Multi-Dimensional Informality and Dynamism of Microenterprises in Africa

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Abstract

The informal economy in Africa has been considered both the cause and result of underdevelopment, and that dichotomous understanding of the formal-informal divide, simply based on a single criterion such as whether an enterprise is registered or not, is not satisfactory. In this paper, we propose Composite Informality Index (CII) as a continuous measure of informality enclosing multiple indicators of individual enterprise. We applied multiple correspondence analysis to quantify CII. We examined whether CII has explanatory power for firm size, sales and growth, and the degree of resiliency seen in shocks received from COVID-19 and recovery from them. We found that informality is associated with a smaller size of employment and sales, consistent with stylized facts of informality. However, CII is not directly related to sales growth, rejecting the general perception of linking informality to slower business growth. A business owner-operator mindset, rather than being more or less informal, determines business growth. The informality is associated with smaller revenue loss from COVID-19 shock, suggesting informal enterprises' higher absorptive capacity. We also found that business perspectives that appreciate the full control of their own business and the flexibility to innovate, which are also linked to higher sales growth, are associated with lower informality. Our method would be particularly useful for devising policies to boost owner-operators' motivation that would help African countries to enhance the dynamism of the microenterprise sector.

Keywords: MCA, sales growth, resiliency
JEL O17, O55, Z13

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1. Introduction

The informal economy in Africa has been considered both the cause and result of underdevelopment. Firms are mostly self-employed, operating on a minuscule scale and at a low level of organization and technology. They are survivalists who avoid taxation and other costs of complying with the established judicial, regulatory, and institutional requirements, taking the risk of being fragile without having institutional protection (Fayomi et al., 2018). The dualistic nature of the labor market predominated by the informal sector has shaped a stark income inequality (David et al., 2023).

The dominant view in economics literature recognizes the informal sector as a by-product of underdevelopment and poor regulatory framework and enforcement. Due to barriers to entry, workers' low level of education prevents them from competing for higher wages in formal employment (Amaral and Quintin, 2006). Malta et al. (2021) found that women are overrepresented in the informal economy because existing gender gaps reduce their access to formal jobs. La Porta and Shleifer (2014) point out that incentives for informal firms to become formal in poorer economies are weak, and as the country develops, informality becomes less important. Devine (2021) and Ohnsorge and Yu (2022) associated informality with institutional settings that burden business activities, such as heavy taxes, heavy-handed regulations, inability to enforce contracts and ownership, corrupt political environment, and the lack of government accountability. These authors argue that streamlining regulatory and tax frameworks and improving enforcement mechanisms should lead to the formalization of the informal economy.

While economists viewed the informal economy as a peripheral entity and a transitional one that would dissolve as the economy and its institutions developed, anthropologists saw it as a lively and free entity and an important complement to the institutional economy for a notable role in development, especially in the provision of employment opportunities among women and youth. It is widely acknowledged that the concept of the informal economy was first proposed by the anthropological framing by Hart (1973) based on his field research in Acra. He communicated with development economists at the time, such as Todaro (1969) and his followers, to abandon the employment/unemployment dichotomy because he noted most city dwellers being occupied in a street economy outside the formal institutional protection of state bureaucracy. In his view, those who enter informal occupations do not do so due to failure to obtain a wage job. He understood that cities attract workers not by the chance of getting a job at higher wages but by the multiplicity of informal income opportunities, which allows migrants to look to the prospect of a good life with or without a formal job. He also noted that personal relationships, such as ethnic and kin-group membership, play a key role in distributing informal jobs and providing shelter for newcomers and those in an emergency. Meagher (2010) argues that all markets are regulated, and an enterprise not being registered does not necessarily mean that it is unregulated. She contends that informality should be conceptualized as an

alternative terrain of regulation operating under social networks outside the state. In this view, people can actively explore the balance between formal and informal regulations. If there is no other choice than to be informal, one would face the regulation based on social networks, which could be more tedious than formal ones in some respects.

Anthropologists also observed that informal traders play a critical role in the market economy by providing multiple benefits that formal retailers do not offer, such as closeness, convenience, flexibility, and selling at lower prices to consumers. Wegerif (2020) noted that unregistered street traders, hawkers, spaza1 shops, and bakkie traders in South Africa contribute to integrating local businesses, from producers to local shops, bars, and restaurants, and they are the eyes on the street that create safer and more hospitable public spaces. He reports that the government ignored these traders without giving due support under the restriction during the COVID-19 sanitary crisis, and the closure of these traders' businesses significantly reduced social welfare.

If we define resiliency as one's capability to absorb shocks, adapt, and restore to shifting circumstances, informal businesses would seem to be less resilient and more fragile to shock because they lack protection from formal institutions. Fragility, it is imagined, might also be associated with the lack of necessary resources to cope with a crisis, such as the deployment of the Internet and online tools under the lockdown.

However, the recent experience from the COVID-19 pandemic presents various examples to challenge the idea that informal businesses were vulnerable. We witnessed numerous informal businesses blossoming during the crisis, such as delivering restaurant food and daily necessities and e-commerce on online platforms. Some replaced or complemented disrupted businesses, and others emerged as completely new businesses from a structural change in consumer demand. Informal businesses are often more resilient because they escape government regulations and respond flexibly to change.

Wrigley-Asante and Frimpong (2023) report that the border closure during the pandemic affected Ghanaian women in informal cross-border trading. However, they used a variety of strategies to get themselves through those difficult times, including switching suppliers, using illegal routes to get their products into the country, and utilizing various social networks created to facilitate their businesses. Analyzing the West African value chain of African print textiles centered in Togo, Ebia (2023) found that the formal traders sourcing from a lead firm in the Netherlands broke the lead firm's rigid sales control and started to rely on the international sales network of informal traders who commercialize non-branded imitations from Chinese manufacturers, thus competing with formal traders. The latter continued its business by changing from the previous method of going to China to buy products, ordering via the Internet, paying by credit card, and receiving goods by delivery service. The negotiations with buyers were also switched to an online platform. The author suggests the flexibility of informal traders had an advantage over the rigidly controlled formal sales system in adapting to the turbulence during COVID-19. Sampson (2020) reported that microenterprises in Aba, a Nigerian

commercial center which is known for the uncommon ability to fabricate or put together anything under the sun, rose together to the lack of personal protection equipment amid the sanitary crisis to mass produce fabric face masks to be sold at affordable prices.

These narratives show that informal businesses can cope flexibly with adversity. However, the ability of individual informal firms to respond to shocks and the extent to which government safety nets are in place might vary from case to case. We cannot easily generalize about whether the informal economy is more (or less) resilient. (Aditya and Amri 2023). The ability to resist also may be short-lived because of the limited resources to sustain them and the lack of government support.

2.   Understanding multiple dimensions of informality in the African economy

ILO's 15th International Conference on Labour Statistics (ICLS) resolution in 1993 broadly defines the informal sector as units that "operate at a low level of organization, with little or no division between labor and capital as factors of production and on a small scale. Labor relations – where they exist – are based mostly on casual employment, kinship, or personal and social relations rather than contractual arrangements with formal guarantees." To operationalize this concept for the compilation of internationally comparable statistics on informality, ILO (2013) specifies informal businesses as household unincorporated enterprises comprising own-account enterprises and enterprises of employees without formal contracts[1]. The 15th ICLS also specified the size criterion for employment for informal enterprises of employees, which can be varied by country. It does not specify the location criterion, whether enterprises are carried out in owners' dwellings or other fixed premises or ambulates without fixed workplaces.

ILO (2013) considers that the informal sector comprises enterprises that do not conform to legal and regulatory frameworks. In this sense, the criterion of not being registered is generally applied. The reference for registration includes laws and acts governing business conduct, labor contracts, tax, and social security, and regulations enacted by local authorities for a license or business permit. Based on a set of similar definitions, Schneider (2005) found that the informal economy in African nations increased remarkably in the 1990s. However, in a follow-up research, Medina and Schneider (2018) report that Sab-Saharan Africa's informal sector size as a percent of GDP declined from 2000-2015, although it stands at the highest level compared to other regions worldwide.

