competing Hypotheses	142
Mining Risks	143
Econometric Model	146

Explanatory Variables	148
Risk Tolerance	148
Access to the Formal Labor Market	149
Access to Informal Income	149
Economic Dependents	150
Econometric Specification	150
Results	151
Discussion	152
Conclusions	156
8 CONCLUSIONS	160
Driving Forces of Small-Scale Gold Mining in Suriname	161
Lessons Learned	164
APPENDICES	
A SUMMARY IN DUTCH	167
B LIST OF FOREIGN WORDS AND DEFINITIONS	171
C HYDRAULIC SMALL-SCALE GOLD MINING METHODS	174
D SURVEY PROTOCOL	175
E RAW DATA FOR INTERNATIONAL AND NATIONAL INDICATORS	179
F MEASURING RISK TOLERANCE	182
REFERENCES	183
BIOGRAPHICAL SKETCH	194

LIST OF TABLES

Table	Page
2-1. Estimated number of small-scale gold miners and gold production in Suriname over the past four years by different sources	31
2-2. Payments system and monthly earnings of several professions in Sella Creek	32
2-3. Estimated earnings of laborers (pit-workers) in (partly) mechanized small-scale gold mining by different researchers (per person grams of gold per month)	33
3-1. Human capital of Ndjuka men and women, miners and non-miners	49
3-2. Main questions, methods, and data generated	50
4-1. Definitions of the variables in the regression analysis	81
4-2. Summary statistics of the variables in the regression analysis	81
4-3. Monthly expenses of a mining operation as a share of the fixed expenses (not counting workers salaries) and as a share of the earnings of the operation	82
4-4. Regression results for the original and the detrended OLS regression models	83
5-1. Summary statistics for the sample population	103
5-2. Frequency ratios of decision criteria mentioned by Ndjuka gold miners and non-miners (N=75, listing only criteria mentioned more than once)	104
5-3. Frequency ratios of decision criteria mentioned by Ndjuka women (N=25)	105
5-4. Frequency ratios of decision criteria mentioned by Ndjuka men (N=50)	106

5-5. Frequency ratios of decision criteria mentioned by Ndjuka gold miners and non-miners in ages 30 and younger (N=37, listing only criteria mentioned at least twice)	107
5-6. Frequency ratios of decision criteria mentioned by Ndjuka gold miners and non-miners older than 30 (N=38, listing only criteria mentioned at least twice)	107
5-7. Frequency ratios of decision criteria mentioned by Ndjuka gold miners and non-miners with four or less years of education (N=40, listing only criteria mentioned at least twice)	108
5-8. Frequency ratios of decision criteria mentioned by Ndjuka gold miners and non-miners with more than four years of education (N=35, listing only criteria mentioned at least twice)	108
6-1. Comparison of ownership of material, human, and monetary resources between Ndjuka women (N=91) and men (N=128)	136
6-2. Mean incomes (US\$) and tests of significance of the differences between men and women, gold miners and non-miners	136
6-3. Definitions of the dependent, explanatory, and control variables	137
6-4. Summary statistics for the variables in the series of multivariate regressions predicting the participation in gold mining as a function of gender inequality	138
6-5. Share of the population that takes at least weekly care of children and tests of significance of the differences between men and women, gold miners and non-miners	138
6-6. Regression results for the probit model predicting the participation in gold mining as a function of gender discrimination	139
7-1. Physical and economic risks of different mining jobs, only listing risks other than the usual risks such as malaria	157
7-2. Definitions of the dependent, explanatory, and control variables	158
7-3. Summary statistics	158
7-4. Regression results for the tobit model predicting the duration of mining	159

LIST OF FIGURES

Figure	Page
1-1. Predictions of the driving forces of small-scale gold mining	8
2-1. Suriname and the Ndjuka territory along the Tapanahony River with the Sella Creek mining area	27
2-2. Estimated Historical Gold Production in Suriname	28
2-3. East-Suriname with the country's main gold mining regions	29
2-4. Sketch of a mining camp (field base-camp)	30
2-5. Amount of gold (in gram) earned by people who worked primarily as pit-workers (N=41) over the month previous to the interview	31
3-1. Numbers of male and female gold miners and non-miners in the sample population (N=219)	46
3-2. Area of residency of the sample participants (N=219)	47
3-3. Percentage-representation of different professions performed by gold miners in the study sample (N=102)	48
4-1. Open market average annual US market price of gold/troy ounce, 1968-mid-1999 (base=1998)	7 2
4-2. World real oil price in US\$ and Suriname guilders (base=1998)	73
4-3. Openness (Imports + Exports)/GDP	74
4-4. Official and experienced annual inflation rates (12 month average)	75
4-5. Consumer price index, annual average (1970=100)	76
4-6. Unemployment as a percentage of the economically-active population (urban area only)	77

4-7. Reported year of first experience with gold mining of Ndjuka miners and ex-miners (N=154, in percentages)	78
4-8. Age distribution of the sample population, number of people in each age-group (N=219)	79
4-9. Standing Number of Miners, corrected for attrition	80
5-1. Decision model for one person	100
5-2. Decision model for two people	101
5-3. Decision model for four people	101
5-4. Composite decision tree model	102
6-1. Lorenz curve of the income distribution for women (N=70) and men (N=117)	135
8-1. Driving forces of small-scale gold mining among the Ndjuka Maroons	166

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Chair: Dr. Ricardo Godoy
Major Department: Anthropology

This dissertation addresses the question: Why do some people become small-scale gold miners, while others do not? Anthropological field research among the Ndjuka Maroons of Suriname, South America, provides the bases for the analysis. Interviews were conducted with gold miners and non-miners in gold mining camps, forest villages, and Paramaribo. Driving forces of small-scale gold mining are analyzed across spatial scales. The researcher integrates qualitative and quantitative methods to collect and analyze data, combining ethnography, participant observation, and decision modeling with econometrics.

Time-series analysis suggests that Ndjuka miners do not respond to fluctuations in global market prices of gold and oil. Within Suriname, high inflation and unemployment encourage gold mining. The impact of national political instability remains ambiguous.

Ethnographic decision modeling indicates that gender and risk shape decisions about gold mining. Ndjuka men are expected to provide the household cash income. Men choose mining because other jobs are not available or pay insufficiently, they lack the education for better work, and mining offers freedom. For men, disappointing experiences in mining and physical inability were the only reasons to not be a gold miner. Only about five percent of Ndjuka miners are women. The study found empirical evidence that childcare responsibilities and limited access to money reduce the access of women to mining. The gender bias in mining is perpetuated by gender traditions, spousal objections, menstrual taboos, and the preference of women to not work in the mining area. Female miners were either family breadwinners or joined mining husbands.

Small-scale gold mining incorporates many physical and economic risks. The hypothesis that risk tolerant individuals with back-up resources become gold miners was rejected. Rather, miners are generally individuals with many economic dependents and few income options. Risk theory is advanced by showing that male and female miners confront different risks, and by measuring and comparing risk attitudes of miners and non-miners. The research contributes to gender studies by exploring the linkages between gender inequality and access to gold mining. A general lesson from the study is that poverty coupled with the elimination of traditional job options encourages ecologically damaging resource use.

CHAPTER 1 INTRODUCTION

Central Question

Why do some people become small-scale gold miners, while others do not? This question is central to my work, and relates to a larger question of why people engage in risky, ecologically destructive behavior. Despite considerable academic concern about the social and ecological disruption produced by gold rushes, how such events arise and what causes people to participate or not remain poorly understood. Researchers have explained gold mining as a last resort for poor, unemployed, and poorly educated people (Cleary 1990; MacMillan 1995; Naughton 1993; Roopnaraine 1996; Schmink and Wood 1992). Yet few social scientists examine why people who share the same political, socioeconomic, natural, and cultural background make markedly different decisions about mining.

I investigate why people participate in small-scale gold mining, using data from field research among the Ndjuka Maroons of Suriname. The Maroons are descendants of runaway African slaves, who established independent communities in the rainforest. The Ndjuka are one of six Maroon groups in Suriname, and are said to be most actively involved in gold mining. In recent years thousands of small-scale gold miners have entered Suriname's portion of the Amazon rainforest, and mining has become the primary

source of subsistence for Ndjuka households. I investigate why small-scale mining boomed in Suriname when it did, and what motivates individual Ndjuka to either become miners or make a living otherwise.

Relevance

There are good reasons for studying the driving forces of small-scale gold mining. It is estimated that over four million poor people in the Amazon live off small-scale gold mining and the surrounding service economy (Sponsel 1997). In developing countries such as Suriname, small-scale gold mining has been welcomed as a way to provide income for the poorest and tax revenues for the government (UN 1996). Anthropologists and ecologists are concerned about mining because it usually harms local people and the natural environment (Greer 1993; MacMillan 1995; Slater 1994). In Suriname small-scale gold mining has caused conflict between miners and others (Almeida 1992; Healy 1996), spread malaria (BOG 1997) and sexually transmitted diseases (Antonius-Smits et al. 1999), and degraded the forest ecosystem (DeKom, VanDerVoet, and DeWolff 1998; Pollack et al. 1998).

Understanding the forces that drive gold mining is especially relevant for Suriname. At present small-scale gold mining drives the economy of Suriname and provides sustenance to the poorest segments of its population. However, small-scale gold mining is also the country's main cause of forest degradation. My work is the only existing study on why people in Suriname become small-scale gold miners, and the only recent in-depth study among the Maroons. Understanding the socioeconomic factors that

motivate Maroons to become gold miners is valuable for the design of public policy that encourages more sustainable subsistence strategies in the Suriname Amazon.

My research is also relevant beyond Suriname. The question of why the Ndjuka mine for gold relates to broader concerns about the human drivers of environmental degradation (Arizpe, Paz and Velázquez 1996; Blaikie and Brookfield 1987; Hecht and Cockburn 1989; Sponsel, Bailey and Headland 1996; Painter and Durham 1995; Wood et al. 1996). My work also contributes to research on the responses of native people to regional, national, and international developments (Gadgil, Berkes and Folke 1993; Godoy, Brokaw and Wilkie 1995; Godoy, Wilkie and Franks 1997; Hames and Vickers eds. 1983; Redford and Padoch eds. 1992; Sponsel ed. 1995). Within this broad theoretical context I am especially interested in household gender relations and individual attitudes and behavior towards mining risks.

I focus on gender because gender differentiation characterizes the Suriname mining population; among the Ndjuka only one out of every 15-25 gold miners is a woman. My observation contrasts recent United Nations estimates that 10-50% of the world population of small-scale miners are women (UN 1996). I will explore why Ndjuka women participate minimally in mining. Because women and men typically have unequal access to power and resources in society (Agarwal 1994; Kabeer 1994; Leach, Joekes and Green 1995; Schmink 1999; Rocheleau, Thomas-Slayer, and Wangari 1996), it is likely that male and female options and constraints to enter mining differ.

Researchers before me have analyzed gender inequality in access to resources in two overlapping areas. One group has primarily been concerned with intra-household allocation of resources and power (Deere 1990; Doss 1996; Handa 1994; Katz 1991; Koopman 1991; Rodgers and Schlossman eds. 1990; Wilk 1989). These scholars have exposed the gender-bias in the divide of material and human resources within the household. Other researchers have studied how gender regulates the rights to, and the distribution and use of the natural environment and ecological resources (Agarwal 1994; Blaikie et al. 1994; Heyzer 1995; Kabeer 1994; Meinzen-Dick et. al 1997; Rocheleau, Thomas-Slayer and Wangari eds. 1996; Schmink 1999; Udry 1996). My study contributes to theory on gender and resource allocation by directly linking inequality within the household to unequal access to natural resources. I argue that the unequal divide of resources, labor, and power in Ndjuka households limits the options of women to participate in gold mining.

It is also important to focus on women in mining because female labor has received minimal attention in mining studies. Even though several researchers report the presence of women in mining areas (Cleary 1990; MacMillan 1995; UN 1996), few have analyzed in-depth why women might enter mining less frequently than men. It also remains unclear if and how the reasons to become a miner and lives in the mining area differ between women and men. Rodrigues (1995) describes the lives of women in Brazilian mining camps in ethnographic detail, but provides little information about how

they compare to male miners. I intend to reveal the differences between male and female decisions about gold mining, and in their lives as miners.

I explore Ndjuka attitudes and behavior towards risk because gold mining incorporates many economic and physical risks; earnings are uncertain and the chances of becoming a victim of malaria or violent crime are high. It is likely that individuals who decide to either enter or not enter mining consider these risks, but few researchers have rigorously analyzed how miners perceive and mitigate the risks they confront (Godoy 1990). I will test if theories of peasant risk behavior are robust to a mining environment. Then I will compare my findings with other studies in an attempt to identify general patterns that motivate people to participate in risky subsistence activities.

My Approach

I take an innovative approach to tackle the research question by integrating traditional anthropological methods with statistical analysis. Some people are concerned that combining ethnography with quantitative analysis will compromise the quality of both methods. Econometricians are likely critical of the small sample size, limited significance, and econometric problems of the statistical models. Meanwhile the sparse descriptive and reflective information may dissatisfy ethnographers. While these concerns are valid, I choose to combine methods for the following reasons. First, because I address several relatively unexplored questions, it is uncertain which method is most appropriate to generate the best answers. Second, I believe that bridging qualitative and quantitative methods will generate more inclusive results than either method in

isolation. I hope to show that quantitative methods are valuable to test the relative importance of qualitatively informed ideas, while ethnography can explain the real life meaning of quantitative findings. In doing so, I intend to combine the emic and the ethic perspectives. Third, I argue that the field of anthropology will gain by experimentation with new ways of doing anthropology that may or may not produce a better understanding than traditional ways.

While the lives and perspectives of the Ndjuka are central to my work, I also wish to show how larger scale political and economic processes influence the behavior of Ndjuka miners and non-miners. Others before me have used qualitative methods to identify links between national and international processes and the subsistence choices of local people (Blaikie and Brookfield 1987; Schmink and Wood 1992; Stonich 1993). My analysis is new in providing quantitative estimates for the relative importance of these links. I depart from most other social science studies on mining by comparing miners with non-miners from the same population. I argue that it will only be possible to identify what motivates small-scale miners by comparing them with a suitable control-group of non-miners.

Predictions

I will test several hypotheses to identify the socioeconomic forces that encourage gold mining. I present my predictions about the distant and approximate forces that

motivate Ndjuka to become small-scale gold miners in figure 1-1. The arrows in figure 1-1 present relations that I expect to find between driving forces and Ndjuka participation in gold mining. The hypotheses specific to each chapter are listed in those chapters.

At the macro scale I test what international and national forces influence local decisions about gold mining. International commodity markets partly determine the profitability and attraction of mining. For example, many researchers believe that changing gold prices sparked the mining boom in the Brazilian Amazon (Cleary 1990; MacMillan 1995). Oil prices are likely to influence gold mining because they largely determine the expenses of a small-scale mining operation. I expect that rising gold prices and falling oil prices encourage mining. At the national level I will analyze the impact of political and economic stability and instability in Suriname. A general pattern that appears from case studies elsewhere is that political and economic instability encourage the unsustainable use of resources by local people (Blaikie and Brookfield 1987; Bohn and Deacon, In press; Painter and Durham 1995). I expect a positive relation between national instability and the size of the mining population in Suriname.

Macro-scale forces interact with micro-scale dynamics to shape Ndjuka decisions about mining (figure 1-1). My prior research suggested that two micro-level factors especially impact Ndjuka decisions about gold mining: gender and risk. At the household level I analyze gender inequality in access to mining. I predict that women are denied access to mining by their reduced income, mobility, and acculturation, and their increased time spent in childcare as compared to men. At the individual level I test if risk attitudes

and risk management affect decisions about gold mining. I predict that most likely to participate in mining are the most risk tolerant individuals who are best equipped to mitigate mining risks. Even though I focus on one specific case, I hope that my findings help understand general patterns that underlie the unsustainable use of resources elsewhere, and that my approach may assist other anthropologists who want to study similar questions.

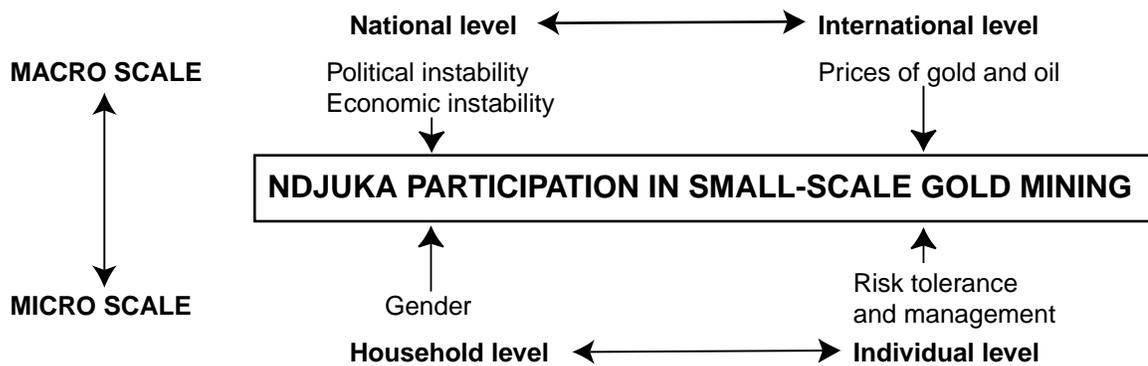


Figure 1-1. Predictions of the forces that drive small-scale gold mining

The arrows in figure 1-1 present the predicted links between macro and micro scale forces and the Ndjuka participation in small-scale gold mining. The figure indicates that distant and approximate processes as well as processes within each level interact with one another. For example, the two-headed arrow between the household and the individual level shows that being a woman or a man influences one's risk perceptions and ability to mitigate risk. It is also likely that subsistence risks experienced by the household influence gender relations.

CHAPTER 2 SURINAME, THE NDJUKA MAROONS, AND SMALL-SCALE GOLD MINING

Here I describe the research site, the people in the study, and the context of small-scale gold mining. The information provides the context in which to place the data analysis in later chapters. I begin by summarizing the culture, geography, and political system of Suriname. I continue by characterizing and justifying the study location and population. Next I describe small-scale gold mining, focusing on both historic and recent developments in gold mining in Suriname. The detailed analysis of the practices and experiences of Ndjuka miners provides a feeling of what life as a gold miner is like.

Study Site

Suriname, previously Dutch Guiana, is located on the South American continent, north of Brazil between Guyana and French Guiana. The country is small, covering a total land area of 163,000 km². The population of Suriname is estimated to be 409,000 (Algemeen Bureau Statistiek 1997). The population is ethnically diverse, being composed of Hindustani (East-Indians, 40%), Creoles (people of mixed African descent, 27%), Javanese (15%), Maroons (10%), Amerindians (2.7%), Europeans (2%), Chinese (1.7%) and several other ethnic groups (Bakker et al. 1998: 9). Of all these groups, almost exclusively the Maroons are working in gold mining. Suriname compares

favorably with other Latin American and Caribbean Countries in infant mortality (29/1000) and life expectancy rates (women: 73, men: 68) (Population Reference Bureau 1999). The National language of Suriname is Dutch, but many other languages are spoken, including Sranan (the national creole), several Amerindian and Maroon languages, and languages specific to other ethnic groups.

Suriname is rich in natural resources. Relatively intact tropical rain forest covers 80% of the country (World Resources Institute 1999). Soils have a texture of sandy loam and clay, and are on the whole unsuitable for agriculture (Dahlberg 1979). The climate is mild but humid, with an average temperature of 27.5°C (range 24°C-30°C) and a relative humidity of 78% (Algemeen Bureau Statistiek 1997). Suriname has a modest variation in elevation that reaches a maximum of 1,230 meters above sea level in the Wilhelmina Mountains. Suriname is also rich in minerals. During 1990-994, raw and processed bauxite accounted for 80% of the annual value of exports (Algemeen Bureau Statistiek 1997). The country's gold deposits are part of the Guiana Shield, a geological greenstone formation that covers 415,000 km² of Venezuela, the Guyanas, and Brazil (Veiga 1997).

Recent Political and Economic Developments

Suriname became independent from the Netherlands in 1975. The Netherlands granted Suriname 3.5 billion Dutch guilders (1.38 billion in 1975 US\$) in treaty money besides development aid. People in Suriname could choose whether they wanted to become Dutch or Suriname citizens (Bakker et al. 1998). Thirty-five thousand people left Suriname in the year of independence (1975) or almost 10% of the population (Tas 1994). In 1995, an estimated 275,000 people of Suriname descent lived in the Netherlands, of whom 182,000 were born in Suriname (Bakker et al. 1998: 165).

After independence Suriname experienced increased unemployment, inflation, ethnic tensions, political strife, socioeconomic inequality, and social discontent (Bakker et al. 1998; Buddingh' 1995). Political and economic instability led in 1980 to the military coup of Sergeant Bouterse. Bouterse stayed in power for 12 years, with the exception of a short interlude between 1987 and 1990. The economic situation worsened when the Netherlands halted payments to Suriname in a reaction to human rights violations by Bouterse's military regime (Buddingh' 1995). The national debt tripled between 1982 and 1983, and reached 24.2% of the GDP in 1985. Monetary financing of the debt caused devaluation of the Suriname guilder; the official exchange rate was artificially held stable at 1.82 Suriname guilders (Sfl.) to the US dollar, but parallel market rates reached Sfl.16 to the US dollar in 1987 (Buddingh' 1995). In early 1999 parallel market exchange rates had reached Sfl. 1,000 to one dollar (pers. obs.).

In 1986 political repression, economic recession, and a personal conflict led to a guerrilla war known as the interior war. The interior war was fought between the military government and a group of Maroons called the Jungle Command, which received support from Surinamers in the Netherlands (Brana-Shute 1990; Polimé and ThodenVanVelzen 1992; Price 1995). The main leader of the Maroon insurgents, Brunswijk, was a Ndjuka Maroon. Even though many Maroons - including many Ndjuka - did not or only halfheartedly support his case, the military government aimed its reprisals at the Maroons. Military activity destroyed much of the social, educational, and economic infrastructure in Eastern Suriname where most Ndjuka live (Polimé and ThodenVanVelzen 1992).

Several anthropologists have documented the distrust and dislike that traditionally characterizes the relations between the Maroons and the city population, in particular the Creoles (Lamur 1965; Price 1995; Polimé and ThodenVanVelzen 1992; ThodenVanVelzen 1990). The animosity worsened during the interior war. In Paramaribo I heard city residents refer to Maroons as primitive forest peoples and criminals, hot-tempered, unmannered, and unreliable. Because Creoles hold the keys to many wage labor jobs, especially in government offices, Maroons have reduced chances of getting such jobs. Several Maroons with wage labor experience mentioned that they felt discriminated against and bossed around. It is likely that their marginal position and discrimination partly explain the disproportionate percentage of young Maroons in the national prison population (Suriname Police Department, pers. com.).

The war stimulated small-scale gold mining in several ways. The isolation of the interior from the urban region caused shortages and price increases for people in the forest. Economic hardship coupled with ethnic discrimination decreased subsistence options, leaving gold mining as a matter of survival for many Ndjuka households. The Jungle Commando also directly stimulated mining; it financed armed struggle with the profits from mining on confiscated river dredges. In 1991 the military government signed a peace treaty with the Jungle Command and held democratic elections. The army was legally removed from politics in 1992 (Bakker et al. 1998). Since then, economic recession, increased inequality, and degradation of the educational and health-care systems have lowered the standard of living of particular the poorest Surinamers (Algemeen Bureau Statistiek 1997; Bakker et al. 1998; Buddingh' 1995).

Ndjuka Territory and Sella Creek

I conducted research among the Ndjuka , one of the largest Maroon groups in Suriname. The Ndjuka live in both Suriname and French Guiana, primarily along the Marowijne and Tapanahony rivers, and in the national capital, Paramaribo (figure 2-1). The central Ndjuka village in the forest is Drietabbetje where the Ndjuka government is seated. I concentrated my research efforts on the Ndjuka villages along the Tapanahony River. The villages along the Tapanahony typically have between 100-200 inhabitants. I selected Drietabbetje as my field bases because the village is accessible by air, and a base-station for many people traveling to the mining area. I also stayed for several weeks in the village of Mooitaki to conduct interviews and observe life in a relatively more isolated and traditional village. My prior personal connections with a schoolteacher in Mooitaki motivated and facilitated my stay in this place. In addition, I visited several Maroon villages for one or several days at a time to better understand the variation among Ndjuka villages.

The village of Drietabbetje has a few hundred inhabitants and is more cosmopolitan than the other Ndjuka villages along the Tapanahony River. From Paramaribo the village can be reached by plane in about two hours, and by motorized canoe in about three days. Drietabbetje has an airstrip, an elementary school, a clinic, and hosts the granman or paramount chief of the Ndjuka. There is generator-driven electricity at night that only works when the government supplies fuel. Rich men in Drietabbetje own televisions, video recorders, and sound-systems, which they run using their personal generators. The people of Drietabbetje are used to outsiders. A nurse of Dutch origin has lived in Drietabbetje for several decades, and since 1995, two Peace-

Corps volunteers have been stationed in the village. The village also receives irregular visits from government officials, migrant miners, and occasional tourists. The village of Mooitaki is smaller than Drietabbetje and only accessible by boat. There is a school in the village but no electricity. Few outsiders visit the village.

The area around the Sella Creek is the main mining site where I conducted fieldwork. Sella Creek is a small tributary of the Tapanahony River between the village of Godo-Olo and the most southern Ndjuka village Gran-Bori (figure 2-1). One reaches Sella Creek traveling by plane or canoe to Drietabbetje or Godo-Olo, and from there by canoe across the shallow rapids of the Tapanahony River to the creek mouth. In the rainy season it is possible to enter the area by canoe. In the dry-season, miners walk for several hours to reach their camps.

I selected the Sella Creek site for several reasons; it has the largest concentration of Ndjuka gold miners, I had connections from prior fieldwork, and the mining camps in the area are at walking distance from one another. Because of its isolation and the dominance of Ndjuka miners, Sella Creek also was safer as a field site. Many Ndjuka prefer Sella Creek for the presence of kin and relatively low incidence of crime. Brazilians dominate the mining population in other mining areas, which decreases social control and, given my interest in Ndjuka miners, the number of potential interviewees.

Ndjuka gold miners estimated that there are between 60 and 70 gold mining camps at Sella, which I confirmed by walking through the area. I calculated that these camps house a shifting population of about 700 people. All gold mining at Sella Creek is land-based. Hydraulic mining machines with two 6-inch pumps were introduced in 1994 and are now the predominant mining method. I estimated the annual gold production of

Sella Creek to be about 1.5 to 2.5 metric tons, which accounts for 7 -17 % of the estimated total gold production in Suriname. This share is sufficiently large to assume that what happens in Sella impacts the trend in small-scale mining in Suriname as a whole.

Study Population: The Ndjuka Maroons

The Maroons

The forest or interior region of Suriname houses and provides sustenance to Amerindians and Maroons, who live in small settlements along major rivers. Maroons have lived in the Suriname forest for about four-hundred years, since the early days of plantation slavery. Their culture incorporates many elements from diverse African cultures as well as adaptations to the Latin American environment. Today approximately 50,000 Maroons, divided between six different groups, live in Suriname. The greatest differences in language and culture are between the Maroons of central Suriname (Saramaka, Matawai, and Kwinti) and those of Eastern Suriname (Ndjuka, Aluku, and Paramaka). Each Maroon group claims a different territory in the forest, but the Suriname government does not recognize these territories or other types of land rights.

Maroon societies maintain a large degree of political, social, religious, and economical sovereignty (Colchester 1995). The main authority of each Maroon group is the granman, who directs lower authorities called kapiteins (captains) who rule over villages or clans. The granman and kapiteins are assisted by basias (heralds, police men). The status of Maroon political leaders is legitimized by religious ideology that guides

social behavior and organization (ThodenVanVelzen and VanWetering 1991). In theory Maroon authorities are paid by, and are in the service of, the government in Paramaribo. In practice the national government does not regularly pay salaries, and Maroon leaders operate on their own. In recent years women have entered governing positions as well, but the national government does not pay female leaders.

The Ndjuka

The Ndjuka Maroons, who are also known as Aukaners, are with the Saramaka the largest Maroon group with an estimated 24,000 members (Price and Price 1999:19). The Ndjuka appear the most mobile and market-oriented of all Maroons. By the early 19th century, the Ndjuka had settled closer to the urban area, along the Cottica and Lower Saramaka Rivers (figure 2-1). Ndjuka men marketed timber to Paramaribo customers and occasionally grew food for plantations along the coast and for Paramaribo (ThodenVanVelzen and VanWetering 1991). Since the 1960s many Ndjuka have moved to Paramaribo, primarily for economic reasons (Lamur 1965). Today, Maroons make up 4.6% of the larger Paramaribo area (Schalkwijk 1994: 22). Most urban Maroons seem to be of Ndjuka origin. If only half of the Maroons in Paramaribo are Ndjuka, then about 30% of the Ndjuka population live in the city today. The Ndjuka work more in mining than Maroons from other groups.

Kinship, marriage, and residency traditions in Ndjuka society reflect their African heritage. Ndjuka society is matrilineal. The central group of a village consists of the descendants in the female line of an ancestral mother (Köbben 1979). For both sexes matrilineal kin define social relations and support networks. Ndjuka communities are

polygynous, but only wealthy men can afford to have more than one wife. The largest number of wives per husband that I observed was three.

Married women typically have a household in their birth-village. Women who share a husband do not live together, even if they are from the same village. Men divide their time and attention between the separate households. Co-wives of one husband may be friends and help one another in daily chores, but women generally detest the existence of multiple wives and/or girlfriends. Women especially dislike being a second or third wife because later wives are inferior to the first wife in the household and have less status in society. Men are supposed to give the first wife preferential treatment, but I observed that men often spent more money on their newly acquired wives. A man favoring newer wives over older ones typically causes conflicts between women. I elaborate on the gender system among the Ndjuka in chapters five and six.

The Maroons are economically, socially, and politically disadvantaged in Suriname. Quantitative data that expose the marginal position of the Maroons are sparse, but qualitative evidence is widespread. Maroons do not fill high positions in either the government or private business. In Suriname, such a lack of personal connections at higher levels poses a barrier to upward mobility. Discrimination, a lack of political connections, and low educational rates undermine the competitiveness of Maroons in the national job market (Lamur 1965; Price 1995; ThodenVanVelzen 1990). With little access to the formal labor market, most urban Maroons earn uncertain and highly variable wages in informal jobs.

Gold Mining in Suriname

A Brief History of Gold Mining

Gold mining in Suriname predates the European conquest. The first recorded official exploration occurred in 1718. It was followed by various private and state efforts to explore and exploit Suriname's gold deposits (Bubberman 1977). Meanwhile free Creoles and Maroons extracted gold on a small scale. After the abolition of slavery (1863) the Dutch colonial government encouraged gold exploration to provide employment for former plantation workers. These efforts sparked a gold rush at the turn of the century (1890-1910) (figure 2-2). Attempts to introduce heavier machinery failed during this earlier gold rush due to mechanical problems, improper planning, and erroneous cost calculations (Degrouchy and Magee 1985; DeVletter and Hakstege 1998).

The production of manual laborers rose steadily throughout the early 1900s, to peak in 1908 at 1,209 kg/yr (figure 2-2). In 1901, 5,551 workers were registered in the mining fields, many of whom were from other parts of the Caribbean (Heilbron and Willemsen 1980). The gold industry collapsed after 1908 due to the lack of management expertise, ineffective exploitation, widespread illegality, tensions between workers and concession holders, and the freezing of the gold price on the world market (Dahlberg 1984). Gold production declined to less than 2 kg/yr by 1976 (Bubberman 1977).

Rapidly rising gold prices in the 1970s inspired renewed interest in the gold deposits of Suriname (Dahlberg 1979, 1984; Gemerts 1986). In 1978, the Geological Mining Service of Suriname introduced small suction dredges on the Lawa River, then a new mining technique. However, a paucity of employees and money hampered the

continuation of exploration and exploitation. All governmental geological activity in the interior came abruptly to an end during the interior war (1986-1992). The interior became inaccessible, and the Jungle Command confiscated the governmental river dredges. According to local knowledge, the Jungle Command invited the first Brazilian miners to Suriname to work on the confiscated dredges.

Historic Mining Activity Among the Ndjuka

Ndjuka mined for gold earlier in history but only occasionally, when they needed emergency cash (Healy 1996). Today it seems that small-scale gold mining has become the primary source of subsistence for a majority of Ndjuka households. During the previous gold rush (1890-1910), Ndjuka navigated goods and people over rivers and rapids to and from mining areas, but they worked less in actual mining (ThodenVanVelzen and VanWetering 1991). In the 1950s and 1960s, miners worked manually, with shovel, a pick-ax, a baté, and a longtom. Older miners agreed that they could recover about 10 g of gold/month with these tools. An elderly Ndjuka remembers how gold miners and their families paddled up-river:

In those times you brought your wife and children. You stayed perhaps seven months. . . . The woman washed, cooked, sometimes she lay down in her hammock. When she lay down and she got bored, she took a baté and she washed gold. We would leave with 60, 70 grams. . . . At that time there were not many people, sometimes maybe only five adults. At times you worked alone, other times you worked with another man. If you had a grown-up boy, you could bring him. You found more money then, because there were fewer expenses. (camp boss, 56)

Today mining has ceased to be a family enterprise and less frequently occurs manually.

Gold Mining in Suriname Today

Today's small-scale gold mining industry in Suriname exceeds all earlier mining activity in technological advancement, gold production, and in the number of miners.

Estimates of the number of small-scale gold miners range from 10,000 to 20,000 (table 2-1). Miners are dispersed over approximately 20,000 km² of Eastern Suriname (Veiga 1997), and are concentrated in several main areas (figure 2-3). Surinamers, mostly of Maroon descent, are estimated to compose approximately one quarter of the mining population of Suriname (Veiga 1997). The remaining three-quarters are Brazilian gold miners called garimpeiros. Garimpeiros have spread over the larger Amazon since the early 1990s when the Brazilian government began to regulate, limit, and control small-scale mining (MacMillan 1995; Schmink and Wood 1992). Garimpeiros said they had left Brazil because there 'every place is a reserve', and the few places that are left to mine are exhausted and overpopulated. They were attracted to Suriname by the relative freedom from bureaucracy, and by exaggerated rumors about its richness. Garimpeiros have modernized the small-scale mining industry in Suriname.

Mining Technology and Production

Modern-day land-based miners work with hydraulic methods. Appendix C contains a discussion and graphical explanation of their work methods. Tractors and all terrain vehicles facilitate the transport of supplies to mining camps. More advanced operations use bulldozers, backhoe excavators, and metal detectors, but such equipment had not yet reached Sella Creek. I observed much variation in the efficiency and economic success of small-scale gold mining operations. Miners who work with six-inch pumps typically form teams with six laborers, a boss, and an overseer. In the Sella Creek area, the monthly gold production of such teams ranged between 275 and 2,750 g, averaging 1129 g/month (N=10, SD=794). The monthly recovery rate was at least five

times higher in the more modern mining operation that I visited along the Lawa River. The Lawa operation worked with two shifts of 6-7 laborers on a 24 h/day schedule.

Due to its informal structure, estimates of the scale and intensity of the small-scale gold mining industry are speculative. Estimates of annual gold production in Suriname vary from 8 to 42 thousand kg of gold, with a figure of 15,000 kg/yr being stated most frequently (table 2-1). In 1997-1998, the Central Bank of Suriname (CBvS), the institution officially in charge of gold transactions, bought 500-600 kg of gold every month. A senior representative of the CBvS estimated that this figure represented 25% of the total amount of gold produced (pers. com.). This figure is consistent with my findings; only a quarter (27%) of the miners at Sella Creek said they sold gold to legal dealers. Approximately a third of the gold miners in the sample reported selling to Chinese merchants, and another third sold to any buyer who paid the highest price.

