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Uncovering the Health Impacts of Informal Employment: Evidence from the Indonesian Longitudinal Data

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Abstract

Informal employment is a complex phenomenon as though it comprises over 60% of the world's employed population, it is an invisible sector to the economy due to its economic activities not recorded and covered by formal arrangements under the national labor legislation. Because of this, informal workers are often deprived of the benefits associated with formal employment, putting them at higher risk of deteriorating physical and mental health. Rather than comparing individuals in formal versus informal employment, this study adds to the literature by comparing the health effects for individuals transitioning between formal and informal employment, treating them as a natural experiment to obtain direct health impact. Using the Indonesian longitudinal data, the paper employs a difference-in-difference approach to compare the health outcomes of individuals who transitions and individuals staying in their respective sectors. Overall health and mental health are estimated using a two-way fixed effect and found a small and insignificant effect of moving to formal employment. Similar observation is also found amongst individuals who transition to informal employment. There are some indications that informal employment is associated with poor health outcomes, but the evidence is not strong enough to conclude this.

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1. Introduction

In 2018, a total of 2 billion workers – comprising over 60% of the world's employed population – are engaged in informal employment (International Labor Organization, 2018). Informal sector workers often find themselves on the periphery of economic and social systems due to the lack of social protection and employment benefits such as health insurance, pension, severance payments, and paid leave. They also face precarious working conditions such as job insecurity, long working hours, and unstable income (IMF, 2021; International Labour Organization, 2018; McCaig & Pavcnik, 2015). These challenges are based on the fact that the informal sectors are mainly unregistered workers within the social security schemes, hence, making it difficult for many informal workers to be receiving protections and benefits compared to formal sector workers. On the other hand, it is also difficult to formalize the informal sectors due to the complex nature of informal employment such as inadequate regulatory framework, lack of transparency and weak enforcement system (International Labor Organization, 2018). These contributed to a heightened health risks and poorer health outcomes among informal workers, which can further deteriorate their health and well-being (Ablaza et al., 2021; Andrade Rios & Alves Nery, 2015; Development Bank, 2011; World Health Organizations, 2022). These challenges are prevalent in many lower middle-income countries (LMICs) where the informal sector is a significant feature of the labor market.

There is a growing body of research on the health effects of informal employment, especially in developing countries, where it is associated with unfavorable physical, mental, and overall health outcomes (Giatti et al., 2008; Hurtado et al., 2017; López-Ruiz et al., 2015a; Ludermir & Lewis, 2003; Sales & Santana, 2003). For instance, Hurtado et al. (2017) found that informal work is associated with a significant 0.15 lower score of life satisfaction (Hurtado et al., 2017). Most of these studies found an association, leaving still an endogeneity issues in the relationship between informal employment and health. This leaves a significant gap in the literature to address the endogeneity in the health effects on informality. Notably, papers by Rodriguez-Loureiro et al. (2020), Lopez-Ruiz et al. (2015), and Ludermir and Lewis (2003) highlight potential endogeneity rooted in their studies. To the best of the author's knowledge, there is little to no evidence on the causal relationship between informal employment and health.

The study focuses on the effects of informal employment on health. To identify these effects, we look into the transitions of employment between formal and informal sectors as it could be regarded as a natural experiment in this case. The key dependent variables are dummy that captures whether an individual transition to formal employment and transition to informal employment. To measure health, we consider two dimensions of health – overall health and mental health. Overall health consists of broader aspects of health, whilst mental health captures the psychological aspect of health. To obtain the health effects, the paper uses a difference-in-difference framework, analyzing four types of effect: (1) moving to formal employment on overall health, (2) moving to formal employment on mental health, (3) moving to informal employment on overall health, and (4) moving to formal employment on mental health. This will be compared to individuals staying in formal and informal employment respectively. A key challenge in the identification strategy is the possibility that health status could drive the decision to transition between formal and informal employment. Addressing this issue is done by testing for the parallel trend assumption to ensure that the treated and control groups are similar in terms of characteristics prior to the transition. If this assumption is fulfilled, the analysis provides a stronger basis for a causal inference.

Furthermore, to analyze the health effects, the paper used an Indonesian longitudinal data, that is the Indonesian Family Life Survey (IFLS) allowing to observe the changes in health outcomes of individuals as they transition between formal and informal employment. Analyzing health effects of informal employment from an Indonesian perspective provide a unique context for the study as over 50% of Indonesia's labor force are in the informal sector (Badan Pusat Statistik, 2020).

Therefore, the research question that this research aim to underline is:

"What is the impact of informal employment on health outcomes among workers in Indonesia? Are these effects differed by gender and place of residence?"

Based on this research question, the first and main objective of this study is to assess the health outcomes of workers in informal employment. This is done by taking advantage of the transitions between formal and informal employment that individuals experience in their life. The health outcomes observed in this research are overall and mental health – measured by the self-reported health and CESD mental health measures. By examining both health outcomes, the research aims to provide a full understanding of how informal employment plays a role in the health of individuals. Another objective is to examine whether the health effects observed

would vary based on gender and place of residence. This include analyzing whether male and female workers experience different health outcomes as a result of being in informal employment and seeing if there are any health disparities based off living in urban or rural areas.

The main finding of this study shows an indication that moving to formal employment generally improves health and well-being for the informal workers experiencing the transition. Similarly, moving to informal employment deteriorates health and well-being for the formal workers making this shift. It should be regarded however, that the effect of the transition is small in magnitude, and it is also not statistically significant. It is unclear whether the health effects observed are due to the benefits and stability associated with formal sector that the informal employment does not have. The lack of robust evidence in the regression also shows that other factors might have influenced the deterioration in health within the informal sector other than the transition itself. There is an indication that informal employment led to poor health outcome, but the evidence was not strong enough to justify this. A heterogeneity analysis based on two dimensions (gender and place of residence) is also conducted to see whether these health effects would vary based on certain characteristics. Similar to the main finding of this paper, there is no difference in the health effects based on gender or place of residence due to the insignificant and weak health effects observed.

The results presented in this paper, which rely on the employment transitions between formal and informal employment, should be interpreted with caution for several reasons. First the estimates provide direct observation of health effects from the employment transition from informal to formal employment and vice versa. The estimates cannot speak directly to other context of informal employment. Second, despite being used as the main outcome, the overall health and mental health diagnosis suffer from measurement error as it is a self-reported measure. Finally, the estimates are local to the formal and informal sector who experience the transition.

Aside from these caveats, the finding still provides important policy implications. The result of the paper is informative to informal workers and policymakers alike to help them understand the informal sectors more and what needed to be done to ensure that these workers are included within the social protection scheme and how these workers are at higher risk of their health.

The remainder of the paper is organized as follows: Section 2 provides some theoretical background and literature review on informal employment and health as well as the hypothesis

for the estimations; Section 3 describes the data sources used in the analysis and the summary statistics; Section 4 discusses the empirical strategy; Section 5 presents the results and discussions; Section 6 concludes.

2. Theoretical Background and Literature Review

2.1 Informal Employment and Health

2.1.1 Informal Employment

The International Labor Organization (ILO) defines informal employment as the economic activities of workers who are not covered by formal arrangements such as national labor legislation, income taxation, social protection, or entitlements to employment benefits. There are a wide range of jobs under informal employment ranging from freelancers, business owners, street vendors, domestic workers, or day laborers. These workers are not protected by formal arrangements. Factors such as inadequate regulatory framework, weak enforcement system and limited legal and social security coverage contribute to causes of informality. Education, ethnicity, and other socioeconomic characteristics also contribute to the likelihood of engaging in informal work (International Labor Organization, 2013; International Labor Organization, 2018).