Many characteristics have already been given here, but this may not be a complete list yet. Mead and Morrisson (1996) likened the informal economy to an elephant because we know it when we see

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[1] The concept of the informal economy excludes any illicit activities and production wholly for its own final use.

it, but we may not be able to define it precisely[2]. De Castro et al. (2014) proposed that the binary classification of formal versus informal firms needs to evolve into a multi-dimensional continuum along which the path to formalization unfolds. The uniform view that informal enterprises meet all the ILO elements is also problematic. They are registered with the authorities and pay taxes in some parts. However, they are unregistered in others, deviate from the regulations, and evade taxes. Bruno Lautier viewed the informal economy as a unicorn. The literature abounds with definitions, but we could never meet one with all those characteristics because it does not exist (reported by Charmes 2016).

Following the foregone discussion, we consider adopting a binary definition of informality, such as whether it is registered with the government or not, is inappropriate. Even if we use a pluralistic definition of informal, it is still a binary definition that defines informal by whether it meets all of the many criteria as set forth by the ILO, and everything else is considered formal. An informal index expressed in real numbers that can be sequentially ordered as more informal when more of the more important criteria are met under the pluralistic criteria would have greater utility for the purpose of empirically analyzing the relationship between informality and business outcomes. In order to use a multi-dimensional definition in a way that is also operational, we propose to weight each criterion as non-arbitrary as possible and aggregate them into a real number score for the informality of each respondent.

In light of the above argument, our task is to construct the concept of informality composed of multi-dimensional information and translate a bundle of multivariate measurements into a composite index in real numbers. We find a similar analytical challenge in social science to enumerate complex ideas such as poverty, social value, social capital, well-being, and consumers' tastes. We follow the approach shown by Asselin (2009) for constructing a multi-dimensional composite index adopting the multiple component analysis (MCA) technique, which we will discuss in some detail in section 4.

3. Data

This study exploits a unique database obtained from a survey of a large pool of microcredit recipients. In June 2021, ASA International (ASA-I) and Duke University Africa Initiative surveyed 1500 ASA-I clients in Kenya, Ghana, and Nigeria[3]. ASA-I is a major microfinance institution listed on the London Stock Exchange, with more than 2.5 million clients in South Asia and sub-Saharan Africa.

The informal economy is predominant in the three countries. ILOSTAT reports that the proportion

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[2] The parable of an elephant originates in an Indian Buddhist tale of blind men and an elephant, which cautions the tendency of people to take as fact only their own limited subjective experiences without looking at the whole.

[3] See Hino et al (2024b) for a comprehensive information of the ASA-I survey.

of informal employment in total employment reaches 78.1% in Ghana (2015), 86.5% in Kenya (2019), and 93.9% in Nigeria (2022). Onyebueke and Geyer (2011) reported that Nigeria has the largest informal sector in Africa, notably among the young working age, due to the largest population in Africa and decades of poor economic performance. According to the Federation of Kenya Employers (2021), Kenya's informal economy accounted for 33.8% of GDP in 2015. William et al. (2020) reports a similar dominance of the informal economy in Ghana, accounting for 28.6% of GDP in 2017.

Five hundred interviewees were chosen from each country using the ASA-I's corporate database of loan recipients. With a stratified random sampling frame, the survey divided the population in regional groups and randomly chose interviewees to be proportionate to the regional distribution of microenterprises in each country. ASA-I's trained loan officers rigorously controlled the interview process. The collected information was put into a database at ASA-I's country head offices, which further underwent data cleaning at ASA-I's Global Headquarters and Duke. The cleaned dataset contains 1371 respondents, although it still includes unreported missing values.

The survey covered a wide range of issues, including clients' social attributes and other characteristics, features of their business such as its location, and indicators of dynamism. Together, the dataset contains information, at the firm level, on (a) personal, social, and personal attributes of business owners (gender, age, education, religion, ethnicity, languages, location, living situation, social activities, etc.); (b) characteristics of their firms (nature of business, ownership structure, the number of employees if any, contractual or other relationship with employees, cash or other methods of payment and receipt, bookkeeping, reliance on family and other personal relations, business venue, years in current business, use of ICT, etc); and (c) indicators of dynamism, i.e., the change in the loan balance, business revenue and services offered. The information is anonymized and recorded with a unique identification code.

Some caveats are in order. First, our sample are all female owner-operators because ASA-I's loan recipients are all female. Second, the survey did not cover the regions where ASA-I is not present. Third, the consistency with the actual distribution of microenterprises by activities was not considered in random sampling. As a result, services and trade are over-represented in our samples for Ghana and Nigeria because the survey covered very small shares of microenterprises in agriculture and manufacturing.

4. Methodology

4.1 Multiple correspondence analysis

The scope of this work is to deploy the multiple correspondence analysis (MCA) technique to construct a composite index of the informality consisting of primary indicators of informality that capture distinct features of informality. As discussed fully by Asselin (2009), MCA is a technique like the

principal component analysis (PCA) for increasing the interpretability of data containing many features per observation in reduced dimensions[4]. This task is accomplished by projecting observations in the data in a coordinate system of fewer dimensions through linear combinations of original primary indicators. The axes of this transformed coordinate system are called dimensions, and each dimension is interpreted as a scale with a distinctive meaning.

Let $X(n, J)$ be the indicator matrix of n observations on K indicators decomposed into J categories, where each indicator $k \in K$ consists of J_k response choices totaling $J = \sum_{k=1}^{K} J_k$. Indicator k represents a question in a questionnaire survey, for example: do you keep a record of business transactions? Categories are response choices, such as: keep detailed and systematic record; detailed but not systematic, somewhat detailed, not detailed, or does not keep record at all (there are five categories in this case). Each element in $X(n, J)$ is a binary code, to which we assign 1 if a person would choose a category J_k for the question k, and otherwise 0. We have $n = 825$ individuals who answered all 6 questions.

We associate individual i with its profile of chosen responses $\{x_{ik}: k = 1, \cdots, K\}$. Point M_i corresponds to this profile in individual space $\mathbb{R}^K$ (Pagès, 2015). The mass of M_i in the individual space constitutes a *cloud N*. Each point M_i in N is referred to the center of gravity of the cloud, and compute χ^2, the total chi-square distance of M_i from the center of the gravity of the cloud[5]. It is known that the inertia, χ^2/n, of the indicator matrix $X(n, J)$ takes on a simple form, depending only on the number of indicators and number of responses (Greenacre, 2010)[6]:

$$inertia(X) = \frac{J - K}{K} \tag{1}$$

Equation (1) implies that $J - K$ is the dimensionality of the data and $1/K$ is the average inertia per dimension.

We transform the indicator matrix into the Burt matrix by B= $X^T X$, The Burt matrix is $J \times J$ symmetric covariance matrix whose entries are frequencies of the co-occurrence of each pair of

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[4] PCA is suitable for the data in continuous numbers. MCA can be viewed as an extension of PCA to categorical and binary data. MCA has a broad range of applications in social science to express complex multi-dimensional concept in operational metrics, such as poverty (Asselin 2009), social capital (Teney and Hanquinet 2012), well-being (Neff 2007), consumers' taste (Le Roux and Rouanet 2010), social perceptions such as meritocracy (Hjellbrekke 2019), and depth and breadth of small and medium enterprises' network content (Lin and Lin 2016).

[5] We can calculate the deviation of a cloud with respect to any point on the space supporting the cloud. It attains the minimum when the point is at the center of gravity of the cloud.