Life in the Mining Area

Life in the mining area is emotionally and physically demanding. The gold miners I interviewed spent, on average, almost 7 months a year in Sella Creek (N= 93, Mean=6.9, SD=3.0), ranging from a minimum stay of half a month to a maximum of the entire year. During this period, miners live with their mining teams in camps that are a long way from home. In addition to pit workers and a boss, each mining team usually employs a cook, and sometimes others who provide temporary services such as construction, clearing, or sex work. Figure 2-4 contains a sketch of the base-camp at Sella Creek. Each camp has sleeping huts or shelters, a kitchen, and a well. The base-camp also had a store, luxury sleeping compounds for the boss and the foreman, an all

terrain vehicle, and an entertainment area with a television and a satellite dish. Adjacent camps can form larger clusters that resemble small villages with stores and entertainment.

Many Maroon miners lament their participation in gold mining and the hardships of mining life. Rice, beans, salted meat, and bread make up the daily diet. The combination of unbalanced meals and strenuous labor reduces the resistance of miners to disease, such as malaria. To the question 'How long do you plan to continue gold mining?', 36% of the miners answered that they wanted to quit as soon as possible (< 1 year). Eleven percent wanted to stay for just a few years (2-4) longer, 6% wanted to quit mining as soon as they found another job, and 18% said they wanted to quit once they had earned enough money to start another enterprise. Only one fifth (22%) of the miners wanted to continue mining for long.

The Economics of Small-Scale Gold Mining

In the mining economy, men and women perform different jobs that partially overlap (table 2-2). Most men are pit-workers or handymen who carry oil, clear forest or act as carpenters for different camps. Maroon women in the mining fields primarily work as traveling merchants or cooks, but men also perform these jobs. I observed sex-workers to be exclusively female. Many Maroon miners combine different jobs. For example, cooks often sell merchandise or wash clothes besides cooking. Overseers may simultaneously be working in the pit, and more successful camp bosses often run a camp store.

All monetary transactions occur in gold, but there are large differences in payment systems and earnings between and within professional groups (table 2-2). The machine-owner typically supplies food, shelter, and equipment in exchange for 70% of

the recovery. The laborers divide the remaining 30%, which translates to 5% per laborer with six pit laborers on the team. Cooks typically receive fixed wages that they may augment by performing small services. On paper, shop owners make some of the highest wages. However, because they are usually paid in credit, they usually receive only about half of what they are owed. The earnings of pit laborers in Sella Creek varied highly, depending on the efficiency of their operations and the gold content of their work site (figure 2-5). Among those who reported an income, gold earnings ranged from 13 to 150 g/month, averaging 43 g per person per month, the equivalent of approximately 387 US dollars (N=32, SD= 27, excluding three outliers)¹. A large share of pit-workers (39%) had earned between 20-40 g/month in the month prior to the interview. Over a quarter (27%) had earned less than that, and three pit workers (7%) reported earnings of more than 160 g/month. These high wages were earned in a mining area other than Sella Creek.

Other researchers who have assessed the earnings of pit workers in Amazon mining have reported slightly different figures (table 2-3). The differences in earnings are a product of differences in time, the personal skills of the gold miners, and local environmental factors, such as the content of gold in the soil, water availability, and the depth of gold-bearing layers. Veiga (1997: 8) found higher recovery rates in Suriname a year before I conducted fieldwork. I expect that his figures come from sites where the gold content was higher or the miners worked more efficiently. The more successful teams in Sella Creek match the data of Veiga (1997). It is likely that the low estimates of Cleary (1990) are a product of the time of his fieldwork, which was more than a decade

¹ Three people reported earnings of over 160 g/month. These high incomes had been earned either on river dredges or in land-based mining elsewhere, prior to coming to Sella Creek. For that reason I excluded the observations from the Sella Creek average figure.

before mine. At that time, miners used less profitable mining methods. Healy's (1996) estimates are also based upon less modern techniques and are therefore lower. Bezerra, Veríssimo and Uhl (1996) also report lower figures than I found, but the reasons for this difference are uncertain.

Machine owners invest approximately 20,000 US\$ to start up an operation (6-inch hydraulic unit). In Sella Creek they spent on average 600 gram/gold every month to keep the operation going (N=21, SD= 421). Despite these expenses, machine owners reported higher average net earnings than people in other professions (N=21, Mean = 344 gram gold/month, SD=364). These earnings ranged from a low of 14 g to over 1 kg/month reported by the most successful camp-bosses. Well-to-do machine owners have introduced bars with generator-powered televisions, satellite dishes that bring Brazilian channels, and video recorders to entertain their laborers and those of surrounding camps. Bosses do not install these luxuries solely for the entertainment of the workers; many have discovered that wages flow back to bosses who entertain their workers in the evening hours. Bezerra, Veríssimo and Uhl (1996) estimated that Brazilian gold miners spent over 60% of their incomes on alcohol and sex. From my observations and their own reports, Maroons in Sella Creek seemed, on average, more conservative consumers than their Brazilians fellow-workers. All the same they spent a significant portion of their wages on cigarettes, alcoholic drinks, sex, and other small luxuries that make mining life more bearable.

Local Mining Rights

The Suriname government considers the small-scale gold mining practices of Maroons illegal. The Mining law (Decree E-58, art. 2.6) states:

No person shall carry out mining and related operations other than in accordance with legal provisions related to mining. These mining operations can only be conducted after rights to do so have been granted by the competent authorities mentioned in article 6 [Minister of mining affairs]. (Government of Suriname 1986)

Maroon miners usually work without mining rights or permits from 'competent authorities'. They feel it is unnecessary to apply for official permission to work on lands that they traditionally view as theirs. The bureaucratic application procedure is complicated, slow, and believed to favor government allies. Maroons also have little means to meet the legal requirements to have an office in Paramaribo, and to supply the Geological Mining Service with a written report of all exploitation and exploration findings every three months (Government of Suriname 1986).

Despite the absence of governmental regulation, to speak about a 'wild-west' situation (DeVletter and Hakstege 1998: 332) simplifies reality. Rules about stakes in the mining area exist but are based on a local system that may be invisible to outsiders. Ndjuka authorities have assigned the concession rights to Sella to three Ndjuka families or clans. One concession holder and machine owner (56) explains how his ancestors earned concession rights to a segment of the region by being the first settlers:

I do not know the time exactly, it was before I was born, in the early days, before the bakáa [white people, outsiders] came, before the peace [1760, between the colonial government and the Maroons]. Nobody was there. It was full of trees, there were caiman, those big ones that you do not see anymore. . . . They [the ancestors] came from the rapid Bigi-ston. They passed the Sella Creek mouth, but they did not enter the creek, another family entered. . . . Near Pai-ston [landing place when entering the Sella Creek mining area over land] they made a camp. The ancestors did not know about gold.

Even though many Ndjuka who work on the concessions of others refuse to pay the 5% concession fees, the concession holder has considerable influence on who works where. Furthermore, the kin-relations between Ndjuka miners and strong social control limit the fighting about stakes in Sella. When conflicts do arise, the granman and the elderly council judge the case, and their voices remain respected by most miners.

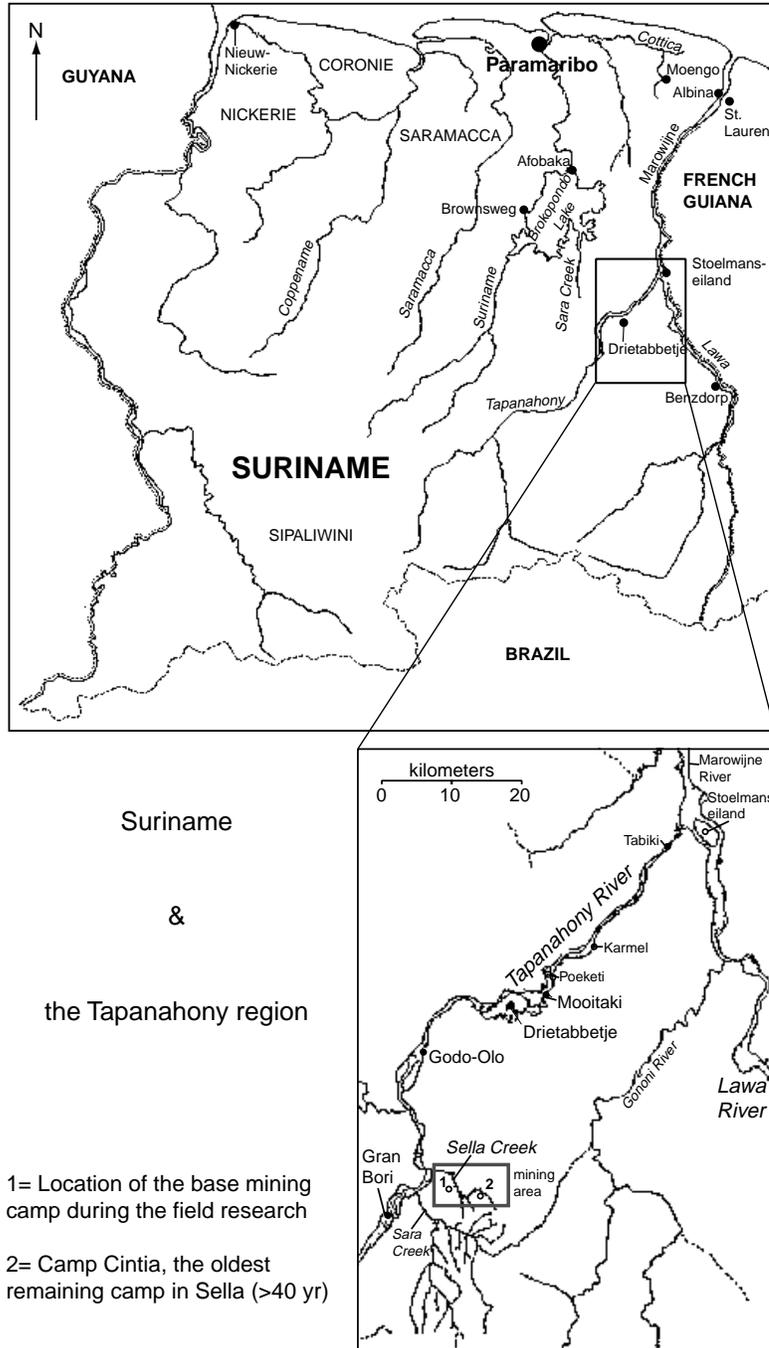


Figure 2-1. Suriname and the Ndjuka territory along the Tapanahony River with the Sella Creek mining area

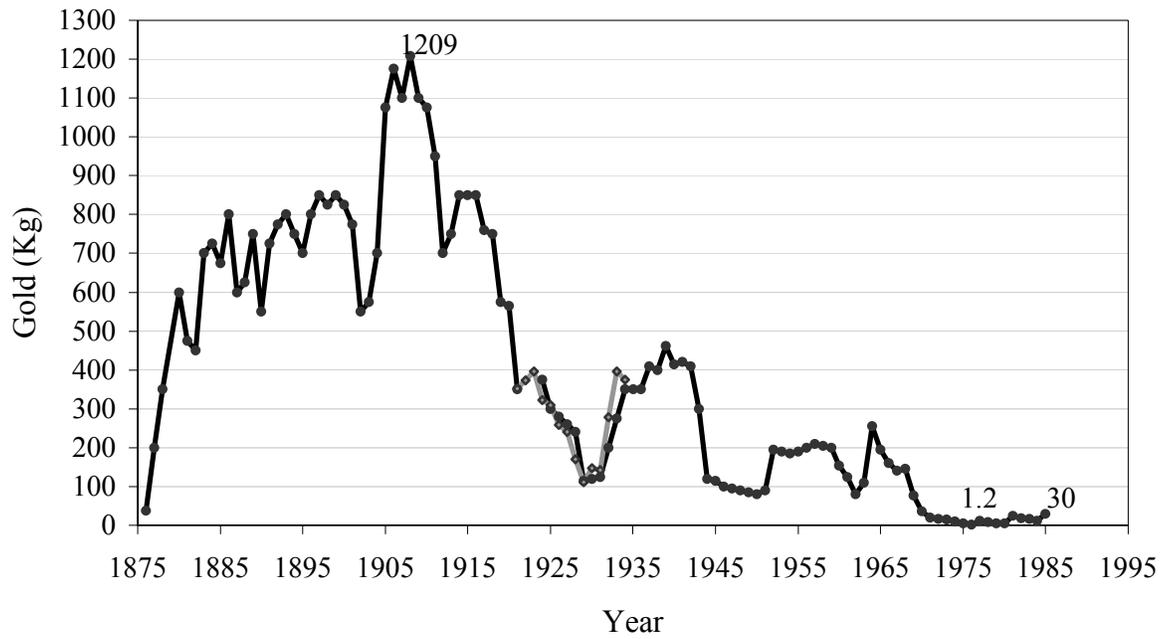


Figure 2-2. Estimated Historical Gold Production in Suriname

Sources:

1875-1974: Mededelingen Geologische Mijnbouwkundige Dienst 22

1921-1934: Heilbron and Willemsen 1980

1960-1985: Gemerts 1986: 21-22

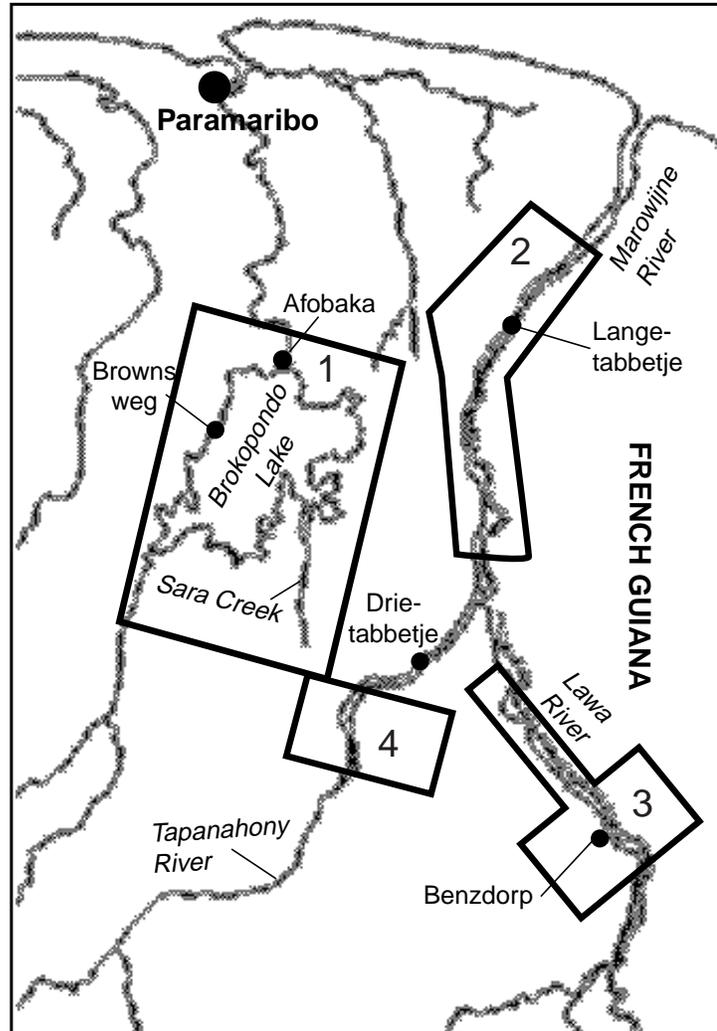


Figure 2-3. East-Suriname with the country's main gold mining regions

1 = In and around the Brokopondo Lake. Many sites are situated near the lake, along the road from Paramaribo to Afobaka and Brownsweg. Mining activity is also concentrated along the Sara Creek.

2 = In and around the Marowijne river, in particular around the Paramaka capital of Langetabbetje

3 = In and around the Lawa River. Benzdorp provides the main entrance to the mining area in the hinterland.

4 = Upper-Tapanahony region. The research site, Sella Creek, is the primary mining site.

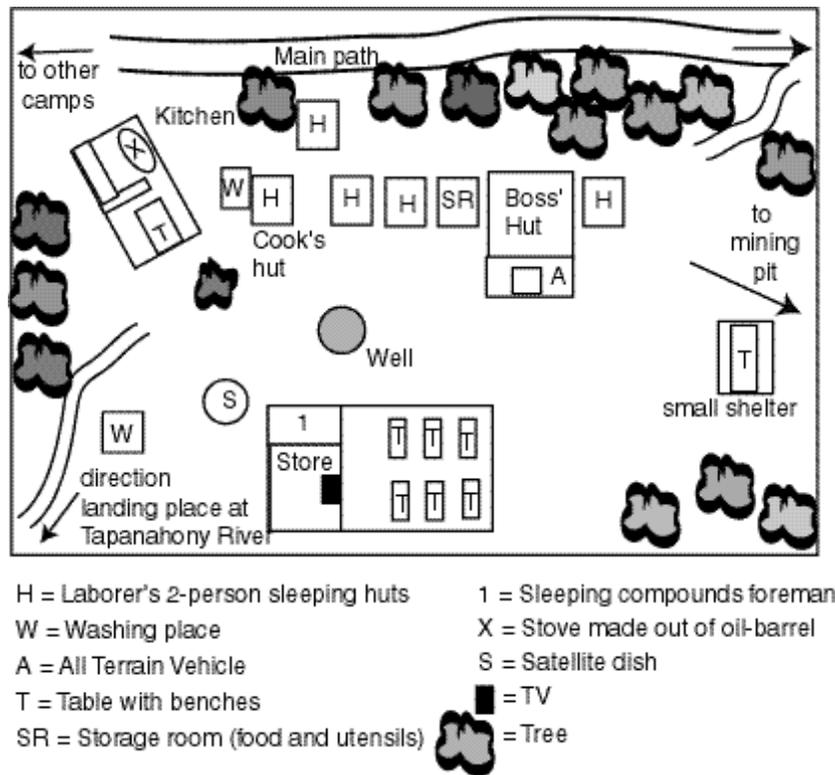


Figure 2-4. Sketch of a mining camp (field base-camp)

Figure 2-4 shows a schematic map of the base-camp during the fieldwork. In this well developed camp, there is a larger hut for the boss, a storage-room, and a shelter area for the all terrain vehicle. There is also an entertainment area where miners gather in the evenings and on free days to watch satellite-TV, play chess, and buy luxury foods and drinks. The mining pit and the nearest neighboring camp are approximately 5-10 minutes walking away.

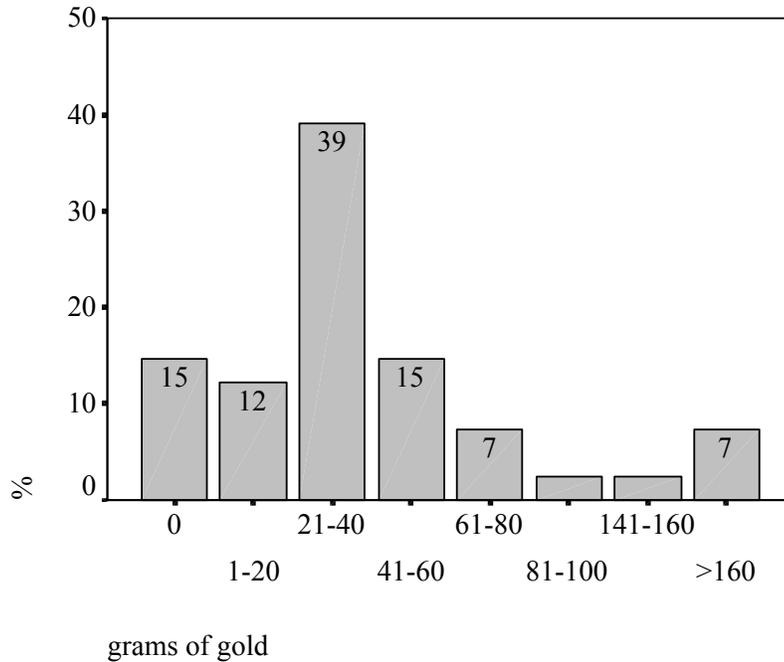


Figure 2-5. Amount of gold (in gram) earned by people who worked primarily as pit-workers (N=41) over the month previous to the interview

Table 2-1. Estimated number of small-scale gold miners and gold production in Suriname over the past four years by different sources

Source(s)	year	estimated # gold miners x 1000	estimated gold production (metric ton)
Li Pauw Sam, manager mining company Wylap Developments Co.	1999	-	30
Cardoso Neto, head <i>Cooperativo de Garimpeiros</i> in Paramaribo	1999	15-18	10-12
Wolfram, director gold CBvS	1998	-	24-29
Pollack et. al. (1998, unpublished)	1997	15-20	10-20
Veiga (1997)	1997	15	8-12
Gemerts, director GMD (Ramcharan 1996)	1995	15	10 (low)
DeKom, VanDerVoet, and DeWolf (1998)	1995	10-15	10

Table 2-2. Payments system and monthly earnings of several professions in Sella Creek

Profession	Payment system(s) observed in the Sella Creek mining area	Monthly net total (g gold)
<i>Jobs performed by women and men</i>		
Boss/Machine owner	60-70% of gold extracted minus production costs (machines, transport of supplies, oil, camp, food)	range: 14-1,063 median: 140
Cook	10 g/pit worker/month, or 5 g/pit worker/month + 30 g from boss, or stable wage paid by boss	60 60 25, 30
Shop owner	Sales minus transport and acquisition costs. Products are typically priced 3-10 times the prices in the city	160, 606 ¹
Transient vendor	idem	range: 0-50 median: 10
<i>Jobs exclusively performed by women</i>		
Wash clothes	1 g/pp/load	20
Sex-worker ²	3-5 g/time 8, 10 or 15 g/night (on credit more expensive)	n.a.
<i>Jobs exclusively performed by men</i>		
Transport tractor	10 g/barrel of oil (200 liter)	varying
Transport All Terrain Vehicle	1.5 g/25 kg transported (cash payment) 2 g/25 kg transported (credit payment)	varying
Pit laborers	5% of gold extracted	range 13-150 ² median: 40
Overseer	5% of gold extracted	range: 20-325 median: 50
Carrier	1 g/40 liter container (1 trip) 10 g/barrel of oil (200 l) (8 days)	range: 35-100 median: 60
Concession holder	5% of gold earnings of each operation on his concession (but often not paid)	n.a.
All-round: carpentry, construction	1 g/board produced, 15 g for cleaning the camp from weeds, 1 g/m ² forest cleared with steel-saw (large trees and under-story)	n.a.

¹ The amount presents the amount sold in cash and credit. Because miners frequently do not pay their debts to shop owners, real profits are much less. The estimate is based upon the information from two men who were exclusively shop owners. Other shop owners had other primary jobs such as being a cook or a camp-boss.

² Figures are exclusive three outliers.

Table 2-3. Estimated earnings of laborers (pit-workers) in (partly) mechanized small-scale gold mining by different researchers (per person grams of gold per month)

source(s)	time & place of field work	earnings of pit workers (g AU/month/pp)
Heemskerk	1998-1999, Sella, Suriname	43 (SD= 27)
Veiga (1997)	1997, Suriname	45 - 150
Healy (1996)	1995, Nieuw Koffiekamp (Royal Hill), Suriname	partly mechanized (2"-3" pump): 16 - 20
Bezerra, Veríssimo and Uhl (1996)	1993, Tapajós, Brazil	17 (low power), 25 (medium power), 48 (high power)
Rodrigues (1994)	1990-1992 Tapajós, Brazil	20 (cook)
Cleary (1990)	1985-1986, Maranhão, Brazil	1.7 - 35

CHAPTER 3 METHODS AND SAMPLE

Here I describe the general methods of data collection and analysis. I begin this chapter by defining small-scale gold mining and gold miners. I then describe the sampling methods and characterize the sample population. Next I discuss how I generated and analyzed ethnographic data, quantitative data, and archival data. In later chapters I explain the methods germane only to those chapters. Definitions of important concepts and foreign words are listed in Appendix B.

Definitions

Small-Scale Gold Mining

The term small-scale gold mining has been used interchangeably with artisanal mining, wildcat mining, informal-sector mining, and -in Brazil- garimpagem (Cleary 1990; MacMillan 1995; Schmink and Wood 1992; UN 1996). All these terms are used to describe mining that is performed informally with rudimentary methods. I will only use the term small-scale gold mining. Small-scale mining includes both manual mining and mining that makes use of pumps, sluice boxes, and other mechanized equipment.

The Suriname mining law defines small-scale mining as:

The reconnaissance, exploration and exploitation of a mineral deposit whose nature, mode of occurrence and quantity warrants the economic mining by simple means and methods. (Decree E-58, art. 2.6, Government of Suriname 1986)

The Geological Mining Service of Suriname applies the term small-scale mining to mining activity on a concession smaller than 200 ha. These official definitions do not clarify the nature of small-scale gold mining. Therefore I use as a working definition of small-scale gold mining, gold mining that is characterized by:

- Informality; large degree of independence of social, legal, and economic regulations implemented by the national government, and
- A labor force that is not formally trained in mining and has a low educational background in general.

Even though efficiency and proficiency vary considerably among small-scale gold mining operations in Suriname, several features characterize all these operations: the absence or low standard of prospecting prior to exploitation; inefficient ore exploitation (extracting and processing) techniques; and high economic and health risks (Bunt and Reussink 1997; Healy 1996).

Gold Miners

To answer my research questions I needed to divide the world in gold miners and non-miners. Because, to my knowledge, no other researchers have clearly defined gold miners or garimpeiros, I developed a broad definition of gold miners that best served my research. I use the term gold miner to refer to anyone who is present in the mining camps, and is part of the mining industry or of the surrounding service economy. This definition includes not only pit-workers and camp-bosses, but also merchants, cooks, and

other people in and around mining camps. It also includes the spouses of miners who visit the area, because they usually take food to share or items to sell, and perform small services for their husbands and others. It excludes people in the city who invested financially in mining equipment but are not physically present in the mining area.

I found the broad definition of gold miners most useful for several reasons. First, Maroons in the mining area typically perform different jobs simultaneously or in sequence. For example, people who were selling at one time could be found in the mining pit a week later. A narrow definition possibly excluded these people. Second, many mining risks are shared, including malaria, violence, crime, and economic uncertainty. Therefore the most important decision for many Ndjuka is whether to work in the mining area, rather than what job they will do. Several people came without a predetermined workplace; they solicited a job in or outside the mining pit once they arrived in the mining area. Third, a narrow definition that only includes pit-workers and bosses excludes most women from the sample of miners. A broad definition of who are gold miners allowed me to investigate gender inequality in access to mining, and to compare non-mining women with female miners.

Throughout the Guiana's, local gold miners are called porknockers (porknockers). Historically, this name was used for independent gold miners who worked on the concessions of others in exchange for 10-15% of the gold extracted. Today porknocker has a negative connotation and gold miners do not identify themselves by this name. Maroon miners refer to themselves as gold miners, the term that I use. I refer to Brazilian gold miners as garimpeiros, a name that is commonly used in Suriname.

Sample

Sampling Methods

The absence of demographic and socioeconomic data on the Maroon population and the high mobility of male Ndjuka prevented me from using random sampling stratified by socioeconomic or demographic characteristics. Moreover, a random sample would not generate sufficient variance in the explanatory variables. For example, due to the small number of women in the mining area, a random sample would not include enough female miners to test the hypotheses. Instead I sampled purposively, interviewing the largest number of female miners possible. Purposive sampling allowed me to analyze the differences between female miners and other women, and between female and male miners. I ensured that the final sample was sufficiently varied in sex, occupation, age, marital or residency status, wealth, and other socioeconomic characteristics relevant to testing my hypotheses.

I conducted interviews in the national capital Paramaribo, in forest communities along the Tapanahony River, and in the Sella Creek mining area. In Ndjuka villages and in mining camps I identified interview candidates by approaching people who appeared unoccupied. I asked these people if they were willing to participate in an interview. On other occasions the interview flowed out of a spontaneous conversation with someone. I minimized the bias of representing only the least occupied persons by making appointments with people who were too busy to participate in spontaneous interviews.

I found opportunities to talk to women while helping out on the land or in domestic chores. In the mining area, the most productive day of the week was the kina or

taboo day. On these days miners were not allowed to work and often bored and eager to talk. I found other occasions to speak with miners when mining machines had broken down, when people were waiting for the boat, when miners were temporarily out of work or, in the case of merchants, when there were no customers.

It was more difficult to identify Ndjuka in the city because they are one of many ethnic groups, and I could not easily distinguish them from city-Creoles or Maroons of other affiliations. Given the tightly connected urban Ndjuka community, I found snowball sampling most useful in the city. I started the process from different sources to prevent the sample from including only people from one single network of friends and family. The first person in each sequence was usually someone who I had met coincidentally over the course of fieldwork.

Sample Population

The sample population includes male and female Ndjuka who are either gold miners or not gold miners (figure 3-1). More than half (57.3%) of the interviewees lived along the Tapanahony River in the area called opo (up-streams), primarily in the villages of Drietabbetje and Mooitaki (figure 3-2). Another large proportion of Ndjuka (37.3%) lived in Paramaribo, and smaller numbers lived in French Guiana (2.3%), belo (down-streams, 2.3%), or in the coastal Cottica region (0.9%). The Ndjuka are typically part of multiple households in different places. I classified people in the place where they spent most time.

The men and women in the sample have a similar distribution of ages. About a third (30%) of the people of both sex-groups are between 16 and 25 years of age. A majority of the men (77%) and women (53%), are in their twenties and thirties. Fifteen

percent of women and 10% of men are over 50 years of age. Seventy-seven percent of the Ndjuka in the sample have a partner. The number of children averages 3.5 (SD=3.6), and ranges from 0 to 26 children. The 26 children belong to a man with three wives who also has children with other women. The number of household residents varies widely between 0 and 20, with an average of 4.4 (SD=2.9) people per household.

There are large differences in human capital between Ndjuka women and men, as well as between gold miners and others (table 3-1). Here I only report the significant differences unless indicated otherwise. The large standard deviations imply that there is much variation within each sex and occupational group. On average, women complete only 3.3 years of formal education and men 5.6 years ($t=4.50$, $p<0.001$). Almost half of the women (48%) and a fifth of the men (19%), have no formal education ($X^2=20.47$, $p<0.001$). Among both men and women, gold miners are more highly educated than non-miners but these differences are not significant at the 5% level. Almost none of the interviewees' parents, 7% of fathers and 5% of mothers, had received any formal education.

Almost all men (94%), particularly among the miners (98%), know how to tell time. In contrast, a quarter (27%) of women are not familiar with western time calculation (X^2 between men and women =18.94, $p< 0.001$). The figure is even higher (31%) among the non-mining women (Between mining and non-mining women: $X^2=4.74$, $p< 0.05$). Men (69%) are more often literate than women (45%) ($X^2=12.34$, $p<0.001$), but both groups compare poorly to national literacy rates of 94% and 89% for men and women (WRI 1999). Women also speak on average fewer languages than men

(2.1 versus 3.6, $t=7.48$, $p<0.001$). Few women speak the national language Dutch (41%) compared with 71% of men ($X^2=21.24$, $p<0.001$).

As compared to non-miners in either sex group, gold miners are advantaged. On average, miners have had more formal education ($t=3.99$, $p<0.001$) and are more likely to be literate ($X^2=9.04$, $p<0.005$), know how to read time ($X^2=25.90$, $p<0.001$), and speak Dutch ($X^2=17.54$, $p<0.001$). Formal education, literacy, multilingualism, and the ability to read time are signs of increased acculturation. The data suggest that gold miners and men are, on average, more acculturated than non-miners and women.

Sample Population: Gold Miners

The sample of gold miners includes people with different professions in the mining area (figure 3-3). I only present the percentage of people in their primary occupations, excluding services that are typically performed as secondary jobs, such as washing clothes. Pit-workers may be under-represented in the sample because I usually found them occupied during the entire day. Machine bosses and merchants were more frequently able to spare time. I estimate that in reality, Ndjuka pit-workers make up just over half of the Ndjuka mining population in Sella Creek. For the other occupational groups, the proportional representation displayed in figure 3-3 reflects the population in Sella Creek.

A fifth (22%) of the Ndjuka miners reported owning a machine. Because of the high economic insecurity, I could find bosses working as pit-workers to pay for the repair of a broken machine. Cooks and merchants both represented about 15% of the mining population, and these jobs were sometimes combined. Fewer people were overseers, delivered transport services, and did all-round jobs. Women did many jobs. Yet because

they combined jobs and remained in the mining area for shorter periods than men, the number of Ndjuka women in Sella creek at a given time was always low.

Sample Population: Non-Miners

Most non-miners in the sample lived in the interior, primarily in the villages of Drietabbetje and Mooitaki. About 30% lived in Paramaribo. The group of non-miners included twice as many women (N=80) as men (N=37) because women dominate the population in forest communities. Non-miners did various jobs. Women were mostly subsistence farmers (62%). Men produced less frequently for subsistence; only 3% of men practiced subsistence agriculture, and 8% lived from foraging. Other women (10%) and men (19%) informally sold goods and services. More than a quarter of non-mining men (27%) and 5% of women were civil servants, and about half as many men (11%) and women (2.5%) worked in other forms of wage labor, mostly in the city. Fewer non-miners were boatmen (5%) or woodworkers (1%), or lived off pensions (5%) or past mining incomes (1%). Many women (17%) reported to depend on others, mostly a husband or matrilineal kin.

Methods

Here I describe the general research methods that I used to collect and analyze data. In table 3-2 I provide an overview of the main questions I address in each chapter of the dissertation, and of the specific methods that I used to answer these questions. I also summarize what type of data each of the methods generated in relation to the

question. The questions are ordered according to their appearance in the data chapters four through eighth. Below I discuss the methods in more detail.

Ethnographic Methods

I used several ethnographic methods, including life histories, ethnographic interviews, semi-structured interviews, and participant conversation and observation. I conducted practically all interviews in Ndjuka and occasionally, upon request, in Dutch. The life histories of elderly Ndjuka helped me understand the historical context in which the present developments take place. Ethnographic interviews revealed a portrait of the daily lives of Ndjuka woman and men today. In 1996, I tape-recorded my in-depth conversations with two women. Because most people were uncomfortable with tape-recording, I recorded all other interviews by hand. All informant names in the dissertation are pseudonyms.

Participant observation and conversation were central to my qualitative understanding of Ndjuka life. In the forest villages, I participated in gossip, tales, discussions, and conversations during daily activities, such as grating cassava, peeling peanuts, and washing in the river. Despite my dislike of the menstrual hut, this place proved an excellent setting where women openly discussed personal and women's issues, marriage and men. In the mining camps, I let free conversations evolve around plays of chess or informal get-togethers during off-work hours. Like Cleary (1990), I found the gold mining area an excellent research setting from the ethnographic point of view. The mining area offers little entertainment and if nothing else, conversations with and observations of a foreign anthropologist were at least a distraction. I found miners pleased with the interest in their lives, and they asked me as many questions about the

Netherlands and the US as I asked them about their lives and ideas. Both in Ndjuka villages and in the mining area I was welcomed with curiosity and generosity, and numerous people shared food and shelter.

I also used structured methods to collect and analyze ethnographic data. In chapter five I use ethnographic decision tree modeling to identify emic justifications for either mining or not mining. An advantage of decision tree modeling over non-ethnographic types of decision analysis is that it allows the decision-makers to say what they think is important. Ethnographic modeling can also integrate important yet difficult-to-measure factors such as morality, commitment, and power. Unlike other ethnographic methods, decision tree modeling allows for prediction and extrapolation of the results to a larger population of interest. Another structured qualitative method that I use is a Likert scale to measure individual risk tolerance. Chapter seven contains a discussion of how I constructed and applied the scale. I explain the tests of validity and reliability of the risk tolerance-scale in Appendix E.