Informal employment is a complex phenomenon, as informal workers are often invisible, and lack the same protections as those in formal employment – which makes the workers particularly vulnerable. Moreover, informal employment comprises a diverse range of occupations under various industries, making it challenging to determine which occupation falls under informal or formal employment. Employment conditions associated with informal employment can significantly influence individuals' health and well-being. Informal workers face higher risks to their physical and mental health because (1) workers face precarious working conditions (long hours, low and unstable jobs, and job insecurity); (2) informal workers does not receive employment benefits as compared to formal sector workers such as healthcare coverage or sick leave and (3) informal workers are more vulnerable to occupational hazard and workplace injuries as informal sector usually include physically demanding jobs (Development Bank, 2011; International Labor Organization, 2022; World Health Organizations, 2022).

Informal employment is primarily concentrated in low- and middle-income countries (LMICs) and accounts for more than half of the global workforce (International Labor Organization, 2013). In many LMICs, the formal sector cannot fully absorb the labor market due to factors such as barriers in education, skills mismatch, stringent regulations, high compliance cost, inadequate infrastructure, and constrained market demand (IMF, 2021). These factors

contribute to a recurring pattern where individuals are not able to secure formal employment, causing them to stay in the informal sector. This in turn also affected health outcomes as it deprives workers from the benefits associated with formal employment. This complexity within the informal sector makes it difficult to fully capture the labor market dynamics in many LMICs.

Given this, Indonesia's informal sector can offer a unique perspective on the relationship between informal employment and health outcomes. Data from Indonesia shows that over 50% of the labor force is engage in informal work, with more informal workers are concentrated in men and those living in the rural areas (Badan Pusat Statistik, 2020). In Indonesia, informal employment is prevalent in rural areas, particularly in the construction and agricultural sectors (Cuevas et al., 2007). This is supported by Ablaza (2021), highlighting that informal employment is higher in economies where traditional sector still dominates, which underline the complexity of the informal labor dynamic in Indonesia (Ablaza et al., 2021). Furthermore, in Indonesia, the informal sector spans various sectors including street vending, small-scale agriculture, construction workers, domestic workers, and gig economy workers – which presents its unique challenges (IMF, 2021). This context is therefore an interesting one for this paper to take place, as the diverse range of occupations and socio-economic diversity within the Indonesian context may provide a valuable insight into the relationship between informal employment and health, which can also be applied to countries with large traditional or agricultural sectors.

2.1.2 Literature Placements

Employment is widely recognized as one of the social determinants of health (Marmot et al., 2008). There is already a large body of work linking employment to health outcomes (e.g. Choo & Denny, 2006; Fletcher et al., 2009; Marmot et al., 1991; Ravesteijn et al., 2018). A multitude of factors, including working conditions, work characteristics, job satisfactions, job security influence the health outcomes of individuals. However, these studies have primarily focused on formal employment, and less is known about informal employment.

There is limited evidence of the impact of informal employment on health due to the difficulty of accurately capturing data, particularly in differentiating between which occupation falls under informal and formal employment. It is difficult to accurately track the proportion of the labor force in the informal employment as informal workers are not registered in the

government. Furthermore, informal employment encompasses various activities, creating further difficulties to define and measure informal employment uniformly. Nevertheless, several studies have attempted to provide evidence on the health effects of informal employment. To date, the available evidence shows that informal employment has negative consequences on health outcomes – both physical and psychological health (Alfers & Rogan, 2015; Giatti et al., 2008; López-Ruiz et al., 2015; Ludermir & Lewis, 2003; Rodriguez-Loureiro et al., 2020; Ruiz et al., 2017; Sales & Santana, 2003). Gender is also an important axiom of inequality in informal employment where females are usually at a disadvantaged working in informal employment (Giatti et al., 2008; Ludermir & Lewis, 2005; Santana et al., 1997). Place of residence (urban and rural residents) also play a role in informal employment as rural residents are usually most deprived of benefits associated with formal employments compared to urban residents (Alfers & Rogan, 2015).

Several papers have tried to propose possible mechanisms to explain what drives the relationship between informal employment and health. For instance, Hurtado et al. (2017) argued that individuals in informal employment have unstable and insecure jobs which often comes with little to no social benefits as well. These factors collectively contribute to the poor health outcomes due to the possible stress and lack of access to resources that individuals may face (Hurtado et al., 2017). Meanwhile, Alfers and Rogan (2014) explained that the precarious nature of their employment such as long working hours can lead to worsening health outcomes (Alfers & Rogan, 2015). Whilst this mechanism was explained in their respective papers, these mechanisms were not tested and were just proposed by the authors of the possible mechanism driving the relationship between informal employment and health. Rodriguez-Loureiro et al. (2020) also attempted to establish mechanisms between informal employment and health by examining whether welfare state regimes in different Central American countries would influence this relationship. Their study found that informal employment and poor health outcomes are prevalent in familialist welfare state regimes (where there is minimal social protection and public welfare provisions) (Rodriguez-Loureiro et al., 2020).

Despite the consistent findings, the existing literature highlights potential endogeneity issues. López-Ruiz (2015) addressed the limitations of their study. They stated that there is still possibility of endogeneity in the form of reverse causality, where it could be the case that people with poorer health are more likely to work in the informal sector (López-Ruiz et al., 2015). In another paper, Ludermir and Lewis (2003), also mentioned possible reverse causality existing in their study in their findings (Ludermir & Lewis, 2003)

2.1.3 Literature Gap

A simple comparison of individuals in formal versus informal employment is insufficient to fully understand how informal employment may affect health outcomes. This is because individuals in formal and informal employment often differ in terms of characteristics. These differences can influence both their employment status and health outcomes, making it challenging to establish causal relationship between the two. The difficulty lies in determining whether the observed health outcomes are due to the specific type of employment or are influenced by underlying characteristics. Rather than comparing formal versus informal employment, the analysis done in this paper focuses on the transitions of individuals between formal and informal employment using longitudinal data.

The study looks into the transitions of moving from informal to formal employment and moving from formal to informal employment to obtain direct comparison of the health effects. These transitions are treated as a natural experiment to how informal employment affects health rather than a simplify comparison of being in formal versus informal employment. It is expected that transitioning to formal employment from informal employment brings more benefits like job security and stable income that are typically absent in informal jobs as it has been established that these factors influence the overall health and well-being of the workers. Conversely, transitioning to informal employment from the formal sector often means losing these formal arrangement benefits – which again, would influence the health of the workers. The use of employment transition to provide stronger evidence of informal employment on health adds to the existing strand of literature and uncover mechanisms through which informal employment affects health.

There are a few papers that have discussed changes in employment status over time and their impact on health outcomes. Gebel and Voβemer (2014) investigated the effect of transition between employment and unemployment. The result from this paper shows that moving to employment has led to improvements in psychological and physical health (Gebel & Voßemer, 2014). While this evidence is important, it does not specifically address the transition between informal and formal employment. To the best of the author's knowledge, there is not yet empirical evidence of the health effects of transition between formal and informal employment.

This paper addresses a gap in the literature by the following. The study compares informal versus formal employment and their health effects by looking at the transitions between formal and informal employment that individuals might experience during the period of observation.

Furthermore, the paper investigates two different health outcomes to obtain a more comprehensive understanding of the multidimensions of health, that is, overall health and mental health. Thus, the paper looks into four types of effect based on this explanation:

1) Impact of moving to formal employment on overall health
2) Impact of moving to informal employment on overall health
3) Impact of moving to formal employment on mental health
4) Impact of moving to formal employment on mental health

Analyzing both ways of transitions can be helpful in addressing the main research question to directly compare the health outcomes of moving into and out of informal employment. People transitioning from informal to formal employment could be different in characteristics to people moving in the opposite direction, thus analyzing the bidirectional transition can see how health effect may depend on the previous employment status.