[6] See also Le Roux and Rouanet (2010).

categories[7]. The total inertia (variance) of the Burt matrix, denoted by $inertia(B)$, quantifies the total variability or information on the association or dissimilarities among the categories in the original data. It is known that the Burt matrix inflate the inertia because of large values in its diagonal elements. The following equation makes adjustment to this issue of the total adjusted inertia of the Burt matrix.

$$inertia^{adj}(B) = \frac{K}{K-1}\left(inertia(B) - \frac{J-K}{K^2}\right) \tag{2}$$

Next, we search principal axes to project cloud B passing through the center of gravity of the cloud on which the cloud is projected with the maximum inertia on the line. For this, we conduct an eigenvalue decomposition of the Burt matrix and obtain eigenvalues [8] λ_α where $\alpha = 1, \cdots, J$. Adjusted principal inertia of the α-th dimension denoted by F_α is given as

$$F_\alpha = \frac{K}{K-1}\left(\sqrt{\lambda_\alpha} - \frac{1}{K}\right). \tag{3}$$

The total adjusted inertia of the Burt matrix is the sum of the adjusted principal inertias obtained by equation (3):

$$inertia^{adj}(B) = \sum_\alpha F_\alpha. \tag{4}$$

MCA projects the J dimensioned cloud on a space in smaller dimensions, with the least loss of information. The smaller the number of dimensions is, the easier interpretation becomes. However, the less dimensions are included, the greater the loss of information is. Equation (3) implies that it is meaningful to consider dimensions only for $\sqrt{\lambda_\alpha} > \frac{1}{K}$. However, researchers would prefer adopting the criterion that $\sum_{\alpha=1}^{\bar{\alpha}} F_\alpha / inertia^{adj}(B)$ is sufficiently large and the contribution of adding dimension $F_{\bar{\alpha}+1}/inertia^{adi}(B))$ is significantly small for determining the number of dimensions to be $\bar{\alpha}$.

4.2 Category weights from MCA to quantify multi-dimensionally defined informality

We chose six primary indicators of informality from the ASA-I data as listed in Table1. The indicators incorporated here are intended to describe the characteristics of informal firms and not about the causes

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[7] The Burt matrix is also called the cloud of categories.

[8] As with the principal component analysis, MCA is referred as eigen decomposition of the data covariance matrix.

or consequences of informality. Admittedly, the list is not exhaustive[9], but it includes characteristics often cited in the literature.

Table 1

The concepts of whether an enterprise is registered in the public system and pays due taxes and whether it complies with the regulations of the respective competent authorities are used in the ILO's statistical standards as a definition of informal. Thus, *pay_salestax*, *registered*, and *govregul* are natural choices for primary indicators of informality. Note that *pay_salestax* and registered are binary choices and replying "no" to them is informal. The reply to *govregul* has six categories (not sure/not at all/rarely/partially/mostly/fully). We consider these replies to be ordered from "not sure" and "not at all" as the most informal to "fully" the least.

Furthermore, we included three indicators related to business behavior. Abdul-Rahamon and Adejare (2014) pointed out that although the availability of accounting information facilitates the solution of business planning, many small business owners have not given much attention to proper bookkeeping because of the lack of sound knowledge and skilled accounting staff. The same authors found that there is a strong positive relationship between accounting records keeping and the performance of small-scale enterprises. Formal firms have a greater capacity for amortizing the fixed costs involved in demanding the services provided by civil society institutions, such as formal accounting procedures (Fajnzylber et al., 2009). The bookkeeping variable (*account*) allows five ordered categories from "no record" as the most informal choice to "detailed and systematic" as the least.

Regarding the business venue, working on the street or in open public spaces is a primary option for informal enterprises (Chen, 2012). They engaged in small shops and workshops. They can be formally set up in a building for rent, or they will be settled in a shared space. The informal sector claims temporary rights for the collective use of public land. Both civil and common law traditions in sub-Saharan Africa can accommodate the broad definition of rights, obligations, and legal persons entailed (Brown, 2015). Thus, among the six choices for the business venue variable (*location*), we presume that shared space, open public space, street, and public rural land are ordered as forms with more informal characteristics, and buildings and private farmland are less so.

Regarding the mode of receiving payment, Medina (2017) states that informal transactions take

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[9] For example, informal business is often characterized by being own-account and the reliance on unpaid family labor, although not considered here. The small size of business is also linked to informality, but we consider it as an outcome rather than an attribute because small firms are not necessarily informal. In the same vein, we consider that low productivity and slow growth are consequences but not characteristics.

the form of cash payments to not leave an observable trace for the authorities. In a mistrusted relationship, one would expect transactions to be self-liquidating, with immediate cash payment and no delayed obligations (Fafchamps, 1996). Thus, we expect that firms only or usually take immediate cash payment and rarely or never later-on credit, which is associated with a higher degree of informality.

We ran MCA using ©STATA based on the Burt matrix The result is shown in Table 2. We selected the first three dimensions because their cumulative contribution reached 78.79% and adding the 4th dimension adds little information. The total adjusted inertia is 0.100942, of which dimension 1 contributes 53.2%.

Table 2

Table 3 presents the MCA output of ©STATA. It reports the coordinates of each category on the space of three factorial axes denominated as $W_{j_k}^{1,k}$, $W_{j_k}^{2,k}$, $W_{j_k}^{3,k}$ for each of three dimensions corresponding to indicators $k = 1, \ldots, 6$, and categories of each indicator $j_1 = 6, j_2 = 5, j_3 = 6, j_4 = 2, j_5 = 2, j_6 = 2$. It also shows statistics for column categories in principal normalization. "Sqcorr" is the squared correlation of the category with the dimension. It represents the amount of inertia of the point of category given by the coordinates $\left(W_{j_k}^{1,k}, W_{j_k}^{2,k}, W_{j_k}^{3,k}\right)$. The squared correlation is also called the squared cosine obtained as the quotient of the squared χ^2 distance from the center of the cloud to each categorical point in the space divided by the squared distance to its projected point onto each axis. The greater the "Sqcorr.", the better the respective dimension represents each category. The "Overall quality" of a category is the sum of "Sqcorr" from the three dimensions. The higher the quality, the better the category is represented by the extracted dimensions. Following Le Roux and Rouanet (2010, p.40), values of "Contrib." denoted as $Ctr_{j_k}^{\alpha}$ in equation (5) present the contribution of $\left(f_{j_k}/J\right)\left(y_{\alpha}^{j_k}\right)^2$, the variance due to category j_k, to overall variance of the dimension α, as they sum up to 1 for each dimension.

$$Ctr_{j_k}^{\alpha} = \frac{\left(f_{j_k}/J\right)\left(y_{\alpha}^{j_k}\right)^2}{\lambda_{\alpha}} \tag{5}$$

where f_{j_k} is the share of individuals who chose category j_k in the total population and f_{j_k}/J denotes the "Mass" in Table 3. The "%inertia" presents overall contribution of each category to the total inertia, whose row-sum adds up to 1.

Table 3

Suppose we find a dimension that encompasses the characteristics of informality that have been pointed out in previous studies. Asselin (2009) proposes that factorial scores generated by MCA on that dimension can be used as category weights to individual i's choices for selected indicators chosen categories to compute a composite index of informality if it satisfies two properties: monotonically increasing in each of the primary indicators considered in its construction (monotonicity axiom), and the population ordering of the primary indicators is preserved with the composite indicator (ordering consistency).

For illustration, it is convenient to plot the coordinates of the first two dimensions, $(W_{j_k}^{1,k}, W_{j_k}^{2,k})$, in the two-dimensional plane of Figure 1, taking respectively dimension 1 and dimension 2 as the horizontal and vertical axis. These plots show distinct positions of each response for each question. For example, regarding the question on the compliance of government regulation (*govregul*), the responses "fully" and "none" are positioned farthest apart on the horizontal measure. Likewise, about the question of keeping a business record (account), the response "systematic and detailed" is the most distant from "no record."

