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Financial Access Constraints, Misallocation and Firm Performance in the Zimbabwean Informal Manufacturing Sector

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Abstract: In this paper, we examine the link between financial constraints, misallocation and firm growth in the informal manufacturing sector in Zimbabwe. Using the employee-employer panel dataset on the informal manufacturing sector survey collected between 2015 and 2018, we explore if financial access constraints attenuate or exacerbate misallocation for high productive firms. We then calculate the aggregate TFP loss as a result of capital misallocation. We further investigate whether financial access constraints hinder productivity-enhanced growth by limiting investment and employment growth activities for high productivity firms. We find a high presence of financial access constraints and are a major source of misallocation that reduces aggregate TFP. We found aggregate TFP loss of between 32 percent as a result of capital misallocation. Further, we find evidence suggesting that financial access constraints are limiting investments activities but not employment. Hence, the need for a policy that promotes ease of access to finance by relatively more productive firms in the informal sector.

Keywords: financial constraints, informal sector, misallocation, aggregate TFP

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1.1 Introduction

Financial access constraints have been shown to be quantitatively fundamental in affecting firm performance, particularly within emerging economies. According to World Bank Enterprise data, 25% of firms in all countries identify access to finance as a major constraint to their business operations. The proportion is substantially higher amongst Sub-Saharan African firms (39%) compared to East Asia and the Pacific (11.9%).[2] Factor and product market distortions prevent the optimal allocation of resources across firms leading to lower than otherwise aggregate total factor productivity (TFP) (León-Ledesma, Miguel A. & Christopoulos, 2016). As such, distortions may prevent production resources from being allocated to best use. One salient distortion that may cause allocative inefficiency is the existence of financial access constraints. Capital market failure is well documented in the literature. To the extent that financial access constraints affect firms differently, it may give rise to allocative inefficiencies.

Financial access constraints affect firm performance and aggregate total factor productivity (TFP) through two mechanisms: First is the direct effect that has received wide attention in the literature (Campello, Graham & Harvey, 2010; Beck & Demirguc-Kunt, 2006). Lack of financial access restricts investment and hiring decisions of firms and hence directly reduces firm output and growth. As such, reducing barriers to financial access to all firms can significantly and directly contribute to firm growth and aggregate TFP (Restuccia & Rogerson, 2017). The second channel - the primary focus of this paper- is an indirect 'reallocation' effect of financial access on firm growth and TFP. Not all firms are equally affected by financial access constraints. In general, larger and more established firms with collateral and established relationships with banks are better able to access finance than smaller new firms (Wu, 2018). This unequal access to finance has an ambiguous effect on aggregate TFP via its impact on allocative efficiency (Berthou et al., 2018; Midrigan & Xu, 2014; Buera, Kaboski & Shin, 2011). For example, preferential access to finance for incumbent firms may contribute to resource misallocation and dampen aggregate TFP if these firms are relatively inefficient (Buera & Moll, 2015; Restuccia & Rogerson, 2013; Banerjee & Duflo, 2005). Alternatively, to the extent that more productive firms are better able to overcome financial constraints to access scarce capital, allocative efficiency can be enhanced.

Therefore, a policy prescription that advocates for the removal of financial access barriers may fail to achieve its intended goals if it does not take into account the misallocation effect. This

[2] Data sourced from https://www.enterprisesurveys.org/data/exploretopics/finance#2 [Accessed 7 July 2019].

paper analyses the extent to which financial access constraints hinder firm performance and contribute to misallocation and thus aggregate TFP in the informal manufacturing sector in Zimbabwe. The analysis of this paper is structured around addressing the following specific questions: (1) What is the link between financial constraints and informal manufacturing firm performance in Zimbabwe? (2) Do financial constraints attenuate or exacerbate aggregate TFP losses through misallocation?

The analysis is based on the new existing matched employer-employee panel dataset of Zimbabwean informal manufacturing firms collected under the "Matched Employee-Employer Panel Data for Labour Market Analysis in Zimbabwe" project. This data consists of three waves of data set on informal manufacturing sector firms. The measures of misallocation are derived from the theoretical framework of the Hsieh and Klenow (2009), and Wu (2018). The measure of financial access constraints is directly derived from rich information on firm financing activities in the dataset.

To explore the link between firm performance and financial constraints, we use the survey data to present a picture of financial access constraints faced by Zimbabwean informal manufacturing firms. This provides insight into the severity and heterogeneity of these constraints across firms. We analyse the implication of financial access constraints on allocative efficiency following two approaches: Firstly, we use regression analysis to study the relationship between firm-specific indicators of financial access and misallocation using the Hsieh and Klenow (2009) measures of misallocation. This allows you to assess the extent to which financial access constraints exacerbate or attenuate the misallocation effects arising from capital market distortions. Secondly, we use the panel of data to study how initial financial access constraints faced by firms affect subsequent growth through aggregate productivity. In particular, we follow Bartelsman et al. (2017) and estimate productivity-enhancing re-allocation regressions.

Zimbabwe presents a relevant case study for the analysis in this paper. Financial access constraints are one of the biggest challenges affecting firms and the effects are exceptionally large in the informal sector. Secondly, the Zimbabwean economy is characterised by a large informal sector that contributes significantly to the country's economic outcomes such as employment and income. The paper advances the understanding of the informal sector and the results of this study are useful in determining the extent to which the nexus between financial constraints and misallocation hinders firm performance in this sector.

The rest of the paper is structured as follows: Section 1.2 presents related literature on financial access constraints and misallocation. Section 1.3 presents the theoretical model. Section 1.4 Discusses the data and methods. The discussion of the results is done in section 1.5 and finally, section 1.6 concludes.

1.2 Related Empirical Literature

This study is related to the strand of literature on the role of financial access constraints as a source of misallocation and its overall impact on aggregate TFP (Wu, 2018; Kinghan, Newman & O'Toole, 2018; Restuccia & Rogerson, 2017; Buera & Moll, 2015; Midrigan & Xu, 2014). This study further extends this line of literature on misallocation by exploring the extent to which financial access constraints impede productivity enhanced reallocation of resources (as in Bartelsman et al., 2017). We apply the approach to the informal manufacturing sector, which is shown to be large and important in emerging economies in terms of contribution to aggregate GDP.

Amid the factors that explain differences in aggregate productivity across firms, industries or countries, misallocation of resources has been at the centre of attention (Wu, 2018; Dias, Marques & Richmond, 2016; Hopenhayn, 2014; Bartelsman, Haltiwanger & Scarpetta, 2013; Hsieh & Klenow, 2009; Foster, Haltiwanger & Syverson, 2008; Restuccia & Rogerson, 2008; Hopenhayn, 1992). The underlying suggestion from these studies is that market frictions play a key role in inhibiting marginal products of inputs across firms to equalise, thereby leading to aggregate productivity losses. The studies by Hsieh & Klenow, 2009, Restuccia & Rogerson, 2008 and Bartelsman, Haltiwanger & Scarpetta, 2013 provide an important framework to quantify the effects of distortions on aggregate TFP. However, distortions in these papers are only modelled in a generic and abstract fashion. Albeit the importance of this strand of literature in evaluating the potential impact of misallocation on firm performance and productivity, it offers less enlightenment on the factors that are associated with this huge presence of misallocation. This paper extends this literature by identifying specific market frictions - financial access constraints- and determine the extent to which they contribute to misallocation

The general suggestions from the empirical literature are that financial frictions could reduce TFP through two channels: The first is that frictions prevent the entry of more efficient firms and the second is that frictions result in the misallocation of production resources amongst incumbent firms. The above empirical literature provides some important aspects. First, there

is no particular pattern on the effects of financial access constraints on firm performance and aggregate TFP in the presence of misallocation. The literature on the relationship between financial access constraints and misallocation on the intensive margins is far from settled as results from different authors provide conflicting evidence. The effects of removing financial access barriers on misallocation and aggregate TFP differs across countries, industries and firms. In some cases, removal of financial access constraints exacerbates misallocation especially in cases where those inefficient firms that were once constrained now have easy access to finance thereby crowding out more efficient firms. This suggests that the empirical findings are case-study specific, hence the need to conduct country-specific research on financial access constraints, reallocations, and firm performance.