I used ethnography to develop my hypotheses and place my analysis in a sociocultural and historical context. Throughout the dissertation I use qualitative data to interpret quantitative results, and to provide explanations where statistics are inadequate. In the interest of brevity, I omit ethnographic details that do not help to answer the research questions in a direct way. For more detailed ethnography about the Maroons the reader is referred to Sally Price's work about gender in Saramaka society (1993), the analysis of Ndjuka religion by ThodenVanVelzen and VanWetering (1991), and studies of social organization and social change among the Matawai (DeBeet and Sterman 1981) and the Cottica Ndjuka (Köbben 1979). Fieldwork for the above studies was primarily

conducted in the 1970s, but recent ethnographic work on the Maroons is sparse. Polimé and ThodenVanVelzen (1992) collected in-depth interviews with refugees and other Maroon victims from the interior war. Richard and Sally Price combine data from three decades of fieldwork among especially the Saramaka, to document developments in Maroon arts (1999). My analysis is the only recent in-depth study about the Ndjuka, whom lives have changed dramatically over the past two decades.

Quantitative Analysis

To collect data for quantitative analysis, I composed a survey on socioeconomic characteristics and mining-related information. I adjusted the questionnaire after the first few interviews in the field, and later perfected the wording of the questionnaire with the help of a Ndjuka key-informant in the city. The final survey included the following eight sections:

1. Personal data
2. Household composition, pooling and labor
3. Health
4. Assets, income, resources
5. Time allocation
6. Mining as a risky activity
7. Mining experiences, and
8. Perspectives on the future

Appendix D contains the entire survey in English. The interview lasted approximately half an hour, which was the maximum time that people were willing to spend answering

structured questions. I typically obtained additional information or clarification in a less formal setting immediately after or before the interview.

I use bivariate and multivariate techniques to test hypotheses. The multivariate models include ordinary least squares, probit, and tobit regressions. I will clarify functional specifications and the reading and interpretation of the coefficients when I use the specific regressions. I will discuss econometric problems and the way I dealt with them in the separate chapters.

Archival Research

I collected archival data from numerous sources in Suriname, the United States, and the Netherlands, where many historical and current records on Suriname are kept. Statistics on macroeconomic historical trends and on social and political indexes are based on secondary data from the Suriname Bureau of Statistics in Paramaribo (ABS), the World Bank, and the International Monetary Fund.

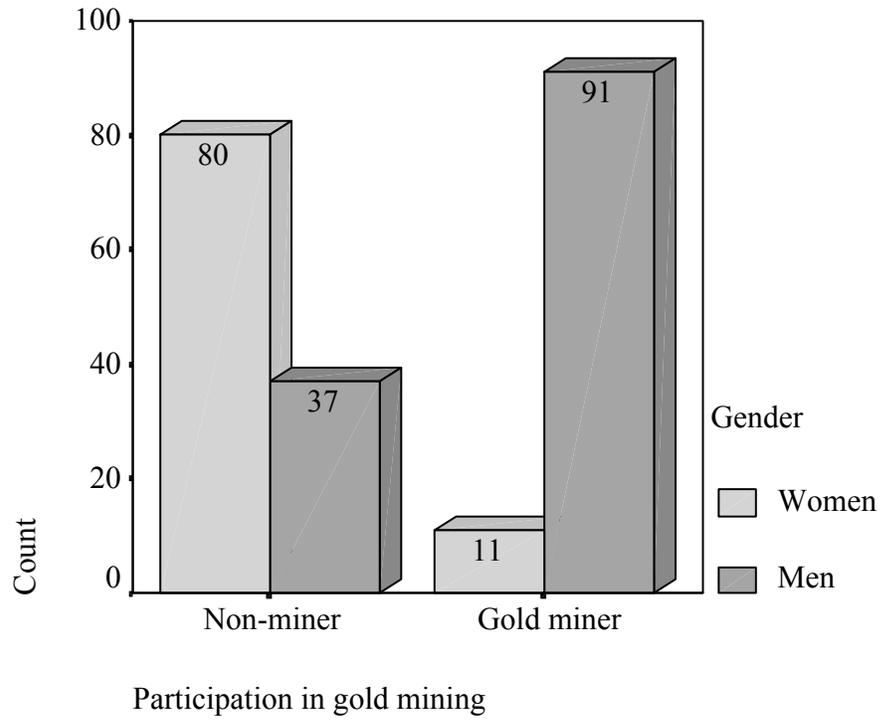


Figure 3-1. Numbers of male and female gold miners and non-miners in the sample population (N=219)

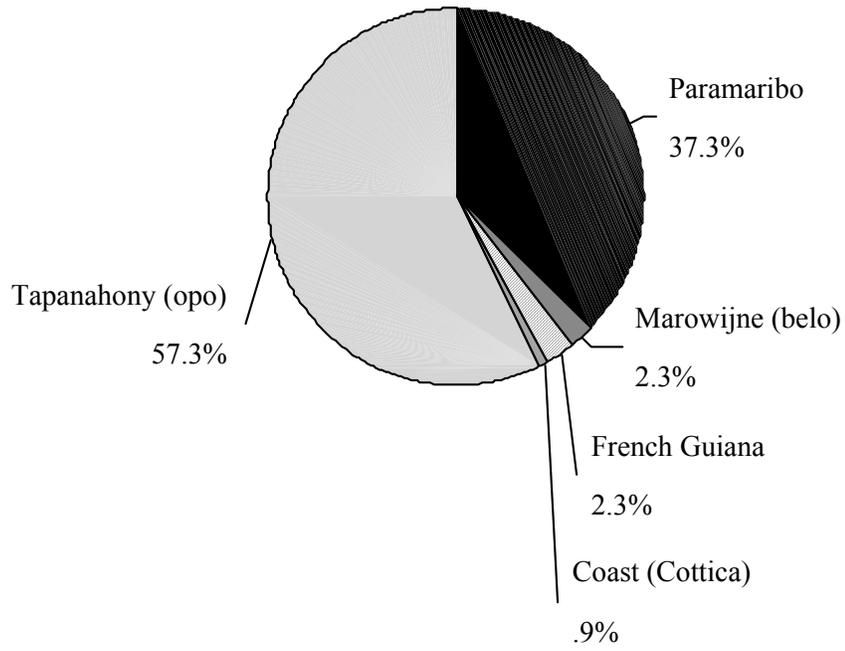


Figure 3-2: Area of residency of the sample participants (N=219)

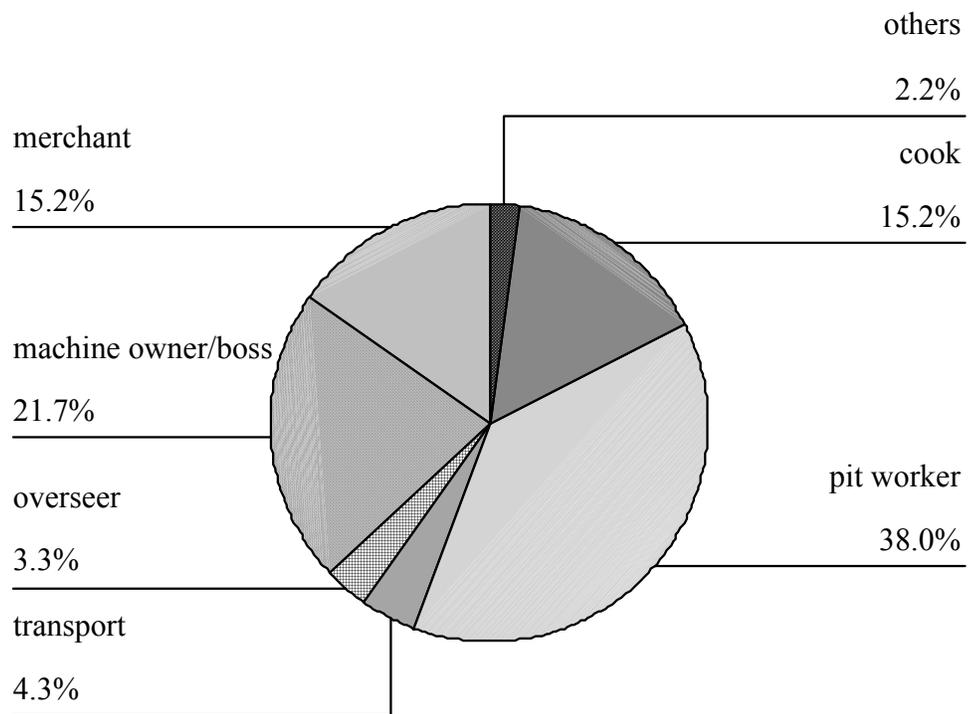


Figure 3-3: Percentage-representation of different professions performed by gold miners in the study sample (N=102)

Table 3-1. Human capital of Ndjuka men and women, miners and non-miners

	Sample	Mining men	Other men	All men	Mining women	Other women	All women
N	219	91	37	128	11	80	91
<i>Education</i>							
mean (SD)	4.7 (4.0)	5.9 (3.3)	5.0 (4.9)	5.6 (3.8)	4.6 (3.7)	3.1 (3.8)	3.3 (3.8)
median	5.0	6.0	4.0	6.0	6.0	0	2.0
range	0-17	0-15	0-17	0-17	0-11	0-14	0-14
<i>Literate</i>	59%	70%	64%	69%	39%	64%	45%
<i>Read time</i>	85%	98%	84%	94%	100%	69%	73%
<i>Number of languages</i>							
mean (SD)	2.8 (1.4)	3.5 (1.1)	3.1 (1.6)	3.4 (1.2)	3.1 (1.6)	2.1 (1.2)	2.2 (1.3)
median	3.0	4.0	3.5	3.5	3	2.0	2.0
range	1-7	1-6	1-7	1-7	1-6	1-5	1-6
<i>Speak Dutch</i>	53%	69%	61%	66%	38%	64%	41%

Table 3-2. Main questions, methods, and data generated

Ch.	Questions	Methods	Data Generated
4	What macro-scale forces caused small-scale gold mining in Suriname to boom when it did?	Oral histories Time series regression Archival research	Ethnographic understanding of historic changes in people's lives and in Suriname Test of the relative impact of national and international indicators on the Ndjuka participation in gold mining Documentation of trends in national and international level indicators over time
5	What criteria do individual Ndjuka consider when they make a decision about gold mining?	Decision tree model Ethnography	Model that structures the decision criteria that encourage or discourage Ndjuka individuals to become a gold miners. Model to predict Ndjuka decisions about mining In-depth emic explanations of why people become, or do not become, gold miners.
6	What barriers does gender compose to the participation of women in mining?	Emic and ethic observations Probit regression Ethnography	Identification of the variables that may be barriers to the entry of women into mining. Test of the relative importance of the selected indicators of gender inequality in mining. Qualitative explanation of the gender bias that remains unexplained in the statistical model
7	Given the high exposure to physical and economic risk, why would anyone choose to be a gold miner?	Likert scale Tobit regression Ethnography Comparative study	Measure and compare risk attitudes of gold miners and non-miners Test of the relative impact of indicators of risk tolerance and of risks and poverty management on participation in gold mining Inform hypotheses Qualitative evidence for or against the hypotheses where quantitative evidence is scanty. Speculation on general patterns in the conditions that encourage risk taking

CHAPTER 4 ZOOMING OUT: DISTANT FACTORS DRIVING THE SURINAME GOLD RUSH

Anthropologists have long studied households and communities, but they increasingly recognize that local people are influenced by, and in turn influence, larger scale processes (Arizpe, Paz and Velázquez 1996; DeWalt and Pelto 1985; Moran 1999; Painter and Durham 1995; Schmink and Wood 1987; Sponsel, Bailey and Headland 1996). Zooming out from the household to the macro-scale reveals how distant forces may or may not affect local subsistence choices. Here I step back from the Ndjuka community to analyze and model the international and national developments that have contributed to the growth of the small-scale gold mining industry in Suriname.

Central Questions

In the conclusion to the book entitled The Social Causes of Environmental Destruction in Latin America, Durham (1995) theorizes how large scale forces affect local resource use decisions. Durham explains unsustainable land-use as a product of inequality at international and national levels. He argues that in Central America, international economic markets motivate the commercial exploitation of ecologically vulnerable areas. As a result local people have less resources available, and engage in unsustainable commercial land-use practices.

By contrast, Durham argues that in South America national forces are more important. National inequality lowers the standards of living and access to resources of unprivileged groups. These groups respond by using marginal lands, over-harvesting, and employing other means of unsustainable resource extraction. International and national forces mutually reinforce one another, but in specific cases one may better explain local behavior than the other. My central questions are:

- Do national or international forces better explain why small-scale gold mining boomed in Suriname when it did?
- What is the relative impact of selected international and national processes on changes in the local mining population?

Approach and Relevance

Globalization, urbanization, and industrialization are making the world more interconnected and inclusive. Communities that were previously relatively isolated are now increasingly exposed to people, commodities, and world-views from outside. As a result, the analysis of national and global developments has become crucial to understanding the local realities in which people live and make decisions. Interactions between larger and smaller scales include diverse sociocultural, political, ecological, and economic processes, and have temporal dimensions (Abrams 1996; Bryant 1992; Balée 1989, 1995; Headland 1997; Peluso 1992). For reasons of brevity I focus here only on selected economic and political links at spatial scales.

I take an unconventional approach to the study of micro-macro level interactions by coupling qualitative documentation with time series regression analysis. This approach allows me to identify what processes are more important than others, and to

estimate the relative impact of selected indicators on the Suriname mining boom. My study contributes to methodology for studying micro-macro level analysis, and to a better understanding of gold mining in Suriname. In addition, identifying the large-scale forces that are driving gold mining may inform public policy that mitigates the impact of these distant forces on the lives of local people. Such policy might encourage subsistence practices that are more sustainable than mining.

Competing Hypotheses

I use the model of Durham (1995) to test two hypotheses about the relative importance of international and national factors in predicting gold mining. Emphasizing the importance of international markets, I hypothesize that:

- (1) By determining the profits and production costs of gold mining, international market prices for gold and oil are driving the local participation in gold mining in Suriname.

Competing with the international markets model is a model that theorizes that political and economic processes within Suriname encourage small-scale gold mining. I hypothesize that:

- (2) Economic and political instability at a national level are driving the local participation in gold mining in Suriname.

The competing models do not cover the range of possible explanations and are not mutually exclusive. A third and a fourth option are that a combination of models, or neither one adequately explains the gold rush.

Econometric Model

I test the hypotheses with an ordinary least squares regression (OLS) to estimate the marginal effect of international and national indicators on the local number of small-scale gold miners. The two hypotheses require different explanatory variables.

Hypothesis 1 predicts that miners respond to international commodity markets. I represent international commodity markets by the international prices of gold and oil, which determine the profits and expenses of a mining operation. I expect that a rising price of gold and a decreasing price of oil encourage small-scale gold mining. I use indicators of national economic and political instability to test the second hypothesis. Consumer prices and unemployment represent economic instability. I use an indicator of the country's openness to international trade to approximate political stability. I predict that consumer prices and unemployment positively relate to the number of small-scale gold miners, and that openness (political stability) negatively associates with mining.

Before I discuss the variables I will document what is known about the size of the small-scale gold mining industry over the past decades. The information will help the reader relate the changes in the variables discussed below to changes in the small-scale gold mining industry. The small-scale gold mining industry seems to have grown since the early 1980s. The last official estimate of annual gold production dates from 1985, and is 30 kg. Today, the annual gold production in Suriname is estimated to have reached a plateau at approximately 15,000 kg. The present annual gold production exceeds the maximum production during the previous gold rush by more than twelve times.

Explanatory Variables

Here I operationalize the explanatory variables and qualitatively discuss why I expect specific variables to impact small-scale gold mining. In the next section I will explain the dependent variable that I created to represent the local participation in gold mining. The variables are defined in table 4-1, summary statistics appear in table 4-2, and the raw data are presented in Appendix E.

Price of Gold

I consider the price of gold for two reasons. First, gold is the international commodity that best suits a test of Durham's international markets model for the case of Suriname. Second, several researchers have argued that a rise in gold prices encourages informal mining (Cleary 1990; MacMillan 1995; Sponsel 1997). Their argument is based on the observation that small-scale gold mining boomed in Brazil in the early 1970s, when the inflation-adjusted global price of gold rose (figure 4-1). The case of Suriname casts doubt upon the theory that rising gold prices initiate gold rushes. Real prices of gold in US dollars and Suriname guilders declined after 1979, with the exception of a rise in the Suriname gold price in 1993 following monetary adjustments. In contrast to what would be expected during falling gold prices, the Suriname mining population grew in the 1980s and 1990s. Because other researchers have emphasized the price of gold, and because of its theoretical importance, the variable remains part of the analysis. I include the price of gold as the log value of the inflation-adjusted price of gold in Suriname guilders. A lack of historical price data on other relevant commodities prevents me from analyzing the impact of the relative price of gold.

Price of Fuel

The price of fuel should affect the expenses of gold mine owners, who use gasoline for transport, the operation of mining machines, and generators that deliver power for televisions and refrigerators. The large variation in fuel use of different mining enterprises, coupled with the sparse written documentation of expenses, prevented the precise calculation of the relative contribution of fuel expenses in the cost structure of mining operations. I used the detailed data from one highly mechanized mining operation in Sella Creek to estimate the relevance of oil prices for miners. In table 4-3 (column 2) I estimate that the operation owner spent about 3,700 US\$ each month on fuel, which accounted for 80% of his monthly variable costs. Given an average gold production of 2 kg gold/month, the equivalent of 18,000 US\$, approximately a fifth of the total production value was reinvested in fuel. Casual conversations with other mine operators suggest that they spend a similar proportion of their gold production on fuel.

The price of oil fell steadily in the early 1980s (figure 4-2). Although real world oil prices recovered soon after 1985, real oil prices in Suriname guilders kept going down, to hit a low in 1993. The price of oil increased after that year, but recently fell again due to an increased world production coinciding with weak demand. By lowering production costs, low oil prices may have made gold mining more profitable. The price of oil is included as the log value of the inflation-adjusted price of oil in Suriname guilders.

Political Instability

Various researchers have argued that national political instability and inequality encourage the unsustainable use of resources by local people (DeWalt and Pelto 1985;

Painter and Durham eds. 1995; Sponsel, Bailey and Headland eds. 1996). I documented in chapter two how in Suriname, military dictatorship (1980-1987 and 1990-1991) and the interior war (1986-1992) impoverished and socially isolated the Ndjuka. It is likely that these forces, in turn, stimulated the participation of Ndjuka in gold mining. I measure the intensity of political instability by the variable openness, following the example of Bohn and Deacon (forthcoming). Openness is calculated as the sum of imports and exports, divided by the Gross Domestic Product (GDP), in formula:

$$\text{Openness} = \frac{\text{Imports} + \text{Exports}}{\text{GDP}}$$

In economic terms, openness measures the ratio of the value of international trade to the value of the national economy. The logic behind the proxy is that political instability makes a country less open by scaring off investors and obstructing international trade.

A graphical representation of how openness to international trade developed over time helps judge the validity of this variable to measure political (in)stability in Suriname (figure 4-3). Suriname became politically less stable after the military coup of 1980. As expected, openness decreased consistently following the military coup and throughout the period of dictatorship (1980-1992). After the return to democracy (1992), the country becomes rapidly more open due to recovery of trade relations with the Netherlands and the influx of large-scale mining and logging companies. The fluctuations in openness since 1995 are less clear. They may partly reflect the return to power of the political party of ex-dictator Bouterse, and the disruption of Suriname trade relations with the Netherlands since then. Because the trend in openness is consistent with political events, I conclude that openness is a good indicator of political stability in Suriname.

Inflation and Consumer Prices

Several researchers have identified a positive relation between inflation and the intensity of small-scale gold mining (Cleary 1990; MacMillan 1995; Roopnaraine 1996). In Suriname, annual inflation rates began to rise during the interior war (1986-'92) and continued to increase thereafter, partly due to a foreign exchange deficit following the collapse of the bauxite industry (figure 4-4). Meanwhile the legal imports of consumer goods stopped almost entirely, causing shortages and a thriving black market (Bakker 1998: 156). Shortages coupled with high inflation caused consumer prices to rise (figure 4-5). Costs of food items increased ten-fold between 1990 and 1997, severely impacting the quality-of-life. From May 1998 to May 1999 consumer prices increased by 102% (IMF 1999), and in May 1999 alone, the Suriname guilder depreciated 40% against the US dollar (NRC 1999). I include inflation as the log value of the consumer price index because this measure has a direct impact on the daily lives of people.

Unemployment

It is likely that people become gold miners when the availability of other jobs decreases. Unemployment rose following the 1982 military coup and peaked at the time of the interior war (figure 4-6). Unemployment rates that had remained under 5% of the economically active population throughout the 1970s, reached over 20% by the late 1980s. The explanatory variable unemployment is included as the percentage unemployed of the economically active population.

Dependent Variable

The dependent variable is the number of local small-scale gold miners. In absence of national data on the mining population I used local survey data to create the dependent variable. I asked the Ndjuka with mining experience (N=154) when they had first entered gold mining and, if applicable, when they had quit mining. Analysis of the number of people who are added to the mining population annually (ignoring exits) shows that many Ndjuka became gold miners during military regime (1980-1987 and 1990-1991), the interior war (1986-1992), and its aftermath (figure 4-7). Less than a fifth (19%) of the Ndjuka with mining experience had begun gold mining before the military coup of 1982, and almost a third (31%) of survey participants first entered the mining fields during the interior war (1986-1992). Renewed accessibility of the interior and increasing costs of living after 1992 may explain the large number of Ndjuka entering the mining fields immediately following the war (16%). The relatively large proportion of people who entered before 1975 (10%) is due to the large time span this bar represents (30 years) in comparison to the other periods (2 years).

The number of new gold miners in a given year may not adequately represent the development in the standing mining population at a given time. The measure ignores that people usually stay for several years. I solve the problem by calculating the cumulative number of miners in a given year; that is, the total number of miners in the previous year plus the number of newly entered miners. Because people leave mining as well, I subtract the number of people who left gold mining in a given year from the cumulative number of miners in that year. Because the macroeconomic data only goes back to the

early 1970s, I limit the analysis to 1973-1998. This recent time span minimizes problems of bias from memory errors.

A more serious problem is one of attrition; people die or move away over time. I corrected for attrition in the following way. I first estimated what proportion is removed each year from the Ndjuka population. This process required data on the age distribution among the Ndjuka. However, the population-pyramid for the entire Suriname population does not differentiate according to ethnicity (ABS 1997). Because the age-distribution in the primarily rural Ndjuka population is likely different from the age-distribution in the entire population, which is mostly urban, I analyzed the age distribution in my survey sample (N=219). The Ndjuka age-distribution is likely to have the pyramid shape that characterizes poor countries, with large numbers of young people, and few people in old-age groups. The sample only includes people over 15 years of age.

The age distribution of the sample does not follow the expected population curve exactly (figure 4-8). A few reasons may explain why I have fewer observations than expected for the youngest age groups. A proportion of the Ndjuka in the ages 20-30 may have been killed or left the country during the interior war. People 15-20 years of age were underrepresented in the sample because they typically move away to schools in the city when they follow secondary education. Furthermore, young men are likely to migrate. After the age of 30, the population distribution follows the expected curve. Except for the youngest age group (15-20), field data seem to reflect the real age distribution in the Ndjuka population. I assume that the population pyramid has remained relatively constant over the past 25 years.

The second step in the correction procedure was to calculate the percentage of people in the sample-population who were old enough to be gold miners in any given year (1973-1995). Because gold miners are typically over 15 years of age, I calculated what proportion of the sample was at least 15 years of age in a given year. For example, I calculated how many people were at least 15 in 1975 by counting how many people in the sample were born in or before 1958. Twenty-nine percent of the people in the sample were at least 15 in 1975 and could have been miners in that year. This suggests that 71% of the people who could have been miners in 1975 died or moved away.

The observed number of gold miners in a given year was corrected for attrition by multiplying their numbers by a factor that made up for the missing people. This factor was calculated as a hundred percent, divided by the percentage of the population that was over 15 in a specific year. For 1975, the correction-factor is $100/29$, which equals 3.5. In that year, there was only one gold miner among all people in the sample who were over 15 and could have been miners (29% of the sample population). To correct for attrition, I multiply the observed number of gold miners in 1975 (1) by 3.5. I thus estimated that 3.5 out of 219 people, or 1.5% of the Ndjuka population, were miners in 1975. From the above follows the equation that I use to calculate the dependent variable, the standing number of miners in a given year t:

$$\text{SNM}(t) = [\text{SNM}(t-1) + E(t) - X(t)] * (100/p(t))$$

in which:

SNM(t) = Standing number of miners in year t

SNM (t-1)= Standing number of miners in the year prior to t

$E(t)$ = Number of people who newly entered gold mining in year t

$X(t)$ = Number of people who exited gold mining in year t

$p(t)$ = Percentage of people in the sample who were at least 15 years of age in year t

The data suggest that the mining population has grown steadily since independence (1975), with plateaus in growth in the late 1970s, and during the initial years of the interior war (1986-1990) (figure 4-9). The stagnation in gold mining at the onset of the interior war (1986-1992) can be explained by the inaccessibility of the interior during these years. Yet few miners leave and their numbers increase again from 1990 onwards. I use the log value of the standing number of miners as the dependent variable.

Econometric and Data Problems

Several problems characterize the data. First, many statistics for Suriname are inaccurate. For example, during my fieldwork in Suriname, the black market gold price was about 10-50% higher than the official price of gold paid by the Suriname Central Bank. As a result, the inflation-adjusted price of gold in Suriname guilders may not reflect well what gold miners received for their gold in reality. A similar discrepancy between official figures and reality characterizes inflation data; black market exchange rates were up to two times higher than officially reported rates. Because better data for Suriname are not available I calculate the Suriname price rates using international prices, and national exchange rates and inflation indices. Second, even accurate data may not

measure the phenomenon at hand. For example, national unemployment rates badly represent the Maroons because the data pertain to formal labor in the urban area. Most Maroons live in the forest and perform informal labor, and are not accounted for in national statistics.

An econometric problem is multicollinearity. Some explanatory variables are significantly correlated with one another, including openness and CPI ($r=0.74$, $p<0.001$), and the price of gold and the price of oil ($r=0.43$, $p<0.05$). Correlations between openness and oil prices ($r=0.39$, $p<0.05$) and between unemployment and gold prices ($r=0.84$, $p<0.001$) are likely an artifact of chance. It is possible to correct for multicollinearity by dropping one of the variables. However, this procedure would increase autocorrelation and create specification bias, and is therefore undesirable.

I used the Durbin-Watson test to detect autocorrelation and found ambiguous results ($d=1.85$). I correct for potential autocorrelation by detrending the time series data. The difference between the models is that the original model analyzes the general trend over time, while by regressing the residuals, the detrended model analyzes annual fluctuations. Despite the possible presence of autocorrelation, the original model may be more accurate because it is likely that miners do not respond to annual political or economic changes, but to general trends over time. The small sample size ($N=22$) impacts the significance of the results.

Results

The results appear in table 4-4. I present both the uncorrected original model and the detrended model. As expected from time series analysis, the predictive value of the original model is high ($R^2=0.97$), and lower for the detrended model ($R^2=0.67$). International market prices of gold and oil are not significant in either effect size or statistical power, and their effect-direction is opposite to what was predicted. For each percent increase in the price of oil -if mining becomes more expensive- the mining population is estimated to grow by 0.12 % ($t = 1.12, p=0.28$). A doubling of the price of gold, and thus in the profitability of mining, is predicted to cause a 25% decrease in the number of miners ($t = -1.94, p=0.07$). In the detrended model international market prices have even less statistical power.

Of the national indicators, only the economic indicators are statistically significant. The CPI and unemployment have the expected positive signs and are statistically strong in the original model. Each 10% increase in consumer prices is predicted to cause a 2% growth in the mining population ($t=3.33, p<0.005$). It is estimated that 1% increase in unemployment will cause a 5% increase in the number of local gold miners ($t=6.62, p<0.001$). In the detrended model, CPI and unemployment continue to present the right sign, but loose statistical significance at the 5% level ($t = -1.66, p=0.12$ and $t = 1.92, p=0.07$, respectively)

In contrast to what I predicted, openness (political stability) is positively associated with gold mining. The statistical power of the index of openness is weak in both models, especially in the original model ($t=0.16, p=0.87$). In the detrended model,

one standard deviation increase in the index of openness is estimated to decrease the standing mining population by 0.00014 %, a negligible effect ($t=1.18$, $p=0.26$).

Discussion

International Commodity Markets

The estimated social effect of international market prices is small, statistically weak, and has a direction that is opposite to what was expected; people have become small-scale gold miners in times that gold prices were dropping, and production expenses were rising. These findings contrast logical expectations and existing theories of the gold rush in Brazil (Cleary 1990; MacMillan 1995). The limited explanatory power of gold prices may in part be due to the discrepancy between the official national price of gold and what miners receive for their gold in reality.

The lack of explanatory power of international commodity markets does not imply that forces outside of Suriname have not influenced the gold rush. My observations and conversations with people in the Suriname mining world, suggest that the migration of garimpeiros to Suriname has stimulated small-scale gold mining in Suriname. Garimpeiros are estimated to make up three-quarters of the mining population, and have introduced more modern and effective mining techniques. Because most migration from Brazil is illegal and goes unrecorded, the effect of international migration on the local participation in mining could not be analyzed with quantitative methods.

Political Instability

Quantitative analysis suggests that political instability in Suriname did not impact small-scale gold mining. The informal mining industry grew steadily in times of political violence, but continued to grow when Suriname returned to democracy in 1992. The index of openness, which I used as an indicator of political stability, is not significant and has a sign opposite to what I predicted. In short, the statistics suggest that political unrest did not encourage Ndjuka to become miners.

The statistical finding contrasts with Ndjuka narratives and work by other scholars. Data from these sources indicate that the interior war (political instability) created the present marginal position of the Maroons in Suriname, which in turn has encouraged mining. In a work entitled Refugees, Rebels, and Other Maroons of Eastern Suriname (1986-1988) (1992, my translation), Polimé and ThodenVanVelzen analyze stories of Ndjuka war victims and human rights reports. They document the killing and torture of hundreds of Maroons, the destruction of Ndjuka villages and agricultural plots, the robbery of Ndjuka savings, and the destruction of religious shrines by the military. Nearly 10,000 refugees, primarily Ndjuka, fled to French Guiana (Brana-Shute 1990). Price (1995) argues that the interior war perpetuated traditional disdain for the Maroons as primitives and criminals by city people. It has been suggested that envy for the relative prosperity of the Maroons in the 1980s exacerbated the maltreatment of Maroons by Creoles during the war (Polimé and ThodenVanVelzen 1992, Price 1995)

In interviews Ndjuka emphasize that the interior war played a significant role in decreasing their educational, economic, and social opportunities in society. Many forest schools closed during the conflict, leaving a generation of young Maroons without

education (Headmaster Drietabbetje, pers. com.). Many Ndjuka students from Paramaribo were spending their summer holidays in the forest when the fighting started, preventing them from returning to school. In the interior, young Ndjuka felt they had few options other than mining for gold. After the war, many had reached the age to earn money or had become parents, as Ina tells: 'I was in the 5th grade of elementary school [in the city], when the fighting started. Then we came to Ndjuka territory [the forest]. I found a husband, and I got children.' Few youngsters went back to school.

Before the interior war many Ndjuka men worked for the government. Eighty-seven of the Ndjuka in my survey sample (N=219) had wage labor experience. Of these 87, 42% had been employed by the government. The percentage compares to the rates found for urban Matawai Maroons in the 1970s (38%, DeBeet and Sterman 1981:452), and to figures mentioned by Lamur (1965) for Ndjuka laborers in the early 1960s.

Ndjuka men worked for the Geological Mining Service (GMD), the Bureau of Hydraulic Power (BWKW), the Bureau of Public Health's (BOG) anti-malaria campaign, the Suriname Airline Company (SLM), and other jobs that required activities in the interior. They cut forest trails, took measurements, maintained airstrips, and worked as guides, assistants, and boatmen for geological mapping and research. A 63-year old man tells:

I worked in Sara Creek for the government. I transported goods by canoe and cut trails. [In the Sara Creek region] I also built the Brokopondo dam and assisted the police and doctors. I stayed there for long with my wife, 15 years, and had five children there. I also worked for 20 years for the airline company.

Many older men had experience in diverse public jobs, mostly in the interior.

Government employment was popular because it was prestigious, paid relatively well, and easily combined with informal jobs. Other Ndjuka in my sample had worked in unskilled labor such as carrying or cleaning (28%), and yet others reported experience in

skilled jobs (e.g. teacher, nurse, 13%), construction (9%), resource extraction (3%), and informal labor (9%).

The war eliminated public jobs in the forest, as well as many jobs in the bauxite, balata, and timber industries, and in construction. However, the data do not show that the war was the main cause of job loss. Many Ndjuka (28%) reported ending wage labor during the war, but many more (43%) lost or quit formal employment in the years following. Several Ndjuka mentioned discrimination and being 'bossed around' as reasons to quit formal labor. The negative stereotypes about Maroons and their low educational rates lower their competitiveness at the formal labor market. Gold mining is a way to meet daily needs independent of city people.

In summary, the impact of political instability on small-scale gold mining is ambivalent. The interior war (1986-1992) placed the Maroons -especially the Ndjuka- in a marginal position and destroyed the social, educational, and economic infrastructure in the interior. However, the return to democracy did not encourage people to leave mining. On the contrary, more people have entered the mining fields since 1992. I argue that the long-term economic and social impacts of the interior war are to blame for the growing number of gold miners in recent years. These impacts include poverty, ethnic discrimination, and the poor education of Ndjuka. A statistical test that compares the periods before 1986 and after supports this argument. There is a structural break in the mining function before and after 1986 (Chow test, $F= 10.01$, $p < 0.01$), suggesting that the start of the interior war significantly changed the forces driving small-scale gold mining.

National Economic Instability

The growth of the small-scale gold mining population between 1973 and 1998 seems best explained by national economic instability, indicated by the increases in unemployment and consumer prices. Rising unemployment is suggested to cause an increase in the number of gold miners. As I mentioned above, the Maroons may have been especially affected by unemployment. It was impossible to test the impact of Maroon-specific unemployment because national employment data are not stratified to region or ethnicity.

The significant positive relation between consumer prices and the number of miners also supports the hypothesis that national economic instability encourages mining. A rising CPI, an indicator of inflation, favors informal gold mining in several ways. In times of inflation it is beneficial to work in the forest, where rising prices for urban housing and services have little impact. Inflation also decreases the purchasing power of formal wages paid in Suriname guilders. In real terms, wages in the mid-1990s were only half of what they were in 1980 (ABS 1997: 39). Wages in construction and government service, jobs in which Maroons are most frequently involved, reached respective lows of 12% and 30% of 1980 wages. As the value of formal wages decreases to below the subsistence minimum, gold mining may offer a more secure way to make a living.

The effect size of the CPI may seem small; each percent increase in consumer prices is estimated to cause a 0.2% growth in the mining population. However, with current Suriname inflation rates of 72% during the first five months of the 1999 (IMF

1999), the mining population could double in just over a year². The fact that the CPI was not statistically significant in the detrended regression does not imply that consumer price changes do not affect gold mining. Rather, it means that the number of miners does not fluctuate simultaneously with annual price changes. This is not surprising because the general trend in prices and wage levels over time is more important for the daily lives of Suriname people than the annual variation.

Conclusions

At the beginning of this chapter I stated two questions:

- Do national or international forces better explain why small-scale gold mining boomed in Suriname when it did?
- What is the relative impact of selected international and national processes on changes in the local mining population?

To answer the first question, it seems that economic change within Suriname has been more important than international economic markets in encouraging small-scale gold mining. Even though the prices of gold and oil determine the profitability of mining, international market prices have played a marginal, if any, role in stimulating mining. More important was the economic recession at home. The analysis suggests that rising inflation and unemployment encouraged many Ndjuka to become gold miners over the past 25 years.