2.2 Theoretical Framework

2.2.1 Theoretical Model

Job Demands-Resources (JDR) model categorizes job characteristics into two main components: job demands and job resources (Bakker & Demerouti, 2017; Brauchli et al., 2015). Job demands are defined as the physical, psychological, social or organizational aspects of a job that require sustained efforts. In contrast, job resources are aspects of a job that help achieve work goals, reduce job demands, and promote growth and development. There is a need to balance the demands and resources. If there is imbalance, it leads to physical and psychological strain, hence, decreased health and lower well-being.

This model provide support to the main research question addressed in this study as the balance between job demands and resources is crucial in understanding how informal employment affects health. In many informal work settings, it often involves physically demanding tasks, irregular working hours and precarious working conditions, which can be seen as the job demands. Informal employment might also come with higher flexibility and autonomy, but often comes with little to no employment benefits, which are seen as the job resources. It is expected that most informal work settings lack the balance between these job demands and resources which heightens the risk of poor health even more if compared to formal sector workers.

2.2.2 Mechanism

Factors such as working conditions, work characteristics, job satisfaction, social support, job security and health behaviors influences the health outcomes of individuals. Traditionally, stable and secure employment condition has been associated with positive health outcomes, as individuals are offered various benefits and job protections under a legal and bounded working arrangements including access to healthcare coverage, paid leave, job security, and decent working conditions.

However, informal employment presents a different reality. Informal employment operates outside of the labor regulation hence, they often lack the protections of formal employment. Individuals engaging in the informal sector experience job insecurity, limited access to social protections, and income instability. As a result, individuals in informal employment are at a higher risk of poor health outcomes.

Informal employment affects health in several ways, as explained by Benach et al. (2014). First, job insecurity and poor working conditions often come with informal employment, leading to high levels of stress and psychological strain, reducing the overall well-being of the workers. Second, adverse working conditions are commonly found in informal employment, such as physically demanding tasks, exposure to toxicity, and high work intensity, can increase the risk of occupational hazard, leading to higher risk of physical injuries and illnesses. This worsens the physical health of those in the informal sector (Benach et al., 2014).

The framework provided by Benach et al. (2014) relates to the JDR model as aforementioned. As informal employment often involves physically demanding task, most of these jobs are done without adequate support leading to increased stress and physical strain due to the high job demands but not balanced with adequate job resources.

2.3 Hypothesis

The first hypothesis will be addressed to confirm the main research question and the general topic of the study concerning the effect of informal employment on health. The hypothesis is the following:

HYPOTHESIS 1: Informal workers experience worse health outcomes compared to formal workers.

This is done by observing individuals who transition between formal and informal employment to compare the health outcomes pre- and post-transition. By doing so, it attempts to isolate the effect of informal employment on health outcomes and determine whether transitioning leads to worsen health outcomes compared to individuals who stay.

As mentioned, the health effects of informal employment may differ depending on characteristics such as gender and place of residence (Alfers & Rogan, 2015; Giatti et al., 2008; Ludermir & Lewis, 2005). The findings on these paper mentions that: (1) females are usually at a disadvantaged working in informal employment and (2) rural residents are limited in terms of the benefits received in their employment. Based on these, the second and third hypothesis are:

HYPOTHESIS 2: Female informal workers experience worse health outcomes compared to male informal workers.

HYPOTHESIS 3: Informal workers residing in rural areas experience worse health outcomes compared to informal workers living in urban areas.

3. Data Collection

3.1 Data

This study uses data from the Indonesian Family Life Survey (IFLS), an ongoing longitudinal survey that covers a wide scope of individuals and households in Indonesia. The IFLS data contains over 30,000 individuals living in 13 of the 27 provinces in the country (RAND, n.d.). Currently, IFLS is the only publicly available population-representative survey in Indonesia with multiple waves of data and detailed follow-up, with five waves of the IFLS.

IFLS collected comprehensive health data, including self-reported health, morbidity, mental health, and physical assessment of health (RAND, n.d.), in which this paper will measure two health outcomes: overall self-reported health and mental health. While overall health provides a broader aspect of health and covers various dimensions of health, including physical and mental health (Idler & Kasp, 1991), mental health specifically refers to the psychological and emotional aspect of well-being. By analyzing these health measure separately, the analysis aims to provide a more rounded up picture of health effects of informal employment.

Overall self-reported health and mental health were analyzed separately due to the data limitations in the IFLS dataset. Overall health questions are available throughout IFLS2 (1998) until IFLS5 (2014), whereas mental health data were introduced only after IFLS3 (2000) (Frankenberg & Thomas, 2000; Strauss et al., 2004, 2016; Strauss & Wattie, 2009). Note that there is a seven-year gap between IFLS3, IFLS4, and IFLS5, whereas the interval between IFLS2 and IFLS3 is three years. Both datasets are treated as panel data.

To ensure the reliability and validity of the findings, the sample focused on the Indonesia's working age population, aged 15-64 years old. Individuals who participated in all rounds of the IFLS survey were not retained due to the small sample size, hence, the dataset included only individuals who participated in at least two rounds of IFLS survey. Setting the threshold to keep at least two rounds of IFLS survey allows to capture changes over time in health outcomes and employment status, allowing for a more dynamic analysis.

3.2 Variables

3.2.1 Outcome Variables

The research question that this paper will try to answer is the impact of informal employment on two measures of health outcome, that is self-reported general health and mental health score. Hence, these two health outcomes are the main outcome variables used in the study.

The first health outcome measured is overall self-reported health. Data from IFLS2 until IFLS5 are utilized to measure this. Overall health in this paper is taken from the self-reported health questionnaire from Book 3A Section KK, available in all four waves of the IFLS dataset. The survey question asked, "In general, how is your health?" The items were coded as follows: 1 = very unhealthy, 2 = somewhat unhealthy, 3 = somewhat healthy, and 4 = very healthy. Scores are then computed. Higher scores indicate that individuals are healthier or at better health conditions.

Overall health measures provide an overall assessment of health status. Providing a separate analysis for mental health offers a focused perspective on the impact of informal employment on health outcomes, as it focuses on one specific aspect of health rather than the overall health impact. Mental health effects in the IFLS data are measured using the 10 items of the Center of Epidemiological Studies Depression (CESD-10) indicator from Book 3A, Section KP, taken from IFLS3 until IFLS5. The questionnaire contains eight negative experience items (e.g., I feel depressed, I felt fearful) and two positive experience items (e.g., I was happy, I felt hopeful about the future). Responses are rated on a four-point scale. Negative experiences are coded as: 0 = rarely or none, 1 = some days, 2 = occasionally, 3 = most of the time and positive experiences are reversed coded. The CES-D score ranges between 0 and 30, with higher scores indicating poorer mental health or higher levels of depression (Andresen et al., 1994; Radloff, 1977).

To ensure comparability across all waves, both health scores are standardized for each wave. The standardized health measures are the health measure used for this analysis.

3.2.1 Dependent Variables

While the study focuses on informal employment, the estimation method of this paper primarily focuses on the transitions between different employment conditions to understand the impact on the outcomes observed.

