

Essays on Informality, Markups, and Resource Misallocation in Developing Country

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I want to take a moment to express my heartfelt gratitude to my amazing wife, Lolita Moorena, our four wonderful kids—Keysa, Aufa, Ezza, and Athan—as well as our loving parents, families, and the incredible friends who are such an important part of our lives.

Disclaimer

I hereby declare that the research presented in this thesis has been conducted solely by myself, except where otherwise indicated within the text. This research was carried out between February 2021 and February 2025, during which I was enrolled as a PhD student at the Research School of Economics at the Australian National University. This thesis, in its entirety or in any portion, has not been submitted to this or any other university for the purpose of obtaining a degree.

A preliminary version of the first paper in Chapter Two has been disseminated and has garnered feedback at the Australasian Development Economics Workshop (ADEW 2023) held in Sydney. Likewise, an earlier iteration of the second paper has been circulated and has received feedback at the International Conference on Computing in Economics and Finance (CEF 2024) in Singapore, the Asian Economic Development Conference (AEDC 2024) in Seoul, and the Australasian Development Economics Workshop (ADEW 2024) in Melbourne. The third paper is currently in working paper format, with the intention of submission to an academic journal.

This thesis has been prepared as a Thesis by Compilation in compliance with the applicable policies of the Australian National University. I have made substantial contributions to each of these journal articles and have authored the text of the papers myself, with the exception of instances where indicated otherwise.



Fajar Oktiyo

19 February 2026

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Alhamdu lillaahi Robbil Aalameen

Abstract

This thesis encompasses three papers that examine the informality, markups, and the misallocation of resources in developing nation. The papers provide a more detailed analysis of the labour market in Indonesia and how the duality of the labour market, comprising both formal and informal sectors, experiences different earning shocks and contributes to inequality. Additionally, we assess the aggregate implications of capital and labour misallocations resulting from the limited job transition between different sectors within the labour market. Moreover, we discuss the misallocation that arises from the perspective of firms, attributed to the markup.

The first paper examines earnings dynamics and inequality in Indonesia characterised by fragmented labour markets and prevalent informality. Our analysis reveals an increasing disparity in earnings between the two sectors throughout the period of the study. Earnings growth for the informal sector has consistently lagged across all income groups. Additionally, transitions between the two sectors exhibit rigidity and asymmetry, with a negligible percentage of informal workers able to transition to the formal sector, thereby exacerbating persistent earnings inequality. Our findings also indicate that labour earnings tend to be less volatile in the formal sector; however, substantial downside risks remain. In contrast, informal workers encounter symmetric earnings risks and experience less severe shocks. The adjustments in the labour market activities of household members can partially mitigate earnings fluctuations, while private transfers within social networks can have a more pronounced effect.

The second paper studies the extent to which the existence of informality affects the allocation of labour and capital in Indonesia. We first document employment segregation and the degree of labour mobility in a highly persistent informal setting. We develop a heterogeneous agent general equilibrium model equipped with occupational choice features for the formal and informal sectors, where informality is an equilibrium outcome. We found that the existence of informality results in stifled output and is mainly contributed to by low labour mobilisation between employment sectors. Furthermore, low labour mobilisation goes hand in hand with low capital accumulation. When labour is mobilised to the formal sector, there will be more capital accumulation in the economy, and their impact on output will be magnified. Labour mobilisation affects inequality differently, depending on sector-specific shocks. If a trade-off exists, which refers to the balance between efficiency and equality, higher labour mobility will lower this trade-off.

The final paper explores the relationship between markup and misallocation and its implications for productivity, employment, and output in Indonesia. Using panel data from Indonesian manufacturing firms, we first identify significant correlations between markup, firm age, productivity, and size. Older firms, particularly foreign-owned, tend to exhibit higher markups, reflecting greater price-cost disparities. Similarly, high-

productivity firms, especially foreign entities, command higher markups, often linked to reduced net employment growth. We then investigate the underlying mechanisms through a theoretical model that combines imperfectly competitive product market competition with Schumpeterian growth dynamics. Our analysis reveals that the creative destruction channel plays a crucial role in shaping markup differences between foreign and domestic firms. A significantly lower entry rate for foreign firms leads to higher and more dispersed markups, exacerbating misallocation in total factor productivity (TFP) and reducing the labour share of income. Our simulations show that relaxing entry barriers for foreign firms can lower both average markups and their dispersion, reducing TFP misallocation and mitigating labour share losses. These effects are particularly pronounced when foreign firms operate across multiple markets rather than being restricted to a few.

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Introduction

Resource misallocation presents a significant issue that has garnered substantial attention in recent studies, aiding our understanding of certain aspects contributing to variations in living standards across countries. When resources are not allocated toward productive activities, it impedes aggregate productivity growth within the country. The differences in a country's capacity to manage its resources result in disparities in productivity and living standards between countries.

Developing countries encounter notably pronounced challenges in resource management owing to significant regulatory barriers and policy uncertainty. The distortions manifested in excessive bureaucracy, inadequate law enforcement, and poor policy implementation create disincentives for business growth and expansion ([Meyer and Peng \(2020\)](#)). Certain developing countries possess a distinctive characteristic that differentiates them from developed nations: a considerable share of informality in their labour markets. Workers within this informal sector often lack access to vital social security benefits, such as annual leave and paid sick leave, alongside lower earnings and erratic working hours, according to [ILO \(2002\)](#) and [ILO \(2013\)](#). Informality prevails and remains persistent in some countries for various reasons, including a scarcity of sufficient employment opportunities, a shift of the primary economic sectors away from labour-intensive industries, or economic shocks that compel workers to transition from formal employment to informal roles to smooth their consumption. The persistence of informality, characterised by low productivity, may result in the misallocation of resources as workers struggle to transition to more productive sectors due to existing distortions. Additionally, misallocation can be exacerbated by firms' behaviours in response to market competition. When a firm faces limited competition, it can elevate prices and create higher markups, consequently reducing demand for additional labour and capital needed for business expansion as they reap increased profits. The allocation of resources to less efficient firms ultimately impedes overall aggregate productivity.

This thesis consists of three papers that elaborate on the topics of informality, markups, and resource misallocation in Indonesia, a country characterised by widespread informality, which renders it a compelling subject of study. The first two papers (Chapters

2 and 3) provide an in-depth analysis of the labour market in Indonesia and assess the implications of prevalent informality on macroeconomic variables. The third paper (Chapter 4) delves further into markup formation and examines how this phenomenon contributes to misallocation, resulting in productivity losses and a diminished labour income share within the economy.

The first paper empirically investigates the dynamics of earnings and risks associated with two distinct sectors—the formal and informal sectors—and their contributions to economic inequality. This paper examines how earnings growth and inequality have evolved in Indonesia, and what role differences between formal and informal sectors play in shaping these trends. We analyse how the labour mobility between formal and informal sectors influences earnings dynamics and inequality. Initially, we document trends in income growth and inequality. Subsequently, we analyse sectoral transitions between the formal and informal sectors and their implications for earnings inequality. Thirdly, we characterise the notable features of the earnings distributions and changes in earnings for both formal and informal workers, as well as the degree to which these distributions deviate from the assumptions of Gaussian normality. Finally, we explore the insurance role of family, extended family, and social networks. Our findings indicate that the significant disparity in earnings growth trajectories between formal and informal workers plays a critical role in exacerbating the high levels of inequality in Indonesia, as informal workers' earnings continue to lag behind, recording lower yields across all earnings categories when compared to their formal counterparts. Furthermore, the transitions between the two sectors exhibit asymmetry and rigidity, thereby contributing to sustained inequality. We also demonstrate that distinctions exist in the nature of the earnings shock processes for formal and informal workers, which contribute to the earnings disparities observed between the two groups. Adjustments in the labour market activities of household members can partially mitigate earnings fluctuations since the household does not depend only on a single source of income, whereas private transfers within social networks can exert a more pronounced effect due to strong social ties within the communities.

The second paper seeks to quantify the extent to which informality inappropriately allocates labour due to a lack of productivity and mobility, thereby reducing aggregate productivity and affecting inequality. This paper aims to provide a deeper understanding of the complex interaction between growth, inequality, and labour dynamics in economies with significant informal sectors. We develop a heterogeneous agent general equilibrium framework that integrates the formal and informal labour markets within a two-sector economy featuring occupational choice, where informality serves as the equilibrium outcome. The frictions in labour mobility, combined with individual wealth and skill levels, will determine the endogenous allocation of labour in each sector. Our findings underscore the significant impact of informality on productivity and inequality,

highlighting the urgent need to address this issue. The novelty of this paper lies in examining the aggregate consequences of informality in the context of lower labour mobility using a theoretical framework, thus expanding the contributions to the literature. We first document the persistence of informality and low labour mobility between occupations using several survey datasets and investigate the characteristics of the labour market. We then develop a general equilibrium framework based on those characteristics. We demonstrate that the prevalence of extensive informality may lead to an efficiency-equality trade-off, and beyond misallocating labour across sectors, it also has an additional impact on capital accumulation.

The third paper emphasises the significance of analysing the relationship between markup, misallocation, productivity, and the share of labour income in the context of inherent differences among firms, specifically foreign and domestic firms. This paper provides a preliminary investigation into the potential channels through which foreign and domestic firms may face different frictions and influence the formation of their markup distribution using the model of [Peters \(2020\)](#). The initial section of this paper delineates the correlation between markup, firms' age, productivity, and size, utilising panel data from various firms. These insights facilitate an examination of the evolution and interrelation of the variables, which are crucial for comprehending the subject matter. We then investigate the underlying mechanisms through a theoretical model that combines imperfectly competitive product market competition with Schumpeterian growth dynamics. Our findings indicate that older firms, particularly foreign-owned, tend to exhibit higher markups, reflecting greater price-cost disparities. Similarly, high-productivity firms, especially foreign entities, command higher markups, often linked to reduced net employment growth. Our analysis reveals that the creative destruction channel plays a crucial role in shaping markup differences between foreign and domestic firms. A significantly lower entry rate for foreign firms leads to higher and more dispersed markups, exacerbating misallocation in total factor productivity (TFP) and reducing the labour share of income. Our simulations show that relaxing entry barriers for foreign firms can lower both average markups and their dispersion, reducing TFP misallocation and mitigating labour share losses. These effects are particularly pronounced when foreign firms operate across multiple markets rather than being restricted to a few.

In addition to the preceding chapters, Chapter 5 will serve as the conclusion of this thesis. I will emphasise the significant insights pertinent to the topics of informality, markups, and resource misallocation in developing countries. Furthermore, I will address the limitations of this study, which may be subjects for future research endeavours.

Informality, Earnings Dynamics and Inequality: The Case of Indonesia

2.1 Introduction

Informality is a pervasive and enduring phenomenon that continues to be prevalent in developing countries. According to [Perry et al. \(2007\)](#), informality can provide distinctive advantages to workers, including autonomy and flexibility. Nevertheless, there are numerous disadvantages associated with informal employment, such as low and unstable incomes as well as inadequate working conditions (e.g., [ILO \(2002\)](#); [ILO \(2013\)](#)). A comprehensive understanding of the causes and consequences of informality carries significant implications for employment, economic growth, and inequality within developing nations (refer to [Ulyssea \(2020\)](#) for a thorough review). Recent advancements in the literature employ extensive panel datasets to illustrate a diverse range of characteristics concerning earnings distributions, earnings dynamics, and inequality in Latin American countries (i.e., [Blanco et al. \(2021\)](#) for Argentina; [Gomes, Iachan and Santos \(2020\)](#) and [Engbom et al. \(2021\)](#) for Brazil; [Puggioni et al. \(2022\)](#) for Mexico). This paper aims to contribute to the existing body of literature by providing new insights from Indonesia, where the economic structure exhibits notable differences and informal employment is particularly pronounced.¹ This paper examines how earnings growth and inequality have evolved in Indonesia, and what role differences between formal and informal sectors play in shaping these trends. We analyse how the labour mobility between formal and informal sectors influences earnings dynamics and inequality.

To achieve this objective, we utilise the Indonesia Family Life Survey (IFLS), a longitudinal study conducted from 1993 to 2014, which encompasses data regarding formal and informal employment, earnings, private transfers, assets, and household demographics. The survey is not conducted annually, so we perform a consistency check

¹The proportion of informal workers in Indonesia exceeds that of Argentina, Brazil, and Mexico. The informal sector constitutes a significant segment of the Indonesian economy. Specifically, over 55% of the labour force and approximately 92% of self-employed individuals in Indonesia are classified as informal workers.

for certain indicators using retrospective questions from the survey that allow us to analyse yearly behaviour for each individual. In this study, we investigate the following matters. Firstly, we document trends in income growth and inequality. Secondly, we analyse sectoral transitions between the formal and informal sectors and their implications for earnings inequality. Thirdly, we characterise the prominent features of the distributions of earnings and changes in earnings for both formal and informal workers, as well as the extent to which they deviate from the assumptions of Gaussian normality. Lastly, we explore the insurance role of conjugal family, extended family, and social networks.

The primary findings are summarised as follows: There has been a significant increase in earnings inequality, particularly in 2014, which can be attributed to the widening earnings gap between formal and informal workers. The rise in earnings dispersion in 2014 within each sector has also contributed to this increasing inequality. An escalation in dispersion in the lower earnings tiers has propelled the overall dispersion among both categories of workers, indicating that the lower earnings group is unable to bridge the gap with the middle earnings group. Conversely, dispersion has diminished in the upper earnings tier across both sectors, suggesting that the middle earnings group is able to catch up with the higher earnings group, particularly for informal workers, who have experienced a notable decline in dispersion. The earnings dispersion appears to be largely similar between male and female informal workers. In contrast, formal workers exhibit distinct dispersion patterns by gender, with the dispersion for formal female workers being higher than that for formal male workers. Although all groups are purported to benefit from economic growth, certain segments, particularly formal workers, reap greater advantages. The substantial disparity in earnings growth trajectories between formal and informal workers plays a critical role in exacerbating high inequality in Indonesia, as informal workers' earnings continue to lag behind, registering lower yields across all earnings categories compared to their formal counterparts.

The transitions between the two sectors exhibit asymmetry and rigidity, thereby contributing to persistent inequality. The level of labour transition between sectors remains consistently low in comparison to other developing nations across various income brackets and age demographics, underscoring this rigidity. The ratio of workers shifting from formal to informal employment is greater than the reverse, indicating a significant asymmetry. Additionally, workers transitioning from formal to informal sectors encounter diminished future earnings, while those moving from informal to formal employment experience an increase in future earnings. Nevertheless, informal workers who make the transition to formal employment encounter heightened earnings risks. Informal workers who opt to remain within their sector face a marginal opportunity to become top earners throughout their lifetime yet still retain a substantial likelihood of achieving over 70% of the lifetime earnings of all the workers.

There exist distinctions in the nature of the earnings shock processes for formal and informal workers. The distribution of earnings shocks among formal workers is characterised by greater changes in future earnings and reduced variance; however, it is notably associated with considerably higher-order earnings risks. Formal workers exhibit negative skewness and excess kurtosis, resulting in a departure from the Gaussian distribution. In contrast, informal workers tend to have a distribution similar to a Gaussian, characterised by smaller fluctuations in future earnings, greater variance, and lower earnings risks.

Family income significantly contributes to the attenuation of earnings risks. It can mitigate the third-order earnings risks encountered by employees by enhancing the degree of skewness, particularly affecting formal workers to a considerable extent. Furthermore, the influence of family income, in conjunction with capital income and private transfers, has a markedly positive effect on alleviating third-order earnings risks, often surpassing the impact of family income alone, notably for low and middle-income groups. The social network, exemplified through private transfers, plays a crucial and substantial role in this regard. This impact is distinctly observed in both categories of workers; however, it is less pronounced among high earners.

Furthermore, we extend the analysis by investigating disparities in earnings dynamics between male and female individuals, as well as between urban and rural areas. Formal female workers consistently exhibit greater earnings dispersion than their formal male counterparts, whereas informal workers show similar dispersion across genders. In terms of geographical distribution, formal workers in urban areas exhibit lower dispersion than their rural counterparts, a pattern that also holds for informal workers. Additionally, we perform a sensitivity analysis using balanced panel data to assess the consistency of the results. Our findings reveal no significant differences between the analyses of unbalanced and balanced panel data. More crucially, the balanced panel data analysis enables us to examine earnings dynamics over the life cycle. Individuals with substantial earnings are primarily non-transitional formal workers, whereas non-transitional informal workers are in the lower earnings group.

