Informal sector dynamics in times of fragile growth: the case of Madagascar

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Abstract

This chapter investigates the dynamics of the informal sector in Madagascar during the 1995-2004 period, which was characterized by sustained growth that ended due to a major political crisis. As conventionally assumed by simple dualistic models, the informal sector indeed fulfills a labor absorbing function in times of crisis. However, informal business creation was also a major trend both during macroeconomic growth and during crisis and recovery. Growth in the informal sector was mostly extensive, with little job creation or capital accumulation. Although such a situation would be consistent with the existence of poverty traps, estimates of marginal returns to capital tend to reject this hypothesis. Certain activities appear counter-cyclical, which points to a degree of heterogeneity within the informal sector. Overall, the behavior of informal firms in terms of earnings, employment and capital accumulation, corresponds to an analytical view of informal activities that goes beyond a simple dualistic model.

Keywords: Informal sector, microenterprise, firm growth, capital returns, Madagascar

JEL codes: O12, O17, L26, D22

1 Introduction

The informal sector is the main source of income and employment for most urban households in the developing world. The informal sector is defined as employment in unincorporated enterprises that are not registered or do not keep any written accounts.[1] Traditionally, informal activities were considered the subsistence segment in a dual urban economy, with low productivity, no accumulation and which was bound to disappear with economic growth and the development of the modern sector. Recent evidence has shown that the informal sector comprises in fact various forms of production and employment typically in very small enterprises, contradicting the assertion that it will disappear with economic growth. While some of these informal firms may indeed represent a form of urban subsistence production, the informal sector is usually also the host of a number of successful entrepreneurs. Such heterogeneity means that there are no straightforward predictions on how size, structure and performance of the informal sector and of the informal businesses that constitute it change during long periods of economic growth or spells of crisis. Yet there is little empirical evidence on the way informal firms react to overall macroeconomic dynamics. This paper is an attempt to provide some evidence on the dynamics of the informal sector in Madagascar between 1995 and 2004. This period is particularly interesting because it comprises both a sustained period of economic growth and a serious economic and political crisis.

After a long period of economic decline which started with the country's independence in 1960 and interrupted only by very short spells of growth, Madagascar experienced an exceptional period of economic expansion between 1995 and 2001. One factor of growth was the development of Export Processing Zones (EPZ), which offer exporting companies an exemption

[1] This definition follows the ILO recommendation (International Labour Organization, 2003).

from all duties and taxes on exports and imports. EPZs attracted foreign industry, in particular textile, which stimulated exports and employment. The rise of tourism also contributed to economic growth. Growth appeared to be associated with a decline in the share of the informal sector in Madagascar's urban employment. In the first half of 2002, the major political crisis following the presidential elections of December 2001 reversed this trend, as general strikes, roadblocks and the vacancy of power caused a temporary collapse of GDP growth and a massive departure of foreign industries in particular those located in the EPZs (Razafindrakoto and Roubaud, 2002). The political crisis had disastrous effects on the economy: exports and foreign direct investments fell sharply, GDP declined by 12.7 percent and inflation was close to 16 percent in 2002 (Gubert and Robilliard, 2010; Cling *et al.*, 2005). The share of employment in the informal sector grew again, as workers were laid off from the private sector, in particular in the EPZs, which were hit hard by the crisis. The conflict lasted until May 2002, when Marc Ravalomana was proclaimed president, and Didier Ratsiraka left the country in July 2002. Despite the severity of the economic downturn, recovery was quick, with a GDP growth of 9.8 percent in 2003 and around 5 percent in the two following years.

Urban households benefited the most from the growth period. In Antananarivo, the real average labor income increased by 53 percent between 1995 and 2001, which corresponds to a huge 8 percent annual growth rate, an unprecedented pace in Madagascar's history (Razafindrakoto and Roubaud, 2002, 2010). Consequently, the poverty incidence decreased from 39 percent to 19 percent while income inequality was also reduced. The 2002 crisis stopped this positive trend: the unemployment rate nearly doubled along with a massive increase in time-related underemployment[2] and child labor. Real incomes dropped by 5 percent. Thereafter, despite the

[2] A person is in a situation of time-related underemployment if he works less than 35 hours a week and wishes to work more.

quick macroeconomic recovery, household living conditions stagnated: in 2004, earnings were as low as in 2002, and in 2006, they were only 2 percent higher than during the crisis (Gubert and Robilliard, 2010).

These first figures suggest that the informal sector in Madagascar fulfills a labor absorbing function in times of economic downturns. Yet, this is only one of the facets of the informal sector. While the heterogeneity of informal activities is well-established in the literature, the dynamic implications of this heterogeneity are less acknowledged and understood. This paper attempts to answer the following question: which transformations occurred in the informal sector in the decade under review and to what extent do these changes relate to the macroeconomic context? To answer this question, we rely on a unique dataset of four representative and perfectly comparable cross-sectional surveys of informal enterprises in Antananarivo collected in 1995, 1998, 2001 and 2004, i.e. before and after the 2002 crisis.

The empirical part of this paper is divided in three parts. In a first step, we take an aggregate view of the informal sector to describe the structural changes that occurred during the period (Section 4). We study the dynamics of labor and capital allocation in the informal sector, by looking at the distribution of employment among industries and institutional sectors of the economy[3] and by describing the accumulation of capital in each informal sector of activity. We then move to a firm-level analysis, and study the determinants of growth (in employment) of informal businesses (Section 5). The objective is to determine whether certain segments of the informal sector did grow and whether this growth was somewhat related to the overall economic conditions. We take advantage of the data which cover several different periods to run a growth regression in which we include proxies for the macroeconomic context. Finally, building on the

[3]The institutional sector refers to the ownership of the enterprise, which can be broadly divided into three categories: informal, formal or public.

recent empirical literature on returns to capital in small-scale activities in developing countries, we estimate production functions to evaluate capital returns in different segments of the capital distribution (Section 6). The stagnation of a number of IPUs may be a sign of the existence of poverty traps, evidence of which can be found in very low returns at very low levels of capital. By adding year interactions we study changes in these returns over time to assess whether they increase or not with economic expansion.

Before presenting these analyses, we discuss the theoretical framework and the related empirical literature in Section 2 and present the data and main characteristics of the informal businesses we analyze in Section 3. The descriptive statistics provide a detailed picture of informal firms and reveal a strong degree of heterogeneity. As explained in detail in the literature review, taking this heterogeneity into account is crucial to the understanding of the dynamics of the informal sector. All the subsequent analyses will therefore disaggregate, whenever possible, the sample by size and industry.

2 Review of the literature

2.1 Heterogeneity and cyclicality of the informal sector

The literature on informal sector dynamics has mostly focused on the reaction of the informal labor market to business cycles. Another strand of research has studied the determinants of small enterprise growth, but the empirical evidence on the subject in Sub-Saharan Africa remains scarce, especially with respect to the impact of the macroeconomic context.

Standard macroeconomic labor market theories viewed the informal sector essentially as the residual of a segmented labor market, caused by rigidities in the formal sector (e.g. Lewis, 1954; Harris and Todaro, 1970). The informal sector was therefore considered to be disguised

unemployment in the absence of unemployment benefits. In contrast, others have argued that informal and formal labor markets are in fact competitive, and workers are, at the margin, indifferent between the two (Maloney, 2004; Joutard and Sagaon Teyssier, 2006). The sector in which they choose to work is optimal given their preferences and the constraints they face. They may switch from one to the other to take advantage of job opportunities. However, empirical observation suggests that this is only likely to be true for a subset of workers (Fields, 2004). In fact empirical evidence shows that informal sector employment is quite heterogeneous, in particular in terms of the motivation to be in this sector. It includes both involuntary salaried labor, queuing for formal jobs, and voluntary self-employment, the latter being similar in many respects to the entrepreneurial, small firm sector in developed countries.

An analogous heterogeneity can be defined at the firm level. The dualistic view implied that informal activities were characterized by low productivity and subsistence levels of income, but this stance was challenged as early as the seventies (Hart, 1973; Moser, 1978). Considering the case of the informal sector in Accra, Hart (1973) argued that classifying the informal sector (which consists of businesses that are not enumerated) as a low-productivity sector or urban traditional sector "beggars analysis by assuming what has to be demonstrated". Studies of informal activities which explicitly stressed their heterogeneous nature however began to really develop in the nineties. According to these theories, the informal sector comprises an upper tier, with modes of production and jobs similar to formal firms, and a lower tier, corresponding to the residual or subsistence sector in the dualistic view (Fields, 2004; Bosch and Maloney, 2010). Cunningham and Maloney (2001) show for Mexico that only a small fraction of enterprises actually corresponds to the disadvantaged self-employment sector of a segmented market. Their findings argue in favor of strong heterogeneity among small firms, of the same nature as in developed countries, where small firms that have reached their optimal long-run size co-exist

with profitable starting firms and start-up firms that will not survive.

Acknowledging the heterogeneous nature of informal employment and businesses yields very different predictions in terms of the dynamics of the informal sector. The simple dualistic view implies that the informal sector follows counter-cyclical dynamics as positive shocks to the economy should raise formal employment and shrink the size of the informal sector. If the informal sector primarily hosts individuals queuing for formal jobs in subsistence activities, economic growth will be accompanied by a depletion of informal capital, as informal activities are globally abandoned for formal jobs. This may be particularly the case if workers with both relatively high human capital and high wealth are at the top of the "waiting list" for formal jobs. In contrast, if informal sector employment is in fact voluntary as workers are indifferent between sectors at the margin, wages and employment in both sectors should move together, in a pro-cyclical way. Potentially successful entrepreneurs may have little incentive to change sectors and may capture the business opportunities offered by economic growth and possibly accumulate capital. With a more complex view of the informal sector, we can expect pro-cyclical movements in the upper tier and counter-cyclical in the lower tier (Bosch and Maloney, 2010). Maloney (2004) shows that the respective sizes (in terms of employment) and wages of the formal and informal sectors can in the short run move in opposite directions, as in Colombia after the 1995 recession or together as in Mexico during the recovery period of 1987-1992.

These considerations illustrate that capital accumulation and labor allocation patterns in the informal sector, and more generally, enterprise behavior during growth and crisis eventually depend on the nature and characteristics of informal activities. In this paper, we assess the cyclicality of informal activities by looking at the joint dynamics of the formal and informal labor markets and the evolution of aggregate and average capital stock in informal enterprises (Section 4). However, as reactions may differ across industry and firm size, a firm-level analysis

is necessary to capture the full heterogeneity of informal sector dynamics.

2.2 Determinants of small enterprise growth

A number of studies use firm-level data to look at the determinants of enterprise growth and empirically test the hypotheses derived from the theoretical literature on the causes of firm growth. In the "learning" model developed by Jovanovic (1982), efficient managers adjust the production scale of the firm in each period as they learn about their efficiency (while inefficient firms exit the market). As the firms grow older, their prediction of the efficiency becomes more and more accurate, which reduces the probability that the output of the period will be very different from the previous period output. This yields the negative age-growth and age-size relationship. Evans (1987) tested the hypotheses derived from various versions of the firm growth model, with a large sample of American manufacturing firms. He finds a negative relationship between firm growth and age, and a negative but non-linear relationship between growth and size. Sleuwaegen and Goedhuys (2002) use a sample of manufacturing firms from Côte d'Ivoire and show that in developing countries, the size and age effect on firm growth holds, but are moderated by reputation and legitimitation effects.

However, the empirical literature on microenterprise or informal business growth determinants in developing countries is rather scarce, especially in Sub-Saharan Africa. Based on a number of country case studies, primarily from Sub-Saharan Africa, Mead and Liedholm (1998), for instance, find that at start-up, firms that are smaller grow more rapidly than those that are larger. They also find that younger informal firms grow faster than older firms. Fajnzylber *et al.* (2006) find for Mexican microenterprises an insignificant relationship between time in business and firm size growth, and a significant, negative effect of firm size on growth. This indicates that larger firms are more likely to have reached their optimal size. They conclude that

microenterprises in Mexico show a dynamic pattern consistent with the standard results from the theoretical literature on firm dynamics. They further substantiate their findings by comparing Mexican and American microenterprises. This comparison shows remarkable similarities with respect to the dynamics of self-employment in both countries.

Empirical evidence on the impact of contextual factors, such as the overall macroeconomic environment, on small firm growth in developing countries is scarce. Mead and Liedholm (1998) cite studies on the Dominican Republic, Kenya and Jamaica to derive the following hypotheses regarding the relationship between economic expansion and firm growth: in times of macroeconomic growth, according to the authors, informal sector job creation is likely to be channeled mainly through firm expansion, while jobs would be destroyed as workers move to better economic opportunities, such as formal jobs. On the other hand, stagnation would lead to downsizing and more new firm creation.[4]

Firm growth in Madagascar has recently been studied by Byiers and Iacovone (2011), using a panel of 135 formal firms collected in 2004 and 2007 in Madagascar. They find a negative effect of firm age on growth. In the same study they also compare labor productivity in small informal firms with labor productivity in small formal firms. They systematically find lower labor productivity in formal firms which might be due, according to the authors, to the high costs of formalization. In line with what we will show below, they find considerable heterogeneity in performance indicators of informal enterprises across sectors.