Figure 1

In Figure 1, the direction to the right of dimension 1 on the horizontal axis corresponds to compliance with the government regulation – "none," business bookkeeping – "no record," business location – "street/public space/shared space," receive payment only with cash – "yes," pay sales tax – "no", and whether a business is registered with the government – "no." On the other hand, in the direction to the left, dimension 1 captures categories such as "fully complying with government regulation", "detailed and systematic bookkeeping," "business venue in building and private farmland", receiving payment only with cash – "no," pay sales tax – "yes," and whether the business is registered – "yes."

The values of squared correlation and contribution guide us to identify which categories should be used to interpret each dimension. For example, regarding compliance with government regulations, "fully" and "none" have distinctively higher values of squared correlation with dimension 1, followed by "not sure," "mostly," and "partially," while "rarely" is barely correlated. "Fully" and "none" also contribute significantly to the total inertia of dimension 1. The contribution of "not sure" is as high as "none" because of the large population who chose this category. "Partially," "mostly," and "rarely" contribute little to the variance of dimension 1. Thus, we select "fully," "none," and "not sure" with compliance with government regulations for the interpretation of dimension 1.

In a similar way, "no record" and "detailed and systematic" from the bookkeeping variable and

"shared space," "public space," and "building" from the business venue variable are more correlated with dimension1 and contribute more to dimension1's variance. The "yes/no" response to binary variables of cash payment, registration, and tax payment are also highly correlated with dimension 1.

Figure 2 presents a synthesis of the above analysis on dimension 1. Overall, there is ordinal consistency in each category's correspondence to definitions of informality as specified in previous research and dimension 1 coordinate $W_{j_k}^{1,k}$ for each indicator $k = 1, \ldots, 6$ (first axis ordering consistency, FAOC-I). It also satisfies the global first axis ordering consistency (FAOC-G) because FAOC-I is fulfilled with the same orientation for all indicators. Thus, Figure 2 shows that dimension 1 aligns with FAOC-I and FAOC-G, which are necessary for the monotonicity axiom (Asselin, 2009)[10].

Figure 2

MCA also allows the inclusion of supplemental variables. They do not contribute to calculating MCA statistics, but they serve for interpretation and comparison purposes. In this analysis, we include variables that designate the type of business (services, trade, manufacturing, and agriculture) and country (Nigeria, Kenya, and Ghana). Using the dimension 1 coordinates as a composite index of informality, we find that services are more informal, and manufacturing and agriculture are less informal regarding the types of business. Concerning country characteristics, the data shows a higher degree of informality in Gahana, while lower in Kenya and Nigeria.

Table 4

5. Composite informality index for individual

Having established the correspondence of dimension 1 to the six indicators included in the MCA analysis, we deploy $W_{j_k}^{1,k}$ as the weighting factors of the composite index of informality for each individual i. This approach follows Asselin (2009), who studies the multi-dimensionality of poverty and proposes to take the first-dimension coordinates of MCA as weighting factors of the composite indicator of poverty. He showed that the composite indicator is monotonically increasing in each primary indicator (monotonicity axiom), which implies a desirable property of the indicator of

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[10] Selected categories with high correlations and contributions to variance on dimensions 2 and 3 are not related to informality as we define it. However, we were not able to find consistent patterns to interpret dimensions 2 and 3 in any meaningful way.

ordering consistency. The latter asserts that the population ordering for a primary variable is preserved with the composite indicator. This can be checked by inspecting that the order of values of $W_{j_k}^{1,k}$ in Table 3 and Figure 1 is consistent with the assertion of the multi-dimensionality of informality that we reviewed in Section 1. Other indicators being equal, if one firm chose a category with a higher $W_{j_k}^{1,k}$, it will get a higher informality index.

Following Asselin (2009), we use the duality property (or transition property) between the category matrix and the indicator matrix, given by the following equation.

$$F_1^i = \frac{\sum_{k=1}^{K} \sum_{j_k=1}^{J_k} \frac{W_{j_k}^{1,k}}{\sqrt{\lambda_1}} I_{i,j_k}^k}{K} \tag{4}$$

where $I_{i,j_k}^k = 1$ if the category j_k applies to individual i and otherwise zero. This property implies that each person is characterized by the per-category average of the normalized category scores over all categories, i.e., $W_{j_k}^{1,k} / \sqrt{\lambda_1}$.

Using equation (4), we calculate F_1^i of each respondent based on the response pattern I_{i,j_k}^k. The raw scores on F_1^i vary with $max = 0.4488$ and $min = -0.4405$ with mean 0 and the standard deviation 0.2319. For the easiness of interpretation, we rescale F_1^i to be measured in the interval $[0,1]$. Following Asselin (2009), we adjust the factorial row scores with the gap between those of the least informal individuals $W_1^{\alpha,k}$ as shown by the following formula:

$$F_1^{adj,i} = \frac{\sum_{k=1}^{K} \sum_{j_k=1}^{J_k} \frac{\left(W_{j_k}^{1,k} - W_1^{\alpha,k}\right)}{\sqrt{\lambda_\alpha}} I_{i,j_k}^k}{K} \tag{5}$$

where $W_1^{\alpha,k}$ denotes the lowest scores in Table 3 from dimension α for each variable k. The score for the most informal individuals $\overline{F_\alpha^{adj}}$ is given by

$$\overline{F_\alpha^{adj}} = \frac{\sum_{k=1}^{K} \sum_{j_k=1}^{J_k} \frac{\left(W_2^{\alpha,k} - W_1^{\alpha,k}\right)}{\sqrt{\lambda_\alpha}} I_{i,j_k}^k}{K} \tag{6}$$

where $W_2^{\alpha,k}$ denotes the highest scores in Table 3 from dimension α for each variable k. Using equations (5) and (6), we obtain the individual informality index as follows:

$$C_i = \frac{F_\alpha^{adj,i}}{\overline{F_\alpha^{adj}}} \tag{7}$$

We denote C_i as the composite informality index (CII) for business operator i. Having been rescaled in the interval of $[0,1]$, CII has the mean 0.495 and standard deviation 0.261. The distribution is shown in Figure 3.

Figure 3

6. Analysis on the relationship between informality and business dynamics

6.1 Informality and employment size

In previous sections, we developed a novel approach for measuring the multi-dimensionally defined informality of business operators. In this section, we deploy the composite informality index (CII) given by equation (7) for the ASA-I data to compute the extent of the informality of each business operator. The CII is meant to synthesize the contributions of six indicators listed in Table 1.

In the first analysis, we analyze the relationship between employment size and CII. It is taken as a stylized fact that the majority of informal enterprises, defined as unincorporated small and/or unregistered business entities, run businesses on their own account (Chen, 2012; Haussmanns, 2004; OECD/ILO 2019). It should be difficult to establish a reverse causality because specialized freelancers abound in formal service contracts.

We employ the number of workers as a dependent variable and set independent variables, including CII, whether the business operator also owns her business (dummy), type of business (trade, manufacturing, and agriculture with service as the base case), and country (Nigeria as the base case for Kenya and Ghana). We estimate an ordinary least square (OLS) regression.

The estimated result reported in Table 5 shows a strong negative correlation between CII and employment size while controlling for owner-operator structure, as well as the heterogeneity by sector and country. It supports the stylized fact regarding the small size of informal enterprises under the proposed multi-dimensional definition of informality. This simple regression serves as a check for the CII to be promising as a measure of informality.