Second, one of the key issues in literature is the measurement of financial constraints. Several studies have derived the measure of the extent to which a firm is financially constrained using firm balance sheet and income statement (Ferrando & Ruggieri, 2018; Moll, 2014; Midrigan & Xu, 2014; Buera, Kaboski & Shin, 2011). However, whether a firm is financially constrained is often not directly observed from business-level data. Authors of such studies often resort to collateral borrowing (constructed by utilising the debt-to-asset ratio) and firm characteristics (such as size and age) as a proxy to measure the likelihood of a firm being financially constraint. These proxy variables may fail to assert the true extent to which a firm is constrained (Abel & Eberly, 2011; Alti, 2003; Cooper & Ejarque, 2003; Kaplan & Zingales, 1997). The lack of proper measurement of financial access constraints makes it challenging for some existing studies to quantify the effects of access to finance on misallocation. This study compliments to this line of literature by using detailed firm-level data. One of the strengths of our data is that the measures of financial access constraints can easily be constructed by exploiting information on firm finance and investment activities drawn from the questionnaire.

1.3 Theoretical Model

The theoretical foundations underpinning the analysis of the effects of financial access frictions on firm performance and misallocation is motivated by the Wu (2018) framework. Wu (2018) model suggest that the correlation between distortion and firm productivity can help to explain the costs of misallocation on aggregate productivity. The model predicts that, in the presence of misallocation, distortions are costly to firm welfare if the presence of high distortions is associated with lower firm productivity outcome. This prediction is synonymous to the conclusions of Bartelsman et al., (2013) and Resstuccia and Rogerson (2008).

The theoretical model is used to illustrate the mechanisms through which policy distortions and financial frictions may cause (capital) misallocation. Wu (2018) argued that financial frictions reduce aggregate TFP through misallocation of resources amongst existing firms. In the model, aggregate TFP loss depends on the dispersion of firm-specific MRPK, which is determined by a set of parameters. These parameters determine the magnitude of firm-specific policy distortions and financial frictions. To quantify the overall effect of financial frictions on capital misallocation and aggregate TFP, they used a cost-constrained model and a quantity constrained model.

Cost Constrained model

The costly external financing model entails the following optimisation problem;

$$\max_{K_i} V_i = \pi(Z_i, K_i) - (1 + \tau_i)K_i - \theta_i \Lambda(K_i, W_i)$$

where K_i is capital stock, Z_i is a stochastic investment opportunity, W_i is the amount inter ofnal funds and τ_i is a measure of distortion[3]. The first order condition is given by

$$\pi_K(Z_i, K_i) = (1 + \tau_i)K_i + \theta_i \lambda(K_i, W_i) \quad (1)$$

Where $\theta_i \lambda(K_i, W_i) \equiv \theta_i \Lambda_K(K_i, W_i) > 0$ is the marginal costs of external financing, with $\lambda_K > 0$ and $\lambda_W < 0$.

In the model, the degree to which a firm is financially constrained is measured by the firm-specific cost parameter θ_i. The parameter θ_i depends on firm characteristics. For example, young and smaller firms are expected to have larger θ_i as they pay higher costs in accessing finance. It also depends on the extend of policy distortions affecting a firm. Hence the cost of accessing finance by firm *i* can be denoted as $\theta_i = \theta(\theta_i^f, \theta_i^p)$, where θ_i^f and θ_i^p represents firm-specific operating through financial fictions and policy distortions respectively in determining the cost of accessing finance.

Quantity Constraint Model

In the quantity constraint model firms seek to raise finance in the capital markets but the amount they can raise is limited to a certain point.

The optimisation problem of the firm is given by;

[3] If $\tau_i < 0$ a firm *i* enjoys a subsidy for its investment expenditure and if $\tau_i > 0$ then a firm suffer a tax from it investment expenditure.

$$\max_{K_i} V_i = \pi(Z_i, K_i) - (1 + \tau_i)K_i \ ,$$

subject to the quantity constraint,

$$K_i - W_i \leq (1 - \phi_i)K_i$$

The first-order condition for the optimal capital investment is given by;

$$\pi_K(Z_i, K_i) = (1 + \tau_i) + \phi_i \mu(Z_i, W_i) \qquad (2)$$

According to Wu (2018), the micro-foundations of the quantity constrained model entails that the firm-specific constraint parameter ϕ_i depends on the volatility of the firm's revenue and pledgeability of firm's assets. In addition, ϕ_i also depends on policy distortions, for example, firms that faces negative policy distortions are expected to have higher ϕ_i. As thus, $\phi_i = \phi(\phi_i^f, \phi_i^p)$, where ϕ_i^f and ϕ_i^p presents firms specific factors operating through financial frictions and policy distortions in explaining the quantity encountering firm *i*.

Financial Frictions, Misallocation and aggregate TFP

To deduce the sources of misallocation, Wu (2018) rewrite equation (1) and (2) respectively as;

$$MRPK_i \equiv \pi_K(Z_i, K_i) = (1 + \tau_i) + \theta_i \lambda(K_i, W_i) \qquad (3a)$$

$$MRPK_i \equiv \pi_K(Z_i, K_i) = (1 + \tau_i) + \phi_i \mu(Z_i, W_i) \qquad (3b)$$

The left-hand side of the equation (3a) and (3b) depicts the firm MRPK. Hence different forms of financial constraints (whether cost or quantity constraint) proclaim same repercussions on misallocation, that is; a firm's optimal investment is equal to its MRPK with its generalised cost of capital. The cost of capital, in turn, depends on policy distortions $(\tau_i, \theta_i^p, \phi_i^p)$ and financial frictions (θ_i^f, ϕ_i^f) encountering the firm, productivity and internal funds (Z_i, W_i).

In an efficient economic system with no frictions or distortions, that is in first-best equilibrium, $\tau_i = \theta_i = \phi_i = 0$. Hence optimal investment assures that MRPK is equalised across all firms.

On the other hand, in the presence of financial frictions and policy distortions, Wu(2018) argued that the actual allocation is influenced by firm-specific user cost of capital which depends on the joint distribution $G(\tau_i, \theta_i^p, \phi_i^p, \theta_i^f, \phi_i^f, Z_i, W_i)$.

The model also shows aggregate TFP loss can be approximated as proportional to the variance of the logarithm of the $MRPK_i$ which is the function of G. Aggregate TFP loss is given by;

$$\Delta logTFP = \frac{1}{2}\frac{\alpha(1-\eta)(1-(1-\alpha)(1-\eta)}{\eta} Var(logMRPK_i) \qquad (4)$$

Where η and α are the average of the inverse of the demand elasticity and capital-output elasticity respectively and $Var(\log MRPK_i)$ is given by;

$$Var(MRPK_i) = Var(1+\tau_i) + Var\big(\vartheta_i \psi(X_i, W_i)\big) + 2Cov\big(1+\tau_i, \vartheta_i \psi(X_i, W_i)\big) \qquad (5)$$

Where $\vartheta_i = f(\theta_i, \phi_i)$ and $X_i = f(K_i, Z_i)$

The model can be used to link aggregate TFP to the variance of the distortions $(1+\tau_i)$ and the covariance between distortions and the degree of financial frictions (θ_i). Further, the model can be used to link the relationship between misallocation $(Var(MRPK_i))$ and financial constraints (θ_i) and the covariance between firm productivity (Z_i) and financial constraints as presented in equation (5). The model predicts a positive link between misallocation and financial distortions. In addition, aggregate TFP loss will be great if misallocation is positively linked with firm productivity.

1.4 Data and Methods

The paper exploits the new existing matched employer-employee dataset of the Zimbabwean manufacturing firms that I collected under the "Matched Employee-Employer Panel Data for Labour Market Analysis in Zimbabwe" project over a period of 2015 to 2018[4]. The dataset consists of formal and informal sector manufacturing firms and workers from the respective firms. In this paper, we utilise the informal sector firms' dataset.

The data consists of three panels of data of firms that were initially interviewed in 2015, two waves of data of firms that were initially interviewed in 2017 and one wave of data set for firms that were initially interviewed in 2018. The first wave of the data that was collected in 2015 constitutes of 130 firms. In a follow-up survey done in 2016 out of 130 firms interviewed in 2015, 99 firms were successfully re-interviewed. In 2017, a new data set was collected consisting of 74 new manufacturing informal sector firms. In 2018, I re-interviewed firms that were initially surveyed in 2015 and managed to successfully re-interview 108 firms. Re-

[4] Data collection processes in 2017 were funded by the German Institute of Global Affairs IAA (GIGA) and the 2018 data collection processes were funded by the PEDL.

interviews were also done on firms that were initially interviewed in 2017 and 68 firms out of 74 firms were successfully contacted. The follow-up interviews were contacted using telephones rather than face to face. The data consists of firms drawn from three key manufacturing industries in the informal sector; namely the Metal, Textile and Wood industries. The data was collected from two major urban cities in Zimbabwe namely Harare and Bulawayo.