These contributions on microenterprise growth have largely improved our understanding of informal activities dynamics. However, they are based on datasets that cover only two or three year periods. We will take advantage in this study of the much longer span covered by the *1-2-3 Surveys* to add empirical evidence to the links between the macroeconomic context

[4]See also Nichter and Goldmark (2009) for similar statements.

and the growth of informal businesses. To this end we will run enterprise growth regressions using retrospective data and include in the specification proxies capturing the overall economic conditions (Section 5).

2.3 Poverty traps in the informal sector

Many studies, including the present paper, find that small businesses in the developing world are stuck with low levels of capital and earnings. Non-convex production technologies combined with imperfect credit markets have been put forward by microeconomic theory to explain this so-called "poverty trap" (Banerjee and Newman, 1993; Galor and Zeira, 1993). Indivisibilities in the production technology would create entry barriers to high return activities. Below a certain threshold of capital stock, entrepreneurs are trapped in activities yielding very low or zero returns. If in addition capital markets do not function for them, they are unable to invest enough to reach the necessary capital threshold and to converge to the optimal level of capital.

However, in line with Cunningham and Maloney (2001), a number of recent studies from diverse settings including Sri Lanka, Ghana, Kenya, West-Africa and Mexico have found very high returns to capital at low levels of capital in small-scale activities, thus contradicting the assumption of low subsistence returns at low levels of capital (McKenzie and Woodruff, 2006; Udry and Anagol, 2006; De Mel *et al.*, 2008; Kremer *et al.*, 2008; Fafchamps *et al.*, 2011; Grimm *et al.*, 2011).[5] In addition, there is mixed evidence on the existence of high entry barriers (McKenzie and Woodruff, 2006; Udry and Anagol, 2006; Grimm *et al.*, 2011). These empirical findings are at odds with the idea of poverty traps and more generally with the idea that the informal sector relates to a large extent to subsistence activities. High returns at low

[5]Though in some cases returns were rather small for female entrepreneurs. For a detailed review of the literature, see Grimm *et al.* (2011)

levels of capital rather suggest that these firms have the potential to accumulate capital and possibly create jobs. To the best of our knowledge, capital accumulation in informal firms has been almost completely ignored in the empirical literature. This may be due to the common assumption that these firms do not accumulate. Another important reason is certainly the limited availability of data to assess this question.

In this paper we study the process of capital accumulation at an aggregate level, across sectors and types of enterprises. In the final section we estimate marginal returns to capital in different segments of the capital distribution to evaluate whether the informal sector exhibits patterns of returns to capital consistent with neo-classical theory or whether such poverty traps exist (Section 6).

3 Data presentation

3.1 *1-2-3 Surveys*

We use data from the *1-2-3 Surveys*, conducted in Antananarivo between 1995 and 2004 (Rakotomanana *et al.*, 2003; Razafindrakoto *et al.*, 2009). These surveys were specifically designed to collect information among representative samples of informal firms. Phase 1 is a labor force survey, conducted every year since 1995, among 3,000 households. Principal and secondary activities of every member aged 10 years and over are recorded, including the type and status of the enterprise in which they work (formal/informal), making the establishment of a list of all informal firms headed by any member of a household possible (whether it is the main or the secondary activity). This list serves as the sampling frame for Phase 2, in which around 1,000 businesses randomly drawn from the Phase 1 listing are surveyed. The stratification scheme, by industry (nine) and type of firms (with or without wage workers), as well as an oversam-

pling of the most atypical kind of firms (e.g. big manufacturing enterprises) make sure that the full heterogeneity of the informal sector is captured. Finally, Phase 3 is a household expenditure survey which interviews another representative sub-sample of households drawn from Phase 1.[6] In this paper we mainly use data from Phase 2, which collects information on the characteristics of firms, such as the number and characteristics of all workers (including contributing family workers), investment, expenditures for intermediate inputs, fees and taxes, sales and profits. Phase 2 has been conducted every three years since the start of the *1-2-3 Surveys*. Hence, we can use data on a representative sample of approximately 4,000 informal firms surveyed in 1995, 1998, 2001 or 2004.

Three key advantages of the *1-2-3 Surveys* over other alternative datasets need to be stressed here. First, the mixed household-enterprise survey frame is the only one to ensure a full representativeness of the informal sector. Previous studies, especially in Africa, are typically based on enterprise surveys which cover only a part of all informal firms; in general the upper tier of the informal sector in some specific industries, mainly manufacturing. Second, our four rounds of surveys are fully comparable, as sampling methodology and questionnaire have been maintained constant over time. To our knowledge, this is the first time ever such a series of repeated cross-sections of informal businesses on a representative basis is available in Sub-Saharan Africa. Third, as informal entrepreneurs do not usually keep books (and in many cases do not even have any written records), the survey questionnaire has been designed to assist them in establishing, product by product, all their sales and expenses, on a flexible period of time, adapted to each individual case. This detailed and comprehensive procedure to collect information is the only way to get reliable data, and to avoid the usual underestimation biases caused by more aggregate questions. The same extensive process is used to reconstitute the cap-

[6]Hence, for a sub-sample of informal firms, information from all three phases is available.

ital stock evaluated at replacement costs to take into account depreciation. Given that for each capital item, the date of purchase is collected, the full sequence of capital accumulation can be obtained, year by year. The only drawback is that we do not have information on capital goods that were fully depreciated or were sold in one of the previous periods. In sum, our dataset offers a unique opportunity to get insights on the evolution and dynamics of the informal sector over a decade.

3.2 Sample and variable definitions

In many of the analyses presented in the paper, we disaggregate the sample according to three dimensions: type, size, and sector. Let us now define these categories. The "type" of business refers to the organization of labor in the enterprise. Most informal production units[7] are owned and operated by a single, self-employed person. This category represents 70.5 percent of the sample on average over the four years. Among the remaining businesses that operate with more than one worker, we distinguish wage and non-wage IPUs, according to whether they operate with employees or not. Non-wage IPUs mostly operate with family workers, often the spouse or children of the owner, who are not formally employed and help the business owner. Overall, wage IPUs represent only 10 percent of the sample.

Secondly, we take into account the "size" of the business measured by its stock of physical capital. We divide the sample into four quartiles of capital stock, which are calculated for each year separately to avoid composition effects which may be a problem with repeated cross-sections. In each survey wave, the sample is therefore divided in four quartiles.

Finally, businesses are classified into eight sectors of activity: food processing, textile and

[7]Throughout the paper, the terms informal enterprise or business are indifferently used to characterize informal production units (IPU). We also use industry as a synonym for sector activity.

clothing, other industries, construction, trade, services to households and enterprises, catering and transport.[8] Examples of the most common jobs in each sector are given in Table 15, which also recapitulates the definitions of the other categories (size and type).

4,041 IPUs were surveyed over the whole period (in four cross-sections) but we excluded from the sample 37 enterprises that had extremely high values of capital or value added, and 9 IPUs for which some key characteristics were missing. In the entire paper, value added is a monthly measure and is calculated as the difference between sales and intermediary consumption. Intermediary consumption includes raw material and inventory purchases, rent and utilities, and other expenses. Value added therefore corresponds to the sum of capital income, all labor income and entrepreneurial profits.

The capital variable is the total stock of capital, measured at the actual replacement value. To obtain real values of capital and value added, the Consumer Price Index (CPI) is used as a deflator. This is of course, at least from a conceptual point of view, not very satisfactory for the capital variable in particular. Capital goods should be deflated over time using a specific price index, since the price of equipment, real estate or vehicles is likely to evolve differently from consumer prices, in particular from prices for basic food- and non-foodstuffs. Unfortunately, specific price indices for physical capital goods are not available in Madagascar (as in most other developing countries), which only provides a CPI and its components by large categories. To test the sensitivity of our results with respect to the deflator used, we alternatively deflated capital by the equipment, furniture and housing component of the CPI. This led to a very similar result in terms of the development of the capital stock over time. Hence, in what follows we always apply the CPI.

[8]There are eight sectors rather than nine as in the stratification scheme because we merged trade of primary goods and trade of transformed goods into a single trade activity.

TABLE 1: MEAN CHARACTERISTICS OF INFORMAL BUSINESS OWNERS

	Age	Education	Experience	Female
Type of firm				
Self-employment	38.2	6.8	9.7	0.55
Non-wage IPU	39.1	6.8	9.7	0.40
Wage IPU	38.3	8.5	10.1	0.34
Capital stock				
1st quartile	37.2	5.6	9.0	0.54
2nd quartile	39.0	6.4	9.9	0.53
3rd quartile	38.1	7.8	9.7	0.54
4th quartile	39.9	8.9	10.5	0.36
Sector of activity				
Food processing	36.6	7.2	5.9	0.50
Textile & clothing	40.0	8.1	11.8	0.81
Other industry	39.5	6.3	12.5	0.20
Construction	39.5	6.2	12.0	0.02
Trade	37.7	6.6	8.4	0.58
Services to households and firms	37.3	6.8	9.3	0.49
Catering	38.2	7.3	6.7	0.74
Transport	41.1	8.3	11.0	0.04
Total	38.4	7.0	9.7	0.50

Notes: Means are calculated using a sample of 3995 IPUs and are weighed using sampling weights. Quartiles are calculated separately for each year. Education is in years of schooling, experience is the number of years for which the owner has been performing his main activity. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

3.3 Main characteristics of the informal sector

In this section we pool the four cross-sections to describe the main characteristics of informal businesses and of their owners. To take into account the heterogeneity of the sector, we disaggregate the sample along three dimensions: type, size, and sector. We start by describing the average characteristics of IPU owners, provided in Table 1.

The average age of an informal business owner is 38.4 years. It is slightly increasing with the capital stock, but the difference is relatively small with 2.7 years separating the average IPU in the first quartile from the average IPU in the fourth quartile. Owner age is variable across sectors, between 36.6 years old for the youngest sectors and 41.1 in the oldest. Both education and experience increase with capital, the correlation being particularly strong for

education, as there is a 3.3 years difference between the average years of schooling in low capital businesses and high capital businesses. Owners of wage IPUs have almost two more years of schooling than the pure self-employed or owners of non-wage IPUs. The experience of the owner is very variable across sectors. While food processing IPU owners have on average 5.9 years of experience in the area, transport, textile, other industries and construction business owners have between 11 and 12.5 years of experience. As the dispersion of the average age of owners across sectors is not as high, this could indicate that in these activities, a minimum level of skills, learned on the job, is required to create and run a business. Finally, half of the informal businesses are owned by women. But this hides big differences across types of businesses. While females are more numerous among the self-employed, they own only a third of businesses that hire wage workers. However, the gender of the owner does not vary much across quartiles and only the top quartile has significantly more male owners than the other three quartiles. Besides, some activities are clearly gender-specific: textile and catering are feminine activities while construction and transport businesses are almost entirely run by men.

We now turn to business characteristics in terms of size, age and performance indicators, such as valued added and capital stock (Table 2). While the average age of the businesses is around 8.7 years, the median age is 3.7 years lower, indicating that there are a lot of very young businesses in the sample, and a few (much) older ones. The time in business is quite stable across quartiles of capital stock and business type, with non-wage IPUs being slightly younger than the other categories. There are some striking differences across sectors. Older IPUs are concentrated in textile, other industries, construction and service activities. These sectors exhibit an average time in business of over nine years. On the other hand, catering, food processing and trade businesses have been running for less than seven years on average.

The average number of workers in an IPU is 1.48 and it is increasing with the stock of

TABLE 2: MEAN CHARACTERISTICS OF INFORMAL PRODUCTION UNITS BY TYPE, SIZE AND SECTOR OF ACTIVITY

TYPE	All		Self-employment	Non-wage IPU	Wage IPU
	Mean	Median			
Age of the enterprise	8.72	5	8.88	8.00	8.96
Size of firm (total staff)	1.48	1	1.01	2.32	3.11
Value added	491.1	201	325.8	584.5	1427.3
Capital (1000 FMg)	2681.6	341	1805.0	2664.9	8559.2
Zero capital stock (=1)	0.11		0.14	0.024	0.023
N	3995		2615	788	592

SIZE (CAPITAL STOCK)	1st quartile	2nd quartile	3rd quartile	4th quartile
Age of the enterprise	8.80	8.99	8.31	8.74
Size of firm (total staff)	1.18	1.46	1.60	1.83
Pure self-employment	0.86	0.71	0.63	0.55
Non-wage IPU	0.12	0.22	0.24	0.22
Wage IPU	0.026	0.078	0.14	0.23
Value added	287.3	369.7	565.7	884.6
Capital (1000 FMg)	21.5	254.7	1347.1	11627.3

SECTOR OF ACTIVITY	Food processing	Textile & clothing	Other industry	Construction
Age of the enterprise	5.03	11.1	11.1	11.5
Size of firm (total staff)	1.97	1.34	1.77	1.75
Pure self-employment	0.43	0.80	0.61	0.66
Non-wage IPU	0.43	0.14	0.20	0.14
Wage IPU	0.14	0.061	0.20	0.19
Value added	465.2	390.4	545.5	800.9
Capital (1000 FMg)	2556.3	2140.7	3138.4	702.9
Zero capital stock (=1)	0.0097	0.016	0.027	0.044
% in lowest capital quart.	0.056	0.17	0.19	0.44
% in highest capital quart.	0.20	0.24	0.26	0.039
N	170	645	448	355

	Trade	Services	Catering	Transport
Age of the enterprise	6.94	9.33	5.60	8.00
Size of firm (total staff)	1.47	1.26	2.05	1.38
Pure self-employment	0.65	0.86	0.39	0.75
Non-wage IPU	0.27	0.070	0.36	0.037
Wage IPU	0.078	0.069	0.24	0.21
Value added	471.3	362.6	690.6	853.5
Capital (1000 FMg)	1614.0	2232.7	2897.2	15623.7
Zero capital stock (=1)	0.089	0.29	0	0.039
% in lowest capital quart.	0.36	0.51	0.041	0.054
% in highest capital quart.	0.13	0.16	0.24	0.80
N	1015	799	287	276

Notes: Means are calculated using a sample of 3995 IPUs and are weighed using Phase 2 sampling weights.
Source: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

capital. The organization of labor is very strongly correlated with capital stock, as the share of pure self-employment decreases as we go up the distribution of capital, while wage IPUs become more frequent. In fact the large majority of businesses operating with very little or no capital just employ the owner and a little less than half of high capital businesses operate with more than one worker. The distribution of wage and non-wage IPUs appears quite different across sectors of activities. Self-employment is over represented in textile industry, services and transport but it represents less than half of food processing and catering businesses. In certain sectors, like textile, trade, and services, wage workers are almost nonexistent.

