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# FIRM-LEVEL INVESTMENT DECISIONS UNDER UNCERTAINTY AND IRREVERSIBILITY IN ZIMBABWE'S PRIVATE FIRMS

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## *ABSTRACT*

Zimbabwe's business operating environment is abounding with both micro and macro uncertainties that regularly impact on firm-level investment decisions. Under uncertainty and irreversibility private firms are forced to integrate into their investment appraisals and decisions some expectations regarding future product demand and prices, likely returns on fixed capital investment, expected margins, cost of capital expectations and cash flow projections. These important issues are not known with definitive assurance and hence, making investment decisions under uncertainty a challenging task for Zimbabwe's private firms. The study examined investment under uncertainty and irreversibility in Zimbabwe's private firms using a polychotomous regression model with the three investment decision outcomes; "invest now", "do not invest now" and "defer investment". The major findings are that; (1) liquidity constraints, firm size and credit constraints significantly influence the probability of investing now irrespective of uncertainties in the economy. (2) Poor public infrastructure, political uncertainty, inconsistent application of the indigenization laws and absence of laws that protect private property rights increase the probability of private firms' deferring investment decisions under uncertainty and investment irreversibility. The paper recommends that policy makers should reduce macro uncertainties in the financial sector that affect firm-level investment decisions, adopt policies that enhance productivity of public infrastructure and must observe national and international laws that safeguard investor property rights.

**Contribution/Originality:** The study is one of the few studies that used a polychotomous probabilistic distribution function to investigate investment decisions of Zimbabwe's private firms given the presence of uncertainty and investment irreversibility.

## 1. INTRODUCTION AND BACKGROUND

High levels of business uncertainties in an economy affect firm-level investment decisions and consequently, aggregate domestic investment behaviour, economic growth and development. Firm-level investment decisions under uncertainty in many developing countries that include Zimbabwe, are both a contemporary area of study and an important issue that face many private firms. Zimbabwe repeatedly experiences episodes of elevated realized socio-political and economic uncertainties that in turn affect the business environment of domestic firms and consequently, firm-level investment decisions. Uncertainties in firms' operating environment largely originate from endogenous shocks that are commonly intensified by exogenous shocks. Exogenous shocks in Zimbabwe's private firms have been a result of supply-side constraints, weak international prices of exported products and services,

heightened global volatilities of exchange, inflation and interest rates, and increased vulnerabilities in financial and capital markets. Nevertheless, a great deal of adverse endogenous shocks that affect firm-level investment decisions in Zimbabwe emanate from economic mismanagement, expansionary fiscal contractions, asymmetric information in domestic credit markets, perceptions of political instability, inconsistent and incoherent fiscal and monetary policies, maleficent disregard of private property rights, ambiguities over the indigenization policies, accelerated de-industrialization in firms' value-chains, technological reversion, and the in-formalisation of most economic transactions. The country also has unsustainably high unbalanced external position, a major consequence of licentiousness expenditure on non-productive public goods and the presence of endemic public corruption. The composition of public expenditures has often been skewed towards recurrent consumption which is regularly financed by unrestrained government borrowings from domestic credit markets. Borrowings by the government from domestic financing intermediaries ordinarily crowds-out private firms in capital markets by exerting upward pressure on domestic real interest rates, inflation and the user cost of capital.

High cost of fixed capital under uncertainty reduces and/or causes firm-level investment decisions to be stalled indefinitely or deferred to future periods. The ultimate effects are reduction of current output, consumption, weak economic growth, under-development and a general low equilibrium domestic investment environment. In addition, investment under uncertainty results in unpredictable cash flows and low returns to long-term fixed capital. This is because when private firms make investment decisions under uncertainty and irreversibility, they are forced to incorporate in their current investment decisions some expectations concerning future outcomes such as expected demand, production and output levels, prices to be charged, levels of future profitability and revenue growth forecasts. However, in empirical literature the final outcomes of investing under uncertainty and irreversibility have been a subject of intense debate (Bloom *et al*., 2018; Davis and Cairns, 2018; Efrem *et al*., 2018; Muzurura, 2018; Niemann and Sureth-Sloane, 2018). Firm-level investment decisions under uncertainty present a formidable challenge not only to Zimbabwe's private firms, but also to providers of long-term investment funding such as banks and other financial intermediaries. In the Zimbabwean economy, uncertainties are also a major source of business cycle fluctuations that eventually result in much lower aggregated domestic investment and economic growth.

Even though most firms may be keen to build their fixed capital stock to optimum investment levels that is, where actual physical capital accumulation approximates or equals the desired capital stock, a number of private firms are unable to do so in uncertain business environments. The firm's desired capital stock can be defined as the optimal level of a firm's fixed capital stock that maximises its expected net discounted present value as specified by its production function, prices, business risks, output, labour costs, output demand, and user/rental cost of capital among other variables. However, under uncertainty and irreversibility, choosing a discounting rate in order to evaluate future net present values of investments decisions is also a formidable task for Zimbabwe's private firms. Empirical literature on the effects of uncertainty on investment timing and investment irreversibility has to a large extent been focused on stock market volatility, sales variances and variability of future profits. However, many studies often ignore broad macro-economic indicators such as the impact of inflation and exchange rates on firm-level investment behaviour.

Furthermore, most studies based on Zimbabwe's private firms often disregard non-monetary factors such as the effects of public corruption, level of country risk, poor corporate governance, public institutional weaknesses, and indigenization laws on firm level investment decisions. These issues are real in Zimbabwe, and hence, a major lacuna in empirical literature. In an endeavour to control natural resources scarcity and also to reduce socio-economic inequalities, Zimbabwe crafted indigenization laws in 2000 that compel foreign companies to cede 51 % equity to indigenous people. The indigenization laws are frequently applied capriciously by politicians and hence, impinge on private property rights. Enforcement of indigenization laws in many instances are accompanied by intimidation, threats of arbitrary expropriation and to some extent the use of violence as a tool of coercion.

Investors have no proper recourse to national laws due to the partiality of the judiciary system and other institutions that enforce good governance. Uncertainties are therefore likely to cause foreign private firms either to defer future investment plans or to shelf current investment plans. Deferring firm-level investment decisions under uncertainty and irreversibility enables firms and investors to at least wait until the arrival of new information regarding future price elasticities, expected profitability levels, product demand, costs and other changes in market conditions and mixes. Thus deferring investment under uncertainty might also enable a firm to trade-off current investable returns from investing now, against the possible gains from being able to make a more informed investment decision in the future, especially when uncertainty clears off. In uncertain business operating environments investing now in long-term projects that have unpredictable future returns, irregular cash flows and may also be subject to state expropriation, is certainly more costly and riskier.