Related literature. This paper relates to a body of literature that documents the non-Gaussian and non-linear characteristics of earnings dynamics in developed nations (e.g., [Guvenen et al. \(2021\)](#) for the US; [De Nardi et al. \(2021\)](#) for the US and Netherlands; [Halvorsen et al. \(2020\)](#) for Norway; [Tin and Tran \(2023\)](#) for Australia). These initial studies predominantly focus on developed countries and do not account for the distinctions between formal and informal employment and earnings in developing nations. Recent advancements endeavour to bridge this gap by documenting earnings risk in developing countries with a specific emphasis on Latin American nations. [Puggioni et al. \(2022\)](#) identify the presence of negative skewness and high kurtosis in the distribution of earnings

changes in Mexico. [Engbom et al. \(2021\)](#) observe that workers transitioning from formal to informal employment in Brazil experience relatively negative and significant earnings changes, characterised by greater dispersion, negative skewness, and diminished leptokurtosis. Furthermore, [Gomes, Iachan and Santos \(2020\)](#) reports that informality correlates with increased earnings volatility, while formal workers face notable downside earnings risks in Brazil. In addition, [Blanco et al. \(2021\)](#) find that the distribution of regular wage changes exhibits positive skewness, manifesting a positive mode and greater symmetry in Argentina. In contrast, this study contributes to the existing literature by presenting new evidence from Indonesia, where the economic structure is markedly different, and the informal sector is more prominent than in Latin American economies. Our findings underscore the distinctions in within-sector earnings dynamics and sectoral transitions, as well as the insurance role played by familial and social networks.

Extensive literature exists documenting the wage disparities and the duality present in the labour market between formal and informal sectors (e.g., [Funkhouser \(1996\)](#), [Maloney \(1999\)](#), [Gong and van Soest \(2002\)](#), [Maloney \(2004\)](#), [Pratap and Quintin \(2006\)](#), [Perry et al. \(2007\)](#), [Gasparini and Tornarolli \(2009\)](#), [Botelho and Ponczek \(2011\)](#)). Utilising data from several Central American nations, [Funkhouser \(1996\)](#) identified that informal workers experience lower returns on education compared to their formal counterparts and that the gender gap is more pronounced among informal workers. According to [Maloney \(1999\)](#), there remains a dearth of compelling evidence substantiating the dualistic nature of the labour market, a notion that was later critically examined in [Maloney \(2004\)](#), which addresses the implications of market duality and the necessity to reassess policies aimed at reducing the prevalence of the informal sector. A study conducted by [Gong and van Soest \(2002\)](#) discovered that the earnings gap between formal and informal workers expands with increased education levels. [Pratap and Quintin \(2006\)](#) notes that the proportion of the informal sector fluctuates across nations and correlates with factors such as economic development, tax burden, and the rule of law. They further posit that dualistic models can accurately portray the scenario, contingent upon the implementation of policies directing resources toward the formal sector. Regardless of the terminology employed to describe labour informality, research by [Gasparini and Tornarolli \(2009\)](#) indicates the absence of a downward trend in the Latin America and Caribbean region. Simultaneously, the research conducted by [Botelho and Ponczek \(2011\)](#) reveals a significant wage differential between formal and informal workers, particularly pronounced among individuals with limited educational attainment and younger demographics.

This paper contributes to the existing literature in Indonesia by investigating the dynamics and evolution of earnings and risks associated with two distinct sectors—the formal and informal sectors—and their contributions to economic inequality, as well as the role of family income in mitigating the earnings risks faced by workers, topics that have

never been discussed in previous literature. Much of the literature elaborates on the factors contributing to informal employment but fails to analyse the interplay between inequality and the existence of the two distinct sectors. [Nazara \(2010\)](#) elucidates the dominance of informal workers within the Indonesian economy and discusses several factors contributing to the high proportion of informal employment. The decline in the manufacturing sector's share, following the Asian financial crisis, has led to a downward trend in employment opportunities within this sector. Moreover, Indonesia's stringent labour regulations are posited to impede job creation in the formal sector. [Rothenberg et al. \(2016\)](#) discovered that the costs associated with registration do not constitute the primary barrier preventing informal firms from formalising. The evaluation results indicate that the government's initiative to reduce registration costs has proven ineffective in enhancing rates of formality. The author contends that the conditions of informality in Indonesia are influenced by a combination of the rational exit and dual-economy theories of informality. [Hohberg and Lay \(2015\)](#) demonstrates that the minimum wage affects only the salaries of formal workers, without any observable spillover effect on informal workers. Furthermore, regarding worker satisfaction, female workers in the informal sector exhibit a relatively low level of discontent, as highlighted by a study from [World Bank \(2010b\)](#). The preference for informal work among women can be attributed to more flexible working hours, a significantly lower number of working hours in comparison to their counterparts in the formal sector, and greater opportunities for reemployment among informal female workers. Our study is closely associated with the research conducted by [Pratomo and Manning \(2022\)](#), which illustrates the low rate of worker transition to the formal sector in Indonesia. Utilising the Indonesian Labor Force Survey, they assert that individuals who previously held informal employment are generally afforded limited opportunities to transition to the formal sector, with a greater likelihood of remaining within the informal sector, signifying an "informality trap".

The remainder of this paper is structured as follows. Section 2.2 offers a comprehensive overview of Indonesia's macroeconomic conditions since 1993, which corresponds to the survey period utilised in this study. Section 2.3 details the data and methodology employed in this paper. Section 2.4 presents the principal findings. Section 2.5 outlines the findings from extensions and sensitivity analyses. Section 2.6 summarises the discussion. The appendices provide supplementary information and results.

2.2 Overview of the Indonesian macroeconomy

Indonesia underwent various economic regimes between 1993 and 2021. Prior to the Asian financial crisis of 1998, Indonesia exhibited the highest economic growth among other Asia Pacific countries, with an average GDP growth exceeding 7% annually. During this period, the economy was characterised by the expansion of the industrial and service sectors.

The workforce in the industrial sector more than doubled in the decade preceding 1997, consequently enhancing the proportion of formal employment. This situation fostered an increase in household income, corresponding with a rapid rise in GDP per capita, which grew by over 170% during the five-year span from 1993 to 1998. This notable surge in income was evident among both male and female workers across urban and rural locales.

The period encompassing the Asian financial crisis, specifically from 1998 to 2005, was characterised by a negative GDP growth rate of -13.1% in 1998. This era was further distinguished by the depreciation of the Rupiah against the US Dollar, which fell to Rp14,900, reflecting a staggering increase of over 500% compared to the preceding year. This economic climate precipitated an inflation rate that surged to 77.5%, thereby diminishing the purchasing power of individuals, as illustrated in Figure 2.1. The combined effects of high inflation and negative GDP growth have relegated Indonesia's status to that of a low-income country, having previously been classified as a lower-middle-income nation since 1993. Indonesia stands out as one of the most severely impacted countries during this crisis and is noted for being among the slowest to achieve recovery, as other countries have experienced a GDP contraction of no more than 10% and have already reached positive growth in the following year. A principal factor contributing to the crisis's severe repercussions was the substantial proportion of short-term private external debt in Indonesia, which fostered considerable economic instability.

During the Asian financial crisis, it was noted that a considerable amount of capital inflow failed to reach productive agricultural or industrial sectors. Instead, it was allocated to the stock market, consumer finance, and real estate. The primary cause of the crisis has been identified as economic mismanagement, which led to a failure in market signals to prompt necessary adjustments until the eventual collapse of the overheated market, as analysed by Greenspan (1997). Consequently, institutional investors and speculators began to withdraw their capital when global financial management recognised discrepancies between currency rates and international competitiveness. The situation was further exacerbated by local dollar purchases, which served as a last-minute effort to mitigate foreign currency exposure in response to concerns regarding potential domestic political instability and social unrest. The lack of efforts to restore social and political stability following the crisis has additionally hindered the economy's ability to gain the momentum necessary for a sustainable recovery.

Indonesia commenced its recovery phase in 1999, recording a GDP growth of 0.8%. However, the real GDP has yet to revert to its pre-crisis trend. Initially, the unemployment rate exhibited a milder impact following the Asian financial crisis, as outlined in a study conducted by Smith et al. (2002). However, a consistent upward trajectory was observed until 2005. The unemployment rate escalated annually from 5.46% in 1998, peaking at

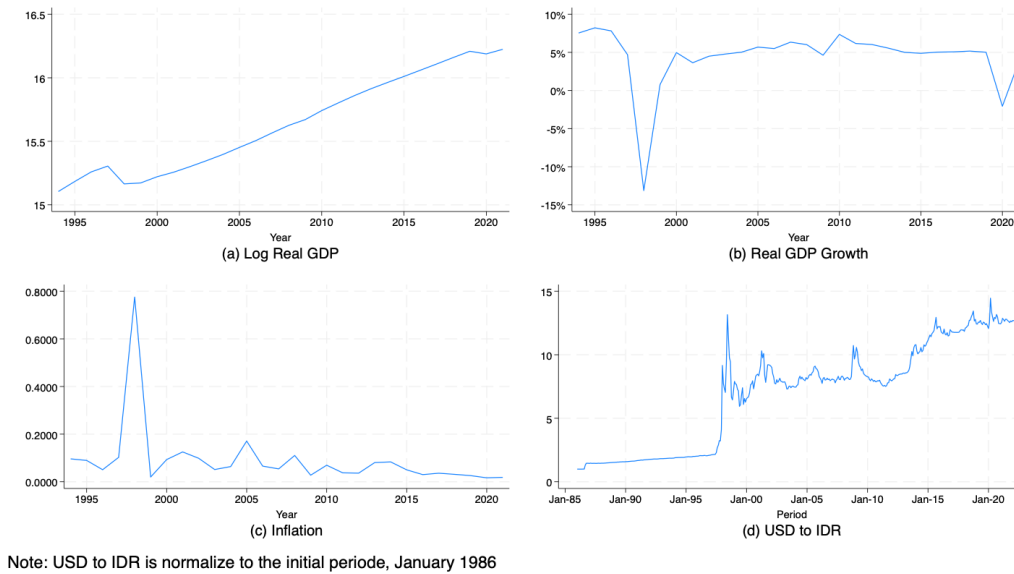


Figure 2.1: GDP, Inflation and Exchange Rate

11.24% in 2005, before experiencing a decline in subsequent years. The crisis resulted in a significant shift of workers from the manufacturing and service sectors to agriculture, partially serving as a substitute for social safety nets, as reported in a study by [World Bank \(2010a\)](#). In 2001, a modification in the definition of the labour force was implemented by the Indonesian Statistics Agency (BPS), which incorporated discouraged workers into the labour force calculations. Nevertheless, employing a consistent calculation methodology across different years, a study conducted by [Suryadarma \(2005\)](#) revealed an equally increasing trend in the unemployment rate, despite variations in the rate itself.

During this recovery phase, firms adopted a cautious approach regarding the continuation of economic recovery. This situation hindered the creation of new job opportunities amidst the rising number of job seekers, thereby perpetuating the increasing trend of the unemployment rate. The sustained rise in the unemployment rate can also be attributed to labour-hoarding practices resulting from high termination costs, leading to gradual rather than immediate adjustments in workforce numbers. This behaviour has persisted into the present, with a study by [Ardiyono \(2022\)](#) indicating that Indonesia experienced labour hoarding during the COVID-19 pandemic, particularly within firms operating in contact-intensive industries. The rising unemployment rate was accompanied by a corresponding increase in the share of informal workers to mitigate earnings shocks, thereby reducing the share of formal workers, as illustrated in Figure 2.2.

The subsequent period, post-2005, witnessed Indonesia experiencing a notable increase in average GDP growth, positioning itself among the highest within the Asia-Pacific and G20 nations. During this time, the unemployment rate exhibited a decline, accompanied by a rise in the proportion of formal employment. The demographic

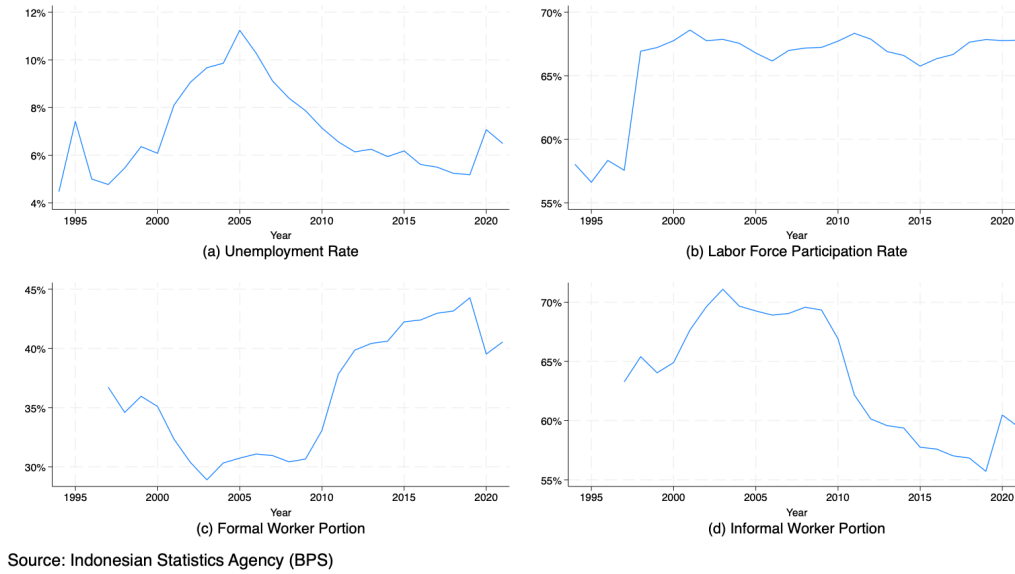


Figure 2.2: Unemployment Rate and Informality

dividend, along with the expansion of employment opportunities in Indonesia, contributed to an almost 400% increase in GDP per capita over a span of 16 years, reaching Rp62.2 million in 2021, which elevated Indonesia to the classification of an upper-middle-income nation by 2019. The economic landscape of this period was characterised by the burgeoning middle class, which significantly enhanced the influence of private consumption on GDP formation. The COVID-19 pandemic in 2020 precipitated an economic contraction and a rise in unemployment, leading to an increased proportion of informal workers. Throughout the pandemic, Indonesia's economic development was bolstered by government expenditure and the country's trade surplus. Following the COVID-19 pandemic, Indonesia successfully sustained its momentum in augmenting non-oil and gas exports, achieving a historical peak in total net exports in 2021, amounting to USD48.6 billion, thereby ensuring a trade surplus for the same year.

2.3 Data and variable constructions

Data. This study utilises data from the Indonesia Family Life Survey (IFLS), a longitudinal individual survey. The IFLS encompasses critical information regarding individuals and households in Indonesia, including aspects such as consumption, income, assets, education, migration, labour market outcomes, and various demographic variables. The analysis incorporates data from five survey waves, specifically those conducted in 1993, 1997, 2000, 2007, and 2014. The most recent survey period, occurring in 2014, comprises over 70,000 individuals and approximately 16,000 households. The inaugural wave, IFLS1, was administered during 1993–1994, representing about 83% of the Indonesian population residing in 13 of the nation's 26 provinces. IFLS2 conducted a

follow-up with the same sample four years later in 1997–1998. IFLS3 was executed with the entire sample in 2000, followed by IFLS4 in 2007–2008 and IFLS5 in 2014–2015. The re-contact rate across all survey waves is 87.8%.

Sample selection. Data utilised in this analysis is derived solely from individuals surveyed across at least two consecutive periods, facilitating the creation of an unbalanced panel. Furthermore, the scope of our analysis is restricted to workers aged between 25 and 55, which constitutes the prime working age throughout the entire survey duration. Workers older than 55 years will enter retirement or retirement preparation, which will result in changes to their income, while workers younger than 25 years may leave the labour force to attend school; therefore, it is difficult to determine the dynamics of workers' earnings when these factors are also at play. Additionally, earnings outliers were adjusted by excluding values that exceed or fall below 1.5 times the interquartile range. The descriptive statistics pertaining to the utilised sample are presented in Table 2.1.

Variables. Total monthly real earnings, hereafter referred to as “earnings ” $y_{i,t}$, are calculated by aggregating the total individual net wage or net profit after tax, subsequently adjusted by the Consumer Price Index (CPI) utilising the base year 2007. This study employs monthly earnings to facilitate a comparison of income between formal and informal workers, deliberately excluding bonuses that are typically awarded solely to formal workers at the conclusion of the fiscal year, as well as to ensure the use of comparable regular earnings for workers in both sectors.

Summary statistics. Throughout the entirety of the survey duration, the prevalence of informal workers in Indonesia remains substantial. During this period, the proportion of informal workers accounted for 61.65% of the total workforce. Notably, in the final survey period of 2014, this figure was recorded at 57.5%. This proportion is closely aligned with the data obtained from the Indonesian Labour Force Survey (SAKERNAS), which indicated a rate of 59.38% in 2014, with a subsequent figure of 57.93% reported for the period spanning 2017 to 2021. It is noteworthy that informal workers exhibit average weekly working hours that are 1.605 hours fewer than those of their formal counterparts. Furthermore, informal workers have an average log of monthly earnings that is lower by 0.463 log points compared to formal workers, with a more dispersed distribution, evidenced by a greater standard deviation when compared to formal workers.

In this study, we employ the precise definition of informal workers as established by the Indonesian Statistics Agency (BPS). Currently, BPS assesses individuals engaged in formal or informal activities based on their employment status in their primary occupation, in accordance with the International Conference of Labor Statistics (ICLS-13) from the International Labour Organization (ILO). A resident classified under formal activities includes those who are self-employed and receive assistance from permanent workers, as well as residents who are designated as workers or employees. Conversely, all

other individuals are categorised as informal workers.² The application of this definition was further driven by the need to uphold consistency across survey waves, given that the earlier surveys lacked comprehensive questions regarding informality indicators when utilising the most recent definition.

