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Behavioural Preferences and Labour Market Attachment among South African Youth

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Abstract

Youth unemployment in South Africa remains a persistent and multifaceted challenge. This study explores how behavioural preferences—specifically risk aversion and probability weighting—vary across employment categories among South African youth. Using structural estimates from incentivised Multiple Price List (MPL) tasks, we estimate parameters for relative risk aversion (r) and probability sensitivity (γ) and examine how these relate descriptively to wage employment, self-employment, and unemployment. Our findings suggest that employed females exhibit higher levels of risk aversion, consistent with a preference for stable income under constrained structural conditions. Unemployed individuals, particularly those exhibiting back-switching behaviour in MPL tasks, display more curved or non-linear probability weighting.

We interpret lower γ values not as psychological pessimism or irrationality, but as reduced sensitivity to probability – potentially a bounded rationality response to uncertainty and limited feedback. We do not infer causality, but highlight how behavioural regularities correlate with labour market status in a high-uncertainty, developing-country context. Our results contribute to the behavioural economics literature by extending models of bounded rationality to explain labour market disengagement. The findings offer preliminary policy insight into how informational environments and employment support structures could be designed to improve labour market participation among youth.

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1 Introduction

One of the most urgent socioeconomic dilemmas confronting South Africa is the enduringly high level of unemployment. As unemployment continues to persist, the burden of the crisis is disproportionately borne by the country's youth. While concerns about the youth becoming a "lost generation" were raised during the 1980s, it wasn't until the latter half of the 1990s that youth unemployment emerged as a critical issue. Unfortunately, a lack of reliable statistics has made it challenging to document the historical experience of young people in the economy. Records from the 1996 Census seem to indicate that more than half of young people were unemployed at the time of the country's democratic transition in 1994. Despite significant government efforts to address youth unemployment, the country has been unable to make any meaningful progress in resolving the crisis. Recent figures from the Quarterly Labour Force Survey (QLFS) indicate that the youth unemployment rate stands at around 63 percent (De Lannoy, Graham, Patel & Leibbrandt 2018).

To promote inclusivity in South Africa, it is vital that youth have access to employment opportunities that enable them to contribute productively to the economy and to society. Employment is not merely a means of earning an income, but also serves to foster a sense of dignity and independence. Thus, a considerable body of research has been dedicated to examining the underlying factors contributing to the high rate of youth unemployment in South Africa. Such research has identified both macro- and micro-level causes: macro-level research attributes high unemployment rates to the effects of sectoral changes on employment opportunities available to youth, while microeconomic factors focus on the specific characteristics of youth and their households that may influence their ability to secure gainful employment (De Lannoy et al. 2018). Importantly, microeconomics has highlighted that from an individual perspective, youth unemployment is largely a function of low education and skills development. The perception that there are few opportunities and a lack of information about the labour market, exacerbate the issue.

Apartheid education policy confined the majority of South Africa's population to a substandard schooling system that lacked essential resources, quality teachers and fundamental infrastructure. Although the youth today have achieved higher levels of education compared to their parents, the present basic education system is still in dire need of improvement. Furthermore, a significant portion of young South Africans drop out of school before matriculating, placing them at a considerable disadvantage in the labour market. University graduates too, despite their achievements, are often faced with a job market that cannot sufficiently absorb the consistent oversupply of labour.

Though this paints a discouraging picture, there is a limited but consistent body of qualitative research indicating that a noteworthy portion of young South Africans maintain positive aspirations for their future, including education and career prospects. This is evident, for example, in African youth's prolonged enrolment in high schools compared to their counterparts, as well as the tendency of African parents to explore opportunities to enrol in superior schools, frequently with English as the medium of instruction. This is often perceived as a demonstration of the belief in education as a means of escaping poverty (De Lannoy et al. 2018). Nevertheless, the youth's perception of their future career prospects may differ from the actual opportunities available to them, given their skill set. Thus, a significant obstacle is that youth often possess limited knowledge on effective job search methods – driven by a scarcity of information that is prevalent particularly amongst those coming from disadvantaged backgrounds (De Lannoy et al. 2018).

It is widely acknowledged in the literature that education (or the lack thereof) plays a significant role in

contributing to youth unemployment. However, there is a growing recognition of the importance of individual behavioural and psychological factors in shaping youth labour market outcomes, particularly with regard to their perception of opportunity. Mlatsheni and Ranchhod (2017) argue that insufficient attention has been given to these factors in understanding the persistence of youth unemployment. Youth with a positive outlook, sense of optimism, and perseverance are more likely to actively seek out opportunities for career advancement and skills development. In contrast, those with low self-esteem, hopelessness, and lack of motivation may face difficulties in engaging with the job search process and may require additional support to overcome these barriers.

The reality is that a substantial portion of youth in South Africa today are economically inactive – that is, not in education, employment, or training (NEET) – a consequence of high levels of discouragement (**?**). This discouragement is a serious concern and has long-lasting negative impacts on young people's well-being, self-esteem, and future prospects. However, there is little exploration in the literature as to how discouragement can impact not only unemployment but could possibly influence job search and occupational choice. In other words, individual preferences can shape decision-making when making the choice to take up wage employment, self-employed, or to remain unemployed. Additionally, there exists an implicit assumption in the current literature that youth as a whole have homogenous preferences, despite suggestions that researchers and policymakers should view the youth as being a heterogenous group, with varying needs and levels of engagement with the labour market (**?**).

Kingdon & Knight (2004) ask why do jobless individuals not seek wage employment, and is this voluntary? The findings indicate that evidence for voluntary unemployment is inconclusive – the unemployed do not necessarily have higher reservation wages than the employed. Rather, barriers to entry into the formal and informal sector prevent the jobless from securing gainful employment.

In this paper we examine a similar question, however, we approach this question with a behavioural lens: we propose that individual differences in risk preferences could offer an explanation as to why individuals may display different levels of attachment to the labour market. We aim to address a gap in the microeconomics literature that examines unemployment from the perspective of the country's youth, so that we may appreciate their lived experience and how this translates into the decisions they make. Our central focus is to examine the factors influencing labour market attachment in South Africa by highlighting the observed heterogeneity in risk preferences and probability distortion. We utilise the concept of risk to illustrate how individuals may, often implicitly, opt for distinct employment states based on their inclinations towards risk-sharing. To explore this, we estimate risk preferences among individuals in different employment states, drawing on recent experimental data from the Activate! study—an investigation into risk preferences among previously disadvantaged youth. Using data from a sample of approximately 400 young individuals, we test several hypotheses related to employment choices. First, we examine whether individuals choose employment based on their willingness to share risk, drawing insights from the Principal-Agent model. Second, incorporating elements of Prospect Theory, we investigate whether differences in underlying sensitivity to probabilities can explain employment decisions in uncertain and information-scarce environments. By understanding how individuals make labour market decisions conditional on their underlying risk preferences and tendency to 'distort' probabilities, we aim to shed light on the intricate interplay between individual preferences and youth (un)employment in South Africa.

2 The dynamics of youth labour market attachment in South Africa

Improvements in employment opportunities serve as robust indicators of the quality and strength of a country's economic transformation and development (Mlatsheni & Ranchhod 2017). In the context of Sub-Saharan Africa (SSA), where the proportion of youth in the working-age population is significantly higher compared to other regions, much of the discourse on employment revolves around the opportunities and challenges faced by young individuals, and the strategies needed to address them effectively.

Youth is recognised as critical phase in one's life – a transitionary period into adulthood, where economic independence becomes crucial. Consequently, employment plays a vital role, offering young people the opportunity to gain skills, improve their human capital, and enhance their long-term earning potential. Moreover, engaging in meaningful work allows youth to develop a sense of identity, self-worth, and accomplishment, all critical elements of their psychological and emotional development (**?**). Employment thus acts as a catalyst for empowering young individuals, enabling them to establish a solid foundation for their futures.

The development agenda places significant attention on youth in South Africa, albeit with a varying attitude towards youth's role in contemporary society. Often, youth are considered a "lost generation" (Dawson & Fouksman 2020), deprived and unsettled. Conversely, they are also celebrated for their resilience and creativity, portrayed as potential saviours of the economy. In this conflicting dialogue, they are both an impediment and a solution to progress. Amidst these complexities, there is a growing emphasis on recognising their entrepreneurial potential to modernise and enhance the country's productivity. However, there remains little clarity or consensus on precisely how the youth are expected to transform into true engines of growth (Dawson & Fouksman 2020).

The prevailing youth unemployment crisis stems from a complex interplay of both historic and economic disparities. The enduring impact of past socio-political injustices has profoundly shaped labour market access today, restricting opportunities for quality education, resources, and prospects among a significant portion of the youth population (Seekings & Nattrass 2008).

At the onset of apartheid, unemployment was not a pressing concern in South Africa. On the contrary, the country's economy grappled with chronic labour shortages, causing the state to become apprehensive about securing an adequate supply of labour in urban areas. This apparent scarcity of labour was partly due to many African (black) families sustaining independent farming setups. Consequently, the capitalist sector either had to resort to coercive measures to create a sufficient labour supply or offer higher wages to attract workers (Seekings & Nattrass 2008).

Throughout the apartheid era, interventions implemented by the government further distorted the labour market. Once the apartheid government assumed power, its focus shifted towards dismantling forms of black independence and compelling the black majority into wage labour. This strategy undermined independent peasant production and involved redirecting labour towards low-paying sectors such as mining, commercial farming, and industry. Pass laws restricted the mobility of black South Africans and linked urban residency to employment recognised by the state. As a result, South African society underwent significant transformation, characterised by "deagrarianisation and proletarianisation" (Seekings & Nattrass 2008).

During this time, there was an increased focus on the distinction between voluntary and involuntary unemployment, especially with regards to urban youth. Throughout the 1950s, nonparticipation in the labour force became a matter of concern for government officials. The State was troubled by the problem of 'idle' youth who chose not to take up low-wage jobs, labelling them as 'parasitic' for avoiding manual labour (Seekings & Nattrass 2008). An interdepartmental committee found that a striking 80 percent of young African individuals aged 15 to 25 were without gainful employment. Such idleness was not only perceived as a social issue but also a potential political problem, as joblessness was believed to be a breeding ground for delinquency and crime. Moreover, youth were 'picky' if they exhibited reluctance towards arduous manual jobs involving long and irregular working hours, such as those in the catering and domestic work sector (Seekings & Nattrass 2008).

The idleness rhetoric held, and still holds, significant implications for the narrative surrounding youth unemployment. During apartheid, it served as a false rationale for the enactment of legislation that aimed to compel young African men and women to participate in the workforce. However, it also reveals a deep-seated frustration with youth acting as rational economic agents by exhibiting selectivity in job preferences. Though youth were perceived as "choosing to do nothing" (Seekings & Nattrass 2008) they were exercising a choice within the given constraints, placing value on their personal time and autonomy over low wages, while considering opportunities in higher-paying sectors of the economy. Evidently, much of how youth interacted with the labour market was deeply misunderstood. Unsurprisingly, by the advent of democracy in 1994, unemployment had emerged as a defining feature of the South African political economy, if not the most prominent one (Seekings & Nattrass 2008).

There has been much emphasis on the current generation of youth – a generation 'born free' into a democratic South Africa that was envisioned to offer equal opportunities to all. However, despite the political freedom they enjoy, young people in South Africa still grapple with the enduring effects of apartheid's legacy. Employment is essential for upward mobility, yet high youth unemployment rates in South Africa deny youth the opportunity to improve their socio-economic circumstances. Statistics from the 1996 Census indicate that just over half of young people between the ages of 15 and 34 years were unemployed at the time of the country's democratic transition. Despite a brief decline in the unemployment rate between 2004 and 2008, figures rose again after the 2009 global economic downturn. Subsequently, youth unemployment rates, especially among the 15–29-year-old age group, have failed to recover, largely driven by increased discouragement among young individuals and a decline in the absorption of young job seekers into the labour market (De Lannoy et al. 2018). The current unemployment rate among youth aged 15 to 24 was at 62.1 percent in the first quarter of 2023; approximately 36 percent of youth in this age category were not in any kind of education, employment and training (NEET) (Statistics South Africa, 2023). It is therefore unsurprising that feelings of joblessness have contributed to a heightened sense of exclusion, especially amongst youth from previously disadvantaged groups. Yet, the narrative of idle youth persists even today (Dawson & Fouksman 2020).

In contemporary South Africa, there is widespread belief that youth are lazy recipients of government handouts. Dawson and Fouksman (2020) provide evidence of how this narrative is expressed, through focus-group discussions with young men living in the Zandspruit informal settlement on the outskirts of Johannesburg. When asked if the child support grant should be extended to include youth aged 18-23 years, most young men, though unemployed themselves, insisted that "[If] you're not working for money, you misuse it" (Dawson & Fouksman 2020). The overarching concern with getting money for 'doing nothing' is that it would dissuade young individuals from pursuing higher education, starting a business, or entering the labour

force (Dawson & Fouksman 2020).

The laziness narrative serves to offer an explanation for unemployment and poverty by implying that poverty is associated with an unwillingness to work. According to Dawson & Fouksman (2020), society tends to attribute laziness as the cause of youth unemployment, lacking an alternative understanding of the structural complexities that underlie the issue. Society thus perpetuates a belief in meritocracy—where success is linked to individual merit and hard work, reinforcing the notion that financial prosperity is solely attainable through diligence and effort. Consequently, young individuals who are unemployed or experiencing financial hardships are unfairly stigmatised as being less deserving or unwilling to work hard. This is a gross oversimplification of the complex issues at hand. And, ironically, Dawson & Fouksman (2020) note that the young men in Zandspruit, while firmly against grant support, also acknowledge the difficulties in finding work. Participants frequently emphasised the importance of social connections – highlighting that securing a job relies on social capital that is independent of merit or hard work (Dawson & Fouksman 2020).

South Africa's youth today face multiple challenges that hinder their ability to effectively participate in the labour market, thus limiting their opportunities for upward mobility. These challenges are well-documented, with literature highlighting education and skills development, networks and job search costs, and unfavourable macroeconomic conditions as pivotal factors influencing these difficulties (Mlatsheni & Ranchhod 2017).