On the other hand, choosing the option of not investing under uncertainty and irreversibility might not be optimum solution due to some opportunity costs on the part of the firm. Hence, faced with various investment options that are risky and uncertain, most private firms in Zimbabwe prefer gradual adjustments of their actual fixed capital stock to the future desired capital stock. The final effect usually manifests itself in low aggregate domestic investment equilibrium, weak economic growth and further increases in unemployment, poverty and under-development. The predisposition to timing investment decisions and deferring irreversible firm-level investment decisions under uncertainties has been over-emphasized in recent empirical literature that focus on developed economies (Born and Pfeifer, 2014; Davis and Cairns, 2018; Furceri *et al*., 2018). However, a huge cavity still exists in Zimbabwean studies that examine firm-level investment decisions under uncertainty and irreversibility. The country often experiences oscillating incidences of inflation, hyperinflation and deflation and also relies on repressed interest and exchange rates regimes, all factors that fuel uncertainty in firms' operating environment. Besides, the legal, regulatory, and accounting structures within which banks that provide capital for fixed capital expenditures operate are often characterized by fragility and financial pellucidity. For instance, prudential supervision by the central bank frequently creates systemic fragilities within the domestic banking sector. In the past decades, political and economic uncertainties have precipitated and compounded bank-runs, currency, cash and financial crises through contagion effect.

However, since 2017 after a soft coup by the military that disposed one of the longest serving African presidents, the country has made some nominal strides to stabilize the economy after elongated period of economic stagnation. Nevertheless, current efforts to rebrand the economy by reducing business risks, minimizing uncertainties and increasing business confidence have not yielded the required investment behaviour by private firms. Perceptible among the key uncertainties besetting the business operating environment include; firm closures, employee redundancy costs, public infrastructure bottlenecks, a persistent liquidity crunch, exchange rate overvaluation, declining international capital inflows and an adversative country-risk premium arising from a huge public debt overhang. Regarding the external position, the country is over borrowed both in the domestic and international markets. A high debt overhang has been causing domestic investment contraction through the crowding-out conduit and thus, making domestic investment and economic growth recovery efforts ephemeral.

The country has insufficient international reserves and yet, most private firms depend on imported capital equipment for their production processes. Increasing firm-level investment spending on imported machinery and equipment is a key determinant of future production of goods and service, technological progress and therefore, long-run economic growth and development. The long-term economic growth of the country, like any developing country is closely correlated to a steady-state accumulation of up-to-date fixed capital stock by private firms. Therefore, low firm-level spending on productive fixed capital stock caused by business uncertainties presents a reliable and credible threat to formulation of developmental policies in Zimbabwe. This is even more substantive if investment decisions undertaken by private firms are envisioned to raise economic growth to levels that is deemed essential for eradicating poverty, increasing employment generation and sustainably improving people's living

standards. The major problem of investing under uncertainties related to firms' investment irreversibility, timing and sunk costs which cannot be recouped. Under uncertainty, the cost of investing in fixed capital stock by a private firm might not be recovered by future resale of the same assets should the firm later decide to defer or reverse its investment decision. In addition, investment under uncertainty and irreversibility have aftereffects that have strong potential of weakening productivity-enhancing reallocation and redistribution of resources within the country. The aftereffects of investment timing, irreversibility and uncertainty usually act in opposite direction by causing productive private firms to contract more rapidly and unproductive firms to contract less. This is likely to generate pro-cyclical productivity within the Zimbabwe economy that could stimulate unintended shocks to business cycles in the form of rapid contraction of aggregate demand, downward stickiness of prices, wage and salary costs. The irreversibility of investment decisions is preventing private firms from selling equipment and machinery even when the marginal revenue product of capital could be low.

The study is significant for a number of reasons. In more recent years, there has been comprehensive concord and mounting evidence in literature that submit that the investment behaviour of private firms is one of the most important determinants of aggregate demand and the long-run rate of economic growth (Stokey, 2016; Drobetz *et al*., 2018; Ozturk and Sheng, 2018). The irreversibility of firm-level decisions under uncertainty have important implications in the understanding of aggregate domestic investment behaviour of Zimbabwe private firms. Understanding firm-level investment decisions under uncertainty and irreversibility is important for policy makers, especially in the formulation and implementation of social, political and economic policies that impels firm-level investment-driven growth. Firm-level investment behaviour acts as a strategic element of countercyclical domestic investment policy that boosts firm productivity, economic growth and development. Furthermore, because firm-level investment decisions are forward-looking activities with irreversible aspects, they tend to be more volatile components of aggregate demand. This suggests the existence of an irreversibility effect, whereby greater uncertainty raises the value of the "call option" to delay a commitment to investment.

Most studies on investment under uncertainty in Zimbabwe have largely ignored micro issues such as firm-level investment decisions (Davis and Cairns (2018). For instance, in Zimbabwe a firm's technology is likely to be firm-specific. This makes it difficult for private firms to interchange or to sell the firm-specific technology to other firms operating in different sectors of the economy should the firm decide to divest or reduce fixed capacity. Because fixed investments cannot be resold in tributary markets, most firms may prefer to have insufficient capacity rather than holding excess fixed capital stock, hence low domestic investment growth. In addition, irreversibility of investment decisions under uncertainty is related to two critical issues in economics, the "lemon effect" and the fixed capital stock specificity. A firm operating under uncertainties can decide either to dispose or reduce its investment by selling off its machinery and equipment to other players in the same industry or in secondary markets. However, because of the "lemon effect", the expected buyers may also be exposed to similar market conditions that prompted the private firm to want to resell in the first place. The end result is being stuck-in-the middle with excess capital stock capacity, no buyers and sellers, hence, general market failure in the capital goods market.

Regarding fixed capital stock specificity, the argument is that, even though fixed capital stock is not firm-specific, the amalgamation of industry-specific demand and supply-side shocks with industry-specific fixed capital stock under uncertainty might result in at least partially irreversible investment. Because secondary markets that can absorb the firm-specific technologies are absent, Zimbabwe's private firms are likely to scrap for recycling or dispose acquired technology at sub-optimal prices. Against this background, the objective of the paper is to explain firm-level investment decisions of Zimbabwe private firms under uncertainty and irreversibility. Specifically, the paper seeks to answer the following question. What factors cause Zimbabwe's private firms to invest or defer investment plans in the presence of uncertainty? The paper contributes to literature on the theory of investment behaviour in the following ways. First, the paper advances empirical literature in developing countries on firm-level

investment behaviour under uncertainty and irreversibility. Second, instead of adopting traditional measures that have been used in similar studies such as stock market volatility, revenue and profit variances, the paper used a broad macro-economic indicator, the inflation rate as a proxy variable for uncertainty. Third, unlike most studies that assume linear regression functions, the paper incorporates both monetary and non-monetary variables at micro-level using a multinomial regression equation. The major assumptions of the paper are that; Zimbabwe private firms' maximize the expected value of the sum of discounted cash flows from fixed capital stock spending; the production functions of a private firms a are not necessarily homogeneous of degree one, and that the profit function of competitive private firms are strictly concave whilst the cost of capital functions are strictly convex. The paper is structured as follows: Section One covers Introduction and Background. Section Two covers Literature Review. Section Three covers Methodology whilst Findings and Recommendation are in Section Four.