Table 5

6.2 Informality and sales and growth

The second analysis inquiries about the relationship between informality and sales. It is widely accepted in empirical studies that informal enterprises have lower sales and lower growth, other things being equal. Regression (1), reported in Table 6, takes the log of sales value converted in US dollars as the dependent variable, and regression (2) takes the ordered categorical variables on sales growth. The latter derives from the replies to the question "How much has your business revenue increased/decreased in the last five years?" in seven categories: "decreased by more than 50%," "decreased by 30-50%," "decreased by 10-30%," "about the same," "grown by 10-30%," "grown by 30-50%," and "grown more than 50%." Other than CII, we included independent variables such as:

"working hours per week" for labor input intensity, "ICT use" for capital intensity specifying the use of telephone, smartphone, and tablet or personal computer, against the base case of "none" as the base case. We also added dummy variables regarding respondents' perception of the advantages of operating their own business, to which we assign one if the respondent affirms "you are in full control of your business," "you are free to innovate," and "you are your own boss". We also controlled for types of businesses and countries.

We estimated regression (1) by OLS. Regression (2) was estimated by ordered logit because the dependent variable is categorical. The regression (1) showed a negative correlation between CII and sales, suggesting that more informal enterprises have lower sales. This result is consistent with the analysis of employment size in Table 5. It seems counterintuitive that work hours per week are negatively linked to sales in regression (1). This result suggests that poorly remunerating operators tend to work longer hours. The magnitude of estimated coefficients of ICT use are positive and statistically significant against the base case of using none, and they are in order of equipment that can handle greater amounts of information. The results showing the correlation of "being her own boss" perception with sales indicate that the sense of freedom is linked to greater sales.

Regression (2) examines the relationship between the same explanatory variables and sales growth. It should be emphasized that there is no statistical relationship between business growth and the degree of informality. Thus, unlike the widely held perception, informal business cannot be linked to lower growth. There is a strong association between high business growth and the use of tablets and personal computers, which suggests the more intensive use of information. Regarding the perception variables, other than *ownboss*, "full control of business" and "free to innovate", translating respectively to autonomy and entrepreneurship, correlate to higher sales growth. A business owner-operator mindset, rather than being more or less informal, determines business growth.

Table 6

6.3 Informality and resiliency to shock
The third analysis addresses the question of resiliency. Table 7 reports the results of estimating a model with two variables on the change in revenue after COVID-19 as dependent variables. The first column reports the regression results for the reply to the question, "How much revenue did you lose or gain as a result of the coronavirus pandemic?" The second column is on the question, "How well has your business recovered from the coronavirus?" Respondents replied to both questions in 9 categories ordered as "lost all revenues," "lost 50-90%," "lost 30-50%," "lost 10-30%," "about the same," "gained by 10-30%," "gained by 30-50%," "gained by 50-90%," or "gained by more than 100%." With this ordered categorical dependent variable, we estimated the model by ordered logit. Other than the independent variables included in the previous analysis, we added variables describing buy/sell

relationships. This information derives from the questions "From whom do you buy materials?" and "To whom do you sell your products?" Respondents were expected to choose from "formal/established companies," "traders," "family, friends, or others you know personally," and "others (for buying)" or "random customers (for selling)." We set dummy variables, taking "others" and "random customers" as base cases.

Column (1) shows that more informal business operators were able to reduce income loss, suggesting a higher capability to absorb unexpected shocks. From buy/sell relationships, revenue loss was greater for those who bought from traders and sold to formal companies. These results suggest that informal businesses had "nothing to sell" because of the disruption of supply chains from traders and "nowhere to sell" because of the temporary suspension of the formal sector during the lockdown.

Regarding the recovery after the shock, column (2) reports that the degree of informality did not have an effect. This observation is similar to the relationship with the business growth in the normal time reported in Table 6. It also reports that those who enjoy autonomous control and entrepreneurial freedom could recover faster. Regarding the buy/sell relationship, those buying inputs from formal companies and traders and selling to traders could recover faster. In contrast, those whose customers are formal companies were slower constrained by the slow recovery of formal companies.

Taken together, the results of the above analysis indicate that more informal firms were able to mitigate the decline in income during the shocks received from COVID. While informality does not help the recovery process, it does not impede recovery either. They are positioned in the supply chain, and their income decline was linked to the disruption of purchases from traders and the loss of sales to formal firms that closed their doors as a result of the lockdown, border blockades, and other drastic measures taken. After the resumption of economic activity, the relationship with traders was particularly important for recovering informal businesses' sales as a supplier and sales destination.

Table 7

6.4 Personal characteristics and informality

The fourth analysis examines how the degree of informality is linked to operators' personal characteristics. In previous studies, informality has been discussed as the result of the exclusion from the formal labor market due to low levels of human capital and the lack of legal and socioeconomic institutions in force making people trust human relationships based on common personal factors such as family, friends, race, language, religion, and neighborhood. Table 8 presents the results of the analysis, taking CII as the dependent variable. Recall that CII is a composite of the following business behaviors: not keeping business records systematically, ambulating without fixed workplaces, not paying taxes, receiving payment only in cash, not being registered, and not complying with regulations. Firms that more often and more clearly fit these characteristics have a higher CII in [0,1]. Independent

variables capture personal characteristics, including the perception of the advantage of operating their own business, which we employed above, years of schooling, and perspectives on who they trust more in running their business (to be chosen from family/relatives/neighbors/religious group/ethnic group/government/strangers).

Table 8 provides some insights into the personal characteristics of informal business operators. Regarding the advantage of operating a business oneself, "being her own boss" is not correlated. Hence, it is a common perception for operators of any degree of informality. Those who feel advantageous in the freedom to innovate (i.e., more entrepreneurial) and enjoy full control of business tend to be less informal. In Tables 6 and 7, we found that these perceptions are related to higher sales growth and faster recovery from the downturn with the COVID-19 shock[11]. The direct effect of CII on sales growth and recovery was found to be negative but statistically insignificant. These results might have been caused by the collinearity between CII and *innovate* and *control* found in Table 8

Next, we analyzed the relationship between years of schooling and informality, using 9 to 11 years (corresponding to the completion of primary education) as the reference case. We found that the coefficient of "1-5 years" (lower primary education) has a positive sign, "6-8 years" (higher primary education) insignificantly differs from the reference, and "12-14 years" (middle education) has a negative sign. Thus, consistently, with a general perception of informality linked to a lower level of education, CII decreases as one acquires a higher level of education. It is notable to find that the case of "no schooling" has a negative sign, which means less informality than the base case. We can infer that to be informal, as specified by the variables composing CII, requires some basic level of literacy, numeracy, and communication skills.

Regarding the reliance on personal relationships, taking the reliance on strangers in the market as the base case, Table 8 reports that CII is positively correlated with the reliance on family and neighbors. Working with family workers or apprenticeships from the same community without paying a regular salary is a natural extension of informal own-account workers. As observed by Meagher (2009) religion has also been a critical factor in the organization of reliable economic networks outside the framework of the state in Nigeria. She points out that religion tends to act as a modernizing force encouraging educational attainment, facilitating relations of trust and solidarity, and fostering ethics of accumulation through skills. Our result suggests that a stronger reliance on religious groups is linked to a lower degree of informality, as for the reliance on the government.

Table 8

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[11] This result corroborates Hino et al. (2024a) which found that owner-operated small businesses tend to raise growth of business revenue if owner's informal motivations are strong, e.g., valuing "freedom" highly.

7. Conclusion

There is a growing understanding of the multi-dimensionality of the informal economy, and that dichotomous understanding of the formal-informal divide, simply based on a single criterion such as whether an enterprise is registered or not, is not satisfactory. The ILO has provided a variety of indicators to define informality, but defining informality as something to which they all apply is extremely limited. It is not clear how they can be applied in practice to synthesize the complex multi-dimensional concept into an operational indicator, which enables us to order enterprises according to their level of informality. This situation is inconvenient because the informal sector is dominant in developing countries, and policymakers and international aid communities are eager to know the evidence-based relationships between informality and economic development.

In this paper, we propose constructing a composite informality index (CII) using qualitative and quantitative information collected from respondents through a questionnaire. We applied multiple correspondence analysis, which has already been used in previous research in the social sciences, to quantify complex concepts. To the best of the author's knowledge, this is the first time that this method has been applied to the analysis of informality.