Table 2.1: Statistics Descriptive for IFLS

Year	Full Sample				
	Observation	Mean Age	Monthly Income	Hours Worked	Formal Shares
1993	33115	27.554	12.93	42.444	.391
1997	39714	37.181	12.961	41.382	.445
2000	49424	36.313	12.925	43.826	.452
2007	62935	37.04	13.169	43.718	.381
2014	75680	38.496	13.408	46.485	.425
Year	Unbalanced Panel				
	Observation	Mean Age	Monthly Income	Hours Worked	Formal Shares
1993	9028	36.471	12.949	43.207	0.424
1997	11035	38.421	13.117	42.361	0.452
2000	12859	37.552	13.076	44.757	0.454
2007	16865	37.641	13.296	44.542	0.388
2014	13627	41.941	13.527	46.867	0.404

Measuring earnings risk. This research employs a non-parametric methodology to analyse earnings dynamics, drawing upon the studies conducted by [Arellano, Blundell and Bonhomme \(2017\)](#), [Guvenen et al. \(2017\)](#) and [Guvenen et al. \(2021\)](#). This approach elucidates the fundamental characteristics of the distribution of earnings shocks and lifetime income. These methodologies provide essential attributes of non-linearity and non-normality, which are critical elements of the earnings process, while avoiding the stringent parametric assumptions of linearity and normality typically inherent in conventional econometric models of earnings dynamics. Investigating deviations from normality are crucial for comprehensively understanding the earnings shocks that an individual may encounter, their magnitude, the direction of the shock, and the frequency of extreme occurrences.

²The most recent definition of informal employment, as established by ICLS-17, extends beyond merely examining employment status to include considerations regarding economic units, contributions to social security, and the entitlements and benefits associated with paid annual leave and paid sick leave. In this study, we reference ICLS-13, which is solely predicated on employment status, to ensure a consistent definition throughout the entire survey period, given that inquiries concerning paid sick leave and paid annual leave were absent.

In accordance with [Guvenen et al. \(2021\)](#), we assess earnings risk by examining the variation in residual earnings change to the adjustment for time trends and deterministic life cycle factors. To accomplish this, we initially conducted a least squares regression analysis of the logarithm of earnings in relation to age and dummy year variables,

$$\ln y_{i,t} = \alpha \text{age}_{i,t} + \beta \text{age}_{i,t}^2 + \gamma \text{year}_t + \varepsilon_{i,t},$$

where $\ln y_{i,t}$ represents log earnings, $\text{age}_{i,t}$ denotes age, and $\text{year}_{i,t}$ signifies year dummies. We track each individual's employment status over time. We then estimate the earnings only for those who have worked. Age is a critical variable in earnings estimation because it serves as a proxy for labour market experience, human capital accumulation, and life-cycle dynamics. Subsequently, we derive the residual log earnings conditional on year-specific age dummies from the equation, referred to as “residual earnings”, denoted as $\widehat{\varepsilon}_{it}$.

Ultimately, we calculate the n -year-forward change in residual earnings, represented as g_{it}^n , henceforth termed “earnings changes” or “earnings shocks”, which will be employed interchangeably within our framework. Formally, $g_{i,t}^n$ signifies the change in future earnings of individual i at time t that transpires after n periods, following the adjustment for both age and time effects.

$$g_{i,t}^n = \widehat{\varepsilon}_{i,t+n} - \widehat{\varepsilon}_{i,t}.$$

We characterise the distribution of earnings shocks through the application of second- and higher-order moments, which encompass (a) *variance*, (b) *standardised (Pearson) Skewness*, and (c) *standardised (Pearson) Kurtosis*. (i.e., *standard deviation*, *skewness* and *kurtosis*). Consequently, the term “*risk*” is quantified by the second and higher-order moments of the distribution of residual changes in earnings.

2.4 Results

This chapter presents a comprehensive analysis of earnings inequality and the dynamics within Indonesia's formal and informal sectors, utilising individual panels sourced from the IFLS. It will illustrate the widening earnings gap between formal and informal workers, which is attributable to the differing characteristics of the earnings shock process inherent to each sector, as well as the notably low transition rate of workers between these sectors. We observe the presence of rigidity and asymmetry linked to worker transitions, which contribute to the persistence of inequality. The level of labour transition between sectors remains consistently low in comparison to other developing nations, across various earnings groups and age cohorts, thereby indicating rigidity. Furthermore, the ratio of

workers transitioning from formal employment to informal employment exceeds that of transitions from informal to formal employment, signifying a clear asymmetry.

The distribution of earnings shocks among formal workers exhibits characteristics of greater future earnings changes and reduced variance. However, it is somewhat paradoxical that there exists a significantly elevated level of higher-order earnings risks. Formal workers demonstrate negative skewness and excess kurtosis, indicating a deviation from the Gaussian distribution. In contrast, informal workers experience lesser future earnings changes and heightened variances, albeit with diminished earnings risks and a distribution that is more analogous to a Gaussian profile. Furthermore, this chapter delves into the influence of family earnings, capital income, and private transfers as forms of insurance aimed at alleviating earnings risks.

2.4.1 Earnings distributions and inequality

Earnings distribution. Formal workers exhibit a higher mean within their log earnings distribution compared to informal workers, as illustrated in Figure 2.3 panel (a). The mean log earnings for formal workers reach as high as 13.47, compared to 12.98 for informal workers. These findings substantiate the presence of wage disparities between formal and informal workers in Indonesia. This situation mirrors that of Brazil, another developing nation characterised by a significant informal sector, as analysed by [Engbom et al. \(2021\)](#), [Ulyssea \(2020\)](#) and [Botelho and Ponczek \(2011\)](#). It is also comparable to the circumstances in Mexico, as examined in the study by [Gong and van Soest \(2002\)](#). Panel (b) delineates the earnings distribution for each category of worker from the commencement to the conclusion of the survey period, specifically from 1993 to 2014. Although all worker groups saw an increase in real earnings, the mean earnings for informal workers in 2014 remained at the same level as that of formal workers in 1993, at 13.2. The earnings of informal workers did not accelerate sufficiently to exceed the initial earnings of formal workers over the span of two decades.

The distribution of formal workers shows a leftward skew, indicating a higher proportion of workers earning below the mean, with a skewness of -0.53. In contrast, the earnings distribution among informal workers tends to be more balanced, with roughly equal shares around the mean and a skewness of -0.04. This left-skewed trend for formal workers is not only evident in the current analysis but also remains consistent when comparing data from 1993 and 2014, with skewness values of -0.56 and -0.54, respectively. Additionally, formal workers' earnings are more concentrated around the mean compared to informal workers, who experience greater variability, indicated by standard deviations of 0.97 and 1.05, respectively. This lower dispersion among formal workers can partly be explained by minimum wage regulations, which limit earnings variability compared to the unregulated earnings of informal workers.

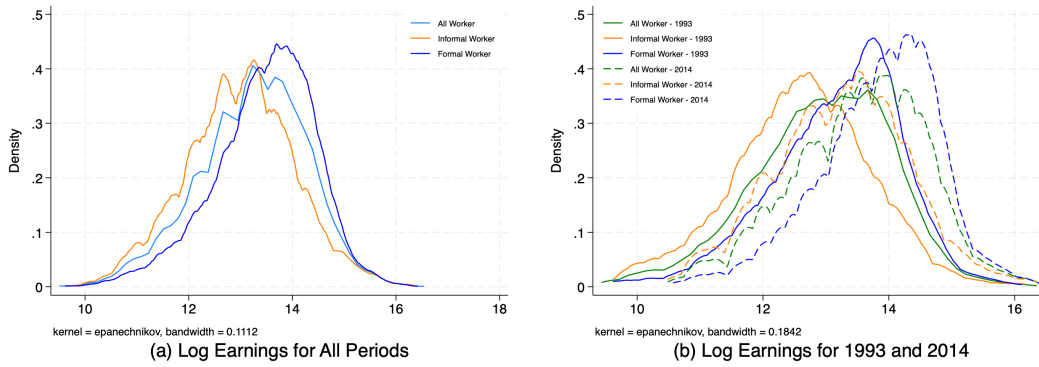


Figure 2.3: The Evolution of Log Earnings for Different Types of Workers

Formal-informal earnings gaps. The dispersion of total earnings between formal and informal workers remains notably high, although it has improved recently, as shown in Figure 2.4 panel (a). It still lacks significant progress and is characterised by a considerable earnings gap between the two groups, as seen in Figure 2.4 panel (c). The increased dispersion within each employment sector contributes to the overall high earnings disparity, with both sectors showing increased dispersion in the last survey period, as indicated in panel (d). Within each sector, the higher dispersion mainly results from a rise in the lower tail of the income distribution, which is not offset by the decline in dispersion at the upper tail for both sectors. Notably, the dispersion in the upper tail has decreased, suggesting that the middle earnings group is moving closer to the high earnings group, especially among informal workers, who have experienced a significant drop in dispersion. Conversely, the dispersion in the lower tail has increased in the most recent survey period, implying that the low-earning group is struggling to close the gap with the middle-earning group. These factors sustain the high level of total earnings dispersion.

Regarding the behaviour between sectors, the widening disparity in earnings between formal and informal workers, particularly post-2000, has significantly contributed to high earnings inequality. Since 2000, formal workers have exhibited a steeper earnings trajectory compared to their informal counterparts, thereby exacerbating the earnings gap. The increase in earnings for formal workers post-2000 can be partially attributed to systematic increases in the minimum wage, as reported in a study conducted by the [ILO \(2015\)](#). Additionally, utilising the Indonesian Input-Output Table, the aforementioned study elucidates that the distribution of income to workers has consistently increased in alignment with productivity growth. Conversely, informal workers appear to have been deprived of the benefits associated with the elevation of the minimum wage, a finding that corroborates the results of the study conducted by [Hohberg and Lay \(2015\)](#), which has further contributed to the widening earnings gap. It is also noteworthy that formal workers experienced a decline in real earnings in 2000 when compared to 1997, a situation

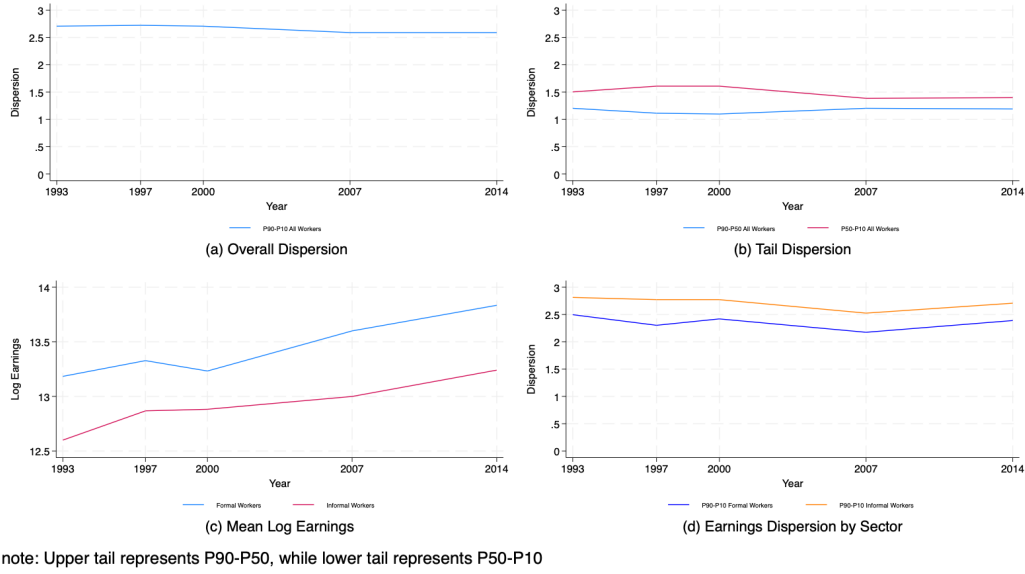


Figure 2.4: Overall Dispersion Over Time

that was precipitated by job losses during the Asian financial crisis. Meanwhile, it is remarkable that informal workers continued to experience an increase in their earnings, which temporarily narrowed the earnings gap during the year 2000 before it ultimately widened again.

In accordance with the level of dispersion observed within the sector, earnings dispersion experienced an increase in 2014 for both categories of employment, subsequent to a previous downward trend. This increase in earnings dispersion in 2014 is evident in both employment sectors, as illustrated in Figure 2.4 panel (d). The escalation of dispersion in the lower tail distribution surpasses the reduction of dispersion in the upper tail distribution across both employment sectors. Since the year 2000, the dispersion in the upper tail distribution has exhibited a decreasing trend in both employment sectors, signifying a diminishing earnings gap between the middle and high earnings groups. Conversely, the increase in dispersion within the lower tail for both employment sectors signifies an expanding earnings gap between the low and middle-earnings groups of workers. Additionally, it is noteworthy that informal workers demonstrate a higher dispersion compared to formal workers in both the lower and upper tail distributions.

All individuals benefit from economic growth, which is characterised by increased earnings for workers across various income groups. However, certain groups experience more significant advantages than others. The earnings level of informal workers at the conclusion of the 2014 survey period did not surpass that of formal workers during the initial survey period in 1993 for some income categories. In fact, some even reported lower earnings, as illustrated in Figure 2.5. Earnings growth for both formal and informal workers, particularly for those in the 50th percentile and above, exceeds that of the

lower percentiles, thereby contributing to greater dispersion within the lower tail of the distribution. The earnings gap within the upper tail distribution is diminishing for both formal and informal workers, indicating that the middle-income group reaps the most substantial benefits from economic growth compared to other income classifications. The Asian financial crisis in 1998 had a pronounced effect on the declining earnings of formal workers across all income groups prior to a rapid increase post-2000. Conversely, informal workers did not encounter a decline in earnings during the Asian financial crisis across all income categories.

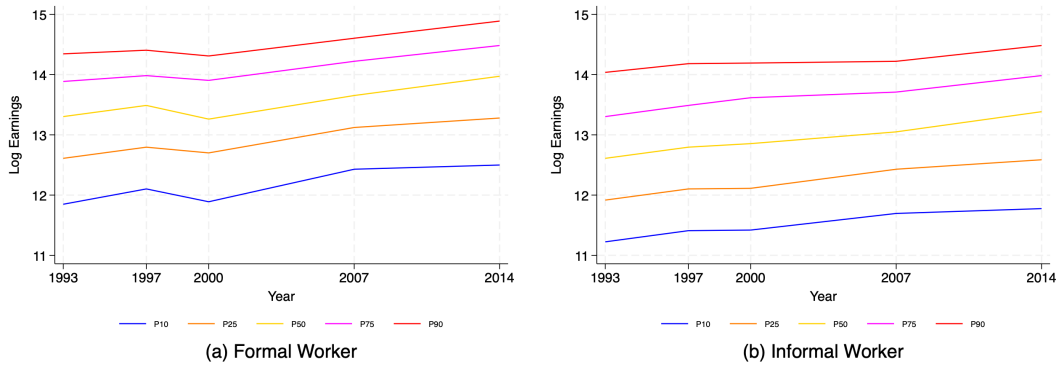


Figure 2.5: Evolution of Log Earnings Percentiles by Sector

Moreover, the top 1% and above of informal workers possess an earnings level commensurate with that of formal workers. The growth in earnings for informal workers within the earnings group exceeding the 90th percentile is more pronounced than that of the 90th percentile group. It is only the 99.9th percentile of formal workers that exhibits a higher growth in earnings compared to the 90th percentile group of workers, as evidenced in Figure 2.6 panel (a) and (b). The ramifications of the Asian financial crisis were likewise observed among the top earners of formal workers, whose earnings experienced a decline in 2000 relative to 1997, whereas the top earners of informal workers did not suffer such a decline. The bottom 1% of formal workers encountered a decrease in earnings in 2014, displaying anomalous behaviour in contrast to the earnings increase exhibited by other groups. Furthermore, the lowest earners among formal workers were adversely affected by the Asian financial crisis, which evidenced a decline in earnings in 2000. In contrast, the lowest earners among informal workers managed to maintain stable earnings levels during the Asian financial crisis. The relative stability of earnings for informal workers underscores the role of the informal sector as a safeguard against earnings risk during economic downturns.