## 2. LITERATURE REVIEW

The major pioneering studies on business uncertainty and investment irreversibility are attributed to Pindyck (1991) and Dixit and Pindyck (1994). However, a number of recent studies on uncertainty and investment irreversibility suggest that once sunk costs are incurred by a firm, such costs cannot be recovered in the short-term without the firm incurring extensive recoupment costs (Abdul, 2017; Markus and Francisco, 2017; Davis and Cairns, 2018). Davis and Cairns (2018) have associated irreversible investment and the concept of real-option value especially for the case of lumpy investment in capital budgeting. Gupta and Jooste (2018) argue that the optimal rule of investment for a private firm operating under complete investment irreversibility and uncertainty is to invest when the expected net cash flow do not cover the Jorgenson's opportunity cost of investment. The findings suggest that investments that are partially reversible have much in common with completely irreversible investments but nothing in common with completely reversible investments. Markus and Francisco (2017) using a 5-year non-overlapping panel data comprising 175 countries during the period 1980 to 2010, find that terms of trade volatility have significant negative effects on domestic investment and economic growth in countries with pro-cyclical government spending.

Knut *et al.* (2018) indicate that delays in carrying out firm-level investment decisions under uncertainty exist when private firms are risk-neutral agents and the future business prospects of demand and output growth are also uncertain. Oniore *et al.* (2016) argue that investment irreversibility is caused by business uncertainty over future interest rates. Bader and Malawi (2010) suggest volatility in exchange rates as sources of business uncertainty. Similarly Bloom *et al.* (2018) cite variabilities in interest and inflation rates and business cycles as major causes of investment irreversibility. Leefmans (2011) indicates that increased costs uncertainty raises the probability of excess fixed capital stock. Most firms prefer to spend less on new business equipment in the current period in order to reduce the probability of excess capacity tomorrow (Born and Pfeifer, 2014); (Kang *et al.*, 2014). Bekoe and Adom (2013) indicate that a firm that defers fixed investment decisions for too long incurs an opportunity cost. Abdul (2017) for Pakistani shows that private firms are likely to cut down their level of investment spending when either idiosyncratic or macroeconomic uncertainties increases. They reveal that the sensitivity of firms' investment decisions to macroeconomic uncertainty is higher as compared to the firm-specific uncertainty. Similarly, Efrem *et al.* (2018) on examining the role played by uncertainty for a number of countries business cycles report factors such as interaction between uncertainty and financial frictions, the global dimension of uncertainty, uncertainty shocks in times of unconventional monetary policy and the imperfect knowledge that agents have over policy targets. The value to waiting, that is, the option value of investment arises when the firm's opportunity cost in current profit terms is lower compared to the cost of carrying out the irreversible investment and being stuck with excessive capital in the event of a business downturn (Bayai and Nyangara, 2013); (Malumisa, 2013). The findings infer that when there is imperfect competition due to the presence of monopolistic firms, an increase in fixed investment in the current period, makes it more probable that a firm will be saddled with too much actual capital stock relative to its

desired level of fixed capital in the future period (Muzurura, 2018). Knut *et al.* (2018) relied on real option effects in United States and demonstrate that high uncertainty dampen the effects of monetary policy shocks, affect aggregate consumption, and that the effect is more pronounced for firm-level aggregate investment.

Corinne *et al.* (2018) examine 26 sub-Saharan African countries that were deemed fragile in the 1990 using a probabilistic framework together with GMM estimation to address endogeneity and reverse causality. They find fiscal institutions, capacity to raise tax revenue and contain current spending and quality of public expenditure as important factors to manage uncertainty. Common uncertainty shocks produce the large and persistent negative response in real economic activity, whereas the contributions of idiosyncratic uncertainty shocks are negligible (Davis and Cairns, 2018; Efrem *et al.*, 2018; Gupta and Jooste, 2018; Ozturk and Sheng, 2018). Similarly, Furceri *et al.* (2018) employed productivity growth of 25 industries from 18 advanced economies over the period 1985-2010 and examined the effect of aggregate uncertainty shocks measured by the stock market volatility on sectoral productivity. They found that the effect on uncertainty and irreversibility was stronger in industries that depended heavily on external finance, that uncertainty induced industries to switch the composition of investment, and that the mechanism was stronger during recessions when credit constraints bound more than during expansions.

Baker *et al.* (2016) established that uncertainty had stronger impact on firm-level investment decisions if economic policy uncertainty was used instead of stock market volatility as a measure of aggregate uncertainty. Wolfgang *et al.* (2018) using the news-based index developed by Baker *et al.* (2016) for twenty-one countries report a negative relation between firm-level investment and the cost of capital. They also find that an increase in policy uncertainty reduces the sensitivity of investment to the cost of capital most for firms operating in industries that depend strongly on government subsidies and government consumption as well as in countries with high state ownership. Ozturk and Sheng (2018) concur, using the price informativeness channel find that an increase in policy uncertainty reduces the investment-cost of capital sensitivity for firms from more opaque countries, firms with low analyst coverage, firms with no credit rating, and small firms. Higher economic policy uncertainty leads to increases in stock volatility and investment irreversibility (Kang *et al.*, 2014; Zhang and Lie, 2015). Economic policy uncertainty when interacting with firm-level uncertainty depresses firms' investment decisions (Stokey, 2016). The effect of economic policy uncertainty on firm-level investment is greater for firms with higher firm-level uncertainty and during a recession (Niemann and Sureth, 2013). This suggests that when private firms are uncertain about the costs of doing business due to possible changes in regulation, cost of health care and taxes, they become more reticent in their future investment plans. Policy uncertainty does not seem to influence the investment decisions of the very largest firms (Baker *et al.*, 2016); (Stokey, 2016). Binding and Dibiasi (2017) establish that uncertainty negatively affects investment in equipment and machinery through real-option effects and that uncertainty positively influences expenditures in research and development through growth-option effects. According to Niemann and Sureth-Sloane (2018) uncertainty about a one-time change in tax policy induces the firm to temporarily stop investing by adopting a wait-and-see policy. The negative influence of uncertainty is more obvious for firms receiving fewer government subsidies (Binding and Dibiasi, 2017).

Bloom *et al.* (2018) confirm that irrespective of the adverse effects of investment irreversibility on the user cost of capital, there is an aftermath effect that arises when investment irreversibility prevents the firm from selling fixed capital even when its marginal revenue product is too low. In agreement, Muzurura (2018) reports that the issues of irreversibility of fixed investment decisions are important to firms operating in developing countries. They say that most firms in developing countries suffer from high and unpredictable inflation rates which are usually and equally matched by high relative price variabilities. Stokey (2016) reports that volatility in interest and inflation rates are uncertainties that affect firm-level investment decisions. Tsai (2017) says that inconsistent changes in taxation policies on fixed capital often leads to a substitution of productive domestic investments in favour of consumption. Kandilov and Leblebicioğlu (2011) used the neoclassical investment model and showed how exchange rate volatility affected investment behaviour of Colombian manufacturers for the period 1981 to 1987. Niemann and

Sureth-Sloane (2018) indicate that firm-level uncertainty affect the timing of future business equipment investment decisions.