The IFLS contains information on the type of work for individuals through two different sources: occupation classification code and list of daily primary duties. The analysis in this paper follows the former type of classification, which is also done on another IFLS studies focusing on employment (Rizky et al., 2020). This classification makes the use of occupation classification code suitable as a benchmark definition of employment sector as data is consistently collected across the waves. The occupation classification code consists of (1) self-employed, (2) self-employed with unpaid family worker/temporary worker, (3) self-employed with permanent worker, (4) government worker, (5) private worker, (6) casual worker in agriculture, (7) casual worker not in agriculture, and (8) unpaid family worker. Categories 1, 2, 3, 6, 7, and 8 are classified into informal sectors while categories 5 and 6 are defined as the formal sector. The same classification is also used by the Central Bureau Statistics of Indonesia (Badan Pusat Statistik, 2018).

As mentioned, the study focuses on employment transitions, which are:

(1) Individuals switching from informal employment to formal employment.
(2) Individuals switching from formal employment to informal employment.

Individuals who experience the transition are defined as “switchers” whereas those who remain in their initial employment sector are “stayers”. The analysis considers two directions of transition to consider both the positive and negative health effects of employment transition. Here, the analysis follows individuals during their first year of transition and its subsequent years. Therefore, the analysis here captures both initial year and the continued state of employment in the following years – which helps to analyze the health effects in the longer run. The dependent variable takes on a dummy variable equating to one if individuals experience employment transition and zero otherwise. Once individual has transitioned, the dummy variable will always be equal to one for the initial year and its subsequent years.

3.2.2 Control Variables

The research includes control variables at individual level consisting of various socio-demographic factors that affect both employment conditions and health outcomes in the models.

Individual and year fixed effects are included as a covariate to control for unobserved time-invariant characteristics and unobserved factors that vary across time but constant across

individuals during the period observed. Given these fixed effects, potential control variables such as gender and age are already absorbed by the fixed effects – hence, not needing to be included as a separate covariate in the model.

The control variables that are included in the analysis are marital status, years of education and place of residence. Marital status and place of residence could be classified as time-invariant variables, but given the data at hand and period observed, individuals had experienced a change in their marital status and place of residence during the period observed – so these variables are included in the analysis. Work-related characteristics such as working hours, industry, and income are also excluded in the analysis as these are potential bad controls, implying that these variables are most likely to change as a result of employment transitions. Moving to either formal or informal employment would experience changes in the working hours, income, as well as industry they are working in. Including these variables would lead to a biased estimate of the treatment effect as the health effects measured would be confounded by these variables.

3.3 Summary Statistics

Table 1 and 2 present the summary statistics for individuals in different employment transition groups. At baseline, there are some significant differences in characteristics for switchers and stayers for both types of employment transitions.

Table 1 presents samples for the overall self-reported health measure. Similar health scores are reported among those who switched to formal employment and remain in informal employment. Some differences are also reported for other characteristics. Higher educational attainment (6.51 years), population of urban residents (54%), and older people (47.88 years) are more likely to transition to formal employment compared to individuals remaining in informal sector. Meanwhile, individuals who move to informal sector have lower health scores compared. Among those remaining in formal employment, they reported higher educational attainment (10.05 years) and urban residents (70%) compared to switchers. Table 2 focuses on mental health measures. It is reported that individuals who moves either to formal or informal employment reports higher average mental health scores compared to stayers. Those who move to formal employment report an average mental health score of 5.43 compared to those staying in informal employment, 3.64. Meanwhile, individuals who move to informal employment reported an average score of 5.13 compared to the stayers, which have an average mental health

score of 3.34. Similarly, higher percentage of married individuals, education years, and urban residents are reported among switchers for both moving to formal and informal employment.

Table 1. Summary Statistics for Self-Reported Health Measure

	Move to Formal Sector		Stay in Informal Sector		Move to Informal Sector		Stay in Formal Sector	
Variable	N	Mean	N	Mean	N	Mean	N	Mean
Health	975	2.94	10,427	2.94	2,355	2.95	5,763	2.98
Health (std)	975	0.65	10,427	0.65	2,355	0.65	5,763	0.66
Age	975	47.88	10,427	46.15	2,355	48.08	5,763	41.32
Female	975	0.30	10,427	0.40	2,355	0.26	5,763	0.34
Married	975	0.84	10,427	0.85	2,355	0.87	5,763	0.84
Education Years	975	6.51	10,427	5.33	2,355	6.07	5,763	10.05
Urban	975	0.54	10,427	0.36	2,355	0.54	5,763	0.70

Table 2. Summary Statistics for Mental Health Measure

	Move to Formal Sector		Stay in Informal Sector		Move to Informal Sector		Stay in Formal Sector	
Variable	N	Mean	N	Mean	N	Mean	N	Mean
Mental Health	762	5.43	8,770	3.64	2,094	5.13	5,163	3.34
Mental Health (std)	762	0.18	8,770	0.12	2,094	0.17	5,163	0.11
Age	796	46.85	8,854	44.99	2,145	47.70	5,240	40.25
Female	796	0.30	8,854	0.38	2,145	0.25	5,240	0.34
Married	796	0.84	8,854	0.85	2,145	0.88	5,240	0.84
Education Years	796	7.59	8,854	5.76	2,145	6.35	5,240	10.45
Urban	796	0.59	8,854	0.37	2,145	0.55	5,240	0.71

4. Empirical Strategy

4.1 Research Design

The paper uses a Difference-in-Difference (DiD) approach. This approach is deemed most suitable to use in this analysis as it focuses on individuals who experience the sector switch – that is, individuals moving between formal and informal employment. By doing so, this approach allows for a direct observation to how these transitions impact health outcomes and capture the dynamic changes in health outcomes due to changes in employment of individuals.

The paper uses two different datasets to measure (1) overall health outcomes and (2) mental health outcomes. The treatment that the paper analyze will be the employment transitions, which are:

(1) Impact of moving from informal to formal employment on overall health
(2) Impact of moving from formal to informal employment on overall health
(3) Impact of moving from informal to formal employment on mental health
(4) Impact of moving from formal to informal employment on mental health.

The DiD approach compares the changes in health outcomes between individuals who experience a transition ("switchers") and those who do not experience a transition ("stayers"). The treatment group includes switchers who continue to experience the transition after the initial year. This research design allows for comparison of changes in health outcomes between switchers and stayers in long-term.

4.2 Estimation Method

The aim of this paper is to address the effects of informal employment on health by exploiting employment transitions between formal and informal employment. A simple multilinear regression may result in several endogeneity concerns, and therefore, might not provide a correct causal interpretation. To reduce endogeneity problems, a two-way fixed effect (TWFE) model is used.

To estimate the overall health outcome, the TWFE specification are as follows:

(1) $Health_{i,t} = \alpha + \beta_1 Transition\ to\ Formal_{i,t} + \gamma X_{i,t} + \lambda_t + \delta_i + \epsilon_{it}$

(2) $Health_{i,t} = \alpha + \beta_2 Transition\ to\ Informal_{i,t} + \gamma X_{i,t} + \lambda_t + \delta_i + \epsilon_{it}$

Meanwhile, to estimate the mental health outcome, the TWFE specification are as follows:

(3) $Mental\ Health_{i,t} = \alpha + \beta_1 Transition\ to\ Formal_{i,t} + \gamma X_{i,t} + \lambda_t + \delta_i + \epsilon_{it}$

(4) $Mental\ Health_{i,t} = \alpha + \beta_2 Transition\ to\ Informal_{i,t} + \gamma X_{i,t} + \lambda_t + \delta_i + \epsilon_{it}$

where:

- $Health_{i,t}$ and $Mental\ Health_{i,t}$ are the health outcomes measured for individual *i* in year *t.*
- $Transition\ to\ Formal_{i,t}$ is a dummy variable that equals to 1 if individual *i* transitions from informal to formal employment in year *t* or any prior year, and 0 otherwise.
- $Transition\ to\ Informal_{i,t}$ is a dummy variable that equals to 1 if individual *i* transitions from formal to informal employment in year *t* or any prior year, and 0 otherwise.
- $X_{i,t}$ is a vector of control variables
- λ_t are the year fixed effects
- δ_i is the individual fixed effect
- ϵ_{it} represents the error term.