2.4.2 Sectoral transitions and labour market duality

This section will examine the transitional behaviour of workers between sectors and the earnings shock profile associated with each type of worker transition. We utilise the

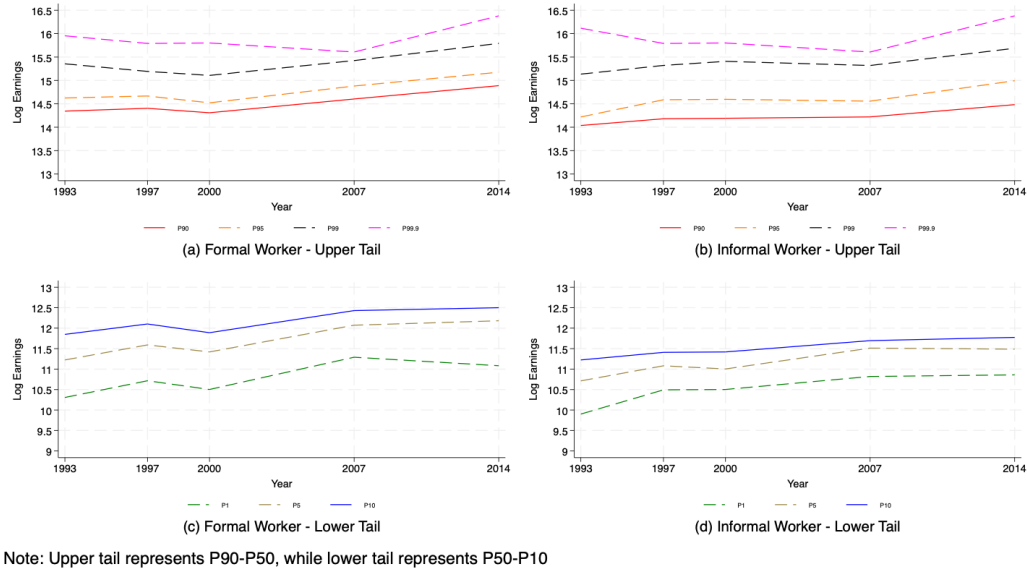


Figure 2.6: Evolution of Upper and Lower Tail of Percentiles by Sector

same data sources and sample selections as previously mentioned; however, we exclude the 1997 IFLS from our analysis to achieve a consistent seven-year interval of earnings changes. Workers' transitions represent one of the determinants of earnings inequality across sectors. A low transition rate between sectors indicates a lack of ability among workers to transfer to alternative employment opportunities in different sectors that may provide enhanced earnings potential, thereby narrowing the income disparity with the higher income group. The analysis will illustrate the transition ratio to assess workers' behaviour within various earnings groups. Each worker's transition is calculated across two successive periods throughout the entirety of the survey duration. There are four categories of workers: those who remain in the formal sector, those who remain in the informal sector, those who transition from formal to informal, and those who transition from informal to formal. Moreover, this section will also address the behaviour of earnings shocks for different worker types.

The transition of workers between employment sectors is characterised by rigidity and asymmetry, as illustrated by the transition probability matrix presented in Table 2.2. A significant majority of formal workers, comprising 69.89%, remain within the same sector, while the remaining 30.11% opt to transition to informal employment. Informal workers display an even greater tendency to stay within their sector, with a retention rate of 84.02% and only 15.98% transitioning to formal employment. One of the contributing factors to the low rate of transition from informal to formal employment is the stringent barriers associated with formal employment opportunities. Indonesia ranks among the nations with elevated hiring and firing costs for employers, rendering the pathway to formal employment relatively more complex. Nevertheless, this study offers an alternative viewpoint from the perspective of workers, wherein informal workers, despite experiencing

minimal average earnings changes and significant variability, exhibit lower higher-order earnings risks compared to their formal counterparts. Furthermore, social networks play a crucial role in alleviating earnings fluctuations for workers, including those in informal employment. A more comprehensive discussion on this topic will be provided in the subsequent subsection.

Table 2.2: Transition Probability

	Formal	Informal
Formal	69.89%	30.11%
Informal	15.98%	84.02%

Note: the transition of each worker is assessed across two successive periods throughout the entire duration of the survey. Approximately 84% of informal workers continue in their current employment type, while only 16% transition into formal employment.

For a more comprehensive examination of transitional worker behaviour, Figure 2.7 illustrates the composition of transitional workers categorised by age and initial earnings. Several key points warrant attention: first, workers who transition between formal and informal sectors predominantly consist of individuals with low earnings, and the likelihood of transition diminishes as earnings increase. This phenomenon is attributed to the low opportunity cost associated with sector transitions for low-earning workers, and it is observed across all age groups. Second, the trend of transitioning from informal to formal employment exhibits a downward trajectory concerning earnings, contrasting with the Brazilian economy, where a study by [Gomes, Iachan and Santos \(2020\)](#) indicates that the transition ratio from informal to formal increases with income. In Brazil, better-compensated informal workers are more inclined to shift to formal employment. This rigidity may be linked to the increased earnings risks faced by the cohort of high-earning formal workers, an issue that will be further examined in the subsequent section, which represents a potentially interesting subject for further study. Third, the transition ratio from formal to informal employment consistently exceeds that of the transition from informal to formal across all earnings deciles, thereby creating an asymmetrical relationship. Conversely, research conducted by [Engbom et al. \(2021\)](#) indicates that in Brazil, the transition from informal to formal employment is more pronounced than the reverse.

By utilising retrospective responses from each individual within the IFLS conducted up to seven years prior to the survey, it becomes possible to compute a one-year transition ratio for each worker. A similar trend is evident in the one-year transition ratios across each decile of initial earnings, as illustrated in Figure 2.8. The transition rate between formal and informal employment, or vice versa, demonstrates an inverse relationship with the increase in initial earnings, indicating that lower earners are more likely to

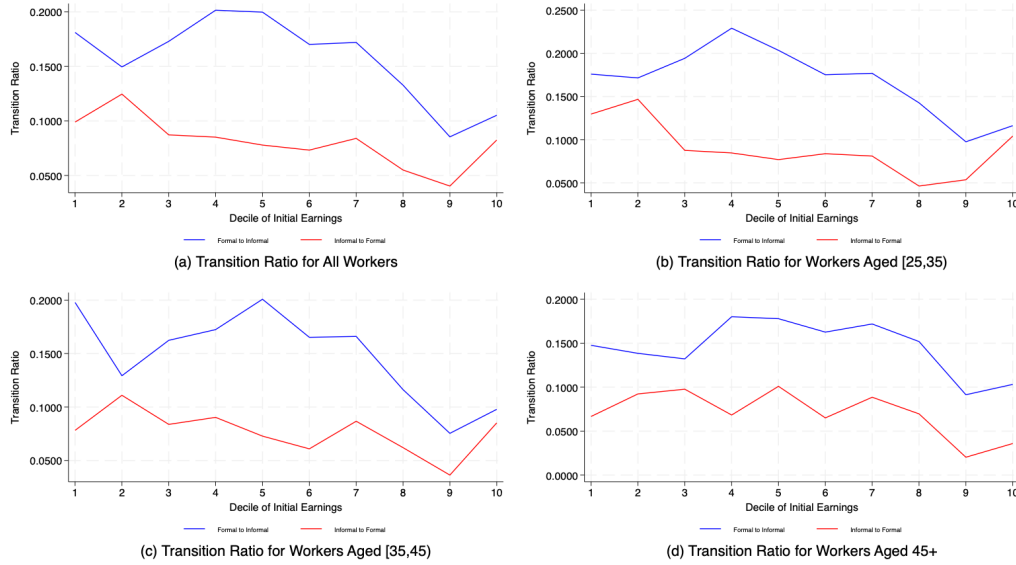


Figure 2.7: Seven-Year Transition Ratios by Age and Initial Earnings

Note: the graphics illustrate the proportion of workers within each earnings decile who transitioned between formal and informal employment, while the remainder of the workers, who maintained their employment type, are not depicted in the graph.

transition between different employment sectors. This observed pattern is consistent across all age groups within both employment sectors. Furthermore, the transition rate from formal to informal employment is consistently higher than that of informal to formal employment across most earnings groups, thereby confirming the observed asymmetry. It is also noteworthy that the transition rate from informal to formal employment exhibits rigidity across all age groups.

We calculate the lifetime earnings, defined as the total earnings accumulated over the survey period. Each worker is subsequently categorised into distinct earnings groups, and the frequency of transitions between these groups during the survey's duration is recorded. According to the lifetime earnings data illustrated in Figure 2.9, it is evident that workers with high earnings are predominantly constituted of non-transitional formal workers, particularly within the uppermost 20% of the earnings group. This phenomenon arises from the fact that workers who remain within the formal sector experience a substantial increase in earnings compared to other worker categories. In contrast, workers with low earnings are primarily composed of non-transitional informal workers. Individuals who choose to stay in the informal sector experience a comparatively lesser increase in earnings relative to most other categories of workers. These findings imply a limited accumulation of productivity among informal workers, which, in turn, results in lower lifetime earnings. This issue is evident in both the seven-year transitions, as illustrated in panel (a), and the one-year transitions, as depicted in panel (b). The restricted mobility of workers between sectors is evidenced by the low transition ratios across various earnings levels,

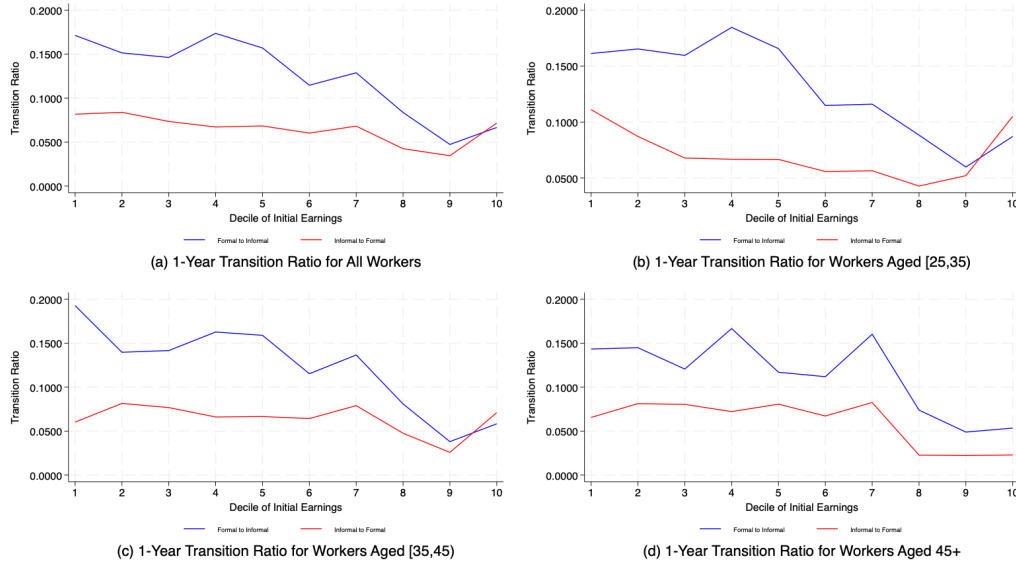


Figure 2.8: One-Year Transition Ratios by Age and Initial Earnings

which consistently do not exceed 20%.

It is noteworthy that, within the earnings group level of 70%, non-transitional informal workers remain predominant in these income categories. This observation indicates that lifetime earnings for individuals who persist in the informal sector are significantly high, reaching up to the top 30% of earners. Meanwhile, workers who maintain formal employment have a considerably increased likelihood of ascending to the status of top earners. Furthermore, it can be posited that an economy characterised by a preponderance of informal workers tends to exhibit lower average earnings, thereby allowing informal workers to achieve substantial lifetime earnings. The dynamics of this situation may alter in scenarios where formal workers comprise the majority of the economic landscape.

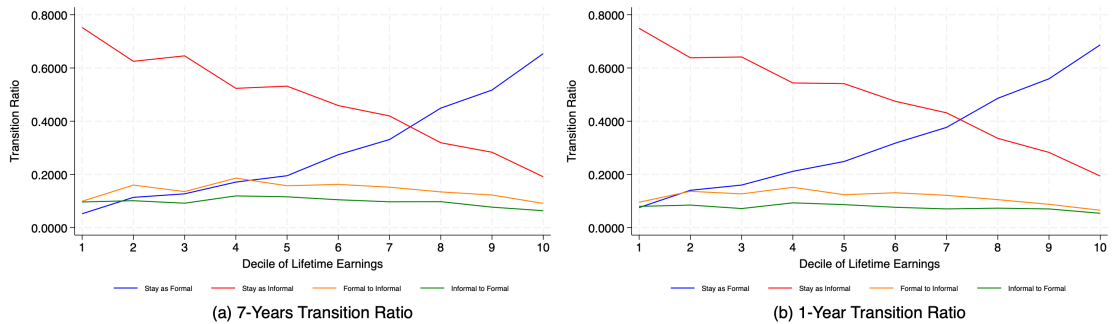


Figure 2.9: Transition Ratios by Lifetime Earnings

Note: individuals are categorised according to their lifetime earnings, defined as the cumulative total of earnings amassed over the duration of the survey. Panel (a) measures the proportion of each type of transition observed over a seven-year interval, whereas panel (b) examines the transition within a one-year interval.

The subsequent analysis examines employee earnings shocks or earnings changes along

with higher-order earnings risks by investigating each higher-order moment, specifically variance, skewness, and kurtosis. Skewness quantifies the asymmetry of the distribution. Negative skewness indicates that a greater number of employees encounter earnings changes below the mean value, while positive skewness suggests that a higher number of employees experience earnings changes that exceed the mean value. A Gaussian distribution presents a skewness of zero, indicating perfect symmetry. Kurtosis is a measure of the tail distribution, where a heightened level of kurtosis signifies a thicker tail, thus elevating the magnitude of extreme earnings changes. In the context of a normal distribution, the kurtosis level is quantified as three, with excess kurtosis registering at zero.

Earnings shock profile for non-transitional workers

Non-transitional workers are defined as individuals who retain their position within a specific sector, whether as informal or formal employees, for a duration of seven years between survey periods. Non-transitional formal workers demonstrate more favourable earnings shocks or earnings changes compared to those who remain in the informal sector, reflecting an average increase in earnings of 0.131 log points. This contrasts with informal workers, who exhibit a marginal earnings change of 0.053 log points. The variability in earnings changes among formal workers is notably lower than that observed in informal workers, with measures of 0.640 and 1.077, respectively. Due to the limitations of the IFLS, our analysis was constrained to examining worker transitions across sectors over a seven-year interval. It is important to note that non-transitional workers may transition to other sectors between survey periods and subsequently return to their original sector in the following survey period. However, our subsequent analysis indicates that the probabilities of workers transitioning to different sectors within a one-year timeframe are low. As a result, it is likely that workers will remain within their initial employment sector.

Non-transitional formal workers experience earnings shocks characterised by a skewness of -0.217, which signifies considerable downside earnings shocks. In contrast, informal workers exhibit a more symmetric earnings shock profile with a skewness of 0.016. The negative skewness observed in non-transitional formal workers suggests that these individuals are more susceptible to economic shocks compared to their informal counterparts. In the event of a negative economic shock, employers are unable to reduce workers' wages below the stipulated provisions; concurrently, they are mandated to continue providing employee benefits in accordance with existing regulations. This scenario presents employers with limited options to safeguard their companies, among which the reduction of the workforce emerges as a potential strategy, forcing affected employees to seek alternative employment. Typically, these individuals face the likelihood of securing positions with lower wages, largely due to diminished bargaining power amid

contracting economic conditions. Furthermore, the excess kurtosis among non-transitional formal workers is significantly greater than that observed in non-transitional informal workers, with figures of 3.288 and 0.768, respectively. The elevated level of excess kurtosis among formal workers indicates a more pronounced distribution tail, reflecting a higher magnitude of extreme earnings shocks. In contrast, informal workers exhibit minimal extreme earnings shocks, as illustrated in Figure 2.10.

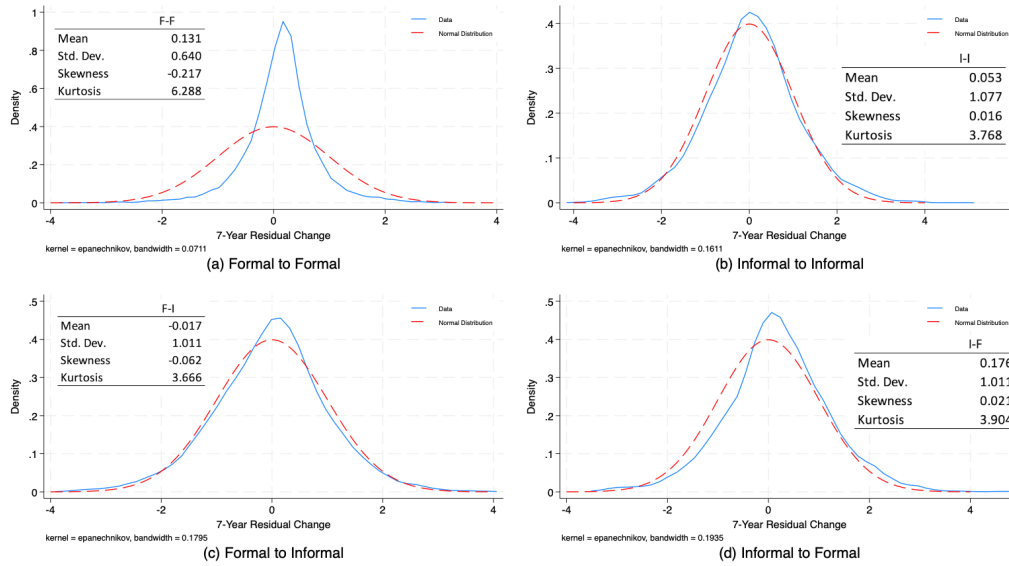


Figure 2.10: Density of Earnings Changes

Earnings shock profile for transitional workers

Transitional workers moving from formal to informal employment experience negative earnings shocks or earnings changes, quantified at -0.017 log points. By contrast, the shift from informal to formal employment is associated with positive earnings changes, recorded at 0.176 log points, as illustrated in Figure 2.10. The decline in earnings suffered by workers transitioning from formal to informal employment aligns with the findings of [Pritadrajati, Kusuma and Saxena \(2021\)](#), which indicate that individuals with prior experience in informal self-employment tend to have lower future earnings, based on data from Indonesia. Although workers transitioning from formal to informal employment face a decline in earnings, they have symmetrical earnings shocks distribution and low-magnitude of extreme earnings shocks, as evidenced by a skewness approximating zero and a kurtosis near three, thereby resembling a Gaussian distribution in comparison to those remaining in formal employment. In contrast, informal workers who transition to formal employment experience a substantial increase in their earnings while maintaining symmetrical and low-magnitude of extreme earnings shocks. The dispersion of earnings among workers undergoing transitions is comparable to one another; it is greater than that of individuals remaining in formal employment yet lower than that of those remaining

in informal employment. Given these findings, the transition to formal employment is beneficial for workers and should be actively encouraged to mitigate the earnings disparity.