## 3. METHODOLOGY

The traditional theoretical literature of firm-level investment behaviour espoused by the flexible accelerator theory, neoclassical investment model and the Tobin *q* suggests that firm-level investment decisions are perfectly homogeneous and therefore, competitive private firms equate marginal return of capital stock to the marginal cost. The paper, nevertheless argues that in idiosyncratic markets with uncertainty and irreversibility frictions, firm-level investment decisions could be heterogeneous. In most investment studies that investigate a homogenous capital stock, a 'private firm' is usually shown as a production possibilities set that converts inputs and inventory into finished and semi-finished outputs. The shortcoming of this methodology is ensconced in its minimalism by assuming investment certainty and a perfectly competitive environment. There is therefore, an urgent need to close the lacuna in empirical literature, particularly on the methodology to be used when private firms invest under uncertainty.

The paper therefore posits that a simple aggregate investment relationship that is based on macro-level data as shown in many studies of investment behaviour in developing countries risks losing potentially significant information on firm-level investment decisions under uncertainty when applied to Zimbabwe. Thus, given the irreversibility of firm-level investment decisions under uncertainty, most private firms in Zimbabwe may choose to forgo an option to invest now. Some private firms might also delay future investment decisions in order to avoid bearing the cost of investing in projects with unpredictable discounted net present values. Using the option investment theory the paper also suggest on the contrary, that risk averse private firms in Zimbabwe might actually undertake more investment under uncertainty and irreversibility. A discombobulating scenario is that, as long as a firm's future profits are more than the user cost of capital plus the opportunity cost of not exercising the option to invest, investment under uncertainty might actually be feasible and beneficial to firms in Zimbabwe. Hence, firm-level investment decisions under uncertainty are likely to follow a polytochomous or a multinomial probabilistic distribution function. The paper uses a broad macroeconomic indicator that is, inflation rate as a proxy for measuring uncertainty since inflation affects real exchange rates, profitability projections, level of output demand, general level of prices, sales volatility, expected future cash flows, diffusion of technology, and cost of capital as well as investment timing. The other advantage of using inflation rate is that, the variable just like investment behaviour, is a forward-orientation measure and therefore incorporates business expectations and confidence.

### *3.1. Conceptual Framework*

Assume the case of private firm that intends to make a long-term fixed investment decision under uncertainty whose present value is Y/1+r. We assume that the firms also incurs present value of the sunk costs C/1+r, where *r* is the firm's discount rate (cost of capital) measured by the average inflation rate. Since firm-level investment decisions under uncertainty are irreversible, the net present value principle says that the firm makes the investment only if $Y - C \geq 0$. Adapting model we adjust it using a geometric Brownian motion with a drift where C varies over time and hence, giving the equation;

$$dY = \delta Y dt + \emptyset Y ds \qquad (1.1)$$

Where $\delta$ is the mean of $dY$ and $\emptyset$ is the standard deviation of $dY$. The term $ds$ is the random increment of a Wiener process given by;

$$ds = \mu_t\sqrt{dt} \quad (1.2)$$

$\mu_t$ follows a standard normal distribution that has as zero mean and variance which are equal to one and is serially uncorrelated, that is, $E(\mu_t\mu_j) = 0, \forall i, j, for\ all\ t \neq j$. A Wiener process also called a Brownian motion, is one where a continuous-time Markov stochastic process whose increments are independent, no matter how small the time interval. Specifically, if $s_t$ is a Wiener process, then any change in *s*, Δs, corresponding to a time interval Δt, satisfies the following conditions: (*1*) the relationship between Δz and Δt is given by $\Delta z = \mu_t\sqrt{dt}$ where $\mu_t$ is a normally distributed random variable with mean zero and a standard deviation of 1; (*2*) $\mu_t$ is serially uncorrelated, that is, $E(\mu_t\mu_j = 0 for\ all\ t \neq j$ in the equation (1.2) the values of Δs for any two different intervals of time are independent, so that $s_t$ follows a Markov process. Thus, if we let Δt's become infinitesimally insignificant, the increment of the Wiener process can be written as in (1.1). In equation (1.2), the term in *ds* disappears because its expectation is zero. Equation (1.1) and (1.2) indicate that future returns associated with investment under uncertainty are log-normally distributed with an expected value given by $E(Q_t) = Q_0\exp(\partial t)$ where $Q_0$ is today's value of *F*, and a variance that grows exponentially with *t*. Under investment under uncertainty a firm will likely time its long-term fixed investment decisions in order to maximize the expected present value of the option to invest, F (Q). This given by equation;$F(Q) = maxE[(Q_{Tm} - C) = Q_0\exp(-\beta T_m)$ (1.3)

Where $Q_{Tm}$ is the value of the investment at the unknown future period in time $T_m$, at which the investment decision is made, and $\beta > \partial$ is the discount rate. If a firm delays or defers the investment decision to a later period whilst holding the option, this is equivalent to holding an asset which pays no return (dividends) but may gain in value with passage of time. As demonstrated by Dixit and Pindyck (1994) the fundamental condition for optimality of Bellman equation, if the firm delays investment and holds the option, is given by

$$\beta F = E(dF)/d_t \quad (1.4)$$

In (1.4), the left side is the discounted normal rate of return that a firm would require from holding the option. The right hand-side of the equation shows the expected total return per unit of time form holding the option. Hence, if this condition holds, the firm is equating the expected return from deferring or delaying the investment with the opportunity cost of deferring investment decisions under uncertainty. In fact equation (1.4) also describes a condition of no-arbitrage. In order to calculate *dF* and because *F* is a continuous time stochastic process, the paper uses *Ito's lemma* to simplify and expand the equation to get

$$dF = F'(X)dQ + \frac{1}{2}F''(Q)(dQ^2) \quad (1.5)$$

Substituting out for *dQ* from equation (1.5) gives

$$E(dF) = \partial Q F'(Q)dt + \frac{\partial}{2} Q''(Q)dt \quad (1.6)$$

Hence, substituting equation (1.6) in equation (1.4) we get

$$\beta F(Q) = \partial Q E F'(Q) + \frac{\partial^2}{2} Q^2 F''(Q) \quad (1.7)$$

Equation (1.7) denotes a second order differential equation in $Q$ and shows that if a private firm follows the optimal investment rule, its value of the option to defer and wait until uncertainty in the economy clears off must satisfy equation (1.7). Furthermore, it must also satisfy three additional boundary conditions that is; (1) $F(0) = 0,$ a condition which shows that if the value of the intended investment falls to 0, the firm's value of the option to invest under uncertainty is zero. (2) $F(\tilde{Q} = \tilde{Q} - C,$ is a second condition that defines the net pay off to the firm at the value of $Q,$ which is the level at which it is optimal to invest now under uncertainty. (3) The final condition is termed the 'smooth pasting' condition. This condition requires that the function F (Q) must be continuous and smooth around the optimal investment timing point.