² Doubling time (dt) was calculated using the formula $dt = \ln 2 / \ln (\% \text{growth})$. Given a 0.2% increase in the number of miners per percent rise in CPI, the number of gold miners would double with a $70/0.2 = 350\%$ rise in CPI. Assuming constant price increase rates, the current CPI increase of 72% in five months suggests a monthly CPI increase of 11.5%. At such rates, the 350% CPI increase needed to double the number of miners is reached within 14 months.

Empirical analysis suggests that political instability did not affect the participation of Ndjuka in small-scale gold mining. This finding contrasts with Ndjuka stories, research by others, and a statistical test that indicates a structural break before and after the onset of the interior war. These sources suggest that the interior war made the Maroons a marginal group in Suriname society. Even though the war ended in 1992, its long-term consequences continue to characterize the lives of Maroons today. I suggest that war-related poverty, coupled with decreasing labor options due to discrimination and poor education, continue to encourage Ndjuka to take up mining.

The small sample size and econometric problems likely account for the limited significance of the results. As a result, I cannot draw strong conclusions about the second question concerning the relative impact of selected indicators. The analysis suggests that international market prices do not influence the number of gold miners, inflation and unemployment significantly encourage mining, and the impact of political instability remains unclear. Based on my analysis, public policy aimed at decreasing the number of gold miners should focus on the repression of inflation and the stimulation of employment, especially at a local scale. Because the Maroons are generally lower educated than other Surinamers, it is possible that public investment in forest schools brings a more structural change in the processes that encourage mining.

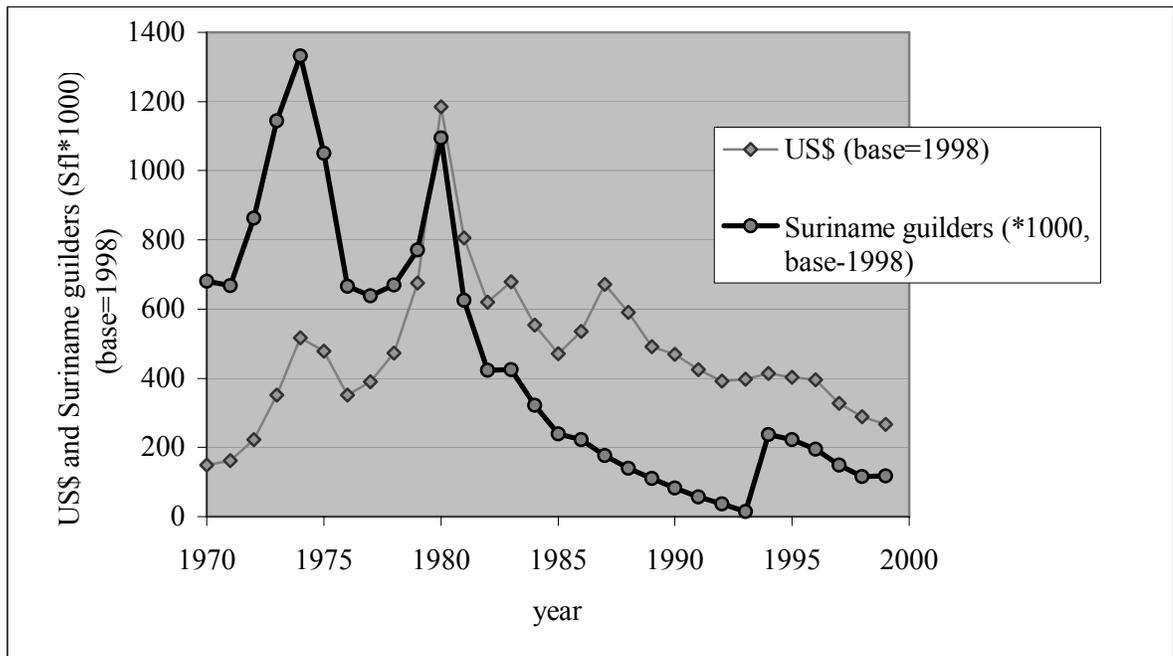


Figure 4-1. Open market average annual US market price of gold/troy ounce, 1968-mid-1999 (base=1998)

Source: see Appendix E

Figure 4-1 shows that gold prices have fluctuated greatly over the past decades. US open market rates differ from Suriname in-country rates due to their dependency upon exchange and inflation rates. The low point in the early 1990's is due to an artificially kept low exchange rate, and rises in 1994 when this rate is corrected from 1.8 to 134.1 Sfl/US\$.

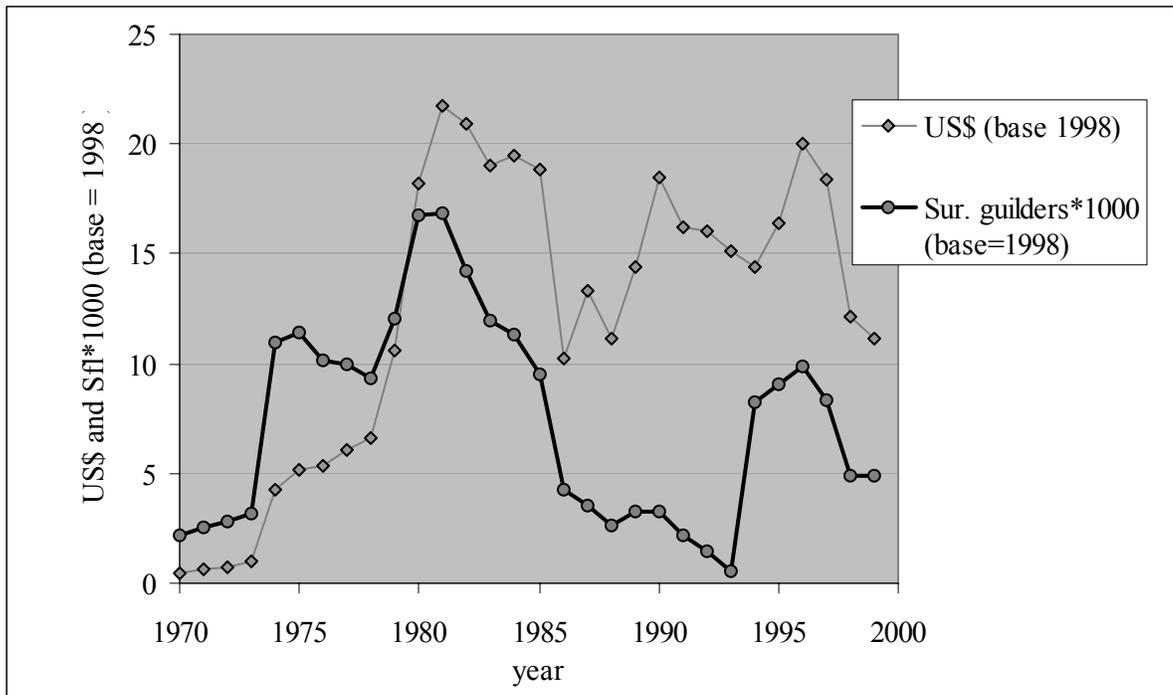


Figure 4-2. World real oil price in US\$ and Suriname guilders (base=1998).

Source: see Appendix E

Until January 1974 prices reflect the official price of Saudi light, and later the refiner acquisition costs of imported crude oil. Real world oil prices decreased during the early 1980s, but recovered soon after 1985. Real oil prices in Suriname guilders kept going down after 1985, to hit a low of 557 Sfl (12.9 US\$) per barrel in 1993. The reason for this drop was the artificially kept low official exchange rate. From 1993 to 1994, the guilder to dollar exchange rate was adjusted from 1.8 to 134.1 Sfl/US\$. As a result, Suriname prices again lined up with world (US\$) rates and Suriname real oil prices rose rapidly.

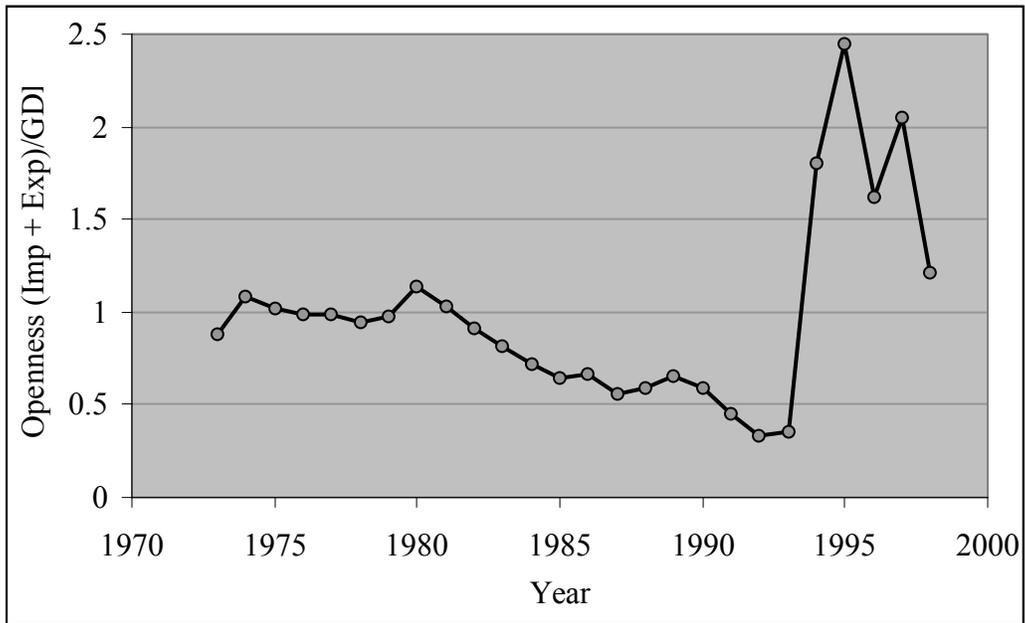


Figure 4-3. Openness (Imports + Exports)/GDP

Source: See Appendix E

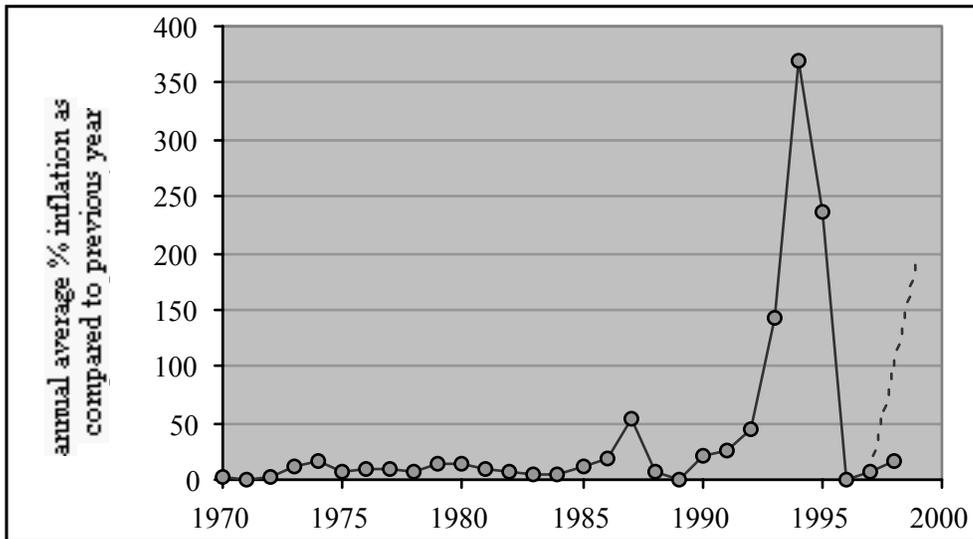


Figure 4-4. Official and experienced annual inflation rates (12 month average)

Source: General Bureau of Statistics, Section Consumer Price Index Numbers (ABS 1997: 36), data on 1997 from ABS 1998b, data on 1998 from IMF 1999

All inflation figures are 1st degree approximations, based upon the all-items index. Official inflation rates after 1996 are largely underestimated due to artificial suppression of the exchange rates by the Suriname Government. The dotted line presents the inflation that was experienced in Suriname from July 1998-July 1999 (about 300%), and diverts strongly from the official rates.

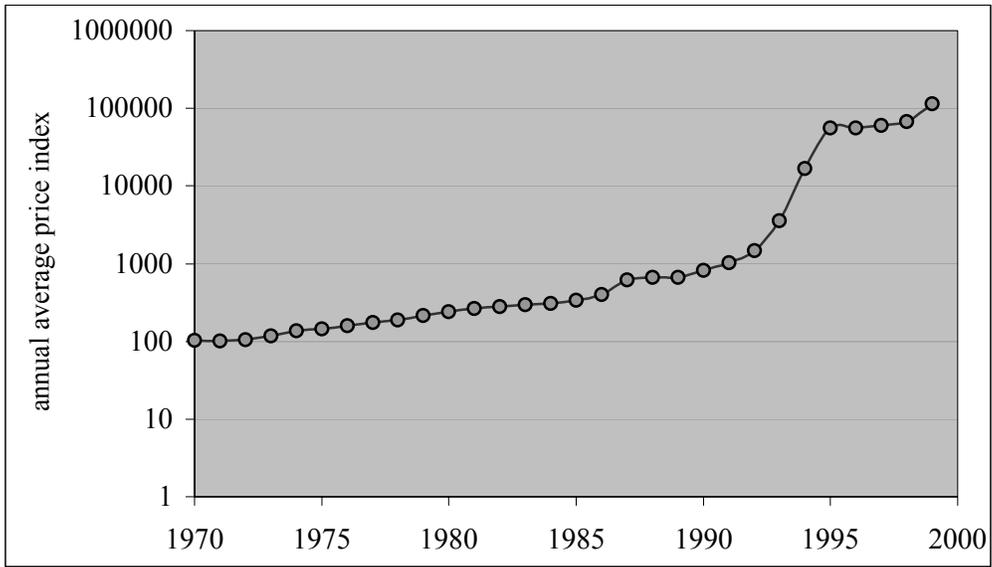


Figure 4-5. Consumer price index, annual average (1970=100)

Source: see Appendix E

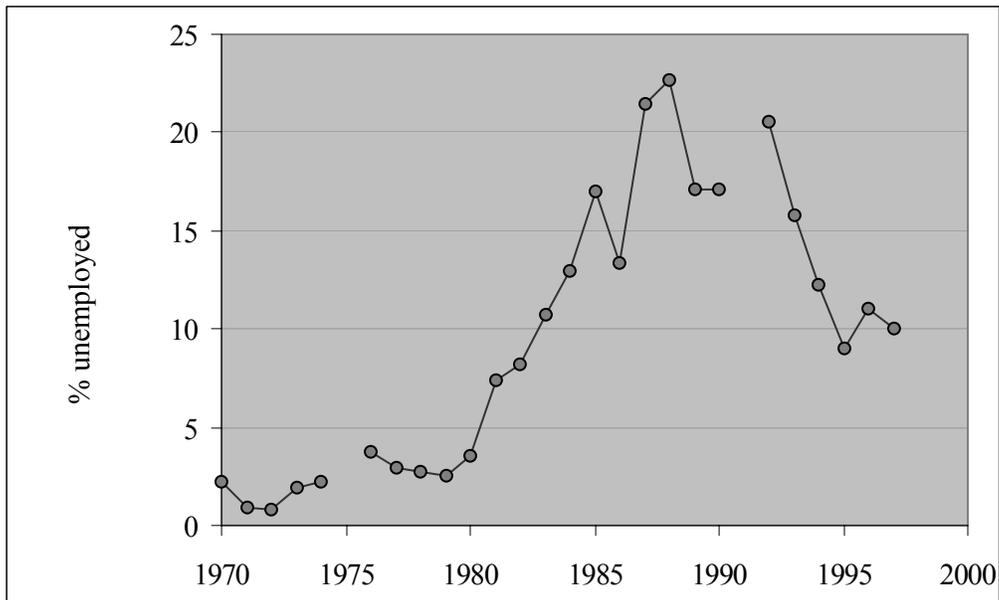
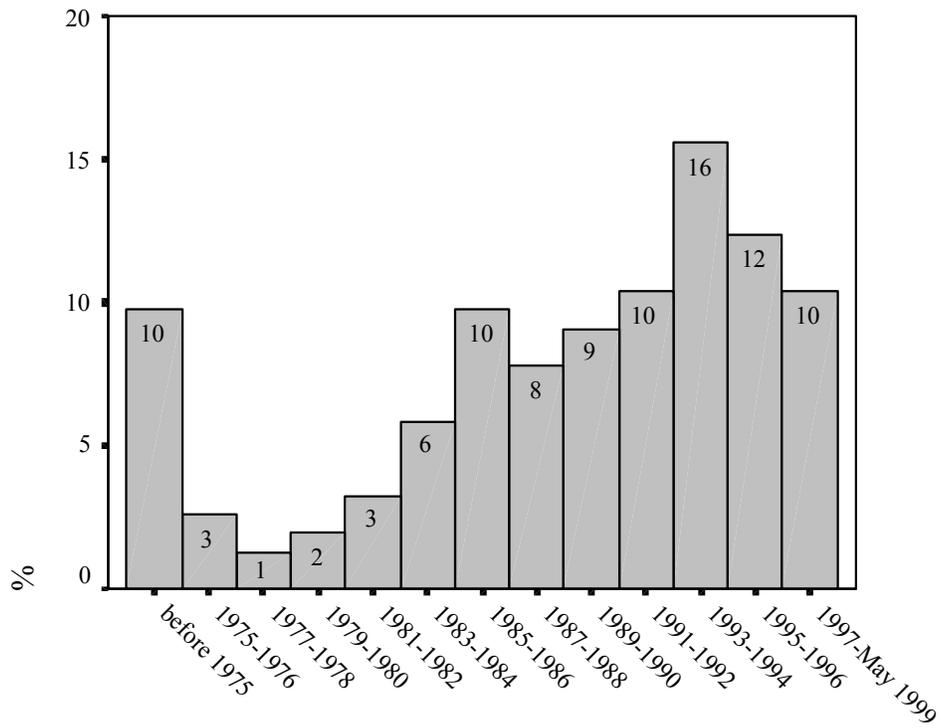


Figure 4-6. Unemployment as a percentage of the economically-active population (urban area only)

Source: see Appendix E

The data used to construct this figure were retrieved from different sources that provide different unemployment rates and use different unemployment definitions. Between 1993 and 1997, unemployment rates averaged 18% under the relaxed definition of the Suriname Bureau of Statistics (ABS), as compared to 11% under the more conservative estimates that follow the ILO definition (used here). Gaps in the figure indicate missing data.



Year of first gold mining experience

Figure 4-7. Reported year of first experience with gold mining of Ndjuka miners and ex-miners (N=154, in percentages)

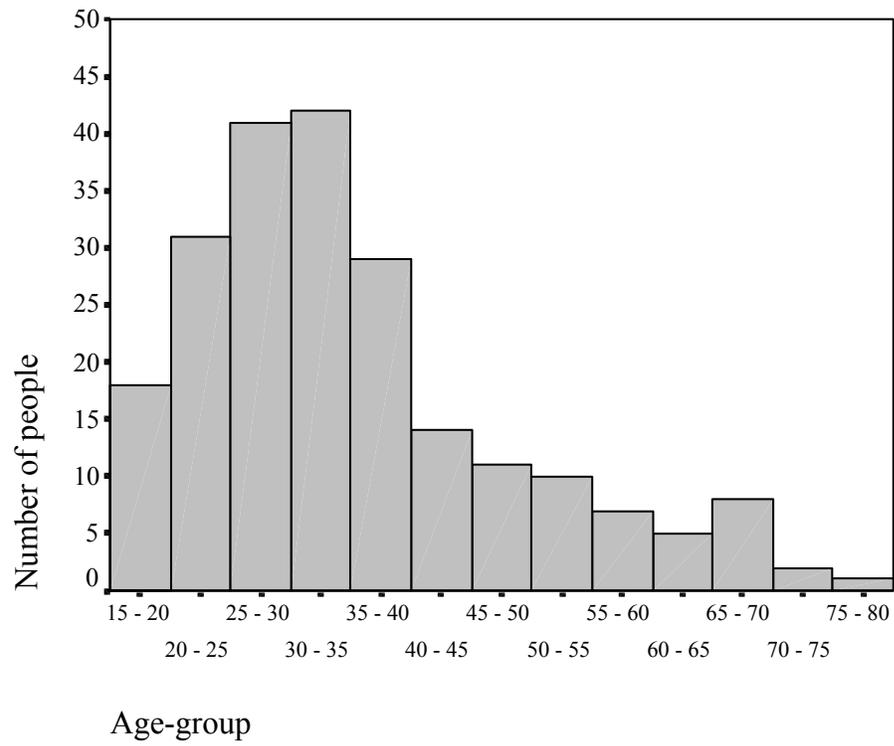


Figure 4-8. Age distribution of the sample population, number of people in each age-group (N=219)

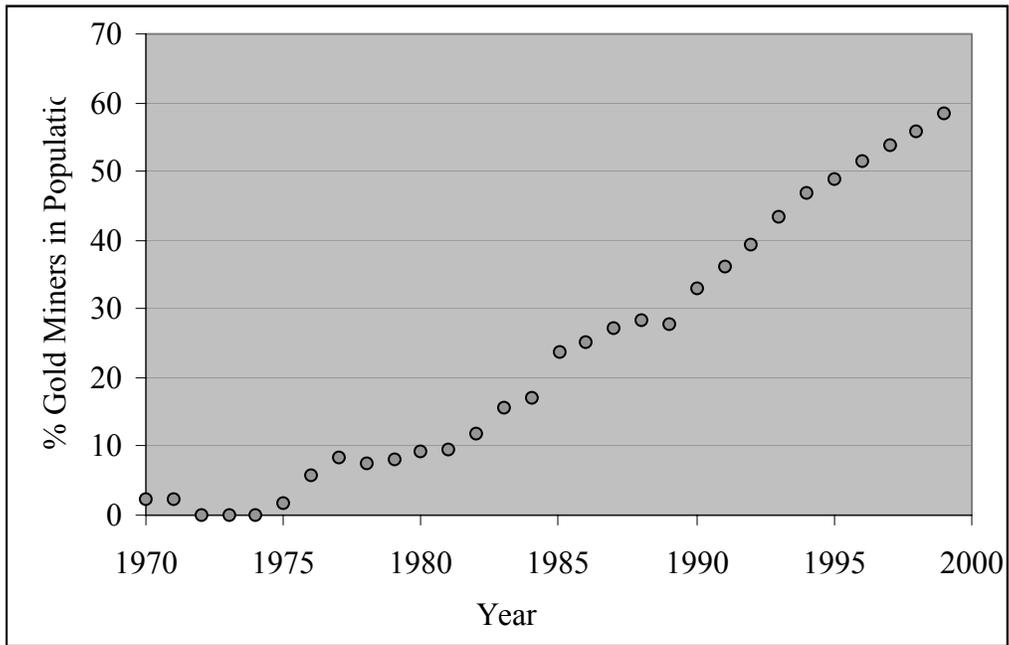


Figure 4-9. Standing Number of Miners corrected for attrition, as a percentage of the total population

Table 4-1. Definitions of the variables in the regression analysis

Variable	Definition
<i>Dependent</i>	
Log (standing number of miners)	Natural log of the standing number of gold miners, corrected for attrition
<i>International explanatory variables</i>	
Log (price of gold)	Natural log of the real price of gold in Suriname in 1000 guilders, corrected for inflation (1998=100)
Log (price of oil)	Natural log of the real price of oil in Suriname guilders, corrected for inflation (1998=100)
<i>National explanatory variables</i>	
Openness	Natural log of the (Imports + Exports) / GDP
Log (CPI)	Natural log of the consumer prices for all items
Unemployment	Percentage unemployed of the economically active population

Table 4-2. Summary statistics of the variables in the regression analysis

Variable	N	Mean	Std	Range
Standing number of miners	30	51	42	0 - 128
Price of gold	30	450	376	15 - 1333
Price of oil	30	7388	4685	557 - 16862
Openness	26	0.98	0.51	0.33- 2.45
CPI	31	589.1	1379.9	6.8 - 4561.9
Unemployment	29	9.4	7.0	1.0 - 22.7

Table 4-3. Monthly expenses of a mining operation as a share of the variable expenses (excluding workers salaries) and as a share of the earnings of the operation

Item	US\$	% (cum. %) of fixed expenses	% (cum. %) of earnings ⁶
gasoline (transport)	1827	40 (40)	10 (10)
gasoline (operation)	1133	25 (65)	6 (16)
additional fuel (generators, motor oil)	719	16 (81)	4 (20)
food (e.g. rice, beans, salted meat, coffee)	333	7 (88)	2 (22)
additional camp and operation needs (e.g. mercury, soap)	33	1 (89)	0.2 (22.2)
amortized capital costs for start-up investment ^{1,2}	317	7 (96)	2 (24.2)
amortized capital costs for sluicibox ³	36	1 (97)	0.2 (24.4)
amortized capital costs for all terrain vehicle ⁴	56	1 (99)	0.6 (25)
amortized capital costs for additional equipment (construction, television, satellite dish) ⁵	56	2 (100)	0.3 (25.3)
labor	varying		35 (60.3)
Total	4566	100	60

¹ Amortized capital costs are the payments for long-term capital investments if the buyer would pay equal shares of the total acquisition costs every month. Amortized capital costs are calculated from the initial acquisition costs and the life span of the item.

² The start-up costs for a 6" mining operation are 19,000 US\$. The lifetime of a mining machine is estimated to be five years.

³ The materials to construct a sluicibox cost about 50 g or 450 US\$. Teams use the sluicibox about 1 year before they move to a far-away place or the box requires replacement.

⁴ An all terrain vehicle costs around 4000 US\$ and has an estimated three year life time in the rainforest

⁵ Mine-owners may invest in a variety of other items for work or comfort. I estimate that these items cost about 2,000 US\$, and need replacement after about 3 years.

⁶ Based upon earnings of 2 kg of gold/month.

Table 4-4. Regression results for the original and the detrended OLS regression models

Explanatory variables	Original Model	Detrended Model
	B (t)	B (t)
(Constant)	2.62 ** (4.13)	7.84 E-02* (2.93)
<i>International</i>		
Log(real price of gold in Suriname)	-0.25 (-1.94) .070	-1.33 E-04 (-0.58) .57
Log(real price of oil in Suriname)	0.12 (1.12) .28	3.46 E-06(0.41) .69
<i>National</i>		
Openness(Exports+Imports/GDP)	3.68 E-02 (0.16) .872	0.14 E-03(1.18)
Log(CPI)	0.217** (3.33) .004	-0.10 (-1.66) .12
Unemployment	4.76 E-02 *** (6.62)	1.62 E-02(1.92) .07

Dependent Variable: Log(standing number of miners)

t-values are in parenthesis

* significant at the 0.01 level

** significant at the 0.005 level

*** significant at the 0.001 level

Model Summary

Statistics	Original Model	Detrended Model
N	22	22
R	0.99	0.82
R2 (Adj. R2)	0.97 (0.97)	0.67 (0.57)
Std. Error of Estimate	0.132	0.10
Durbin-Watson	1.85	

CHAPTER 5 UNRAVELING THE CHOICES OF GOLD MINERS AND NON-MINERS

In the previous chapter I argued that national level economic instability, and possibly political instability, have encouraged increasing numbers of Ndjuka to become gold miners over the past twenty-five years. Yet the Ndjuka are not a homogeneous group, and not all Ndjuka were equally eager or able to be gold miners when confronted with inflation, unemployment, and civil warfare. The reasons for getting or not getting into gold mining differ among individuals who vary in gender, age, wealth, health, personal character, or otherwise. While recognizing the heterogeneity in the choices of Ndjuka, it also is likely that general patterns underlie local decisions about gold mining. In this chapter I zoom in to the local level to investigate these common patterns. I use ethnographic decision tree modeling to identify and structure the emic reasons for being or not being a gold miner.

Central Question and Relevance

My central question is: What options and constraints do Ndjuka themselves consider when they decide to either become a gold miner or to do something else? The answers to this question may reveal why different Ndjuka make different decisions about mining, and helps predict the decisions of Ndjuka who were not part of the sample. The

ideas that appear from the decision tree analysis inform the hypotheses that are tested empirically in subsequent chapters. The results also draw the attention to reasons for mining that remain hidden by the statistical models that may have measurement or specification errors.

Methods

I use ethnographic decision tree modeling to analyze how Ndjuka justify decisions about gold mining. Gladwin (1989) developed ethnographic decision tree modeling as a structured yet qualitative way to model individual choice processes. A basic assumption is that people simplify complex choice processes by unconsciously making decisions in two stages (Gladwin 1980: 46-7). In the first stage, the decision-maker narrows the choices to a feasible selection by eliminating irrelevant or unreal choices. In the second stage, people make a more detailed and conscious decision by ranking alternatives according to relevant criteria (Gladwin 1980, Gladwin and Murtaugh 1980). The choice processes in this second stage are represented in a decision tree. A decision tree has a hierarchical form that guides the decision-maker from the choice alternatives (in {} at the top of the tree) to the predicted outcome (go mining/do not go mining), following a set of if-then rules (Gladwin 1989).

Seven Steps to Ethnographic Decision Tree Modeling

Constructing a decision model involved seven steps. First I collected data by asking different Ndjuka whether they worked in the gold mining area and why (not). From the responses, I extracted the decision criteria that justified the participation in gold mining

or the lack thereof (second step). I used the criteria in the third step to construct models for the decisions of one or a few persons. Next I structured the decision criteria from all Ndjuka in the sample by grouping similar criteria under umbrella terms. I used these umbrella criteria to construct a preliminary composite decision model (fifth step).

I tested the preliminary model on a new group of people from the sample population (step six). Based on their responses the tree should correctly predict whether they are gold miners or not. The success rate of a decision tree model is calculated by counting the number of false predictions, and dividing the total number of successful predictions by the total number of cases. A model is acceptable when it successfully predicts the choices of at least 85% to 90% of the people (Gladwin 1989). The original model had a high error-rate and was adjusted by adding, deleting, and rephrasing criteria, and by rerouting tree paths (step seven). The corrected model was tested again and proved to work well.

Sample

The initial sample used to construct the preliminary decision model included gold miners (N=41) and non-miners (N=34) of both sexes (N=75, 50 men, 25 women). I sampled to capture the variation in the Ndjuka population in sex, age, occupation, education, and other social characteristics (table 5-1). Because there were no observations for urban male non-miners, the preliminary model does not well represent the decisions of that specific group. The small sample of female miners (N=6) did not affect the model accuracy because the women in the mining area predominantly mentioned the same reasons for mining, and additional interviews did not provide new reasons.

In the testing stage, I guided individual Ndjuka who had not been part of the initial sample through the preliminary model. The model was changed based on the

responses of people whose choices were not correctly predicted. When new cases did not require more changes, I tested the second order model on a different sample of Ndjuka. The test-sample consisted of 15 men and 5 women of whom 13 people were miners and 7 were non-miners. The test sample compared to the initial sample in age, which averaged 30. More people from the test group lived in Paramaribo (75%). People from the test sample had, on average, more education (Mean = 8 year) and were more often literate (80%) than people from the initial sample. The test-sample better represented male and female urban non-miners than the initial sample, increasing the chances that the second order model predicts the choices of both urban and rural Ndjuka with accuracy.

Of the five women in the test-sample, only one was a gold miner. I corrected for the limited variation among the women in the sample by controlling the model with the stories of all women who had ever been to the mining area. These women were part of the sample of Ndjuka who had responded to the larger survey (N=219) that was conducted over the year of fieldwork. Forty women in the survey sample had previous mining experience. Using the detailed ethnographic notes from interviews with these women, I was able to guide many of them through the model. This procedure was effective in showing the robustness of the female branch of the model. I only used the information of the 40 women with mining experience to test and correct the model, not in the calculation of the prediction error.

Results in Seven Steps

Now I will illustrate the seven steps of decision tree modeling for my case, and present the results that were generated in each step. In the discussion section I elaborate on the findings and on the lessons that can be drawn from the model.

Step 1: Collecting Data

My mother died early and I am the oldest child, so I had to take care of my younger brothers and sisters. I first went to hossel [informal trade] at the French side [French Guiana]. . . . At the French side the gendarmes took all the money. (Sonia, 35, traveling merchant)

Sonia has been working in Suriname gold mining areas since 1993. Before that, like many Ndjuka women from the coastal Cottica region, she worked as a traveling merchant commuting between Paramaribo and French Guiana. A few years ago, the French started to enforce strict border control to prevent the smuggling of drugs and gold, making it risky for Maroon women to sell their merchandise in French Guiana. Maroon women who had been caught by the French border patrols, said that the French had confiscated their merchandise, thrown their possessions in the river, or taken their money. Now that gold mining has increased in popularity, Ndjuka merchants find new markets with willing buyers in the gold mining areas. In doing so, they have become part of the mining economy.

I asked a varied group of Ndjuka why they had or had not taken up gold mining. Some people did not give much thought to their choice: ‘Nothing, I just went, here you work for yourself.’ (Ralf, 28, pit worker and carrier) Others shared more complicated narratives. Roki (27, pit worker) explained that he first came upriver after his parents divorced, and he did not get along with his stepmother in town. His mother, who lived upriver, asked him to

join her. Because a young man cannot stay without work, he went to the gold fields with his stepfather. Roki does not enjoy the work but he wants to stay upriver for a while because he has trouble with the police in town. 'Here you will always find some money to take care of yourself', he said. He wants to return to town when he has earned enough: 'I do not want my children to work in gold mining, they should study. Therefore I save [money].'

Steps 2 and 3: Extracting Criteria and Constructing Individual Decision Models

Five decision criteria can be extracted from Roki's account: (1) To escape family problems and the police, Roki had come upriver as a city person. (2) The male duty to earn money forced him to find employment in the forest. (3) Mining offers security: you never return empty-handed. (4) The introduction to the gold fields by a relative enabled him to go. (5) The desire to provide his children with a decent education increased the pressure to generate income. The criteria mentioned by each individual can be organized into a decision model. For a less complex example, consider Alex's (25, pit worker) reasoning:

I came back from the French side. My brother told me 'Come, let's go to the gold mining area.' I come, and see it pays better than the city. In the city you cannot make it. You maybe work for 60,000Sfl per month. One bag of rice costs 5,000Sfl, how are you going to make it? A man perhaps works three jobs to be able to survive. So you have to work in gold mining.

Alex mentions two main criteria: city jobs do not pay sufficiently, and he has a family member working in the area who introduced him. Figure 5-1 represents his story.

The links between the decision criteria of different people become apparent when other people are added to Alex' model. Jaimi (41, non-miner) justifies not working in gold mining by his illness that prevents him from working in the pit. Moreover, he went a few times but was disappointed by his earnings (figure 5-2). As a final example, two more people are added. Tomassi (53, non-miner) is unable to work as a miner because he

is too old. Moreover, the first time he went gold mining he was not successful. Cecilia (35, non-miner) used to go to the mining area with her husband but he stopped mining. Now she does not have anybody anymore to take her to Sella. The model that combines the information for Alex, Jaimi, Thomassi, and Cecilia appears in figure 5-3. As more people are added, it is important to keep the model elegant by excluding criteria that were mentioned but may be irrelevant. For example, because physical weakness due to illness and old age directly lead Jaimi and Thomassi to the prediction 'do not go mining', it is unnecessary to add the other reasons they mentioned.

Step 4: Data Structuring Using Freelists

After gathering the responses of a sufficiently varied sample, I evaluated and structured the decision criteria by placing criteria with a similar meaning under umbrella terms. For example, the label 'work towards a specific goal/for a better life' combined answers like:

- 'You work, you save money, if it grows you do something.'
- 'I want to reach a goal, have a good house, money as insurance for the old day. When I find a lot, I'll stop the work immediately.'
- 'I will work until I reach a goal.'
- 'To reach something, have a house.'