Global evidence shows that higher education increases youth employment prospects (Bank 2007). In South Africa, the strongest effects occur after matric (Mlatsheni & Ranchhod 2017). Despite having completed secondary schooling, youth encounter difficulties in the labour market, emphasising the importance of higher education, not just for employability, but also for fostering entrepreneurship. Though youth recognise the importance of education, they encounter financial constraints that hinder their pursuit of post-secondary qualifications. Even those who manage to secure financial means for further education may choose early entry into the labour market, accepting low-paying, mediocre jobs to supplement family income, particularly when younger siblings require support (Mlatsheni & Ranchhod 2017).

Additionally, prolonged periods of high unemployment often lead to discouragement, causing youth to lose motivation to search actively for work. As job opportunities become scarce, many young individuals become disheartened and opt to remain disengaged from the labour market, rendering themselves NEET (Not in Education, Employment, or Training). On the other hand, one of the reasons why many youths refrain from actively seeking employment is the difficulty in accessing areas that offer potential job opportunities. This issue predominantly affects black South African youth, given the persisting spatial inequalities inherited from the apartheid era; townships were designed to be geographically distant from business centres and economic hubs (Mlatsheni & Ranchhod 2017). An insufficient policy response has reinforced existing inequalities: youth policy in South Africa lacks evidence-based research and fails to deliver on the promised level of active engagement in current youth programs.

The approaches of government and other key stakeholders in addressing the unemployment crisis are seen as operating in "silos" (De Lannoy et al. 2018) and lacking in effective communication and coordination. According to the authors, there are several concerns that contribute to the perception of an incoherent policy approach to youth unemployment. Firstly, there has been a varied stance on how job creation could be successfully achieved in South Africa. Development policy during the 2000s assumed that redistribution would drive equitable growth; however, policies such as the Reconstruction and Development Programme

(RDP) and the Growth and Employment Redistribution policy (GEAR), while partially effective in driving access to basic goods and services, did not live up to expectations concerning job creation (De Lannoy et al, 2018). Critics of government policy argued that it was often (incorrectly) assumed economic growth and redistribution would lead indirectly to job creation. Subsequent to this assessment, bodies such as the National Youth Development Agency (NYDA) were formed to safeguard youth's interests and foster economic participation. However, the NYDA has faced criticism for the lack of robust monitoring and evaluation mechanisms to assess the impact and effectiveness of its programs (De Lannoy et al. 2018). As of today, policymakers still have a limited understanding of elements that reinforce recurring unemployment patterns. Among these are employer hiring preferences; the role of 'matching' in effectively connecting young work seekers and employers; and persistent individual and household level barriers such as the cost of work seeking (De Lannoy et al. 2018).

It is evident that in the absence of any consistent strategy to address the youth unemployment crisis, there is a need to develop a more holistic understanding of the complex dynamics and structural factors at play. An overarching question is whether youth unemployment should be considered merely as a component of the wider issue of unemployment, or if it stems from distinct attributes of young people in South Africa (De Lannoy et al. 2018). Given the challenges mentioned above, it would be inappropriate to characterise the youth in South Africa solely as 'lazy' or 'idle', since unemployment can trigger a range of behavioural responses that influence decision-making. Indeed, Kingdon and Knight (2004) argue against classifying non-searching unemployed individuals as economically inactive because they are not necessarily distinguishable from the searching unemployed in characteristics. Rather, they may face obstacles such as poverty, high search costs, long durations of unemployment, and adverse local economic conditions, which impede their active job search efforts (De Lannoy et al. 2018). Thus, what we hypothesize is missing from contemporary analysis of the unemployment crisis is a focus on understanding the underlying the mechanisms with which youth choose to interact with the labour market, and their internally held preferences for employment.

Zizzamia (2020) adds colour to this, suggesting that in South Africa especially, it is misleading to assume that labour market inclusion is always a positive outcome. Zizzamia (2020) proposes that individuals with stronger outside options are more likely to avoid wage employment. Younger workers, those with fewer dependents, alternative sources of support, and robust social networks tend to possess stronger outside options, leading them to reject what they perceive as 'bad' jobs. This necessitates a reconceptualisation of the social and economic value attributed to work, particularly in contexts of high inequality and unemployment (Zizzamia 2020).

For the unskilled urban poor, specific forms of wage work can be viewed as "survivalist", akin to certain unprofitable informal self-employment endeavours typically associated with survival strategies. This phenomenon has prompted an emerging body of literature in both economics and economic anthropology to investigate why poor workers opt to forgo wage jobs and what these decisions reveal about the characteristics of these workers and the jobs they can access (Zizzamia 2020). Supporting this argument, Dawson (2020) draws from the focus-group sessions in Zandspruit, finding that many urban South African youth may consciously "choose" unemployment. Instead of pursuing wage jobs with their accompanying stress and indignities, they opt for informal, township-based livelihood portfolios. This decision showcases the complexities surrounding labour market choices for these youth and highlights the importance of understanding the broader social and economic context influencing their decisions (Zizzamia 2020).

Existing research has not fully considered how youth act and react as economic agents within their unique

constraints. Unemployment cannot be solely ascribed to direct attributes of youth; rather, it arises from underlying structural economic dynamics. Though, gaining insights into how youth choose to navigate these constraints and dynamics is central to 'reconceptualising' the value of work for youth. Teasing out the complex interrelationships between the structural constraints confronting young people and their behaviour is crucial. Young people do not passively undergo their context – they act upon it as well. The primary objective of this study is to contribute to the extant literature by improving our understanding of youth labour market attachment. Specifically, we endeavour to investigate the potential influence of risk preferences on labour market choices, considering that these preferences are endogenously shaped by prevailing circumstances. By exploring risk preferences, we aim to shed light on the complexities of youth labour market decisions and the dynamic interplay between individual preferences and contextual factors.

This is discussed in the sections below.

3 Risk in the Labour Market

3.1 The Principal-Agent Model

The concept of risk sharing is fundamental to understanding the underlying dynamics of the labour market, and the process by which new entrants might choose between types of employment. At its core, the principal-agent model provides a theoretical framework that describes how risk and reward applies to productive settings. By exploring how a principal and agent interact under differing levels of uncertainty, the model provides a theoretical basis for understanding the incentives and behaviour of both employers and employees in different contexts (Macho-Stadler & Pérez-Castrillo 2001).

In the model, standard employer-employee relationships are represented according to a principal-agent framework: the principal (employer) recruits an agent (employee) to act on their behalf to achieve a certain outcome. However, the agent, with their own goals or objectives, may not have the same incentives as the principal. To align incentives and manage risk, the principal designs a contract to ensure that the agent delivers according to the terms of the employment. In microeconomics, this is an "informational asymmetry" or information uncertainty – a concept that describes a situation where a contract is incomplete because it is difficult to specify all possible contingencies and outcomes that govern the principal-agent relationship. Incomplete contracts recognise the limitations of foreseeing and specifying all possible future circumstances in complex economic relationships.

There are a few variations of the principal-agent framework, each describing how the employment relationship changes under different types of information uncertainty (Macho-Stadler & Pérez-Castrillo 2001). The variations include a so-called 'base case' under symmetric information, and the more commonly known case of asymmetric information, describing the dynamics of the relationship in the presence of adverse selection and moral hazard. In both cases, the unit of analysis governing the relationship between the two parties is the employment contract, which is a function of employee productivity (effort), compensation (wages) and output. Put simply, the agent exerts a level of effort (e) that leads to a certain output (Y), in exchange for a wage (w).

Effort is a key variable that is considered to be unobservable. In other words, the principal (employer) cannot perfectly observe the effort exerted by the agent (employee). In an incomplete contract setting, the agent's wages may be structured to incentivise effort and align the agent's interests with those of the principal. For example, performance-based pay, bonuses, and profit-sharing arrangements are common ways to motivate agents to exert effort. Hence, when contracts are incomplete, this invites a wide range of mechanisms which can be used to elicit optimal responses from the parties to a given interaction. The responses are not solely restricted to the domain of conventional economics.

The principal-agent (P-A) model essentially answers the question: "what is the most efficient employment contract within the constraints of differing types of uncertainties?" Insights from other disciplines about the behaviours giving rise to (the attenuation of) the contractual incompleteness will be crucial. However, first let's consider the problem from a strictly economic point of view (Macho-Stadler & Pérez-Castrillo 2001).

When some of the information pertaining to an exchange is private, then three broad classes of problems arise. In other words, there are three possible instances in which information uncertainty can affect the

underlying dynamics of the contract. Moral hazard (when private information arises after the signing of the contract); adverse selection (when private information is present before signing); and signalling (when private information is used prior to signing to influence an outcome). For example, one significant challenge for the principal is identifying and measuring the agent's ability. Initially, the principal must rely on trust that the agent possesses the necessary skills to accomplish the task. However, such information can be challenging to verify, and the agent may possess more information regarding their personal characteristics and ability, resulting in an adverse selection problem. A second issue is that moral hazard can arise after the contract is offered – this concerns the difficulty of monitoring the agent's behaviour and verifying that they are exerting the necessary level of effort as stipulated in the contract. Both adverse selection and moral hazard represent different aspects of information asymmetry in the principal-agent model, and lead to the enforcement different optimal contracts (Macho-Stadler & Pérez-Castrillo 2001).

The principal therefore designs a contract; the agent considers it, and then signs if utility obtained from signing is greater than his or her reservation utility. Once the contract is signed, the agent conducts a task (stipulated in the contract) on behalf of the principal. In this situation, the principal has all the bargaining power, so the agent cannot make a counter-offer. Excluding bilateral bargaining is perhaps not that bad an assumption. Most markets work this way (i.e., where the principal can afford to offer someone else the same contract without losing anything – e.g., labour markets; credit markets, certain goods markets). The agent's objectives are in conflict with those of the principal – they undertake to do a task that would otherwise be done by P. This implies a cost, which A must incur, but also be compensated for by P. When not all of the elements of the exchange process can be completely contracted for, then the problem of asymmetric information arises. Generally, when contracts are incomplete, the framework of analysis is that of non-cooperative game theory. "Incomplete" means that there could be a breach of a contract that could not be litigated, since there is no way of verifying the breach, and enforcing the terms of the exchange in a court of law.

However, for the purposes of our analysis we shall focus on the base case of the model. In this case, information uncertainty exists not in the attributes or behaviour of the agent, but in production settings that are characterised by high degrees of risk. In other words, in situations where output is determined by external factors that are beyond the principal or agent's control. In this hypothetical 'base case', the labour market clears. In simpler terms, when there are no unknown or hidden characteristics of the employee conventional problems of adverse selection and moral hazard fall away. Thus, the employer and employee are able to negotiate an enforceable contract based on optimal effort. In this context, risk sharing forms the basis of the optimal contract since it describes the underlying mechanism that governs both employer and employee incentives during the process of wage negotiation. The implication is that the agent's payoff is determined by an optimal distribution of this external (stochastic) risk between the two parties (Macho-Stadler & Pérez-Castrillo 2001).

We'll begin by considering a reference case in which everything pertaining to the contract is common knowledge. Note, this does not require that P and A have complete information about the aspects of the exchange that needs to be contracted for (in all possible contingencies). Only that each can readily verify the actions of the other. We consider the following models that arise: (1) Symmetric information: everything hinges on the distribution of risk between P and A. (2) Moral Hazard: arises when A's action is non verifiable, or when A has private information after the contract has been signed – effort not verifiable, the term "moral" comes from the canonical example of this type of information problem, related to insurance – the exercise of "moral" responsibility, or the lack thereof, once the contract has been signed thereby indemnifying one.

(3) Adverse selection: arises when A holds private information before the exchange begins (Macho-Stadler & Pérez-Castrillo 2001).

Consider the following set up: an exchange makes possible a certain result/outcome x. Let X denote the set of all possible outcomes/results. The result that obtains, depends on the effort of A and the value of a random variable for which both P and A have some prior distribution. This implies that the outcome is stochastic.

If X is finite, then we can specify the probability of a given outcome as:

$$\sum_{i=1}^{n} p_i(e) = 1 \tag{1}$$

This says that every effort level leads to a result.

We then describe both the principal (P) and agent's (A) utility as a function of the outcome, level of effort and the wage: P's utility is given by $B(x - w)$, with $B' > 0$ and $B'' \leq 0$. Consequently, A's utility function is given by $U(w, e) = u(w) - v(e)$, with $u'(w) > 0$, $u''(w) \leq 0$, $v'(e) > 0$ and $v''(e) \geq 0$. Note, both P and A are either risk-averse or risk-neutral. Conflict of interest is evident: P cares about x (the outcome), but not A. A cares about e (effort level), but not P. Greater effort makes better results more likely. P offers A the contract who either accepts or rejects based on the utility he would get through other opportunities, i.e., his reservation utility (sometimes called the "outside offer"). Reservation utility $= \bar{U}$, is assumed exogenous.

If the utility from signing the contract exceeds $\bar{U}$, then A will participate in the agreement. This condition is known as the participation constraint (PC), and can be expressed as:

$$\sum_{i=1}^{n} p_i(e)u(w(x_i)) - v(e) \geq \bar{U} \tag{2}$$

Under this symmetric information case, what will the optimal contract look like? Recall that the result is stochastic and that symmetric information implies that the contract should depend on both e and w. This means that the principal gets to decide on the wage to be offered in every possible contingency. But, the result depends on effort, so not only must P work out all possible combinations of e and w, but he must also decide which ones will be acceptable to A.