Solving equation (1.7) subject to conditions 1-3 given above gives

$$F(Q) = aQ^b \quad (1.8)$$

Where $a = (\tilde{Q} - S)/\tilde{Q}^b$ and $b$ is given by equation (1.22) which is

$$b = \frac{1}{2} - \frac{\partial}{\beta^2} + \sqrt{(\frac{\partial}{\beta^2} - \frac{1}{2})^2 + \frac{2p}{\beta^2}} \quad (1.9)$$

And by substituting equation (1.9) in condition 1 and 2 boundary conditions above, the net pay off associated with the optimal investment timing is given by;

$$\tilde{Q} = \frac{b}{b-1} S \quad (2.0)$$

Hence, if $b > 1$, it follows also that $\frac{b}{b-1} > 1$ such that $\tilde{Q} > S$ and therefore, when investing under uncertainty and irreversibility the standard net present value (NPV) criterion that consists of setting equation $\tilde{Q} = C$ no longer holds. It is apparent from equation (2.0) that the magnitude of the wedge between $\tilde{Q}$ and $C$ is increasing with the degree of uncertainty about future returns to capital in the firm's operating environment as measured by the variance $\partial^2$. It can thus be argued that by increasing the value of the option to wait or defer investment, a firm can actually reduce long-term investment under uncertainty. The investment rule in the presence of uncertainty and irreversibility entails that expected future profits be no less than the user or rental cost of capital plus the opportunity cost of exercising the option to invest. The option to invest now has value because by deferring or delaying the decision to invest, the firm can opt not to invest in future business environment when it has become seeming that profits will be low. Hence, the expected future return from the investment tends to be higher by deferring invest decision than without not investing. However, the option has no value if investment

decisions can be reversed, because divestment can take place in low-profit business environment that often characterized by uncertainty. This suggests the existence of an irreversibility effect on investment decisions of a firm whereby, greater uncertainty raises the value of the call option to defer a commitment by the firm to invest. The model implies that irreversibility effect dominates any positive impact on investment indicating that greater uncertainty increases the marginal profitability of capital on risk taking private firms. Expanding the conceptual framework further, the paper argues that any investment decision that a firm is likely to have multiple outcomes. That is, firm-level investment decisions are likely to follow a polychotomous distribution function in the form of Multinomial Logit (MNL) regression.

*The Model Specification*

Unlike linear models, the MNL is more robust to violations of assumptions of equal variance-covariance matrices across a cross-section of firms in a sample. The basic MNL model used in the paper was generalized from binary logistic regression equation. Under conditions of uncertainty, we selected a MNL model with three investment decision outcomes "Not Invest (NI)", "Invest (I)" and "Defer Invest (DI). The *NI* decision was chosen as the baseline category from which a firm's investment decision was compared against other decisions. Thus, the study compared a firm's decision to *I* relative to *NI* as the first investment decision that faced a private firm. Similarly, we then compared the decision by the firm to *DI* relative to the *NI* baseline category. The critical challenge of using MNL models to examine firm-level investment behaviour is that, the sign of the estimated model coefficients do not determine the direction of the relationship between an independent variable and the probability of choosing a specific alternative. In order to obviate the dilemma, the paper used the relative risk ratio (RRR) for data analysis and interpretation. Data was criterion-referenced in such a way that private firms that chose the investment decision *I* that is, "invest now" were given a value of 1, firms that chose "not invest" *NI*, decision were given a value of 2. Firms that opted to "defer investment" *DI*, were assigned a value of 3. The model had three dependent outcomes denoted by (1, 2, and 3) likely investment outcomes. The three investment decision outcomes were unordered, that is, any of the three outcomes were not necessarily better or worse than the other. In other words, there was no hierarchy among the three investment options chosen by firms. This gave each investment outcome an equal probability of being chosen.

Starting from equation (2.1) the probability of making an investment decision under uncertainty is given by;

$$Pij = \text{Probality}(y_i = jx_i = \frac{\text{Expn}(x_i\varphi_j)}{\sum_{j=0}^{2}\text{Expn}(x_i\varphi_j} \quad (2.1)$$

Where $y_i$ and $jx_i$ denote the exponentiated probability of the firm-level investing decision. Since investment outcomes are three we expand (2.1) into three equations to represent the three outcomes; "invest now"; "not invest" and "defer investment".

$$P_{ijt},\ 1= P\ (Y_{ijt}=1) = [\text{Expn}\ [X'_{ijt}\varphi_1]/\ [\text{Expn}\ [X'_{ijt}\ \varphi_1] +[X'_{ijt}\varphi_2] +[X'_{ijt}\varphi_3]] \quad (2.2)$$

The equation represents the probability that the *ith* private firm will choose alternative j (j = 1, invest now decision)

$$P_{ijt},\ 2= P\ (_{ij}t=2) = [\text{Expn}(X'_{ijt}\varphi_2]/\ (\text{Expn}[X'_{ijt}\varphi_1] + [X'_{ijt}\varphi_2] +[X'_{ijt}\varphi_3]] \quad (2.3)$$

Equation (3) represents the decision "not to invest".

$$P_{ijt},\ 3= P\ (Y_{ijt}=3) = [\text{Expn}(X'_{ijt}\varphi_3]/\ (\text{Expn}[X'_{ijt}\varphi_1] +[X'_{ijt}\varphi_2] +[X'_{ijt}\varphi_3]] \quad (2.4)$$

Equation (2.4) the decision to "defer investment". X'i are firm-specific regressors such as; firm size, firm age, firm constraints, firm competitiveness, firm borrowing costs, indigenization that explain firm-level investment decision under uncertainty. The elasticities $\varphi_1$, $\varphi_2$ and $\varphi_3$ are the coefficient vectors which are assumed to have positive signs. There is one set of coefficients for each choice alternative or variable. In order to guarantee identification of the

equation, $\varphi_j$ is set to zero for the referent or baseline category, which is the firm's decision to "Not invest" outcome. Setting $\varphi_0 = 0$ and computing the predicted probabilities yields the equation (2.5) below;

$$P_{ij} = \Pr(y_i = jIx_i = \frac{\text{Expn}(x_i\varphi_j)}{\text{Expn}(x_i + \sum_{j=0}^{2} \text{expn}(x_i\varphi_j} \quad (2.5)$$

$$= \frac{\text{Expn}(x_i\varphi_j)}{\sum_{j=2}^{2} \text{Expn}(x_i\varphi_j} \quad (2.6)$$

The baseline/referent category which is the decision "not invest" is given by equation (2.6) which can be further reduced to equation (2.7) in order to show all options that a firm has. The choice of "not invest" as a baseline category was informed by the number of respondents who chose that option.