The coefficient of interest in the estimation strategy are β_1 and β_2, which identifies the average treatment effect on the treated (ATT) of the transition to formal or transition to informal employment on overall health and mental health. Furthermore, under TWFE, there is an assumption that without any changes in health, the health outcomes of individuals who stay in either formal or informal employment would have followed the similar trends over time (parallel trend assumption). This assumption will be further analyzed in the following section.

In equations (1) and (3), the regression is run on individuals initially in the informal sector, whereas in equation (2) and (4) the regression is run on individuals initially in the formal sector as this equation analyzes the transition.

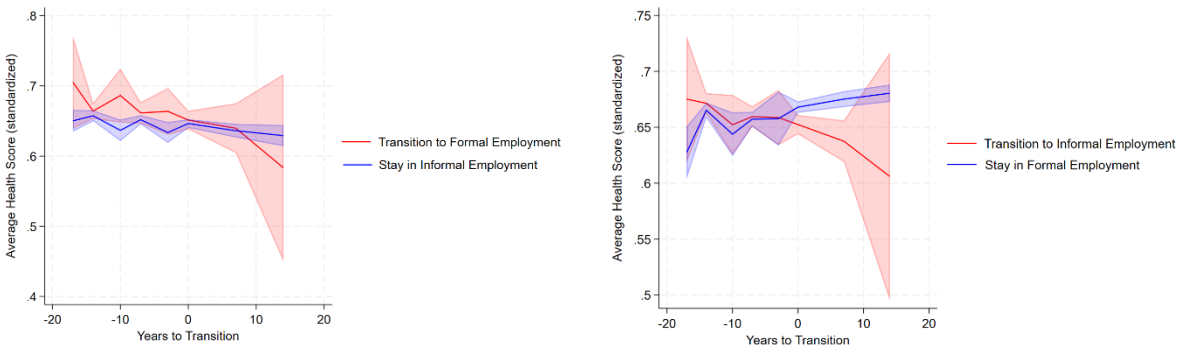
By analyzing this transition, the TWFE model allows for direct observation of how changes in employment status impact both overall health and mental health. This estimation method controls for both individual-specific and time-specific unobserved heterogeneity through individual and time fixed effects. Due to the nature of the estimation method, time-invariant variables such as gender are absorbed by the fixed effects, hence, are not explicitly included in

the regression output done in the following section (Chapter 5). This is essential to attempt to isolate the causal impact of employment transitions on health outcomes.

4.3 Identification Assumption

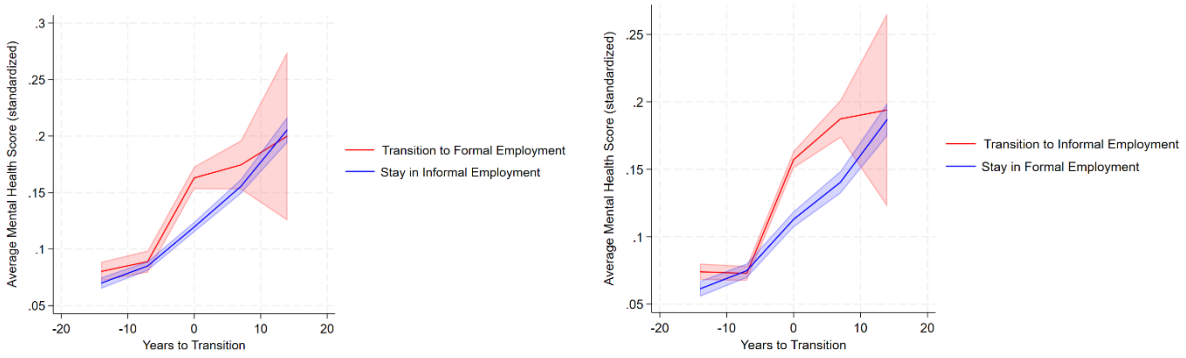
A significant concern is on how changes in health status can influence individuals' decision to transition between formal and informal employment. This concern suggests that the health changes leading to the transition should be independent of the factors related to the employment status itself. For instance, if deteriorating health is driven by factors associated with the working environment of a specific employment such as stress levels or physical strain, then it could bias the interpretation of the health outcomes. Understanding whether health outcomes observed are directly influenced by job types or by the underlying changes in health is crucial.

Thus, it is important to ensure that the observed health effects are exogenous to the employment transition – implying that health changes leading to the transition should be independent factors related to the employment. One way of mitigating this concern is checking the validity of the Parallel Trend Assumption (PTA) to ensure that any observed differences in health outcomes are exogenous and not because of other underlying factors. The aim of PTA is to see that in the absence of the employment transition, the health status of the treatment group (switchers) and the control group (stayers) would follow similar trend pre-transition. This is done by plotting the average health scores over time for switchers and stayers and comparing the trends in health outcomes for both groups. By plotting the average health scores, it can be inferred whether the health scores for both groups are similar or diverge significantly. If this assumption is fulfilled, it would suggest that the changes in health outcomes observed are due to the transition itself, rather than the pre-existing change. The graphs are presented in Figure 1 and 2 below.



Panel A. Moving to Formal Employment Panel B. Moving to Informal Employment

Figure 1. Pre-Transition Health Trend for Overall Health Outcomes



Panel A. Moving to Formal Employment Panel B. Moving to Informal Employment

Figure 2. Pre-Transition Health Trend for Mental Health Outcomes

To look into details, in figure 1 panel A, there appears to be a decline in health scores in the years leading up to the transition. In panel B, there is no clear trend of improvements or decline in health prior to the transition. The unclear trend pre-transition makes it challenging to establish the parallel trend assumption, despite the overall trend in Figure 1 showing that there is no significant difference in overall health between switchers and stayers.

Following the transition period (post t=0), the treated and control groups exhibited divergent patterns in overall health outcomes. Those who remained in formal employment (Figure 1 Panel B) exhibited an improvement in overall health. This contrasts with those who remained in informal employment (Figure 1 Panel A), where individuals experienced a slight decline in their overall health. However, based on the confidence intervals, there is no significant difference in the overall health outcomes between treated and control groups post-transition (Figure 1 Panel A and B) as seen from the overlapping confidence intervals. This indicate that the differences in overall health outcome post-transition are not statistically significant and that the transition most likely has had minimal impact on the health outcomes of the switchers compared to stayers.

On the other hand, despite the parallelism shown in the mental health trend, the confidence intervals shown in Figure 2 are not perfectly parallel and do not overlap between switchers and stayers across all types of employment transitions observed. This would indicate that there is a pre-transition difference in mental health between switchers and stayers. It would be difficult to say that the parallel trend assumption does hold. The difference between switchers and

stayers prior to the transition have shown that the groups are not comparable with each other, violating the assumption.