Mean monthly value added is 491,000 MGF (35€) while median value added is only 201,000 MGF (14€), indicating substantial heterogeneity across businesses.[9] This is even more visible in the value of the capital stock, whose distribution is strongly skewed to the right. The mean is over 2,600,000 MGF (189€) but the median is only 341,000 MGF (24€). There are a few businesses operating with a very high capital stock, while the large majority owns very little or no capital at all. In fact, 10 percent of businesses operate with no physical capital whatsoever. While value added increases in a broadly linear manner across capital quartiles, the value of the capital stock increases ten-fold between the first and the second, and between the third and the fourth quartiles respectively. This suggests, at this stage, decreasing returns to capital.

Interestingly, the size and type of the IPU is not associated with its performance in terms of profit. Construction and transport have both high rates of pure self-employment and the highest mean value added of the sample, but these two sectors stand out as opposite extremes in terms of their capital stock. Capital profitability is very high in construction businesses as the mean capital stock is the lowest of all sectors. At the other end of the distribution, 80 percent

[9]The amounts in Euros are calculated using an exchange rate of 1€=13,700MGF, in effect on May 2nd, 2012. Another helpful indication of the order of magnitude of these figures is the absolute monthly poverty line in Madagascar. Deflated using the same price index used for the other variables, it is equal to 76,723 MGF per person and per month (Source: INSTAT, 2005; author's calculation).

of transport businesses are situated in the highest quartile of capital stock, due to the fact that vehicles represent the main type of investment in that sector. The two other sectors in which businesses are largely owner-operated are services and textile manufacturing and they have the lowest average value added. Half of all service businesses have a capital stock below the 25th percentile of the distribution. The catering sector appears rather well performing from these descriptive statistics, with a larger size, high value added and capital stock.[10]

Although a large majority of businesses are purely self-employed owners operating with a low stock of physical capital, other types of informal businesses are also present in the informal sector. Size and performance indicators are quite variable, particularly across sectors of activity. Over time, this heterogeneity suggests that certain types of businesses may be able to grow and take advantage of favorable macroeconomic circumstances while others would stagnate more. In the rest of the paper we will therefore carry out the analyses taking this heterogeneity into account, by showing descriptive statistics and regressions run on various sub-samples of businesses, according to their organization of labor, size and sector of activity.

4 Structural changes in the informal sector

The dynamics of the informal sector are first studied taking an aggregate approach, looking at general trends in employment and capital allocation across sectors and industry branch. Many aspects of informal businesses (size and growth, value added, capital stock) over time will be discussed throughout the paper, except for owner characteristics and enterprise age, on which we briefly comment now (results not shown). There was no substantial change in the distribution

[10] Another important characteristics of the informal sector in Madagascar is that IPUs cater mainly to households and other small enterprises. Subcontracting for larger, formal firms is marginal. In addition, the main supplier of inputs for IPUs are other IPUs or households. Therefore the informal sector appears to be rather disconnected from formal product and input markets (MADIO, 1998).

of the main socio-demographic characteristics of entrepreneurs, except for a slight increase in age and experience. The proportion of enterprises owned by females dropped by 6 percentage points in 2001, owing probably to the shift of females to Export Processing Zones.

The average age of enterprises in our sample slightly increased over time, and particularly between 2001 and 2004, where the difference is significant, from 8.4 to 9.6 years old. This could be an effect of the 2002 crisis, with somewhat older enterprises being more resistant to an economic downturn than younger ones. A reduced rate of business creation would also be consistent with this figure, however, as we will see in the next section, the number of IPU owners increased strongly during that period. Older businesses being more resistant seems a more plausible explanation but we do not want to push this interpretation too far given the cross-sectional nature of our data, which does not give information on entries and exits of enterprises.

4.1 Labor market dynamics

As mentioned in Section 2, the dynamics of the informal sector has mainly been studied from a labor market perspective. We first take this approach and look at distribution of employment by institutional sector over time (Table 3). We define three large institutional sectors: the public sector, which includes public administration and enterprises, the formal private sector, and the informal sector. The formal private sector includes in particular firms operating in Export Processing Zones. Informal sector jobs are divided in two categories: dependent and independent.[11]

As in other cities in Sub-Saharan Africa, the informal sector represents the largest share of

[11] Independent workers are self-employed or business owners, while dependent workers are employees and family helps in informal enterprises. Formal dependent and independent employment are not distinguished because the number of observations of the former is extremely low.

TABLE 3: EMPLOYMENT IN ANTANANARIVO BY INSTITUTIONAL SECTOR (% AND GROWTH)

	1995	1998	2001	2004
Public sector	14.1	13.3	10.7	10.4
Formal sector	28.3	29.9	36.2	31.2
EPZ	3.1	5.4	10.2	9.0
Other	25.2	24.5	26.0	22.2
Informal sector	57.6	56.7	53.2	58.4
Dependent	27.6	22.8	19.0	19.9
Independent	30.0	33.9	34.2	38.5
Total	100.0	100.0	100.0	100.0
Total employment (1,000 jobs)	415	476	540	604
		Share of a sector in t is significantly different from share in t-3 (p-value)		
Informal		0.42	0.00	0.00
Informal dependent		0.00	0.00	0.31
Informal independent		0.00	0.79	0.00
		Growth rate (base 100 = 1995)		
Informal dependent	100.0	94.8	89.3	105.0
Informal independent	100.0	129.9	148.5	187.2
Total employment	100.0	114.6	130.1	145.5

Notes: Figures calculated using Phase 1 sampling weights. *Source*: *1-2-3 Surveys*, Phase 1, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

employment in Antananarivo. Even if its share is 10 to 15 percentage points lower than in other West African urban centers, it remains the first job provider, totalizing more than one out of two jobs. Considered globally, the informal sector in Antananarivo seems to follow counter-cyclical dynamics. Reversing a previous process of informalization of the economy, its share steadily decreased between 1995 and 2001, from 57 to 53 percent of total employment, and that drop was statistically significant in the second three-year period studied (1998-2001). This drop occurred in a context of public administration and state enterprise downsizing, as part of the structural adjustment program. Therefore, in terms of employment, this process mainly benefited the private formal sector, in particular thanks to the rapid development of EPZs. The average annual growth rate of employment over the period was 27 percent in EPZs but only 3 percent in the informal sector (Cling *et al.*, 2005). As shown in Table 3, in Antananarivo this led

to a tripling of the share of EPZs in total employment between 1995 and 2001, from 3 to more than 10 percent, while the share of private formal sector jobs remained stagnant at 25 percent.

However, within the informal sector, we also observe two opposite trends during this period: an increase in the share of independent informal jobs (especially between 1995 and 1998), and a sharp drop in the share of dependent informal jobs, the latter being statistically significant over both three-year periods. Interestingly, in the period of strongest growth (1998-2001), although dependent informal labor was absorbed in formal enterprises, the absolute number of enterprises continued to increase, slower than before, but still faster than the overall growth of the employed labor force (bottom panel of Table 3). This is a sign that informal sector employment growth is extensive rather than intensive, as it happens mainly through the creation of new businesses rather than the expansion of employment in existing ones. Additionally, a fraction of the fast growth in the number of informal businesses is explained by new entries on the labor market.

The 2002 crisis totally reversed the trend of employment formalization. Between 2001 and 2004, the informal sector reconquered its previous share of the labor market, increasing its share by 5 percentage points, and reaching thus a higher level than in 1995. Informal jobs absorbed both laid-off workers from closing formal enterprises and new entrants on the labor market, deprived from any alternative source of jobs. As the recovery in EPZs was fast, it lost only one percentage point of its share of employment over that three-year period.[12] Recovery of other domestic formal enterprises seemed to be limited. While both dependent and independent informal employment increased between 2001 and 2004, the growth in the number of informal entrepreneurs was much faster than the overall increase in the number of workers. In the period of crisis and the following recovery, the decrease in formal employment seems to have been

[12]Intermediary year data from Phase 1 of the *1-2-3 Surveys* show that employment in EPZs was divided by three in 2002 but recovered its pre-crisis number of jobs by 2004 (Cling *et al.*, 2005)

mainly compensated by an increase in informal independent labor (its share in total employment increases from 34.2 percent to 38.5 percent), rather than informal hired or family labor, suggesting that existing businesses were not able to absorb the surplus labor released by the formal sector, and most of these workers started an informal business.

To sum up, both during growth and crisis periods, informal independent employment increased, in absolute number of IPUs and in share of total employment. Although, part of that growth in the last three-year period was probably due to the absorption of surplus labor from the formal sector, this is also a sign of a relative disconnection of the informal sector from the global macroeconomic context.

4.2 Shifts in the distribution of activities

As shown in Table 4, there were large changes in the distribution of activities within the informal sector. In 1995, trade activities represented 40 percent of all informal businesses in Antananarivo but this share was only 31 percent nine years later. The share of industrial activities, which comprise food, textile and other manufacturing, also decreased over time, while services and construction businesses gained importance. These changes could be due to a reallocation of activities within the informal sector only, but they may also reflect a general trend in the economy. A shift in the share of an industry among informal businesses could also be explained by a reallocation of that activity between institutional sectors, that is, a change in the distribution of employment between the formal, informal and public sectors, independent of a change of the weight of the activity in the economy. To disentangle these effects, we present in Table 5 the share of each activity in total employment and the share of each institutional sector within an activity, by year.

Formalization of food processing and textile production combined with a slight general de-

TABLE 4: SECTORAL DISTRIBUTION OF INFORMAL PRODUCTION UNITS (%)

	1995	1998	2001	2004
Food processing	4.0	3.2	2.6	1.4
Textile & clothing	20.3	17.0	13.5	14.9
Other industry	7.0	7.3	9.0	8.4
Construction	3.6	6.6	7.4	8.0
Trade	39.9	36.9	36.8	31.4
Services to households and firms	16.3	20.1	22.8	25.4
Catering	4.2	3.5	2.8	5.6
Transport	4.7	5.5	5.0	5.0
Total (%)	100	100	100	100
Total (1,000 IPUs)	123	162	203	238

Notes: Percentages are calculated using sampling weights. The total is the absolute number of firms estimated using frequency weights. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

cline in employment in industrial activities between 1995 and 2004 contributed to the reduction in the share of these sectors among informal businesses. For textile production in particular, there was a clear shift of labor from informal to formal firms before 2001, particularly through the quick development of EPZ firms (Table 5). As textile goods produced in EPZs are exported while those produced by informal firms are for the domestic market, the reallocation of labor from informal to formal firms was due to competition on the labor market rather than the product market. Workers, in particular women, seem to prefer employment in EPZs over informal employment as it often represents an increase in earnings especially at low levels of schooling (Glick and Roubaud, 2006). Between 2001 and 2004, formal (non-EPZ) textile employment dropped, and we notice that independent informal textile employment, rather than dependent, increased. This is a sign that absorption of surplus labor in that sector happens at the extensive margin, through the creation of new businesses, rather than through the hiring of labor. Formal food processing activities gained over 20 percentage points over the 1995-2004 period, decreasing the share of the informal sector in these activities. Other types of manufacturing activities went through a process of informalization, with both formal and public employment decreasing

their share and the overall weight of the sector remaining stable.