$$P_{ij} = \Pr(y_i = jx_i = \frac{\text{Expn}(x_i\varphi_j)}{\text{Expn}(x_1 3) + \sum_{j=0}^{2} \text{exp}(x_i\varphi_j} \quad (2.7)$$

$$P_{ij} = \Pr(y_i = jx_i = \frac{1}{1 + \sum_{j=1}^{2} \text{Expn}(x_i\varphi_j} \quad (2.8)$$

With the decision "not invest" outcome being set as base category, we expand equations (2.7) and (2.8) as follows in order to show the relative risk ratios of making an investment decision.

$$\Pr_{ijt}, 1 = \Pr(Y_{ijt}=2) = [\text{Expn}[X'_{ijt}\varphi_2] / 1 + \text{expon}[X'_{ijt}\varphi_2] + \text{Expn}[X'_{ijt}\varphi_3]] \quad (2.9)$$

$$\Pr_{ijt}, 3 = \Pr(Y_{ijt}=3) = (\text{Expn}[X'_{ijt}\varphi_3] / 1 + \exp[X'_{ijt}\varphi_2] + \text{Expn}[X'_{ijt}\varphi_3]] \quad (2.10)$$

$$\Pr_{ijt}, 2 = \Pr(Y_{ijt}=1) = [1/1 + \text{Expn}[X'_{ijt}\varphi_2] + \text{Expn}[X'_{ijt}\varphi_3]] \quad (2.11)$$

The coefficients of the "invest" and "defer invest" were interpreted with the respect to the base category (not invest). We then computed the probabilities of each alternative relative to the benchmark option "not invest" as follows;

$$\Pr(Y_{ijt}=2)/\text{Prob}[=Y_{ijt}=1) = \text{Expn}(X'_{ijt}\varphi_2) \quad (2.12)$$

This equation shows the relative risk of "invest" outcome relative to "defer invest" outcome, an important equation in the interpretation of data.

$$P(Y_{ijt}=3)/\Pr[=Y_{ijt}=1] = \text{Expn}(X'_{ijt}\varphi_3) \quad (2.13)$$

Similarly, this equation represents the relative risk of "not invest" relative to "defer invest". The relative risk ratio (RRR) indicates how the relative risk of the alternative compared to the benchmark option changes with a unit increase in the explanatory variable. From equations (1.9) and (2.0) we demonstrate that in investing under uncertainty there exists an option value for a private firm to delay an investment decision in order to await the arrival of new information about market conditions such as changes in sale price of demand elasticity. For the purpose of data interpretation the relative risk ratio investment decision was specified as follows:

$$\text{RRR} = [\Pr\{Y_{ijt}=h|x_{ijt}+1\}/P\{Y_{ijt}=3|x_{ijt}+1\}] / [\Pr\{Y_{ijt}=h|x_{ijt}\}/\Pr\{Y_{ijt}=3|x_{ijt}\}] \; I, j=1\ldots N; I \neq j; t=1\ldots..T \quad (2.14)$$

Equation (2.14) shows that an increase of the explanatory variable increases or decreases the likelihood of the firm investing, compared to not taking the investing decision. The final empirical model was therefore specified as follows;

$$Y^*_{ijtm} = \boldsymbol{\Psi}_I + \boldsymbol{\Psi}_j + \Re_{tm} + X'_{ij}\varphi + \mu_{ij} \; I, j=1\ldots N; I \neq j; t_m=1\ldots T \quad (1.15)$$

Where; $Y^*_{ijt}$ is the investment decision, from firm $i$ to firm $j$ in time $t_m$ and is a qualitative variable with three possible outcomes denoted by 1 if a firm decides to "invest", 2, if a firm does "not invest" and 3, if a firm "defers" investment. $X'_{ij}$ is a vector of explanatory variables such as uncertainty, firm size, and level of competitiveness, indigenization laws and infrastructural constraints. Data on these variables was collected from a stratified sample of

120 Zimbabwe's private firms. Time-invariant unobservable source and firm fixed effects ($\Psi_I$ and $\Psi_j$) were used to account for peculiar firm-level characteristics. Unobservable time were denoted by fixed effects ($\Re_{tm}$) whilst $\mu_{ij}$ is the unobservable white noise disturbances. A critical consequence of employing multiple discrete choice models, such as the MNL regression model, raised in many similar studies is the fundamental assumption of independent of irrelevant alternatives (IIA).The IIA is defined as the ratio of probability of choosing two alternatives that are independent from an existing third alternative. This suggests that the odds for any pair of investment decision outcomes such as "Invest" or "not invest" are determined without reference of any other alternative such as "Defer Investment" that may be available to a private firm. Essentially, the IIA assumption entails that the ratio of the choice probabilities of any two alternatives is unaffected by the systematic utilities of any other available alternatives. If the IIA assumption is violated, it follows that the MNL model is not usable, valid and reliable. The most frequently used tests for IIA are the Haussmann and McFadden (HM) test and the Small and Hsiao (SH) test. However, the Small and Hsiao test shows poor properties in small samples and often gives conflicting results under certain data structures that include inflation variable (Muzurura, 2018). The MNL regression model also requires that individual investment decision outcomes be tested for possible combination. The rationale for outcome and variable combination test was to ensure that firm-level investment decisions such were indeed independent and could not be collapsed to a binary choice outcomes. Using the likelihood ratio test (LRT) combination test, we tested the null hypothesis that the estimated coefficients were jointly zero.

### *3.2. Variable Definition*

**Uncertainty** ($\emptyset$)-Inflation was used a proxy variable for uncertainty. Zimbabwe private firms import most of their machinery and equipment and hence uncertainty in; real exchange rates, demand, output prices, business expectations, cost of capital, investment timing, are better captured by broad macroeconomic indicator such as inflation. A prior, business uncertainty, is expected to have a negative and significant relationship with firm level investment decisions.

**Firm Size and Age**-Whilst firm size is measured either as the natural logarithm of the book value of total assets, or its actual age or total employees, the paper used total employees and actual age of the firm. Small firms are more likely to be financially constrained owing to many reasons. Transaction costs are likely to be fixed, hence making external finance relatively more expensive for smaller firms. Smaller firms often tend to be less diversified and display greater earnings volatility and suffer from greater informational asymmetries between lender and borrower because they less rated. Younger firms are likely to be a riskier investment destinations due to shorter track record. Smaller firms are limited to the extent of their internal earnings and the potential for issuing equity especially when deciding to invest under uncertainty. Small firms are more likely to be unable to obtain capital at market interest rates for fixed capital stock and therefore, are subject to credit rationing. The paper predicts that the size of a private firm is likely to influence the likelihood of investing under uncertainty.