This leads to a standard non-linear programming problem:

$$\begin{aligned} \max_{e, w(x_i)_{i=1,\ldots,n}} & \sum_{i=1}^{n} p_i(e)B(x_i - w(x_i)) \\ \text{s.t} \quad & \sum_{i=1}^{n} p_i(e)u(w(x_i)) - v(e) \geq \bar{U} \end{aligned} \tag{3}$$

We then use a Lagrangian to solve for the optimal contract:

$$\mathcal{L} = p_i(e)B(x_i - w(x_i)) + \lambda(p_i(e)u(w(x_i)) - v(e) - \bar{U}) \tag{4}$$

Find the first-order condition:

$$\frac{\partial \mathcal{L}}{\partial w(x_i)} = -p_i(e^0)(B'(x_i - w^0(x_i)) + \lambda^0 p_i(e^0)u'(w^0(x_i)) \equiv 0 \tag{5}$$

Solving for the optimal contract:

$$\lambda^0 = \frac{B'(x_i - w^0(x_i))}{u'(w^0(x_i))} > 0 \ = \text{constant} \tag{6}$$

The solution proposes that the optimal wage scheme is a point of tangency at each party's indifference curves, and from this extend three possible risk allocations. If the principal is risk-neutral, then the wage received by the agent does not depend on the result. If B' and u' are constants – in other words, if the level of risk one is willing to bear does not change with the outcome x, both parties can be considered as risk neutral. If neither B' or u' are constants, both the principal and agent are risk averse. If only B' is a constant, the principal is risk neutral and would take on the risk of completely insuring the agent; vice-versa if u' is a constant. If both the principal and agent are risk averse, risk-sharing and "trade-offs" would occur depending on the degree of risk aversion of the principal over the agent. For this case, to see what happens, we go back to the general case (involving n possible outcomes) and rewrite the KT condition as:

$$-B'(x_i - w^0(x_i)) + \lambda u'(w^0(x_i)) = 0$$

Then differentiate with respect to x, substitute in for λ and rearrange:

$$\begin{aligned}
-B''\left(1 - \frac{dw^0}{dx_i}\right) + \lambda u'' \frac{dw^0}{dx_i} &= 0 \\
-B''\left(1 - \frac{dw^0}{dx_i}\right) + \frac{B'}{u'} u'' \frac{dw^0}{dx_i} &= 0 \\
-\frac{B''}{B'}\left(1 - \frac{dw^0}{dx_i}\right) + \frac{u''}{u'} \frac{dw^0}{dx_i} &= 0
\end{aligned}$$

Now define the Arrow-Pratt measures of absolute risk aversion for P and A, respectively $-\frac{B''}{B'} = r_p$ and $-\frac{u''}{u'} = r_a$, to give

$$\begin{aligned}
r_p\left(1 - \frac{dw^0}{dx_i}\right) - r_a \frac{dw^0}{dx_i} &= 0 \\
r_p - r_p \frac{dw^0}{dx_i} - r_a \frac{dw^0}{dx_i} &= 0 \\
\frac{dw^0}{dx_i}(r_p + r_a) &= r_p \\
\frac{dw^0}{dx_i} &= \frac{r_p}{r_p + r_a}
\end{aligned}$$

If the principal is risk-neutral, then the wage received by the agent does not depend on the result.

The respective levels of risk-aversion of the employer and employee dictate the nature of the employment contract – either party could be risk averse or risk neutral. Traditionally, the employee is assumed to be risk averse. If this is the case, the employee is likely to negotiate a fixed wage for a given level of effort, in other

words, 'pure employment'. In this example, the employer would bear the risk of any external factors that influence the degree to which the output can be achieved. Macho-Stadler and Castrillo (2001) demonstrate this logic using the example of a shop assistant who is hired by a swimwear store owner to manage day-to-day activities in return for a fixed hourly wage, where effort is defined by work hours. A possible external factor that could affect store sales is seasonality – even if the shop assistant exerts an optimal level of effort, sales would inevitably decline in winter months. In this situation, the shop assistant earns a fixed hourly wage, and is not responsible for bearing the risk of lost revenue. This is defined as pure employment, where the intuition is that risk-averse employees are less likely to accept output-contingent compensation contracts (Macho-Stadler & Pérez-Castrillo 2001).

In the base model of principal-agent relationships where external risk is the unknown factor, it is possible to model different employer and employee relationships based on risk sharing. The resulting outcome uncertainty introduces risk that must be borne by someone. When outcome uncertainty is low, the costs of shifting risk to the agent are low and outcome-based contracts are attractive. However, as uncertainty increases, it becomes increasingly expensive to shift risk. At one end of the spectrum, risk-averse employees prefer pure employment, where the employer bears the risk. At the other end, there are employees who elect to become own operators. These are self-employed individuals who take on the external risk and are prepared to bear the uncertainty of variable income. In between these extremes, there are franchise holders who pay the employer to minimise external risk, for example, minimising sales risk through the use of a branded store.

For an empirical account of the principal-agent model in action, economists have investigated the correlation between crop risk and the prevalence of sharecropping. Sharecropping is an agricultural arrangement whereby landowners allow tenants to use their land in exchange for a share of the crop – this incentivises the tenant to work towards achieving the highest possible yield. The significance of risk-sharing in agricultural economies has been analysed using the principal-agent framework, which suggests that sharecropping is more likely to occur in situations with higher output uncertainty (Brancaccio 2001). In traditional farming activities, there are three different arrangements: wage contracts, fixed rent contracts, and share tenancy contracts. In a wage contract, the landowner (principal) employs a tenant (agent) who works under their direction, is paid a wage, and the landowner retains the entire output. In a fixed rent contract, the tenant directly manages the farming activity, retains all output, and pays rent to the landowner for the use of the land. In a share tenancy contract, the tenant farms the land but only keeps a portion of the final output. When farming becomes increasingly uncertain, the desire to share risk takes precedence over incentives. Consequently, share tenancy agreements should be observed more commonly than fixed rent contracts (Brancaccio 2001).

It is clear that even at the most foundational level, risk is an essential element of any employment relationship – risk sharing between employers and employees is an important mechanism that ensures the efficient functioning of the labour market. External risks are inherent to most economic activities – government policies, economic climate, and technological change can cause uncontrollable fluctuations in productive outcomes. Risk attitudes are thus inherent to understanding or modelling decisions concerning wage employment, self-employment, and unemployment in South Africa. Our research aims to apply the theoretical framework of the principal-agent model to shed light on the phenomenon of low labour market attachment in the presence of elevated external risk levels, as observed in the context of South Africa. By utilising this model, we seek to understand how external risk factors influence individuals' decisions regarding labour market participation. While recognising that practical application might require contextual adjustments, our efforts to adapt the model to account for the specific dynamics of the South African labour market can offer valuable insights

into the relationship between external risk, individual incentives, and labour market outcomes in this setting.

3.2 Risk and occupational choice: risk as a pre-requisite for entrepreneurship

Identifying the unique characteristics and preferences that differentiate individuals in the labour market is crucial to gaining a clearer understanding of how workers might allocate themselves between different occupations, and of the constraints they face in their occupational choices.

The role of individual risk preferences in this context has received increasing attention. A large body of the existing literature on risk has concentrated on the relationship between risk preferences and entrepreneurship, most notably earlier work by Kihlstrom and Laffont (1979). The authors' theory of entrepreneurship postulates that individuals become entrepreneurs due to differences in their attitudes towards risk. The central argument is that more risk-averse individuals will be less likely to become entrepreneurs, while those more willing to take on risk will be more likely to engage in entrepreneurial activity (Kihlstrom & Laffont 1979).

Entrepreneurship involves taking risks. This risk may be financial, personal, or both. Risk can be appealing in the sense that the expected returns given these risks can be higher than the expected returns from formal salaried employment. Thus, entrepreneurs are willing to bear a higher level of risk in order to potentially achieve higher rewards. In the model presented in Kihlstrom and Laffont (1979), the decision to become an entrepreneur is based on a comparison of the expected returns of entrepreneurship with the expected returns of other available opportunities. In other words, an individual has a choice between operating a risky firm or working for a riskless wage. The choice is largely based on an individual's willingness to face uncertainty, presented in the form of an expected utility maximization problem (Kihlstrom & Laffont 1979).

The expected utility from entrepreneurship is determined by the perceived probability of success, and the potential payoff if the venture is successful. Kihlstrom and Laffont (1979) argue that individuals who are less risk-averse will be more likely to choose entrepreneurship, as they place a higher value on the potential rewards of entrepreneurship, even if the probability of success is lower. In other words, for these individuals, expected utility is higher if they take on the venture. Conversely, individuals who are more risk-averse will be less likely to choose entrepreneurship and more likely to work for a riskless wage, as they place a higher value on avoiding potential losses, even if the probability of success in entrepreneurship is high.

This definition suggests that entrepreneurs are individuals who identify and pursue opportunities, often in the face of uncertainty and risk, and who create economic value by introducing new products, services, or methods of production (Shane & Venkataraman 2000). Naturally, self-employment is often equated with entrepreneurship since the self-employed tend to start their own businesses to pursue their ideas. Self-employment receives attention in this regard because it is considered a crucial driver of labour market growth and firm growth (Margolis 2014).

In the context of South Africa's severe unemployment and youth unemployment rates, investigating the drivers behind transitioning to self-employment is of great significance, as self-employment presents a viable alternative to unemployment. Hence, there has been a renewed focus on identifying the factors that motivate the decision to take up self-employment, and what constraints an individual may face when they make this decision. This can be extended into conceptualizing more broadly what drives labour market participation amongst youth in South Africa, and the role of individual preferences in explaining differences in occupational

choices.

In this paper, we conceptualize the problem by modelling labour market choices amongst youth in South Africa as the choice between three states: self-employment, wage employment, or unemployment. This is a choice set that we propose adequately and broadly represents the current distribution of the labour participation of youth in South Africa. Risk preferences play an important role in driving decisions towards participation in each respective state – however, this relationship may not be as intuitive as Kihlstrom and Laffont (1979) propose. In developed economies there is a clear and intuitive association between risk preference and labour market choices; in developing economies the dynamics of this relationship aren't as well understood. We discuss this below.

3.3 Self-employment, wage employment, and the risky choice in developing economies: a more nuanced view of occupational choice in the context of poverty

"It is often said that the main asset of the poor is their labour" – Gary Fields (Fields 2013).

In developing countries, self-employment is a popular alternative to wage employment, but its relation to risk contrasts with the traditional view that emphasizes the 'entrepreneurial spirit' discussed previously.

Self-employment is the predominant form of labour in developing economies: 53% of workers in low-income countries and 36% in lower-middle-income countries are self-employed (Fields 2013). In 2019, over 70% of the working-age population in Sub-Saharan Africa were self-employed (Shah 2022). These individuals may be in urban or rural areas, working in or outside of agriculture. To equate self-employment with entrepreneurship in developing economies can be misleading and inaccurate (Fields, 2015). Though self-employment is seen as the norm, it is often a response to insufficient labour market opportunity. Indeed, self-employment is considered an easier option in many instances compared to formal wage employment, since the widespread lack of formal sector employment leads individuals to turn to self-employment as a means of earning a livelihood. Moreover, lower start-up costs encourage individuals to start a smaller (often informal) business. These require less capital compared to securing a formal sector wage-based job, making self-employment a more accessible option. Further, cultural and social norms that value perceived "self-sufficiency" can push individuals to turn to self-employment (Margolis 2014).

Poverty and labour markets are linked (Fields 2013). Since labour is the main asset of the poor, workers in low-income countries reluctantly turn to what is described as survival employment to make ends meet. It would be deceptive to characterize these individuals as risktakers – they are self-employed not by choice, their employment driven not by market need, but by necessity in the circumstance of poverty. Supporting this view, Gindling and Newhouse (2013) explore the heterogeneity in characteristics between self-employed own-account workers, employers, and wage and salaried workers in developing countries. The authors find that only a minority of the self-employed in developing economies display the "innovative and successful" characteristics traditionally associated with an entrepreneur. The majority are low-earning own-account workers who have been rationed out of wage jobs. As expressed by Fields (2013): the goal of the self-employed in these developing economy settings is to secure at least some form of income, however small – until such a time where a more stable and remunerative option becomes available.

Entering into self-employment in developing economies is not without its challenges and significant drawbacks. Self-employed workers often lack access to benefits such as paid sick leave, retirement benefits, and health insurance, and are subject to unpredictable income and market fluctuations. Additionally, starting and running a business can be costly, with many expenses such as taxes, licensing fees, and regulatory compliance requirements. The Small Enterprise Development Agency (SEDA), reports that for youth in developing countries especially, challenges such as lack of basic support and mentorship networks, lack of adequate infrastructure, and limited access to funding are particularly difficult to overcome (Madzivhandila & Dlamini 2015).

However, for the youth in this environment, the costs of finding stable formal sector wage employment are often prohibitively high. The process of finding a formal sector job can be expensive, with costs such as transportation, interview expenses, and job search fees rendering the search process inaccessible for many. Moreover, wage employment is sometimes associated with the added vulnerability of poor working conditions, low pay, and low job security (Madzivhandila & Dlamini 2015). Margolis (2014) contends that labour market frictions in developing economies result in increased costs, such as time, energy, and financial resources, to obtain information on job availability and remuneration; even if this information is available, associated transportation costs and low wages can make some jobs not worthwhile.

Thus, if we think of the youth in developing countries as needing to make a choice between self-employment and wage employment, we can define contrasting choice sets on the basis of risk. Against the (un)successful and expensive exercise of seeking a formal wage-earning job, it is difficult to assume that self-employment in this context is an inherently 'risky' option or choice. If we were to conceptualize different choice sets: one choice would be to forego the risky process of finding a wage-paying job in favour of self-employment, since partaking in formal job search is too costly. In this case, an individual has measured the costs and uncertainty of self-employment against the equally uncertain prospect of finding formal wage employment and chosen the former. However, a large number of people might prefer a wage-paying job (Margolis 2014). Another, possibly riskier, choice would be to then engage in a costly search for formal employment, without the guarantee of finding one. Finally, other people might self-employed because they were wage-employees, could have continued in wage employment, but willingly left wage-employment to create their own self-employment enterprise (Fields 2013).

Clearly, what constitutes occupational risk is ambiguous and highly subjective in the developing context. This raises the question of how risk appears in the South African context given the unique labour market dynamics in the country, which we explore below.

3.4 Self-employment, wage employment, and occupational choice in South Africa

The South African economy is marked by chronically high levels of youth wage unemployment. This has led to increasing interest in the potential of self-employment as a means of creating jobs and reducing unemployment amongst youth. Despite this, evidence suggests that self-employment is not a viable option for many young people in South Africa. Though most developing economies in Sub-Saharan Africa have a high proportion of self-employed workers, South Africa remains an exception. In 2008, only 19 percent of the employed were in self-employment. In 2020, the figure dropped to 15 percent (Shah 2022). Survey data reveals that the vast majority of young people who are unemployed remain so, and that self-employment is not a common pathway out of unemployment, and according to Shah (2022), South Africa's labour market is

highly distinct in that those who are excluded from wage work are more likely to be unemployed rather than working in informal, own-account jobs. Only a small proportion of young people in South Africa who are unemployed have started their own businesses, and these businesses are often not successful or sustainable (Shah 2022).