We computed CII using data from a survey of microcredit clients in Ghana, Kenya, and Nigeria conducted in cooperation with ASA-I and Duke University. We adopted six features of informality in business practice: not keeping business records systematically, ambulating without fixed workplaces, not paying taxes, receiving payment only in cash, not being registered, and not complying with regulations. From the statistical viewpoint of first axis ordering consistency and the global first axis ordering consistency (Asselin, 2009), we concluded that the first factorial scores on the first-dimension axis serve as CII.

We tested whether CII has explanatory power for informality regarding firm size, sales and growth, and the degree of resiliency seen in shocks received from COVID-19 and recovery from them. Regression results show that CII is linked to a smaller size of employment and sales, consistent with the stylized facts of informality. However, we also found that CII is not directly related to sales growth, rejecting the general perception of linking informality to slower production growth. Regarding resiliency, we found that the informality measured with CII is associated with smaller revenue loss, suggesting informal enterprises' higher absorptive capacity of a shock.

We also examined the relationship between entrepreneurial characteristics and CII. We found that business perspectives that appreciate the full control of their own business and the flexibility to innovate, which are also linked to higher sales growth, are associated with a lower informality. CII is correlated with business operators' lower education level and reliance on personal relationships with family and neighbors.

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Overall, we consider that CII works well as an operational measure of the degree of informality that could be used in empirical studies. Our method has the advantage of synthesizing diverse informal factors into a composite index with statistically determined weights that are not based on a priori arbitrary judgments. However, this conclusion is based on a specific data set and needs to be considered more often.

From a policy standpoint, the paper confirms that informal enterprises are generally poor and small. This is not surprising, and there could be many reasons for this. However, the key takeaway from the paper is that this does not mean informal enterprises are "inferior," as often alluded to in the development economics literature. Rather, informality tends to contribute to raising business growth and enhance resilience to withstand negative shocks. The CII is an effective tool for identifying which aspects of informality have such positive qualities and which ones do not. Therefore, the CII would be particularly useful for devising policies that would help African countries to enhance the dynamism of the microenterprise sector. We should remember that all microenterprises have some elements of informality – it is not a matter of either formal or informal.

Tables and figures

Table 1. List of indicators from ASA-I data

Indicators	Variable name	Number of categories
1. Extent of keeping a record of business transactions (detailed and systematic/detailed but not systematic/somewhat detailed/not detailed/no record)	*account*	5
2. Location of business (building, shared space, open public space, street, private farmland, public rural land)	*location*	6
3. Whether or not the respondent pays sales tax (yes/no)	*pay_salestax*	2
4. Mode of receiving payment (only or usually immediate cash payment and rarely or never later on credit) (0/1)	*reconlycash*	2
5. Whether or not business is *registered at any level of government*- country, state, or local (yes/no)	*registered*	2
6. Extent of compliance with government regulations/registration (not sure/not at all/rarely/partially/mostly/fully)	*govregul*	6
Total number of categories		23

Table 2. MCA analysis of the ASA-I data

Dimension	Principal inertia	%	Cumulative %
Dim 1	0.053703	53.20	53.20
Dim 2	0.013767	13.64	66.84
Dim 3	0.012063	11.95	78.79
Dim 4	0.001643	1.63	80.42
Dim 5	0.000965	0.96	81.38
Dim 6	0.000231	0.23	81.60
Total	0.100942	100	

Method: Burt/adjusted inertias

Table 3. Statistics for column categories in principal normalization

Categories	Mass	Overall quality	%inertia	Dimension_1			Dimension_2			Dimension_3		
				$W_{j_k}^{1,k}$	Sqcorr	Contrib	$W_{j_k}^{2,k}$	Sqcorr	Contrib	$W_{j_k}^{3,k}$	Sqcorr	Contrib
Govregul												
None	0.012	0.855	0.046	0.441	0.481	0.042	-0.169	0.071	0.024	-0.350	0.304	0.117
not sure	0.023	0.735	0.081	0.325	0.299	0.045	0.369	0.386	0.228	0.132	0.049	0.033
Partially	0.025	0.812	0.043	0.148	0.125	0.010	-0.252	0.366	0.116	0.236	0.321	0.116
Mostly	0.033	0.476	0.010	0.081	0.215	0.004	-0.019	0.011	0.001	-0.088	0.249	0.021
Rarely	0.004	0.250	0.014	-0.016	0.001	0.000	-0.242	0.158	0.016	-0.184	0.091	0.011
Fully	0.070	0.912	0.056	-0.269	0.904	0.094	0.019	0.004	0.002	-0.019	0.004	0.002
Account												
no record	0.034	0.818	0.078	0.363	0.564	0.082	-0.144	0.089	0.051	-0.197	0.165	0.107
not detail	0.023	0.145	0.009	0.027	0.018	0.000	-0.065	0.102	0.007	0.032	0.025	0.002
some detail	0.021	0.491	0.017	0.023	0.007	0.000	-0.116	0.168	0.021	0.158	0.316	0.045
detail nossys	0.024	0.680	0.027	-0.089	0.072	0.004	-0.156	0.218	0.043	0.209	0.390	0.088
detail sys	0.064	0.741	0.060	-0.172	0.316	0.036	0.196	0.407	0.179	-0.041	0.018	0.009
Location												
shared space	0.027	0.694	0.024	0.186	0.383	0.017	0.002	0.000	0.000	0.168	0.311	0.062
public space	0.032	0.577	0.017	0.164	0.507	0.016	0.054	0.055	0.007	0.028	0.015	0.002
Street	0.024	0.746	0.030	0.126	0.123	0.007	-0.158	0.193	0.043	-0.235	0.430	0.110
public land	0.024	0.677	0.021	-0.122	0.166	0.007	-0.157	0.274	0.042	-0.146	0.238	0.042
private land	0.007	0.790	0.033	-0.132	0.037	0.002	-0.377	0.300	0.073	0.463	0.452	0.126
Building	0.054	0.848	0.034	-0.173	0.469	0.030	0.155	0.379	0.095	0.008	0.001	0.000
Reconlycash												
Yes	0.117	0.848	0.049	0.188	0.842	0.077	0.005	0.001	0.000	0.014	0.005	0.002
No	0.050	0.848	0.114	-0.441	0.842	0.180	-0.012	0.001	0.001	-0.032	0.005	0.004
Registered												
No	0.075	0.833	0.069	0.267	0.762	0.099	0.063	0.042	0.022	-0.052	0.029	0.017
Yes	0.092	0.833	0.056	-0.217	0.762	0.081	-0.051	0.042	0.018	0.042	0.029	0.014
pay_salestax												
No	0.108	0.879	0.039	0.170	0.788	0.058	0.024	0.016	0.005	0.053	0.076	0.025
Yes	0.059	0.879	0.073	-0.314	0.788	0.107	-0.044	0.016	0.008	-0.097	0.076	0.046

Table 4. Supplementary variables: type of business and country

	Mass	Overall quality	%inert	Dimension 1		Dimension 2		Dimension 3	
				Coord	Sqcorr	Coord	Sqcorr	Coord	Sqcorr
type_bis									
Services	0.302	0.061	0.694	0.083	0.029	0.061	0.016	0.060	0.016
Trade	0.518	0.098	0.643	0.012	0.001	0.033	0.009	-0.105	0.088
Manufacturing	0.098	0.120	0.661	-0.154	0.035	-0.166	0.040	0.174	0.045
Agriculture	0.082	0.169	0.710	-0.198	0.045	-0.234	0.063	0.231	0.061
Country									
Ghana	0.286	0.734	0.658	0.195	0.163	-0.227	0.222	-0.285	0.350
Nigeria	0.428	0.408	0.696	-0.069	0.029	0.204	0.255	0.143	0.125
Kenya	0.286	0.075	0.740	-0.092	0.032	-0.079	0.024	0.071	0.019