**Indigenisation Laws (PPI) -** Unfair enforcement of indigenization laws and lack of laws that protect private property from arbitrary government expropriation increase uncertainty in private firms. Due to colonial appendages, the country has instituted laws that allow for forced reduction of controlling interests. Private firms are required to comply with indigenization laws or else their equity might be expropriated without compensation. Various studies have found that perceptions of unfair indigenization laws, cumbersome licensing regulations, unpredictability of the judiciary, lack of rule of law, abuse of property rights, and quality of institutions that enforce indigenization laws all impact firm's expectations. Firm-level investment decision are not easily irreversible under uncertainty, and if there is some flexibility in the timing of investment decisions, it is likely that firms awaiting indigenization or are fearful of expropriation policies, have a positive-value option to wait and delay investment

decisions. The paper therefore postulates that if a firm defers investment, the relative risk of not investing in the future is low, holding other variables constant.

**Financial Constraints (FC)**-Fluctuations in internal finance as shown by the levels of cash-flow generation capability and the ability get credit lines both in the domestic and international markets are in determining the level of future fixed capital stock investment. Large firms have better access to external funding, collateral and face little financial frictions in capital markets. According Bloom *et al.* (2018), if private firms are credit rationed the rate of capital expenditure on business equipment depends not only on the market interest rate and the profitability of investment, but also on the availability of investible funds in the credit market and the firm's liquidity. In uncertain business environment, small and innovative firms have more constraints and face difficulties in accessing unsecured financing, because they tend to have riskier investment projects and business models. The paper posits that if there is a unit increase in the firm's financial constraints be it liquidity constraints or credit availability, the relative risk ratio of not investing will increase by high proportionate factor.

**Public Infrastructure (PI)**-In Zimbabwe, government expenditure on productivity public infrastructure plays a critical role in enhancing the productivity of firm-level investment. Public expenditure in infrastructure such as roads, rail energy, utilities and communication systems increases the marginal productivity of existing factor inputs in private firms. Productive public infrastructure increases the level of private firms' production and also reduces marginal production and distribution costs. As noted by Bayai and Nyangara (2013) increasing expenditure on public investment crowds-in externalities that reduce the production costs in private firms. However, if public investment is financed by deficit and seignorage it may crowd-out private investment through high cost of capital and credit rationing. High deficit may need to be financed through taxing private firms, hence, eroding profits and cash flows required for future business equipment. We expect private firms to defer some investment due to high operating costs caused by public infrastructure constraints.

## 4. FINDINGS AND DISCUSSIONS

### *4.1. Findings*

To ensure robustness and appositeness of the MNL firm-level investment model, the model diagnostic tests in the form of multicollinearity, independence of irrelevant alternative (IIA) and Wald tests were carried out.

#### *IIA Test*

Both the Haussmann and Small-Hsiao test for IIA are shown in table 1 below. The "invest" outcome has a coefficient of -13.9 and "not invest" -614.8 and "defer" invest outcome has a coefficient of -216.3.

**Table-1.** Haussmann and Small-Hsiao Tests IIA Assumption

| **mlog test, Haussmann Smhsiao base** | | | | | | | |
|---|---|---|---|---|---|---|---|
| *** Haussmann tests of IIA assumption (N=79) | | | | | | | |
| Ho: Odds (Outcome- J) vs Outcome-k) are independent of other alternatives | | | | | | | |
| **Omitted** | **Chi 2** | **df** | **P>chi1** | **evidence** | | | |
| invest | -1.666 | 8 | ------ | ------ | | | |
| defer invest | -7.709 | 8 | ------ | ------ | | | |
| Not invest | 0.000 | 8 | 1.000 | for Ho | | | |
| note: if chi2<0, the estimated does not meet asymptotic assumptions of the test | | | | | | | |
| Ho Odds(outcome-J) vs Outcome-K) are independent of other alternatives | | | | | | | |
| **Omitted** | **lnl(full)** | **lnL (omit)** | **chi2** | **df** | **P>chi1** | **Evidence** | |
| Invest | -13.90 | -6.10 | 15.7 | 8 | 0.046 | against $H_o$ | |
| Defer invest | -614.80 | -0.00 | 29.6 | 8 | 0.000 | against $H_o$ | |
| Not invest | -216.30 | -0.00 | 32.6 | 8 | 0.000 | against $H_o$ | |

Since the coefficient are all negative we conclude that IIA assumption has not been violated and therefore we reject the hypotheses that the three investment outcomes under uncertainty, that is "invest", "not invest" and "defer

investment" have no material effect public infrastructure, firm size and other variables deemed significant for a private firm's investment decision.

Using also the p-value in table 1 it is clear that a private firm's decision to invest is statistically significant at 95% level whilst the decision to defer investment and not to invest are at 99% level of confidence, hence, suggesting further non-violation of IIA assumption.

### *The Wald Test*

The Wald test in Table 2 was carried out in order to check that the investment decision chosen by a firm did not differentiate pairs of investment outcome categories. As shown below, the results are statistically significant at 95% level of confidence. This findings shows that the decision to "invest", "not invest" and "defer investment" are separate decisions and cannot therefore be combined into either one or two decisions. For instance, if the finding showed otherwise this may have necessited using either panel regression or binary models such as Tobit and Probit models.

**Table-2.** Wald Tests

| **.mlogtest, combine** | | | | |
|---|---|---|---|---|
| ***Wald test for combining alternatives (N=79) | | | | |
| $H_o$: All coefficients except intercepts associated with a given pair | | | | |
| of alternatives are 0 (i.e alternatives can be combined) | | | | |
| **Alternative that was tested** | | **chi-squared** | **df** | **P>chi-squared** |
| Invest (I) | Defer Invest (DI) | 14.81 | 7 | 0.04 |
| Invest (I) | Not Invest (NI) | 11.58 | 7 | 0.02 |
| Defer Invest (DI) | Not Invest (NI) | 15.90 | 7 | 0.03 |

### *Likelihood-Ratio Variable Fitness Test*

Table four shows cost of capital was found to be insignificant whilst all other variables were found to be significant suggesting that the cost of capital variable could be dropped in the analysis.

**Table-3.** Likelihood-Ratio Variable Fitness Test

| **.mlogtest, lr** | | | | |
|---|---|---|---|---|
| ***Likelihood-ratio tests for independent variables (N=79) | | | | |
| Ho: All coefficients associate with given variable(s) are 0 | | | | |
| **predictor** | **chi-squared** | **df** | **P>chi-squared** | |
| firm size | 7.54 | 2 | 0.02 | |
| credit constraints | 8.67 | 2 | 0.01 | |
| Uncertainty | 18.84 | 2 | 0.00 | |
| liquidity constraints | 12.968 | 2 | 0.002 | |
| borrowing costs | 0.06 | 2 | 0.971 | |
| infrastructural constraints | 8.125 | 2 | 0.017 | |
| indigenization | 14.784 | 2 | 0.001 | |

### *4.2. Discussions*

Table four is used to explain a firm's decision to "invest now" under uncertainty relative to "not investing" and the decision to "defer investment" compared to "not investing"