The persistently low self-employment rate among youth remains a cause of concern for policymakers. A range of factors account for the lack of formal wage employment, as well as the limited self-employment opportunities for young people. Among the reasons identified are the difficulties and risks associated with establishing and operating a business, as well as inadequate access to crucial financial and other resources that are necessary for success in self-employment ventures.

As in most developing economies, self-employment and youth engagement in entrepreneurial business activities in South Africa are strongly motivated by necessity (Madzivhandila & Dlamini 2015). This confirms that there is indeed a difference between being a "business owner" and being an "entrepreneur". These individuals are forced to become business owners because of a lack of other alternatives. In other words, they are entrepreneurs who started their business mainly because they could not find a well-paid or suitable job and needed a source of income, or they were unemployed. Little is known about the performance and characteristics of youth-owned businesses in South Africa, and it is often assumed that necessity-driven businesses will be less successful than those started to pursue an opportunity. SEDA reports that youth owned SMMEs in rural areas (such as Limpopo) generate on average less than R200 000 annual revenue, again indicating that the existence of these businesses stems from necessity rather than a willingness to fulfil a market opportunity.

Multiple studies have documented the different barriers to entry that prevent youth from taking up self-employment (Mlatsheni & Ranchhod 2017); (De Lannoy et al. 2018). Young people in South Africa lack the skills, knowledge, and experience required to start and run a successful business. Youth in South Africa do not have access to the financial resources that are necessary to start and run a business, such as start-up capital, business training, and mentorship. SEDA (2020) reports that financial institutions are reluctant to offer loans to young business-owners due to lack of a credit record, business unpredictability and also because youth are seen as having a higher perceived risk factor. In addition to these challenges, the regulatory environment in South Africa also presents significant barriers to self-employment. It can be difficult and time-consuming to obtain the necessary licenses and permits to start a business, and there may also be restrictions on the types of businesses that can be established. This can further limit the potential for self-employment, particularly for young people who may not have the resources or the experience to navigate the complex regulatory landscape (De Lannoy et al. 2018).

Several researchers (Wittenberg 2002); (Mlatsheni & Ranchhod 2017) have also pointed to low perceptions of opportunity as a barrier to youth employment in South Africa. It is reasonable to assume that how young people view the job market has a significant impact on how much effort they put into finding employment. Studies conducted internationally have shown that these perceptions are partly influenced by the neighbourhoods in which young people live (Case & Katz 1991). A study on impoverished areas in Boston by Case and Katz (1991) revealed that peers in the community have a significant influence on young people's behaviour, including their motivation to work. Negative perceptions have also been shown to have an adverse effect on job search in South Africa. Wittenberg (2002) found that fewer than 50 percent of unemployed individuals engage in active job search, which suggests that discouragement is often based on perceptions of the job market rather than personal experience. SEDA adds to this view, reporting that youth entrepreneurs in South

Africa face considerable self-doubt when entering the labour market, caused by anxieties around perceived lack of experience. In the face of this self-doubt, it is common for youth to abandon the idea of starting their own business, should it turn out to be unsuccessful. Conversely, the state of remaining unemployed or jobless can lead to a depressive paralysis that prevents individuals from engaging in structured job search. Thus, when perceptions of the job market are overly pessimistic, the inadequate search attempts that follow can contribute to perpetuating youth unemployment (Mlatsheni & Ranchhod 2017).

What are the implications of these findings for our understanding of how youth in South Africa make decisions regarding employment, particularly in relation to risk? South Africa's labour market more closely resembles developing economy labour markets. This is relevant when examining the take up self-employment, which is often chosen out of necessity rather than preference. We have also established that obtaining a formal wage-earning job in South Africa is particularly difficult, due to high job search costs and a low probability of success. Taking these factors into consideration, we hypothesize that individual risk preferences may play a role in shaping the willingness of individuals to actively participate in the labour market, whether through wage employment or self-employment.

4 Risk preferences and self-employment

The concept of risk preference is a fundamental component of economic and psychological theories of decision-making, and it is frequently used to elucidate behaviours and variations among individuals in various domains, such as financial decisions, health-related choices, and occupational decisions (e.g., entrepreneurial pursuits). Risk preferences, which may also be referred to as "risk attitudes" or "risk tolerance" are typically perceived as a personal trait (Fehr-Duda & Epper 2012).

An individual's risk preferences are not always consistent or stable, but rather depend on the context and the potential outcomes involved (Harrison & Elisabet Rutstrom 2008). Furthermore, the presence of constraints, such as income or time, can also affect risk preferences. Those with higher income may be more willing to take on risk, as they have more resources to fall back on in the event of a negative outcome. Similarly, individuals with more time may be more willing to take on risk, as they have a longer horizon over which to recover from losses (Fehr-Duda & Epper 2012).

Others have highlighted the importance of emotions in shaping risk attitudes. In "Risk as Feelings" Loewenstein et al (2001) propose that emotions can influence risk preferences by affecting individuals' perceptions of the potential outcomes of a decision (Loewenstein, Weber, Hsee & Welch 2001). The instability of individual risk attitudes is also found to be related to the experience of poverty. Haushofer and Fehr (2014) argue that poverty can reinforce itself by influencing the psychological characteristics of the poor, and that poor people tend to be more risk-averse (Haushofer & Fehr 2014).

Risk attitudes are pervasive in individuals' decision-making processes and are shaped by their unique personal experiences. It is reasonable to assume that risk attitudes may also play a significant role in an individual's employment decisions. Individuals' attitudes towards risk should impact the decision to enter into self-employment or wage employment. Empirical studies have consistently shown a robust association between risk preferences and employment status, suggesting that individuals with lower levels of risk aversion are more likely to be self-employed (Cramer, Hartog, Jonker & Van Praag 2002); (Ekelund, Johansson, Järvelin & Lichtermann 2005). This relationship is somewhat of a 'stylized fact' (Falco 2014). However, the statistical

validity of the exact causal relationship in these findings is questioned given the concern of reverse causality; it is possible that the experience of self-employment could cause individuals to become less risk averse. To address this issue, recent studies have utilized panel methods to measure the predictive effect of risk aversion on future entry into self-employment, where data suggests that risk attitudes have a causal effect on the probability of entering self-employment (Caliendo, Fossen & Kritikos 2009); (Brown, Dietrich, Ortiz-Nuñez & Taylor 2011). Nevertheless, empirical literature testing this relationship in developing economies is scarce. Furthermore, the increasing prevalence of self-employment in developing countries underscores the need for a more nuanced understanding of the motivations for engaging in self-employment. It is important to differentiate between those who choose to become self-employed and those who do so out of necessity (Ahunov & Yusupov 2017).

Cramer et al. (2002) conduct an early empirical test of the relationship between risk attitudes and selection of individuals into entrepreneurial positions. Using retrospective occupational choice data from the Netherlands in 1952 to a follow-up in 1993, the authors explore whether risk attitudes could inform the selection of individuals into wage- and self-employment. In the survey, risk aversion is measured using a lottery that elicits a reservation price for a gamble. Respondent's answers are then categorised into tiers measuring high and low risk aversion. Using this measure, the authors test the distributions of the reservation prices across categories of employment and found that wage-employed individuals are significantly more risk averse than those in self-employment. Formalized Arrow-Pratt coefficients based on these categories are shown to be significant in a probit model with a binary dependent variable for self-employed, where lower levels of risk aversion is associated with a greater probability of being self-employed. Although the results suggest a negative relationship between risk aversion and the choice of self-employment, the authors do not draw any definitive conclusions regarding the causality between risk aversion and entrepreneurial selection, since the retrospective data is unable to capture the effect of wealth within the time frame of self-employment (Cramer et al. 2002).

Ekelund et al. (2005) conduct a similar test of the risk-employment relationship using retrospective psychological test data from a Northern Finland 1966 Birth Cohort study, with follow up data from 1997 and 1998. The psychometric data used in the study assumes that personality is regarded as the sum of time-stabile attitudes and ways of behaviour. According to this view, four distinct dimensions of personality are identified – novelty seeking, harm avoidance, reward dependence, and persistence. The authors use a subset measure of the harm avoidance dimension – fear of uncertainty – as a proxy for risk aversion. Individuals with high scores on this measure were described as cautious, apprehensive, fearful, inhibited, shy, and apprehensive worriers. Individuals with low scores were described as confident, relaxed, optimistic, carefree, uninhibited, and energetic (Ekelund et al. 2005).

Findings from Ekelund et al. (2005) show that there is a statistically significant negative relationship between the 'fear of uncertainty' measure of risk aversion and the probability of being self-employed; increased risk aversion is associated with a lower likelihood of being self-employed. However, the authors highlight issues of reverse causality that arise in their estimation: it could be the case that an individual enters self-employment for some reason and then develops a personality that shows up as lower scores on the risk aversion indicator at the age of testing (Ekelund et al. 2005).

Empirical literature to this point makes the assumption that a person's risk attitude is a preference that is stable over time. Furthermore, prior research assumes that the risk information reflects the circumstances at the time when the decision to pursue self-employment was made, disregarding the time interval between

the assessment of risk preferences and the transitions in and out of employment statuses.

Caliendo et al. (2009) circumvent these issues by adopting a unique approach to examining the impact of risk attitudes on the decision to become self-employed at a direct future point (Caliendo et al. 2009). They overcome the limitations of previous studies by using a panel approach with data from the German Socio-Economic panel (SOEP). This approach enables the authors to conduct a direct test of whether risk attitudes influence the decision to become self-employed, and whether this decision is influenced by risk attitudes at the time it is made, which contrasts with Cramer et al. (2002) and Ekelund et al. (2005).

Caliendo et al. (2009) use two waves of panel data from 2004 and 2005 to track changes in employment status, identifying a transition into self-employment if an individual was not self-employed in the 2004 wave but was in the 2005 wave. Risk preferences are constructed using two measures: the authors test subjective responses for an individual's willingness to take risks on a scale of 1-10. Secondly, responses from a lottery question about how much an individual is willing to invest in a risky asset are used to derive an approximate Arrow-Pratt coefficient of relative risk aversion for each individual. The individual propensity to transition into self-employment between 2004 and 2005 is assumed to be unobserved but reflected in the observed state of being self-employed in 2005. Thus, the authors make use of a latent dependent variable regression to model the choice. Findings indicate that individuals with a higher inclination towards risk in 2004 have a significantly higher probability of becoming self-employed in the next period. However, sensitivity analysis reveals that this result holds only for those individuals who were previously employed and does not hold for transitions from unemployment into self-employment (Caliendo et al. 2009).

Similarly, Brown et al. (2011) examine the relationship between attitudes towards risk and self-employment, with a focus on identifying a causal relationship while controlling for unobserved individual heterogeneity and addressing concerns for reverse causality (Brown et al. 2011). The researchers exploit the panel aspect of the US Panel Study of Income Dynamics (PSID) and analyse a sample of individuals in the PSID for the years 1996, 1997, 1999, 2001, 2003, and 2005. The benefit of using the PSID is that it includes an appropriate measure of risk attitudes through its Risk Aversion Section, which contains information on individuals' attitudes towards risk, as measured by five questions related to hypothetical gambles with respect to lifetime income. The authors create a six-point risk attitudes index for the head of the household and test the effect of risk attitudes in 1996 on self-employment in future periods (1997 – 2005). Results indicate support for an inverse relationship between risk aversion and future self-employment – a one standard deviation increase in the risk attitudes index is associated with a 6% higher probability of self-employment over the future period (Brown et al. 2011).

While research on this topic in developing economies is limited, it is widely acknowledged that enhancing employment prospects for the most vulnerable individuals is crucial to addressing poverty. A key component of this effort is to obtain a more comprehensive understanding of how individuals assign themselves to various occupations and the limitations that impede their occupational decisions. To this end, Falco (2014) examines the influence of risk aversion on the distribution of labour between formal and informal sectors in Ghana, while Ahunov and Yusupov (2017) investigate the relationship between risk attitudes and entrepreneurial motives in transition economies (Falco 2014); (Ahunov & Yusupov 2017).

In Falco's (2014) research on occupational choices in Ghana, the author seeks to establish a framework for modelling occupational preferences in the absence of government-funded insurance schemes to assist the unemployed. Falco (2014) proposes a model of sector allocation for risk-averse laborers, utilizing experimental

data to measure individual risk attitudes. The theoretical model of sectoral selection with risk-averse workers is motivated by the observation that occupational decisions are fraught with "risk" in two significant aspects. Firstly, the job search process is inherently uncertain, with job seekers facing the possibility of remaining unemployed if their search is unsuccessful. Secondly, even after finding a job, the earnings variation between "good" and "bad" states of the world can be substantial. These uncertainties impact the expected utility that risk-averse workers derive from potential job opportunities, ultimately influencing their allocation decisions (Falco, 2014). The author's approach makes the theoretical assumption that individuals choose the sector with the highest expected utility. As in Caliendo (2009) occupational choice is modelled using a latent variable that describes the propensity of worker i to sort into sector j at time t. Using a limited dependent variable estimator with the risk aversion coefficient (CRRA) among the explanatory variables, Falco (2014) models the likelihood of being in each of the occupational categories (which together comprise all the workers in the sample): informal sector, formal sector, and unemployment. Results from a multinomial logit regression suggest that risk-aversion decreases with the likelihood of being in the informal sector and it increases with the likelihood of being in the unemployed queue. Falco's (2014) study of sectoral choice is a preliminary indicator of the nuances of what constitutes employment decisions in developing economies (Falco 2014).

The conceptualization of self-employment as a voluntary decision is widely accepted in the developed world but remains a topic of debate in the context of developing economies. Research on the risk attitudes of entrepreneurs is fairly comprehensive, but there is little distinction made between those who choose self-employment and those who are compelled to run their own businesses for survival. This lack of differentiation between "entrepreneurs by choice" and "entrepreneurs by necessity" is a common oversight in the literature, which often treats the self-employed as a homogenous group (Margolis, 2014). However, there could be significant heterogeneity among the self-employed in terms of their preferences for risk. To fully understand the dynamics of entrepreneurship in developing countries, it is critical to acknowledge the diversity within the self-employed population and the circumstances that lead individuals to pursue self-employment.

Ahunov and Yusupov (2017) investigate the relationship between risk attitudes and entrepreneurial motives in transition economies. The authors examine the relationship between individual (stated) risk preferences and likelihood of entrepreneurial entry, disaggregating the self-employed group into individuals that self-identified as being entrepreneurs by choice, and those that were self-employed out of necessity. Results suggest that overall, the likelihood of entering self-employment by choice tends to mostly increase with risk tolerance, while necessity-driven employment is not sufficiently shown to be associated with lower levels of risk aversion (Ahunov & Yusupov 2017).