2.4.3 Measuring earnings dynamics

The following analysis elucidates the reasons behind the widening earnings gap between formal and informal workers, attributing this phenomenon to the variation in the earnings shock processes encountered by individuals for each employment sector. Workers in formal employment status demonstrate a distribution that deviates from Gaussian characteristics, exhibiting more pronounced future earnings changes compared to their informal counterparts. While formal workers experience a lower second-order earnings risk, quantified as variance, they unexpectedly contend with greater higher-order earnings risks, evidenced by notable negative skewness and high kurtosis, as illustrated in Figure 2.11. In contrast, the distribution of informal workers aligns more closely with Gaussian principles. The more substantial earnings changes and diminished second-order earnings risk attributable to formal workers have contributed to an increasing disparity in earnings levels when compared to informal workers. A similar trend has been observed among both categories of workers in Brazil, as evidenced by a study conducted by [Gomes, Iachan and Santos \(2020\)](#). Additionally, a study by [Puggioni et al. \(2022\)](#) utilising data from Mexico corroborates these findings regarding formal workers.

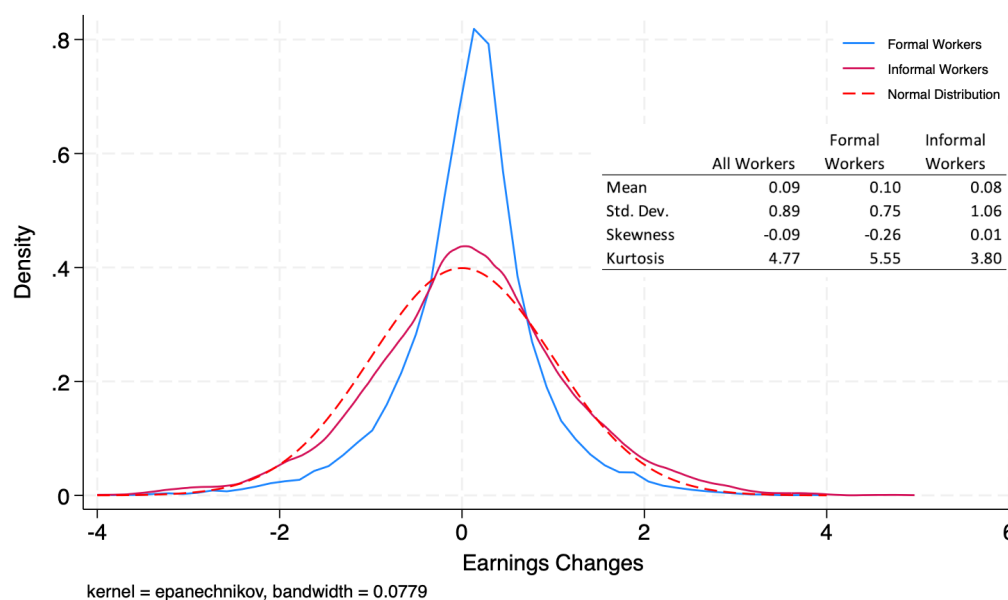


Figure 2.11: Earnings Changes by Sector

Second-order risk

Informal workers exhibit a significantly greater level of dispersion in earnings changes compared to formal workers across both upper and lower tail groups. This high level of dispersion among informal workers is consistent with the nature of their employment, which is predominantly casual and often characterised by irregular working hours, thus impacting their earnings. In contrast, the dispersion of earnings changes for formal workers has shown a decreasing trend for both the upper and lower tails during the recent survey period. Notably, informal workers display contrasting trends in dispersion; they experience increased dispersion of earnings changes in the lower tail, while the upper tail exhibits reduced dispersion, as illustrated in Figure 2.12. Analysing the data by gender reveals that the lower tail distribution demonstrates greater dispersion for both male and female workers. Although the dispersion gap between the lower and upper tails is narrowing for male workers, female workers have encountered a widening gap in the most recent year.

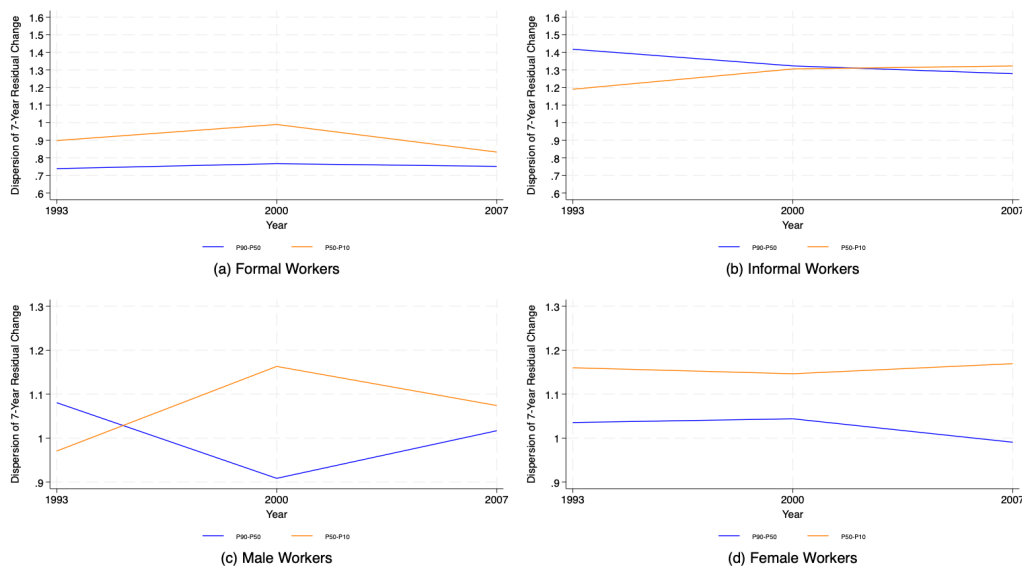


Figure 2.12: Dispersion of Earnings Changes by Sector and Gender

Figure 2.13 illustrates that formal workers exhibit a comparable dispersion pattern across both genders, with the lower tail group consistently surpassing the upper tail, showing a decline for both male and female workers in recent years. Conversely, informal workers have experienced distinct earnings dispersion patterns between males and females. For female workers, the dispersion in the upper tail is greater than that in the lower tail. In contrast, male informal workers have recently demonstrated an inverse situation. The dispersion among female workers in informal employment surpasses that of their formal counterparts across both tail distributions, and this trend is also observed among male workers. This situation diverges from the earnings level dispersion, where female informal

workers display lower dispersion than formal female workers. Variations in behaviour within the lower tail distribution significantly contribute to this outcome. The changes in earnings dispersion for female informal workers exceed those of formal female workers, illustrating the opposite scenario at the earnings level. This suggests that female informal workers positioned within the lower earnings group are experiencing more substantial changes in future earnings, aiming to align with the middle earnings group.

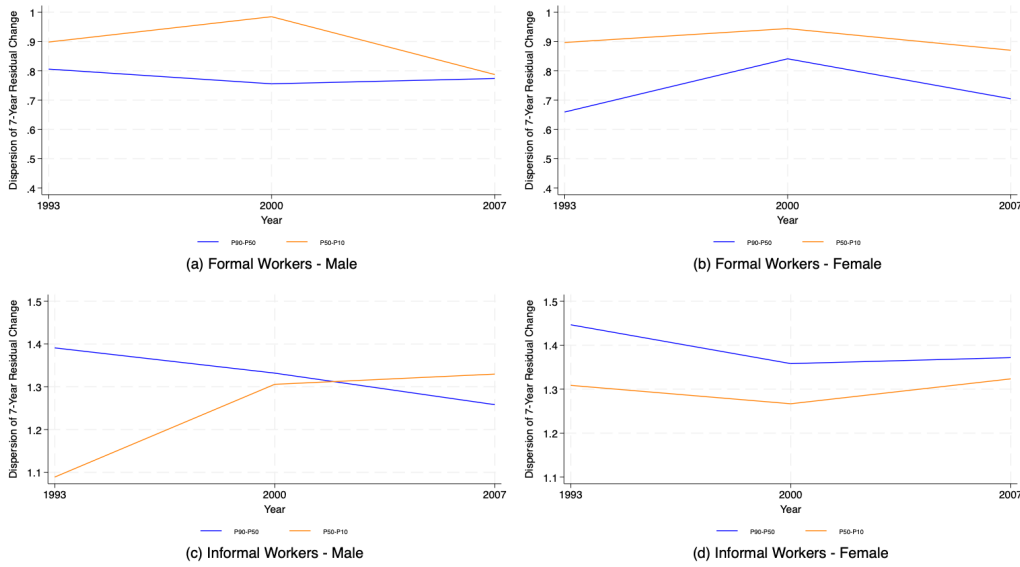


Figure 2.13: Dispersion of Earnings Changes by Gender for Each Sector

Second-order earnings risks, as represented by the variance levels within distinct initial earnings groups, exhibit a U-shaped distribution. Workers categorised within the low earnings group demonstrate a significantly elevated variance across all occupational categories. Concurrently, as one ascends the initial earnings groups, the variance levels for all workers exhibit a continuous decline. However, an increase in variance is observed within the highest earnings group. This phenomenon correlates with findings from studies conducted by [Tin and Tran \(2023\)](#) utilising Australian data and by [Gomes, Iachan and Santos \(2020\)](#) employing Brazilian data. The results suggest that workers within the low-earnings group are subjected to a heightened level of second-order risk in comparison to their counterparts in higher-earnings groups. In contrast, a distinct pattern emerges for informal workers, who display a relatively stagnant variance from earnings group decile two to decile nine, followed by an increase beyond that threshold. Furthermore, informal workers consistently maintain a variance level that exceeds that of formal workers, as illustrated in Figure 2.14.

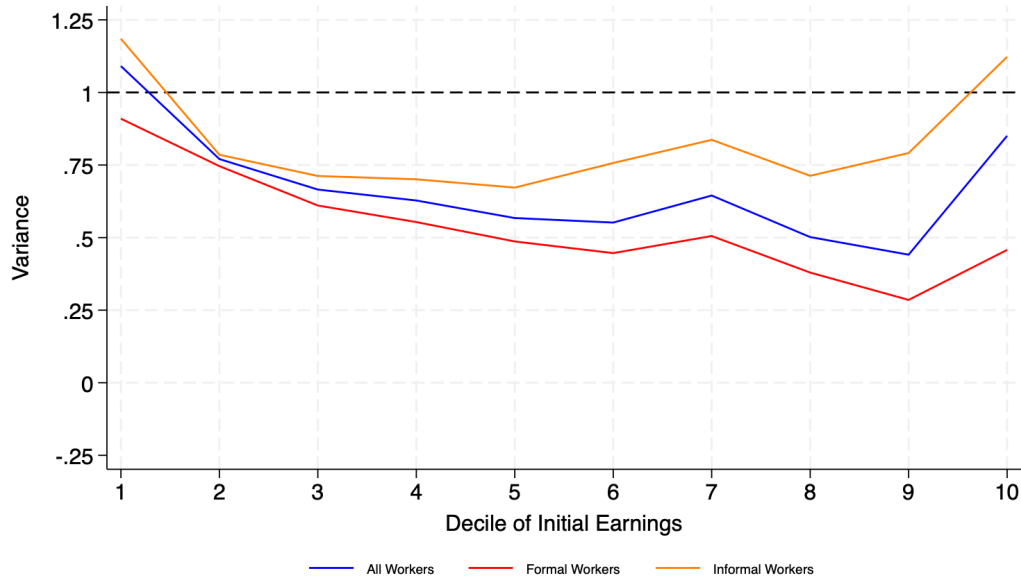


Figure 2.14: Variance of Earnings Changes by Initial Earnings

Third-order risk

In the majority of periods, third-order earnings risks, or skewness, for informal workers exhibit a positive trend, whereas formal workers have encountered increasingly negative skewness. The negative skewness experienced by formal workers suggests a significant downside earnings risk, potentially attributable to job loss arising from macroeconomic conditions or the employer's inability to remain competitive in the market. Unlike informal workers, whose upside earnings risks have improved in recent years, formal workers face escalating third-order earnings risks over time. This finding indicates that the risk of earnings decline among formal workers is not confined to times of crisis. A contrasting scenario is evident in Brazil and Argentina, where the skewness of formal employment is procyclical—demonstrating negative skewness during recessionary periods, as examined by Engbom et al. (2021) and Blanco et al. (2021), respectively. The data illustrated in panels (c) and (d) of Figure 2.15 reveals no significant disparities in earnings risk patterns between genders; both male and female workers have observed an enhancement in skewness in recent years. Both male and female formal workers are subjected to the same trend of deteriorating skewness. Conversely, male and female informal workers have experienced improvements in skewness in the most recent survey. Improved conditions for informal workers, characterised by upside earnings risks, serve as an incentive for these workers to continue within their respective employment sectors.

The degree of skewness diminishes as the initial earnings increase, as illustrated by Figure 2.16. As the earnings obtained rise, the associated downside risks intensify.

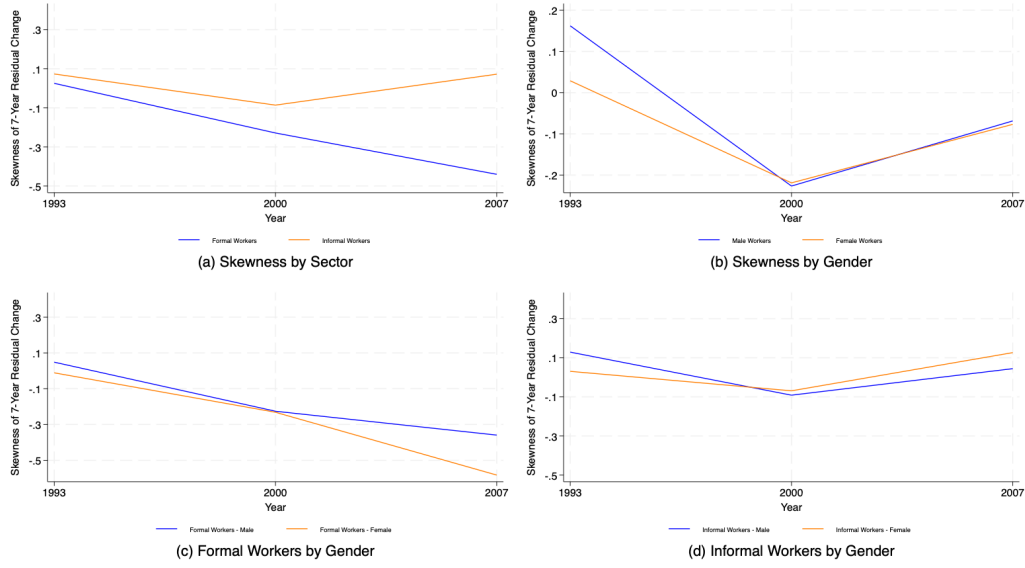


Figure 2.15: Skewness by Sector and Gender

These findings are supported by Australian data from a study conducted by [Tin and Tran \(2023\)](#) and Brazilian data from a study undertaken by [Engbom et al. \(2021\)](#), which utilises information from formal or wage workers, as well as research by [Gomes, Iachan and Santos \(2020\)](#), which examines both formal and informal workers in the Brazilian economy. Notably, informal workers exhibit a distinct behaviour, characterised by relatively stable skewness across various earnings groups. They maintain a skewness level approximating zero for multiple earnings categories, signifying a symmetrical risk profile between downside and upside risks. These conclusions suggest that, regardless of the earnings category among informal workers, the third-order earnings risks they encounter tend to be symmetrical, thereby offering incentives for informal workers across different earnings levels to remain within their sector.