I sorted the reduced set of criteria on the bases of how frequently they were mentioned.

The freelist of decision criteria presented in table 5-2 shows that economic reasons explain much of why people become gold miners. Many people go mining for reasons of money/poverty (16 people, 21%) and the lack of other work that pays sufficiently to sustain one's family (10 people, 13%). Others mention the desire to buy specific items

(11%), goals that require investment (12%), or the children's future (12%). The most important reason to not work in gold mining is physical inability from illness or old age (12%).

I observed that women mentioned different types of reasons and constraints than men. To research if gender was relevant to decision-making, I separated and compared the choice criteria of women (table 5-3) and men (table 5-4). The sex-specific freelists show that the criteria of men and women overlap only partly. Men only consider one out of the top five decision criteria of women. Of the 16 reasons that men mentioned at least three times, only three appear among women's ten most frequently mentioned reasons. I observed two main qualitative differences between women and men. First, men have many reasons to go, while women mention more reasons to not go. Second, economic reasons dominate the considerations of men, while domestic responsibilities and family largely determine the decisions of women.

To reduce the chances that the observed differences were a random effect, I also tested for the influences of age and education. To test for age effects, I divided the sample into young (age ≤ 30 , N=37) and old people (age > 30 , N=38). Except for a few age-specific effects, such as the higher frequency of physical incapacity of older people, the criteria mentioned in the different age-groups are similar (tables 5-5 and 5-6). Half (50%) of the criteria from the younger group were mentioned by the older group as well, and *visa versa* (56%).

Higher (> 4 years) and lower (≤ 4 years) educated people (tables 5-7 and 5-8) also share about 50% (7) of the criteria that were mentioned at least twice by the members of either group (15 and 16 criteria, respectively). Only two of the observed differences

relate to education; the higher educated seem more concerned with the education of oneself and one's children (table 5-8, criteria 5 and 14). Other differences between the higher and lower educated are not produced by education. Instead the differences are an artifact of women and elderly having less formal education than young men. For example, the lower educated mention physical complaints and the influence of a husband as reasons to not go mining. Physical complaints and subordination to a husband are probably not produced by one's education, but are related to age and gender. Based on the comparisons of criteria I conclude that gender is more important than age or education in differentiating decisions about gold mining.

Steps 5, 6, and 7: Building, Testing, and Adjusting a Composite Model

Because gender shapes Ndjuka decisions about gold mining, I used the sex-specific freelists of criteria to construct a composite decision model (not shown). The reasons and constraints were first separated and then modeled in such a fashion that any reason to work in mining led the decision-maker along the tree, while a constraint stopped him or her from working in mining. An individual did not need to go through all possible reasons or constraints to come to a conclusion.

I tested the preliminary model by guiding a new set of people through the model, using a questionnaire with an if-then structure. I only asked Ndjuka who had not been part of the initial sample to respond. After a few questions the interviewee would reach the end of a path. Based upon his or her responses, I would predict that the person would either go or not go mining. I then compared the predicted outcome with the reported or observed behavior. After a few iterations, I adjusted the preliminary decision model to account for the observed errors. A parsimonious model was obtained by combining criteria and deleting

trivial phrases. For example, one question in the model was reformulated as 'Have you had a bad economic experience in gold mining?' This question summarized the experiences of people who had worked in the mining pit but had not found gold, people who had invested financially in a mining operation that went bankrupt, and people who had worked as merchants but had failed to collect outstanding credit accounts.

I tested the second order model (figure 5-4) with a new group of Ndjuka. Only one out of the 20 Ndjuka in the test did not reach the predicted outcome, which means that 95% of the decision outcomes were predicted correctly. Because the test sample was small, it is desirable to re-test the model with a larger sample in the future.

Discussion: Gender and Risk in Gold Mining

The decision tree (figure 5-4) models decision-making about gold mining, and predicts the decisions of Ndjuka who were not interviewed. The decision model splits into a male and a female branch with different criteria and a different structure. For women, there are only two reasons to consider entering mining: the economic responsibility over an urban household, and the desire to stay with a mining husband. Yet many constraints keep women from mining, including transport and domestic limitations, and the risks to one's reputation and health. Men become miners for multiple economic reasons and are only held back by the economic and health risks of mining. These risks often had been experienced during previous participation in mining. Below I draw conclusions from the model, focusing on gender and risk.

Gender

In Ndjuka forest communities, labor and space are separated along gender lines. Ndjuka men provide the household with cash and non-produce consumer goods. Many men are miners to meet their financial responsibilities towards their wives and children. Frequent travel outside the forest further increase the financial needs and desires of men. Several men wanted to buy specific items such as a bus, a house in the city, or new clothes. Others saved their money to buy a shop or taxi, or to travel to the Netherlands. Even though miners favor the independence that mining offers, gold mining is primarily a negative choice; other jobs do not pay enough or else require more education. Gold mining is a last resort, explains Albert (23, pit worker):

[In the city] with 60,000 Sfl you'll have to pay for school, a car to drive to work, money for electricity. The money [in gold mining] softens the suffering. I am able to struggle for one year, two years. Then you can work in town, more relaxed. But if you start working a city job, then you'll work forever to have a good life, you need to eat as well.

Like many Ndjuka miners, Albert perceives gold mining as a short-term sacrifice for a better future for himself and his children. Eighty-six percent of miners did not want their children to be gold miners, compared with 6% of miners who would welcome their children in mining. Five percent of miners felt that their children should decide for themselves; and the children of the remaining 3% already were gold miners. Most miners wanted their children to become educated for doing less strenuous 'sitting' work. Some miners specifically mentioned work 'in an office' or 'with a computer'. One gold miner explained that 'if you come [to the mining area] you miss out on a lot. In the city you find newspapers, development. In terms of personal development, you can only go backwards here.'

A few women become miners for the same reasons that men do: to earn the household income. Marijke (36, traveling merchant) is a female miner. Marijke used to hossel, to sell goods and services informally, elsewhere. Her then husband introduced her to the mining area. Today she and her husband are separated, and Marijke travels with male relatives who bring supplies to the camps. Eight out of the eleven mining women in the larger survey sample were single mothers and the household breadwinners (73%). They needed the mining income to provide for their children or younger siblings, and to give their children a better future.

Most women, however, find gold mining incompatible with their household and child-care responsibilities. A young woman (18) explains:

I went to Sella once, about a year ago. I sold kwakka [cassava product] in Chicago [name of one of the mining camps in Sella Creek]. Now I have a baby I do not go anymore. I will return when the baby no longer needs breast-feeding.

Husbands often impact the decisions of women about gold mining. Almost half of the women (47%) mention the influence of a spouse. Many men forbid their wives to go, as one woman (40) says: 'I have been wanting to go to Sella. My younger sister has asked me to come, but my husband does not want it. He does not want me to leave him.' Women may also follow their husbands to assist or watch the work. Olga (35) used to go to the Sella Creek mining area to cook for her husband. Now that he has another wife he no longer takes her, and consequently she stays home.

Husbands and male kin are crucial for the introduction and transport to the mining area. Out of 40 women with mining experience, more than half (53%) had been introduced to gold mining by a partner and 18% by a brother. With men dominating motorized river transport, 28% of Ndjuka women perceived mobility as a barrier to travel

to the mining area. One woman (31) explained that she did not work in the mining area because 'I have nobody there. I have not found the opportunity to go. You need to have family [in the mining area].'

In contrast, men did not mention their partners' impact on the decision to be or not to be a gold miner. It is unclear whether female partners have no influence, or whether men do not acknowledge the influence of their wives in interviews. Many women agreed that 'if you do not have someone to be a gold miner, you will not have money.' It is likely that women who recognize the financial benefits of gold mining, encourage their husbands or sons to go mining. Even so, field observations and conversations with men and women suggest that the ultimate power of decision-making is in hands of the man.

Risk

Considerations of risk play an important role in decisions about mining. Health concerns and economic uncertainty are the only reasons for men not to go mining. Iwan (42, ex-miner) learned from his prior engagement in mining:

I went with a goal, but failed to realize it. The equipment wasn't good, so I did not want to continue. Perhaps you are lucky and you find something. But perhaps you go, you are not lucky, and you do not find anything. With other work you are sure that your children will have something.

In the preliminary decision model, I assumed that male miners neglected health risks because of the economic prospects of mining. Yet when I tested the preliminary model by asking miners if expected profits overruled health concerns, they strongly denied that this was the case. Gold miners explained that they were actually acutely aware of the health risks of mining. However, they believed that they were able to mitigate health risks by variously: staying in the mining area for limited periods at a time, mining only for a few years before retiring, using protective magic, and not working in the pit. For example, Boi

(32, pit worker) avoids health problems by returning to town after a few months of work, to let his body rest and build up strength. 'You know how we struggle, your health is always more important. That is why one should not stay for six months.'

Many Ndjuka men perceive mining as a short-term evil that will enable them to save for a better future. Adan (29, machine owner) explains that 'gold mining is a risky job, you cannot do it your whole life long. For a short period of time you can do it, to set up another job.' Ndjuka men also protect themselves against accidents and illness by using obia, traditional magic. Men cover their bodies with plant extracts or drink teas from selected branches or leaves to protect themselves from harm.

Other male miners reduce health risks by not working in the pit where most accidents occur. Joti (52) runs diverse errands in one of the camps. He cleans the place from weeds, he cuts canoe-paddles for sale, and sometimes he carries loads. This way, he says, he does not overly stress his body. Moreover, the chance of contracting malaria is lower for people who have grown up in a malaria-prone environment and who have developed a natural resistance. Joti for example has never experienced malaria.

Yet other men (6%) mine because they find it provides more security than wage labor in town, explains Erwin (25, pit worker):

[I mine for gold] for the money. I myself I do not want to do the work, I don't like it. I already did other jobs, but in gold mining you do not lose your money. When you come, you only need to take your clothes with you. The boss has all costs.

With today's increased prices for food and housing, an uncertain yet on average better mining income may provide more security than a devaluated salary in the city. In the mining camps, Erwin does not pay for food or housing, and can save all the money he

earns. Although mining earnings are variable, he knows that 'you will always find something.'

Women refer less often to economic and health risks than men, in part because they face so many other obstacles to entry into gold mining. Moreover, many women in the mining area are traveling merchants, who may be exposed to fewer economic and health risks than, for example, pit workers. The female merchants I met stayed shortly in the mining area and often refused to sell on credit.

While it is the norm that men are miners, women who travel to the mining area face serious social risks. Many people believe that women who work in the mining area independent of a husband participate in sex-work. As a result, these women may severely damage their reputation in the tightly connected Ndjuka communities. In addition, women in the mining area are subject to sexual harassment and jokes, which adds emotional stress to the already hard existence in the mining camps.

The Outlier

To better understand the limitations and strengths of the model, it is useful to evaluate why some people do not 'correctly' follow the tree diagram. The outlier in the presented model (figure 5-4) is a Ndjuka woman, who I will call Gracia (42, machine owner), a single mother of seven children. Gracia supports her children with her gold mining business. She used to work as a schoolteacher 'but with that money you cannot support your family.' After her divorce, Gracia returned from French Guiana to Suriname where she heard much about the mining business. She decided to give it a try. She bought a machine and traveled to Sella Creek with her brother, who was already working there.

The experience has not been good. Gracia had never lived in the interior, and she does not feel at home because she does not know most people. Moreover, the disappointing earnings do not compensate the frequent bouts of malaria and other hardships. Based upon her story, the tree model predicts that Gracia does not go mining, yet she does. This erroneous prediction may soon become truth. Gracia wants to sell her mining equipment and return to Paramaribo as soon as possible.

Conclusions

The decision model presents with accuracy 95% of the choices of individual Ndjuka about gold mining. The model shows that Ndjuka who choose between gold mining and other subsistence strategies weigh economic concerns and risks against one another. Gender affects this choice: men and women have distinct economic responsibilities, and face different risks when they go mining. Men have many reasons to become gold miners. They are expected to financially sustain their households and feel that their limited education eliminates other job options, which in any event pay less than they need. Mining offers a possibility to work in the forest, free from city bosses and the expenses of city life. Other ways to make a living are only considered to avoid often previously experienced health or economic risks related to gold mining.

Women only travel to the mining area when they either are the economic providers for their families, or want to join mining husbands. The freedom of choice of women is limited by ideological and material constraints; women have less access to transport, are responsible for domestic work and child-care, and confront objections of

husbands. A woman who neglects her appropriate gender role risks losing the respect of her husband and the community. Becoming a social outlier is too much of a risk for women in the forest communities, who depend upon the economic contributions of a husband and reciprocal relations with community members for their well-being.

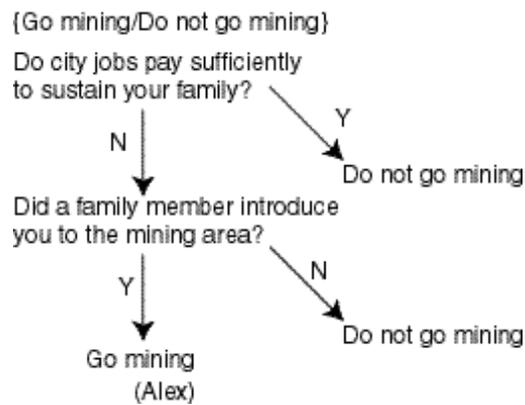


Figure 5-1. Decision model for one person

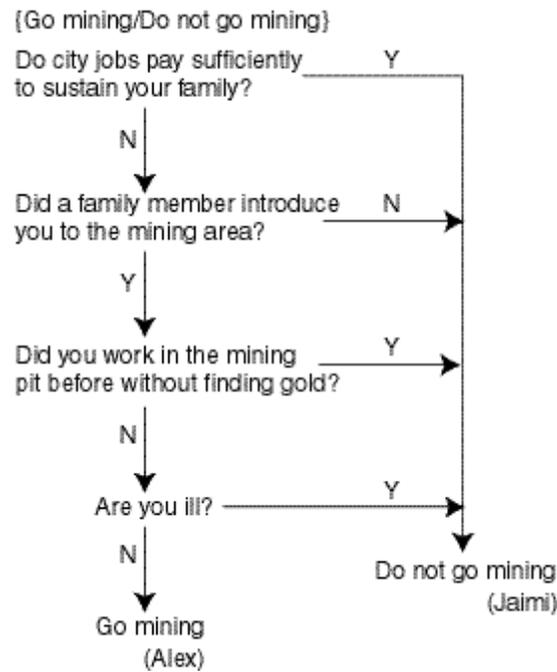


Figure 5-2. Decision model for two people

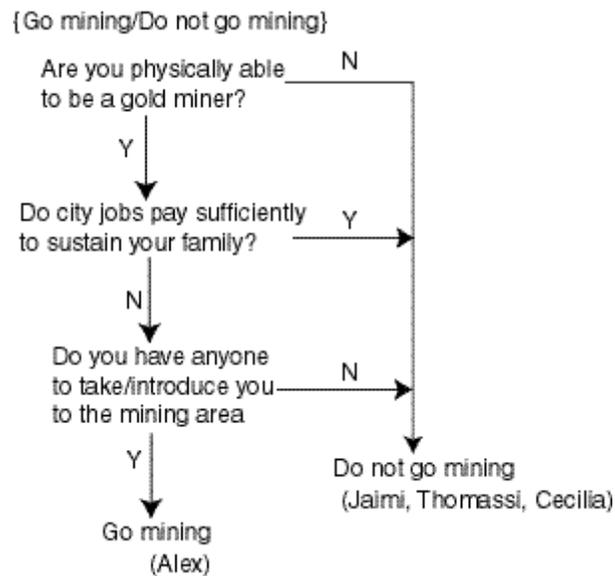


Figure 5-3. Decision model for four people.

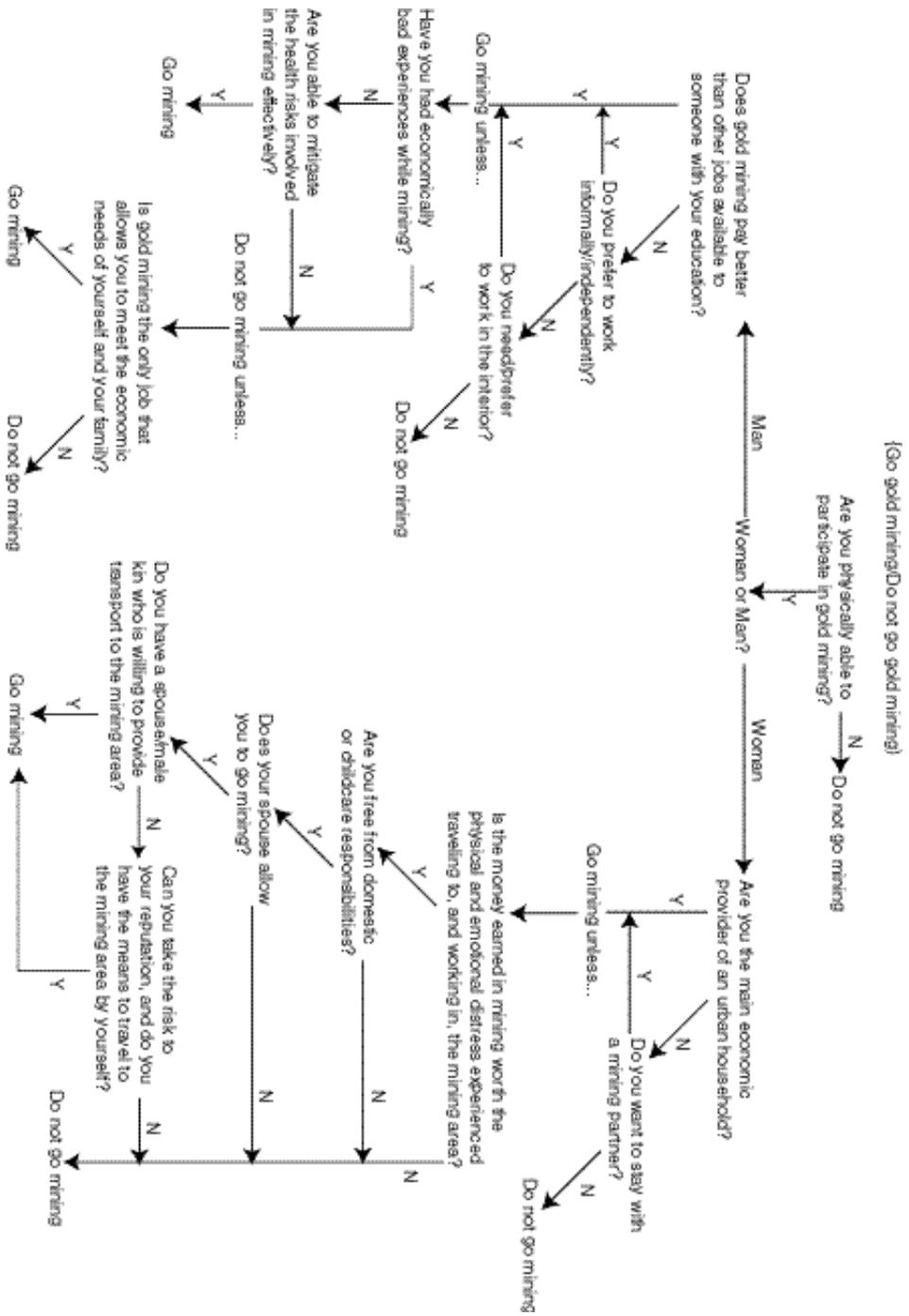


Figure 5-4. Composite decision tree model

Table 5-1. Summary statistics for the sample population

		Men			Women		
	Sample	All	Miners	Others	All	Miners	Others
N	75	50	35	15	25	6	19
Age (years) Mean (range)	33.3 (16-79)	34.4 (16-79)	30.1 (16-48)	44.5 (25-79)	31.8 (18-58)	26.3 (19-39)	33.5 (18-58)
Education (years) Mean (range)	4.4 (0-15)	5.3 (0-15)	6.1 (0-15)	3.6 (0-9)	2.4 (0-8)	4.3 (0-8)	1.8 (0-7)
Literate N (%)	40 (53%)	33 (65%)	25 (71%)	7 (50%)	7 (28%)	3 (50%)	5 (21%)
Urban ¹ N (%)	24 (32%)	18 (36%)	18 (51%)	0 (0%)	6 (24%)	2 (33%)	4 (21%)

¹Urban refers to residency in the capital Paramaribo, versus residency in any of the forest or in the coastal villages

Table 5-2. Frequency ratios of decision criteria mentioned by Ndjuka gold miners and non-miners (N=75, listing only criteria mentioned more than once)

	Criterion	Freq.	%
1	Money/poverty	16	21
2	Freedom/independence (from city-bosses)	12	16
3	Other work does not pay sufficiently to sustain a family	10	13
4*	Physically unable to go (old age, illness)	9	12
5	Work towards a specific goal/for a better life	9	12
6	Children's future	9	12
7	To buy what I want (shop/bus/clothes)	8	11
8	Bad experience in the city or with city-jobs	7	9
9*	I have nobody to take me there, lack of transport	7	9
10	There is no other work	7	9
11	I found a mining job in Sella that does not require working in the pit	6	8
12*	Husband does not take me there anymore (has another wife, is too old, no longer goes)	5	7
13*	I went a few times, but I did not find money working in the hole	4	5
14*	I need to take care of the household/children/baby	4	5
15	To stay with husband/partner who is a gold miner	4	5
16	Gold mining earns more than in other jobs	4	5
17	Security	3	4
18*	Work is too heavy/ damages your health	3	4
19	Experience as a merchant, mining areas are a good market	3	4
20*	The trip is too long	3	4
21	No papers/training/qualifications for a better job	3	4
22	Looking for new opportunities/ a challenge	3	4
23	I just go with the flow (how the wind blows)	2	3
24	My father took me as a young child	2	3
25	I have no husband to support me and my children	2	3
26*	I earn money doing other things	2	3
27	The civil war made me come upriver	2	3
28	I am from here, so it is easier to make money here	2	3
29*	Other people sell my things in Sella for me	2	3

* Reasons to not participate in gold mining

Table 5-3. Frequency ratios of decision criteria mentioned by Ndjuka women (N=25)

Criterion	Freq.	%
1* I have nobody to take me there, lack of transport	7	28
2* My husband does not take me there anymore (has another wife, is too old, no longer goes)	5	20
3 Money/poverty	5	20
4* I need to take care of the household/children/baby	4	16
5 To stay with husband/partner who is a gold miner	4	16
6* The trip is too long	3	12
7 Experience as a merchant, mining area is a good market	3	12
8* Other people sell my things in Sella for me	2	8
9 I have no husband to support me and my children	2	8
10 Children's future	2	8
11* Husband does not allow me to go	1	4
12* Physically unable to go (old age, illness)	1	4
13* Afraid of malaria	1	4
14* I do not have anybody there, you need family there	1	4
15* Women do not work in gold mining	1	4
16 I have to (financially) care for my younger siblings	1	4
17 Work towards a specific goal/ a better life	1	4
18 Gold mining earns more than in other jobs	1	4
19 Other work does not pay sufficiently to sustain a family	1	4
20 To buy what I want/specific items (shop/bus/clothes)	1	4

* Reasons to not participate in gold mining

Table 5-4. Frequency ratios of decision criteria mentioned by Ndjuka men (N=50)

	Criterion	Freq.	%
1	Freedom/independence	12	24
2	Money/poverty	11	22
3	Other work does not pay sufficiently to sustain a family	9	18
4*	Physically unable to go (old age, illness)	8	16
5	Work towards a specific goal/for a better life	8	16
6	To buy what I want/specific items (shop/bus/clothes)	7	14
7	There is no other work	7	14
8	Bad experience in the city or city-jobs	7	14
9	Children's future	6	12
10	I found a job in Sella that does not require working in the pit	5	10
11*	I went a few times, but I did not find money working in the pit	4	8
12	I have no papers/training/qualifications for a better job	3	6
13	Gold mining earns more than other jobs	3	6
14*	Work is too heavy/ damages your health	3	6
15	Security	3	6
16	Looking for new opportunities/ a challenge	3	6
17*	I earn money doing other things	2	4
18	The civil war made me come upriver and need a job here	2	4
19	I just go with the flow (how the wind blows)	2	4
20	I am from here, so it is easier to make money here	2	4
21	My father took me as a young child	2	4
22*	My brother died in Sella after an accident	1	2
23*	The shop where I worked in Sella closed	1	2
24*	Government job offers social security	1	2
25*	The place is <i>wreed</i> (cruel, evil)	1	2
26*	I used to work in <i>hosselen</i> elsewhere	1	2
27*	I went a few times to sell but people never paid me, so I did not earn my money	1	2

* Reasons to not participate in gold mining

Table 5-5. Frequency ratios of decision criteria mentioned by Ndjuka gold miners and non-miners in ages 30 and younger (N=37, listing only criteria mentioned at least twice)

Criterion	Freq.	%
1 Money/poverty	13	35
2 Other work does not pay sufficiently to sustain a family	6	16
3 Freedom/independence	5	13
4 Children's future	4	11
5 There is no other work	4	11
6 Work towards a specific goal/ a better life	4	11
7* I need to take care of the household/children/baby	4	11
8 To buy what I want/specific items (shop/bus/clothes)	4	11
9 Security	3	8
10 Gold mining earns more than other jobs	3	8
11 To stay with husband/partner who is a gold miner	3	8
12 I found a job in Sella that does not require working in the pit	2	5
13 I have no papers/training/qualifications for a better job	2	5
14* I have no money to come sell things	2	5
15* I have nobody to take me there	2	5
16 I just go with the flow (how the wind blows)	2	5
17 Bad experience in the city or city-jobs	2	5

* Reasons to not participate in gold mining

Table 5-6. Frequency ratios of decision criteria mentioned by Ndjuka gold miners and non-miners older than 30 (N=38, listing only criteria mentioned at least twice)

Criterion	Freq.	%
1* Physically unable to go (old age, illness)	9	24
2 Freedom/independence	7	19
3 To buy what I want/specific items (shop/bus/clothes)	5	14
4 Bad experience in the city or city-jobs	5	14
5 Work towards a specific goal/ a better life	5	14
6* I have nobody to take me there/ lack of transport	5	15
7* My husband does not take me there anymore	4	11
8 Children's future	4	11
9 Other work does not pay sufficiently to sustain a family	4	11
10* I went a few times, but I did not find money working in the pit	4	11
11 I found a job in Sella that does not require working in the pit	3	8
12 Money/poverty	3	8
13* Work is too heavy/ damages your health	3	8
14* I earn money doing other things	2	5

* Reasons to not participate in gold mining

Table 5-7. Frequency ratios of decision criteria mentioned by Ndjuka gold miners and non-miners with four or less years of education (N=40, listing only criteria mentioned at least twice)

Criterion	Freq.	%
1 Money/poverty	8	21
2* I have nobody to take me there/ lack of transport	6	15
3* Physically unable to go (old age, illness)	6	15
4 Other work does not pay sufficiently to sustain a family	5	13
5* My husband does not take me there anymore (has another wife, is too old, no longer goes)	5	13
6 To stay with husband/partner who is a gold miner	4	10
7* I have no money to come sell things	3	8
8* I need to take care of the household/children/baby	3	8
9* Work is too heavy/ damages your health	3	8
10 To buy what I want/specific items (shop/bus/clothes)	3	8
11 Freedom/Independence	3	8
12* Other people sell my things in Sella for me	2	5
13 I have no husband to support me and my children	2	5
14* I earn money doing other things	2	5
15 Children's future	2	5
16* I went a few times, but I did not find gold	2	5

* Reasons to not participate in gold mining

Table 5-8. Frequency ratios of decision criteria mentioned by Ndjuka gold miners and non-miners with more than four years of education (N=35, listing only criteria mentioned at least twice)

Criterion	Freq.	%
1 Freedom/independence	9	26
2 Work towards a specific goal/ a better life	8	23
3 Bad experience in the city or city-jobs	7	20
4 Money/poverty	7	20
5 Children's future	6	17
6 Other work does not pay sufficiently to sustain a family	5	14
7 I found a job in Sella that does not require working in the pit	5	14
8 To buy what I want/specific items (shop/bus/clothes)	5	14
9 There is no other work	4	11
10 Gold mining earns more than other jobs	4	11
11* Physically unable to go (old age, illness)	3	9
12 Security	3	9
13* I went a few times, but I did not find gold	2	6
14 I have no papers/training/qualifications for a better job	2	6
15 Looking for new opportunities/ a challenge	2	6

* Reasons to not participate in gold mining

CHAPTER 6

HOW GENDER LIMITS THE PARTICIPATION OF WOMEN IN GOLD MINING

In the previous chapter I explored how individual Ndjuka decide to either become gold miners or not. I concluded that men and women make decisions about mining differently because they face different options, responsibilities, and constraints in their daily lives. One observed difference was that men mentioned many reasons to become gold miners, while women mentioned many reasons to not do so. Here I explore in more detail what keeps women from entering mining in numbers equal to men. I will empirically test explanations that appeared in the decision model, as well as possible barriers to entering mining that I observed in the field.

It is curious that few Ndjuka women participate in mining for two reasons. First, small-scale gold usually attracts poor people with limited access to the formal labor market. Ndjuka women are among the poorest and the least privileged people in Suriname, and their on average low education and literacy rates obstruct formal employment. Given their precarious economic position and limited options to earn cash money, why do Ndjuka women forego the opportunity to earn a mining income?

Second, women make up a substantial proportion of gold miners in Africa. The United Nations (1996) has estimated that 75% of artisan miners in Ghana are women, and that women represent 50% of the miners in Madagascar, Mali, and Zimbabwe. Shaffer (1998) reports that in the Republic of Guinea, gold mining is the principal economic

activity of women, while men are mainly agriculturists. In contrast, I estimated from observation that for every Ndjuka woman in the mining area there were about 15-25 Ndjuka men. The average man in the sample had spent more than 8.5 years in mining over his life time; the average woman had mined for less than a year total (N=219; $t=-9.6$, $p<0.001$). Given that women in several African countries participate in mining as much as men, what prevents Ndjuka women from doing so? This question is especially intriguing when one realizes that the Ndjuka originate from Ghana, Togo, Côte d'Ivoire, and Nigeria, and share many cultural traits with people in these regions.

Central Question

Why are so few Ndjuka women gold miners? It is important to identify the barriers that exclude Ndjuka women from small-scale gold mining because participation in mining typically allows women to gain greater wealth, economic security, and authority in making decisions (Labonne 1996). Policy aimed at improving the economic well-being of Ndjuka women and their children could address these barriers once they are known.

Studying women in mining is also relevant because women are generally overlooked in mining studies (but see Rodrigues 1994). Some researchers do not mention the sex of miners (Bezerra, Veríssimo and Uhl 1996) but implicitly refer to miners as men (Cleary 1990; MacMillan 1995; Naughton 1993; Slater 1993). At best the presence of women in mining is noted without revealing details about their experiences (Healey 1996; UN 1996). I observed that women in the gold mining areas of Suriname

had different reasons to become miners than men, partly because women did different mining jobs and faced different mining risks as compared to male miners. Therefore generalizations about gold miners that are based on interviews with men may not apply to women. I hope to clarify the decisions of women about mining.

Approach

I use quantitative and qualitative methods to determine what factors influence the probability of a woman to enter mining. My quantitative model is informed by factors that were mentioned by Maroon women, and by my interpretation of field observations. Based on findings from the tree model (chapter 5) I will test for the influences of mobility (transport) and childcare responsibilities. Mobility is important because miners continuously travel between the city, forest villages, and the mining camps. Women also mentioned that their domestic duties, especially childcare, were incompatible with mining. Taking children to the mining area is undesirable because it is a diseases-prone environment and far from schools.

In addition to emic reasons--those mentioned by Ndjuka women--I will test some of my own ideas from fieldwork. I noted that people who want to become miners need money to pay for travel and buy work supplies, such as boots and a flashlight. Women typically have no or little cash money, which likely limits their ability to buy supplies and to travel. I also observed that miners are usually more acculturated than non-miners. I use the term acculturation to refer to one's ability to integrate in life outside the local communities. In the next section, I will discuss gender in Ndjuka society and explain why men have more contact with the world outside Ndjuka territory than women. The

ability to operate in the outside world is important for gold miners who continuously travel to and trade in Paramaribo.

I will use qualitative methods to control the quantitative findings and to analyze factors that remain unexplained in the quantitative model. For example, some women said they were not mining because they feared the disapproval of their husbands. I cannot test the effect of spousal domination with quantitative methods because I do not have data to measure the individual variation this variable. I will use ethnography to explore how ideological factors that could not be measured quantitatively, interact with material variables to shape the options of women to enter mining.

Hypothesis

I propose that the Ndjuka gender system restrains the participation of women in mining by two means: (1) Women have less access to resources (e.g. mobility, money, acculturation) that are critical to being a miner, and (2) Women are more frequently involved in domestic tasks that are incompatible with gold mining. I hypothesize that:

Gender inequality restrains the entry of women into small-scale gold mining by limiting the access of women to money, mobility, and acculturation, and by assigning women the responsibility over childcare.

It follows from this hypothesis that a quantitative model that controls for the indicators of gender inequality (e.g. money, mobility, acculturation, and childcare) should find that women are as likely as men to be miners. Before turning to the methods, results, and discussion sections I discuss gender in Ndjuka society. The qualitative description below informed the hypothesis and frames the discussion of results later in the chapter.

Gender in Ndjuka Society

In Ndjuka households and communities, men and women operate largely independent from one another (DeBeet and Sterman 1981; Price 1993, 1988; ThodenVanVelzen and VanWetering 1991). Men provide game, money, and city products. Their responsibility for the household cash income typically requires men to leave the forest communities for prolonged periods of time. Women are almost solely responsible for their offspring, domestic tasks, and growing food for the family. Because men are frequently absent from the home, women make most decisions about the management of the household and agriculture.

Ndjuka women in the interior usually control agricultural land, a house in a forest village, and a canoe (table 6-1). Among rural women only, 84% owned land, a similar percentage owned a house in a forest village, and almost half (48%) owned a canoe. More Ndjuka women (66%) than men (30%) in the sample owned land ($X^2=29.13$, $p<0.001$). Also more women than men owned a house in the interior and a non-motorized canoe, but these differences were not significant ($X^2=3.10$, $p=0.21$; $X^2=2.60$, $p=0.11$, respectively). Formally, no institutions keep women from acquiring land and other possessions.

Husbands and Wives

The apparent autonomy of Ndjuka women is deceptive. Gender inequality in Maroon society limits the access of women to political positions, money, and contacts with the outside world (Price 1988, 1993). Male labor provides the basis of the lives of women in the interior. Men clear the forest for subsistence plots, build canoes and

paddles, and own motor boats and saws. A man also supplies his wife or wives with essential city goods, such as oil, salted fish and pork, rice, kitchen tools, fabrics, and other household supplies, or the money to buy these items in the city (Price 1993). Rosa (29) explains that to be single is synonymous with poverty:

If you do not have a husband then you yourself will have to figure out what to do. And if you have to clear [land] yourself, it will never be a large plot, it will be a small plot, nothing more, because you cannot clear the forest like a man. Or maybe you have family that helps you clear. But for the largest share, if you do not have a husband, you will have to do it yourself with your tools. That is heavy! If you do not have a husband, and you do not cut yourself, then you will have no place to plant. Maybe a family member, who has just returned [from her field] will give you a little bit, or a man has a bit for you to take.

In the above narrative Rosa indicates that single women typically only clear a small subsistence plot. Other unmarried women rework old plots, but such land has a lower output. As a result single women are usually unable to produce sufficient food for themselves and their children, let alone surplus to sell for money.

Unmarried or widowed women depend on matrilineal kin relations, but they often feel that begging a male kinsman for help is shameful. Begging is also unattractive because men tend to deliver services of less quality to their sister or mother than they would to their own wife, such as food that is left over from their own household.