The upward trend in Figure 2 shows that both switchers and stayers across all types of employment transition shows worse well-being, but those who transition appears to increase at a faster rate than the stayers. Mental health exhibited an upward trajectory for both treated and control groups across both employment transitions. It seems counterintuitive that there is an upward trend for both groups, as it is expected that switchers and stayers will follow different trend. This could be due to data issues. Appendix B provide data regarding this increase in mental health scores. An increase in mental health scores mean that there is worsening depression based on the CESD-10 scores indication. Over time, the mental health scores increase for all individuals in the dataset, which would mean that individuals reported higher prevalence of depression as time goes by. As illustrated in Figure 2, both individuals who transitioned and remained in their respective sectors shows a deterioration in mental health. The confidence interval also does not overlap between the switchers and stayers across both types of transition immediately after the transition. However, despite the initial divergence in trend between the two groups, the average mental health scores eventually converged over time (Figure 2 Panel A and B). This would mean that upon the transition, there are significant difference in mental health outcomes between switchers and stayers across both types of transition. The convergence in mental health scores over time suggest that the difference diminish and stabilizes in the long run. Putting this convergence into context, initially, transitions can lead to significant changes in individuals' health – hence, why the health effects observed might be more pronounced. Over time, switchers would adapt and adjust to their new working conditions so the differences in mental health for switchers and stayers are less pronounced.

5. Results and Discussions

5.1 Baseline Estimates of Employment Transition on Health Outcomes

Table 1 contains the first set of results on the impact of employment transition on health outcome. This is the simplest specification as it does not include any other control variables or other fixed effects. Table 2 introduced a set of control variables and the individual and year fixed effects. Column 1 and 2 shows overall health effects, while column 3 and 4 presents mental health effects of employment transition. The estimations are calculated based on all individuals who were initially in either formal or informal employment.

Table 1. Simple Regression of Employment Transition on Self-Reported and Mental Health

	Dependent Variables			
	Overall Health (1)	Overall Health (2)	Mental Health (3)	Mental Health (4)
Moving to Formal Employment	0.0014631 (0.006)		0.0420965 (0.005) ***	
Moving to Informal Employment		-0.011721 (0.004) ***		0.00456302 (0.0036) ***
Observations	12,301	10,256	10,299	9,156
R^2	0.0000	0.0008	0.0052	0.0167

Note: Standard errors are reported in parentheses. *** Significant at 1%, ** Significant at 5%, and * Significant at 1%.

Without controlling for any other covariates, the effect size of moving to formal employment on overall health and mental health is 0.00014 and 0.0420965 standard deviation units respectively (column 1 and 3). Conversely, moving to informal employment is associated with a decline in overall health and deteriorating mental health with a coefficient of -0.011721 and 0.0046 standard deviation units. Of course, the coefficients cannot be meaningfully interpreted since the dummy variable moving to formal employment and moving to informal employment are endogenous and may be correlated with other characteristics associated with overall health and mental health.

Table 2 included a number of control variables such as marital status, education years, and place of residence. The regression also used individual and year fixed effects. The reported effect size of moving to formal employment is 0.0068 standard deviation units. This indicate that ceteris paribus, on average, moving to formal employment leads to an improvement in overall health by around 0.7% of a standard deviation (column 1). Column 3 estimates the mental health effects of moving to formal employment and found that the coefficient for mental health is -0.0019 standard deviation units. Ceteris paribus, moving to formal employment on average declines the mental health scores by 0.19% of a standard deviation. Given that higher scores of mental health shows worsening mental health or increased depression based on the mental health measure used in this study, this would mean that moving to formal employment would improve mental health. The effect is quite relevant, given that the average standardized health score among those that move to formal employment is 0.65, while the average standardized mental health score is 0.18. However, estimated coefficients in the regression are not statistically significant.

Column 2 and 4 re-estimates the equation but using moving to informal employment as the dummy dependent variables. In column 2, the reported overall health coefficient is -0.01 standard deviation units, meaning that on average, moving to informal employment leads to decline in health by 1% of a standard deviation. Similarly, in column 4, the estimated coefficient on mental health is 0.008 standard deviation units, meaning that on average, moving to informal employment reduces well-being by 0.8% of a standard deviation. Again, the estimated coefficients are presented above are not statistically significant.

The finding suggests that there might be a positive effect of moving to formal employment on health outcomes in Indonesia, and a negative effect is observed when moving to informal employment. This provide some indication that informal employment declines health, which aligns with what is evidenced from the existing strand of literature (Hurtado et al., 2017; López-Ruiz et al., 2015b; Rodriguez-Loureiro et al., 2020). Benefits associated with formal employment becomes evident when individuals make the transition to formal employment, as formal employment provide greater job security and employment benefits that is not available with the informal sector. As individuals receive these employment benefits within the formal sector, it directly translates to the improved health outcomes of the individuals – which is something that these informal sector workers might not have had or experienced prior to the transition. The same thing can be said regarding individuals making the opposite transition to

informal employment. As individuals move to informal sector, they might lose these benefits associated with formal employment, hence, worsening their health.

Contextualizing these findings to Indonesia context, informal employment is usually characterized by physically demanding labor with many working in the construction, fishing, and agriculture sectors (Cuevas et al., 2007; Rothenberg et al., 2016). This induces a physical strain on individuals which can negatively impact health especially as informal sectors are not protected by many employment benefits that formal workers would get – thus, it is expected that moving to formal employment is often beneficial for them because of the reduced physical strain. Formal employment often involves less physically demanding tasks and better working conditions compared to informal sectors as it is more regulated, which in turn, gives these workers further protection and benefits in their jobs such as access to healthcare – further improving their overall health.

While the finding provides some indication that informal employment leads to poor health and well-being, the coefficient should be interpreted with caution. It is important to note that the observed health effects do not significantly change in response to any of the employment transitions. In all cases, the estimated coefficients have a small effect as a result from employment transitions, indicating a weak health effect. The small effect sizes would suggest that the effects of transitions on health is minimal. The coefficients are also not statistically significant at all levels. This applies to both health outcomes measured (overall health and mental health). With regards to the overall health, the observed effect is not strong enough to establish causality in the relationship between informal employment and overall health. Regardless of the PTA being fulfilled, the lack of statistical significance makes the finding not robust to provide conclusive evidence.

Similarly, mental health has a minimal and statistically insignificant impact from the transition. Prior to the transition, switchers and stayers are already different in characteristics which undermines the validity of using the two-way fixed effect (figure 2). Without the PTA being fulfilled, the regression estimates cannot be relied on to make any causal inferences. In addition, the lack of statistical significance in the regression estimate suggests that the differences observed could be due to random variation. This provide further evidence there is a very weak effect of moving to informal employment on mental health.

Whilst there is slight indication that informal employment leads to poorer health outcomes based on regressions on table 2, there is an insignificant and a small effect. Given this, the study

provides no meaningful effect of employment transition on health. It is most likely that the estimation above could be biased as figures 1 and 2 also underpins the validity of the PTA. Based on this, the study was unable to confirm the first hypothesis "informal workers experience worse health outcomes compared to formal workers"

Table 2. Employment Transition on Self-Reported and Mental Health

	Dependent Variables			
	Overall Health (1)	Overall Health (2)	Mental Health (3)	Mental Health (4)
Moving to Formal Employment	0.0068532 (0.008)		-0.0019946 (0.0076)	
Moving to Informal Employment		-0.0100693 (0.0064)		0.0083551 (0.0054)
Married	0.0215728 (0.008) ***	0.0073844 (0.0078)	-0.0126618 (0.007) **	-0.0032621 (0.006)
Education Years	0.000085 (0.002)	-0.000697 (0.0017)	-0.0008174 (0.0015)	-0.0007876 (0.002)
Urban	0.0166309 (0.008) ***	0.0034937 (0.008)	-0.0018945 (0.007)	0.0079984 (0.007)
Constant	0.6214024 (0.0116) ***	0.659244 (0.0164) ***	0.1597663 (0.011) ***	0.1401834 (0.016) ***
Year Fixed Effects	Yes	Yes	Yes	Yes
Individual Fixed Effects	Yes	Yes	Yes	Yes
Observations	12,290	10,250	10,217	9,069
R^2	0.5101	0.4982	0.5782	0.5821

Note: All regressions include control variables mentioned prior. Standard errors are reported in parentheses. *** Significant at 1%, ** Significant at 5%, and * Significant at 1%.