The share of transport and catering activities in the informal sector was stable. The increase in the share of the construction sector is quite important, starting from less than 4 percent in 1995 and representing 8 percent of informal businesses in 2004. During the growth episodes the demand for housing might have increased and triggered an increase in supply in response. We also see in construction a strong process of informalization of the economy and, unlike other activities, construction IPUs seem to absorb some labor through a growth in dependent employment rather than solely by increasing the number of businesses. Services have gained the most over the decade, from 19.6 percent of all firms to 30 percent, a trend that does not seem to have been affected by the crisis, as it increased by 2.5 to 5 percentage points over each three-year period. We find that in the sectors which gained the most, services and construction, a large share of IPUs belong to the lowest quartile of capital stock, as shown in Table 2. This suggests that rather low entry barriers, in terms of the amount of capital necessary to operate a business, encourage the start-up of less capital intensive activities such as petty reparations, car mechanics, laundering or hairdressing. In contrast, industrial activities and transport, which exhibit higher stocks of capital shrank or did at least not expand much over the observation period. Surprisingly there also seems to be no straightforward link between the profitability of an activity (in terms of value added per capital stock) and its development over time, except for construction.

4.3 Patterns of capital accumulation

The *1-2-3 Surveys* collect detailed data on the stock of capital of informal production units. For each business, we thus know the replacement value of every item of physical capital used in the production process. This includes buildings and land, furniture, vehicles, tools, machines, and

TABLE 5: SECTORAL DISTRIBUTION OF EMPLOYMENT AND SHARE OF INSTITUTIONAL SECTORS WITHIN EACH ACTIVITY (%)

Sector of activity (% of total employment) *Institutional sector (% of sector of activity)*	1995	1998	2001	2004
Food processing	3.3	3.2	2.6	2.2
Formal sector	*33.8*	*38.1*	*43.6*	*54.7*
Informal sector, dependent	*23.7*	*23.7*	*24.9*	*16.5*
Informal sector, independent	*38.9*	*31.9*	*29.8*	*21.7*
Clothing and apparel	17.4	15.3	18.3	16.3
Formal sector	*24.3*	*17.2*	*9.0*	*3.7*
EPZ	*17.9*	*34.0*	*55.5*	*55.2*
Informal sector, dependent	*24.4*	*15.2*	*8.5*	*8.3*
Informal sector, independent	*33.0*	*33.3*	*26.8*	*32.7*
Other industry	7.4	7.9	8.7	8.0
Public sector	*11.3*	*14.2*	*8.3*	*8.6*
Formal sector	*41.1*	*41.4*	*37.1*	*33.3*
Informal sector, dependent	*24.8*	*12.5*	*17.5*	*22.5*
Informal sector, independent	*21.8*	*28.3*	*33.1*	*33.2*
Construction	4.7	5.7	5.6	6.8
Formal sector	*42.5*	*34.2*	*32.4*	*21.2*
Informal sector, dependent	*31.0*	*26.3*	*22.4*	*31.4*
Informal sector, independent	*21.4*	*33.9*	*43.8*	*44.8*
Trade	22.6	22.7	22.4	21.0
Formal sector	*29.7*	*26.8*	*29.4*	*23.1*
Informal sector, dependent	*19.2*	*16.2*	*16.6*	*15.2*
Informal sector, independent	*50.2*	*56.4*	*53.4*	*61.6*
Services to households and firms	36.5	36.3	33.8	36.5
Public sector	*36.3*	*32.4*	*28.6*	*26.9*
Formal sector	*17.0*	*19.8*	*25.6*	*25.2*
Informal sector, dependent	*33.4*	*30.9*	*25.2*	*23.5*
Informal sector, independent	*13.4*	*16.8*	*20.6*	*24.4*
Catering	4.1	3.5	2.8	4.3
Formal sector	*35.1*	*34.3*	*38.1*	*22.4*
Informal sector, dependent	*28.8*	*28.2*	*18.7*	*28.5*
Informal sector, independent	*35.5*	*33.6*	*38.9*	*48.4*
Transport	4.0	5.4	5.8	5.0
Public sector	*12.2*	*9.7*	*6.7*	*4.1*
Formal sector	*44.1*	*44.0*	*53.2*	*48.7*
Informal sector, dependent	*20.5*	*14.5*	*10.4*	*12.1*
Informal sector, independent	*23.2*	*31.7*	*29.7*	*35.0*
Total (%)	100	100	100	100
Total (1,000 jobs)	383	447	512	570

Notes: Figures in italics are the percentage of each institutional sector in the employment of a given sector. Total does not add up to a hundred because institutional sectors with a share inferior to 5% are not shown, to lighten the table. Percentages are calculated using sampling weights. The total is the absolute number of workers estimated using sampling weights, excluding the agricultural sector. Formal sector employment excludes EPZs. *Source*: *1-2-3 Surveys*, Phase 1, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

other types of equipment. We also know the date at which each investment was made. However, investments made in the business but subsequently sold are excluded from the questionnaire. It is therefore not possible to look at the actual path of capital accumulation by IPUs. Instead, we take advantage of this very rich source of data to describe capital accumulation at a more aggregate level, looking at the changes over time of the average capital stock per IPU and the total capital stock of the informal sector.

The measure of the stock of capital of a business is the sum of the replacement value of all the equipment of the firm. We first look at the structure of capital in each year, to see whether buildings and land, furniture, vehicles, tools, machines, and other types of equipment represented a stable share of the stock of capital across the four waves of the survey. Table 16 in the Appendix shows the share of each category in the total capital, calculated as the weighted (with sampling weights) sum of the values of all equipments of a given category over the total value of capital in that year. We see that the structure of capital quite stable across time. Buildings and land represent roughly half of the value of capital, and vehicles between 23 and 35 percent. 10 percent of the capital is machines. The shares of buildings and vehicles do vary but they could be strongly influenced by a few businesses that made these very high investments. In the table below we will present mean and total capital including and excluding buildings and vehicles to check whether the figures are driven by these very lumpy investments. The relatively high stability of the structure of capital across time is however a sign that it is correctly measured and not excessively noisy.

Table 6 shows that the average and median stock of capital with which IPUs operate increased quite strongly between 1995 and 1998 but subsequently dropped, reaching in 2004 a level inferior to its initial level. This trend is confirmed when we look at the stock of capital excluding buildings and machines. Since we use sampling weights to calculate the figures, Table

6 provides an estimation of the total capital stock of the informal sector by year. Overall the informal sector accumulated capital between 1995 and 2001, and then rather stagnated. In the 1995-1998 period, the percentage of IPUs operating with no physical capital sharply dropped, from 12 to 7 percent. In the following three years, the mean stock of capital dropped, therefore the increase in total capital during that period was mainly due to the multiplication in the number of IPUs, another sign of extensive growth in the informal sector. Without buildings and vehicles, the total capital stock actually stagnated between 1998 and 2001.

TABLE 6: MEAN, MEDIAN AND TOTAL CAPITAL STOCK BY YEAR

	1995	1998	2001	2004
Capital per IPU (1000 MGF)				
Mean	2554.9	3149.2	2824.3	2306.3
Median	334	485	318	239
Mean (excl. buildings & vehicles)	593.0	673.0	510.7	540.0
Median (excl. buildings & vehicles)	48	74	68	64
Zero capital stock (% of IPUs)	12.3	6.9	12.9	10.3
Total capital stock (bn MGF)	313.1	509.7	574.0	548.2
Total capital excl. buildings and vehicles (bn MGF)	72.7	108.9	103.8	128.4
N	1013	1028	908	1046

Notes: Exchange rate on the 2/5/2012: 1€=13,700MGF, or equivalently, 1 million MGF=73€. Figures are calculated using Phase 2 sampling weights. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

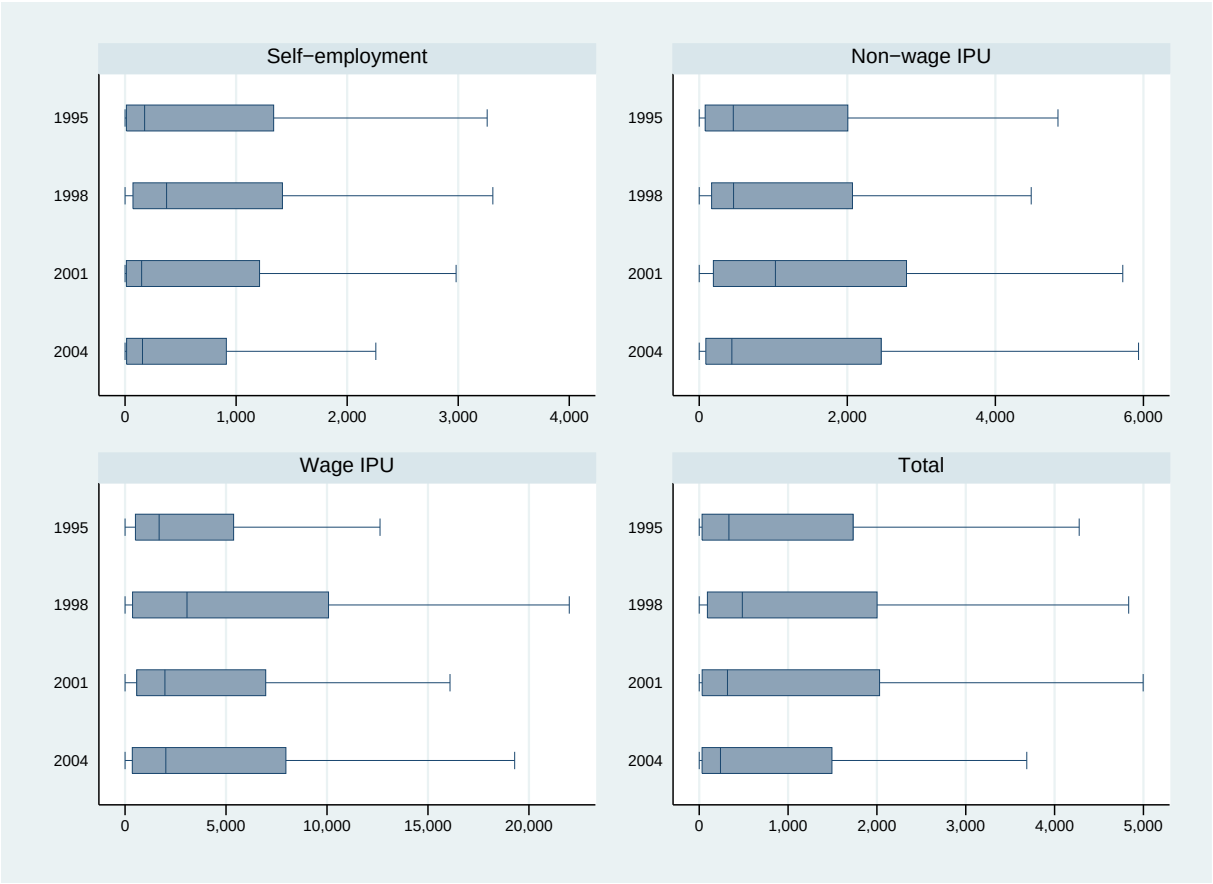
Results shown in Table 6 are rather unexpected, because economic growth was strong until 2001, but we see capital accumulation only until 1998. This suggests that the global macroeconomic context did not completely integrate the informal sector, which seemed to stay outside of the growth process. In addition, we notice that the average stock of capital of firms in 1995 and 2004, was roughly the same. Although we must be cautious when interpreting such intertemporal comparisons, due to price measurement issues when deflating the capital stock, it is striking to see that as a whole, the informal sector stagnated, and capital accumulation did not really happen.

Figure 1 and 2 are box plots of the stock of capital of IPUs disaggregated by type of firm (in terms of organization of labor) and sector of activity. These graphs show the median and the distribution of capital rather than simply showing means. Whether self-employment, wage or non-wage, all types of IPUs had the same median capital stock in 1995 and 2004 with some differences in the intermediary years. Only non-wage IPUs increased their median capital stock after 1998, rather than after 1995.

The total stock of capital by sector and year is shown in Figure 3, and can be used along with the box plots to analyze whether capital accumulation (or depletion) in each sector was due to an actual increase (or decrease) in the amount capital with which firms operate or due to a change in the number of IPUs in the sector. Textile manufacturing firms show a significant decline in both the median capital stock per firm and the total capital stock in that sector. As the share of this activity decreased in the informal sector, this indicates that, in addition to textile activities being less frequent, the remaining ones also have a lower capital stock on which they operate. Firms in the construction sector increased in number, but they operate on less and less capital as well. On the other hand, food processing businesses saw their median capital stock rise, while the total capital stock clearly decreased. As there are fewer firms in this sector in 2004, this suggests that only the food processing businesses that had a rather high capital stock are still active in 2004, unlike the pattern observed for textile industries. Other sectors do not exhibit such clear patterns of capital accumulation or depletion. On the contrary, the global picture is one of stagnation rather than dynamics.