Table 5. CII and firm size

VARIABLES	(1) num_worker
own_bis	-2.462***
	(0.477)
CII (Composite Informality Index)	-1.261***
	(0.469)
2.type_bis	-1.438***
Trade	(0.276)
3.type_bis	-0.0274
Manufacturing	(0.458)
4.type_bis	-1.217**
Agriculture	(0.489)
2.countrycode	-1.525***
Kenya	(0.293)
3.countrycode	-0.929***
Ghana	(0.304)
Constant	7.086***
	(0.552)
Observations	721
R-squared	0.121

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. CII and business growth

VARIABLES	(1) logsales_usd	(2) increase_bis
CII (Composite Informality Index)	-0.346***	-0.153
	(0.116)	(0.256)
workperweek	-0.0741*	0.106
	(0.0386)	(0.0951)
2.ictuse_telephone	0.174*	-0.806***
	(0.0966)	(0.206)
3.ictuse_smartphone	0.382***	0.197
	(0.0946)	(0.204)
4.ictuse_tablet/pc	0.851***	1.484***
	(0.166)	(0.360)
2.countrycode_kenya	0.205***	-0.901***
	(0.0767)	(0.175)
3.countrycode_ghana	0.141*	0.00324
	(0.0786)	(0.178)
control	0.00895	0.650***
	(0.0869)	(0.200)
ownboss	0.134**	0.330**
	(0.0666)	(0.153)
innovate	-0.238***	0.450***
	(0.0685)	(0.149)
2.type_bis/trade	-0.110*	-0.334**
	(0.0665)	(0.149)
3.type_bis/manufacturing	0.00409	-0.249
	(0.114)	(0.260)
4.type_bis/agriculture	0.181	-0.671***
	(0.119)	(0.258)
/cut1		-3.089***
		(0.716)
/cut2		-1.634**
		(0.691)
/cut3		-0.607
		(0.687)
/cut4		0.712
		(0.686)
/cut5		2.300***
		(0.691)
/cut6		4.206***
		(0.709)
Constant	6.260***	
	(0.290)	
Observations	750	779
R-squared	0.106	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7. CII and resiliency to the COVID shock

VARIABLES	(1) covid_loss	(2) covid_recover
CII (Composite Informality Index)	1.615***	-0.305
	(0.286)	(0.276)
2.ictuse_telephone	0.511**	0.112
	(0.222)	(0.217)
3.ictuse_smartphone	0.0441	-0.450**
	(0.223)	(0.224)
4.ictuse_tablet/pc	1.621***	-1.737***
	(0.390)	(0.366)
2.type_bis/trade	-0.116	0.0376
	(0.148)	(0.146)
3.type_bis/manufacturing	-0.0449	-0.475*
	(0.241)	(0.245)
4.type_bis/agriculture	-0.0585	-0.733***
	(0.256)	(0.256)
2.countrycode_kenya	-1.362***	-0.500***
	(0.185)	(0.176)
3.countrycode_ghana	-1.245***	-0.475***
	(0.188)	(0.175)
control	-0.451**	1.149***
	(0.204)	(0.192)
ownboss	-0.373**	-0.0346
	(0.156)	(0.151)
innovate	-0.215	0.279*
	(0.153)	(0.149)
buy_formalco	-0.286	0.968***
	(0.198)	(0.197)
buy_traders	-0.413**	1.422***
	(0.197)	(0.193)
buy_personal	-0.135	0.241
	(0.216)	(0.227)
sell_formalco	-0.536**	-0.685***
	(0.237)	(0.233)
sell_traders	0.186	0.396***
	(0.153)	(0.152)
sell_personal	-0.162	0.244
	(0.158)	(0.157)
/cut1	-4.570***	-1.029***
	(0.437)	(0.386)
/cut2	-4.187***	-0.956**
	(0.423)	(0.385)
/cut3	-3.039***	-0.448
	(0.402)	(0.381)
/cut4	-1.282***	0.544
	(0.388)	(0.379)
/cut5	0.554	1.482***
	(0.385)	(0.382)
/cut6	1.991***	1.979***

	(0.398)	(0.385)
/cut7	2.518***	3.537***
	(0.409)	(0.394)
/cut8	3.961***	6.450***
	(0.484)	(0.480)
Observations	822	822

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8. CII explained by personal characteristics.

VARIABLES	CII
ownboss	0.0255
	(0.0228)
innovate	-0.0700***
	(0.0223)
control	-0.0763***
	(0.0289)
1.y_school_no schooling	-0.181***
	(0.0579)
2.y_school_1-5 years	0.0996**
	(0.0477)
3.y_school_6-8 years	-0.0438
	(0.0290)
4.y_school_9-11 years	(Reference)
5.y_school_12-14 years	-0.0456*
	(0.0266)
6.y_school_over 14 years	0.00958
	(0.0341)
rely on family in business	0.0395***
	(0.0119)
rely on relatives in business	-0.0133
	(0.0122)
rely on neighbors in business	0.0712***
	(0.0107)
rely on religious group in business	-0.0552***
	(0.0113)
rely on ethnic group in business	-0.00824
	(0.0117)
rely on government in business	-0.0496***
	(0.0133)
2.type_bis/trade	-0.0450**
	(0.0228)
3.type_bis/manufacturing	-0.0796**
	(0.0388)
4.type_bis/agriculture	-0.0804**
	(0.0370)
2.countrycode_kenya	-0.000960
	(0.0309)
3.countrycode_ghana	0.150***
	(0.0287)
Constant	0.594***
	(0.0509)
Observations	536
R-squared	0.269

Standard errors in parentheses
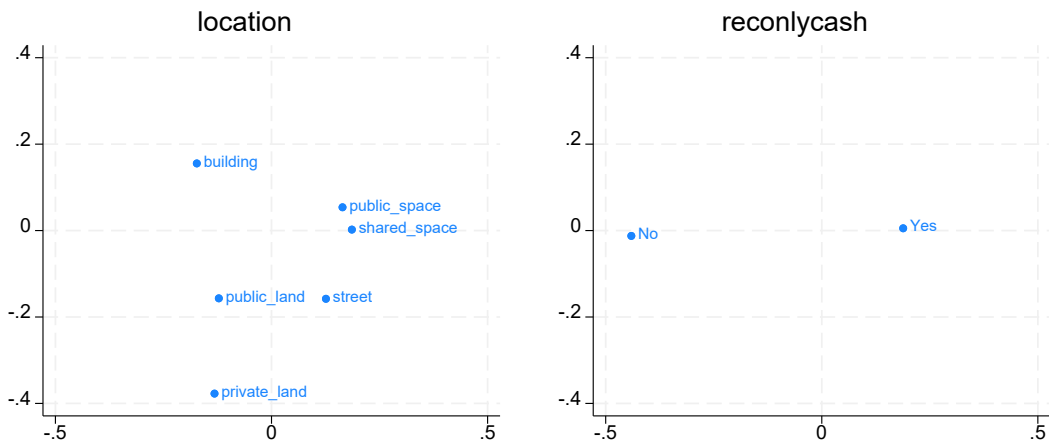*** p<0.01, ** p<0.05, * p<0.1