5.2 Heterogeneity Analysis

The effects of employment transitions between formal and informal employment may be heterogenous along the dimensions of gender and place of residence. Thus, heterogeneity analysis is conducted by running separate regressions based on the two dimensions. Appendix B presents the regression result for the analysis, whereas figures 3 and 4 provides the graphical interpretation of the analysis.

In all cases, the health effects of moving to formal employment is strongest for males. Based on the estimates reported in the table, moving to formal employment for males improves overall health by 0.8% compared to females, with improvements in overall health by only 0.09% of a standard deviation (Appendix A1). The same thing can be inferred that mental health effects of moving to formal employment is also strongest for males compared to females. Females experience worse well-being when moving to formal employment, with increased depression by 0.09% of a standard deviation, whilst males experience improve well-being by 0.5% of a standard deviation. On the other hand, moving to informal employment decreases overall health for both males and females. Males experience worse overall health, as moving to informal employment decreases health by 1.1% standard deviation units, whereas females experience worse overall health of around 0.7% of a standard deviation. Similarly, the mental health effect of moving to informal employment is worse for males than females. The reported effect size is 0.0072603 standard deviation units, indicating that when moving to informal employment, males experience increased depression by 0.7% of a standard deviation whilst females reported a 0.4% of a standard deviation increase in depression.

The scope of our finding would suggest that there is some slight indication that females tend to be at a disadvantaged based on the regression result. However, the study found no statistically significant difference in health outcomes between males and females when they transition to either formal or informal employment. This is not enough to prove that there is heterogeneous effect in health outcomes in terms of gender. Furthermore, the left-hand side of figures 3 and 4 shows the confidence intervals of health effects by gender. In all figures, there is a wide and overlapping confidence intervals indicating that there is no statistically significant difference in both overall and mental health between genders when moving to formal and informal employment.

In Appendix A2, another dimension of heterogeneity in impact is explored, that is, place of residence. For urban residents, moving to formal employment improves health and well-being

by 3.2% and 1.2% of a standard deviation respectively (column 1 and 3). Only the overall health effect is statistically significant. Intuitively, moving to informal employment would provide the opposite effect. Column 2 and 4 shows that moving to informal employment worsens health by 0.9% of a standard deviation and increased depression by 1.2% of a standard deviation, but the effects are not statistically significant. For rural residents, moving to formal employment worsens health outcome. There is a decline in overall health by 0.8% and increased depression by 0.5% of a standard deviation (column 1 and 3). Similarly, moving to informal employment also declines health outcomes for rural residents. These effects, again, are not statistically significant.

There is a statistically significant improvement in overall health for urban residents moving to formal employment, suggesting that formal employment in urban areas is beneficial for overall health. The effect is statistically significant at 1% significance level. Given the findings, it would be intuitive to expect that there is negative health and well-being effect of moving to informal employment for urban residents. However, the study does not find statistically significant result to support this. In all the other cases, whilst there are changes in health and well-being when moving to formal and informal employment, the effects are small and not statistically significant.

The right-hand side of figures 3 and 4 shows wide confidence intervals and overlapping ones between urban and rural residents indicating that there is no difference in health outcomes based on place of residence. Despite finding a statistically significant overall health effects for urban residents moving to formal employment, it is still important to contextualize the findings. The significant positive effect for urban residents in formal employment might suggest that increasing formality is beneficial for them. However, when being compared to rural residents, the wide confidence intervals (top left of figure 3) shows that there is lack of clear differences in health effects between rural and urban residents.

This study found that there is no difference in health outcomes between males and females, as well as between urban and rural residents. In all cases, these effects are not statistically significance. The lack of statistical significance in the average effect itself are also making it challenging to determine whether there are heterogenous effects in terms of health outcomes between the different groups. Given this, the study does not provide strong evidence of differences in health effects. Therefore, the second hypothesis that “female informal workers experience worse health outcomes compared to male informal workers” cannot be accepted.

Similarly, the third hypothesis, "informal workers residing in rural areas experience worse health outcomes compared to informal workers living in urban areas" also cannot be accepted.