Overall, the total capital stock in the informal sector somewhat increased over the first three years of the period considered, after which it seems to have rather stagnated. However, as mentioned above, the total number of informal firms increased over the entire decade. Again, extensive growth seems to be one driver of this development. The share of households owning

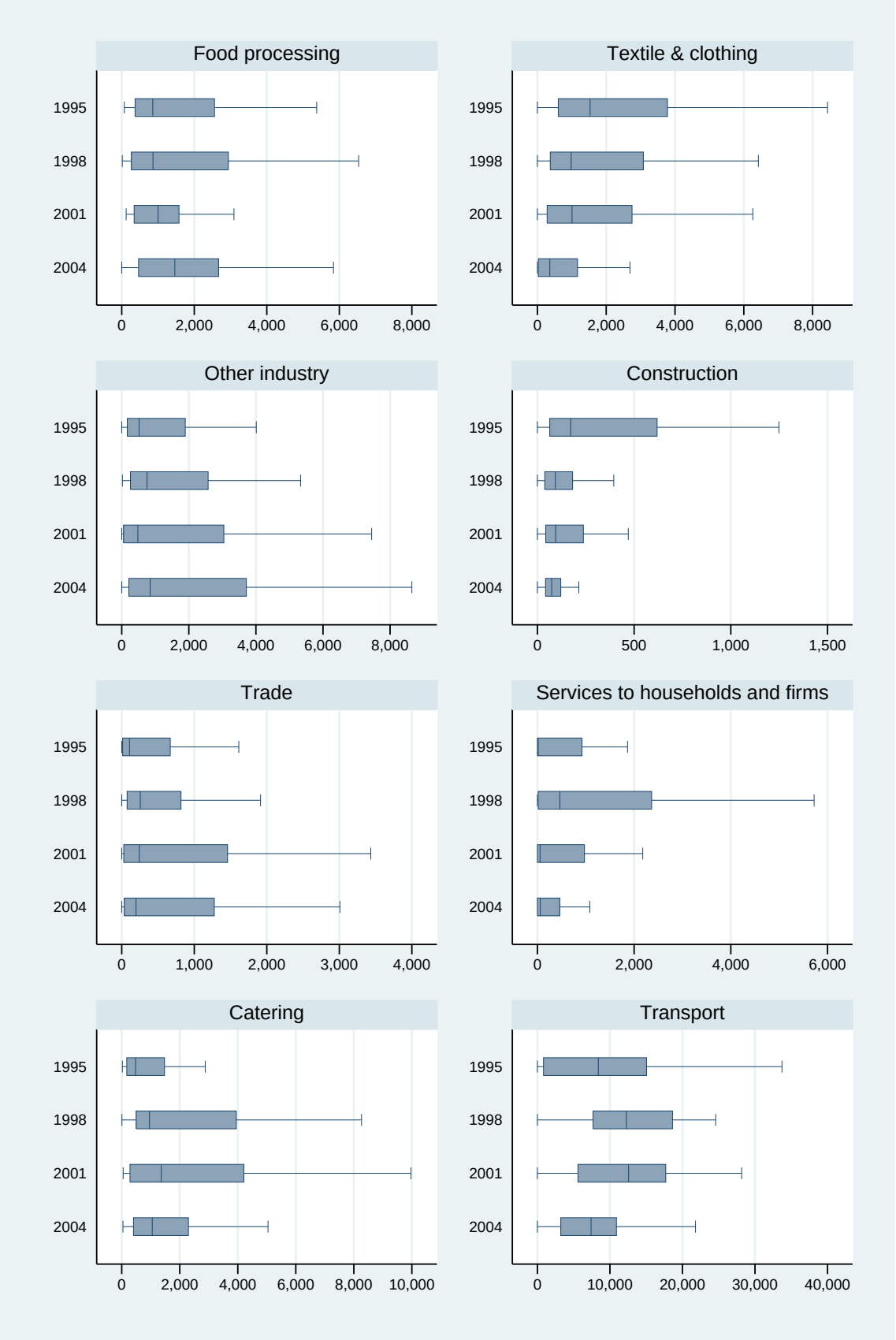
FIGURE 1: CAPITAL STOCK BOX PLOT BY TYPE OF IPU



Notes: Boxes show the median (middle line), 25th and 75th percentiles of the capital stock (in 1,000 MGF). Figures are calculated using Phase 2 sampling weights. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

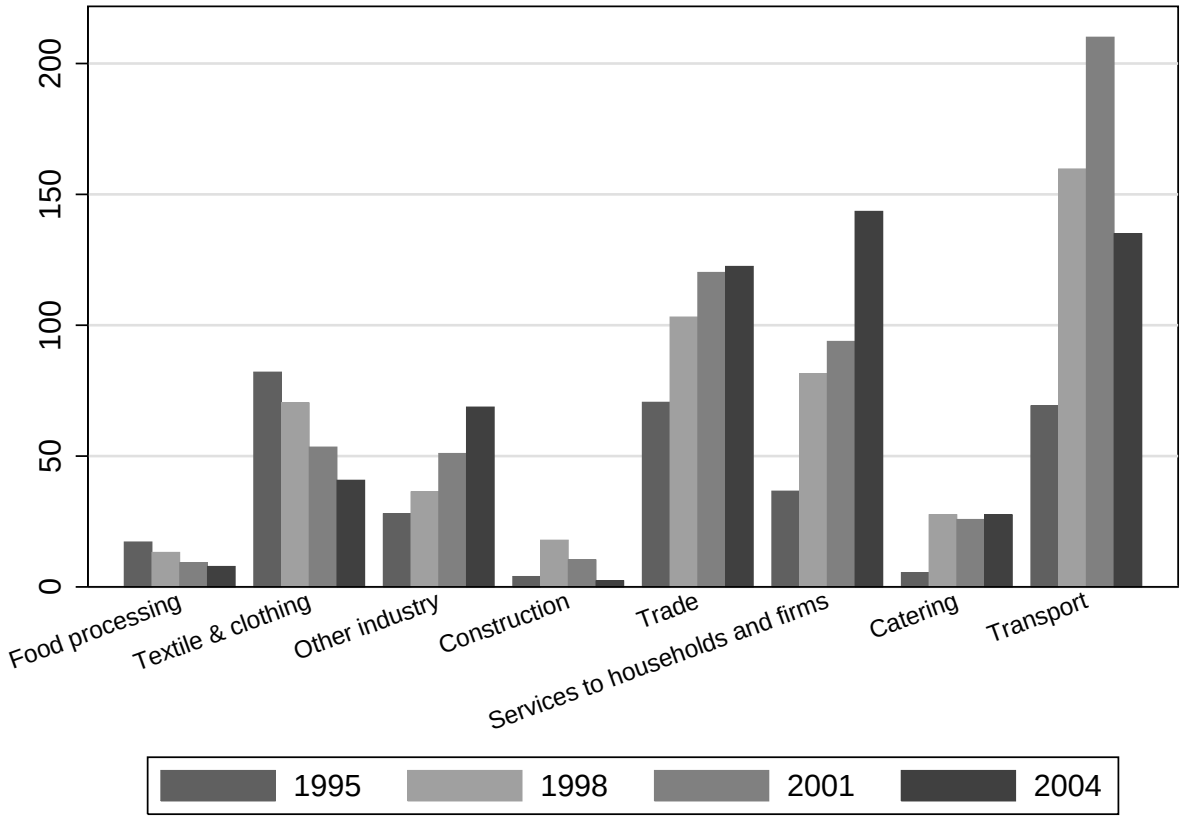
at least one IPU increased from 50 to 60 percent between 1995 and 2004. Among owners, 21 percent of households owned more than one IPU, and this share increased by 8 percentage points during the period (Table 7). The survey includes a question on the projected use of a loan if the entrepreneur could obtain one for his or her activity. A little less than half declared that they would invest it in the existing firm and about 40 percent declared that they would rather start another business. Investing in a new enterprise rather than expanding an existing one is hence a common strategy. This is particularly true in the service sector where 50 percent of business owners would opt for extensive rather than intensive growth.

FIGURE 2: CAPITAL STOCK BOX PLOT BY SECTOR OF ACTIVITY



Notes: Boxes show the median (middle line), 25th and 75th percentiles of the capital stock (in 1,000 MGF). Figures are calculated using Phase 2 sampling weights. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

FIGURE 3: TOTAL CAPITAL STOCK BY SECTOR OF ACTIVITY



Notes: Total capital stock in billion MGF, extrapolated using Phase 2 sampling weights. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

Informal sector growth appears to be extensive both in times of growth and crisis, with a continually expanding number of businesses which seem globally incapable of accumulating capital and creating jobs for workers other then the owner. We now move on to an anlysis at the level of the production unit to detect whether certain segments of the informal sector benefited from the context of economic expansion.

TABLE 7: IPU OWNERSHIP (% HOUSEHOLDS)

	1995	1998	2001	2004
IPU ownership (% households)				
Yes	49.0	43.8	42.1	39.3
No	51.0	56.2	57.9	60.7
Number of IPUS owned (% households IPU owners)				
One	78.4	70.9	70.0	69.9
Two	17.1	22.5	25.0	25.1
Three or more	4.5	6.6	5.0	5.0
Total	100.0	100.0	100.0	100.0

Notes: Figures extrapolated using Phase 1 sampling weights. *Source*: *1-2-3 Surveys*, Phase 1, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

5 Growth of informal businesses

As detailed in Section 2, theory predicts an expansion of the size of enterprises in times of general macroeconomic growth, and contraction during recession or stagnation, with more businesses being created to absorb excess labor. In this section we look at size and growth patterns of informal businesses over time in Antananarivo. We first present descriptive statistics before estimating an econometric model of the determinants of informal business growth.

5.1 Descriptive statistics

The distribution of IPU size by year confirms that growth in the informal sector was mainly extensive (Table 8). There is much more self-employment in 2004 than in 1995, and there are less businesses with more than one worker. The share of IPUs that are only operated by the owner increased over time, both in the 1995-2001 period of growth, and in the 2001-2004 period of crisis and recovery. We do however see an increase in the share of wage IPUs until 2001, from 8.4 to 13.3 percent of all IPUs, which had dropped again by more than four percentage points in 2004. In contrast, the share of non-wage IPUs lost almost 10 percentage points before the crisis and remained stable between 2001 and 2004. This is consistent with heterogeneity

of informal employment, comprising both voluntary entrepreneurs, as indicated by the increase in the number of single-worker businesses, and involuntary informal labor, queuing for a better job. Here the data suggest that family workers (those working in non-wage IPUs) take advantage of the period of growth to move to a wage job either within the informal sector to wage IPUs or in the formal sector. In the period of crisis and recovery (2001-2004), it is however mainly through the start-up of new activities that unemployed workers responded to the crisis.

TABLE 8: IPU SIZE AND TYPE BY YEAR (% IPUS)

	1995	1998	2001	2004
Type (% IPUs)				
Self-employment	63.4	71.7	69.8	74.1
Non-wage IPU	28.2	17.3	16.9	16.7
Wage IPU	8.4	10.9	13.3	9.1
Size of IPU (% wage and non-wage IPUs)				
Two workers	72.0	63.6	58.3	68.9
Three workers	16.7	25.0	23.7	15.1
Four or more workers	11.3	11.4	18.1	16.0

Notes: Percentages extrapolated from a sample of 3995 IPUs using Phase 2 sampling weights. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

From 1998 onwards, the *1-2-3 Surveys* asked respondents about the number of workers in the IPU when the business was set up. This enables us to look at growth in employment at the level of the production unit, rather than in an aggregate manner as we did with the study of capital accumulation. Table 9 shows the proportion of IPUs which expanded, contracted or stagnated in terms of the number of workers involved in the business. To reduce recall bias problems we restrict our sample to enterprises that are 20 years old or younger, dropping thus 10 percent of the sample. We disaggregate the sample by initial size, as businesses that started as pure self-employment can only stagnate or expand. We look at growth according to the age of the IPU and the sector of activity.

We can note from Table 9 that the large majority of IPUs that started with only one worker

TABLE 9: INFORMAL BUSINESS GROWTH SINCE START-UP (% IPUS BY INITIAL SIZE)

	More than one worker at start-up				Pure self-employment at start-up		
	Contracted	No growth	Expanded	Total	No growth	Expanded	Total
Overall	20.8	67.0	12.2	100.0	88.1	11.9	100.0
Time in business							
1 year or less	16.3	79.0	4.7	100.0	92.4	7.6	100.0
2 years	16.9	72.9	10.2	100.0	92.6	7.4	100.0
3 years	7.8	80.5	11.6	100.0	82.1	17.9	100.0
4-5 years	19.1	67.0	13.9	100.0	89.1	10.9	100.0
6-10 years	27.5	57.9	14.6	100.0	85.5	14.5	100.0
11-15 years	22.5	61.9	15.7	100.0	87.9	12.1	100.0
16-20 years	30.6	53.0	16.4	100.0	85.3	14.7	100.0
Sector of activity							
Food processing	1.5	78.3	20.3	100.0	85.1	14.9	100.0
Textile & clothing	32.7	51.0	16.3	100.0	94.1	5.9	100.0
Other industry	20.3	56.6	23.2	100.0	78.4	21.6	100.0
Construction	36.2	37.4	26.4	100.0	87.3	12.7	100.0
Trade	16.3	78.0	5.7	100.0	84.4	15.6	100.0
Services	32.7	59.5	7.8	100.0	93.5	6.5	100.0
Catering	13.5	72.3	14.2	100.0	71.6	28.4	100.0
Transport	14.9	78.4	6.7	100.0	93.6	6.4	100.0

Notes: Size and growth are defined in terms of the number of workers in the business. Percentage extrapolated from a sample of 1825 IPUs that started with more than worker, and 727 IPUs that started as pure self-employment, using Phase 2 sampling weights. IPUs older than 20 years old are excluded from the table. The year 1995 is not included because the data on the number of workers at start-up is not available. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

did not grow at all, as only 12 percent increased in size. The proportion of businesses with several workers at start-up that expanded is also around 12 percent, while contraction is much more frequent, close to 21 percent. Some age-growth patterns emerge from the table: expansion is positively correlated with age but so is contraction, in the relevant group of IPUs. This higher share of growth among older businesses could be linked to a survival effect: enterprises that grow are more successful and have higher rates of survival, explaining why they are over-represented among older businesses. There also seems to be an adjustment period during the first two years of business, as IPUs that have been running for three years are those which have the least negative growth. Again this could be due to selection on survival, with IPUs laying off employees before reaching three years of business having a much lower chance of survival than

those who did not. Unobserved exits are one of the main limitations of the data. In addition to exits due to death of enterprises, it is possible that very successful enterprises formalized and were thus excluded from the survey. Therefore both contraction and expansion may be underestimated in the data.