The panel data on the informal sector firms used in this paper is unique and to our knowledge is of its first kind in the informal manufacturing sector in Zimbabwe. The data consists of key variables that allow us to explore the study research questions. The variables include information on production costs, sales, employment, capital and investment, obstacles affecting firm growth among other key variables. The data is recent, and one advantage is that I was involved in that data collection process with the help of other research assistants, hence I have first-hand in-depth knowledge of the data as well as the operations of the informal sector firms (respondents).

Measurement of Key Explanatory Variables

This study is interested in exploring how financial access constraints affect firm performance through misallocation. As such, our key variables are a measure of financial access constraints, firm-level productivity, firm size and firm age. These variables are borrowed from theory and empirical literature). Other controls include firm owner characteristics (which include gender, age, experience and education), firm industry and location.

Financial Access Constraint

Our measures of financial access constraints consist of both subjective and objective measures. The subjective measure (FA_sub) is obtained from the respondents stating that financial access constraints are either one of the three major obstacles affecting their growth of businesses. This variable is coded 1 if a firm states financial access constraint as one of the three major obstacles affecting firm performance and 0 otherwise. The subjective measures can offer useful insights into the business environment. However, they have some limitations. The first limitation is that they are based on firm owner perception about the business environment and could reflect pessimism or optimism of the respondent (Aterido, Hallward-Driemeier & Pagés, 2011; Ayyagari, Demirguc-Kunt & Maksimovic, 2008; Beck & Demirguc-Kunt, 2006). Secondly, self-reported responses are likely to be influenced by firm performance and experience and hence may be endogenous. As thus using our rich data set, we also construct objective measures

of financial access constraints from the information on financing and investment activities of the firm collected on the questionnaire. Table 1 below summaries how the objective measures were constructed from the available data.

Table 1: Indicators of Financial Access Constraints

Indicator	Definition
Objective Measures	
Fin_Acess1: Credit rationed /Discouraged Borrowers	Variable = 1 if the firm has been rejected for a loan and 0 otherwise Variable = 1 if the firm did not apply for a loan due to a) possible rejection, b) the process was too difficult or c) the interest rates were too high and 0 otherwise
Fin_Access2: Cannot obtain Credit Purchases	Variable = 1 if firms do not purchase raw materials on credit and do not owe suppliers and 0 otherwise
Fin_Acess2b: Owed funds by Customers	Variable = 1 if firms sell products on credit and are owed by customers
Subjective Measure	
Fin_Access3	Variable = 1 if firm mentioned lack of finance as of the three major constraints affecting the growth of business and 0 otherwise
Fin_Access4	Variable = 1 if firm mentioned that it has problems in sourcing finance and 0 otherwise

Firm productivity

The productivity variables are constructed from information on output, employment, capital and raw materials. The output is measured as value-added. Value added is computed as the difference between sales and cost of raw materials, overhead expenses, and energy costs (electricity, fuel, gas). Capital is measured by netbook and market value of fixed assets, summed across vehicles, machinery and equipment, and land and buildings. Raw materials represent the costs of inputs used in producing goods. Employment is measured as the number of workers.

Several methods have been suggested in the empirical literature on measuring productivity based on the estimation of the production function. These include the Olley and Pakes (1996), the Levinson and Petrin (Levinsohn & Petrin, 2003) and the Ackerberg et al. (Ackerberg, Caves & Frazer, 2015). The productivity measure produced from these models is revenue-based. In addition, Productivity can be measured using total factor productivity (TFP) or using

partial productivity measures which takes into account the contribution of inputs such as capital and labour. Consistent with the literature, we built our measure of productivity based on firm TFP. Our measure of TFP is based on Foster et al. (2009) model as applied by Hsieh and Klenow (2009). Foster et al. (2008) constructed an alternative measure of TFP that is based on physical productivity rather than the ubiquitous revenue-based productivity. This measure of TFP does not require inference from econometrics but rather it can be constructed from available firm-level data. Physical TFP, according to Foster et al. (2008) and modified by Hsieh and Klenow (2009) can be computed as;

$$TFPQ_{si} = A_{si} = \frac{(P_{si}Y_{si})^{\frac{\sigma}{\sigma-1}}}{K_{si}^{\alpha_s}(L_{si}^{1-\alpha_s})} \quad (6)$$

where A_{si} is firm specific productivity (TFP), $P_{si}Y_{si}$ represents firm value added, K_{si} and L_{si} are the capital and labour inputs respectively, σ is elasticity of substitution. All these variables are observed from the available data. Based on the argument of Hsieh and Klenow (2009), we use the wage bill instead of the units of labour to take into account the quality of the workers. As an alternative, we also construct a productivity measure based on labour productivity. Labour productivity is constructed as the ration of value added per work. For robustness check, an index of revenue based TFP is constructed based on labour productivity.

Other variables

Firm age is measured as the difference between the current year and the year the firm was established. The firm industry is a categorical variable that captures the difference in industries and is coded one, two and three for metal, textile and wood industries respectively. Firm location is a dummy variable that is coded one for Harare and zero for Bulawayo. Table 4.0 contains the summary statistics for the variables of interest.

Table 4.0 Summary statistics for key variables (in base periods 2015 and 2017)

Variable	Obs	Mean	sd	Min	Max
Value added per worker (log)	167	7.78	0.82	5.35	9.82
Capital (log)	171	6.41	1.19	3.40	9.62
Output (log)	170	9.65	0.83	7.09	11.72
Firm age	169	9.86	7.10	0.00	28.00
Employment	172	3.06	1.50	1.00	10.00
Labour costs (log)	165	8.21	1.00	4.97	10.35
Profit Margin	170	0.23	0.23	-1.17	1.00

Source: Author Computations from the Data set. The results are the base period (the year of first interviews-2015 and 2015) for firms that we able to follow-up in 2018.

Measuring Misallocation

The measures of misallocation are derived using the Hsieh and Klenow (2009) and Wu (2018) models. According to this Hsieh and Klenow (2009) model, the optimal allocation of resources occurs in a scenario where there are no factor market frictions or distortions that impedes capital and labour from being accessed by high productive firms and marginal products of capital and labour should be equal across firms within the same industry. Distortions or frictions can affect firms differently which leads to deviations from an efficient allocative equilibrium. The firm-level measures of misallocation are derived as;

$$1 + \tau_{Ksi} = \frac{a_s}{1-a_s}\frac{wL_{si}}{RK_{si}} \tag{7}$$

$$1 - \tau_{Ysi} = \frac{\delta}{1-\delta}\frac{wL_{si}}{(1-a_s)P_{si}Y_{si}} \tag{8}$$

$$MRPK_{si} = \alpha\frac{\sigma-1}{\sigma}\frac{P_{si}Y_{si}}{K_{si}} = R\frac{1+\tau_{Ksi}}{1-\tau_{Ysi}} \tag{9}$$

$$TFPR_{si} = \frac{\sigma}{1-\sigma}\left(\frac{R}{a_s}\right)^{a_s}\left(\frac{w}{1-a_s}\right)^{1-a_s}\frac{(1+\tau_{Ksi})^{a_s}}{1-\tau_{Ysi}} \tag{10}$$

Where K_{si} and L_{si} are the capital and labour inputs, $P_{si}Y_{si}$ is the firm's value-added, w and R are the unit cost of labour and capital respectively, a_s is the share of capital and σ is the elasticity of substitution which is conventionally set at 3 in literature. The term τ_{Ksi} in equation (7) denotes firm-specific capital distortions which increase cost of capital (e.g. access to credit, credit rationing) and τ_{Ysi} shows firm specific distorts of output which reduces revenue. Equation (7) is the measure of capital distortion, equation (8) is the measure of output market distortion and equation (9) is the measure of capital misallocation. If resources are efficiently allocated MRPK would be the same across firms within the same industry. This implies that firms with higher than average MRPK face high barriers (such as financial constraints) as compared to firms with below than average MRPK. Equation (10) is the aggregate measure of misallocation. For more details on these measures see Hsieh and Klenow (2009).