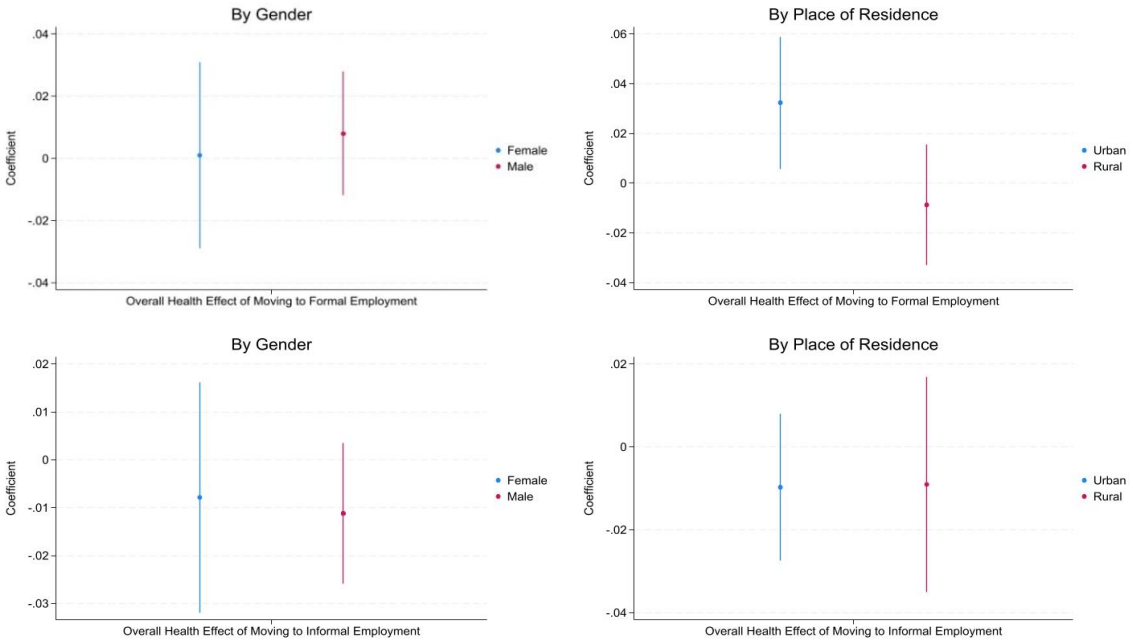


Figure 3. Heterogenous Analysis of Overall Health Effect

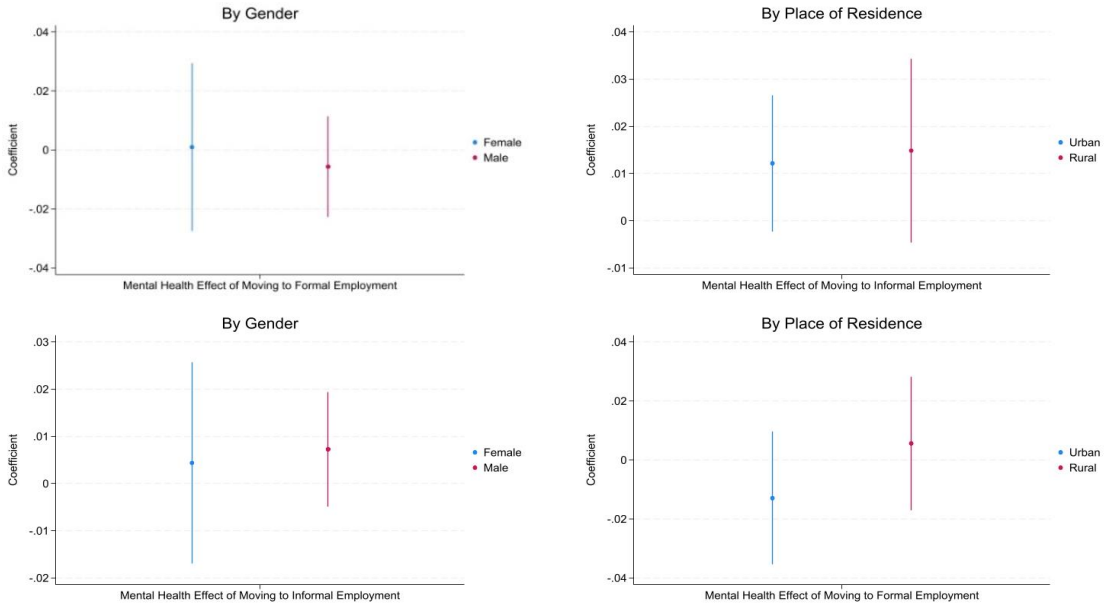


Figure 4. Heterogenous Mental Health Effect

6. Conclusion

6.1 Conclusion

Informal employment comprises a large part of the labor force in many LMICs. Existing empirical evidence on informal employment and health have indicated an association between informal employment and poor health outcomes (Alfers & Rogan, 2015; Giatti et al., 2008; López-Ruiz et al., 2015a; Ludermir & Lewis, 2003; Rodriguez-Loureiro et al., 2020; Ruiz et al., 2017; Sales & Santana, 2003).

This paper has explored the effects of informal employment, and, in particular, the effects of employment transitions between formal and informal sector, on two health outcomes – overall health and well-being, measured by CESD-10 score. The employment transition is used as a natural experiment to understand how informal employment affects health. This is done using a two-way fixed effect.

There are two main findings to this study. First, there is no effect of employment transitions on health outcomes, both overall and mental health. Despite some indications that transitions from informal to formal employment improves health and well-being while the opposite is observed when workers move from formal to informal employment, this effect, despite small, is not statistically significant to conclude that informal employment leads to poor health. The paper was unable to confirm the first hypothesis because of this. Second, there is no differences in health effects between males and females, and urban and rural residents. Again, the coefficients are not statistically significant. Urban residents benefit significantly from formal employment but shows no difference when being compared to rural residents. This makes it difficult to accept the second and third hypothesis as well.

To conclude, in all cases, the findings point out the weak effect between informal employment and health outcomes (for both overall and mental health) as well as the lack of statistical significance in the results. Regardless, there are still some indications that informal employment would negatively affect health and well-being of the informal sector works.

This provides some important policy implications. As informal employment is still dominating the Indonesian labor force, informal workers are not part of the social protection schemes and not covered by health insurance. Despite the attempts to include them into various government social protection program, as informal sectors are not regulated and protected, this makes it

difficult to calculate exactly how many of the Indonesian population are absorbed in the informal sector (Maloney, 2004; Rothenberg et al., 2016; The Conversation, 2024). Efforts should include engaging with these communities in all areas to map the number of informal workers in each area so that social protections and health insurance can be given to these workers. By doing so, government can also help identify specific health needs and disseminate information on health insurance and available health services for the informal workers so they can also be informed and be offered these benefits and services. In Indonesia, one of the reasons why informal sector workers are still engaged in informal sectors are because of the difficult bureaucracy to formalize or even register to a health insurance. Simplifying the registration process can also help for these informal workers be informed and receive social security.

6.2 Limitations and Further Research

The results from this study are subject to limitations. First, the health outcome measured are mainly self-reported health measures for both overall and mental health, as data are taken from the IFLS. The IFLS are survey data for individuals, households, and communities in Indonesia and could be subject to biasedness as individuals could underestimate or overestimate their health. For instance, if individuals underestimate their perceived health, then the health effects observed might be understated and show an overly pessimistic view of the informal sectors' workers, leading to a misinformed conclusion and policy implications. Further research direction can use a precise and accurate measurement of health outcomes, by using medical records or physical examinations to reduce the possibility of this measurement error.

Furthermore, there could still be potential omitted variable in the study that was not included in the model that can bias the results. The model might exclude important variables that could potentially impact both health outcomes and the dependent variable, that is the transitioning to either formal or informal employment. Further research could include additional variables such as health behaviors like smoking and alcohol consumption. These data were available in the IFLS but only in the most recent survey years. As this study uses IFLS 2 until IFLS 5, it was not possible to include these variables in the model.

In addition, potential areas for further research not only include using a more reliable health measure and including other covariates but also could include sector-specific analysis. By analyzing how health impacts would vary across different sectors such as agriculture, manufacturing, or construction sectors, it could provide a comprehensive framework regarding

how informal employment affects different sectors as these sectors have its own specific characteristics that differs between industries even when they are categorized under informal employment.

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Appendix A: Heterogenous Effect

Table A1. Health Effect of Employment Transition by Gender

Variables	Dependent Variables			
	Overall Health (1)	Overall Health (2)	Mental Health (3)	Mental Health (4)
If Female				
Moving to Formal Employment	0.0009898		0.0009735	
	(0.015)		(0.014)	
Observations	*4,717*		*3,828*	
R2	*0.5333*		*0.5790*	
Moving to Informal Employment		-0.0078403		0.0043704
		(0.012)		(0.0108)
Observations		*3,156*		*2,773*
R2		*0.4936*		*0.5768*
If Male				
Moving to Formal Employment	0.0079438		-0.0056353	
	(0.01)		(0.0088)	
Observations	*7,571*		*6,387*	
R2	*0.4929*		*0.5765*	
Moving to Informal Employment		-0.011193		0.0072603
		(0.007)		(0.0062)
Observations		*7,090*		*6,291*
R2		*0.4990*		*0.5852*

Note: All regressions include control variables mentioned prior. Standard errors are reported in parentheses.

Table A2. Health Effect of Employment Transition by Place of Residence

Variables	Dependent Variables			
	Overall Health (1)	Overall Health (2)	Mental Health (3)	Mental Health (4)
If Urban				
Moving to Formal Employment	0.0323773 (0.014) ***		-0.0129134 (0.011)	
Observations	*3,956*		*3,393*	
R2	*0.5257*		*0.5931*	
Moving to Informal Employment		-0.0097304 (0.009)		0.012172 (0.0074)
Observations		*5,708*		*5,106*
R2		*0.5031*		*0.5984*
If Rural				
Moving to Formal Employment	-0.0086941 (0.012)		0.0056373 (0.5771)	
Observations	*7,136*		*5,677*	
R2	*0.5030*		*0.5771*	
Moving to Informal Employment		-0.0090527 (0.013)		0.0148762 (0.009)
Observations		*1,879*		*2,816*
R2		*0.5666*		*0.5588*

Note: All regressions include control variables mentioned prior. Standard errors are reported in parentheses.

Appendix B: Mental Health Scores Over Time

Table B1. Mental Health Score Over Time Among Workers Moving to Formal Employment and Staying in Informal Employment

Year	Mean	Min	Max
2000	2.119224	0	18
2007	3.350237	0	25
2014	6.063843	0	27

Table B2. Mental Health Score Over Time Among Workers Moving to Informal Employment and Staying in Formal Employment

Year	Mean	Min	Max
2000	2.030558	0	18
2007	2.939366	0	21
2014	5.823934	0	26