The empirical literature highlights the elusive nature of the measurement of risk attitudes and its impact on entrepreneurship choices. While the relationship between risk aversion and employment status is often considered a stylized fact, recent research has revealed that it is far more complex than previously thought. Indeed, a growing body of research has begun to differentiate between entrepreneurial and necessity-driven self-employment, which has led to a more nuanced understanding of the risk-employment relationship in developing contexts. Given these complexities, there is a need for continued research that explores the mechanisms underlying the relationship between risk attitudes and entrepreneurship, especially in the context of developing economies where self-employment is often a necessity rather than a choice.

4.1 Do risk preferences differ across genders?

A substantial body of literature in behavioural and experimental economics explores the extent to which risk preferences differ by gender. This research consistently finds that women are, on average, more risk-averse than men across various domains, including financial decision-making, occupational choices, investment strategies, and health behaviours (Croson & Gneezy 2009); (Eckel & Grossman 2002); (Cramer et al. 2002); (Ekelund et al. 2005). These findings have been extended into developmental psychology, where early socialisation processes are shown to influence the emergence of gendered patterns in decision-making, with girls typically encouraged to be cautious and boys encouraged to take initiative and accept risk (Eckel & Grossman 2002).

In the context of labour markets, risk aversion is often used as an explanatory variable in understanding gender differences in occupational sorting. Women may be more likely to pursue stable wage employment in the formal sector, whereas men may be overrepresented in self-employment and entrepreneurial activities. This occupational sorting has been linked to differential preferences over income stability versus variance, with implications for earnings trajectories and labour market participation (Margolis 2014).

However, interpreting these patterns requires caution. Sociobiological and evolutionary theories have posited that gender differences in risk preferences may be rooted in reproductive strategy and parental investment, suggesting that women historically benefited from risk-averse behaviour to protect offspring, while men may have faced evolutionary incentives to engage in risk-seeking behaviour as a form of status or resource acquisition Eckel & Grossman (2002). While influential, such accounts have been criticised for over-determining behaviour and underestimating contextual and institutional influences.

Cultural, environmental, and structural explanations offer a more dynamic understanding. For example, Burns, Halliday & Keswell (2012) explore how multiple-choice test formats with penalty structures may differentially penalise women due to lower risk tolerance, despite equal competence. Similarly, Niymbanira & Sabela (2019) discuss how women's labour market engagement in South Africa is shaped by unpaid care responsibilities, income volatility, and access to stable employment, factors that plausibly influence observed preferences for income security.

Empirical studies from South Africa have reinforced these patterns. In an experimental study of fishing communities, Brick, Visser & Burns (2012) found that female fishers were significantly more risk-averse than their male counterparts. Female participants with fishing rights, in particular, exhibited the highest levels of risk aversion, highlighting how gender interacts with access to productive assets and roles within the household. This finding aligns with international studies that associate female risk aversion with occupational roles, household responsibilities, and socio-economic constraints.

In our analysis, we use structural estimation to calculate coefficients of relative risk aversion (r) across different employment groups, disaggregated by gender. Employed women emerge as the most risk-averse group. However, these results must be interpreted within the limitations of our modelling approach. Specifically, each employment group is estimated separately, meaning that male constants and female marginal effects are computed within—not across—employment types. Therefore, any comparison of r between, for instance, self-employed males and employed females, does not arise from a joint model and cannot be treated as statistically comparable.

Additionally, while there are modest gender differences in self-employment rates within the dataset, wage employment rates are nearly identical across gender. This indicates that observed behavioural differences in estimated risk aversion may not fully explain occupational choice. The alignment of higher r values with employed women could just as plausibly reflect structural realities—such as care burdens, financial responsibilities, and the importance of steady income in household dynamics—as it does internal preferences.

From a methodological standpoint, our MPL-based elicitation of risk preferences is a useful but imperfect proxy. Risk aversion estimates in such tasks can be influenced by framing effects, understanding of probabilities, or task engagement. Moreover, the context in which these choices are made—a controlled, monetary setting—may differ meaningfully from the everyday risk decisions faced by participants in their employment and livelihood strategies.

Thus, we resist interpreting our findings as evidence of biologically fixed gender differences. Rather, we interpret higher female risk aversion as a rational response to environmental and institutional conditions. This approach is supported by Harrison & Ross (2018), who argue for a bounded rationality framework in understanding gendered behaviour, and Buchak (2013), who contends that subjective probability weighting and caution under uncertainty can be rational given asymmetric exposure to risk.

In sum, our findings confirm the pattern of greater risk aversion among employed women, consistent with parts of the literature. However, we contextualise this within a broader structural framework that emphasises adaptive behaviour, endogenous preferences, and the influence of roles and responsibilities. This approach avoids essentialism and allows for more meaningful policy insights regarding the labour market experiences of women in South Africa.

5 Methods

5.1 Utility Formation of Choice Under Risk

Suppose that a decision maker takes some action that leads to an objective probability distribution over a set of possible outcomes. This is a situation of risk. The neoclassical approach to conceptualising decision making in such a situation is expected utility theory (EUT) (Dhami 2016).

Let $X = \{x_1, x_2, ..., x_n\}$ be a fixed, finite, set of real numbers such that $x_1 \leq x_2 \leq ... \leq x_n$. One may interpret X as the set of all possible levels of wealth of the decision maker. We define a lottery, or gamble, as

$$L = x_1, p_1; x_2, p_2; ...; x_n, p_n... \tag{7}$$

where $p_1, p_2, ..., p_n$, are the respective probabilities corresponding to the outcomes $x_1, x_2, ..., x_n$, such that $p_i \in [0, 1]$ and $\sum_{i=1}^{n} p_i = 1$. The lottery $(x_i, 1)$ denotes an outcome x_i received with certainty, so we sometimes simply denote it as x_i. The lottery in Equation (1) is sometimes also known as a simple lottery. Given two simple lotteries, $L1$ and $L2$, a lottery of lotteries, say, $L1, p; L2, 1 - p$, where $p \in (0, 1)$, is known as a compound lottery, or prospect.

A situation of risk arises when the probabilities $(p_1, p_2, ..., p_n)$ are objectively known, and a decision maker bears risk should he or she make a choice between two different lotteries, as denoted above. A decision maker

evaluates these choices through the use of a utility function, for example

$$U = x^r \tag{8}$$

The utility u(xi) is generally a non-linear transformation of the outcome xi. The function represents an assumption about the decision makers preferences over outcomes. Expected utility can therefore be understood as the expected value of the utilities derived from each outcome. Under the assumption of expected utility, $EU = \sum p_i u(x_i)$. The utility $u(x_i)$ is translated from the given objective outcome x_i based on the individual's evaluation, and the decision is based on the maximisation of EU (Dhami 2016).

Attitudes to risk in EUT are determined entirely by the shape of the utility function. Although most people may believe that probabilities have something to do with risk, they play no role in EU in determining risk attitudes. In EUT, risk is measured using the concept of a certainty equivalent value, in other words, a sure amount. An individual is risk averse if they would rather accept a sure amount that is lower than the expected value of the lottery, in order to avoid playing the lottery. Due to the subjective evaluation of utility and the formation of expected utility (EU), optimal choices can vary between individuals. This variation is reflected in the difference between evaluated utilities for the same outcomes. Risk attitude in the expected utility formation is classified into three types: risk aversion, risk neutrality, and risk seeking. These categories differ based on preferences towards a lottery (or prospect) and its expected value. Risk aversion occurs when risky prospects are less preferred than the expected value of the prospect. This is true only when utility function is concave, as shown in the figure below. Observe that the utility of the expected value of the gamble $U(0.5x_1 + 0.5x_2)$ for $x_2 > x_1$ exceeds that of the expected utility of the gamble, $0.5U(x_1)+0.5U(x_2)$. Under the expected utility framework, risk aversion arises solely because of a sensitivity to outcomes, where the reverse relationship $U(0.5x_1 + 0.5x_2) < 0.5U(x_1) + 0.5U(x_2)$ leads to a propensity for risk, or "risk lovingness," with strict equality implying risk neutrality.

Expected utility theory has two main features. Firstly, EU makes the assumption that individuals weight probabilities linearly, i.e., there is, in a sense, an objective probability distribution over outcomes that is known to the subject when making choices over lotteries. Formally, this means that

$$EU(L1, p; L2, 1-p) = p \cdot EU(L1) + (1-p) \cdot EU(L2) \tag{9}$$

This assumption is fundamental to many areas in economics. However, extensive empirical evidence shows that EUT does not find support in practical contexts. Most non-EU decision theories relax the linearity assumption in some manner. Secondly, EU offers no insights about human behaviour in the domain of gains and losses. By contrast, empirically observed behaviour of decision makers is fundamentally different in the domain of gains and losses. Indeed, differences in behaviour in gains and losses are not only an essential driver of many important results in other decision theories such as prospect theory, but there is empirical confirmation of these predictions.

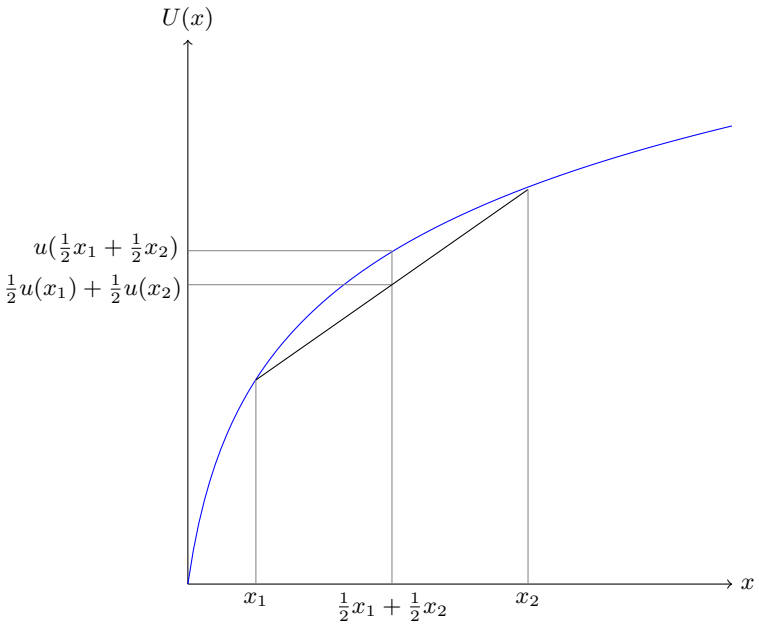

Figure 1: Risk aversion as concavity of the utility function

The expected utility of the gamble is $0.5u(x_1) + 0.5u(x_1)$. The utility of the expected value of the gamble is $u(0.5x_1 + 0.5x_2)$. The graph shows the case of risk aversion where $u(0.5x_1 + 0.5x_2) > 0.5u(x_1) + 0.5u(x_2)$.

5.2 Measuring risk aversion

We measure risk aversion using a structural approach. We start by defining a constant relative risk aversion (CRRA) utility function, where x is money, and r is the risk parameter to be estimated from the data:

$$\begin{aligned} U(x) &= \frac{x^{1-r}}{1-r} \qquad x \geq 0, \quad -\infty < r < +\infty, \quad r \neq 1 \\ &= \ln(x) \qquad r = 1 \end{aligned} \tag{10}$$

In the function, r is the coefficient of relative risk aversion where $r > 0$ for a risk averse individual, $r = 0$ for a risk neutral individual, and $r < 0$ for a risk loving individual. We then offer subjects the choice of pairs of gambles/prospects, one riskier than the other, and ask them to choose between the two. As a simple example, consider the following gambles:

$$\begin{aligned} \text{Prospect S (safe choice)} &= (1, 5) \\ \text{Prospect R (risky choice)} &= (0.5, 0; 0.5, 10) \end{aligned}$$

If the subject chooses Prospect S, they win \$5 with certainty; if they choose Prospect R, they win nothing with 50% probability and \$10 with 50% probability. A risk averse individual will choose Prospect S, while a risk loving subject will choose prospect R. Risk neutral subjects will be indifferent between the two prospects as both have the same expected value. To see this, we calculate the expected utilities of both prospects:

$$\begin{aligned} \text{EU}(S) &= (x+5)^r \\ \text{EU}(R) &= (x+0)^r + (x+10)^r \end{aligned}$$

Now assume computational (Fechner) errors ϵ, where $\epsilon \sim N(0, \sigma^2)$. Thus, the safe choice is made if $\text{EU}(S) - \text{EU}(R) + \epsilon > 0$. For each subject, we elicit whether they would choose S or R if offered pairs of gambles to choose between. Thus, for every subject we observe a binary outcome of the choice between S and R. From these choices, we first estimate r. To proceed on this front, we first define the probability of making the safe choice $\Pr(S) = Pr[\text{EU}(S) - \text{EU}(R) + \epsilon > 0]$ and compute the joint density:

$$\begin{aligned} \Pr(S) &= \Pr[\epsilon > \text{EU}(R) - \text{EU}(S)] \\ &= \Pr\left[\frac{\epsilon}{\sigma} > \frac{\text{EU}(R) - \text{EU}(S)}{\sigma}\right] \\ & 1 - \Phi\left[\frac{\text{EU}(R) - \text{EU}(S)}{\sigma}\right] \\ & \Phi\left[\frac{\text{EU}(S) - \text{EU}(R)}{\sigma}\right] \end{aligned}$$

from which we derive the log-likelihood function:

$$\log \mathcal{L} = \sum_{i=1}^{n} \ln \Phi\left[yy_i \times \frac{(x+5)^r - (x+0)^r + (x+10)^r}{\sigma}\right]$$

where $yy_i = 1$ if S is chosen and $yy_i = -1$ if R is chosen. This function is then solved numerically for values of r the maximise the function.