We also derive the measure of capital misallocation from the Wu (2018) model. Song and Wu (2015) and Wu (2018) constructed a measure of capital misallocation ($MRPK_{i,t}$) based on firm $ARPK_{i,t}$. The constructed the measure based on the linear relationship between ARPK and MRPK as presented in equation (11) below;

$$MRPK_{i,t} \equiv \frac{\partial R_{i,t}}{\partial K_{i,t}} = \alpha_i(1-\eta_i)\frac{R_{i,t}}{K_{i,t}} \equiv \alpha_i(1-\eta_i)ARPK_{i,t} \tag{11}$$

They argued that although ARPK has been used to infer misallocation in literature it is a biased measure in the presence of unobserved heterogeneity and argued that MRPK is a sufficient measure of capital misallocation. Wu (2018) attested that ARPK can only be a valid proxy for MRPK if $\alpha_i(1-\eta_i)$ in equation (11) is similar across firms and this may not hold in cases where other firms have market power due product distortions or frictions or where firms differ in terms of capital intensiveness due to frictions or distortions in technology adoption. Using the first-order Taylor expansion, Wu derived the approximation of for log $MRPK_{i,t}$ as;

$$logMRPK_{i,t} \backsimeq logARPK_{i,t} + log\frac{\pi_{i,t}}{R_{i,t}} - \eta_i\frac{R_{i,t}}{\pi_{i,t}} \qquad (12)$$

Compared to ARPK, this measure of MRPK is not contaminated with frictions or distortions highlighted earlier. They then obtain, the estimate of log $MRPK_{i,t}$ as the residuals from the regression model in equation (13).

$$logARPK_{i,t} = \beta_0 + \beta_1 log\frac{\pi_{i,t}}{R_{i,t}} + \beta_2\frac{R_{i,t}}{\pi_{i,t}} + \beta_3 industry_{i,t} + \beta_4 location_{i,t} + \zeta_{i,t} \qquad (13)$$

Where $logARPK_{i,t}$, is the log of revenue-capital ratio, $log\frac{\pi_{i,t}}{R_{i,t}}$ is the log of profit-to-revenue ratio, $\frac{R_{i,t}}{\pi_{i,t}}$ is revenue-to-profit ratio, and $industry_{i,t}$ and $location_{i,t}$ are dummies for firm industry and location respectively.

The advantages of this measure of MRPK is that: It takes into account heterogeneities in production functions and market power as compared to other measures in literature and it only displays the cost of capital. In addition, this measure being a residual it has a sample mean and some interesting economic interpretation (Wu, 2018). For example, if $logMRPK_{i,t}$= 0.15 then the MRPK for that particular firm is 15 percent higher than the average MPRK in the economy. The weakness of this measures as illustrated by Wu (2018) emanates from misspecification. Hence ARPK will be more usefully measure if misspecification problem is higher that heterogeneity problem.

1.4.1 Estimation Strategy

This study approaches the research questions in two parts. The first part links financial access constraints and misallocation and this allows us to answer our first research question. The second part links financial access constraints and firm growth. (Song & Wu, 2015)

Understanding the link between financial access constraints and misallocation

This part of this study intends to investigate the extent to which lack of financial access attributes to the dispersion in misallocation. To achieve this, the study regresses the measures of misallocation on financial access variable and a set of firm characteristics controls. The model is specified as;

$$lnD_{ist} = \beta_0 + \beta_1 FA_{ist} + \beta_2 TFP_{ist} + \beta_3 FA_{ist} \times TFP_{ist} + X_{ist}{}'\gamma + \varepsilon_{ist} \qquad (14)$$

where $ln\mathrm{D}_{ist}$ represents the measures of distortions (in equations (7) to (10)), FA is the measure of financial access constraint , X_{is} a vector of firm characterises which includes firms size (measured by the number of employees), firm age, firm industry and location and owner characteristics, ε_{is} is white noise error term. The coefficient of interest is β_1 , β_2 and β_3.

Following Ledesma (2016), for MRPK and TFPR, a positive sign on the coefficient of financial access variable, β_1, stipulates that the presence of financial constraints results in increasing MRPK. On the other hand, a negative coefficient is interpreted as lowering MRPK such that output distortions are relatively high compared to capital distortions, that is, a firm uses more labour relative to capital than optimal. For factor market distortion τ_{Ksi} regression, a positive coefficient shows high τ_{Ksi}. This implies that financial constraint acts as a tax on capital relative to labour. In an efficiently operating system with no distortions, MRPK is the same for all firms within an industry, hence all coefficients should be insignificant for obstacles. Hence, a significant β_1 shows that financial access constraints are a source of misallocation. If misallocation is high for more productive firms, we expect $\beta_2 > 0$. Restuccia and Rogerson (2008) argued that misallocation will be a cost if it there is a positive correlation between firm productivity and misallocation. Berthou et al. (2018) also echoed the same sentiments highlighting that distortions are costly to aggregate TFP if the presence of distortions reduces firm's productivity. If financial access constraints are inefficiently affecting more productive firms, we expect $\beta_3 > 0$, indicating that financial constraints are systematically greater for more efficient firms.

Financial access constraints and reallocation

The second part of the empirical analysis focuses on exploring the impact of financial constraints on impeding productivity enhanced reallocation of resources (labour and capital). To achieve this, the study estimates the employment and investment equations and investigate whether these sources of firm growth are influenced by financial access constraints. Further,

the study identifies the association between firm growth and initial firm productivity by assessing whether financial access constraints are restraining growth for high productivity firms. This analysis allows us to determine the extent to which financial access constraints are a source of allocative inefficiency in the informal manufacturing sector in Zimbabwe. The empirical model is specified below;

$$\Delta Y_{ist} = \alpha + \beta TFP_{ist-1} + \gamma' FA_{ist-1} + \delta TFP_{ist-1} \times FA_{ist-1} + \rho X_{ist} + \upsilon_{ist} \qquad (15)$$

where ΔY_{ist} is the average growth rate in employment, or investment in firm i, in industry s at time t. TFP is firm level (log) total factor productivity in time t-1 relative to industry mean, FA is a measure of financial access constraint. The coefficients of interest are β, γ and δ. The coefficient β determines if productivity enhanced growth is achieved in the informal sector. A positive coefficient, β, implies that more productive firms are associated with higher growth rates, hence reallocation is productivity enhancing. Furthermore, the coefficient γ shows the impact of obstacles on firm growth and it is expected to be negative. The coefficient, δ, of the interaction term between initial TFP with the measures of financial access constraints signifies the extent to which financial access constraints are constraining the growth of high productivity firms. In other words, it indicates the impact of obstacles in restraining productivity enhanced growth, that is the extent to which financial constraints contributes to allocative inefficiency.

The below paragraphs explain how the depended variables (employment growth and capital growth) were constructed. These variables have been borrowed from theory and empirical literature and can be constructed from the available data. Following Davis and Haltiwanger (1992) and Davis et al. (1996)(Davis, Haltiwanger & Schuh, 1996) models, employment growth, g_{ist} at a firm level between time t and t-n is given by;

$$g_{ist} = \frac{\Delta X_{ist}}{m_{ist}} = \frac{X_{ist} - X_{ist-1}}{0.5(X_{ist} + X_{ist-1})} \qquad (16)$$

where X_{ist} is the number of workers in firm *i*, in industry *s* at time *t*, m_{ist} is the average firm size between time *t* and *t-n.* The employment growth in equation (16) is computed by dividing the change in employment by average firm size between period *t* and *t-n*. This measure of growth rate has become the standard measure in the analysis of firm dynamics (Foster et al., 2016). Note that we use the average firm size rather the initial firm size as usually done. Using the average firm size has a number of advantages. The key advantage is that it reduces measurement errors that are associated with transitory high or low initial and ultimate firm's

sizes that may induce overestimation of growing small firms. In this study, growth is considered from *t-2* and *t-1* for firms initially interviewed in 2015 and 2017 respectively.