Fourth-order risk

The fourth-order earnings risks, or kurtosis, for formal workers consistently exhibit significantly greater values than those for informal workers across all examined periods, as illustrated in Figure 2.17. This phenomenon is characterised by excess kurtosis, also referred to as leptokurtic distribution. It presents the characteristics of a pronounced central spike and substantial tails, indicating a heightened magnitude of extreme earnings risks associated with formal workers. In 2007, the excess kurtosis for formal workers reached a value of 3.23, which is markedly higher than the excess kurtosis of 0.61 recorded for informal workers, which has displayed a decreasing trend. The relatively modest excess kurtosis observed among informal workers signifies a lower degree of extreme risks related to earnings fluctuations. A similar trend is evident among formal workers in

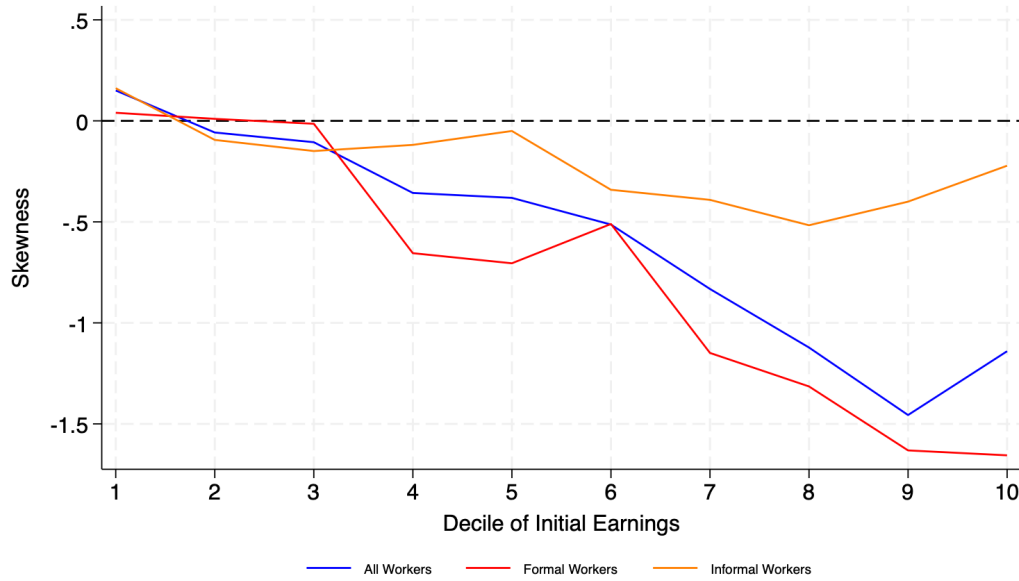


Figure 2.16: Skewness of Earnings Changes by Initial Earnings

Brazil and Argentina, where excess kurtosis has escalated in recent years, as reported in studies by Engbom et al. (2021) and Blanco et al. (2021), respectively. In 2007, formal workers experienced an increase in excess kurtosis for both genders, male and female, while informal workers have demonstrated a declining trend across both genders. Notably, the differences in excess kurtosis patterns for various sectors surpass those observed in gender comparisons.

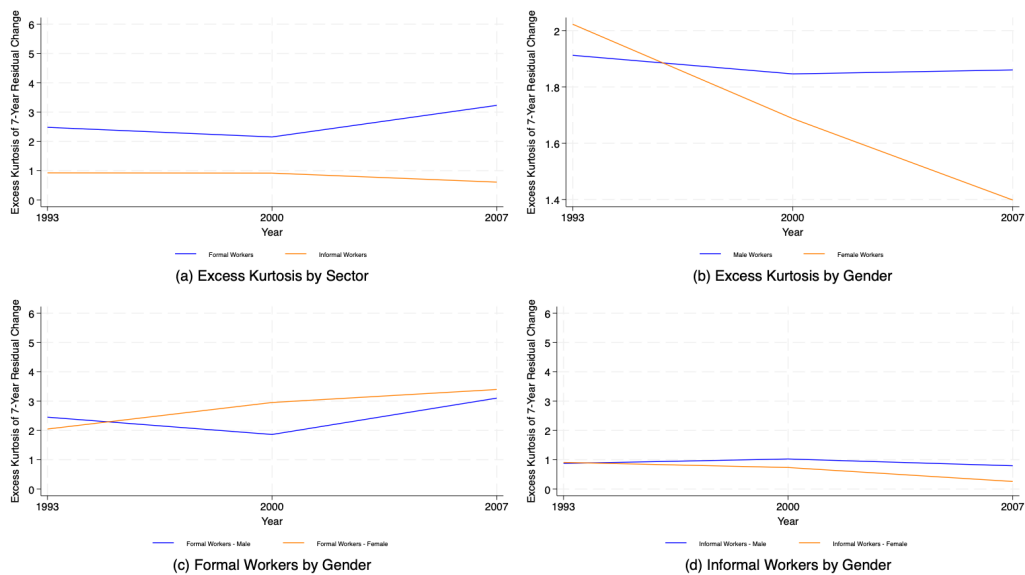


Figure 2.17: Excess Kurtosis by Sector and Gender

The degree of kurtosis shows an increase commensurate with rising earnings. Higher earnings correlate with a greater incidence of extreme earnings risks, particularly among

formal workers. In contrast, informal workers exhibit a stable level of kurtosis across various earnings levels. The excess kurtosis observed in informal workers approaches zero, adhering to a normal distribution pattern. A similar phenomenon has been documented in Brazil, as indicated by a study conducted by [Gomes, Iachan and Santos \(2020\)](#) concerning both categories of workers, alongside a separate study by [Engbom et al. \(2021\)](#) focused on formal workers.

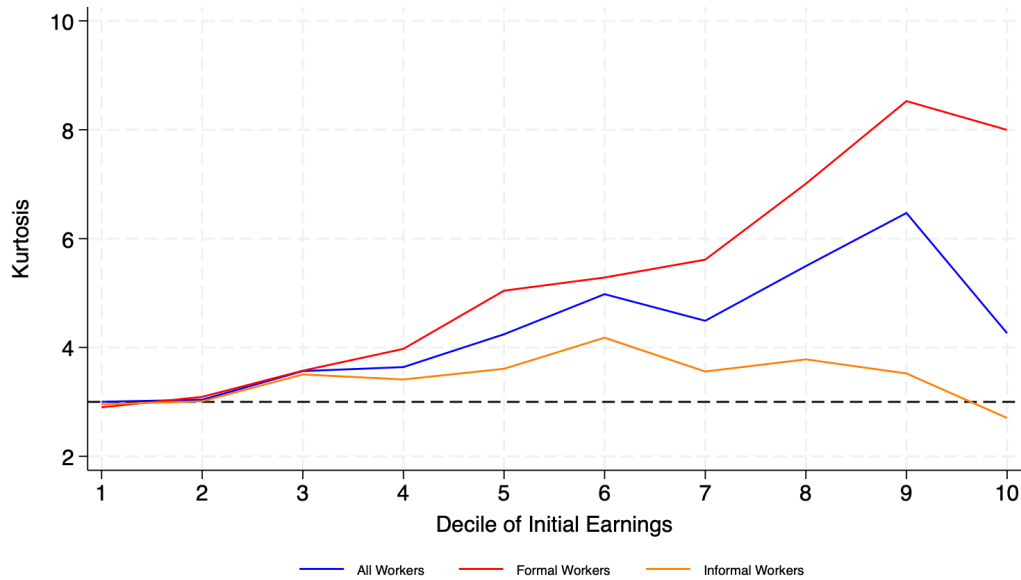


Figure 2.18: Kurtosis of Earnings Changes by Initial Earnings

2.4.4 Risk sharing within family and social network

This section conducts a comprehensive analysis of the significance of various income sources in alleviating earnings risks for workers. The examination will focus on the contribution of family income and the extended social network. Firstly, it will explore how family income can help mitigate the earnings risks confronted by workers. Secondly, it will assess the combined effects of family income, capital income, and private transfers in reducing these risks. Additionally, the analysis will examine the diverse types of employment for both formal and informal workers, which are categorised according to the nature of the head of the household's occupation.

Variables constructions. The unit of analysis employed in this study is a family unit or household, which comprises a head of household, a spouse, children, and other family members residing in the same domicile. We have developed three new variables: (i) total labour earnings of household members, referred to as family earnings, (ii) capital earnings, and (iii) private transfers.

Firstly, family earnings represent the aggregate income generated by all members of

the family unit. This is essentially the summation of all earnings from household members. Secondly, capital earnings are derived from the annual income produced by owned assets, calculated on a monthly basis, adjusted to reflect the ownership proportion, and indexed to the price levels of 2007. Such assets may include properties such as houses, land, farms, industrial plants, transportation vehicles, household equipment, as well as financial instruments like savings and deposits. Lastly, private transfers, which stem from social networks, are computed based on yearly income transfers divided into monthly amounts, also adjusted to the 2007 price level. These transfers can originate from parents, siblings, relatives, friends, or neighbours who are not household members and may manifest in various forms, including cash contributions, assistance with educational expenses, healthcare costs, medical treatment, food provisions, or other goods in currency equivalents.

Insurance role of family earnings and social network. Family earnings serve a critical function in alleviating earnings risks for two key reasons. First, the existence of an income pooling effect allows the secondary earner to consistently contribute to the family's income, thereby reducing the dependency solely on the primary earner. Second, the added worker effect enables secondary earners to dynamically adjust their working hours in response to fluctuations in the primary earner's income. Furthermore, private transfers, which stem from close social networks, play a significant role in smoothing consumption patterns. Communities often have strong social ties, and within these networks, helping others can be seen as a moral obligation. Familial earnings can alleviate third-order earnings risks encountered by workers by enhancing the level of income skewness, particularly benefitting formal workers who are profoundly impacted. The second earner within the family structure, whether a spouse or another household member, can mitigate the risks associated with declines in earnings from the primary earner or head of household. Importantly, the advantages of this arrangement tend to accrue primarily to formal workers, leaving informal workers at a disadvantage. Nevertheless, the influence of social networks is substantial for all worker categories, both formal and informal, in mitigating third-order earnings risks. Conversely, the impact of capital earnings is minimal and is primarily experienced by high-income workers.

The influence of family earnings on second-order earnings risk or variance is minimal for the majority of group earnings; however, it significantly escalates the variance for top earners. The marginally higher variance associated with family earnings compared to individual earnings suggests that the income pooling effect predominates, as secondary earners do not modify their working hours in response to earnings fluctuations experienced by the primary earner. Figure 2.19 illustrates this behaviour for middle and high earnings groups, whereas the low earnings group exhibits relatively consistent variance between individual earnings and family earnings. Furthermore, the contribution of family earnings,

in conjunction with capital earnings and private transfers, has resulted in a substantial increase for top earners.

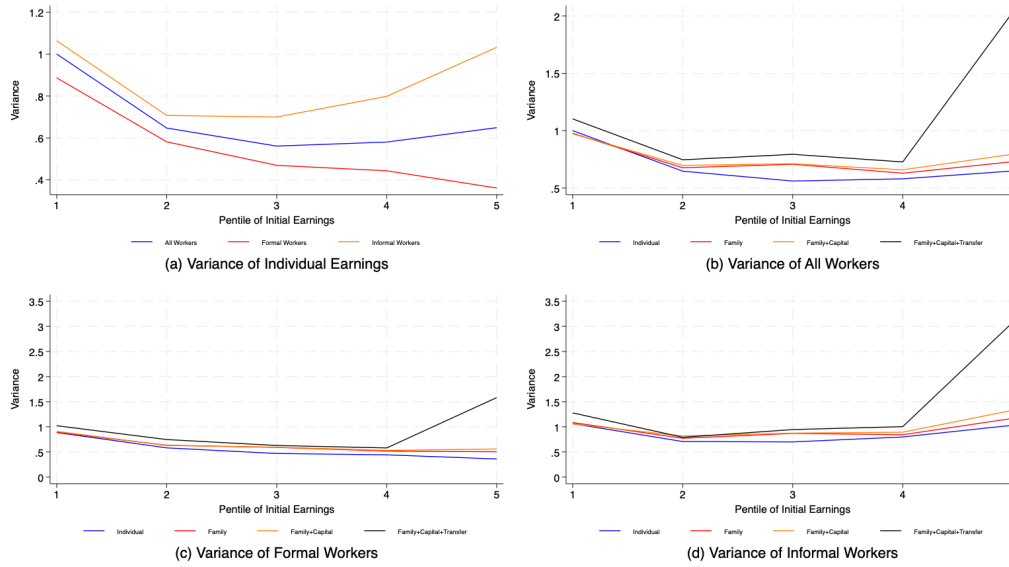


Figure 2.19: Role of Family Earnings on Second-Order Earnings Risks

Note: Panel (a) illustrates the level of variance for individual earnings, categorised by initial earnings group. The remaining panels present the variance level in individual and family earnings across household earnings groups for different types of workers.

Family earnings play a significant role in alleviating third-order earnings risks by enhancing the level of skewness, as illustrated in Figure 2.20. The positive impact of family earnings is notably more pronounced for formal workers, although it falls short of elevating skewness to the levels observed among informal workers. For formal workers, family earnings result in a less negative skewness across all earnings groups, with the most substantial effects evident among middle- and high-earning individuals. In contrast, informal workers perceive the influence of family earnings as minimal, having little effect on both low- and high-income segments. Furthermore, social networks significantly mitigate risks for both categories of workers. The interaction of family earnings, alongside capital earnings and private transfers, substantially influences the skewness levels for all worker types, managing to achieve a positive skew in most earnings groups, excluding the top earners. Notably, formal workers can exhibit skewness levels that are relatively comparable to those of informal workers, when accounting for the contributions of family earnings, capital earnings, and transfers. The negative earnings experienced by top earners can be attributed to the high proportion of their income derived from capital earnings and transfers, rendering them vulnerable to fluctuations in income due to decreased capital earnings or transfer receipts.

Family income has less influence on the level of kurtosis, for both formal and informal workers. Figure 2.21 illustrates the negligible impact of family income across various

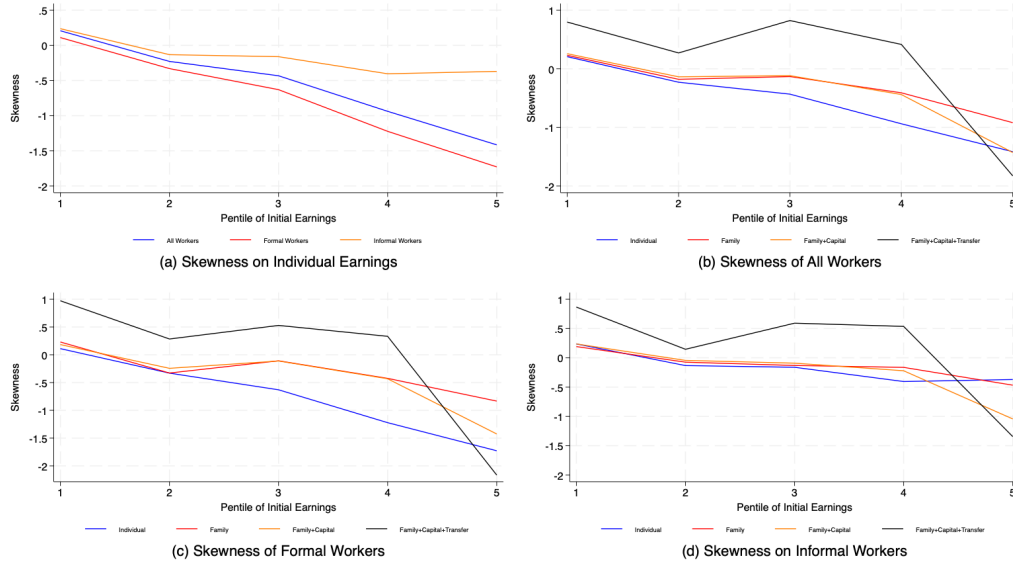


Figure 2.20: Role of Family Earnings on Third-Order Earnings Risks

earning groups. In the case of formal workers, family income may slightly mitigate kurtosis within the middle and upper earning groups, thus diminishing the risks associated with extreme earnings. In contrast, for informal workers, family income has a marginal effect of increasing the risks of extreme earnings within the same earning categories, albeit these risks remain lower than those observed for formal workers. Additionally, the contributions of family income, capital earnings, and private transfers enhance the kurtosis for both categories of workers across diverse earning groups. The elevated kurtosis is also attributable to the nature of capital earnings and private transfers, which can undergo significant fluctuations relative to the earnings of the preceding period.

The family income, in conjunction with capital income and private transfers, exerts a notably substantial positive influence in alleviating third-order earning risks. This effect is even more pronounced than that of family income alone, particularly for low and middle-income groups. Social networks, manifested through transfers, play a crucial role and provide more impact. This influence is markedly evident for both types of workers, although it does not extend to top earners, who experience a lower level of skewness compared to individual earnings. Conversely, the impact on second-order earnings risks remains negligible, while its repercussions on fourth-order earnings risks exacerbate the situation.