5.3 Elicitation of Risk Attitudes

We use the multiple price list (MPL) method to elicit risk attitudes (Holt & Laury 2002). We offer subjects four sets of choices of less risky versus more risky lotteries, with varying levels of spread between the safe and risky choices. Outcomes are binary (less risky or more risky). There are 10 configurations of each pair of lotteries with varying probabilities . For instance:

$$\begin{aligned} \text{Price list A (less risky)} &= (0.9, 5; 0.1, 7) \ldots (0, 5; 1, 7) \\ \text{Price list B (more risky)} &= (0.9, 0; 0.1, 10) \ldots (0, 0; 1, 10) \end{aligned}$$

In A, the winnings are 5 (bad) and 7 (good) respectively, whereas for B, the winnings are 0 (bad) and 10 (good) respectively. Given that probabilities vary in intervals of 0.1 over the unit interval, there are 10 configurations of both lotteries making up a price list. Subjects are asked to choose between A and B for each configuration.

Each subject was presented with 4 price lists, each differing in spread between A and B. Therefore each subject made 40 lottery choices. Table 1 shows an example of the practice round of the lottery task.

Table 1: Practice round lottery "price" list

Choice	p	x_h^A	$1-p$	x_l^A	p	x_h^B	p	x_l^B	EV(A)	EV(B)	EV(A) − EV(B)
0	0.1	R138	0.9	R92	0.1	R245	0.9	R31	R96	R52	R44
1	0.2	R138	0.8	R92	0.2	R245	0.8	R31	R101	R74	R28
2	0.3	R138	0.7	R92	0.3	R245	0.7	R31	R106	R95	R11
3	0.4	R138	0.6	R92	0.4	R245	0.6	R31	R110	R116	(R6)
4	0.5	R138	0.5	R92	0.5	R245	0.5	R31	R115	R138	(R23)
5	0.6	R138	0.4	R92	0.6	R245	0.4	R31	R119	R159	(R40)
6	0.7	R138	0.3	R92	0.7	R245	0.3	R31	R124	R181	(R57)
7	0.8	R138	0.2	R92	0.8	R245	0.2	R31	R129	R202	(R74)
8	0.9	R138	0.1	R92	0.9	R245	0.1	R31	R133	R224	(R90)
9	1	R138	0	R92	1	R245	0	R31	R138	R245	(R107)

Notes: p is the probability of winning x; x_h^A is the high payoff for lottery A and x_l^A is the low payoff for lottery A; analogously defined for lottery B. EV(A) is the expected value of lottery A, analogously defined for lottery B. The last column is the difference in expected values. Choices are labelled $0-9$ as this is the conventional labelling used on a 10-sided die. Rand values in December 2022 prices.

Each row in the table presents the subject with a choice of either lottery A or lottery B. Each table in the experimental rounds had the same structure as Table 1; ten outcomes for two lottery choices where the probabilities vary from 0.1 to 0.9 but winnings are fixed for each set of probabilities. For each row of each such table, participants were instructed to circle their preferred lottery option, A or B, to indicate their preference. For example, row 5 of Table 1, asks subjects to choose either option A with even odds of winning R138 or R92 or option B with even odds of winning R245 or R31. As one moves down the rows in the table, the probability of the good state increases. Risk averse subjects will choose A rather than B, switching to B only when the probability of a good outcome is greater than %50. Risk loving individuals will switch to B for lower probabilities of good outcomes.

At the end of the activity, each participant had made forty different lottery choices. Outcomes of the task were then implemented in three steps. First, one of the four price lists was randomly drawn. Then the payout was determined by two rolls of a 10-sided die, with values $0, 1 \ldots, 9$. Participants were told that the chance of winning a particular monetary payment would be determined by the roll of a 10-sided die. The first roll determined the choice that will be implemented. Suppose the subject had drawn a table such as the hypothetical Table 1 and had chosen lottery A for Choice 2. The payouts corresponding to this choice is R138 with a 30% probability, versus R92 with 70% probability. To determine which of the two outcomes to effect, the die was rolled a second time; if any number other than 0 or 1 appeared, the outcome would be R92. Since rolling a zero *or* a one occurs with 30% probability, if either of these numbers are rolled, the outcome with be R138.

5.4 Accommodating Probability Distortions

There is no reason why risk aversion ought to arise solely, or even at all, due to sensitivity of outcomes. Sensitivity to probabilities is equally, if not more important to determining risk attitudes. As (Wakker 2010) notes,

> "I expect that most people, when they first learned about the characterisation of risk aversion through concave utility, were amazed. Utility seems to describe sensitivity to money, and this seems to be a concept different from attitude to risk. How can your feelings about money determine your risk attitude? What about your utility and behaviour for other quantitative outcomes, such as amounts of wine, life duration, or hours of listening to music? And what about your behaviour for non-quantitative outcomes such as health states? Shouldn't risk attitude have something to do with feelings about probabilities? Utility curvature does not seem to capture risk attitude in a homeomorphic manner."

Indeed, a long tradition in psychology, culminating in original prospect theory (OPT), has approached the problem of risk aversion from the vantage point of probabilistic sensitivity. Kahneman & Tversky (1979) introduced explicit behavioural content into the expected utility framework by conceptualising decision makers facing risky prospects as engaging in two distinct stages where they first interpret (i.e., edit) the information presented to them, before they proceed to the second stage of evaluating the utility of a given prospect. During the editing process, probabilities can be further discretised, truncated to extremes, up-weighted at lower probabilities, and down-weighted at high probabilities. Thus, probabilities are taken to be not what they are objectively, but what they are perceived to be by the decision maker (Wakker 2010). This deviation from linearity of probabilities is appropriately understood as a form of bounded rationality and has been studied in this way in recent years (Zhang, Ren & Maloney 2020). Our approach combines the two traditions, incorporating sensitivity to outcomes, where outcomes are transformed non-linearly through the utility function, and sensitivity to probabilities, where probabilities are transformed through a probability weighting function.

By a probability weighting function, we mean a strictly increasing function $w : [0, 1] \to [0, 1]$. Consider $w(p)$ as the subjective weight placed by decision makers on the objective probability, p (these ideas carry over to non-negative subjective probabilities that sum up to 1). Probability weighting implies that somehow people do not "believe" stated objective probability distributions over lotteries, or at least, when making decisions they "weigh" probabilities in a manner that is not quite proportional.

Expected utility requires that there exists a $u : X \to R$ such that the function

$$U(p) = \sum_{i=1}^{n} p(x_i)u(x_i) \tag{11}$$

is used to describe preferences. If we allow for a probability weighting function, we would require another function $v : [0, 1] \to [0, 1]$ such that

$$V(p) = \sum_{i=1}^{n} w(p(x_i))u(x_i) \tag{12}$$

It takes the true objective probabilities and turns them into what are sometimes called decision weights. For example, we could think of a probability weighting function that increases the weight on very low probabilities (so, for example $w(0.01) = 0.05$).

Probability weighting bears several implications for how we conceptualise risk (Dhami 2016). Prospect theory posits that individuals' choices under uncertainty differ from the patterns anticipated by expected

utility theory. Specifically, when confronted with rare events occurring with small probabilities, people tend to overweight these probabilities. This pertains to both gains and losses. Within this context, probabilities are replaced by decision weights. Consequently, other probabilities, particularly the larger ones, receive lower decision weights compared to what the objective probabilities would imply if used directly (Dhami 2016).

The concept of probability distortion is formally captured in prospect theory through the use of a probability weighting function. Kahneman & Tversky (1979) first introduced a stylised probability weighting function that demonstrated a collection of fundamental properties designed to systematise the empirical deviations from classical expected utility theory. The two primary components of the early conceptualisation (Figure 2) include the tendency to overweight small probabilities and underweight large probabilities, in other words, the idea of inverse-S distortion.

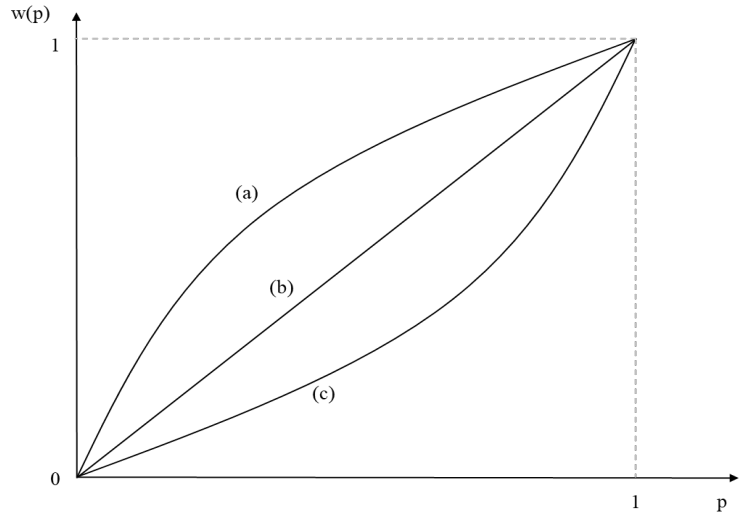

Figure 2: Illustration of various probability attitudes

Panel (a) reflects greater curvature (more distortion), (b) depicts approximately linear weighting, and (c) shows a weighting function with reduced curvature. These represent differing levels of probability sensitivity, not affective states. Adapted from Wu & Gonzalez (1996)

While early models sometimes labelled these shapes as "optimistic" or "pessimistic," we clarify that in the current framework, we interpret the curvature of the probability weighting function in terms of probabilistic sensitivity – how sharply individuals discriminate between different probability levels – rather than emotional disposition or cognitive bias.

The figure above further illustrates how the shape of the probability weighting function varies with γ values. Individuals with lower γ values may respond to rare events more significantly than they objectively are, while higher γ values suggest more linear or even under-reactive treatment of probabilities. These transformations matter in real-world decision settings, particularly where individuals face limited feedback, ambiguity, or structurally constrained environments. Accordingly, our interpretation of γ in the remainder of the paper aligns with the view of probabilistic sensitivity as a bounded rationality response to complexity (Simon 1982).

While the one-parameter function we employ is widely used for tractability and comparability, it should be noted that this form imposes symmetry and monotonicity that may not be empirically accurate for all individuals. For example, Wilcox (2023) and Harrison & Swarthout (2023) show that more flexible

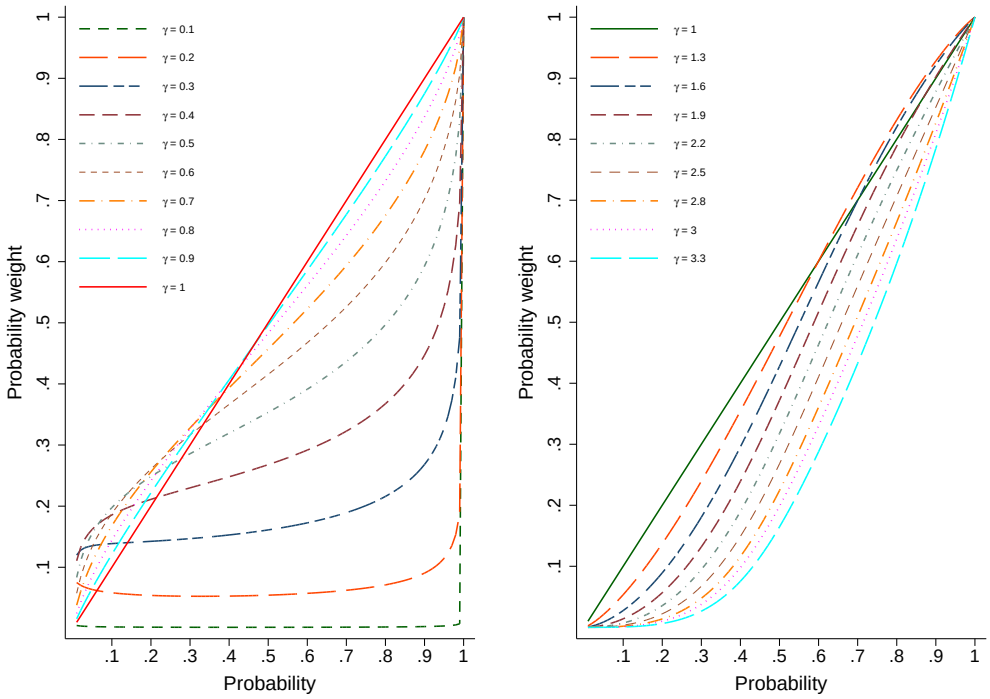

Figure 3: Probability Distortion

Notes: The figure shows different types of probability distortion corresponding to different hypothetical values of γ, modelled with the non-linear probability weighting function $w(p) = \frac{p^{\gamma}}{(p^{\gamma}+(1-p)^{\gamma})^{\frac{1}{\gamma}}}$ where $\gamma = 1$ implies no distortion

specifications, such as the two-parameter Prelec function or non-parametric approaches, often yield a range of forms that go well beyond the canonical inverse-S shape. These include S-shaped, linear, and even disjoint functions. Accordingly, our estimates should be understood as approximations of average tendencies, not definitive characterisations of individual behaviour.

An additional behavioural dimension considered in our study is "back-switching" within Multiple Price List (MPL) tasks. This occurs when respondents switch from a safe to a risky option and then switch back again – a deviation from monotonicity expected under standard utility models. Following Harrison & Elisabet Rutstrom (2008), such behaviour is often interpreted as a sign of confusion, limited attention, or task complexity. In our analysis, we include back-switching as an indicator variable to examine whether this behaviour correlates with higher estimated probability distortion. However, we do not claim that it reflects a systematic behavioural type; rather, it may point to context-sensitive inconsistencies that require further study.

Back-switching is of interest not merely as a noise artefact, but as a potential proxy for behavioural instability or reduced confidence in decision tasks involving uncertainty. Particularly in low-feedback environments such as those encountered by unemployed youth, back-switching may reflect the cognitive effort required to form a consistent belief structure about risk. Its presence may also suggest that the decision-making process is more susceptible to momentary hesitation, preference reversals, or ambiguity. By testing whether back-switching correlates with more pronounced probability weighting, we explore whether those individuals who exhibit

this inconsistency are also those whose subjective representation of probabilities deviates most from objective benchmarks. In doing so, we position back-switching as a plausible behavioural signal of informational strain or uncertainty rather than a mere statistical nuisance.

It is also worth clarifying that although our framework shares features with RDU-style models, it differs substantively in its structure. Unlike canonical RDU models, our framework does not impose fixed forms of probability transformation but allows γ to vary systematically with observable covariates such as employment status, gender, and back-switching behaviour. Furthermore, we do not include parameters for loss aversion or reference dependence – such as the commonly used λ (lambda) coefficient in Prospect Theory – which captures differential weighting of gains and losses. As such, the design of our experiment was not intended to test for loss aversion or to fit models that require mixed gain–loss domains.