We derive our measure of capital growth (investment) based on the questionnaire of whether firms purchased equipment or machinery and if yes how much. However, one of the challenges in estimating investment models especially for informal sector firms is the considerable number of zero values of investment. This is because many informal sector firms invest on a lumpy and infrequent basis. Given this concern, a poisson estimator may be better than if the level of investment is used. We can, therefore, generate a binary indicator for investment as;

$$\boldsymbol{I} = \begin{cases} \mathbf{1}\ \boldsymbol{if}\ \boldsymbol{I^*} > \mathbf{0} \\ \mathbf{0}\ \boldsymbol{if}\ \boldsymbol{I^*} \leq \mathbf{0} \end{cases} \tag{12}$$

The variable I takes a value of 1 if the firm purchased equipment and machinery ($I^* > 0$) and zero if no purchases were made. This variable has been coded this way because for some firms the value of the investment is zero. This imply that the regression model for investment on financial obstacles and lagged TFP is a discrete probability model and the probit model is used.

1.5 Results

1.5.1 Stylized Facts Emerging from the Data

In this section, we present and discuss the observable features that are characterised by our data set on the relationship between financial access constraints, misallocation and firm performance. We start off by assessing the extent to which access to finance is a constraint in the informal manufacturing sector in Zimbabwe.

In this section, we present and discuss the observable features that are characterised by our data set on the relationship between financial access constraints, misallocation and firm performance. We start off by assessing the extent to which access to finance is a constraint in the informal manufacturing sector in Zimbabwe. Given our definition of financial access constraints and various measures of these constraints, Table 1.1 shows the dynamics of the prevalence of financial access between 2015 and 2018. The first two variables are subjective measures of financial constraints while the last two are objective measures. From table 1.1, we observe that financial access constraints have remained high. For example, if we look at Fin_Acess1- our objective measure of financial constraints, 88 percent of firms had either have their loans applications denied or did not apply for loans or borrow money due to reasons that

confirm financial rationing or discouraged borrowing. This figure is even higher as compared to the 2015 prevalence of 66 percent for the same variable.

Table 1.1 Prevalence of financial access constraints

year	2015	2017	2018
Objective Measures			
Fin_Access1	0,66	0,88	0,88
Fin_Access2	0,87	0,97	0,40
Subjective Measures			
Fin_Access3	0,79	0,86	0,84
Fin_Access4	0,93	0,54	0,65

Notes: The Table shows the prevalence of our measures financial access constraints as defined in Table 1.

Similar sentiments can be observed from the other variables measuring financial constraints. For example, looking at Fin_Access3-a measure of subjective financial constraints, 84 percent of firms reported that financial access constraints limit the growth of their business in 2018 as compared to 79 percent in 2015. The main interesting fact from table 1.1 is that financial access constraints are very high within the informal manufacturing sector and on average seem to be increasing with time.

In table 1.1a we present the reasons why firms are not able to borrow finance for business productivity-enhancing investments.

Table 1.1a. The main reasons why informal sector firms are not able to borrow finance

Main Reason	Freq	Percentage
Procedures Complicated	29	17.68
High Interest Rates	31	18.90
Too Much Collateral	56	34.15
None to Borrow from	21	12.80
No need for Loan	13	7.93
Other	14	8.54
Total	164	100

Notes: The table shows what firms reported as the main reasons why they are constrained to access finance. Most of the reasons are from the supply-side.

As the figures in table 1.1a shows, 34.15 percent of firms are not able to borrow due to too much collateral requirements. The other common reasons firms cited for not borrowing include high interest rate (18.9 percent of firms), complicated procedures when applying for finance (17.68 percent) and no availability of institution or individuals to borrow from (12.8 percent). A very small proportion of firms (7.93 percent) did not need a loan. This shows that internal

funds may have been the main source of finance for these firms. The results in table 1.1a imply that supply-side barriers to financial access are a major problem constraining firms from accessing finance.

Literature has shown that firm characteristics can help to explain the extent to which a firm is financially constrained. Table 1.2 presents the breakdown of financially constrained firms according to firm size, firm age, and industry sector.

Table 1.2. The proportion of financially constrained firms in the sample by firm age, firm size and industry sector

	Measures of Financial Access Constraints			
	Fin_Access1	Fin_access2	Fin_access3	Fin_Acess4
By Firm Age				
2 or less	0.88	1.00	0.81	0.94
3-5	0.73	0.90	0.82	0.82
5-10	0.73	0.87	0.78	0.80
10-20	0.71	0.92	0.86	0.78
20+	0.75	0.94	0.84	0.66
By Firm Size				
4 or less	0.75	0.91	0.84	0.78
5+	0.67	0.92	0.63	0.88
By Firm Industry				
Metal	0.71	0.86	0.86	0.80
Textile	0.70	0.95	0.80	0.69
Wood	0.81	0.90	0.78	0.86

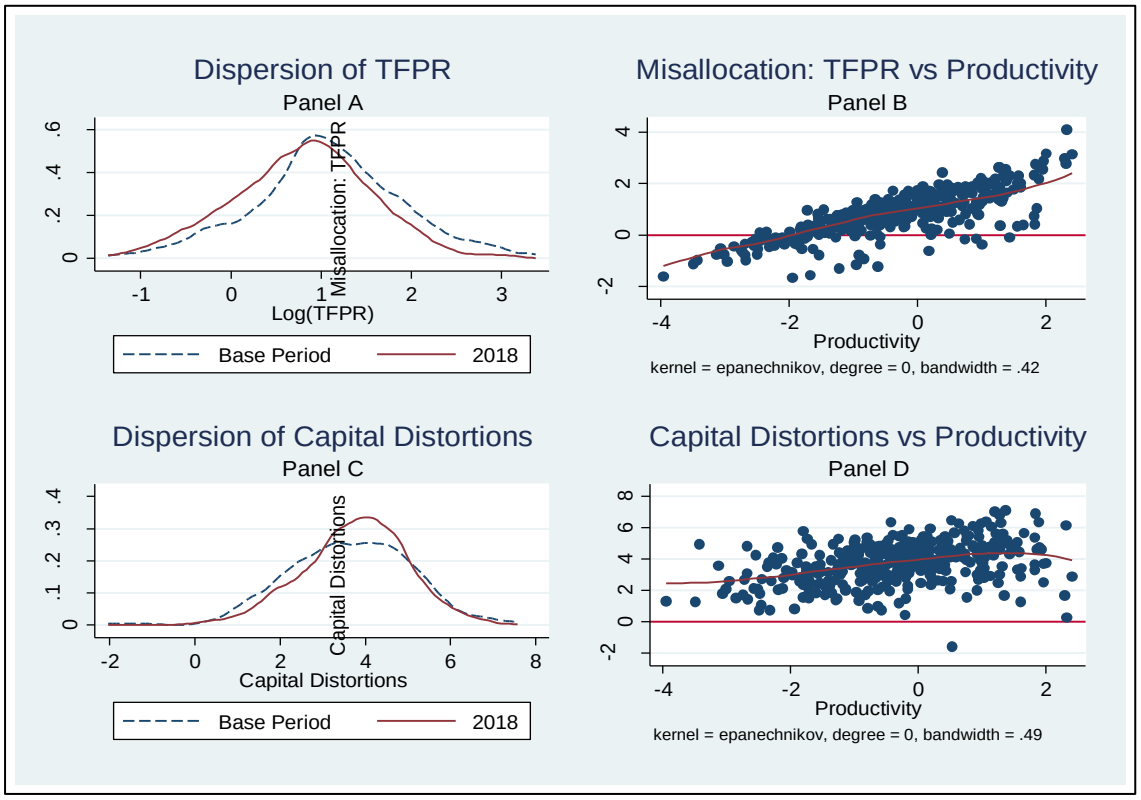
Notes: The table shows how our four measures of financial constraints vary with firm characteristics. The general conclusion is that there is some firm heterogeneity in terms of access to finance.

We observe that young firms (2 years or less) are more constrained than old firms (those aged 20 years and above). For example, if we look at the objective variable Fin_Acess1 we find that 88 percent of those age 2 or less are financially constrained compared to 75 percent of firms aged 20 years and above. The same trend can be found on the objective measures of financial constraints variable Fin_Access4 were 94 percent of firms aged 2 years or less are constrained compared to 66 percent of firms aged 20 and above. This is in line with literature which shows that young firms are more likely to be constrained than large firms. Financial constraints are however high across all age groups (above 75 percent on average). Further table 1.2 shows that the prevalence of financial constraints differs with firm size. We find that the proportion of firms with financial access constraints is relatively high for smaller firms across all measures. For instance, we can observe that 75 percent of firms with less than 5 workers are constrained as compared to 67 percent for firms with 5 or more workers. The same can be deduced on other

measures. The prevalence of financial access constraints seems on average not systematically differ much across the industrial sector.