2.5 Extension and sensitivity analysis

This section offers an extension of the study on earnings level patterns by gender and location, aiming to enhance understanding of earnings dynamics. Furthermore, we present

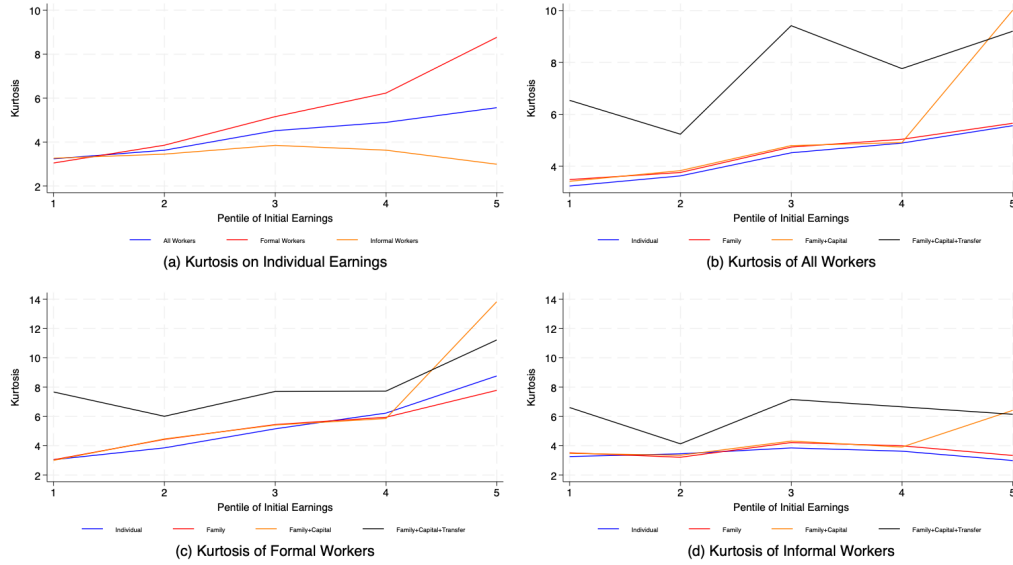


Figure 2.21: Role of Family Earnings on Fourth-Order Earnings Risks

two additional analyses to assess the sensitivity of our primary analysis results. The first sensitivity analysis uses a different sample selection, where we analyse respondents who have been surveyed throughout the entire period, thereby creating a balanced panel. The subsequent analysis employs alternative model specifications, incorporating education level as a control variable in our main regression. We will demonstrate that the results from these two exercises are largely consistent with our findings in the primary analysis.

2.5.1 Pattern of earnings level by gender and location

Male vs. Female. According to gender analysis, formal female workers consistently exhibit greater earnings dispersion compared to their formal male counterparts, whereas informal workers display similar dispersion levels between genders. The elevated dispersion observed among formal female workers is primarily attributed to the higher dispersion found in the lower tail of their earnings distribution. In contrast, formal male workers present a uniform level of dispersion across both the upper and lower tails, particularly in recent years. Notably, the earnings dispersion for female workers in informal employment is less significant than that in formal employment, which serves as a motivation for women to engage in informal work. For informal female workers, the dispersion between the lower and upper tails remains relatively equal, with no discernible dominance from either end. In contrast, the dispersion among informal male workers is predominantly influenced by the lower tail of the distribution, as illustrated in Figure 2.22. For male workers, formal employment results in lesser earnings dispersion compared to informal employment, a trend that contrasts with the experiences of female workers.

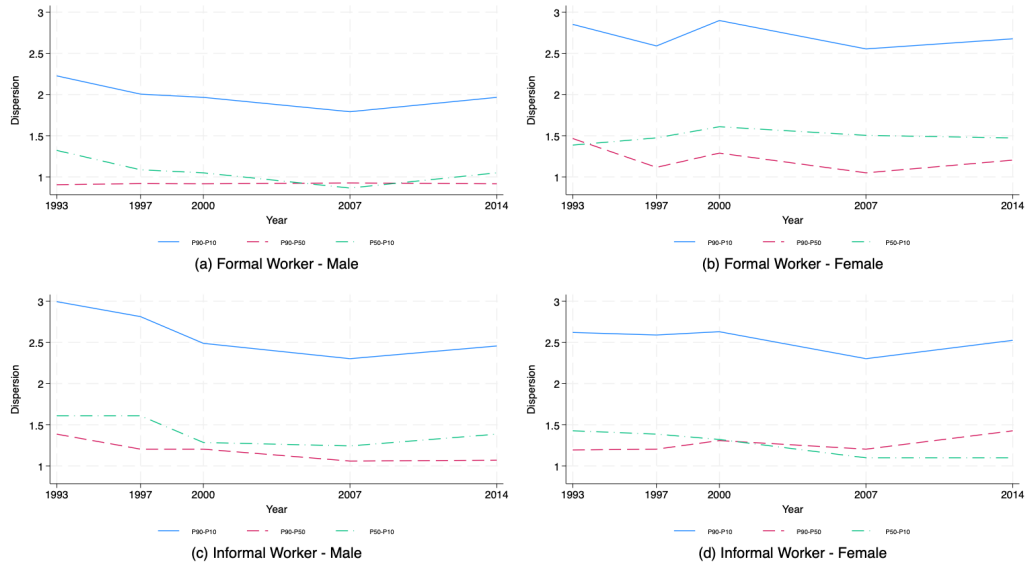


Figure 2.22: Dispersion by Sector and Gender

Urban vs rural area. In terms of geographical distribution, formal workers situated in urban areas exhibit a lower level of dispersion compared to their counterparts in rural areas. This observation also applies to informal workers; however, the disparity in dispersion between urban and rural informal workers is not as pronounced as that observed among formal workers. Notably, for all demographics, the lower tail of the distribution contributes more significantly to dispersion than the upper tail. Furthermore, within rural areas, formal workers display lesser dispersion than informal workers, a trend that is also evident in urban areas, as illustrated in Figure 2.23.

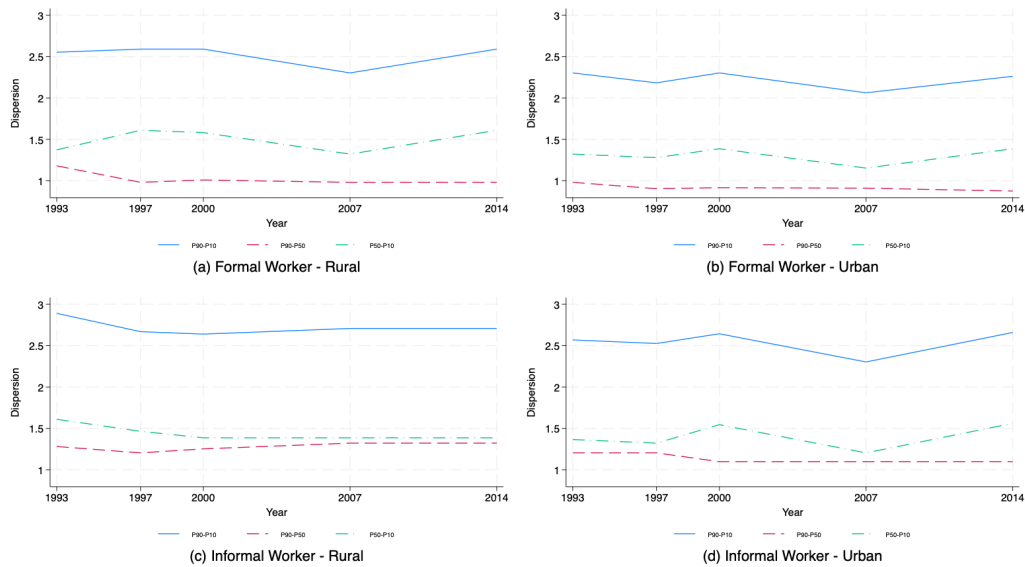


Figure 2.23: Dispersion by Sector and Location

2.5.2 Balanced panel data

This section conducts an analysis utilising respondents surveyed throughout the entire survey period to establish a balanced panel, thereby encompassing a more limited group of individuals than the primary analysis. Nevertheless, it effectively captures their lifetime behaviour from the inception of their careers to the approach of retirement age. The analysis yields results consistent with the main findings in the previous section, implying that different generations experience relatively similar conditions regarding earnings dynamics.

In each survey wave, over 3,100 respondents were surveyed, all of whom were aged between 25 and 55 years during the survey period. Given the span of 21 years between the initial and final surveys, the respondents who were aged 25 to 34 during the first survey, are now no older than 55 years at the time of the last survey. The proportion of informal workers remains predominant; however, it is noteworthy that in 2007, there was a significant increase in the share of informal workers in the balanced panel data, as shown in Table 2.3.

Table 2.3: Statistics Descriptive for Balanced Panel IFLS

Year	Balanced Panel				
	Observation	Mean Age	Monthly Income	Hours Worked	Formal Shares
1993	3148	29.708	12.831	41.748	0.434
1997	3148	33.654	13.068	42.348	0.481
2000	3148	36.342	13.016	43.341	0.433
2007	3148	43.528	13.264	42.481	0.296
2014	3148	50.354	13.434	45.055	0.301

The disparity in earnings between formal and informal workers is progressively increasing, which contributes to a rise in inequality. Figure 2.24 illustrates a consistent trend in earnings over time, akin to the primary analysis, wherein the earnings gap diminished shortly following the Asian financial crisis but has since expanded since 2000. Earnings among informal workers have been consistently lagging behind those of formal workers across all earnings categories. Formal workers were particularly impacted by the Asian financial crisis, as they experienced a decline in earnings across most earnings groups. Conversely, informal workers managed to stabilise their earnings, avoiding significant decreases across the majority of earnings categories.

Formal workers exhibit a less Gaussian distribution of earnings shocks, characterised by significant levels of skewness and excess kurtosis, indicating an asymmetric distribution with pronounced tails. In contrast, informal workers display a distribution resembling a

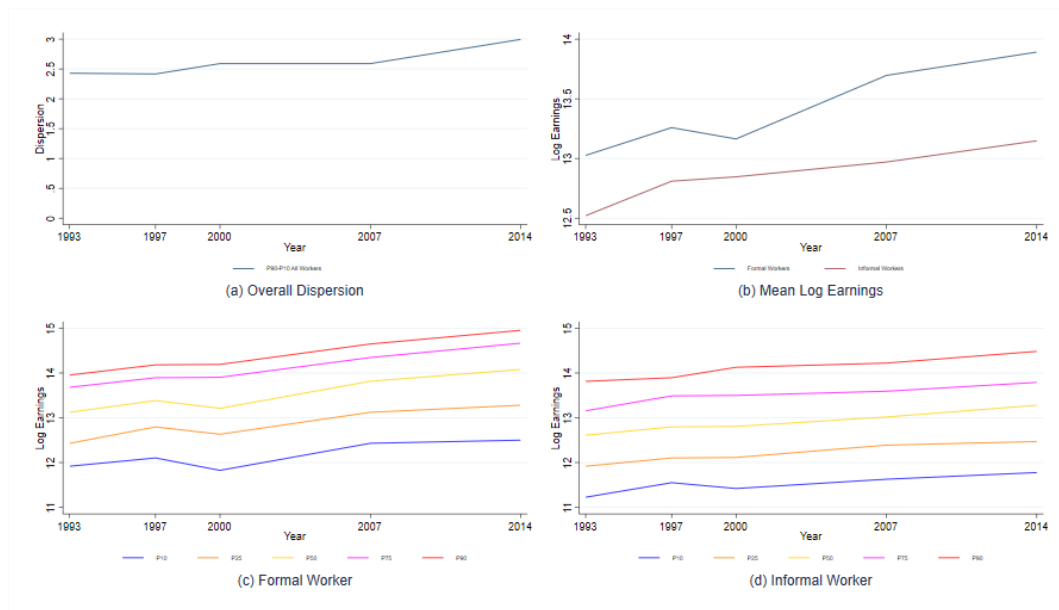


Figure 2.24: Overall Dispersion Over Time

Gaussian curve, with skewness and excess kurtosis approximating zero, as illustrated in Figure 2.25. The earnings risks within this sample demonstrate the same behaviour as observed in the primary analysis, revealing that formal workers encounter greater earnings risks compared to their informal counterparts. Moreover, the third-order earnings risks for formal workers are negative, suggesting a left-skewed distribution, wherein a portion of the workforce experiences negative earnings shocks.

Informal workers experience earnings shocks that exhibit a more symmetrical distribution, where the third-order earnings risks approximate zero, in contrast to their formal counterparts, as illustrated in Figure 2.26 panel (a). The skewness of informal workers has remained positive for several periods, notably in 1993 and 2007, with an overall average close to zero, while formal workers consistently remains negative throughout the observed period.

Concurrently, informal workers experience minimal extreme earnings shocks, as illustrated in panel (b). Formal workers consistently exhibit a greater excess kurtosis compared to their informal counterparts throughout the year, with an even more pronounced gap observed in the final survey period. In contrast, informal workers demonstrate a decline in excess kurtosis, ultimately reaching zero on an annual basis. These findings align with the primary analysis presented in the preceding section.

The transition of workers between employment sectors exhibits a markedly low rate, with the shift from formal to informal employment being more pronounced than the reverse transition from informal to formal sectors, mirroring the behaviour observed in the principal analysis. Table 2.4 illustrates that a significant proportion of informal workers opt to remain within their current employment sector, with a retention rate of 88.01%,

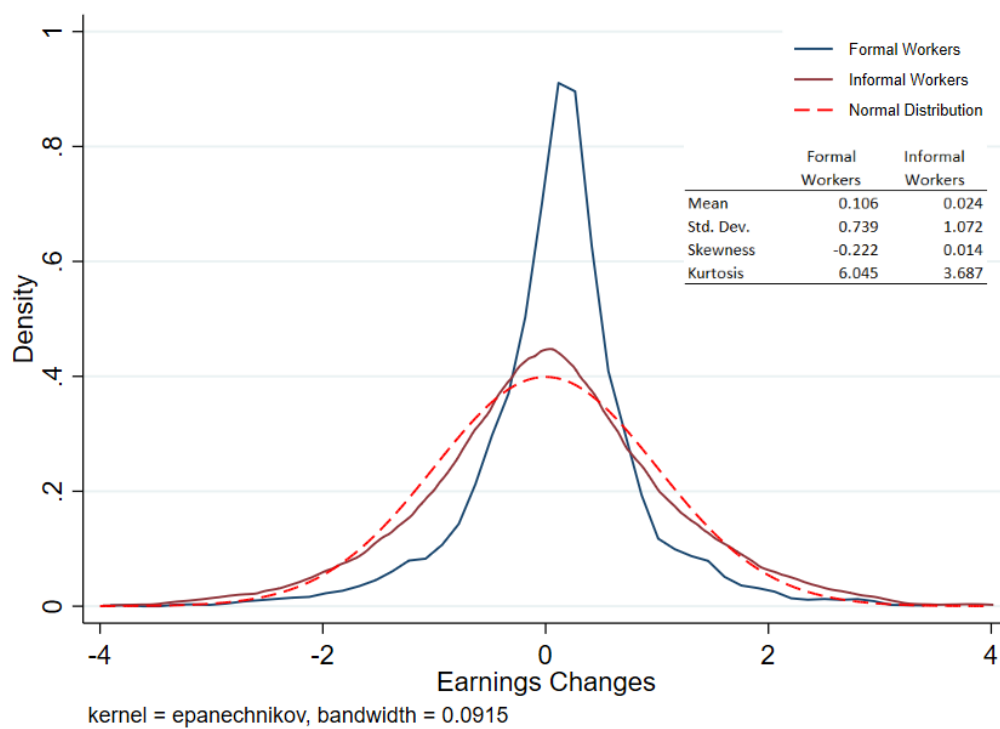


Figure 2.25: Earnings Changes by Sectors for Balanced Panel

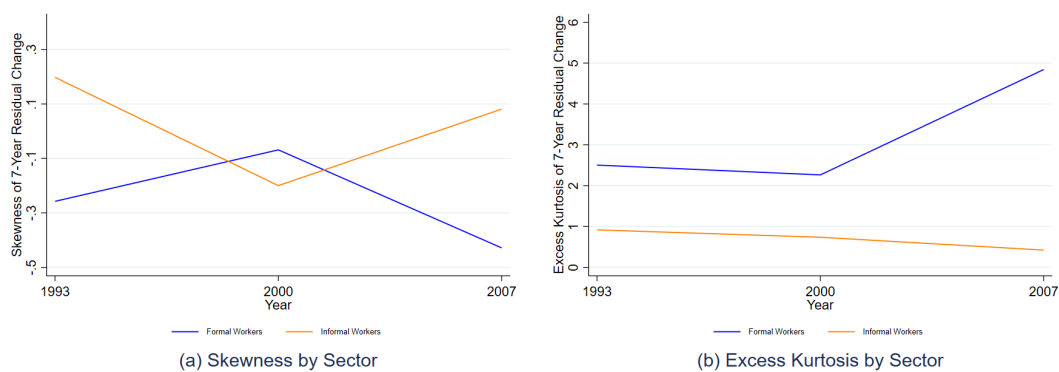


Figure 2.26: Higher-Order Earnings Risks

while less than 12% choose to transition to formal employment. These findings indicate a greater rigidity compared to the principal analysis conducted on the unbalanced panel, where the corresponding proportions are 83.78% and 16.22%, respectively. The proportion of formal workers who either remain within their current sector or change sectors aligns closely with the results presented in the previous section of the main analysis.

Table 2.4: Transition Probability for Balanced Panel

	Formal	Informal
Formal	68.87%	31.13%
Informal	11.99%	88.01%

The proportion of formal workers transitioning to informal employment diminishes as initial earnings increase. Figure 2.27 illustrates that the pattern of decreasing transition ratios predominantly occurs among younger and middle-aged workers, whereas older workers exhibit a relatively unpredictable pattern. The transition from formal to informal employment remains consistently higher across various initial earnings levels, particularly among younger and middle-aged workers. Conversely, the transition from informal to formal employment remains relatively constant at a low level and does not depend on initial earnings. This behaviour contrasts with the findings of the primary analysis, where the transition ratio decreases as initial earnings increase.