**Table-4.** Relative Risk Ratios

| | | | | | | |
|---|---|---|---|---|---|---|
| mlogit, rrr | | | number of observations = | | | 79 |
| | | | LR Chi2(14) | | = | 66.04 |
| Multinomial logistic regression | | | Prob > chi2= | | | 0.00 |
| | | | Pseudo R-squared = | | | 0.51 |
| Log likelihood= - 31.79 | | | | | | |
| **Firm investment Decision** | **RRR** | **std. Err** | **z** | **P>IzI** | **95% conf.** | **interval** |
| **Invest** | | | | | | |
| Firm size | 0.34 | 0.16 | -2.35 | 0.02 | 0.14 | 0.84 |
| Credit constraints | 0.00 | 0.00 | -2.09 | 0.04 | 2.79 | 0.58 |
| Political Uncertainty | 15020.58 | 84759.33 | 1.70 | 0.09 | 0.24 | 9.56 |
| Liquidity constraints | 0.00 | 0.000 | -2.57 | 0.01 | 8.66 | 0.08 |
| borrowing costs | 0.04 | 1.579 | -0.23 | 0.82 | 0.00 | 1216.48 |
| infrastructure constraints | 0.99 | 0.0182 | -0.02 | 0.99 | 0.70 | 1.43 |
| indigenization laws | 0.06 | 0.158 | -1.07 | 0.29 | 0.00 | 10.60 |
| **Not Invest** | **base outcome** | | | | | |
| **Defer Invest** | | | | | | |
| Firm size | 1.06 | 0.36 | 0.18 | 0.86 | 0.546 | 2.07 |
| Credit constraints | 0.02 | 0.06 | -1.47 | 0.14 | 0.000 | 3.47 |
| Political Uncertainty | 1.07 | 408586.1 | 3.04 | 0.00 | 61.299 | 1.89 |
| Liquidity constraints | 27.20 | 101.91 | 0.88 | 0.38 | 0.176 | 42014.7 |
| Cost of capital | 1.06 | 3.39 | 0.02 | 0.99 | 0.002 | 563.29 |
| Public infrastructure | 0.00 | 0.00 | -2.37 | 0.02 | 4.696 | 0.31 |
| Indigenisation laws | 1783.57 | 4944.58 | 2.70 | 0.01 | 7.789 | 408391.2 |

*Comparing the "Invest" Against "Not Investing" Decision*

**Firm size and Age-** If a private firm size were to increase its size during the period of uncertainty by one unit, the relative risk for investing relative to not investing would be expected to decrease by a factor of 0.34 provided other variables in the investment model are held constant. Thus, we argue that size of a firm matters in uncertain operating environments. The results imply that in Zimbabwe small privately owned firms are unlikely to spend more on business machinery and equipment under uncertainty. Our findings suggest that small firms reduce business equipment spending under uncertainty due limited access to domestic and international capital markets. In contrast, large firms have collateral, quality financial statements and good credit history and therefore are more than likely to invest under uncertainty provided the projects give positive net present values. Small and young private firms are more sensitive to cash flows fluctuations, have riskier business models than larger man firms and hence, under uncertainty are likely to face liquidity and credit constraints which are barriers to more investment.

**Credit constraints and unavailability-** If a private firm's current credit constraints were to increase by one unit, the relative risk for investing relative to not investing would be expected to decrease by a factor of 0.02, suggesting that private firms are more likely not to invest under uncertainty. In Zimbabwe private firms lack quality collateral and this hinders the ability to access domestic and international credit lines.

**Liquidity (cash flow) constraints-** If a firm's liquidity constraints or cash flows challenges were to increase by one unit in uncertain business environment, the relative risk for investing relative to not investing would be expected to be constant given the other variables in the model are held constant. The findings suggest that under uncertainty most private firms are indifferent on whether to invest or not. However, we argue that a greater liquidity for private firms indicates a greater return on assets and permits firms to expand their fixed capital budgets. The findings agree with the Tobin *q* and the neoclassical investment theories that demonstrate that a private firm that has low or negative current cash flows and little cash reserves, can still invest in new equipment if such fixed investment is expected to have a high future marginal profitability.

*"Deferring Investment" Relative to "Not Investing" Decision Outcome*

**Public infrastructure.** The results show that if public infrastructure constraints were to increase by one percent in uncertain business environment, the relative risk for a firm's decision to defer investment would be expected to increase by a factor of 0.001 given the other variables in the model are held constant. The findings imply that in Zimbabwe public infrastructure constraints any increase in uncertainty in the firm's operating environment causing private firms to defer new business equipment spending. The likely explanation is that the state of public infrastructure especially, roads, rail and energy and other communication networks increase production costs to private firms.

**Political uncertainty -** If the level of political uncertainties were to increase by one percentage point under uncertainty, the relative risk for a firm's decision to defer investment would be expected to increase by a factor of 304 given the other variables in the model are held constant. The results suggest that if political uncertainty increase in the business environment, private firms would prefer to defer future investment plans rather than not investing at all. The findings suggest that the reason for deferring investment could be linked to the need to avoid over-capacity due to political uncertainty. Furthermore, an increase in political uncertainty reduce the level of product competitiveness and hence causing significant reductions in private firm's market share. The findings suggest that the probability of deferring current and future investment plans increases until political uncertainty clears off.

**Private Property and Indigenisation Laws -** If the ratio of indigenization laws and lack of laws that safeguard private property rights were to increase by one percent, the relative risk for a firm's decision to defer investment would be expected to increase by a factor of 1783. The findings imply that private firms and especially foreign owned prefer to defer future investment decisions relative to not investing at all when they are required to comply with indigenization laws or if the country does not safeguard private property from arbitrary expropriation. The findings strongly suggests that indigenization laws that seek to force foreign companies to cede controlling interests signal to current and other investors the inadequacy of laws that protect private property rights. Unpredictability of rulemaking, high risk of contract repudiation, corruption and time inconsistence of government policy towards foreign investors exacerbate uncertainty and causes private firms to defer investment in the hope that common sense will prevail in the minds of policy makers. Inconsistent application of indigenization laws and failure to observe laws that safeguard private property rights create uncertainty in foreign owned firms. This causes potential investors to hold back from committing to new projects or to prefer short-term projects to longer-term ones that would have higher returns and more impact on productivity growth.

## 5. CONCLUSIONS

Most studies on domestic investment emphasize the role of business equipment spending behaviour of manufacturing firms in enhancing technological progress, increasing efficiencies in manufacturing processes, improving employment generation and facilitating human capital development. Private firms offer more distinctive opportunities for rapid national fixed capital accumulation, technological diffusion, and employment generation within an economy. Our findings indicate that the probability of shelfing current investment decisions by private firms is influenced significantly by liquidity constraints, firm sizes and credit constraints. Likewise, the probability of deferring investment decisions was caused by political uncertainty, public infrastructure, lack of private property laws and indigenization laws. The paper recommends reducing all uncertainties in the economy, enhancing productivity of public infrastructure and observance of national laws that safeguard private property rights.

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