Additionally, it is important to note that our research does not attempt to falsify Expected Utility Theory itself. Rather than conducting hypothesis tests between EUT and alternative models, we aim to describe the heterogeneity of decision-making behaviour in risky environments. This decision-theoretic modelling approach aligns with applied literature that uses probability weighting to characterise individual and group-level variation. As Wilcox (2023) points out, non-linear probability weighting should not be dismissed as an artefact of imposed functional form, but recognised as an empirically validated and meaningful feature of real-world decision behaviour.

Finally, we reiterate that non-linear probability weighting is well established in applied decision theory, and our empirical goal is to extend this work into the context of youth labour market attachment in South Africa. Far from overclaiming, our approach is cautious in both design and interpretation, and aligns with a growing body of research that treats distortion in probability weighting as an empirically observed feature of bounded rationality.

6 Data

The data used in this dissertation contains a sample of approximately ˜400 young Black African adults aged 20–30 who participated in a risk experiment such as the experiment described in Section 5 (Keswell & Burns 2023). The sample is split into three major categories: (1) Unemployed; (2) Self-employed; and (3) Wage-employed (hereafter referred to as employed). In the sample, an individual is categorized as unemployed if they self-report as unemployed, do not report any positive working hours, and did not identify as self-employed. An individual is classified as self-employed if they have self-reported as such, have a positive number of working hours, and were not in casual or wage-work. Finally, the employed are those who participate in wage work, casual or other work, and have a positive number of work hours. Excluded are students or unpaid volunteers.

Table 2: Summary statistics

Variable	Males	Females	Total
Chose riskier lottery (lottery B)	0.541	0.508	0.527
	(0.498)	(0.500)	(0.499)
Female (1=yes)	0	1	0.411
	(0)	(0)	(0.492)
Completed matric (1=yes)	0.577	0.527	0.557
	(0.494)	(0.499)	(0.497)
Completed some type of tertiary training after matric (1=yes)	0.385	0.413	0.397
	(0.487)	(0.492)	(0.489)
Have had HIV test (1=yes)	0.832	0.916	0.867
	(0.374)	(0.277)	(0.340)
Have had unprotected sex (1=no)	0.396	0.395	0.396
	(0.489)	(0.489)	(0.489)
Excellent health (1=yes)	0.510	0.341	0.441
	(0.500)	(0.474)	(0.497)
Smokes cigarettes (1=no)	0.824	0.928	0.867
	(0.381)	(0.258)	(0.340)
Consume Alcohol (1=no)	0.389	0.485	0.429
	(0.488)	(0.500)	(0.495)
Locus of control (1=yes)	0.879	0.862	0.872
	(0.327)	(0.345)	(0.334)
Unemployed (searching)	0.113	0.114	0.113
	(0.317)	(0.318)	(0.317)
Unemployed (not searching)	0.0795	0.102	0.0887
	(0.271)	(0.302)	(0.284)
Self-employed: self-identifed	0.130	0.0898	0.113
	(0.336)	(0.286)	(0.317)
Employed: receives a regular wage	0.414	0.425	0.419
	(0.493)	(0.494)	(0.493)
Observations	239	167	406

Notes: Standard deviations in parentheses. *Locus of control* = 1 if subject reported being either "Totally or mostly in control of their daily lives". *Employed: receives a regular wage* = 1 if subject had at least one regular wage earning form of employment

The summary statistics presented in Table 2 provide insights into various socio-economic and health-related behaviours, with particular attention to indicators of potential risky behaviours. Notably, a higher proportion of males (61.1%) compared to females (51.5%) report consuming alcohol, while smoking rates are lower for females (7.2%) than males (17.6%). This gender difference in risky health behaviours is further highlighted by the fact that males have a slightly higher incidence of choosing the riskier lottery (54.1%) compared to females (50.8%), suggesting that risk-taking may be more prevalent among males across different domains. These patterns of risk-taking behaviours could be a preliminary indication of underlying differences in risk preferences across genders.

7 Results and discussion

This section presents and interprets the key empirical findings of the study, based on structural estimates of the coefficient of relative risk aversion (r) and the probability weighting parameter (γ) across different employment groups. The aim is to evaluate whether systematic behavioural variation exists across categories of labour force attachment – specifically, wage employment, self-employment, and unemployment – and how such variation may relate to individual decision-making under uncertainty. The interpretation of these findings is guided by behavioural decision theory, bounded rationality, and the South African labour market context.

As outlined in Section 5.4, all models were estimated separately by employment group to allow for group-specific baselines and covariate effects. Within each model, gender and back-switching were included as covariates, enabling us to assess heterogeneity in preference parameters. The coefficients estimated are not marginal effects in a discrete choice model, but rather structural shifts in estimated preference parameters. Following conventions in structural elicitation (Harrison & Rutström 2008), we interpret each coefficient as indicating the direction and magnitude of deviation from the group-specific reference category (typically male, non-back-switcher).

7.1 Risk aversion: patterns by employment group and gender

Our estimates of the coefficient of relative risk aversion (r) reveal considerable heterogeneity across the three employment groups. Employed individuals, on average, exhibit the highest levels of risk aversion. Within this group, the female dummy variable on r is positive and statistically significant ($r = 0.314$, $p < 0.01$), suggesting that employed females are more risk-averse than employed males. This finding is consistent with the Principal-Agent model, where more risk-averse individuals are more likely to select into wage employment with stable income streams (Kihlstrom & Laffont 1979).

In the self-employed group, the average r value is lower than among employed respondents, although still positive. The female dummy in this model is not statistically significant ($r = 0.087$, $p = 0.22$), suggesting that among self-employed youth, gender differences in risk aversion are less pronounced. Among unemployed individuals, the estimated r value is 0.188 (SE = 0.051), indicating mild risk aversion on average. The female dummy in this model is not statistically significant.

It is important to clarify how the estimated risk aversion coefficients (r) should be interpreted in this framework. These are structural estimates derived from utility-based models fitted within each employment group. The coefficients reflect how risk preferences vary within that group relative to the baseline, but they are not marginal effects and do not predict employment status. For example, the significant female coefficient in the employed group indicates that employed females have, on average, higher estimated risk aversion than employed males. However, models were estimated independently by employment status, and comparisons of coefficients across groups (e.g., employed vs. unemployed) are descriptive, not inferential.

Additionally, while the point estimates suggest directional differences – such as a higher risk aversion coefficient among employed females ($r = 0.842$, SE = 0.115) compared to unemployed males ($r = 0.217$, SE = 0.141) – the overlapping 95% confidence intervals (employed females: [0.616, 1.068]; unemployed males: [-0.059, 0.493]) suggest that these differences may not be statistically robust.

From a behavioural standpoint, the higher levels of risk aversion among employed individuals, particularly women, may reflect not only intrinsic attitudes toward risk but also the structural context in which employment decisions are made. For many young women in South Africa, the opportunity cost of income instability is high, given ongoing caregiving roles, limited access to financial instruments, and greater vulnerability to labour market exclusion. Thus, the preference for wage work may be less a function of pure risk aversion and more a rational response to constrained choice sets and elevated exposure to downside risk. Our modelling captures this indirectly through the structural estimates of r, which we interpret as a revealed behavioural tendency under these contextual pressures.

7.2 Probability weighting: non-linearity in probabilistic reasoning

Under expected utility theory (EUT), the assumption is that the parameter $\gamma = 1$, that is, individuals weight probabilities linearly (Dhami 2016). Our results suggest that individuals do not, on average, conform to this assumption. However, the extent and direction of departure from EUT varies across employment categories and subgroups. Results for γ are presented in the third panel of Table 3. In all models, the constant term is significant and interpretable. However, as with the results for r, gender effects are statistically significant only in the self-employed and employed models (models 6 and 9, respectively). To explore differences in γ across groups, Figure 5 provides boxplots, and Figure 6 offers a graphical representation of γ weighting functions for specific subgroups.

Wald test results and Figure 6 indicate that there are three notable differences in estimated γ across groups that are statistically distinct at conventional levels. These include: (1) self-employed females who back-switch vs. unemployed individuals who back-switch; (2) self-employed females who back-switch vs. employed individuals who back-switch; and (3) self-employed males vs. unemployed males who back-switch. These comparisons provide insight into how probability sensitivity may vary across demographic and behavioural profiles, particularly under ambiguity.

Figure 6 illustrates that unemployed individuals who back-switch exhibit the most curved weighting function, with an estimated $\gamma = 0.488$ (green dashed line). This is significantly below the normative linear value ($\gamma = 1$), suggesting an underweighting of high probabilities and overweighting of low probabilities. This pattern is consistent with inverse-S weighting, but we avoid interpreting it as a fixed cognitive deficit. Rather, we understand it as a behavioural tendency potentially shaped by the uncertain and often discouraging feedback unemployed individuals receive in their environments.

Self-employed individuals who back-switch (males: $\gamma = 0.611$, orange dashed; females: $\gamma = 0.858$, blue dashed) show a more refined sensitivity to probability. These values are closer to linear weighting and suggest more differentiated processing of outcome likelihoods. This supports the interpretation that self-employed youth who persist in their ventures are more probabilistically calibrated. Notably, self-employed males who do not back-switch show $\gamma = 0.968$ (brown dashed), implying almost no distortion in weighting. This group may represent a comparatively confident subgroup with strong probabilistic intuition or access to consistent feedback mechanisms.

Employed individuals who back-switch display a $\gamma = 0.485$ (dotted line), nearly identical to unemployed back-switchers. This is particularly notable, as it complicates a purely occupational explanation. Even within formal employment, some individuals may experience the decision environment as sufficiently ambiguous to

produce similar distortions in probability weighting. This suggests that structural features alone may not account for behavioural patterns – perceptions and internalised expectations likely play a role.

Importantly, we interpret these distortions not as irrational or affectively driven, but as boundedly rational adaptations. Probability distortion can arise from exposure to uncertainty, poor feedback, cognitive load, or limited ability to infer outcome likelihoods from prior experience (Simon 1982), (Wilcox 2023), (Haushofer & Fehr 2014). In our setting, youth who face ambiguous or unstable opportunity structures may simplify decision-making by applying curved weighting to probabilistic inputs. Our modelling imposes a one-parameter functional form, which allows for such curvature but does not infer it as a revealed truth. Real-world decisions may follow a more flexible structure than our model captures.

The broader implication is that behavioural differences in probability sensitivity may influence occupational choice – but they should be interpreted cautiously. The descriptive profiles observed here suggest that perceptions of uncertainty and probability transformation differ by employment state and behavioural profile. However, whether these profiles are stable traits or responses to context remains a question for future longitudinal or experimental work.

7.3 Contextualising behavioural heterogeneity

The joint interpretation of r and γ across employment states offers insight into how individual preferences may map onto employment status in a high-uncertainty labour market. Employed individuals, especially females, exhibit higher risk aversion and more linear weighting of probabilities. This profile is consistent with demand for predictability and insulation from risk. Self-employed individuals appear moderately risk-averse but relatively probability-sensitive, suggesting tolerance for risk paired with more refined probabilistic reasoning. Unemployed individuals exhibit lower risk aversion but more curved or distorted probability weighting – including group-average convex weighting (i.e., $\gamma > 1$) in the unemployed model – a pattern that may be associated with discouraged job-seeking.

This behavioural profile is broadly consistent with models of labour market disengagement that hinge on perceived returns to effort rather than effort costs alone. As Kingdon & Knight (2004) and Zizzamia (2020) have noted, many unemployed youth are not idle due to unwillingness, but due to an internalised expectation that job search will not yield meaningful results. Our findings suggest that probability distortion – specifically, reduced probabilistic sensitivity – may be associated with this discouragement. When probabilities are perceptually compressed, the subjective payoff landscape becomes flatter, and differences in effort may seem less consequential.

Moreover, the inclusion of back-switching as a behavioural correlate provides additional nuance. Those who exhibit this pattern are not necessarily confused or disengaged. Rather, it may reflect increased decision difficulty or contextual ambiguity. The fact that back-switching is significantly associated with variation in γ but not r suggests that it is more likely to reflect perceptual instability than shifts in outcome-related utility. This interpretation is consistent with a bounded rationality view, where agents adaptively simplify choices under uncertainty or limited feedback.

These results are derived from a one-parameter probability weighting model, which allows for curvature but does not impose inverse-S or convex shapes. As discussed in Section 5.4, real-world behaviour may vary

considerably and include linear, S-shaped, or task-induced patterns (Wilcox 2023) (Harrison & Swarthout 2023). Our interpretation remains descriptive: we do not assert that individuals are inherently more or less rational, but that probability weighting may serve as one behavioural channel through which structural constraints and uncertainty manifest in observed labour market behaviour.

7.4 Implications

While the study does not imply causal pathways, the strength and coherence of the observed associations support a growing argument for integrating behavioural metrics into labour market analysis. Individuals who exhibit higher risk aversion and more stable probability sensitivity are more likely to be engaged in employment. Those with distorted perception of risk — both structurally (low γ) and behaviourally (back-switching) — are more likely to be unemployed. These patterns are correlational but theoretically consistent with a bounded rationality framework.

Future work could explore whether γ and r are malleable in response to interventions that increase exposure to reliable feedback or structure. For instance, access to job-matching services or entrepreneurship mentorships may reduce ambiguity and promote more linear probabilistic reasoning. Additionally, embedding behavioural tracking in longitudinal surveys could test whether employment transitions reshape individual risk and probability profiles over time.

From a policy perspective, these findings suggest that improving information quality, reducing ambiguity, and creating lower-stakes entry points into employment could yield disproportionately positive behavioural responses. Rather than correcting distorted behaviour, interventions could aim to recalibrate individual belief systems by shifting the informational environment in which decisions are made. In this way, behavioural and structural interventions are not substitutes, but complements.

8 Conclusion

This study set out to examine how behavioural preferences related to risk and probability are associated with labour market outcomes among young adults in South Africa. Drawing on incentivised experimental data and structural estimation techniques, we analysed individual-level variation in two key parameters: relative risk aversion (r) and the probability weighting coefficient (γ). These parameters were estimated using utility-based models across three employment categories – unemployed, self-employed, and wage-employed—while also accounting for gender and behavioural inconsistencies such as back-switching.