Employment dynamics by sector yield further interesting insights. We first note that there are quite different dynamics between the sectors in function of the initial size. For example, there is a remarkably small number of IPUs in the food processing sector that contract while in this industry, IPUs with initial pure self-employment exhibit an average rate of expansion. This is the only dynamic sector both in terms of employment growth and capital accumulation. Textile, transport and service businesses which were pure self-employment at start-up have the highest rates of stagnation: the very large majority never gets past the single worker barrier. While textile and service activities are the least performing sectors in terms of value added, which potentially explains their slow growth, transport businesses have a high average value added and capital stock (see Table 2). However entrepreneurs in the transport sector are mostly drivers of their vehicles (taxi drivers, rickshaws and cart pullers), which is an intrinsically individual activity and hiring staff would require very large and often unaffordable investments, such as buying a new vehicle. The same explanation applies to the small rate of expansion (6 percent) in that sector for businesses that started with more than one worker. The high rate of contraction in service enterprises could be explained by the high share of these IPUs that operate with no capital, as workforce can be more easily reduced without leaving capital idle. In the textile industry, the high rate of contraction is consistent with the shift of the workforce from informal to formal enterprises in Export Processing Zones. Textile activities are a striking example of the heterogeneity that exists within a sector, as the patterns of growth are very different according to the initial size. Other industries, catering and construction also appear

quite dynamic, with a lot churning in these sectors. The first two are also the highest job creators, among those that started as pure self-employment. These appear to be sectors with a high growth potential, which obey more to an entrepreneurial rather than survivalist logic.

5.2 Determinants of informal business growth

5.2.1 Empirical strategy

We now carry out a multivariate analysis of the determinants of small enterprise growth, with several objectives. First, we can test whether informal businesses in Madagascar follow the growth patterns predicted by theory, in terms of the relationship between age, size and growth. Second, we want to study which types of enterprises, and in particular which industry, have the most potential to grow. Third, we try to assess the role of the macroeconomic environment on growth, with data spanning a much longer period than what previous studies on the same topic have used.

Following previous work by Evans (1987) and McPherson (1996), we measure enterprise growth as the change in the number of workers over the life of the business. Although growth can be measured through sales or profit, we only have retrospective data on the number of workers at start-up, which is assumed to be somewhat correlated to growth in sales.[13] In addition, as we are interested in the dynamics of informal businesses from a job creation point of view, this is not an unsatisfactory measure. We define the dependent variable $Growth_j$ as the annual logarithmic change in employment between the year IPU j was surveyed (T_j) and the year it was created (t_{0j}):

[13] See the discussion on this issue in McPherson (1996).

$$Growth_j = \frac{lnSize_{T_j} - lnSize_{t_{0j}}}{Age_j}.$$

Measuring growth in this manner is subject to several caveats. Firstly, we only know the size of the enterprise at two points in time, at start-up and the year of the survey, which will hide any intermediary changes in the size of the unit. This may be particularly true in the case of older businesses, which experienced subsequent phases of success or contraction. Secondly, as size is measured in the number of workers, and not the number of hours worked (or another continuous variable such as sales), it is a rather lumpy variable.[14] An entrepreneur may intensify his own effort before actually hiring a new employee. Therefore, provided growth of the enterprise somewhat follows the general macroeconomic context (this question being the object of this analysis), the dependent variable will less finely reflect such dynamics. Third, we should be cautious when interpreting the coefficients, as informal businesses often use family labor, which is included in the size measure, but is often not paid. Employment growth may then not necessarily reflect job creation to answer an increasing demand for the goods or services produced by the IPU, but rather absorption of excess labor causing a decrease in productivity to supply work to unemployed family members.

The following equation is estimated using an Ordinary Least Squares regression:

$$Growth_j = \alpha_0 + \sum_{i=1}^{5} \alpha_i Agesize_{ij} + \sum_{i=1}^{8} \beta_i Owner_{ij} + \sum_{i=1}^{7} \delta_i Sector_{ij} + \phi GDP_j + \varepsilon_j. \qquad (1)$$

The *Agesize* vector includes the logarithms of age and initial size of the IPU, with quadratic and interaction terms: $lnAge$, $(lnAge)^2$, $lnSize$, $(lnSize)^2$, $(lnAge) * (lnSize)$. This specification

[14] We use the number of workers as a measure of size because retrospective data on the number of hours worked at start-up are not available.

allows for non-linearity in the effect of age and initial size on growth. The *Owner* vector is a set of the following owner characteristics: age when started firm, female, marital status, education (three dummy variables indicating whether the owner completed primary, middle or high school), a dummy variable indicating whether the household of the entrepreneur owns more than one informal business. *Sector* includes seven dummies indicating the sector of activity of the IPU: food processing, textile and clothing, other industry, construction, services, catering and transport (trade is the reference category).

In addition to this standard firm growth specification, we include the variable *GDP*, which we define as the average annual GDP growth rate in Madagascar over the lifespan of the enterprise:

$$GDP_j = (\prod_{t=t_{0_j}}^{T_j} GDPgrowth_t)^{\frac{1}{T_j - t_{0j}}},$$

where t_{0j} and T_j denote as above the birth year and the survey year of IPU j and $GDPgrowth_t$ is the rate of growth of GDP in year t.[15] We make use of the temporal dimension of the data, which were collected in three different years, 1998, 2001 and 2004, to identify the effect of the macroeconomic context on enterprise growth.[16] GDP_j should capture the effect of economic conditions since the birth of the enterprise and until the time of survey, net of the age effect, which is already controled by the *Agesize* vector. As this variable is an average, it is of course an imperfect proxy of the macroeconomic context, especially for older enterprises. Alternative specifications will be explored in the next sections.

The effect of the global macroeconomic environment may be different according to the sector of activity of the IPU. Some sectors may benefit more than others from overall growth,

[15] Source of the GDP growth data: World Development Indicators, The World Bank.

[16] As mentioned above, the year 1995 is not included in this analysis because no information was collected then on size at start-up.

if they are perhaps more integrated to the "modern" economy through forward and backward linkages. To study this possible source of heterogeneity, the model is also estimated with a set of interactions of the sector dummies and the *GDP* variable.

A few econometric issues warrant discussion, before we look at the estimation results. A potential bias in the estimates may arise from selective survival of firms, based on age or initial size. For any given age, only enterprises that survived up to that age are observed in the survey. The size coefficient may be upward biased if small firms that experience negative growth have a higher rate of failure than larger firms. Unfortunately, we cannot control for the selection of failures because our data are retrospective, not longitudinal. Therefore we never observe enterprises that died, only those that survived. While we should keep in mind that such a bias may exist, the fact that our data are representative cross-sections of all firms at a given point in time means that we are carrying out the analysis on a sample of survivors, which is of interest in itself. Besides, studies in other settings have found this bias to be insignificant (McPherson, 1996). Another bias linked to selective exit may arise from the fact that we do not observe informal businesses which have formalized. If these IPUs showed higher employment growth than those which remained informal, our model would underestimate the extent of firm growth and the size coefficient would be downward biased.

The regression is run on the sample of enterprises younger than 20 years old, and separately by initial size of the IPU. We distinguish between IPUs that started as pure self-employment, which can only stagnate or grow, and those that started with two workers or more, to acknowledge the possibility that these two types of enterprises follow a different type of productive process, the latter perhaps being more entrepreneurial, and the former more subsistence-oriented. We cannot distinguish here between wage and non-wage businesses because we do not know the structure of the workforce at start-up, only the number of workers.

5.2.2 Results

Table 10 presents summarized results, showing only the sector and GDP growth variables and interactions and the partial derivatives of the age and size variables, evaluated at the sample mean.[17] Let us first comment the results for the full sample of enterprises. The partial derivative for the age and initial size variables reveal that both have a strong negative effect on growth, as predicted by Jovanovic's model (Jovanovic, 1982). Looking at the age$\times$size interaction variable, we notice however that it is positive and significant, suggesting that the negative age-growth and age-size relationships do not hold for larger businesses. As they grow older, IPUs that started "large" (in our case, with several workers rather than one or two only) experience a growth rate that does not slow down as fast as for smaller firms. These results are consistent with other findings such as Sleuwaegen and Goedhuys (2002) in Cote d'Ivoire.

IPUs owned by females grow significantly slower than their male-owned counterparts, and the owner being married also has a significant positive impact on growth. The effect of the marital status can be seen as a proxy for access to cheap or even free labor, as the growth in employment includes family labor in the number of workers. An entrepreneur who is married potentially has an available supply of free labor in his spouse and children. Surprisingly there is no effect of the human capital variables at all. Neither schooling, age or experience seem to play a role in the rate of growth of an enterprise. It is possible that these variables only play a role in the survival of these enterprises rather than in their growth.

The sectoral dummies confirm what we saw already in the descriptive statistics. Catering, other industrial activities and food processing experienced employment growth while service and transport activities have a negative impact on the growth of businesses.

The variable proxying the macroeconomic environment during the life of the enterprise has

[17] Full results are available upon request

TABLE 10: DETERMINANTS OF EMPLOYMENT GROWTH

	Start-up size					
	All IPUs		$\geq$ 2 workers		= 1 worker	
Firm age and initial size						
∂Growth/∂Age	-0.011***	-0.012***	0.019*	0.016*	-0.019***	-0.020
	(0.004)	(0.004)	(0.010)	(0.010)	(0.004)	(0.004)
∂Growth/∂Size	-0.072***	-0.071***	-0.064*	-0.056		
	(0.014)	(0.014)	(0.034)	(0.035)		
Macroeconomic environment						
GDP	0.007*	0.008	-0.007	0.021	0.013***	0.002
	(0.004)	(0.008)	(0.011)	(0.020)	(0.004)	(0.009)
Food proc.*GDP		0.022		-0.003		0.034
		(0.022)		(0.034)		(0.028)
Textile*GDP		-0.017		-0.034		-0.009
		(0.017)		(0.051)		(0.018)
Other ind.*GDP		0.015		-0.021		0.036
		(0.025)		(0.041)		(0.029)
Construction*GDP		0.001		-0.133**		0.041
		(0.028)		(0.065)		(0.029)
Services*GDP		-0.023**		-0.073*		-0.011
		(0.011)		(0.044)		(0.010)
Catering*GDP		0.054**		-0.009		0.089**
		(0.024)		(0.028)		(0.035)
Transport*GDP		-0.019		-0.056*		-0.004
		(0.013)		(0.032)		(0.013)
Test of H_0: All sector$\times$GDP interactions = 0						
F statistic		2.441		1.215		2.444
p-value		(0.017)		(0.292)		(0.017)
N	2602	2602	727	727	1875	1875

Notes: OLS regression results, * p<0.1, ** p<0.05, *** p<0.01. Robust standard errors in parentheses adjusted for clustering at the household level. Size is the number of workers at start-up. Partial derivatives of growth with respect to age and size are calculated at the mean of the sample on which the regression is run, using Phase 2 sampling weights. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

a positive and significant effect at the 10 percent level. Enterprises that experienced a higher average GDP growth rate since their birth grew faster than others, while a more recessive or stagnant environment would then imply a slower growth. The set of interactions of the sector dummies and the GDP growth variable are jointly significant at the 5 percent level, suggesting that the effect of the macroeconomic context is heterogeneous in the sectors. Only the catering sector interaction has a stronger positive impact than the reference sector, with a total effect

significant at the 10 percent level. Service IPUs seem to follow a counter-cyclical trend, as the sign of the coefficient is negative and the total effect significant at the 1 percent level, indicating that they perform a labor absorbing function during recession and contract in times of macroeconomic growth. As shown in the descriptive statistics (Table 2), services to households and firms operate with very little physical capital and are mostly owner-only operated. These businesses can easily absorb excess labor because no extra capital is needed by worker. Such IPUs will quickly shrink in size when there is more employment elsewhere, suggesting that the jobs they offer in times of stagnation correspond to queuing jobs. One can think of such businesses hiring family helps to give them an occupation and relieve the entrepreneur of some of his work, without them being necessarily paid or very productive. In such a case, growth in employment cannot be considered a stricly "positive" outcome for the business, whose overall labor productivity will strongly drop.