Figure 1. Individual MCA coordinate plots of dimension 1 and 2

MCA coordinate plot
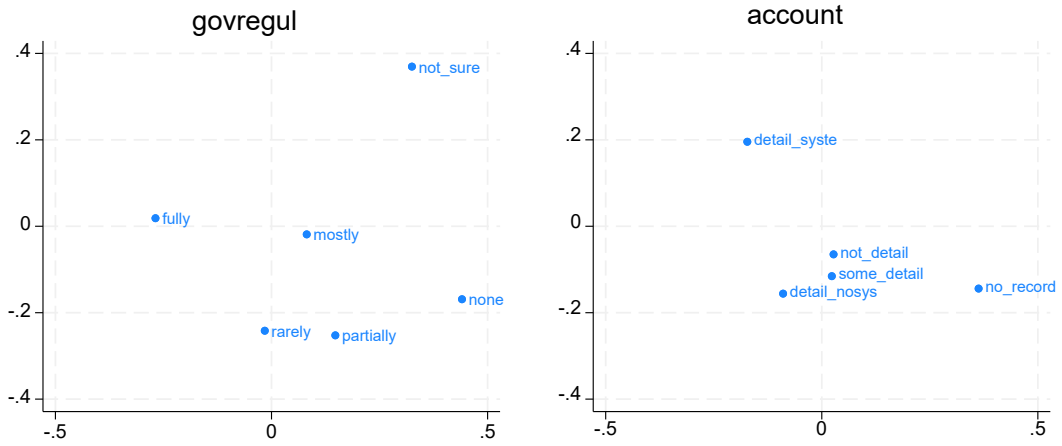
Dimension 1 (horizontal) explains 53.2% inertia
Dimension 2 (vertical) explains 13.6% inertia
Coordinates in principal normalization
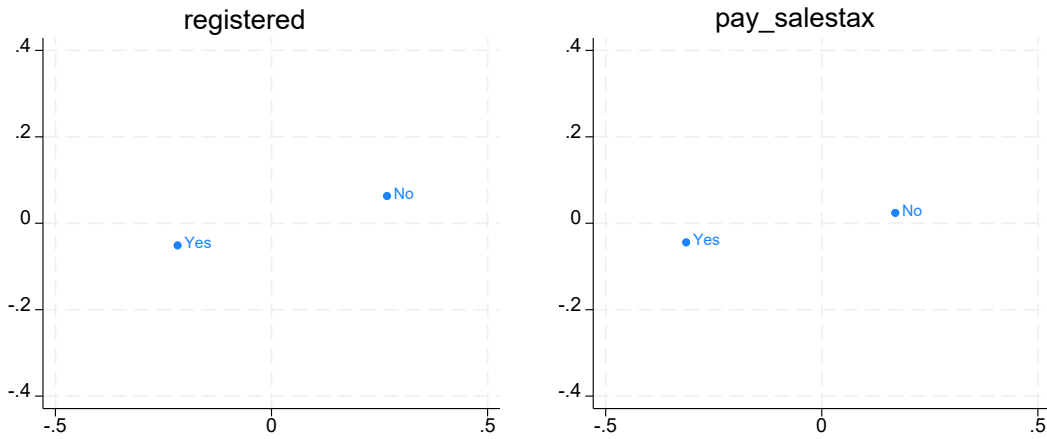
MCA coordinate plot

Dimension 1 (horizontal) explains 53.2% inertia
Dimension 2 (vertical) explains 13.6% inertia
Coordinates in principal normalization

MCA coordinate plot

Dimension 1 (horizontal) explains 53.2% inertia
Dimension 2 (vertical) explains 13.6% inertia
Coordinates in principal normalization

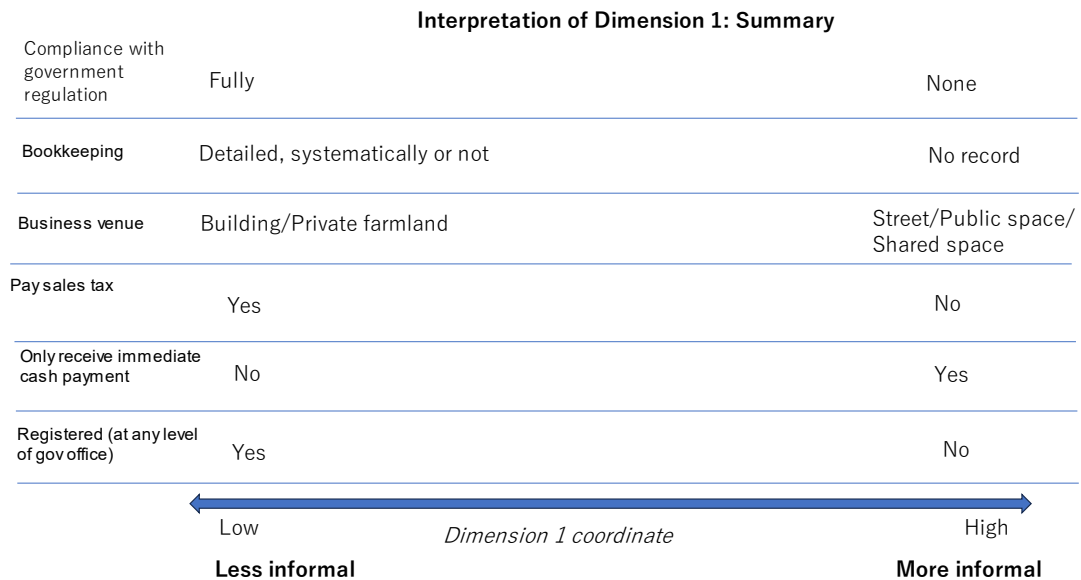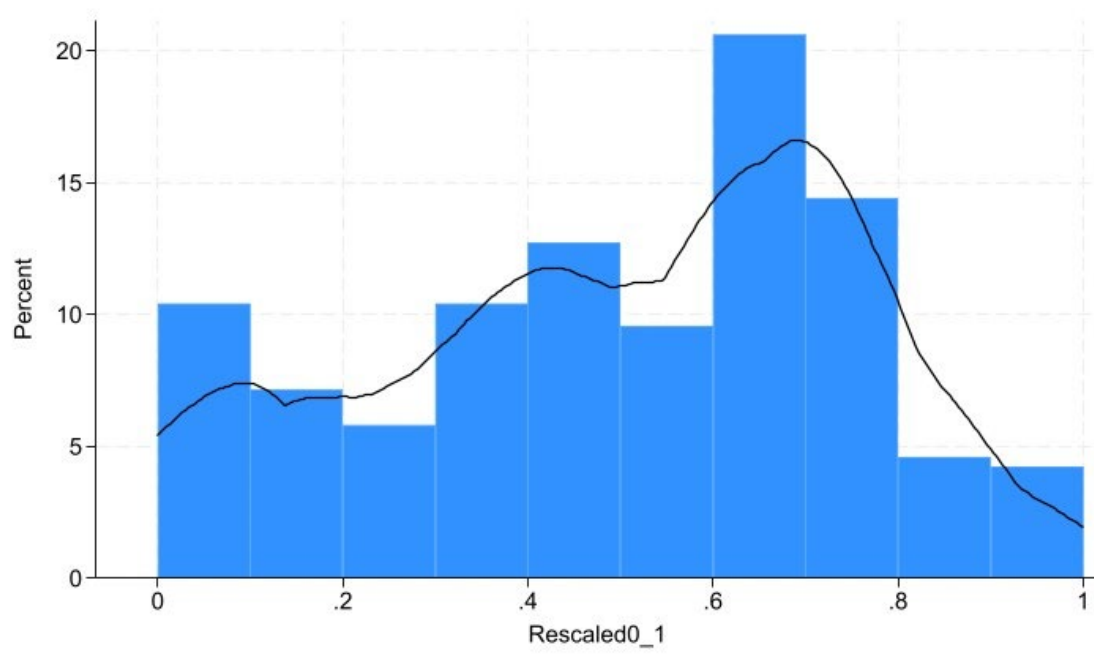Figure 2. Interpretation of dimension1 from the MCA results

Interpretation of Dimension 1: Summary

Compliance with government regulation	Fully	None
Bookkeeping	Detailed, systematically or not	No record
Business venue	Building/Private farmland	Street/Public space/ Shared space
Pay sales tax	Yes	No
Only receive immediate cash payment	No	Yes
Registered (at any level of gov office)	Yes	No

Low   *Dimension 1 coordinate*   High

Less informal   **More informal**

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Figure 3 Histogram of the informality index with a Kernel density plot

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