The study finds that employed women exhibit significantly higher risk aversion compared to other groups. We interpret this not as a gendered disposition but as a rational response to structurally imposed constraints. For many women, caregiving responsibilities, income instability, and limited access to capital and networks make wage employment a safer and more feasible option. The higher r values observed in this group may reflect both preference and constraint in a context where stability carries a premium.

Unemployed individuals, particularly those who exhibit back-switching behaviour in multiple price list (MPL) tasks, tend to display more pronounced deviations from linear probability weighting. These individuals exhibit higher curvature in their estimated γ values, including convex probability weighting on average. Rather than interpret this as pessimism or bias, we frame such distortion as a boundedly rational adaptation

to environments characterised by uncertainty, high search costs, and ambiguous outcomes. In this view, non-linear weighting reflects not cognitive failure but limited ability to update beliefs in the absence of reliable feedback.

Importantly, the study does not claim that r and γ cause labour market outcomes. Our findings are descriptive, not predictive, and all models were estimated separately for each employment group. However, the results are consistent with theoretical frameworks that link economic decision-making to subjective representations of risk and probability—particularly under constrained conditions.

We contribute to the literature in two key ways. First, we extend the use of structural risk elicitation methods into a policy-relevant labour market setting. This allows us to measure how variation in r and γ aligns with different forms of economic participation. Second, we reframe probability weighting not as an irrational tendency to be corrected, but as an adaptive mechanism that may signal informational or experiential deficits. This interpretation lends nuance to common narratives about youth unemployment and disengagement.

The findings also open several directions for future research. Panel data would allow researchers to test whether behavioural parameters like r and γ shift in response to employment shocks, new information, or programmatic interventions. Pooled models with interaction terms could improve statistical power and enable clearer comparisons across groups. Finally, experimental interventions that aim to reduce ambiguity, improve feedback, or scaffold opportunity could help test whether perceptions of risk can be recalibrated in real-world settings.

In closing, our results suggest that behavioural factors such as risk aversion and probability sensitivity are not peripheral to youth labour market outcomes – they are part of the complex ways individuals navigate structural constraints. Behavioural insights should not be used to pathologise job-seekers, but to inform policies that reduce the cognitive burden of decision-making under uncertainty and expand the range of viable economic choices.

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A Appendix

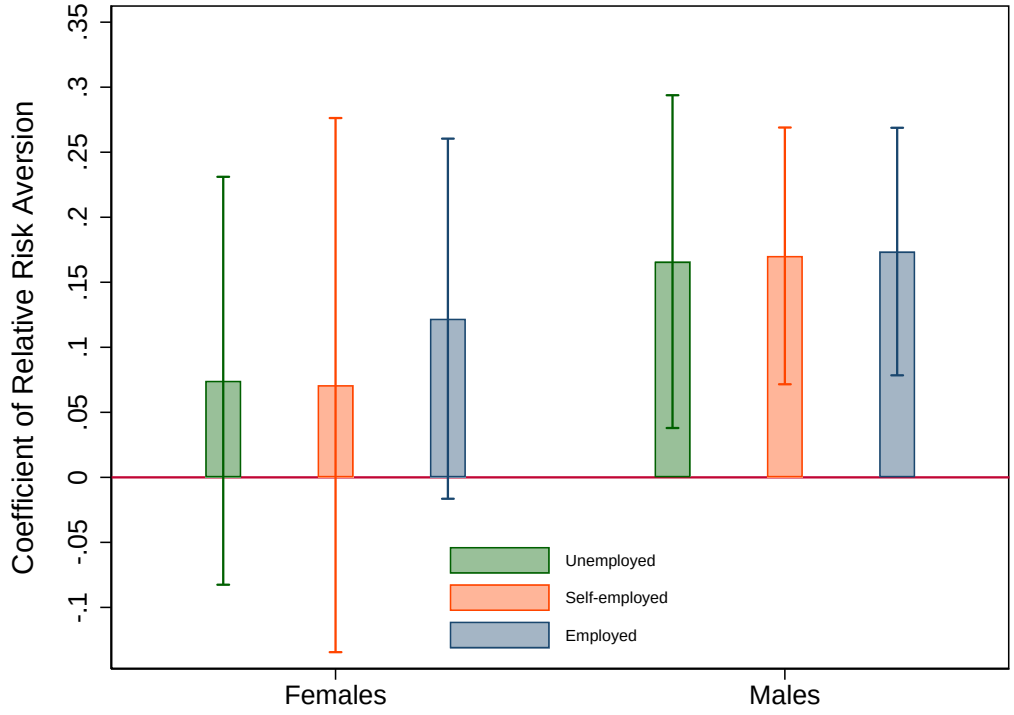

Figure 4: Risk aversion and employment status controlling for probabilistic sensitivity

Notes: The figure shows the Panel A (r) regression coefficients of Model 2 (green bars), Model 4 (orange bars), Model 6 (blue bars) and Model 8 (magenta bars) of Table 3. The bars labelled "Males" are the constant terms from each model. The 95% percentage confidence intervals are also shown. Coefficients with error bars that include $r = 0$ have an economic interpretation of risk-neutrality, whereas coefficients with error bars where the lower limit of of the bar is $r > 0$ can be interpreted as evidence of risk-aversion.

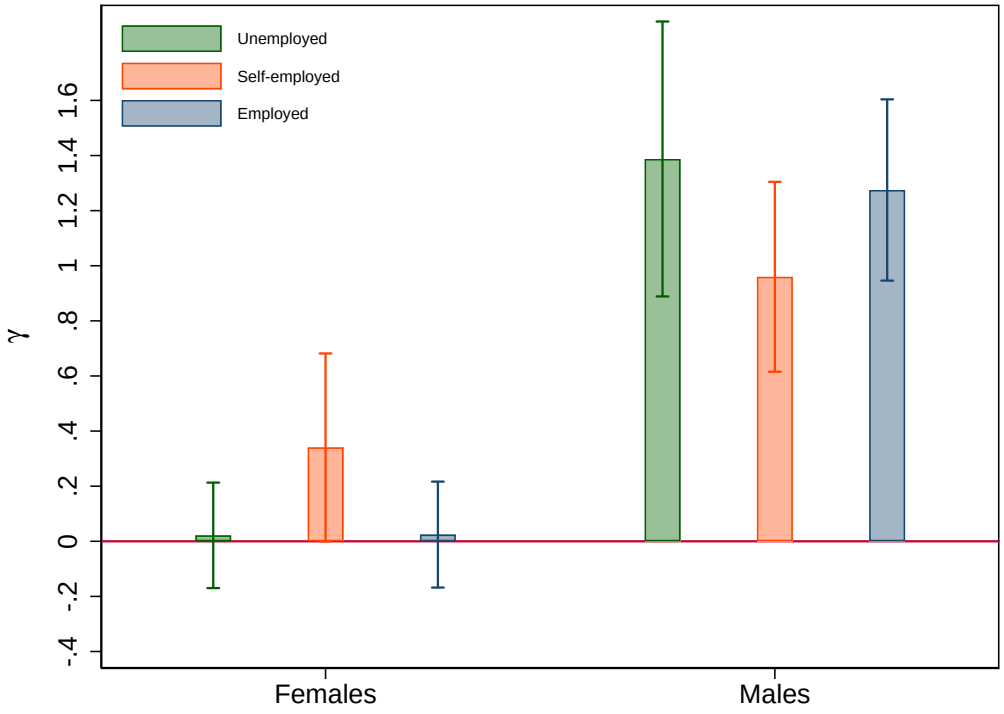

Figure 5: Risk aversion and employment status controlling for probabilistic sensitivity

Notes: The figure shows the Panel A (γ) regression coefficients of Model 2 (green bars), Model 4 (orange bars), Model 6 (blue bars) and Model 8 (magenta bars) of Table 3. The bars labelled "Males" are the constant terms from each model. The 95% percentage confidence intervals are also shown. Coefficients with error bars that include $\gamma = 1$ has an economic interpretation of no probability distortion.

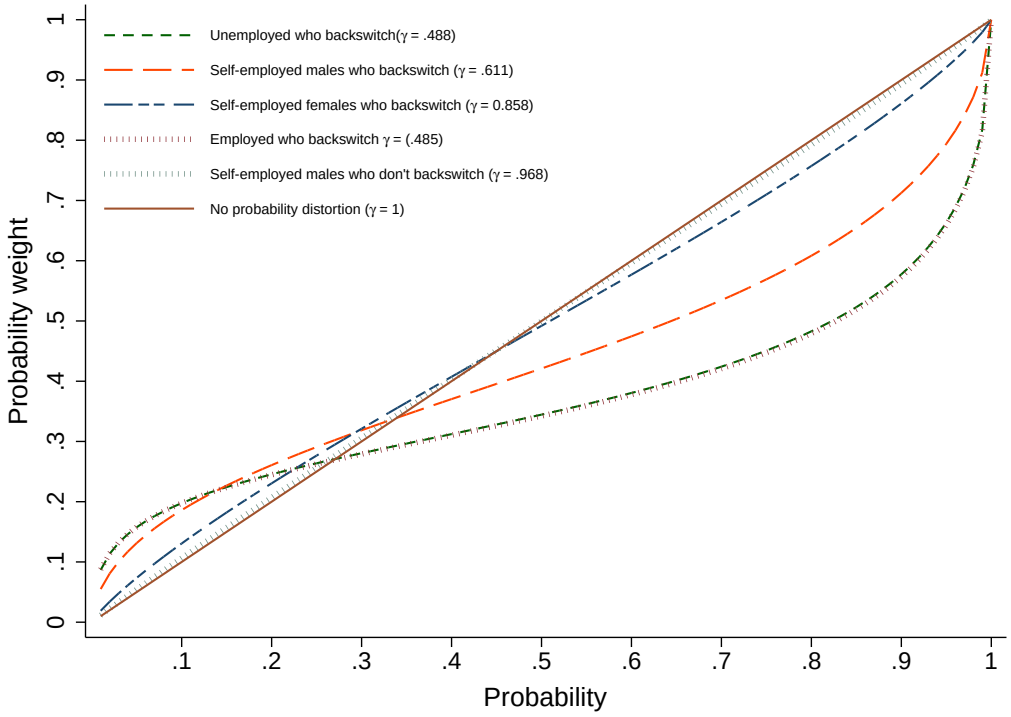

Figure 6: Probability Distortion

Notes: The figure shows the magnitude of probability distortions corresponding to the tests reported in notes 3f-3h of Table 3. γ is modelled with the non-linear probability weighting function $w(p) = \frac{p^\gamma}{(p^\gamma+(1-p)^\gamma)^{\frac{1}{\gamma}}}$ where $\gamma = 1$ implies no distortion.

Table 3: Risk Attitudes with trembles and probabilistic distortions

	Unemployed			Self-employed			Employed		
r									
Female		0.0928	0.0743		0.0773	0.0709		0.156*	0.122*
		(0.0866)	(0.0800)		(0.102)	(0.105)		(0.0826)	(0.0706)
Constant	0.188***	0.145**	0.166**	0.181***	0.154***	0.170***	0.193***	0.132**	0.174***
	(0.0510)	(0.0665)	(0.0653)	(0.0488)	(0.0542)	(0.0504)	(0.0461)	(0.0557)	(0.0485)
μ									
Constant	0.158***	0.157***	0.147***	0.166***	0.166***	0.157***	0.193***	0.192***	0.168***
	(0.0162)	(0.0162)	(0.0141)	(0.0163)	(0.0167)	(0.0160)	(0.0193)	(0.0195)	(0.0156)
γ									
Female		-0.0237	0.0216		0.500**	0.341*		0.0557	0.0243
		(0.141)	(0.0977)		(0.252)	(0.174)		(0.155)	(0.0981)
Switched to less risky gamble (task 1)			-0.909***			-0.374***			-0.401***
			(0.302)			(0.144)			(0.151)
Switched to less risky gamble (task 2)			-0.171			-0.209			-0.391**
			(0.162)			(0.142)			(0.186)
Switched to less risky gamble (task 3)			0.0470			0.000998			-0.0994
			(0.134)			(0.124)			(0.114)
Switched to less risky gamble (task 4)			-0.128			-0.0610			-0.134
			(0.137)			(0.107)			(0.172)
Constant	0.639***	0.647***	1.388***	0.704***	0.627***	0.960***	0.806***	0.788***	1.275***
	(0.0626)	(0.101)	(0.255)	(0.0616)	(0.0657)	(0.176)	(0.0691)	(0.0825)	(0.168)
r difference (employed females)		$\chi^2(1) = 3.06^e$			$\chi^2(1) = 2.74^d$				
		$(p = 0.0804)$			$(p = 0.0979)$				
γ difference (self-employed females)		$\chi^2(1) = 3.76^f$						$\chi^2(1) = 3.38^g$	
		$(p = 0.0524)$						$(p = 0.0661)$	
γ difference (self-employed males)		$\chi^2(1) = 2.93^h$							
		$(p = 0.0869)$							
	3199	3199	3199	4757	4717	4717	6189	6189	6189

Notes:

(a) Standard errors in parentheses. $^*p < 0.10$,$^{**}p < 0.05$,$^{***}p < 0.01$.
(b) Top panel shows estimates of the coefficient of relative risk aversion r, where $r = 0$ implies risk neutrality, $r > 0$ implies risk aversion, and $r < 0$ implies risk seeking.
(c) Bottom panel shows propensity for probability distortion, γ, for weighting function $w(p) = p^\gamma/[p^\gamma + (1-p)^\gamma]^{1/\gamma}$ where $\gamma = 1$ implies no distortion and $0.279 < \gamma < 1$, implies propensity to distort probabilities.
(d) Non-linear Wald test of r difference between employed females and the self-employed: $\chi^2(1) = 2.74$ $(p = 0.0979)$
(e) Non-linear Wald test of r difference between employed females and the unemployed: $\chi^2(1) = 3.06$ $(p = 0.0804)$
(f) Non-linear Wald test (switched back to less risky gamble) of γ difference between self-employed females and unemployed $\chi^2(1) = 3.76$ $(p = 0.0524)$.
(g) Non-linear Wald test (switched back to less risky gamble) of γ difference between self-employed females and employed: $\chi^2(1) = 3.38$ $(p = 0.0661)$.
(h) Non-linear Wald test (did not switch back to less risky gamble) of γ difference between self-employed males and unemployed males $\chi^2(1) = 2.93$ $(p = 0.0869)$.