Turning now to the regression run on the sub-sample of IPUs that started with more than one worker, we see that the size-growth negative relationship holds, although it is weaker than in the full sample, but the effect of age on growth becomes positive. As hinted by the positive sign of the age$\times$size coefficient in the full sample regression, for enterprises that started with at least two workers, becoming older has a positive effect on growth. The gender and marital status of the owner no longer matter in the growth process of these IPUs. This is a sign that entreprises starting with more than one worker follow a different productive organization than owner-only units, less embedded in the household and dependent on it. None of the sector dummies are significantly different from trade. We no longer have an effect of the average GDP growth rate and the sector$\times$GDP interactions are not globally contributive to the model, as indicated by the F-test. However we can note again counter-cyclical dynamics in the services sector, as well as in transport and construction, the latter being the only significant total effect. This counter-cyclical

effect in services and construction can again be explained by the labor-intensive functioning of these activities, which can easily use more labor (even if it is not very productive).

Finally, we again find a strong negative relationship between age and growth among IPUs that started with one worker. The female owner variable has a coefficient close to the full sample estimate but is not significant (but the p-value is equal to 10 percent exactly). The marital status is again positively correlated with growth, which corroborates our hypotheses that self-employment is dependent on the family environment for growth, thanks to easily accessed family labor. The sector effects are similar to those found in the full sample regression. The GDP growth variable has a strong positive effect on enterprise growth, significant at the one percent level, indicating that businesses that started out as pure self-employment were pulling the effect of the macroeconomic context in the full sample regression. Once again, the catering sector benefits the most from growth (or suffers the most during economic recession).

5.2.3 Alternative specifications

The GDP_j variable used in the regressions as a proxy for the global macroeconomic context during the life of the business is an average growth rate. As it is very aggregate in nature, it may hide quite different overall economic dynamics for a same average figure.[18] We show alternative specifications of the macroeconomic context in this section. We refine specification (1) by introducing a measure of the volatility of GDP growth. Volatility is measured by the standard deviation of GDP growth between the survey year and the birth year of the enterprise. For the full sample and the sub-sample of IPUs that started as owner-only units, results are robust to the addition of this variable, which is not significant (Table 18). IPUs that started with two workers or more reveal an interesting positive and significant effect of the standard deviation of GDP

[18]However, the magnitude of the negative GDP growth rate in 2002 is sufficient to influence the average for IPUs who experienced the crisis.

growth on their employment growth, with the GDP growth variable still non-significant. This variable proxies volatility and thus the higher it is, the more variations in the macroeconomic context the enterprise experienced. The positive effect could be a survival effect. Larger enterprises at start-up that grow fast resisted better to large changes in the economy, such as the crisis. This would cause these enterprises to be overrepresented in the data, and explain this positive effect of volatility on their growth.

Another possibility is to introduce a variable measuring the number of years the IPU experienced a positive GPD growth rate, as a ratio of its age. The effect of this variable is significant only for businesses that started with one worker, for which it is positive (Table 18).

We present a last possible specification to study the effect of the macroeconomic context on employment growth in informal businesses, in which the regression is run on separate age group sub-samples. Seven age groups are defined: IPUs aged one year and less (that includes enterprises born the year of the survey), 2 years, 3 years, 4 to 5 years, 6 to 10 years, 11 to 15 years, and 16 to 20 years old. In this manner we completely control for the age effects, and compare enterprises at the same stage in their "life cycle" in different macroeconomic contexts. Rather than using the GDP_j variable defined above, we include year dummies, which identify the effect of the context in function of the birth year of the enterprise. Results are shown in Table 17, which presents only the coefficients of the year dummies.

In most cases, the year dummies are not significantly different form zero. In the full sample regression, we note a positive coefficient for the 2001 variable in the sub-sample of businesses that are two years old. This suggests that IPUs born in 1999 and surveyed in 2001 benefited from the general positive macroeconomic context, as they did not (yet) experience the crisis. The oldest businesses suffered the most from the crisis, as they are the only age groups with a significant negative effect of the year 2004. However this could also be due to their specific

year of birth, rather than the survey year. There is a significant negative effect of being born in 2001 if the business was surveyed in 2004 (ie. the three years old age group) suggesting a fully negative effect of the crisis on businesses set up just before that crisis.

To sum up, employment growth in informal businesses is marginal relative to the process of extensive growth followed by the largest faction of the sector. However, there is some heterogeneity across sectors and IPU size, with some segments exhibiting a high growth potential, and a more entrepreneurial model. The global macroeconomic context of growth during the 1995-2001 period does not seem to have triggered a more intensive growth process in the informal sector, which mainly continued to grow at the extensive margin. Such a finding of stagnation would be consistent with the hypothesis of extremely low returns to capital in very small-scale activities in developing countries. In the next section, we seek evidence of the existence of such poverty traps.

6 Returns to capital in the informal sector

6.1 Empirical strategy

We investigate this question now by estimating production functions to analyze returns to capital, using the four cross-sections of data available. Unfortunately, there is no retrospective information on capital accumulation and value added that would enable us to analyze returns to additional investments within each IPU. We therefore have to rely on cross-sectional data to infer these returns.

Let VA_j be the monthly value added of IPU j. We estimate the following Cobb-Douglas production function with two factors, capital (K_j) and labor (L_j):

$$lnVA_j = \beta_0 + \beta_1 lnL_j + \beta_2 lnK_j + \sum_{i=1}^{8} \gamma_i HC_{ij} + \sum_{i=1}^{9} \delta_i IPU_{ij} + \sum_{i=1}^{3} \phi_i Year_{ij} + \varepsilon_j. \quad (2)$$

Labor is the total monthly number of hours worked by the owner, paid and unpaid workers. Capital is defined, as in Section 3, as the total replacement value of all the equipment of the firm. HC_{ij} is a set of human capital variables and other owner characteristics (sex, education, experience, age, marital status). IPU_{ij} is set of IPU characteristics, including seven sector dummies (as in the growth regressions) and the age and age squared of the IPU. $Year_{ij}$ is a set of three variables indicating the survey year, with 1995 as the reference.

As we wish to test whether informal firms exhibit patterns of decreasing returns consistent with neo-classical theory or on the contrary if poverty traps appear, we follow work by Grimm *et al.* (2011), and estimate the production function on the entire pooled sample and on sub-samples of capital stock, defined by the quartile of capital stock to which the IPU belongs.[19] In line with the previous analyses presented in the paper, we want to study performance and returns in the informal sector, considering its heterogeneity, to obtain a finer idea of what may drive the dynamics in the various segments of the sector. Therefore we also look at returns according to the size of the enterprise in terms of the number of workers, dividing the sample into owner-only IPUs and IPUs operating with more than one worker.[20] Given the sectoral heterogeneity, we also run the same regressions on sub-samples by sector (and capital stock). Changes in marginal returns over time are considered by adding year×capital and year×labor interaction terms to the list of regressors.

In equation (2), β_2 is the elasticity of value added with respect to capital. Marginal returns to capital (MRK) are obtained by multiplying the estimated elasticity by the mean average product

[19]To avoid composition effects which may by a problem with repeated cross-sections, we defined the quartiles separately for each year. Therefore, in each survey wave, the sample is divided in four quartiles.

[20]We merged wage and non-wage IPUs into a single category to have sufficiently large samples.

of capital in the sample over which the estimation is run:

$$MRK = \hat{\beta}_2 \times \frac{\overline{VA}}{\overline{K}}.$$

Let us now discuss a few econometric problems common to the estimation of production functions. Although the available data limit what can be done to correct some of these issues, we attempt to present how they might bias the coefficients in the production function. One source of bias is measurement error, which we tackled by dropping influential outliers from the regression, identified by the DFITS-statistic (Belsley *et al.*, 2004). Applying this procedure, we lose about 5 percent of the observations. Another problem is the simultaneity of the level of observed inputs and output. Labor and capital are chosen by the entrepreneur and may be correlated with an unobserved productivity shock or an unobserved input, such as managerial ability of the owner. The estimated coefficients of the input variables can therefore be biased upward, in particular labor which is more flexible than capital and thus more easily adjusted following a shock. In the same vein, an upward bias will be caused by reverse causality between the level of profit and capital. We cannot appropriately tackle this issue with the data at hand, as correcting this bias usually requires instrumenting with input prices or using panel data (Ackerberg *et al.*, 2007; Aguirregabiria, 2009; Olley and Pakes, 1996).

A third common problem in the estimation of production function is endogenous exit which introduces a selection bias, an issue which we already discussed in the analysis of the determinants of growth. In a cross-section, as we move up the distribution of firm age, the only firms we observe are survivors. As smaller firms are known to be more vulnerable than larger ones, surviving small firms are likely to be selected and have high levels of outputs. This would tend to bias downwards the capital stock coefficient (Ackerberg *et al.*, 2007; Aguirregabiria, 2009).

Finally, we consider specification issues. Firstly, IPUs operating with no capital or who have a zero (or negative) value added are excluded from the regression, because these variables are expressed in logarithms. As this could bias the coefficient of the capital variable, we also estimated a modified equation which allows the inclusion of enterprises operating with no capital. Following Battese (1997), in this specification, a dummy variable equal to one if the IPU runs with zero capital is included and lnK_j is modified to be equal to zero when the zero capital dummy equals one (instead of being a missing value). Secondly, as the Cobb-Douglas production function imposes strong constraints on the technology, we also estimated a translog specification which allows a more flexible functional form.[21] Results were very robust to these changes and are not presented here.

6.2 Results

We briefly describe the evolution of value added over the decade under study before looking at the regression results. During the period of economic growth (1995-2001), mean monthly value added of informal businesses increased steadily (Table 11). Between 2001 and 2004 it roughly stagnated, reflecting the sharp economic contraction that occured in 2002. Consistent with our previous findings of extensive growth, the total value added of the informal sector continued to increase throughout the entire period, even after the crisis.

Table 12 reports the capital and year coefficients estimated on the full sample and on the four quartiles of capital stock separately. The marginal returns to capital are shown at the bottom of the tables. The time dummies indicate that the increase in value added over the entire period was significant, but, although value added remained higher in 2004 than initially, the difference

[21] The translog (or transcendental logarithmic) function can be written as (omitting the other control variables):

$$lnVA_j = \beta_0 + \beta_1 lnL_j + \beta_2 lnK_j + \beta_3 (lnL_j)^2 + \beta_4 (lnK_j)^2 + \beta_5 (lnL_j) * (lnK_j) + \varepsilon_j.$$

TABLE 11: MEAN AND MEDIAN VALUE ADDED IN IPUS AND TOTAL VALUE ADDED OF THE INFORMAL SECTOR (MONTHLY)

	1995	1998	2001	2004
Mean (1000 MGF)	401	465	521	529
Median (1000 MGF)	162	182	243	214
Total (bn MGF)	49.1	75.3	105.9	125.9

Notes: The total value added, expressed in billion MGF, is an estimation of the total value added of the informal sector extrapolated from the sample of 3995 IPUs, using Phase 2 sampling weights. Mean and median value added of IPUs are also weighted. Exchange rate on the 2/5/2012: 1€=13,700MGF, or equivalently, 1 million MGF=73€. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

TABLE 12: PRODUCTION FUNCTIONS

		Quartiles of capital stock			
	All	1st	2nd	3rd	4th
Log capital	0.15***	0.16***	0.09*	0.18***	0.35***
	(0.01)	(0.03)	(0.05)	(0.07)	(0.05)
Year 1998	0.31***	0.26**	0.42***	0.30***	0.30***
	(0.05)	(0.11)	(0.09)	(0.10)	(0.10)
Year 2001	0.49***	0.56***	0.59***	0.46***	0.38***
	(0.05)	(0.11)	(0.08)	(0.10)	(0.10)
Year 2004	0.54***	0.63***	0.54***	0.62***	0.33***
	(0.05)	(0.11)	(0.08)	(0.10)	(0.10)
R^2	0.456	0.343	0.463	0.363	0.398
N	3414	658	911	923	902
Mean monthly value added	487	248	368	496	892
Mean capital stock	2862	32	256	1340	11329
Marginal returns to capital	0.025	1.190	0.129	0.068	0.028

Notes: OLS regression results, * p<0.1, ** p<0.05, *** p<0.01. Robust standard errors in parentheses adjusted for clustering at the household level. Marginal returns to capital are calculated at the weighted mean monthly value added and capital stock of the sample on which the regression is run. Value added and capital stock are in 1000 MGF. Exchange rate on the 2/5/2012: 1€=13,700MGF, or equivalently, 1 million MGF=73€. Full regression shown in Appendix. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

between the 2001 and the 2004 dummy coefficients is not significant. This result is in line with a crisis effect which slowed down the progress in income and profits in the informal economy. This is true for all quartiles but the third, which is the only one that experienced a significant increase between these two years. In fact, in the highest segment of capital stock, value added was lower in 2004 than in 2001.

Once the level of factor inputs, owner characteristics and time are controlled for, the sector effects are slightly different from what was shown in the descriptive statistics. Transport businesses do not have a significantly higher value added than trade, while they had the highest mean value added in the informal sector. Textile, other industry and service IPUs are the least profitable, while construction exhibits the highest value added.[22]

We find an estimated elasticity of capital of 15 percent, lying between 9 and 35 percent across quartiles. As shown in the first column of Table 12, the implied marginal returns to capital are 2.5 percent. However, at low levels of capital, they are much higher, equal to 119 percent. An "average" entrepreneur, operating with a stock of capital of 32,000 MGF (2.3 €) and realizing a monthly value added of 248,000 MGF (18 €) would increase his or her monthly value added by 11,900 MGF (0.86 €) if the equivalent of 10,000 MGF (0.73 €) was invested in the IPU. The estimated elasticity in the second quartile of capital stock is lower (9 percent), and the marginal returns are almost ten time lower. Although the estimated production elasticities are higher above the median of the distribution of capital, implied marginal returns are, with 6.8 percent and 2.8 percent for the third and fourth quartiles respectively, substantially lower than in the lowest segment of the capital distribution.