Now that we have established the extent to which firms are financially constrained, the next step is to assess how these constraints are a source of misallocation. From our theoretical model, there are two ways of assessing this. The first is to find how financial constraints correlate with measures of misallocation. The second is to find the extent to which financial access constraints affects relatively more productive firms. To achieve this, we first present the evidence to show that misallocation is a problem in the informal manufacturing sector and it acts as tax by punishing more productive firms. Figure 1.1 shows the dispersion of the firm-level misallocation demeaned at industry level using the geometric mean and the relationship between productivity and misallocation. As discussed above, in the absence of misallocation we expected the dispersion of TFPR from industry mean to be zero. Panel A and panel C in figure 1.1 show large dispersion of TFPR and capital distortions respectively in both the base periods (2015/2017) and 2018. Such large dispersions signify the presence of misallocation according to Hsieh and Klenow (2009).

Figure 1.1 The extent and dynamics of misallocation in the informal manufacturing sector



Notes: The measures of misallocation are based on the HK model

Panel B and D show the relationship between misallocation (as measured by TFP and capital distortions) and firm productivity. In the absence of misallocation, all firms should be on the zero-rated line and only differ by their productivity. The positive relationship between misallocation and firm productivity entails that misallocation acts as a tax on more productive firms hence contributes negatively to aggregate TFP. Supplementing the results in figure 1.1, Table 1.3 shows the dynamics of the correlation between firm productivity and measures of misallocation. The results in table 1.3 reveal that the cost of misallocation as a tax to more productive firms has increased with time.

Table 1.3 Correlation between firm productivity and firm-level misallocation measures over time

	Correlation with firm TFPQ		
	overall	base	2018
TFPR	0,92	0,90	0,94
Capital Distortions	0,42	0,37	0,47
Output Distortions	0,59	0,59	0,60

Notes: The measures of misallocation are based on the HK model

The positive relationship between misallocation and firm productivity entails that misallocation acts as a tax on more productive firms hence contributes negatively to aggregate TFP. The results in Figure 1.1 and Table 1.3 are not a surprise given the constraints that firms in the informal (manufacturing) sector face. As such, we assess how financial access constraints are correlated with measures of misallocation and the results are presented in Table 1.4. The results presented show how our two prime measures of financial access (Fin_Acess1 and Fin_Acess4) are correlated with firm productivity and measures of misallocation. The results in the table indicate a negative correlation between firm productivity and financial access constraints. This suggests that an increase in the prevalence of financial access constraints contributes negatively to firm productivity. As argued in the theoretical model, financial access frictions can contribute negatively to aggregate TFP through misallocation if they are negatively related to firm productivity, that is, if they dampen firm productivity enhance growth.

Table 1.4 The correlation between financial access constraint, productivity and misallocation

	Objective	Subjective
log_S_TFPRs	Fin_Acess1	Fin_access4
Firm Productivity		
TFPQ	-0.13	-0.17
Measures of misallocation		
TFPR	0.16	0.14
Capital Distortions	0.05	0.01
MRPK	0.10	0.03

Notes: The measures of misallocation are based on the HK model. Financial access constraints are as defined in Table 1.

Further, the observed results indicate a positive correlation between financial access constraints and misallocation. For example, the correlation between our objective measure of financial access constraint and TFPR dispersion is 0.16 while its 0.10 form MRPK. As noted by Restuccia and Rogerson (2017) it should be emphasized that sources of misallocation are diverse and some are unobservable. As such the correlation between the specific source of misallocation may be very low. What is important is the direction of the correlation. To sum up, the results in table 1.4 are important as they show us the important mechanism (as predicted by theory) through which financial access constraints can be costly to aggregate productivity in the presence of misallocation. The first important stylised fact is the negative relationship between financial access constraints and productivity. The second important observed result is the positive relationship between financial access constraints and misallocation. These two stylised facts provide the base to further our analysis.

Thus far, we have established that financial access constraints are huge and they correlate with firm productivity and misallocation. We have also established that misallocation acts as a tax by negatively affecting relatively more productive firms. In the next analysis, we look at firm characteristics and document the differences in firm characteristics of constrained and non-constrained firms. We provide the summary for two key dependent variables: investment and employment growth and other five key firm characteristics: total factor productivity (TFP), labour productivity (value-added per worker), capital per worker, firm age and profit margin. We speculate that, in the first best equilibrium, firms with no financial constraints invest more, are more productive and achieve high growth rates than constrained firms. Table 1.5 presents the differences.

Table 1.5 Differences in firm characteristics between constrained and non-constrained firms

	Financial Access Constraints	
	No	Yes
Key Depended Variables		
Investment	0.51	0.33
employment growth	0.06	0.06
Other Key Firm Characteristics		
TFP	5.73	5.87
Value Added per Worker	7.77	7.86
Capital/L	5.55	5.34
Firm age	9.93	9.83
Profit Margin	0.28	0.21

Notes: The table shows the differences in firm performance between constrained and non-constrained firms.

Table 1.5 shows that the levels of investment are, on average, different between constrained and non-constrained firms. The table shows that 51% of non-constrained invested in new equipment and machinery while only 33% of the constrained firms managed to invest. These results reveal the importance of access to finance to advance firm investment drive. Financial access constraints put a barrier to firms' capacity to invest and literature has shown that financial access is a key driver to firm investment. The presence of both high levels of financial access constraints and misallocation in the informal sector has a larger bearing in firm growth and hence aggregate productivity. Because financial access constraints limit firms' abilities to expand, the capacity of informal sector firms to generate employment can also be curtailed. However, Table 1.5 shows that there is no difference in the average employment growth between constrained and unconstrained firms. This result can be explained by two factors. The first is that there is no relationship between access to finance and employment as shown by some literature (Kinghan et al, 2018). The literature argues that financial access has a direct effect on firm investment rather than employment. Financial access affects employment growth only through the investment channel, that is, as firms invest in capital and expand business then they are expected to demand more labour. However, if investment and employment are substitutes, a decrease in investment as a result of more financial constraints can actually increase firm employment growth as firms substitute workers for machines. Importantly and contracting to our expectations, Table 1.5 shows that more constrained firms are more productive than unconstrained ones across our two measures of productivity; TFP and labour productivity. The results show that constrained firms have an average TFP of 5.87 as compared to TFP of 5.73 for unconstrained firms. The results also suggest that firms with financial access

constraints have mean (log) labour productivity of 7.86 as compared to 7.77 for non-constrained firms. If an economy is operating in the first best equilibrium, we expect more productive firms to have more access to finance relative to less productive firms. The results that it is more productivity firms that suffer more from financial access is an indication that misallocation acts as a tax on relatively more productive firms as also indicated by our earlier results. Table 1.5 also shows that financially constrained firms have lesser profit margins as compared to unconstrained. This shows that financial access constraints reduce the profitability of firms.

In summary, the data shows the huge presence of financial access constraints and allocative inefficiency in the informal manufacturing sector. There is also much heterogeneity on firm characteristics between constrained firms and unconstrained firms except on employment growth. The data further shows that high performing firms are the ones that are relatively constrained by financial access constraints. This, therefore, implies that financial markets are inefficiently allocating finance and this may have the effect of reducing aggregate TFP. In the next section, we present econometric results.

1.5.2 Empirical Results

Misallocation and Aggregate TFP loss

We start by assessing the distribution of our misallocation measures. As deduced from the theoretical model, high dispersion of log MRPK implies misallocation. Table 1.5a shows the dispersion of various measures of misallocation.

Table 1.5a Variance of logarithms of MRPK, ARPK and TFPR and Aggregate TFP losses.

year	2015	2016	2017	2018	Average	TFP_Loss
(1) Var(mrpk_WU)	1,180	0,940	1,502	1,179	1,201	0,316
(2) Var(arpk_WU)	1,739	1,284	1,830	1,178	1,508	0,389
(3) Var(mrpk_HK)	1,924	1,673	1,545	1,438	1,645	0,180
(4) Var(TFPR_HK)	0,755	0,821	0,421	0,635	0,658	0,438

Notes: Row (1) and Row (2) shows the variance of Wu (2018) measure of capital misallocation (MRPK and ARPK). Row (3) and Row (4) shows the variance of HK measures of misallocation (MRKK and TFPR). TFP loss is computed from equation (5). We have set $\alpha = 1/3$ and $\eta = 0.15$ as borrowed from mainstream literature.