Moreover, explains Rosa as she continues, reliance on kin does not provide security:

Some people [family members] they help you clear forest for a plot, because it is only once a year that the forest is cleared. So maybe they will help once, but he/she will not help every year, two years, three years.

Unmarried women are also less mobile. Most Ndjuka villages are situated on islands in the river, and women can often only reach their agricultural fields by water. A boat is an important wedding gift that a man presents to a new wife. Women without a boat must borrow a boat, which creates obligations to return labor or produce. Rosa continues:

If you do not have a husband, you will not have a boat. If you go somewhere, you borrow the boat from someone, you see. Then you go. . . . If you come back, then you announce that you have come, and she will take her boat back.

Rita, a single woman (40), confirms that being single means depending on charity:

My husband left and went to live with another woman. He just left me with the children; ten, eighth, and fourteen years old. . . . Now my husband has another wife in the city, he no longer supports me. Sometimes someone gives me a piece of clothing that I can give the children. My children wear shabby pants, shabby dresses.

A husband can provide economic and material security, but husbands are scarce.

Even though many men have two or three wives, there are more women without husbands than men without wives (Price 1988; pers. obs.). The surplus of women is partly explained by the younger age of marriage for women and the larger number of men who migrate temporarily or permanently. Due to their dependence on men and the lack of available husbands, women have little power to protest polygyny or other disliked male behavior. In theory a man who wants to marry an additional wife needs the agreement of the earlier wife or wives. In practice that does not happen, says Juliana (28):

If the man wants to take another wife then he will have to ask you first. But if you do not agree he will do it anyway. The only thing you can do is leave, but how will you support yourself? . . . It is better if a man takes another wife than a buitenvrouw [mistress], because a buitenvrouw is free to leave and take another man if she wants to. Therefore a lot of time and money are spent on her. As for your wife, you do not need to put so much energy in pleasing her anymore.

Voicing the feelings of many Ndjuka women with whom I talked, Juliana notes that a divorce is usually not an option for a woman who is dissatisfied with her husband's involvement in new relations. Even though the Ndjuka community typically accepts a woman's decision to leave her husband, especially when they believe that she was not treated well, a lack of economic self-sufficiency forecloses this option for most women.

During the time of fieldwork I only experienced one case of a woman leaving her husband in a forest village. The woman concerned originated from the city, spoke Dutch, and had wage labor experience, increasing her ability to support herself.

Juliana also explains how men take advantage of the dependency of women by involving in extramarital affairs. Men try harder to please a buitenvrouw, she says, because that woman will take another man if she does not receive the support and attention she desires. Notwithstanding the favorable treatment, being a mistress compares negatively to being a wife, which provides more economic security. It is not uncommon that a buitenvrouw ends up with a child from the man, increasing her precarious economic position. To be an unofficial partner is also disadvantageous because the community usually does not respect you. It is not uncommon, I observed, that a woman scolds or physically molests the buitenvrouw of her husband with the approval of community members.

Unequal Education and Income

Women have less access to human and capital resources than men (table 6-1). The similarity in the average ages of men (34) and women (35) in the sample makes it unlikely that disparities are produced by age-effects. I provide both the mean and the median of selected variables to minimize distorted data interpretation due to the large variance within same-sex groups. On average men have more education than women. A majority of men complete the six years of elementary school (57%) versus only 29% of women ($X^2=17.39$, $p<0.001$). More than half of the women drop out before or in the third grade. Most men (68%) but less than half of the women (42%) are literate

($X^2=12.34$, $p<0.001$), and more men (71%) than women (41%) speak the national language Dutch ($X^2=21.24$, $p<0.001$).

Income may be the clearest measure to compare the well-being of people. I measured income as the aggregated cash earnings of a person over the calendar year before the interview, and express it in US dollars. The income measure does not include production for own consumption. Because women are more often subsistence farmers than men (57% versus 1%) and much of their income is non-cash, the income measure underestimates the production value of women's incomes. Because my concern is with access to cash money, the measure is appropriate for the analysis.

Women earned on average less money than men. In the year before the interview 31% of women had earned no cash, compared to only one man in the sample (0.8%). Half of the women earned the equivalent of 80 US\$ or less annually. In comparison, the median annual income of men was 2,700 US\$. The average incomes of men (6,500 US\$) and women (1,793 US\$) are high compared to the GDP per capita of Suriname of 1,320 US\$ in 1997 (PRB 1999). Informal mining incomes are not included in the GDP statistic. Gold miners account for the high average income of the Ndjuka in the sample, and earned significantly more than non-miners among both women and men (table 6-2). The discrepancy in income among women is large; mining women earned on average 9,822 US\$ annually, compared to the 296 US\$ average of non-mining women ($N=70$; $t=-4.33$, $p<0.001$). The income difference among men is smaller, but mining men still earned about four times more than non-mining men ($N=117$; $t=-2.55$, $p<0.01$).

Given the extent to which the incomes of gold miners exceed the average per capita income in Suriname, why do not all Surinamers become miners? The answer is

partly found in the gross underestimation of the Suriname GDP in national statistics, which do not account for the country's gray economy. The undocumented economy is large, consisting of remittances, incomes from gold and people smuggle, and drugs money. Another reason for the minimal participation of non-Maroons in mining is their typical disdain for life in the forest, for the absence of city comforts, and for the Maroons. Further the average city-resident is more likely than the average Maroon to contract malaria and other tropical diseases. The owner of a medium-scale mining operation in Suriname, a Surinamer of Chinese descent, works primarily with Chinese laborers flown over from China, in addition to Maroons and Brazilians. He mentioned the difficulty of finding reliable mining laborers in Paramaribo.

Lorenz curves for men and women separately visualize the large income inequality within same-sex groups, especially among women (figure 6-1). The Lorenz curves show what share of the population earns what percentage of income, separated by sex. If incomes are equally distributed in a population, each equal share of the population earns an equal percentage of the total income, and the graph produces a straight line. The steeper the curve, the higher income inequality. Figure 6-1 indicates that income is distributed unequally among men and women, and that income inequality is largest among women.

The income inequality among women is primarily caused by the exceptional income of the one woman, a mining camp owner. She was estimated to earn 60,750 US\$ annually, which accounts for just over 50% of the total female income. This woman had been in the mining business for 21 years. She had started as a traveling merchant, and now owned two mining machines. Male miners agreed that she owned one of the most

beautiful and productive camps in the vicinity. The richest 10% of women shared 83% of the total income for women, all earning more than 2,000 US\$/pp over the calendar year before the interview. The 5% wealthiest men -all gold miners- earned 36% of the male income, while the poorest 50% of men shared 9% of the total male income. When I exclude the richest woman from the sample, the Lorenz curves of women and men almost overlap.

Income inequality between the sexes disappears among gold miners (table 6-2). Female miners earn annually on average 1,500 US\$ more than male miners, but the difference is not significant ($N=95$; $t=0.34$, $p=0.63$). The findings suggest that for both women and men, gold mining is economically beneficial as compared to local and national job alternatives. Given the evident economic benefits that mining can offer Ndjuka women, it is curious that not more women become gold miners.

Men and Women in the Outside World

Maroon culture facilitates the acculturation of men, yet inhibits women from acquiring experience with the world outside the local communities (DeBeet and Sterman 1981; Price 1993; ThodenVanVelzen and VanWetering 1991). Men prove their masculinity by earning money outside the community (Price 1988). The ideology that equates mobility with manhood is reinforced by the Maroon social organization. Because of polygyny and matrilineal residency rules, most men are part of multiple households that are usually situated in different villages. These villages include the man's natal village (the village of his matri-clan) and the birth-village(s) of his wife or wives. Men also regularly buy household and other supplies in the city. Their continuous travel between the maternal household, the marital household(s), the city, and the work place, gives men

more experience with external cultures than women. Travel and adaptation skills, or acculturation, are beneficial to a career in mining.

Ndjuka women seldom travel far from their communities. Most subsistence plots are close enough to the villages that they allow women to return home after a day's work in the field. Women do reside for longer periods in temporary agricultural camps but these camps are usually closer to the residential village than are the mining camps. In these camps women work among other Ndjuka women. For produce and supplies from the city, women rely on men. Limited cash and acculturation cause rural Ndjuka women to feel uncomfortable traveling outside the tribal territories without men.

Menstrual Taboos

Menstrual taboos impose a further obstacle on the freedom, status, and mobility of women. Menstrual taboos are embedded in a devote belief in supernatural powers, and isolate women physically from the community during a portion of each month.

Menstrual taboos prohibit a menstruating woman from staying in the same hut as men, from having sex with or cooking for men, and from touching items used by men. They also prevent her from taking part in sacred ceremonies and from washing in the river.

Menstrual taboos, in short, mark menstruating women as impure and polluting elements that need to be set apart from the rest of society (Small 1999).

Women themselves believe that they will bring calamities upon the village and themselves by violating menstrual taboos. Alicia explains how feelings of responsibility and guilt keep women from breaking the taboos:

[if you do not go into isolation] Ooooh we are talking about that! Then, if your father is there, or your husband, in the house, he will get ill. His stomach will be in pain. Maybe he will die because of you, because he must not eat the food. [Food cooked by a women in her menstrual cycle] kills the man, it will not kill the

woman. He will get weaker, weaker, weaker, and weaker. . . . So if you do not go [in menstruation seclusion], and you find your husband dead, you know you brought death. Then people will say: 'Ooh, that woman of so and so, with the moon-sickness [menstruation], he will come back to kill [take revenge].' And you will not live long. Maybe after two days you will be dead yourself. Then they will say: 'well, she sinned.'

The above fragment shows the strong believe in the polluting and harming powers of menstrual blood. In the preface to the second edition of Co-Wives and Calabashes (1993), Price discusses her own and other researchers' interpretations of how women experience menstrual taboos. My experiences and conversations in and outside the menstrual hut, lead me to support Price's (1993) argument that Maroon women generally find menstrual taboos inconvenient and distasteful.

Econometric Model

I hypothesized that gender inhibits the entry of women into small-scale gold mining by limiting their access to money, mobility, and acculturation, and by assigning women the responsibility over childcare. I use a probit model to test this hypothesis. The dependent variable is a binary variable that takes the value of one if the person is a gold miner, and the value of zero if the person is not a miner. The explanatory variables are being female, and indicators of access to money, mobility, acculturation, and childcare. The sample population (N=219) consists of men and women, gold miners and non-miners, as defined in chapter three.

I present the results of the complete model, called model one, in column two of table 6-6. In alternative models I exclude the indicators of gender inequality one at a time. The results of the alternative models appear in columns three through six of table

6-6. The coefficients in table 6-6 represent the change in the probability of being a gold miner when the explanatory variable increases by one unit above its sample mean, and all other explanatory variables are held constant at their mean value. For example, the coefficient for female in model one is -0.29, which means that women are estimated to be 29% less likely than men to be gold miners.

The change in the coefficient of female following the exclusion of any predictor indicates how much that predictor affects the probability of a woman to become a gold miner. The coefficient of female from model one is especially important. If the lesser presence of women in mining can be entirely explained by income, mobility, acculturation, and childcare, then that coefficient should be close to zero. However, if the coefficient of female in model one is significantly different from zero, then women are denied access to mining for reasons other than those that I control for in the model. I use ethnographic data to explore these reasons. Below I operationalize the variables. The explanatory variables are defined in table 6-3 and summary statistics appear in table 6-4.

Explanatory Variables

The explanatory variables are sex, income, mobility, acculturation, and childcare. Sex is used as a binary variable, female, that has the value of one if the person is a woman, and the value of zero if the person is a man. I discussed how I measured income in the previous section. The variable income has more missing observations than the other variables (N=187 out of N=219). I use two variables to represent mobility: ownership of a motorized canoe and moving history. Moving history is included as a binary variable that has the value of one if the person now lives in a different region than that where he or she was born. I distinguish six residency regions that are relevant to the

Ndjuka, including Paramaribo, the upper Tapanahoni river (opo), the lower Tapanahoni river (beló), French Guiana, Cottica (coastal region), and other regions. The variable moving history has the value of zero if the person lives in his or her natal area.

I approximate acculturation by the ability to speak Dutch, the ownership of a house in the city, and experience in wage labor. Knowledge of Dutch indicates increased acculturation because Dutch is generally spoken in the city but not in the forest. Owners of a house in the city probably spend time in the city and pay bills. Experience in wage labor indicates familiarity with receiving formal wages, financial transactions, and with city life.

I measured the time spent on childcare on a qualitative scale that ranged from never to daily (Appendix D, section V.b.). Because it was impossible to collect accurate time-allocation data from every person in the sample, interview participants self-reported the frequency of their involvement in childcare. I use the variable childcare as a binary variable that has the value of one if the person reports looking after his or her children at least once a week. The variable will be zero for most adults without own children in their homes. Bivariate analysis (table 6-5) shows that 71% of women versus 18% of men spend at least weekly time with their children ($X^2= 63.23, p<0.001$). Only 17% of miners compared with a majority of non-miners (61%) look after their children regularly ($X^2= 43.93, p<0.001$). The data suggest that childcare not necessarily keeps women from gold mining; female miners (55%) and other women (74%) do not spend significantly different amounts of time on childcare ($X^2= 1.75, p=0.19$).

Control Variables

Control variables are age, children, marital status, and urban versus rural residency. Age and children are continuous variables that measure respectively the age and the number of children of a person at the time of the interview. I consider as married anyone who is married legally or by common law. The variable urban is a binary that expresses whether a person lives primarily in a city or town rather than in the forest. I consider as cities or towns: Paramaribo, Cayenne (the capital of French Guiana), Moengo, Albina, and St. Laurent. The latter three places are coastal villages in Suriname and French Guiana with a predominantly Maroon population.

Econometric Specification

I tested for heteroskedasticity and rejected the assumption of constant variance of error terms at the 0.05 level. To correct for heteroskedasticity I estimated the model with Hubert-White robust standard errors. I tested for multicollinearity among the explanatory variables and excluded variables whose pairwise partial correlation coefficients were above 0.6. In the presented model, female correlates moderately with income ($r=-0.60$) and childcare ($r=0.58$). These variables remain included because they are important for testing the hypothesis. All other pairs of variables have correlation coefficients below 0.35.

I expect that income is endogenous because miners earn significantly more income than non-miners (table 6-2). The variable 'house in the city' may also be endogenous because city houses are possibly bought with mining revenues. I could not control for the bias in these variables because I do not have suitable proxies for the

mentioned variables. I did not exclude income and house in the city because they are theoretically important.

Results

In contrast to what I predicted, I find no evidence that mobility and acculturation affect the probability of women to become miners. In line with the hypothesis, income and childcare do seem obstacles to the entry of women into mining. An unexpected finding is that when controlled for income, childcare, mobility, and acculturation, women remain 29% less likely than men to become gold miners. Here I first discuss the results of the complete model (model one), and then evaluate how the exclusion of different predictors affects the probability of women to become gold miners.

The results of model one suggest that gender, income, and childcare are statistically significant explanatory variables for participation in gold mining. A 1% increase in income is estimated to increase the probability to be a gold miner by 13% ($Z=3.20$, $p<0.005$). People who spend time with their children at least weekly are 25% less likely to be gold miners than others ($Z=-2.01$, $p<0.05$). Being a woman decreases the probability to become a gold miner by 29% ($Z=-2.33$, $p<0.05$). The indicators of mobility (motorized canoe, moving experience) are statistically weak and have a small social effect. Two of the three indicators of acculturation (Dutch, wage labor experience) have a sign that is opposite than what was predicted, and none of the acculturation variables is statistically significant.

In the alternative models income, mobility, acculturation, and childcare are excluded one at a time. When income is excluded the coefficient of female decreases from -0.29 to -0.62. This change suggests that income inequality alone makes that women are 33% less likely than men to be miners ($Z = -6.35$, $p < 0.001$). When childcare is excluded from the complete model, the coefficient of female drops from -0.29 to -0.38, suggesting that childcare accounts for another 9% of the reduced probability of women becoming miners ($Z = -3.96$, $p < 0.001$). Excluding mobility and acculturation has no noticeable effect on the variable female.

Discussion

Gender inequality restrains the participation of Ndjuka women in small-scale gold mining in several ways. The reduced access of women to cash money seems to restrict the options of women severely; at the median level women earn 34 times less money than men. My findings agree with those of UN observers (1996), who have noted that the reduced access of women to money, especially credit, obstruct the equal participation of women in mining. Because it is likely that income is endogenous, it is not possible to draw definite conclusions about its influence on the involvement of women in mining.

Childcare responsibilities also seem to limit the options of women. Ethnographic data, some of which I shared in chapter 5, support the quantitative finding. Several women said that their children, especially newborns, prevented them from working in the mining area. Alina (19) who first went to Sella Creek in 1996 explains: 'My husband

took me [to the mining area], I came to hoesel. I stayed one month to sell kwakka and cassava bread. Now I have a baby I go no longer.'

It remains unclear to what extent children tie a woman to her home. The observation that mining and non-mining women did not spend significantly different amounts of time looking after their children, suggests that child-care barriers can be overcome. For example, mining women usually had their mother or other female relatives looking after the children. That option is not open to all women; some non-mining women mentioned that their husbands objected to such solutions. The finding that more female miners (55%) than male miners (12%) regularly spent time with their children ($X^2= 5.86, p<0.05$) may explain why women tend to stay in the mining area for shorter periods at a time than men. I argue that more important than children per se, is the possibility to arrange childcare support. Husbands may eliminate such arrangements.

A thought-provoking finding is that after controlling for the discriminatory effects of income, childcare, mobility, and acculturation, women remain 29% less likely than men to be gold miners. The socioeconomic and demographic covariates in the model cannot explain this observation. Ethnographic data and literary sources suggest several explanations that may underlie the gender effect. These explanations include: 'Women are physically too weak to be miners', 'Female miners earn less than male miners', 'Gold mining is a man's job; good women do not mine', 'Husbands keep women at home', 'Menstrual taboos complicate working in the mining area', and 'Women do not want to be gold miners'. Below I discuss each of these explanations and their fit to the case of Suriname. I conclude with an analysis of female miners, in which I speculate why some Ndjuka women are less restricted by gender-obstacles to entering gold mining.

Women Are Physically Too Weak to Be Miners

Popular among male miners is the idea that women are less suitable for gold mining because they lack the physical strength to work in the mining pit and live in the uncultivated forest. Some women share this perception. Several women told me that 'Women can not do the work [gold mining]' or 'Women cannot go look for gold'. The argument that women are physically unable to be miners is invalidated by observations elsewhere that female miners work long hours at heavy mining jobs, such as digging and carrying ore (Labonne 1996; Schaffer 1998; UN 1996). Moreover, Ndjuka women traditionally perform agricultural work that involves digging for hours in the heat of the day, and carrying heavy bags of cassava through the forest.

Even if physical capacity limited the involvement of women in pit-labor, there are many other jobs in the mining industry that Ndjuka women can perform, such as cooking, trading, or running a mining camp. United Nations observers (1996: 221) report that women take part in mining as 'concession owners, hawkers and providers of services and goods, laborers, dealers and buying agents, food preparers, and equipment owners, who hire out items such as shovels and pans.' Rodrigues (1994) conducted interviews with women in Brazilian mining areas who are cooks, sex-workers, machine owners, and vendors. Further, Brazilian, Maroon, and other women are employed in Suriname mining areas, even though in small numbers. For these reasons it is questionable that biological characteristics of women do not suit mining.

Female Miners Earn Less Money Than Male Miners

Some researchers argue that small-scale gold mining may be less attractive for women because female miners typically earn less than male miners (Labonne 1996;

Schaffer 1998). Labonne (1996: 119) expresses the concern that women in mining do not "benefit from artisanal mining as much as men. Women have not fully taken advantage of the 'islands of prosperity', like many of their male counterparts." The argument is not supported by my data; the average income of female miners in the sample was not significantly different than that of male miners. Rodrigues (1994) also reports similar earnings for female and male laborers in mining camps in the Tapajós, Brazil. My sample of female gold miners is too small to either verify or reject the argument that female miners earn less than men.

Gold Mining Is a Man's Job; Good Women Do Not Mine

In casual conversations Ndjuka women and men mentioned that gold mining is a man's job. The belief that it is appropriate for men, but not for women, to become gold miners stems from traditional Ndjuka gender roles, which I described above. Women and men generally agree on what is appropriate behavior for either sex (see also chapter 5). One woman (40) explained that she did not work in the mining area because 'the man has to work for the woman.' She added that women should not become gold miners like men. When asked if he wanted his children to be gold miners, one man answered 'I only have daughters', indicating they would naturally not become miners.

If gold mining is not an appropriate job for women, it follows that women who work in the mining area are not good women, unless they join a mining husband. Before the early 1980s, the only reason for a woman to be in the mining area was to assist a mining husband and to keep him company. Today Ndjuka women are coming by themselves. The decision model (chapter 5) revealed that women are afraid to gain a bad reputation by involving in mining independently. 'If a man does not want to take you [to

the mining area] you cannot go', explains Ana (29): 'The people will say you go whoring.' Because the well-being of women in the small forest communities depends on reciprocal and support networks, damage to one's reputation in these communities has serious consequences. Labonne (1996) also notes that traditional societies limit the potentials of women in mining, but she does not further explain this point.

Husbands Keep Women at Home

Husbands exercise considerable influence on the activities of their wives. In chapter 5 I noted that some women did not mine because their husbands objected, as one woman noted: 'My husband works in Sella, but I never go because my husband does not take me.' Men typically do not allow their wives to travel to the mining area with people other than themselves or people appointed by them. As I mentioned above, the objections of a husband may also eliminate childcare arrangements. Because women dependent on their husbands for access to non-agricultural assets and food, not obeying a spouse or otherwise losing his favor has serious consequences for the well-being of a woman and her children.

Menstrual Taboos Complicate Work in the Mining Area

Menstrual taboos complicate labor in the mining area because they prohibit a woman to have contact with men during her menstrual period. The taboos forbid women to travel, have sex, and trade with men, and to cook for them. As a result women cannot work with men for several days each month, and are less attractive laborers to camp bosses. Despite the integration of many female miners in modern city-life, where taboos are more loosely applied, the Ndjuka women that I met in the mining area obeyed menstrual taboos strictly. One of them was a woman from Paramaribo, Gracia (42), a

camp-boss and previous schoolteacher (chapter 5). During her menstrual period Gracia did not enter the huts of men, sat on a bucket that was not used by men, ate separately, drank from a cup that was not touched by men, and did not dip her cup in the communal bucket of drinking water. Nor did she cross any creeks, which limited her walking area in the rainy season to several meters. She extended her space when some of the creeks dried up in the dry season, but only insofar she would not contact men.

Menstrual taboos are difficult to follow in the mining area because female support networks that help women cope with seclusion in the villages are absent. Some women who travel to the mining camps take contraceptive pills for prolonged periods of time to prevent menstrual periods. Yet contraceptives are not readily available. Other women avoided having their menstrual period in the mining area by only staying for two or three weeks at a time. Menstrual taboos and the nuisance of obeying them in the mining area possibly make mining less attractive to women.

Women Do Not Want to Be Gold Miners

It is possible that many women are not miners simply because they do not want to be miners. Comments from mining women support this position. Women generally dislike the tiring travel and the inconveniences of life in the uncultivated forest. Others complained about harassment by men. One woman in the mining area said she wanted to quit working as soon as she would find a husband who could provide for her and her children. Ina (35), a female miner, was concerned that by working far from home she could not give her seven children the attention they deserved. Yet as the family breadwinner, she felt that only a gold mining income could assure the economic well-being of her children:

I will stop [mining] as soon as I find a solution, if I receive support every month. Then I will stay in the city and take care of the children. The children must go to school, therefore I suffer deprivation, for them. [You work in mining] at the moment that you see no other way out. I regret leaving the children. . . . Taking care of children does not only mean to support them, it requires giving personal attention.

The comments of Ina and other women suggest that women who have the autonomy and resources to become miners may only choose for mining when they feel they have to.

Female Miners

What allows women to depart from the mentioned barriers to becoming gold miners? The number of female miners in the sample is too small to determine the factors that encourage women to become gold miners with multivariate methods. I use ethnographic data and bivariate statistics to identify general patterns among mining women. Future work with female gold miners may provide more conclusive evidence.

The decision tree model showed that female miners are generally either spouses of gold miners or family breadwinners. Most of the mentioned barriers do not apply to spouses of miners who are invited by their husbands. The husband has agreed and will finance or arrange her travel, and the community approves of women joining their mining husbands. A husband who has asked his wife to come is less likely to object to childcare arrangements, and he may assist his wife during her monthly period. Probably spouses experience less harassment from men, and worry less about earning enough money. Joining mining husbands fits in the long tradition of mining as a family enterprise, and is compatible with traditional gender roles.

In contrast to spouses of miners, women who come alone break with Ndjuka traditions. I suggest several factors that allow them to do so. Ethnographic observations and bivariate analyses suggest that female miners are more acculturated than other

women; eight out of the eleven female miners in the sample (73%) resided in the urban areas, versus 28% of non-mining women ($X^2= 8.95, p<0.005$). Rigid gender roles that dominate in forest communities necessarily weaken in an urban setting, where Ndjuka women interact with women from other ethnic groups and can not maintain strict menstrual taboos. For example, a befriended professional Ndjuka woman from Paramaribo did not cook for her husband during her menstrual period, but she could not afford to leave work for five days out of every month. Social disapproval is also less likely in an urban setting with limited social control.

In addition to being more acculturated and less controlled by the Ndjuka community, urban women also have increased opportunities to earn money. Ndjuka women from Paramaribo and the Cottica region traditionally are active as informal entrepreneurs (Polimé, VanWetering, pers. com.). Today Ndjuka women dominate the Central Market in Paramaribo where they sell fruits, vegetables, and traditional forest remedies. Economic autonomy may decrease the acceptance of conservative gender roles and of spousal dominance. Further, women with money are more mobile; they can finance a trip to the mining area independent of male support. They will also have fewer problems buying supplies and goods for resale in the forest.

The analysis of female miners conforms to the hypothesis that to be a miner requires acculturation and access to money and mobility. I also noted that many women in the mining area were single mothers. Fifty-five percent of female miners were single mothers, compared to 19% of other women ($X^2= 6.98, p< 0.01$). Single mothers differ from other women in that they are not constraint by objections of a husband. Single mothers may also be more desperate for income than are other women. Many Ndjuka

women in the city are single mothers, but not all become gold miners. The comments of female miners that I shared above suggest that women who are not withheld by gender barriers, like men, only consider mining as a last resort.

Conclusions

Small-scale gold mining can offer poor women opportunities for economic and social empowerment. However, Ndjuka women confront many barriers that keep them from becoming gold miners. These barriers include the reduced access of women to cash money and their larger involvement in childcare. Multivariate methods leave a significant share of gender inequality in gold mining unexplained. Ethnographic analysis suggests that traditional gender ideology, the objections of husbands, and menstrual taboos compose additional barriers to the entry of women in mining. In addition, women typically disliked mining. Physical constraints and economic disadvantages of women in mining seem less likely explanations. Least affected by the mentioned barriers are spouses of miners and urban women with relative economic and social autonomy. It appears that women who are less restricted by gender barriers only become independent miners when they are the family breadwinners and feel they have no economic alternatives.

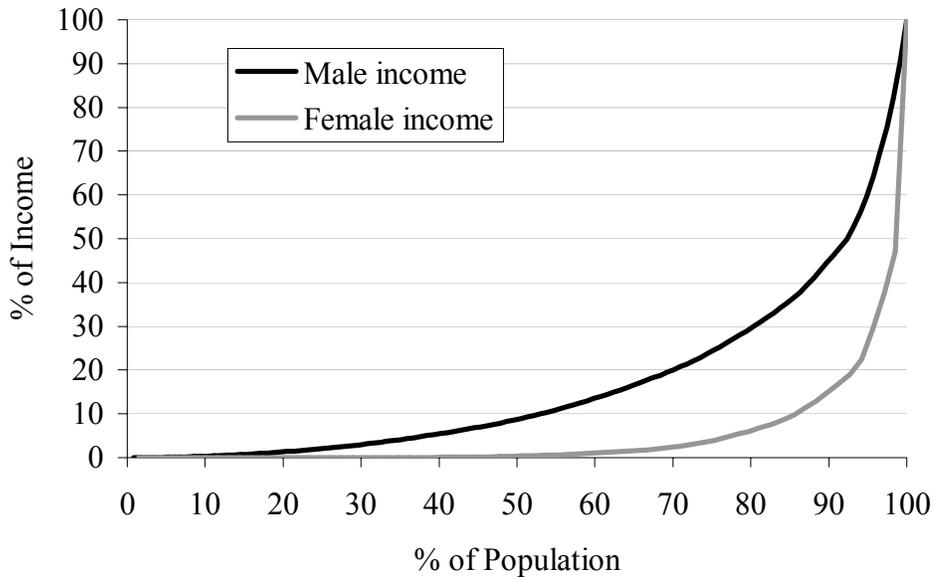


Figure 6-1. Lorenz curve of the income distribution for women (N=70) and men (N=117)

Figure 6-1 shows the percentage income earned by the percentages of women and men. If the income distribution is equal, the Lorenz curve displays a straight line. A steeper curve indicates a more unequal distribution of income.

Table 6-1. Comparison of ownership of material, human, and monetary resources between Ndjuka women (N=91) and men (N=128)

	Median			Mean		
	<i>sample</i>	<i>men</i>	<i>women</i>	<i>sample</i>	<i>men</i>	<i>women</i>
age	31.5	31	33	34.4	34.0	35.0
<i>Material Capital</i>						
house in interior (y/n)	yes	yes	yes	63%	59%	67%
land (y/n) ***	no	no	yes	45%	30%	66%
canoe (y/n)	no	no	no	28%	29%	34%
motorized canoe (y/n) ***	no	no	no	18%	30%	1%
house in city (y/n)*	no	no	no	23%	29%	14%
<i>Human Capital</i>						
education (years)***	5	6	2	4.64	5.60	3.39
finished elementary school (y/n) ***	no	yes	no	45%	57%	29%
literacy (y/n)***	literate	literate	illiterate	57%	68%	42%
Dutch speaking (y/n)***	yes	yes	no	59%	71%	41%
<i>Monetary Capital</i>						
cash income (y/n) ***	yes	yes	yes	88%	99%	69%
annual income (US\$) **	1440	2700	80	4780	6567	1793

*= significant difference between men and women's means at the .05 level

**=significant difference between men and women's means at the .005 level

***= significant difference between men and women's means at the .001 level

Table 6-2. Mean incomes (US\$) and tests of significance of the differences between men and women, gold miners and non-miners

	Miners	Non-Miners	Pooled	T-test
Women	9822 N=11	296 N=80	1793 N=91	-4.33 (0.000)
Men	8303 N=91	2151 N=37	6567 N=128	-2.55 (0.006)
Pooled	8479 N=102	961 N=117	N=219	-5.07 (0.000)
T-test (p)	0.34 (0.63)	-4.39 (0.000)	-2.99 (0.002)	

Table 6-3. Definitions of the dependent, explanatory, and control variables

Variable	Definition
<i>Dependent</i>	
Gold miner	1=The person is a gold miner, 0=The person is not a gold miner, as defined in chapter 3
<i>Explanatory</i>	<i>Model 1</i>
Female	Binary of the sex of a person, 1=Female, 0=Male
Log (Income)	Log value of the estimated total cash income of the person during the calendar year before the interview, in US dollars
Childcare	Binary of the frequency that the person takes care of his or her children, 1=The person takes care of his or her children at least once weekly, 0=The person takes care of his or her children less than weekly
Motorized canoe	Binary of ownership of a motorized canoe, 1= The person owns a motorized canoe, 0=The person does not own a motorized canoe
Moving experience	Binary of residency in another region of Suriname than where one was born, 1=The person has moved, 0=The person has not moved
Dutch	Binary of speaking Dutch, 1=The person speaks Dutch, 0= The person does not speak Dutch
City-house	Binary of the ownership of a house in the city, 1=The person owns house in the city, 0=The person does not own house in the city
Wage labor experience	Binary of wage labor experience, 1=The person has experience in wage labor, 0=The person has no experience in wage labor
<i>Controls</i>	
Age	Age of the person
Marital status	Binary of legal or common law marriage, 1=The person is married, 0=The person is not married
Children	Number of children of the person
Urban	Binary of residency in an urban setting versus the forest, 1=The person is an urban resident, 0=The person is a forest resident

Table 6-4. Summary statistics for the variables in the regressions predicting gold mining as a function of gender inequality

Variable	Obs.	Mean	Std. Dev.	Range
<i>Dependent</i>				
Gold miner	219	0.47	0.50	0-1
<i>Explanatory variables</i>				
Female	219	0.42	0.49	0-1
Income	187	4780	10,783	0-74,250
Childcare	219	0.40	0.49	0-1
Motorized canoe	217	0.18	0.38	0-1
Moving experience	219	0.35	0.48	0-1
Dutch	219	0.53	0.50	0-1
House in the city	218	0.23	0.42	0-1
Wage labor experience	219	0.37	0.48	0-1
<i>Controls</i>				
Age	219	34.48	13.10	16-79
Marital status	219	0.79	0.41	0-1
Children	219	3.52	3.61	0-26
Urban	218	0.40	0.49	0-1

Table 6-5. Share of the population that takes at least weekly care of children, and tests of significance of the differences between men and women, gold miners and non-miners

	Miners	Non-Miners	Pooled	X² (p)
Women	54.6% N=11	73.8% N=80	71.4% N=91	1.75 (0.186)
Men	12.1% N=91	32.4% N=37	18.0% N=128	7.39 (0.007)
Pooled	16.7% N=102	60.7% N=117	N=219	43.93 (0.000)
X² (p)	5.86 (0.016)	22.53 (0.000)	63.24 (0.000)	

Table 6-6. Regression results for the model predicting the participation in gold mining as a function of gender inequality³

1	2	3	4	5	6
Excluded		Income	Childcare	Mobility	Acculturation
Variables	dF/dx (Z)	dF/dx (Z)	dF/dx (Z)	dF/dx (Z)	dF/dx (Z)
Female	-0.29* (-2.33)	-0.62*** (-6.35)	-0.38*** (-3.96)	-0.28* (-2.31)	-0.25* (-2.13)
Log(Income)	0.13** (3.20)		0.14** (3.44)	0.13** (3.21)	0.14*** (3.53)
Childcare	-0.25* (-2.01)	-0.33** (-3.08)		-0.24* (-1.98)	-0.22* (-1.97)
Motorized canoe	-0.05 (-0.44)	-0.03 (-0.24)	-0.04 (-0.41)		-0.03 (-0.30)
Moving experience	0.01 (0.08)	0.02 (0.22)	-0.03 (-0.29)		0.04 (0.44)
Dutch	-0.08 (-0.71)	-0.06 (-0.57)	-0.09 (-0.83)	-0.08 (-0.74)	
House in the city	0.21 (1.59)	0.23* (2.03)	0.15 (1.34)	0.20 (1.48)	
Wage labor experience	-0.09 (-0.93)	-0.13 (-1.32)	-0.09 (-1.00)	-0.09 (-0.97)	
Age	-0.02*** (-3.71)	-0.02*** (-4.66)	-0.02*** (-3.61)	-0.02*** (-3.74)	-0.02*** (-3.76)
Marital status	-0.19 (-1.84)	-0.38*** (-3.56)	-0.24* (-2.44)	-0.19 (-1.76)	-0.17 (-1.66)
Children	0.03* (2.20)	0.05** (3.04)	0.02 (1.66)	0.03* (2.16)	0.03* (2.07)
Urban	0.08 (0.76)	0.20* (1.97)	0.11 (1.06)	0.08 (0.86)	0.10 (1.06)
N	186	216	186	186	186
Log Likelihood	-57.04	-77.94	-59.40	-57.12	-58.58
X ² (p>X ²)	78.38 (0.000)	104.90 (0.000)	79.43 (0.000)	74.35 (0.000)	64.69 (0.000)
Pseudo R ²	0.56	0.48	0.54	0.56	0.55

* significant at the 0.05 level

** significant at the 0.005 level

*** significant at the 0.001 level

³ The models are run with robust standard errors to correct for heteroskedasticity

CHAPTER 7 IS RISK-TAKING AT THE ROOTS OF DECISIONS ABOUT MINING?