The sharp drop in returns as we move up the distribution of capital is due to the very strongly

[22]Other controls have the expected sign. In particular, female entrepreneurs are less productive than their male counterparts. The gender performance gap is analyzed extensively in Nordman and Vaillant (2013). Full results available upon request from the authors.

decreasing average product of capital. Decreasing returns to capital contradict the standard theory of poverty traps, but are in line with findings from other studies on Africa, Latin America and Asia (e.g Grimm *et al.*, 2011, for West-African countries). We should hence reconsider poverty traps as an explanation of stagnation at subsistence levels for a large share of entrepreneurs. High returns indicate that there is a growth potential, as a small entrepreneur reinvesting part of his or her gains would reap larger profits, relative to the investment made.

TABLE 13: ESTIMATED MARGINAL RETURNS TO CAPITAL, BY SIZE AND SECTOR OF ACTIVITY

		Quartiles of capital stock			
	All	1st	2nd	3rd	4th
Size of IPU					
Self-employment (1 worker)	0.017	1.138	0.050	0.023	0.022
$\geq$ two workers	0.033	0.460	0.620	0.217	0.011
Sector of activity					
Food processing & other industries	0.025	0.551	0.040	0.167	0.013
Textile & clothing	0.019	0.934	0.217	0.019	0.030
Construction	0.255	2.367	0.584	NA	NA
Trade	0.029	1.602	0.291	0.149	0.007
Services	0.025	0.648	-0.083	-0.011	0.030
Catering	0.080	NA	0.431	0.213	0.020

Notes: * p<0.1, ** p<0.05, *** p<0.01. Marginal returns to capital are calculated using the estimated elasticity obtained from the respective sub-sample regressions (full results not shown), at the weighted mean monthly value added and capital stock of the sample on which the regression is run. Regression includes same set of controls as the full sample model. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

We now look at returns to capital by type of IPU and sector to assess whether this pattern of decreasing returns emerges in every segment of the sector. Table 13 shows the marginal returns to capital calculated using the estimated elasticities from the regressions run on separate size sub-samples (full regressions not shown). We find very high returns to capital (114 percent) in the smallest IPUs (owner-only), but these returns are even more sharply decreasing than in the full sample, dropping in the second quartile to 5 percent only. In IPUs with two or more workers, the pattern is different: returns are not as high in the lowest segment, and are

TABLE 14: MARGINAL RETURNS TO CAPITAL BY YEAR

		Quartiles of capital stock			
	All	1st	2nd	3rd	4th
Log capital	0.16***	0.24***	0.14	0.48***	0.27***
	(0.02)	(0.07)	(0.10)	(0.17)	(0.08)
Log capital*1998	0.01	-0.16*	-0.07	-0.36*	0.26**
	(0.02)	(0.09)	(0.15)	(0.21)	(0.12)
Log capital*2001	-0.02	0.00	-0.19	-0.07	0.02
	(0.02)	(0.10)	(0.13)	(0.23)	(0.12)
Log capital*2004	-0.04*	-0.11	0.05	-0.44**	-0.02
	(0.02)	(0.09)	(0.14)	(0.20)	(0.11)
R^2	0.454	0.344	0.457	0.359	0.416
N	3410	651	907	919	904
Test of H_0: all capital*year interactions = 0					
F statistic	1.961	1.526	1.463	2.475	2.448
p-value	0.118	0.207	0.223	0.060	0.062
Marginal returns to capital by year					
1995	0.020	2.019	0.197	0.169	0.017
1998	0.025	0.359	0.069	0.040	0.038
2001	0.026	2.499	-0.069	0.139	0.023
2004	0.025	1.340	0.432	0.021	0.024

Notes: OLS regression results, * p<0.1, ** p<0.05, *** p<0.01. Robust standard errors in parentheses adjusted for clustering at the household level. Marginal returns to capital are calculated at the weighted mean monthly value added and capital stock of the sample on which the regression is run. Other controls not shown: labor×year interactions, owner characteristics, sector, year dummies. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

actually increasing between the first and the second quartile. Even in the third quartile, returns remain quite high, over 20 percent, and only in the highest quartile are returns very low. The relationship between capital and value added in these enterprises is somewhat flatter than in the smallest IPUs, suggesting that in this category of businesses, capital seems allocated in a more efficient manner than in the smallest businesses, where returns are extremely heterogeneous.

Table 13 also presents marginal returns implied from the sector sub-sample regressions. Food processing and other industries are aggregated in a single sector to ensure that the sample size is large enough to get a reliable estimate. Given small sample sizes, returns are not estimated in the third and fourth quartiles of capital for the construction sector, nor are they in

the first quartile for catering.[23] We find for all sectors the same pattern of decreasing returns to capital. Construction exhibits very high returns overall (25 percent), followed by catering (8 percent). We find for the other sectors similar returns to the pooled estimation, around 2-3 percent. In the least capital-intensive segment, construction and trade have the highest returns, but all sector exhibit returns above 50 percent. In the higher segments, returns are very low, and nil in capital-intensive trade firms. What we concluded above for the informal sector as a whole is hence confirmed at the sectoral level: strongly decreasing returns to capital lead to reject the poverty trap hypothesis.

We now discuss the change in marginal returns to capital over time, looking at the results of the regression augmented with capital$\times$year interactions (Table 14). We note that the marginal returns to capital are remarkably stable over time (between 2 and 2.6 percent). With a few exceptions, in each year, returns to capital roughly follow the same pattern of strongly decreasing returns to capital. In 1998, returns to capital start out much lower than the other years (35 percent), due both to a lower elasticity and a higher average stock of capital in the lowest quartile (leading to a lower average productivity of capital). In 2001, an odd pattern emerges in the second quartile, which presents negative returns, due to a negative elasticity of value added with respect to capital.

7 Conclusions

Little is known on the dynamics of the informal sector in times of growth and crisis in developing countries. This paper is an attempt to analyze in detail how the informal sector changed over time, and whether it benefited or not from growth. We assess whether it has a potential to grow,

[23] We do not run this regression on the transport sector in which capital stock is mostly vehicles and therefore very high and lumpy.

create jobs and wealth for the urban population or if it comprises only subsistence-oriented, stagnant enterprises. The context we have chosen, Madagascar between 1995 and 2004, is particularly interesting because it refers to a period of fragile growth, characterizing many African countries today.

A first aggregate approach of the informal sector shows that the informal labor market followed a counter-cyclical dynamic, shrinking during growth and absorbing excess labor in crisis. Within the informal sector however, independent employment increased throughout the entire period. In other words, informal business creation was a major trend both during the first period of positive macroeconomic context, but also during crisis and recovery. Studying growth at the level of the informal production unit shows a large amount of stagnation as most enterprises remained very small. In addition, capital accumulation was slow and enterprises mostly operated with little physical capital. Only the smallest, owner-operated enterprises expanded in accordance with the macroeconomic context, while in larger IPUs, growth appears somewhat disconnected from the context. The situation however is quite heterogeneous. Some activities appeared counter-cyclical, expanding during crisis and shrinking during growth.

The analysis of such a rich dataset reveals lots of different dynamics, by sector or size, and the heterogeneous character of the sector. However, it appears that growth in the informal sector was mostly extensive, with little job creation or capital accumulation. Although such a situation would be consistent with the existence of poverty traps, estimates of marginal returns to capital tend to reject this hypothesis. On the contrary, with decreasing returns to capital, the informal sector actually exhibits patterns consistent with the neo-classical theory of the firm. An efficient allocation of capital should then direct investment towards the smallest enterprises to reap the gains of these high returns to capital.

One question that therefore remains to be answered is: why are microentrepreneurs not

reinvesting their gains in their business if returns are so high at low levels of capital? First, it may be rational for the entrepreneur to stay small and invest his gains to create a new business, thus benefiting from the high returns to capital in very small units. Second, the entrepreneur faces a number of constraints that may explain a behavior different from what would be expected from a rational investor. Capital market imperfections and high risks in conjunction with risk aversion are likely to be important causes of this inefficient capital allocation. Another possibility is that the entrepreneur would rather keep his business small to stay completely in control, rather than hire labor which could entail high supervision costs.

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8 Appendix

TABLE 15: CATEGORY DEFINITIONS AND EXAMPLES

Category	Share (%)	Definition or examples
Type of labor organization		
Self-employment	70	IPU owner is the only worker
Non-wage IPU	22	IPU operates with more than one worker but no salaried employees
Wage IPU	10	IPU operates with more than one worker with at least one salaried employee
Size of business (capital stock)		
1st quartile	25	
2nd quartile	25	Quartiles of capital stock are calculated
3rd quartile	25	separately for each year.
4th quartile	25	
Sector of activity		
Food processing	3	butcher, baker, yoghurt maker
Textile & clothing	16	tailor, knitter, embroider, linen maker, shoemaker, leather apparel maker
Other industry	8	woodworker, basket maker, brick maker
Construction	7	builder, plumber, electrician
Trade	35	fruit and vegetable retailer, convenience store owner, cigarettes retailer, clothing retailer
Services to households & firms	22	battery charger, repairman, jeweler, mechanic, realtor, teacher, hairdresser, launderer, docker
Catering	4	restaurant owner
Transport	5	taxi, transporter, rickshaw

TABLE 16: STRUCTURE OF THE STOCK OF PHYSICAL CAPITAL BY YEAR (% OF TOTAL CAPITAL)

Type of capital	1995	1998	2001	2004
Buildings & land	53.0	43.3	48.8	50.9
Machines	11.8	11.4	9.1	10.6
Furniture & office equipment	1.3	1.8	1.7	2.0
Vehicles	23.6	35.3	33.1	25.7
Tools	8.6	7.1	6.3	9.3
Other	1.6	1.2	1.2	1.3
Total capital stock	100.0	100.0	100.0	100.0

Notes: Percentages are calculated using Phase 2 sampling weights. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

TABLE 17: DETERMINANTS OF EMPLOYMENT GROWTH BY AGE GROUP

	Time since start-up of IPU						
	1 year	2 years	3 years	4-5 years	6-10 years	11-15 years	16-20 years
	All IPUs						
Year indicator (ref: 1998)							
2001	0.040	0.061*	0.045	0.021	0.014	-0.061	-0.088
	(0.031)	(0.036)	(0.059)	(0.036)	(0.036)	(0.053)	(0.077)
2004	0.034	0.020	-0.060	0.039	0.034	-0.089*	-0.132**
	(0.027)	(0.035)	(0.054)	(0.032)	(0.035)	(0.052)	(0.062)
N	481	271	219	432	629	356	214
	Start-up size $\geq$ 2 workers						
2001	0.012	0.071	0.047	-0.000	-0.091	-0.178*	-0.133
	(0.078)	(0.094)	(0.106)	(0.077)	(0.085)	(0.104)	(0.240)
2004	0.088	0.076	0.132	0.072	-0.013	-0.245*	-0.160
	(0.070)	(0.103)	(0.119)	(0.067)	(0.086)	(0.128)	(0.216)
N	132	73	63	130	170	101	58
	Start-up size = 1 worker						
2001	0.047	0.057	0.062	0.040	0.047	-0.023	-0.067
	(0.032)	(0.038)	(0.082)	(0.041)	(0.039)	(0.059)	(0.086)
2004	-0.006	-0.000	-0.148**	0.033	0.047	-0.044	-0.078
	(0.028)	(0.032)	(0.072)	(0.036)	(0.036)	(0.058)	(0.065)
N	349	198	156	302	459	255	156

Notes: OLS regression results, * p<0.1, ** p<0.05, *** p<0.01. Robust standard errors in parentheses adjusted for clustering at the household level. Controls not shown: initial size, characteristics of owner, sector indicators. 1 year age group includes IPUs born the year of the survey. *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.

TABLE 18: DETERMINANTS OF EMPLOYMENT GROWTH WITH ALTERNATIVE MACROECONOMIC CONTEXT PROXIES

	Start-up size					
	All IPUs		$\geq$ 2 workers		= 1 worker	
GDP growth	0.009*		0.003		0.011**	
	(0.005)		(0.012)		(0.005)	
GDP standard deviation	0.042		0.353**		-0.075	
	(0.084)		(0.172)		(0.092)	
Years positive GDP growth		0.030		-0.070		0.076***
		(0.025)		(0.060)		(0.026)
Observations	2602	2602	727	727	1875	1875

Notes: OLS regression results, * p<0.1, ** p<0.05, *** p<0.01. Robust standard errors in parentheses adjusted for clustering at the household level. Controls not shown: initial size, characteristics of owner, sector indicators *Source*: *1-2-3 Surveys*, Phase 2, 1995-2004, INSTAT/DIAL/MADIO; author's calculation.