Row (1) and (2) provides the dispersion of the Wu (2018) measures of misallocation and row (3) and (4) provides HK measures of misallocation. The results in Row (1) suggests high dispersions in log MPRK, with an average variance of 1.20 across years. Compared to results

in Row (1), the HK measure of MRPK in Row (3) also shows high variance across years with an average of 1.65. The dispersion of the misallocation measures seems to be persistent over time, with no evidence of significant reduction. Table 1.5a also present the results for aggregate TFP loss as a result of misallocation. The result in Row (1) shows that the aggregate TFP loss in the informal sector as a result of capital misallocation in about 32 percent. The table further presents the results for the variance of log ARPK in Row (2). As pointed by Wu (2018) and Song and Wu (2015) the differences between Row (1) and Row (2) suggest the existence and importance of market power and firm-specific production technology. Having failed to account for such heterogeneities, we would have overestimate aggregate TFP loss by about 7 percent. The end result of this study is to unpack the extent to which financial constraints explain such a huge presence of misallocation.

Financial Access Constraints and Misallocation

We extend our analysis by regressing our measures of misallocation on financial access constraints and initial level of firm productivity as specified in equation (14). The regression results are shown in Table 1.6.

Table 1.6 Correlations between Misallocation and Financial Access constraints

VARIABLES	(1) TFPR	(2) MRPK	(3) τ_k	(4) τ_y
Fin Constraint	0.435***	0.254**	0.024***	-0.183*
	(0.097)	(0.126)	(0.004)	(0.098)
TFP_lag	0.465***	0.478***	0.008***	-0.166**
	(0.065)	(0.080)	(0.003)	(0.071)
Fin Constraint × TFP_lag	0.056	0.249**	-0.006*	-0.165*
	(0.077)	(0.105)	(0.004)	(0.086)
Constant	6.619	-235.082**	29.528***	-29.731
	(69.577)	(103.107)	(3.847)	(75.690)
Observations	433	433	433	433
R-squared	0.441	0.392	0.499	0.196
Location control	Yes	Yes	Yes	Yes
Industry control	Yes	Yes	Yes	Yes

Notes: The measures of misallocation are based on the HK model. We have used an objective measure (Fin_Acess1) as our main measure of financial access constraint. Robust standard errors in parentheses.*** p<0.01, ** p<0.05 and * p<0.1 represents 1%, 5% and 10% levels of statistical significance.

Columns (1-4) shows the results of the misallocation outcomes (scaled TFPR, MPRK, capital distortions and output distortions) against the dummy for financial constraints and initial firm

productivity (TFP). TFPR is an aggregate measure of misallocation. In line with the theoretical predictions, the results in column (1) show a positive and significant correlation between financial access constraints and TFPR. The results imply that all being equal, on average, firms with financial access constraints have a higher presence of misallocation as compared to firms with no financial constraints. We interpreted a positive coefficient on TFPR as determinants of capital distortions relative to output distortions since high values of TFPR indicates that the firm is using relatively lower capital than it would in the absence of frictions. Further, the results in column (1) reveal a positive and significant correlation between initial firm productivity and TFPR. This shows that more productive firms have a higher prevalence of misallocation and this is consistent with our earlier findings. The results signify that misallocation acts as a tax on more productive firms. Restuccia and Rogerson (2008) argued that misallocation is costly and reduces aggregate TFP if there is a positive correlation between firm productivity and misallocation. As such we interpret the positive association between firm productivity and misallocation as evidence that misallocation hinders the aggregate performance of firms in the informal sector. We also interacted financial constraints and firm TFP to explore if financial access constraints affect misallocation differently based on firm productivity. The results in column (1) show a positive but insignificant association between aggregate misallocation and the interaction term. This result shows that the effects of financial access constraints on misallocation do not systematically differ with firm productivity.

Column (2) in Table 1.6 presents the results on capital misallocation as measured by MRPK. The positive and significant correlation between financial constraints and capital misallocation confirms our earlier findings that lack of access to finance contributes significantly to misallocation. The positive correlation suggests that financial access constraints act as a tax on capital relative to labour. This means that firms are using relatively less capital than labour than they would if there was no misallocation and distortions. The results in column (2) also show a positive and significant correlation between firm initial productivity level and capital misallocation, implying that relatively more productive firms suffer from capital misallocation. Further, a positive and significant correlation between capital misallocation and the interaction between firm TFP and financial constraints signifies that impact of financial access constraints on capital misallocation is higher for more productive firms.

To better understand the importance of financial constraints as a source of misallocation, we decompose the aggregate measure of misallocation (TFPR) into factor markets distortions; capital distortions (τ_k) and output distortions (τ_y). The results are shown respectively in

column (3) and column (4). A positive and significant correlation between financial constraints and capital distortions shows that the distortion acts as a tax on capital by increasing the cost of accessing capital, hence firms use less capital than optimal. For output distortion, a negative and significant coefficient of financial constraints implies that the distortions act as a tax on size which prevents firms from growing to optimal size. The results in column (3) and (4) also shows consistent results that more productive firms have more prevalence of distortions and this may result in huge losses in aggregate TFP as argued above.

Comparing our results to existing literature, Cirera et al. (2017) in Sub-Sahara Africa find that financial access constraints increase misallocation by increasing the costs of capital than optimal. Kalemli-Ozcan and Sorensen (2014) also find that access to finance is significant sources of misallocation. They find that firms with high financial constraints have high MRPK, signalling the significant association between financial constraints and capital misallocation. Kinghan et al, (2018) find evidence of capital misallocation as a result of financial constraints. They also find that firms with the highest returns have a lower likelihood of accessing finance.

Financial Access Constraints and Firm Performance

In the section above, we have established that financial access constraints are an important source of misallocation. In this section, we estimate the importance of financial access constraints in affecting firm performance. Firm performance is measured by firm investment and employment growth. We start by regressing firm investment on financial access constraints controlling for firm characteristics (firm age, industry and location) as specified in equation (15). The results from the investment regression are shown in Table 1.7 below. Column (1-4) report the results of a probit analysis on the impact of financial access constraints on the probability of a firm investing. Column (1) provides the results for the baseline model. In column (2) we include firm initial productivity and in column (3) we include the interaction between financial access constraints and firm productivity. Finally, in column (4) we include the interaction between financial constraints and firm age. Starting with column (1), we find that there is a negative relationship between financial access constraints and the probability of a firm investing. This relationship is significant at 1 percent level. The negative coefficient of financial constraints implies that financially constrained firms are, on average, less likely to invest as compared to non-constrained firms by 20 percent.

Table 1.7 Firm investment and Financial Access Constraints (Marginal Effects)

VARIABLES	(1) base	(2) Initial TFP	(3) Fin_Acess × Initial TFP	(4) Fin_Acess × Firm Age
Fin Constraint	-0.200***	-0.284***	-0.284***	-0.121
	(0.058)	(0.060)	(0.060)	(0.111)
TFP_lag		0.021	0.031	0.024
		(0.021)	(0.031)	(0.022)
Fin Constraint × Firm age				-0.015*
				(0.009)
Fin Constraint × TFP_lag			-0.019	
			(0.041)	
Firm age	0.046***	0.037**	0.037**	0.051***
	(0.014)	(0.015)	(0.015)	(0.016)
Firm Age^2	-0.002***	-0.002***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	422	408	408	408
Location control	Yes	Yes	Yes	Yes
Industry control	Yes	Yes	Yes	Yes

Notes: Column (1) shows the baseline model. In Column (1) we control for initial firm productivity. In Column (3) we control for the interaction between Fin_Access1 and initial TFP. In Column (4) we control for the interaction between Fin_Access1 and Firm Age. Robust standard errors in parentheses. *** p<0.01, ** p<0.05 and * p<0.1 represents 1%, 5% and 10% levels of statistical significance.