Ethnographic findings from chapter 5 suggested that gender and risk are key factors that differentiate decisions about small-scale gold mining. In this chapter I use quantitative methods to examine how risk perceptions influence who becomes a gold miner and who does not. It is likely that risk attitudes and one's ability to manage mining risks play an important role in decisions about mining, because mining incorporates more risks than other subsistence options available to the Ndjuka. Mining exposes a person to physical, economic, and social risks due to its tough and insecure nature. Miners suffer from physical injury, work accidents, and high incidences of tropical diseases such as malaria. Income from mining is variable, contracts are uncertain, and gold miners may be robbed or harmed by criminals. The illegal movement of people and gold across international borders enhances the chaos and insecurity of life in the mining sector. The entire sector and its regulation are beyond the control of the Suriname government.

Central Question

Given the high exposure to economic and physical risk, why would anyone choose to be a gold miner? Here I test two possible answers. One answer is that some people take more risks than others because they are adventurers; they are less risk averse and better equipped to deal with risk than others. A second answer is that people adopt

high-risk behaviors when they are poor and have few income alternatives, regardless of their risk attitudes. Below I explain these hypotheses and the theories underlying them.

Gold Miners Are Adventurers

It is often suggested that gold miners enter mining for the adventure, the gamble, and the possibility of a lucky strike. MacMillan (1995: 73) argues that small farmers who go mining see mining as 'an adventure' and a 'welcome break from the monotony of agricultural work.' Naughton (1993) found gold miners boasting about their resilience, and several researchers report that miners have exaggerated expectations of striking it rich (DeVletter and Hakstege 1998; MacMillan 1995; Naughton 1993; Slater 1994). I found in chapter 5 that the main reason men quit gold mining was to avoid further exposure to physical injuries and economic uncertainty.

If risk taking characterizes gold miners, one might infer that gold miners are by nature more tolerant of health risks than other people. Cultural theory poses that each individual judges risks differently due to variation in personality, culture, and environment (Douglas 1985, 1992; Douglas and Wildavsky 1982). I measured the risk tolerance of each Ndjuka individual to test if risk attitudes influence gold mining. Other researchers have argued that peasants with back-up resources are more likely to gamble on risky options with high potential payoffs than are people without safety nets (Popkin 1979; Scott 1976). This theory predicts that the Ndjuka who have the most back-up resources that could insure against economic risks will be more likely to become gold miners.

Gold Miners Are Marginalized People

A second possible answer to why people enter mining is that people adopt high-risk behaviors when traditional subsistence formulas are disintegrating and alternatives are inaccessible or provide insufficient income (Blaikie et al. 1994; Little and Horowitz 1997; Stonich 1993). In interviews Ndjuka mentioned that poverty, limited education, the need to support the household, and a lack of alternative well-paying jobs, motivated them to become miners. Qualitative data from other researchers also suggest that gold mining is attractive to people who are poor and have no access to alternative sources of income (Cleary 1990; Naughton 1993; Roopnaraine 1996; Schmink and Wood 1992; Sponsel 1997). These researchers would reject the first answer, and predict that the Ndjuka with the fewest back-up resources become gold miners, regardless of their risk attitudes.

Explaining why people decide to become miners contributes to anthropological theory of what factors motivate risky behavior among subsistence producers. Risk behavior in tribal and peasant societies has been analyzed in-depth (Barlett ed. 1980; Cashdan ed. 1990; Popkin 1979; Scott 1976), but few anthropologists have studied how small-scale miners deal with risk (but see Godoy 1990). My study addresses this theoretical gap in risk research.

Competing Hypotheses

I test the two competing hypotheses, which I call the risk hypothesis and the poverty hypothesis. The risk hypothesis states that

- (1) Ndjuka will work longer in gold mining if they are more tolerant of physical risks and have better access to back-up resources.

The poverty hypothesis states that

- (2) Ndjuka will work longer in gold mining if they have more economic dependents and less access to income alternatives.

The explanatory variables of the two models partially overlap, but with the crucial difference that the risk model predicts a positive association between gold mining and financial security, while the poverty model predicts a negative relation between these variables. The effect direction of the coefficients largely determines which explanation is best. Before I turn to the methods, results, and discussion, I will elaborate on mining risks. I will explain how mining risks differ among miners, how mining risks differ from risks encountered in other professions, and how miners perceive risks.

Mining Risks

Working in the mining area exposes a person to risks such as violence and disease. In addition, different types of miners confront profession-specific risks. The listing of profession-specific risks presented in table 7-1 suggests that camp bosses face most economic risk; they usually borrow money to set up a mining operation, and are responsible for all operation costs. Several observations indicated that the risk of bankruptcy is high. Over the past years, several Ndjuka lost city houses that served as a security for mining loans. I also regularly encountered machine owners working for others when their operation had run out of money for fuel and supplies. A mining equipment salesman in Paramaribo said he had stopped extending credit to Maroon miners because many miners had not been able to pay him back (pers. com.). Camp bosses may experience fewer physical hazards than other miners, especially when they rely on overseers and spend most of their time in Paramaribo.

Pit workers frequently experience back injuries and work accidents, and typically earn a percentage of the uncertain gold production. Sex workers have a large chance of contracting sexually transmitted diseases and to be harassed. In economic terms, sex workers, merchants, and others who are paid on credit, risk never being paid.

Wilhelmina (31) sells food and apadonsiri, the popular pulp of the Assaí palm, to the miners in Sella Creek. She tells about the economic risks she experiences as a saleswoman:

When I am bored and I do not have money, I come to sell. Many people never pay, they buy on credit. That sucks. [Selling] goes with fortune. Perhaps one person buys a beer, and the rest of the month you do not sell anything else. I used to sell more, but now people do not buy much anymore. Before there were more Brazilians, they spent more, they love to eat chicken.

In the above fragment Wilhelmina explains that she faces two kinds of economic risks; people do not pay off debts, and you lose money when you cannot sell perishable goods.

Harold (29), a traveling salesman, confirms:

It is difficult to find money [as a salesman], I do not find it easily. If people need to pay you 100 gram, you perhaps receive 50 or 60 gram. It can take one or two years [before they pay].

Evert (32) saws planks for sluice boxes and camp huts. The problem, he says, is:

People do not pay their debts. They need me before they start extracting gold, and pay later. If you perform the job now, you maybe find your money four or five months later. Often you never see the money. There are few ways to get it; I am not a troublemaker, I am not going to fight with people. I have the same problem as shop owners; you cannot trust people in the interior to pay you back.

Men and women who are cooks earn relatively stable wages and confront few health risks other than the usual ones such as disease. I documented in the previous chapter that women who come without a husband risk sexual molestation and a bad reputation.

How do mining related health risks compare to health risks in other professions?

The average miner in the sample had experienced 8.5 bouts of malaria over his or her lifetime (N=96, SD=6.1), which was significantly more than the 5.5 bouts (N=116, SD=6.1) reported by the average non-miner ($t=3.56$, $p<0.001$). Nevertheless an average of 5.5 bouts of malaria remains worrisome; an individual who experiences repetitive lapses of malaria damages his or her health and immunity system, and malaria is a leading cause of death in the interior (BOG 1997). The Sella Creek mining area did not seem to have more violence than Paramaribo, partly due to its kin-based social organization. Work injuries affected far more people than crime, but I do not know how the number of work accidents in mining compares to the number of accidents in other professions. Field observations suggest that mining is more physically harmful than other jobs that Ndjuka typically do.

It is also difficult to determine how the economic risks of mining compare to those of other jobs. Mining incomes are uncertain and variable, but so are incomes of other informal jobs. Some people mentioned preferring formal wage labor due to the health insurance and pensions it offered. Others were skeptical about the economic security offered by the government. One miner (30) said:

Even if you are eligible for child benefits or pensions, the government does not pay. Moreover, with the money of social wages you cannot do anything. I myself have worked for the government to pay social benefits in the interior. Only once a year or once every six months the government comes to pay something to the people.

Several elderly men who received pensions were gold miners because their pensions were insufficient to live off. Some miners commented that mining was economically less risky than relying on the government or wage labor, because the mining boss at least gives you

food and shelter. With the present high inflation rates, a stable wage in Suriname guilders actually has been dropping in value, and may no longer cover basic needs.

For the context of the research question it is important to understand how gold miners perceive mining risks. After all, if miners do not find mining more risky than other jobs, then it is irrelevant to ask how risk influences decisions about gold mining. MacMillan (1995: 79) reports that small holders who go mining do not fully understand 'the realities of garimpo life, health risks, and the true nature of gold earnings'. I argue that the Ndjuka, in contrast, understand mining risks well. The narratives that I presented in chapter 5 support my position. I also found that 72% of gold miners (N=53) believed that gold mining was more dangerous than other jobs, 23% denied this and 5% did not know. Only 36% of gold miners said they found gold every month, while 62% said this was not the case. Further, 66% of Ndjuka believed that participation in gold mining increased the chances of getting malaria (N=142), 30% denied that, and 4% did not know. Based on these results and my experience in Suriname, I argue that Ndjuka miners are typically well aware of mining risks.

Econometric Model

I use one tobit regression to simultaneously test the risk and the poverty hypotheses. The dependent variable is the number of years that a person has been mining for gold. The logic is that the longer an individual mines, the greater the risks to his or her health and economic stability. The time-measure differs from a measure of present involvement in mining in that it allows me to include people who are no longer mining

today. In this way I decrease the bias that would result from the most successful miners leaving the mining industry. I include the dependent variable as the log of the number of years spent in mining. The coefficients in table 7-4 represent the percentage change in the time spent in mining due to one unit change in the explanatory variable, when all other explanatory variables are held constant.

Explanatory variables include a measure of risk tolerance, indicators of access to formal and informal income, and a measure of economic dependents. The risk hypothesis is supported if I find that the duration of mining positively relates to risk tolerance and access to alternative income sources. The poverty hypothesis is supported if I find that the most persistent miners are people with the least income alternatives who have most dependents. I control for sex and age. Sex is expressed as a binary called female that has the value of one if the person is a woman, and the value of zero if the person is a man. Age is a continuous variable.

My approach differs from most anthropological studies on risk by using a quantitative model to test ethnographic findings and existing theories. The approach allows me to estimate the relative importance of selected indicators, and can reveal reasons for mining that were not captured by qualitative interviews. Other than most econometric models, my model integrates material indicators with a measure of personal attitudes. In doing so I hope to offer a more inclusive representation of the forces that drive human behavior, which are likely a combination of material and ideological forces.

In the next section I operationalize the explanatory variables. I separately discuss individual risk tolerance, access to formal income, access to informal sources of income, and economic dependents. Definitions and summary statistics of the variables appear in

tables 7-2 and 7-3. I evaluate econometric problems and their treatment in the following section.

Explanatory Variables

Risk Tolerance

I used a Likert scale to measure attitudes towards physical risk. A Likert scale is a set of statements, to which interview participants express their opinion: agree-disagree, approve-disapprove, or favor-oppose (Bernard 1995: 297-305). Typically seven-point, five-point, or three-point scales are used. I used a three-point scale with 10 statements about activities that are familiar to the Ndjuka and perceived as hazards. A typical statement would be 'I am afraid to cross the rapids by canoe'. The Likert scale measures attitudes towards risks rather than actual behavior. Appendix D, section VI-B contains a description of the Likert scale that was administered. After collecting the responses, I recoded statements in the scale in such a manner that a positive answer on any question indicated a risk tolerant attitude and a negative answer indicated risk aversion. Tests of validity and reliability of the scale are discussed in Appendix F. The corrected scale contains 5 items and is internally reliable (Cronbach's alpha = 0.87).

Interviewees received a risk attitude score based on their responses to the statements. I calculated these scores as follows. I assigned a numeric value to each answer possibility (agree=1, disagree=0, neutral= 0.5) so that the set of statements can be perceived as a risk test on which different people score differently. Someone who

answered most risk tolerant to the 5 items in the scale, scored a 1 for each statement. I calculated the average risk tolerance (RT) -score of each person as

$$RT = \frac{(\text{sum of the answer scores})}{(\text{total number of responses})} * 100\%$$

This formula allowed me to include cases with a missing answer. The answer-scores range from 0% to 100%, and indicate whether someone is more risk tolerant (high score) or risk averse (low score). A maximum risk-taker would score 5 points divided by the 5 questions he or she answered, ending up with a total score of 100% on the risk tolerance scale. Bivariate analysis suggests that gold miners are more risk tolerant than others; the average gold miner (RT=73%) scored significantly higher on the risk tolerance scale than the average non-miner (RT=45%; $t=-5.10$, $p<0.001$).

Access to the Formal Labor Market

I measure access to the formal labor market by literacy, previous wage labor experience, and government employment. Literacy is expressed as the person's ability to read and write in Dutch. Previous wage labor experience is measured as the number of years that a person has worked in wage labor. I observed that several miners were government employees, suggesting that the flexibility of government jobs permits temporary engagement in gold mining. The receipt of public wages is included as a binary variable that has the value of one if the person is employed by the government.

Access to Informal Income

For those with little access to the formal labor market, informal jobs offer an alternative. The Ndjuka are typically involved in multiple informal jobs, including hosselen, raising livestock, agriculture, and river transport. I generated a binary variable that has the value of one if the person earned income from any one of these informal

sources in the year before the interview. Another informal way to deal with economic deficits is to borrow or receive gifts from friends and family. I include loans as a binary variable that has the value of one if the person reported that he or she was able to receive loans. The variable loans does not measure whether the person actually received loans, but whether the person believed that he or she could get a loan if needed. I included remittances as a binary variable that has the value of one if the person had received remittances from family abroad during the year before the interview.

Economic Dependents

People need more money when they have more economic dependents. I assume that people have more economic dependents when they have more children but fewer household members to help out financially. I measure economic dependency by the ratio of the number of children of the person, to the number of adults in the household.

Econometric Specification

I tested and corrected for heteroskedasticity, endogeneity, and multicollinearity. The Cook-Weisberg test indicated that the assumption of constant variance of error terms could not be rejected ($X^2=1.08$, $p>X^2=0.30$). Access to loans may be endogenous because credit arrangements are more common in the mining area than elsewhere among the Ndjuka. I keep this variable in the model because it is important to test the hypotheses. One could argue that the receipt of alternative income from informal labor or the government is endogenous because being a gold miner may prevent a person from exploring other job options. However, in my experience Maroons are not less likely to

engage in alternative labor just because they are gold mining; the average gold miner mined for less than seven months per year ($N=93$, $\text{Mean}=6.9$, $\text{SD}=3.0$) which leaves much time for engaging in other jobs.

I tested for multicollinearity and excluded educational measures that strongly correlated with literacy, such as education ($r=0.79$) and Dutch language skills ($r=0.73$). I found a strong negative correlation between being female and risk tolerance ($r=-0.61$), indicating that women in the sample were on average more risk averse than men. Despite multicollinearity I left risk tolerance in the model because the variable is important for testing the risk hypothesis. When I ran the model as an ordinary least squared regression I found small differences in the estimated social effect and statistical power of the coefficients, but not in their directions. I decided not to use the more common ordinary least squared regression because the tobit model better represents a functional form with many zero-values for people who have never been gold mining.

Results

The regression results for the model that predicts the duration of gold mining as a function of risk tolerance and economic indicators of risk and poverty management appear in table 7-4. Only the receipt of government income and the ratio of children to adults in the household are significant at the 95% confidence level. Government employees are estimated to spend 174% less time in mining than others ($t=-4.58$, $p<0.001$). Having more children and less adults in the household increases the duration of mining. People with twice as many children as adults in the household are estimated

to mine 10% more years than people with equal numbers of children and adults ($t=2.00$, $p<0.05$).

The remaining results are statistically weak. Risk tolerance has a negligible social effect; the coefficient ($\beta=0.002$) suggests that even a 100% difference in risk attitude - between the most risk averse and the most risk tolerant- would increase the duration of mining by only 0.2% ($t= 0.89$; $p=0.38$). Indicators of access to the formal labor market are negatively associated with working in mining. Literate people are estimated to spend 9% less time in mining than illiterates ($t=-0.45$, $p=0.66$), and wage labor experience decreases the number of years in mining by 15% ($t=-0.8$, $p=0.43$). People who earn income from informal labor or remittances are estimated to spend respectively 4% ($t=-0.19$, $p=0.85$) and 15% ($t=-0.37$, $p=0.71$) less time in mining. Access to loans is suggested to increase the number of mining years by 18% ($t=0.99$, $p= 0.32$).

Discussion

The risk hypothesis stated that Ndjuka will work longer in gold mining if they are more tolerant of physical risks and have better access to back-up resources. The results lead me to reject this hypothesis. Even though bivariate analysis suggested a significant positive relation between gold mining and risk tolerance, I found no proof of such a relation after controlling for gender. Not one miner mentioned entering mining with the expectation to strike it rich. One man responded to my inquiry if mining provided good chances of getting rich: 'I do not know any rich gold miners. When I get rich then I will leave.' I found no evidence for the exaggerated expectations of mining incomes that

others have reported (MacMillan 1995). Rather, Ndjuka gold miners estimated the economic prospect of mining in a realist fashion.

Economic security seems to discourage rather than encourage gold mining. The effect directions of the coefficients suggest that people who have access to formal labor or receive income from informal labor or remittances are less frequent miners. Only access to loans had a positive sign but this variable is likely endogenous. Several miners mentioned to continue mining until they would have enough money to leave mining and begin something else. The economic vulnerability of miners also appeared from their limited resilience to shocks. I frequently observed that small misfortunes such as an excess of rain, ill laborers, or broken equipment, caused bankruptcy of the machine owner. From these comments and observations I conclude that long-term miners are generally people who have little economic security.

The poverty hypothesis stated that Ndjuka will work longer in gold mining if they have more economic dependents and less access to income alternatives. The data fit the poverty hypothesis better than the risk hypothesis, but few results are statistically significant. I draw on ethnographic data to verify, control, and explain what is suggested by the statistics.

People become gold miners partly because they are the primary economic providers for their families. People with more children to support and less adult household members that could offer economic assistance, mined significantly longer than people with less economic dependents. Ethnographic data verify the economic responsibility of miners towards their families. In chapters 4 and 5 I presented several Ndjuka narratives that expressed the concerns of miners about their children and their

children's education. A female camp-boss (39) in Sella Creek explained how gold mining allows her to give her children a good education:

I am always busy hosselen, I cannot sit down. First I was selling, and I used my profits to buy a machine, a 4-cylinder, which cost a million guilders (approximately 1,500 US dollar). Four of my children go to school, one goes to the Havo [higher level high-school], and another one to the Mulo [medium level high-school]. Only one daughter is here. I pay for school with the gold mining income. I want my children to complete their education, then they can go somewhere else. In the early days you received child benefits, now you have to try everything you can.

Gold miners typically reported not only supporting their nuclear household. Many miners supported their mother, father, brothers, and sisters, or gave them pocket money. Because men are traditionally responsible for the family cash income, they mine on average significantly more than three times longer than women.

The results suggest that people with access to alternative income do not become gold miners. Only government employment is statistically significant, and seems a strong incentive to not participate in gold mining. Bono (29) acknowledges that the benefits of a formal job are that 'you are covered medically, and you receive AOV [Algemene Ouderdoms Voorziening; an old age pension].' However, he does not have a wage labor job because 'the city-system does not allow me to stay and work in the city. In a company, because you have not finished your education, you work below your capacities.'

The link to education in the above fragment appears in the narratives of many gold miners. Another miner confirmed that 'because I have not studied more, [mining] gives me the best income.' The negative link between education and mining was not significant in the quantitative analysis. A possible explanation is that because many Ndjuka are illiterate, literacy does not distinguish miners from non-miners within the

ethnic group. Because the literacy rates of the Ndjuka are much lower than the national average (chapter two), illiteracy may decrease the labor options of Ndjuka at a national level. Qualitative data that I presented in chapter 5 support this argument.

The remaining indicators of access to income are also statistically weak, but the direction of their effects agrees with the poverty hypothesis. Wage labor experience and the receipt of remittances seem to discourage mining. Gold miners also appear less likely than others to earn income from informal activities other than mining, including agriculture, transport, hosselen, and livestock. In conversations, Ndjuka miners mentioned that they did not have the capital to begin an informal business as a taxi driver, boatman, or shop owner. Mining is viewed as a temporary solution that allows one to save to start up something else.

Summarily, information obtained from the few significant results, the effect direction of the remaining results, and qualitative observations, suggests that the poverty hypothesis fits the data better than the risk hypothesis; risky behavior among the Ndjuka seems to be the outcome of poverty and marginality. Some studies support my argument. In Bolivia, Sanabria (1993) finds that poor peasants opt for an economically and politically risky crop such as coca when alternative income sources are inaccessible or pay too little. Mining researchers have likewise concluded that gold mining is a rational alternative when other livelihood options decline (Naughton 1993; Roopnaraine 1996). My findings contrast the explanation of MacMillan (1995:79) about why small-holders go mining:

[It is a] false impression that they mine because they are desperate and this is the only livelihood available to them. . . . Only a small fraction of professional garimpeiros depend entirely upon that form of employment for a living. Everybody else in the pit is there to supplement their other forms of income. . . .

The point here is that deterministic forces may play less of a role here than is often believed, and for this reason reducing poverty will not necessarily be reflected in smaller numbers of garimpeiros. . . . No doubt migration to the garimpos will continue as long as mining offers the slim possibility to strike it rich. (1995: 79)

According to MacMillan, small farmers go mining to earn extras, rather than out of necessity. In contrast, my research suggests that even though few people mine year-round, Ndjuka become gold miners when they do not have access to other employment that secures family survival. In contrast to what MacMillan argues, I believe that poverty relief and improved job availability will decrease the number of Ndjuka gold miners.

Conclusions

I draw two conclusions from the quantitative and qualitative findings. First, the realization that mining is not preferentially embraced by risk-takers proves negative stereotypes of gold miners as adventurous gamblers invalid. Second, gold mining is more attractive to people who are economically worst, rather than best, secured. People seem to tolerate mining risks when they have many economic dependents and few back-up resources. Several policy directions appear from these conclusions. An understanding that gold mining is a last resort rather than an adventure may be a first step towards more effectively communication of policy makers with miners. The analysis further suggests that public policy that improves the access of Ndjuka to employment, for example through education or the creation of public jobs, may discourage mining. The contrasting visions in risk research invite future research on the general patterns that underlie risky behavior among the poor.

Table 7-1. Physical and economic risks of different mining jobs, only listing risks other than the usual risks such as malaria

Job	Economic risk	Physical and Social risk	Male or Female?
<i>Camp boss</i>	inability to pay investment and operation expenses; bankruptcy	higher chance of being a victim of violent crime or robbery	M/F
<i>Pit-worker</i>	the risk of not earning an income versus the security of receiving food and shelter	work accidents that cause the loss of fingers or life; back pains from heavy work	M
<i>Cook</i>	low risk; usually receives a fixed wage	back problems, burns; female cooks confront sexual harassment	M/F
<i>Merchant</i>	not being paid for goods sold on credit	back problems from carrying heavy loads	M/F
<i>Sex worker</i>	not being paid for delivered services	sexual harassment or molestation; contracting sexually transmitted diseases; community disapproval;	F
<i>Carrier</i>	low, except when services are paid in credit	back problems from carrying heavy loads	M

Table 7-2. Definitions of the dependent, explanatory, and control variables

Variable	Definition
<i>Dependent</i>	
Log(Years in gold mining)	Log value of the total number of years the person has been gold mining
<i>Explanatory</i>	
Risk tolerance	Likert scale of risk tolerance, ranging from most the risk averse (RT=0) to the most risk tolerant (RT=100)
Public wages	Binary of receiving public wages, 1=The person is employed by the government, 0=The person is not employed by the government
Remittances	Binary of receiving remittances, 1=The person receives remittances, 0=The person does not receive remittances
Loans	Binary of access to loans, 1=The person is able to borrow, 0= The person is not able to borrow
Literacy	Binary of ability to read and write in Dutch, 1=The person is literate, 0=The person is illiterate
Wage labor experience	Number of years experience in wage labor, in years
Alternative informal jobs	Binary of whether the person receives income from any or all of the following sources: <u>hosselen</u> , livestock, agriculture, or transport, 1=The person receives income from at least one of these sources, 0=The person receives income from none of these sources
Ratio children-adults	The ratio of the number of children of the person, to the number of adult workers in the household
<i>Control</i>	
Female	Binary of sex (1=Female, 0=Male)
Age	Age of person in years

Table 7-3. Summary statistics

Variables	N	Mean	Std. dev.	Range
Years in gold mining	219	5.44	7.64	0-46
Risk tolerance	203	58.37	41.07	0-100
Public wages	217	0.09	0.29	0-1
Remittances	219	0.16	0.36	0-1
Loans	219	0.37	0.49	0-1
Literacy	219	.59	0.49	0-1
Wage labor experience	210	1.6	4.83	0-37
Alternative informal jobs	219	0.75	0.43	0-1
Ratio children-adults	214	2.03	2.08	0-13
Female	219	0.42	0.49	0-1
Age	219	34	13	16-79

Table 7-4. Regression results for the tobit model predicting the duration of mining

Variables	β	t (p)
Risk tolerance	0.002	0.89 (0.37)
Public wages***	-1.74	-4.58 (0.00)
Literacy	-0.09	-0.45 (0.66)
Wage labor experience	-0.15	-0.80 (0.43)
Informal income	-0.04	-0.19 (0.85)
Loans	0.18	0.99 (0.32)
Remittances	-0.15	-0.67 (0.51)
Ratio children-adults*	0.10	2.002 (0.05)
Female***	-2.18	-9.00 (0.000)
Age	-0.005	-0.58 (0.57)
Constant)***	1.89	4.34 (0.000)

Dependent: Log(Years in gold mining)

* $p < 0.05$

*** $p < .001$

Model information

N=194; 72 left-censored observations at Log(Years in gold mining) ≤ 0 , 127 uncensored observations

Log Likelihood = -235.38

X^2 ($P > X^2$) = 147.42 (0.000)

Pseudo R^2 = 0.2385

CHAPTER 8 CONCLUSIONS

Why do some people become small-scale gold miners, while others do not? I could conclude this dissertation by stating that mining is most attractive to poor men who have many dependents and few job options. Such an answer, however, does not capture the wide variation in responses to the gold rush in Suriname. It does not explain why poor and marginal men of other ethnic groups are not mining, why some poor Ndjuka choose to not be gold miners, and why women minimally participate in mining. Nor does it clarify why, despite poverty's historical presence, large numbers of Ndjuka have entered mining only during the past two decades. In this work I explained much of the variation in local responses to the Suriname gold rush.

In chapter one I made several predictions about the distant and approximate factors that encourage the participation of Ndjuka in small-scale gold mining (figure 1-1). I integrated diverse qualitative and quantitative methods to study these predictions (table 3-2). At the international level I predicted that the mining population would grow in response to rising gold prices, and shrink with rising prices of oil. Within Suriname I tested for the relative impacts of political and economic instability. At the local level I first analyzed the criteria that Ndjuka individuals considered when making decisions about gold mining. I used their responses to construct an ethnographic decision tree model. The decision model suggested that gender and risk differentiate personal decisions about mining.

Informed by qualitative findings and field observations, I hypothesized that women are less likely to be gold miners due to their reduced access to money, mobility, and acculturation, and their responsibility for childcare. Furthermore, because small-scale gold mining is economically and physically risky, I predicted that most likely to participate in mining are risk tolerant individuals who are best equipped to mitigate mining risks. A competing hypothesis stated that mining is the choice of people with many economic dependents and few back-up resources.

I supported some hypotheses, rejected others, and remain inconclusive about other predictions. Here I conclude with a model that integrates the findings from previous chapters (figure 8-1). Figure 8-1 organizes the drivers of small-scale gold mining in Suriname from larger to smaller levels of social organization. Represented by the continuous arrows, the model highlights the supported links between causal factors and small-scale gold mining. I provided either empirical or ethnographic evidence for these links. The dashed arrows indicate relations that likely exist, but for which the evidence is scanty due to data paucity or statistical uncertainty. Relations that I rejected do not appear in the model.

Driving Forces of Small-Scale Gold Mining in Suriname

Ndjuka small-scale gold miners respond to interrelated processes at the macro, intermediate, and small scale. Macro-scale analysis suggests that fluctuations in the global economy do not influence Ndjuka miners. The data only allowed for time-series analysis over a thirty-year time span, and its statistical power was weak. Nevertheless I can reject the existence of a positive relationship between gold prices and participation in

gold mining; increasing numbers of Ndjuka became miners while gold prices were falling. Neither did rising oil prices discourage people from entering mining. Qualitative data suggest that Brazilian migrant miners modernized and stimulated the growth of the Suriname small-scale mining industry. The absence of accurate documentation of the migration of garimpeiros prevented the analysis of its relative importance with quantitative methods.

Economic changes within Suriname have been more important than international economic changes in stimulating the local participation in gold mining since the 1980s. Many Ndjuka took up mining in response to inflation and unemployment. The effect of political instability, which escalated during the interior war (1986-1992), remained ambiguous. Even though political stability had little statistical power, interviews suggest that the interior war and its aftermath left the Ndjuka as a marginal ethnic group in Suriname, decreased their subsistence options, and encouraged gold mining. A significant structural break in the regression model before and after the onset of the interior war supports the qualitative data.

When asked about their reasons for gold mining, Ndjuka miners mention that there are no jobs other than gold mining, that available jobs pay insufficiently, and that they lack the educational skills necessary for better work. Miners also refer to discrimination in the city and prefer mining for its freedom from city bosses. Poor urban dwellers of other ethnic groups are less impelled to enter mining because they are typically unfamiliar with life in the forest, and averse to working there.

All Ndjuka are members of a poor and marginal ethnic group, but not all are equally likely or willing to become gold miners. Within the household and community,

gender influences the choice of an individual to either enter or avoid the small-scale mining industry. Among the Ndjuka there is a strong cultural expectation for men to financially sustain their families. For many men small-scale gold mining is the only job that allows them to meet this expectation. Meanwhile no local barriers exist to dissuade men from becoming miners.

Women are more restricted in their subsistence options than are men. The larger involvement of women in childcare, coupled with their reduced access to money, limits the access of women to mining. Contrary to expectation, I did not find empirical evidence that limited mobility and acculturation deny women access to mining. A provocative finding is that even with equal incomes, mobility, time spent on childcare, and acculturation, women are significantly less likely than men to become miners.

Ethnography provides several plausible explanations for the gender bias in mining. In Ndjuka culture it is respectable for men, but not for women, to mine or otherwise earn an independent income far from the home. Women reported to avoid mining out of fear of community or spousal sanctions, which may stigmatize and isolate women who break with expected gender roles. Further, women may less frequently participate in mining in part because menstrual taboos complicate working in the mining area. The comments of some women also suggested that they preferred staying in their communities rather than exposing themselves to the harsh conditions in the mining camps.

It follows from the above that Ndjuka men are more likely to pursue mining rather than another job, while the opposite is true of Ndjuka women. However, there are exceptions to this pattern, some of which were explained in the decision model. Non-

mining men tend to justify their choice by previously disappointing experiences in mining and by physical weakness due to illness or old age. Female miners were either the economic providers of their families or had joined their mining husbands. Qualitative analysis of the differences between mining and non-mining women suggested that single motherhood, urban residency, and previous engagement in marketing activities, allowed women to overcome gender barriers to entering mining. Emancipated women, like men, usually only became gold miners because they saw no economic alternatives.

I concluded the analysis with an investigation of risk. Because small-scale gold mining entails many physical and economic risks, it is likely that miners and non-miners perceive and manage risk differently. Notwithstanding the limited statistical power of the numerical analysis, I could draw several tentative conclusions. First, I reject the stereotype of gold miners as adventurous risk-takers. Second, it is unlikely that mining is the choice of Ndjuka who have most back-up resources. Rather it seems that Ndjuka who have many economic dependents and few income options tolerate the economic and health hazards of small-scale gold mining for the sake of family economic survival.

Lessons Learned

Through the analysis of the forces that drive of small-scale gold mining in Suriname, I touched upon larger questions of why people choose hazardous, uncertain, and ecologically damaging subsistence strategies. Inflation, poverty, and inequality are common themes that characterize both the mining environment in Suriname and other unsustainable land-use in Latin America (Arizpe, Paz, and Velázquez 1996; Painter and

Durham 1995; Sponsel, Bailey and Headland 1996; Schmink and Wood 1992; Stonich 1993; Stonich and DeWalt 1996). Yet in contrast to other Amazon countries, forest degradation in Suriname is not caused by population pressure, land scarcity, road-building, or national colonization policies (Moran 1993; Sanabria 1993; Schmink and Wood 1987, 1992; Wood et al. 1996). I agree with other researchers that gold miners are typically poor, poorly educated, and not competitive in local and national job markets (Cleary 1990; MacMillan 1995; Naughton 1993; Roopnaraine 1996). However, I question other existing explanations for mining, including the importance of gold prices and an adventurous character. A recurring theme in my and other studies is that poverty coupled with the elimination of traditional job options encourages ecologically damaging resource use.

My research addresses several methodological and theoretical gaps in existing anthropological research. First, my research is innovative in integrating quantitative with qualitative methods, and personal narratives with generalizing models. Risking rejection by both statisticians and postmodern anthropologists, I hope to have shown that the integration of methods produces more informative and convincing arguments than either method in isolation. Second, risk research among subsistence producers has primarily focused on peasants. To my knowledge I provide the first attempt to differentiate the risk attitudes of, and risks faced by, male and female miners and non-miners. Third, few researchers inquire why women might not enter mining in numbers similar to men. My research may be the first to explore in detail how gender inequality within the household and community limits the access of women to gold mining.