The results in column (1) also show that there is an inverted U relationship between firm investment and firm age. The relationship is significant at 1 percent level. This shows that young firms have low investment drives so as older firms. In column (2) and (3) the sign and significance for financial access constraints and firm age remain the same as in column (1). The results of financial access constraints in column (2) and (3) shows that constrained firms are less likely to invest by 28 percent as compared to unconstrained firms and this relationship is significant at 1 percent level. Further, the results on the interaction between financial constraints and firm age on investment in column (4) show a negative sign. This relationship is significant at the 10 percent level. This result implies that financial access constraints are associated with a 1.5 percent decrease in the probability of investing in young firms. In addition, we get a positive but insignificant relationship between firm productivity and the probability of investing in all specifications. In the absence of distortions, we would have expected more productivity firms to have a high probability of investing. As such the insignificant relationship between firm productivity and firm investment performance signals that productivity-enhancing capital reallocations are not being achieved in the informal sector.

The results in column (3) also report a negative but insignificant relationship between firm investment and the interaction between financial access constraints and productivity. These results show that the effects of financial access constraints on investment do differ with firm productivity. In a frictionless economy, we would have expected more productive firms to be less financially constrained and have a high likelihood of embarking of productivity-enhancing investments.

The second measure of firm performance that we consider is employment growth. We test the link between firm employment growth, financial constraints and firm initial productivity. Kinghan et al. (2018) argued that the mechanism through which financial access constraints affect employment growth is not as direct as the case with investment. The argument is that investment requires a large amount of funds at a point in time while employment can be expanded in stages hence relatively demand less finance as compared to investment. Nevertheless, employment growth may be slowed if firms cannot access enough finance to expand operations or manage the day to day business expenses such as wages.

Table 1.8 presents the regression results on the effects of financial access constraints on employment growth as specified in equation (15).

Table 1.8 Firm Employment Growth and Financial Access Constraints

VARIABLES	(1) base	(2) Initial TFP	(3) Fin_Acess × Initial TFP	(4) Fin_Acesss × Firm Age
Fin Constraint	-0.032	-0.080	-0.080	-0.081
	(0.059)	(0.062)	(0.062)	(0.062)
Initial_TFP		0.069***	0.095**	0.070***
		(0.025)	(0.037)	(0.026)
Fin Constraint × Firm age				0.002
				(0.005)
Fin Constraint × Initial_TFP			-0.049	
			(0.049)	
Firm age	-0.014	-0.018	-0.018	-0.020
	(0.014)	(0.013)	(0.013)	(0.014)
Firm Age^2	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.190*	0.221**	0.217**	0.225**
	(0.099)	(0.094)	(0.093)	(0.096)
Observations	354	323	323	323
R-squared	0.049	0.076	0.079	0.076
Location control	Yes	Yes	Yes	Yes

Industry control	Yes	Yes	Yes	Yes

Notes: Column (1) shows the baseline model. In Column (1) we control for initial firm productivity. In Column (3) we control for the interaction between Fin_Access1 and initial TFP. In Column (4) we control for the interaction between Fin_Access1 and Firm Age. Robust standard errors in parentheses. *** p<0.01, ** p<0.05 and * p<0.1 represents 1%, 5% and 10% levels of statistical significance.

The results in Table 1.8 shows a negative but statistically insignificant relationship between employment growth and financial access constraints. We also find a statistically insignificant interaction between financial access constraints and initial firm productivity in the employment model. This suggests that the impact of financial constraints on employment growth does not vary significantly with firm productivity. In efficient economies, we would have expected a positive and significant coefficient of the interaction term, signifying that more productive firms have less financial access constraints and attain high employed growth relative to less productive firms. The results further show a positive and statistically significant relationship between firm productive and employment growth. This result signifies that productive enhancing reallocation of labour is realised in the informal sector.

1.6 Conclusion

The study explores the impact of financial access constraints on firm performance and aggregate TFP and determine the importance of financial access constraints as a source of allocative inefficiency. The study is based on the informal sector firm-level panel dataset. We constructed the measures of misallocation using Hsieh and Klenow (2009) framework. We also use both subjective and objective measures of financial access constraints present in our dataset. We find evidence suggesting the following stylised facts. Firstly, we find that a high proportion of firms that are financially constrained in the informal manufacturing sector and are on average increasing with time. In this regard, we also find that financial access constraints emanate from the supply side, that is, there are no sufficient funds in the market to match the high demand for such funds. We also find evidence suggesting that relatively young and small firms are more financially constrained. Moreover, there is a negative correlation between financial constraints and firm productivity. This suggests that financial access constraints reduce firm productivity and hence aggregate TFP. Secondly, there is a huge presence of misallocation in the informal sector as shown by the dispersion of TPFR. Importantly, we find a positive correlation between misallocation and firm productivity. This entails that distortions acts as a tax on relatively more productive firms and this reduces aggregate TFP. Further, there is a positive correlation between financial access constraints and misallocation, suggesting that

financial access constraints are an important source of allocative inefficiency. Thirdly, exploring the relationship between financial access constraints and firm performance, the study finds that the proportion of constrained firms that have carried out investment initiatives are lower as compared to unconstrained firms. Average employment growth is, however, not different between constrained and unconstrained firms.

Importantly, the study provides some empirical evidence on the impact of financial access constraints on misallocation and firm performance. First, the study explores the question of whether financial access constraints are a source of misallocation and whether financial access constraints are inefficiently affecting relatively more productive firms. The results provide evidence that financial access constraints are an important source of misallocation. The empirical results also reveal a statistically significant association between misallocation and firm initial productivity. This suggests that more productive firms that relatively suffering from misallocations costs. Further, we find a statistically significant association between the interaction of financial access constraints and firm initial productivity on capital misallocation. This provides evidence that financial access constraints are inefficiently affecting relatively more productive firms in the informal manufacturing sector. As such, this result has an important implication of financial constraints dampening the aggregate productivity with the informal sector through the misallocation channel.

Second, the study empirically explores the question of the impact of financial access constraints on firm performance. To explore this question, we regress investment and employment growth equations and determine the extent to which financial access constraints affects these sources of firm performance. We then assess whether financial constraints are limiting investment and employment growth for those firms with higher productivity levels. The empirical results from the investment model show that there is a negative and significant relationship between financial constraints and investment. This signifies that financial constraints reduce the investment drive by firms. The results further show a statistically significant relationship between firm productivity and investment and this is against our theoretical predictions that efficient firms are expected to invest more. As such, this result signifies allocative inefficient of finance in the informal sector. This result is further supported by an insignificant relationship between investment and the interaction of financial constraints and firm productivity-which suggest that the effects of financial access constraints on investment do differ with firm productivity. In standard neoclassical models, we would have expected more productive firms to have more access to finance and allow them to embark on productivity-enhancing

investments and growth. The insignificant results of firm productivity imply that productivity-enhancing capital allocations are not realised in the informal manufacturing sector.

The empirical results from the employment model show that financial access constraints are statistically insignificant in explaining employment growth. In addition, we do not find any statistically significant interactions between firm productivity and financial access constraints in the employment model. This suggests that financial access constraints do have a direct link with employment growths. Thus, the results show the negative effects of financial access constraints on firm growth and efficiency runs through the investment channel and not through employment growth. We, however, find that productivity enhanced reallocation of labour is achieved in the informal sector as revealed by the positive and significant association between firm initial productivity and employment growth.

The results of this study have important policy implications. The findings that financial access constraints are huge, a major source of allocative inefficiency and impedes investment in informal manufacturing sector requires immediate policy attention to revive the productivity of the informal sector. There is a need for policy prescription that eases financial access by firms. However, care must be taken when designing such policy as easy access to finance by all firms may create inefficiencies that will, in turn, reduce aggregate productivity. As thus easy access to finance must be conditional on firm productivity-as supported by our finding that it is more productive firms that are financially constrained and hurt relatively more by misallocation. To deal with the supply-side barriers to financial access, there is a need to increase awareness amongst firms. There is a need to provide adequate information on the process needed to successfully apply for external finance.

Notwithstanding the study's potential contribution, we suggest that it would be useful in future to extend our analysis to the formal sector and give some insightful comparison between the formal and informal sector. In addition, it would be informative if we would extend and compare our results to other informal sectors in developing economies. However, the major challenge is the availability of panel datasets on informal sector economies. Further in would be also interesting in future if we extend out sample time dimension to give robust dynamics about informal sector efficient growth. Due to data limitations, we are only able to base our analysis on the intensive margins. It would important to assess how the exit and entry of firms affect misallocation and contribute to the productive growth of the informal sector.

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