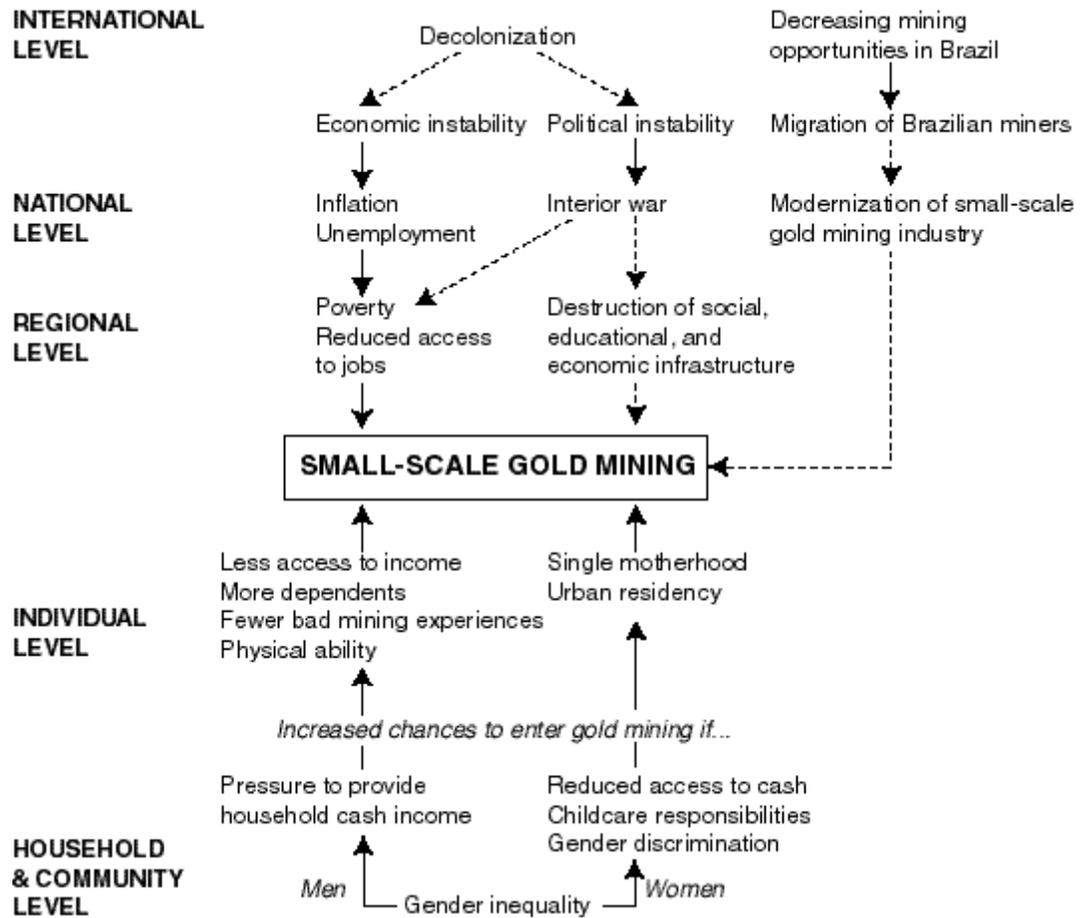


Figure 8-1. Driving forces of small-scale gold mining among the Ndjuka Maroons

The model organizes and links the drivers of small-scale gold mining in Suriname from the international level (at the top) to smaller levels of social organization (below). The arrows in the model indicate the direction of the relationships between processes at different levels of social organization and gold mining. The dotted arrows suggest links that likely exist, but for which no conclusive evidence could be presented.

APPENDIX A SUMMARY IN DUTCH

Waarom werken sommige mensen in de kleinschalige goudwinning, en waarom doen anderen dat niet? Deze vraag staat centraal in dit proefschrift, en is gerelateerd aan het theoretische vraagstuk waarom mensen kiezen voor een riskant en ecologisch destructief bestaan. Wetenschappers hebben zich verontrust uitgesproken over de negatieve consequenties van de kleinschalige goudwinning voor de volksgezondheid, het milieu, en voor de sociale cohesie in plaatsen waar goudwinning plaatsvindt. Desondanks ontbreekt de kennis van hoe goudbooms ontstaan, en wat mensen ertoe brengt al dan niet deel te nemen. In het algemeen blijkt de goudwinning een keuze van de armen, werklozen, en laaggeschoolden. Het blijft echter een raadsel waarom in dezelfde sociaal-culturele en economische omstandigheden, sommige mensen ervoor kiezen goudzoekers te worden en anderen niet.

Onderzoeksopzet

Antropologisch veldwerk bij de Ndjuka marrons in Suriname vormt de basis voor deze studie. De marrons zijn afstammelingen van ontsnapte Afrikaanse slaven die onafhankelijke gemeenschappen stichtten in het regenwoud. Men schat dat er ongeveer 50,000 marrons in Suriname wonen, verdeeld over zes groepen die politieke en sociaal-cultureel vrij autonoom zijn. Van alle etnische groepen in Suriname nemen de marrons het actiefst deel aan de goudwinning. Met ongeveer 25,000 leden vormen de Ndjuka één van de grootste marrongroepen. Zij leven voornamelijk in Oost Suriname en Frans Guiana, langs de Marowijne en de Tapanahoni rivieren, in het Cottica gebied en langs de Sara Kreek. De Ndjuka werken meer in de goudwinning dan leden van andere marrongroepen. Ik onderzoek de redenen voor de explosieve groei in de Surinaamse goudsector sinds de jaren tachtig, en voor de participatie van individuele Ndjuka die verschillen in leeftijd, sexe, rijkdom, en andere karakteristieken.

Methoden

Veldwerk werd verricht in goudzoekerskampen, in Ndjuka dorpen in het binnenland, en in de hoofdstad Paramaribo. De studie werd voornamelijk uitgevoerd in de goudzoekers regio Sella Kreek en in de dorpen Drietabbetje en Mooitaki. De mijnbouw in Sella Kreek is bovengronds, bereikt ongeveer vijf meter diepte, en wordt voornamelijk verricht met hydraulische methoden. Interviews werden afgenomen met mannen en vrouwen, goudzoekers en andere marrons.

Ik definieerde als goudzoeker een ieder die zich in het goudwinningsgebied ophield en een inkomen verdiende in de goudwinning of daaraan gerelateerde diensten. Behalve de kampbazen en gouddelvers omvat deze definitie ook de koks, hosselaars, sexwerkers, dragers, en anderen. De ruime definitie werd verkozen omdat individuen vaak wisselden van baan of meerdere banen tegelijkertijd verrichtten. Iemand die komt

als winkelier kan een week later als delver werken. Kampkoks (m/v) vullen hun inkomen vaak aan door voedingswaren en sigaretten te verkopen. Onder een ruime definitie was de classificatie van deze personen duidelijker. Verder was de belangrijkste beslissing voor velen of zij al dan niet in Sella Kreek gingen werken, en op de tweede plaats kwam de keuze voor het type werk.

Onderzoeksmethoden omvatten zowel kwalitatieve en kwantitatieve methoden voor data verzameling en analyse, en zijn opgesomd in tabel 3-2. Ik koos voor een brede methodologische aanpak om verschillende redenen. In dit relatief nieuwe onderzoeks-terrein is het onzeker welke methoden het beste resultaat zullen opleveren. Verder hoop ik aan te tonen dat de integratie van kwalitatieve en kwantitatieve methoden, en van lokale en grootschalige factoren, een vollediger beeld oplevert dan één van deze methoden apart. In de derde plaats geloof ik dat de antropologie baat heeft bij experimenteren met nieuwe manieren van onderzoek en data-analyse, die al dan niet een beter resultaat opleveren.

Voorspellingen

Ik voorspelde dat verschillende factoren de explosieve deelname aan de goudwinning hebben veroorzaakt (figuur 1-1). Ik verwachtte dat het aantal goudzoekers zou toenemen met stijgende internationale goudprijzen en dalende wereldolieprijzen. In navolging van bevindingen in andere landen, voorspelde ik dat dat politieke en economische instabiliteit binnen Suriname een toename in de goudwinning zouden veroorzaken. Op lokaal niveau werd gekeken naar gender en risico. Ik schatte dat slechts één op elke 15 tot 25 Ndjuka goudzoekers een vrouw was. De genderhypothese stelde dat Ndjuka vrouwen worden weerhouden van participatie in de goudwinning door hun gebrek aan geld, mobiliteit en acculturatie, en hun verantwoordelijkheid voor de kinderopvang. Risicogedrag leek belangrijk omdat goudwinners dagelijks veel economische en gezondheidsgevaaren confronteren. De risicohypothese stelde dat goudzoekers in vergelijking met andere marrons geneigd zijn meer risico's te nemen, en meer alternatieve inkomstenbronnen hebben om economische tegenvallers te compenseren.

Resultaten

Internationale en Nationale Factoren

Uit tijdserie regressie analyse blijkt dat Ndjuka goudzoekers niet reageren op prijsveranderingen op de wereldmarkt. Slechts een periode van dertig jaar werd bekeken, en de resultaten waren statisch gezien matig. Desondanks kon worden vastgesteld dat, in tegenstelling tot wat andere onderzoekers hebben beweerd, er geen positieve relatie bestaat tussen goudprijzen en het aantal goudzoekers. Stijgende olieprijs waren evenmin van invloed. De migratie van Braziliaanse goudzoekers lijkt belangrijk voor de groei en modernisering van de goudsector. Deze relatie kon niet worden getest met kwantitatieve methoden vanwege het gebrek aan data voor de veelal illegale migratie.

Op nationaal niveau bleken de aanhoudende inflatie en de stijgende werkloosheid in Suriname gedurende de laatste twintig jaar een belangrijke motivatie om de goudsector te betreden. De Surinaamse bevolking incasseerde de stijgende kosten voor levensonderhoud. Voedselprijzen vertienvoudigden tussen 1990 en 1997, en van mei 1998 tot mei 1999 rezen consumenten-prijzen met 102%. Hoge inflatie maakt de goudwinning

aantrekkelijker omdat de kampbaas in de goudwinning alle kosten op zich neemt. Inflatie resulteerde ook in een verlaging van de koopkracht van werkenden in Paramaribo. De goudprijs is daarentegen gekoppeld aan een meer stabiele wereldprijs. De invloed van politieke instabiliteit kon niet kwantitatief worden aangetoond. Verhalen van inwoners suggereren dat de binnenlandse oorlog (1986-1992) de Ndjuka heeft gemarginaliseerd binnen de Surinaamse maatschappij. Door de toenmalige vernietiging van de economische, educatieve, en sociale infrastructuur in het binnenland zijn de huidige kansen van Ndjuka op de arbeidsmarkt geminimaliseerd.

Lokaal Niveau: Beslissingenmodel

In hoofdstuk 5 analyseer ik de redenen die Ndjuka individuen zelf geven voor participatie in de goudwinning. De antwoorden zijn gestructureerd weergegeven in een etnografisch beslissingenmodel (figuur 5-5). Dit model voorspelt het gedrag van 95% van een nieuwe groep Ndjuka correct. Uit de analyse bleek dat Ndjuka de economische belangen tegen de risico's van de goudwinning af te wegen. Gender speelt hierbij een belangrijke rol: mannen en vrouwen hebben verschillende taken en confronteren verschillende risico's in de goudwinning.

Van mannen wordt verwacht dat zij het huishouden financieel onderhouden. Zij worden goudzoekers omdat er geen andere banen zijn voor iemand met hun beperkte scholing, omdat andere banen niet voldoende geld opleveren, en voor de onafhankelijkheid van een baas in de stad. De enige redenen om geen goudzoeker te worden zijn ouderdom, ziekte, of een negatieve ervaring met de verdiensten of de gezondheidseffecten in de mijnbouw. Vrouwen reizen naar het goudwinningsgebied als zij een goudzoeker als echtgenoot hebben of als zij economisch verantwoordelijk zijn voor hun familie in de stad. De vrijheid van vrouwen worden beperkt door transport, de verantwoordelijkheid voor het huishouden en kinderen, en het verbod van echtgenoten.

Gender

In hoofdstuk zes gebruikte ik een probit regressiemodel om de factoren die vrouwen weerhouden deel te nemen aan de goudwinning verder te onderzoeken. Uit de statistische analyse blijkt dat vrouwen deels worden beperkt in hun bewegingsvrijheid door hun beperkte cash inkomen en hun grotere verantwoordelijkheid voor de verzorging van kinderen. In tegenstelling tot de verwachting vond ik geen bewijs voor de rol van beperkte mobiliteit en acculturatie.

Verrassend is dat zelfs met gelijke inkomens, mobiliteit, akulturatie en de tijdsbesteding aan kinderverzorging, vrouwen nog 29% minder kans hadden om goudzoekers te worden. Etnografie biedt verschillende plausibele verklaringen voor deze observatie. De Ndjukacultuur verwacht van mannen dat zij een onafhankelijk inkomen verdienen ver van huis, maar accepteert dit niet van vrouwen. Vrouwen vertelden dat zij de goudwinning vermeden omdat zij bang waren voor de afkeuring van de echtgenoot en de gemeenschap. Omdat vrouwen over het algemeen afhankelijk zijn van de echtgenoot en van relaties met burens en familie, heeft verstoting door de gemeenschap voor gepast gedrag serieuze consequenties voor een vrouw en haar kinderen. Het is ook waarschijnlijk dat menstruele taboes vrouwen weerhouden om in de goudgebieden te werken. Verder vertelden verschillende vrouwen dat zij bij voorkeur de gevaren en het

harde leven in de goudkampen vermeden. Vrouwen die de genderbarrières doorbraken waren vaak alleenstaande moeders uit de stad die ervaring hadden met hosselen. Deze sociaal en economisch meer autonome vrouwen participeerden alleen in de goudwinning als zij geen andere uitweg zagen om in het onderhoud van hun familie te voorzien.

Risico's

De goudzoekerij brengt veel risico's met zich mee, zoals onzekere inkomens en contracten, de aanwezigheid van criminelen, en besmetting met tropische ziekten zoals malaria. Verder zijn er beroepsspecifieke risico's, en verschillen de risico's van mannen en vrouwen (tabel 7-1). Mijnwerkers hebben rugklachten, zijn het slachtoffer van ongevallen, en verdienen een onzeker percentage van de opbrengst. Sexwerkers hebben een grote kans op infectie met seksueel overdraagbare ziektes. Net als anderen die op krediet betaald worden, zoals winkeliers, klussers en dragers, lopen zij het risico niet betaald te worden voor geleverde goederen of diensten. Verder lopen vrouwen extra risico's van seksuele intimidatie en het verkrijgen van een losbandige reputatie.

Gezien het scala aan economische en fysieke risico's voorspelde ik in hoofdstuk zeven dat goudzoekers risico-toleranter waren dan anderen, en beter uitgerust om economische tegenvallers op te vangen. De stelling werd getest met een tobit regressiemodel. De veelal statistisch zwakke resultaten werden aangevuld met kwalitatieve observaties. De stereotypering van goudzoekers als avonturiers en gokkers werd verworpen. Goudzoekers bleken niet meer of minder risico te accepteren dan andere Ndjuka. In tegenstelling tot wat andere onderzoekers hebben gesteld vond ik geen bewijs voor overdreven verwachtingen van fortuin in de goudwinning. Het is ook onwaarschijnlijk dat goudwinners de beste economische compensatie mogelijkheden hebben. Juist de personen met meer mensen die van hen economisch afhankelijk zijn, en die minimale toegang tot de arbeidsmarkt hebben, blijken de risico's in de goudwinning te accepteren voor het welzijn van de familie.

Bijdragen

De analyse van de de goudwinning in Suriname draagt bij aan algemene kwesties betreffende waarom mensen kiezen voor een gevaarlijk, onzeker, en ecologisch destructief bestaan. Een terugkerend thema in dit werk en andere studies is dat wanneer armoede gekoppeld is aan de eliminatie van traditionele arbeidsmogelijkheden, de kans op duurzaam gebruik van natuurlijke hulpbronnen nihil is. Het onderzoek vult verschillende theoretische hiaten op. Het is weinig onderzocht waarom vrouwen en mannen niet gelijkwaardig deelnemen aan de goudwinning. Mijn onderzoek verklaart de link tussen gender ongelijkheid in het huishouden en in de toegang tot de goudwinning. Ten tweede, onderzoek naar risicogedrag heeft zich voornamelijk bezig gehouden met kleinschalige boeren. Naar mijn weten is dit de eerste studie die de risico's van de heterogene goudzoekerspopulatie beschrijft, en die zoekt naar verschillen tussen hoe goudzoekers en leden van een toepasselijke controle groep risico's aanvaarden en confronteren.

APPENDIX B
LIST OF DEFINITIONS OF RELEVANT AND FOREIGN WORDS

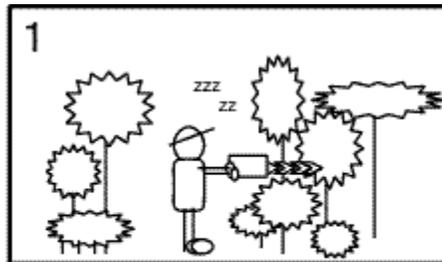
The list below contains definitions of foreign words and other terms relevant to the dissertation. The meaning of concepts in this dissertation may or may not be the same as their meaning in other work. The words are organized in alphabetical order.

Word	Definition/Translation
Apadonsiri:	Purple pulp from the fruits of the Assai palm (<i>Euterpe oleracea</i>). Apadonsiri is popular among Maroons and Brazilians, who eat it pure or add sugar or baked cassava crumbs (<u>kwakka</u>). The pulp is said to strengthen the blood.
Basia:	Assistant in the Maroon governing system, responsible for delivering messages, services for the higher authorities, and a participant in decision-making. Each matrilineal clan has at least one basia.
Baté (batea):	Mining equipment, a circular metal pan with a pointed bottom, 40-60 cm in diameter.
Beló:	Down river; Ndjuka matrilineal clans have traditionally been divided into those living upriver and those living down river. Belo refers to the territory along the upper Tapanahony river, north (or down river) of its confluence with the Lawa river.
Buitenvrouw:	Extramarital partner
Garimpeiro:	Brazilian word for small-scale or informal gold miner; the garimpo is the mining area and garimpagem refers to the activity of mining. In Suriname the term garimpeiro refers to Brazilian miners.
Gold miner:	In this study a gold miner is anyone who is present in the mining area and is part of the mining industry or of the surrounding service economy.
Granman: or Gaanman (Ndjuka)	Paramount chief. Each Maroon group in Suriname has its own granman who is the head of the group's political hierarchy. All important decisions affecting Ndjuka life are taken collectively by the granman, other local authorities, male elders, and usually some senior women.

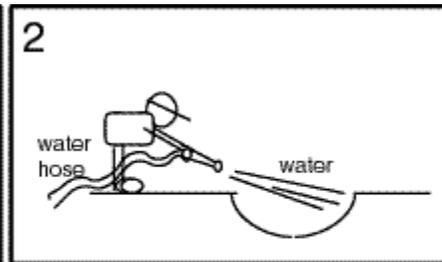
Hosselen:	Informal trade of goods and services (verb).
Kapitein: or Kabiten (Ndjuka)	Headman. Each matrilineal clan has at least one kapitein who governs the village in name of the granman.
Kina:	Religious taboo, often ordered by ancestral spirits and place specific. Examples of kina are menstrual taboos, taboos on incest, and taboos on working on a specific day of the week (often Saturday or Sunday).
Kwakka:	Cassava product, in Brazil known as <u>farinha</u> . Women make kwakka by grading cassava and roasting the pulp, creating a crispy cassava crumbs. Kwakka is a main staple among the Maroons, and popular for travel or work in the forest because it does not decay.
Longtom:	A long and narrow type of sluicebox, often used in manual or low mechanized operations that use water.
Maroons:	Descendants of escaped slaves who established independent communities throughout the Americas. Suriname Maroon communities have maintained a large degree of cultural and political autonomy. Suriname Maroons refer to themselves as <u>Busi nengée</u> or <u>Bosnegers</u> .
Ndjuka:	The Ndjuka are one of the six Maroon groups in Suriname, and refer to themselves as Ndjuka. The name Okanisi (in Dutch: Aukaners) is also used. In the literature the Ndjuka are known as 'Djuka' or 'Djoeka', and 'Aukaners' or Aucaners'.
Opo:	Upriver; Ndjuka matriclans have traditionally been divided in those living upriver and those living down river. Opo refers to the territory along the upper Tapanahony river, south of its confluence with the Lawa river.
Obia (obeah):	(Super)natural power that is available to people. Objects can be charged with natural power and carried along as amulets. On other occasions the concept is used for invading spirits.
Pangi:	Piece of cloth, worn as a skirt, apron, cape, or waist kerchief. As girls approach adolescence, they exchange the waist-string of infancy for a pangi. A pangi-girl is a girl that has outgrown infancy.
Porknokkers: (Porknockers)	Term used throughout the Guianas to name small-scale, informal, gold miners. City residents and newspapers in Suriname use the name porknokkers, often negatively, but the gold miners themselves do not.

- Sluicelox: Mining equipment consisting of two or three flat wooden boxes, with a length of 2.3-3.5 m, and a width of 15-100 cm. (see also Appendix C). When gold-bearing material flows through the sluicelox, gold particles are trapped in the boxes.
- Small-scale gold mining: gold mining that is characterized by:
-Informality; large degree of independence of social, legal, and economic regulations implemented by the national government, and
-A labor force that is not formally trained in mining and has a low educational background in general.

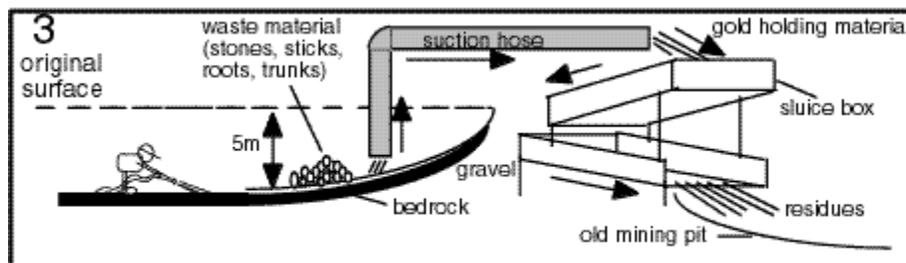
APPENDIX C HYDRAULIC SMALL-SCALE GOLD MINING METHODS



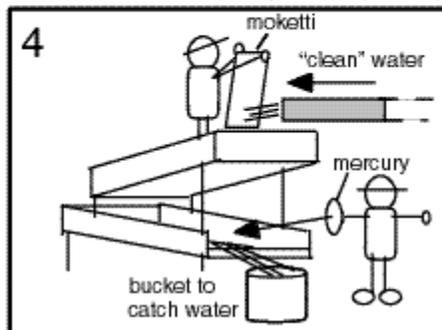
1 First, the forest is cleared. The cleared area is about 80 x 80 m,



2 Next, hydraulic power is used to remove the topsoil, and later the gold bearing layer of sand and clay. This work is done by teams of about 6 persons



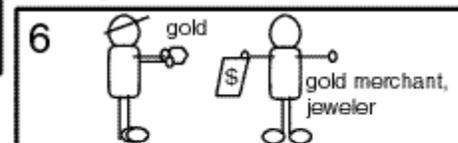
3 Gold bearing slurry is sucked away and pumped into the sluice box. The bottom of the sluice box -a construction of two to three wooden boxes- is covered with furry material called moketti in Suriname. The moketti captures the heavier gold and stones, while residues wash away, often into a previously used mining pit. As a mining pit is cut, waste materials such as stones and branches, are placed in piles to prevent them from clogging up the suction hose



4 After about three weeks of work, the moketti is washed out, using clean water. The gold particles previously held by the moketti are captured by the application of mercury in the lower box. Mercury binds with gold to form easily removable lumps. A bucket is placed beneath the sluice box to prevent the loss of the gold that remains in the waste water. The material caught in the bucket is later washed using a bate, an iron, pointed gold-pan



5 The mercury-gold amalgam is burned off in a bate. In this process, the mercury evaporates and the gold is left behind



6 Finally, the gold is sold to licensed gold-buying houses or to informal jewelers and gold traders. The current price of gold is about 8 US\$ per gram. Most workers in Sella earn about 30 to 50 grams per month, while those in more successful operations earn up to 100 or 150 grams per month.

APPENDIX D
SURVEY PROTOCOL

I. Personal Data

1. Name
2. Age in years
3. Place of birth (open ended)
4. Place of residency (open ended)
5. Sex (0=Female, 1=Male)
6. Head of household (0=No, 1=Yes)
7. Occupation (open ended)
8. Nationality (1=Suriname, 2=Dutch, 3=French, 4=other)
9. Years of formal education
10. Literacy (0=Illiterate, 1=Literate)
11. Ability to write name (0=No, 1=Yes)
12. Ability to read time (0=No, 1=Yes)
13. Languages spoken (a=Ndjuka, b=Sranan, c=Dutch, d=Portuguese, e=English, f=French, g=Other)
14. Father's maximum education in years
15. Mother's maximum education in years
16. Clan affiliation (1=Ndjuka, 2=Saramacca, 3=Aluku, 4=Paramacca, 5=Matawai, 6=Kwinti)

II. Household Composition; Pooling of Resources and Labor

1. Number of legal or common law partners
2. Number of children
3. Number of household residents
4. In addition to your primary job, what additional work do you do to sustain yourself? (open ended)
5. If you earn money or produce food, do you share with your partner? (No=0, Yes=1)
6. What/how much do you give? (open ended)
7. If you earn money or produce food, do you share with your extended family? (No=0, Yes=1)
8. What/how much do you give? (open ended)
9. With whom do you share most? (open ended)
10. Does your husband/wife share with you? (No=0, Yes=1)
11. What/how much does he/she give you? (open ended)
12. Does your extended family share with you? (No=0, Yes=1)
11. What/how much do they give you? (open ended)
12. Who would you ask for a loan? (open ended)

13. Who would you ask for help with work? (open ended)

Men only

14. Did you clear forest for a subsistence ground for your wife this year? (No=0, Yes=1)

15. Did you clear forest for a subsistence ground for someone else this year? (No=0, Yes=1)

16. For whom? (open ended)

Women only

14. Did your husband clear forest for a subsistence ground for you this year? (No=0, Yes=1)

15. Did someone else clear forest for a subsistence ground for you this year? (No=0, Yes=1)

16. Who? (open ended)

III. Health

1. Have you been ill this year? (No=0, Yes=1) How long? (in weeks)

2. How many malarias have you had in your life?

3. Did your near family experience malaria this year? (No=0, Yes=1)

IV. Assets, Income, Land

A. Assets

Do you own (0=No, 1=Yes):

a. House in the interior

b. House in the city

c. Paddle

d. Canoe

e. Motorized canoe

f. Golden teeth

e. Flashlight

h. Capital equipment (e.g. chain-saw)

i. Gun

j. Golden jewelry

k. Radio/TV

l. Mining camp

m. Western medicine

n. Mosquito netting

o. Livestock (e.g. chickens, ducks)

B. Income

Do you receive income from any of the following sources (0=No, 1=Yes):

a. Remittances

b. Agriculture

c. Trade

d. Transport

e. Owning a mining machine

f. Sociale services (e.g. pensions, child bennefits)

g. Civil service

h. Wage labor

i. Gold mining

j. Livestock

k. Credit

3. What was your income over the past year (cash money or product-value)

4. How much income does your partner generate/month? (cash money or product-value)

5. Do you have wage labor experience? (0=No, 1=Yes)
- 6.a. If No: Why not? (open ended)
- 6.b. If Yes: When and for how long did you work/have you worked in wage labor? (open ended)
7. How much did you earn in your wage labor job(s)? (in local currency)

IVC Land

1. Do you own land? (0=No, 1=Yes)
2. What kind of land? (e.g. agriculture, fallow; open ended)
3. How far away is your land? (in time walking, by canoe)

V. Labor Allocation

1. How often do you engage in:

1= Never	3= A few times per year	5= Every week
2= Once a year	4= Every month	6= Every day

- | | |
|------------------|----------------------------------|
| a. Cooking | g. Work with technical equipment |
| b. Childcare | h. Wood carving |
| c. Clearing land | i. Agriculture |
| d. Hunting | j. Trade |
| e. Gathering | k. Wage labor |
| f. Fishing | l. Gold mining |

2. How much time per year do you spend in Paramaribo? (in months)
3. How much time per year do you spend in Sella? (in months)
4. How much time per year does your husband/wife spend in Sella? (in months)

VI Gold Mining as a Risky Activity

The Likert-scales below are coded in the following way:

1=agree, 0.5 =neutral/don't know, 0=disagree

Do you agree or disagree with, or feel neutral about, the following statements:

A. Risk perceptions.

1. Participation in gold mining increases the chances of getting malaria.
2. People fight more in the mining area than elsewhere.
3. Gold mining is more dangerous than other work.
4. As a gold miner, you find gold every month.
5. There is as much malaria in the villages as there is in the mining area.
6. Working with mercury damages your health.
7. As a gold miner, you have a good chance of becoming rich
8. If you know how to use it, mercury is not dangerous.
9. As a miner, you might not find any gold for one or two months.
10. Gold mining is not more risky than other work.
11. There is more evil (*ogíi*) in the mining area than there is in the city.

B. Risk seeking versus risk averse attitudes

1. I like gold mining
2. When I encounter a snake I will kill it
3. I am afraid when I walk alone in the forest
4. I don't like to go outside at night
5. I like to gamble
6. I walk on my own to other fields, camps
7. I run away when I see a snake
8. I am afraid when I pass the rapids by boat
9. I will fight/protest if the government sells the forest
10. I have been involved in gunfight

VII. Mining experiences

1. When did you go gold mining for the first time? (year) Where? (open ended)
2. How did you get the idea to go mining? (open ended)
3. Who took you to the mining area? (open ended)
4. In what mining area do you work now? (open ended)
5. Have you worked in other mining areas? (0=No, 1=Yes)
6. Why do you work as a gold miner? (open ended)
7. Does mining pay more than other jobs? (0=No, 1=Yes)
8. Where do you sell your gold? (open ended)

VIII. Future perspectives*gold miners*

1. For how long do you want to continue mining? (open ended)
2. When you quit mining, what do you want to do? (open ended)
3. Do you want your children to become gold miners? (0=No, 1=Yes)

non gold miners

1. Do you have any desires for the future, something you would like to do or have? (open ended)
2. What do you want your children to do when they grow up? (open ended)

APPENDIX E
RAW DATA FOR INTERNATIONAL AND NATIONAL INDICATORS¹

International Indicators

year	nominal gold price (US\$)	nominal oil price (US\$)	US CPI	real gold price (US\$)	real oil price (US\$)	ex- change rate	Sur. CPI	real gold price (1000 Sfl)	real oil price (Sfl)
data	a	b	c			d	e		
1970	552.96	1.80	27.05	151.08	.39	1.885	0.15	681	2215
1971	570.37	2.13	28.45	163.90	.48	1.785	0.15	669	2500
1972	753.61	2.46	29.65	225.71	.57	1.785	0.16	862	2819
1973	1120.95	3.14	31.32	354.67	.78	1.785	0.17	1145	3212
1974	1512.81	12.41	34.14	521.67	3.45	1.785	0.20	1333	10932
1975	1281.38	13.88	37.34	483.27	4.23	1.785	0.22	1050	11378
1976	888.13	13.47	39.53	354.60	4.36	1.785	0.24	666	10100
1977	927.03	14.53	42.08	394.02	5.03	1.785	0.26	639	10007
1978	1048.37	14.56	45.13	477.94	5.46	1.785	0.28	669	9290
1979	1377.64	21.54	49.00	681.92	9.10	1.785	0.32	771	12060
1980	2213.26	33.97	53.53	1196.87	16.59	1.785	0.36	1094	16798
1981	1375.96	37.07	58.57	814.10	20.18	1.785	0.39	626	16862
1982	997.18	33.59	62.26	627.17	19.50	1.785	0.42	423	14242
1983	1045.40	29.35	64.90	685.38	17.60	1.785	0.44	425	11918
1984	821.34	28.87	67.36	558.87	18.09	1.785	0.46	322	11305
1985	675.34	27.00	69.68	475.31	17.55	1.785	0.51	239	9536
1986	748.96	14.32	71.50	540.94	9.49	1.785	0.60	223	4262
1987	910.02	18.05	73.69	677.39	12.40	1.785	0.92	177	3501
1988	773.12	14.62	76.38	596.52	10.48	1.785	0.99	140	2643
1989	617.75	18.07	79.60	496.74	13.60	1.785	0.99	111	3242
1990	565.16	22.20	83.06	474.18	16.29	1.785	1.21	83	3272
1991	492.31	18.74	86.36	429.44	15.57	1.785	1.53	58	2192
1992	441.66	18.12	88.73	395.87	15.51	1.785	2.19	36	1475
1993	437.13	16.66	91.07	402.12	14.71	1.785	5.34	15	557
1994	443.99	15.41	93.24	418.17	13.97	134.12	25	238	8266
1995	422.63	17.15	95.39	407.25	15.99	442.23	83.9	223	9039
1996	406.68	20.58	97.19	399.25	19.78	401.26	83.3	196	9910
1997	331.02	18.62	99.00	333.42	18.32	401	89.3	149	8363
1998	288.38	12.13	100.0	303.91	12.13	401	100	116	4862
1999	263.70	11.00	100.9			764.9	172	117	4892

National Indicators

year	CPI	unemployment (%)	openness	SNM
source	c	f	g	h
1970	0.15	2.5	.	5
1971	0.15	1.1	.	5
1972	0.16	1.0	.	0
1973	0.17	2.2	0.88	0
1974	0.20	2.4	1.09	0
1975	0.22	.	1.02	3
1976	0.24	4.2	0.99	13
1977	0.26	3.3	0.98	18
1978	0.28	3.0	0.94	17
1979	0.32	2.8	0.97	18
1980	0.36	2.7	1.14	20
1981	0.39	4.2	1.03	21
1982	0.42	8.2	0.91	26
1983	0.44	11.9	0.82	34
1984	0.46	14.4	0.72	38
1985	0.51	18.8	0.64	52
1986	0.60	14.9	0.66	55
1987	0.92	21.4	0.56	60
1988	0.99	22.7	0.59	62
1989	0.99	17.1	0.65	61
1990	1.21	17.1	0.59	73
1991	1.53	17.2	0.46	79
1992	2.19	17.2	0.33	86
1993	5.34	14.7	0.35	95
1994	25.00	12.7	1.80	103
1995	83.90	8.4	2.45	107
1996	83.32	11.00	1.62	113
1997	89.27	10.00	2.05	118
1998	100.00		1.21	123
1999	172.00			128

¹ data for 1999 are calculated up to August

Data Sources

a: US Geological Survey (pers. com, February 1998). Most recent monthly rates that were used for 1998-August 1999 are available at <http://www.kitco.com/gold-history>.

b: United States, Energy Information Administration, January 1999.

Originally published by the Department of Energy's Office of the Strategic Petroleum Reserve, Analysis Division. Updates for 1995, 1996, 1997, and 1998 are from the Energy Information Administration.

c: US Gross Domestic Product Implicit Price Deflator, which is available at <http://www.economagic.com/> (base = 1998)

d: Exchange rates for conversion of US\$ to Sfl from IMF International Financial Statistics Yearbook.

e: General Bureau of Statistics, Section Consumer Price Index numbers (ABS 1997: 36), data on 1997 from ABS (1998b), data on 1999 from IMF 1999

f: Unemployment:1970-1991: UN Statistical Yearbook (conversions to % by the author); 1992-1995: Central Bureau of Statistics, Table 8.2 Pp 42 (ABS 1997); 1993-1997: Households in Suriname 1993-1997. Suriname in Figures # 181: 1998/01 (ABS 1998a: 12 & 20).

g. Openness = (Imports + Exports)/GDP. Rates were obtained from IMF International Statistical Yearbooks.

h. SNM = number of persons who newly entered gold mining in a given year - number of persons who quit gold mining in a given year, using survey data from upper-Tapanahony region.

APPENDIX F MEASURING RISK TOLERANCE

The initially constructed Likert scale contained 10 statements regarding the physical risks that Ndjuka confront regularly. During the first six weeks of fieldwork, I used the responses of 63 test-observations to test the scale for face validity. I corrected the scale by deleting some statements, and adding or reformulating others, based upon my impression of how well the statements measured risk tolerance (Bryman and Cramer 1997). Correcting the scale in the field allowed me to return to people, and to make sure that the people in the test-sample responded to the corrected questions. This procedure allowed me to include people from the test sample in the final sample.

The corrected statements that were administered are listed in Section VI.b of the Survey Protocol that appears in Appendix D. A total of 203 people responded to the adjusted scale, which like the original scale contained 10 items. I used the results for the complete sample to test for validity and reliability. Statements 5 ("I like to gamble") and 10 ("I have been involved in gun fight") were omitted because practically none of the participants had these experiences. I tested the eighth leftover statements for internal reliability using the Cronbach's alpha procedure and factor analysis (Bernard 1995; Bryman and Cramer 1997). Reliability refers to the internal consistency or unidimensionality of the scale. A scale is reliable if all answers measure a single idea (Bernard 1995). The results from these tests made me delete the items that produced the most error (keeping statements 2,3,6,7 & 8). The final scale of personal tolerance towards physical risk contains 5 items and is reliable ($\alpha = 0.87$). There is one main factor underlying the scale, indicating unidimensionality of the scale.

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BIOGRAPHICAL SKETCH

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