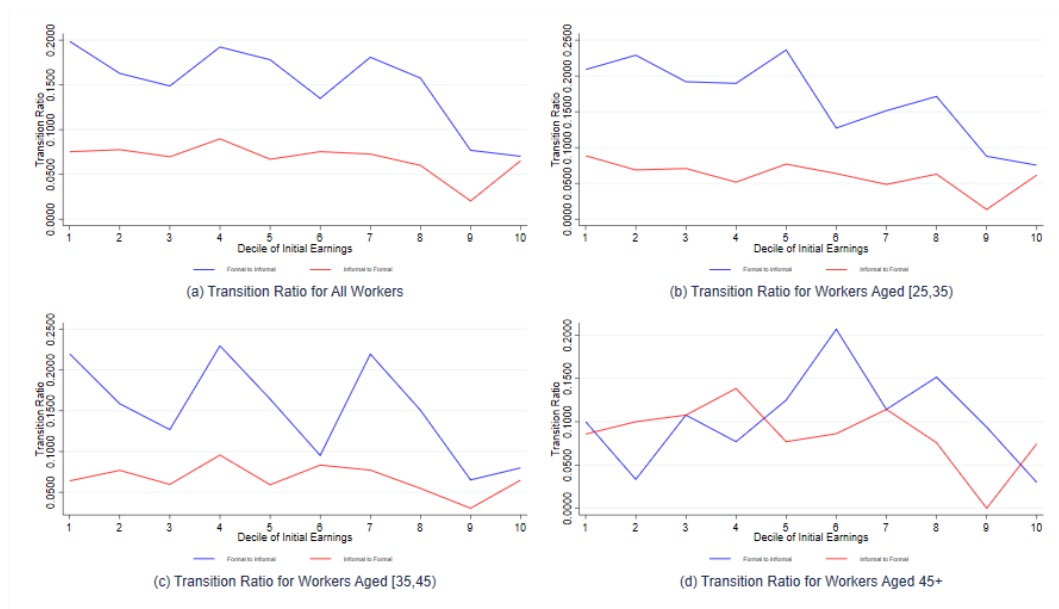


Figure 2.27: Seven-Year Transition Ratios by Age and Initial Earnings

Individuals with substantial earnings are primarily comprised of non-transitional formal workers, whereas non-transitional informal workers account for up to 80% of the earnings group. Figure 2.28 illustrates the distribution of employee types across each lifetime

earnings decile. The preeminence of formal workers within the top earning categories aligns with the notable positive earnings shocks experienced by formal workers in contrast to other worker classifications. Furthermore, the percentage of individuals remaining in informal employment diminishes as lifetime earnings increase, which corresponds to the lower earnings shocks observed for informal workers. The rate of transitions among workers—both from formal employment to informal and vice versa—remains consistent and is maintained at a low level.



Figure 2.28: Transition Ratios by Lifetime Earnings

Note: individuals are classified based on their lifetime earnings, which are defined as the aggregate total of income accumulated throughout the duration of the survey. The line delineates the proportion of each category of transition observed over a seven-year period.

Workers classified as non-transitional formal employees experienced the most significant fluctuations in earnings. Conversely, those classified as transition workers reported higher earnings compared to individuals who continued as informal workers. Figure 2.29 illustrates the distribution of earnings changes for each category of worker, encompassing both those who persist in the employment sector and those who undergo transitions. It is noteworthy that formal workers exhibit the most pronounced changes in earnings relative to other categories; however, they concurrently face the highest risks associated with third-order and fourth-order earnings, as evidenced by markedly negative skewness and elevated kurtosis. In contrast, the other categories of workers display a skewness approximately equal to zero and a kurtosis around three, resembling a Gaussian distribution closely.

This behaviour aligns with the primary analysis employing unbalanced panel data, though disparities emerge concerning the earnings changes experienced by workers transitioning from formal to informal status. Notably, in the balanced panel data, earnings changes for formal workers transitioning to informal positions are positive, whereas, in the unbalanced panel data, these changes are negative.

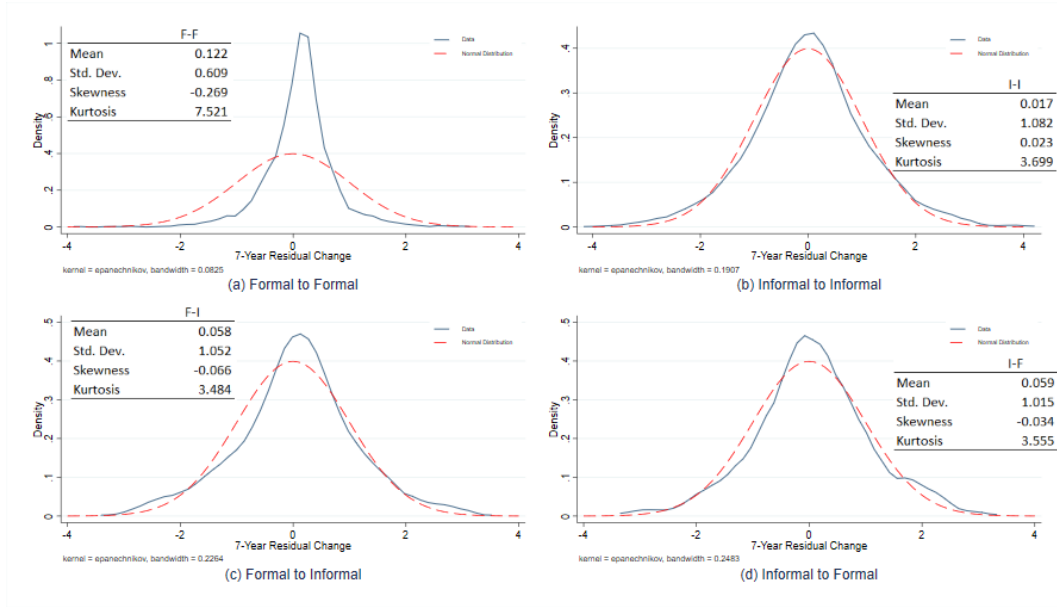


Figure 2.29: Density of Earnings Changes

2.5.3 Regression with education

Subsequently, we extend the model to account for the education level in assessing earnings shocks. By controlling for education, we are able to analyse how various employment sectors affect earnings shocks for all workers, irrespective of their education level. To achieve this objective, we performed a regression analysis of the logarithm of earnings relative to age, dummy year variables, and a dummy variable for high skill, as follows

$$\ln y_{i,t} = \alpha \text{age}_{i,t} + \beta \text{age}_{i,t}^2 + \gamma \text{year}_t + \delta \text{skill}_{i,t} + \varepsilon_{i,t},$$

where $\text{skill}_{i,t}$ denotes the educational attainment level of workers, which is assigned a value of 1 if the individual has successfully completed at least their senior high school or Year 12 education. The findings are consistent with our primary analysis, indicating that formal workers exhibit a less Gaussian distribution of earnings shocks, characterised by left-skewness and elevated kurtosis in comparison to their informal counterparts, who conform more closely to a Gaussian distribution. Additionally, formal workers demonstrate a higher mean and reduced variability in their earnings changes, aligning with our primary analysis, as illustrated in Figure 2.30.

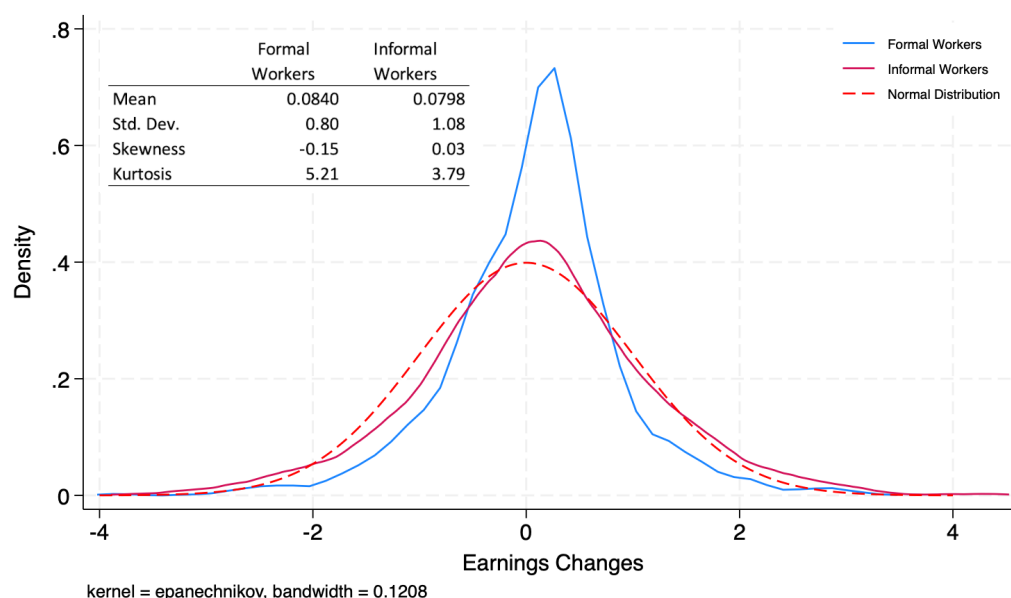


Figure 2.30: Earnings Changes by Sectors

Informal workers encounter earnings shocks that display a more symmetrical distribution, with the third-order earnings risks approximating zero during the study period. This is in contrast to their formal counterparts, as depicted in Figure 2.31 panel (a). The skewness for informal workers exhibits the same trajectory as observed in our primary analysis, maintaining a positive value for the period 1993 and 2007, with an overall average nearing zero. Conversely, the skewness for formal workers continues to decrease, aligning with the primary analysis, ultimately falling into negative territory during the recent periods. The fourth-order earnings shocks for formal workers are substantially greater across all periods compared to their informal counterparts, as shown in panel (b). The gap in excess kurtosis between the two sectors becomes even more pronounced in the final survey period. In contrast, informal workers exhibit a decline in excess kurtosis, eventually stabilising at zero. These findings are consistent with the primary analysis presented in the preceding section.

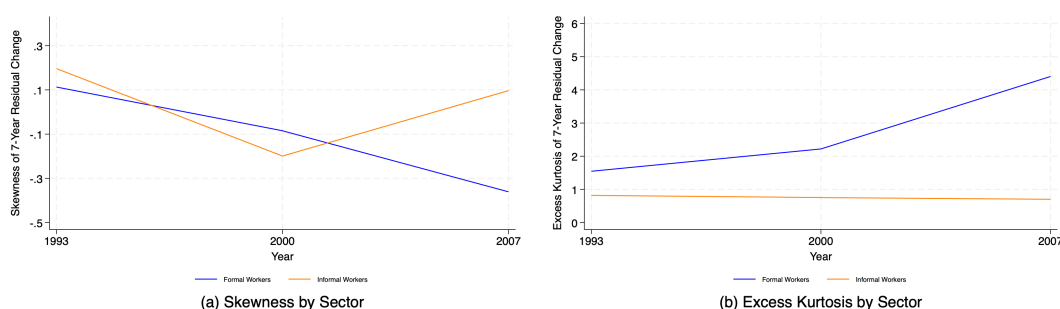


Figure 2.31: Higher-Order Earnings Risks

Individuals who remain in the informal sector experience the lowest changes in earnings.

In contrast, workers transitioning between informal and formal employment, or vice versa, exhibit relatively similar changes in their earnings, reflecting findings consistent with our primary results. However, individuals who maintain formal employment are no longer associated with the highest changes in earnings, as transitional workers have begun to earn a greater amount, as illustrated in Figure 2.32. Upon controlling for educational factors, the transition between sectors yields improved benefits for changes in earnings. The variation in earnings changes between the two types of transitions is similar, demonstrating a nearly symmetric distribution with minimal excess kurtosis. The distribution of earnings for individuals who remain in formal employment deviates from Gaussian distribution, exhibiting negative skewness and high excess kurtosis, while those who remain in informal employment display a distribution more akin to Gaussian.

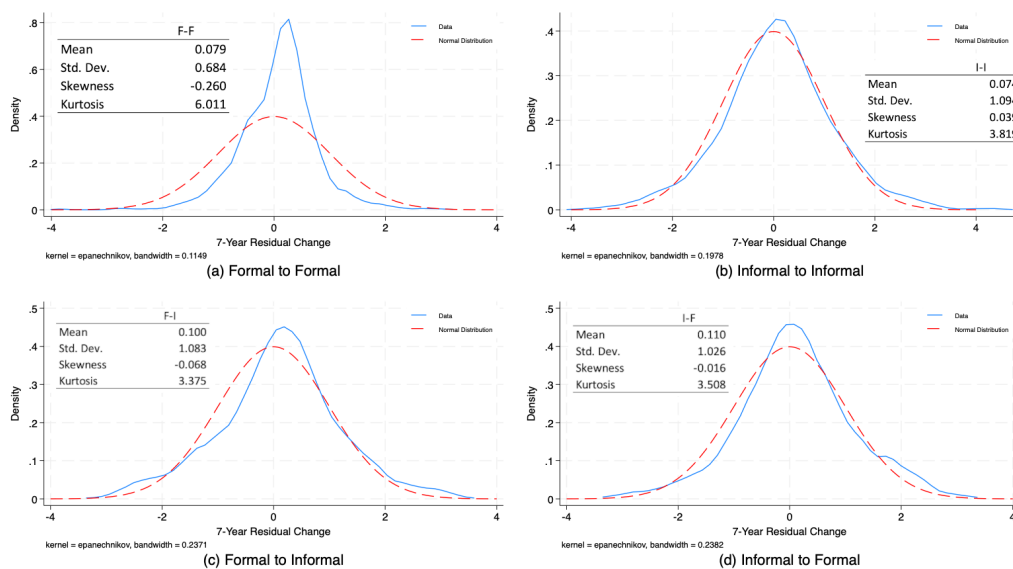


Figure 2.32: Density of Earnings Changes

2.6 Conclusion

We document the empirical pattern of labour earnings inequality and dynamics within the developing economy of Indonesia, which is predominantly characterised by informal workers. Utilising individual panel data, our findings indicate that the substantial earnings disparity between formal and informal workers significantly contributes to elevated levels of earnings inequality. The rigidity and asymmetry associated with workers' transitions between sectors further exacerbate this disparity, resulting in informal workers' earnings lagging behind across various earnings groups. An increased transition ratio from informal to formal employment is anticipated to enhance earnings fluctuations for the involved workers and mitigate the widening earnings gap. It is important to note that workers within each employment sector encounter different characteristics of the earnings shock process. Formal workers exhibit a less Gaussian distribution, characterised by lower variances, but they experience greater third-order and fourth-order earnings risks when compared to informal workers. Informal workers, in contrast, adhere to a Gaussian distribution, characterised by symmetric earnings risks and a limited extreme earnings risks.

We also investigate the extent to which family earnings, capital income, and private transfers contribute to the alleviation of earnings risks. In the context of mitigating third-order earnings risks, family earnings assume a pivotal role, particularly for formal workers, who are markedly affected by these risks. Family earnings are able to enhance skewness, thereby assisting in the mitigation of potential declines in earnings from the primary earner or the head of the household. Furthermore, social networks, in relation to private transfers, significantly enhance efforts to mitigate third-order earnings risks, particularly among low- and middle-income earners as well as both formal and informal workers. Notably, the impact of social networks surpasses that of family earnings alone.

It is imperative to increase the share of formal workers to narrow the earnings gap by reducing informal employment. While social networks help mitigate some of the earnings risks for individual workers, facilitating the transition to formal employment needs to be encouraged to improve aggregate macroeconomic indicators.

Prevalent Informality and Labour Allocation

3.1 Introduction

In many developing countries, informality is significant in generating employment and income, particularly for workers who may not have access to formal sector jobs. Informality can help reduce poverty by providing a source of income and employment immediately and offering flexibility and autonomy, which benefit certain workers. Conversely, the large share of informality in the economy results in less tax revenue because informality is unregulated, leading to lower allocations for social security and the provision of public goods. Working informally provides lower income than formal workers and limited access to formal sector work conditions, such as stable employment, safe working conditions, and social protection. This study aims to enhance the understanding of the complex relationship between growth, inequality, and labour dynamics in economies with large informal sectors. We assess and quantify how informality leads to resource misallocation due to low productivity and limited mobility, which in turn reduces overall productivity and exacerbates inequality.

Evidently, high informality positively correlates with low GDP per capita and high inequality. The low level of productivity in informal activities results in low-income levels and income growth, resulting in a wide income gap with workers in the formal sector who have higher productivity. Significant differences in real income and labour productivity across formal and informal sectors have persisted for long periods. These persistent differences suggest the presence of structural frictions that limit the ability of workers to arbitrage the gaps away by transitioning towards a more productive formal sector. Such frictions to labour mobility could lead to aggregate losses by misallocating labour across sectors.

Labour mobility, the ability to transition between occupations, is an essential factor for individual wealth and the economy as a whole. It helps workers find jobs that match their skills and interests, thereby boosting their productivity and output. Increased

productivity can lead to higher income for workers. At the aggregate level, labour mobility promotes more efficient resource allocation, particularly during economic structural changes. It allows workers to be allocated to critical sectors that underpin economic growth, thereby maintaining economic stability.

Despite the importance of labour mobility, it remains relatively low in developing countries for several reasons. One major obstacle is the high level of informational friction, which limits access to accurate and timely labour market information, thereby reducing workers' ability to make job transitions. Additionally, some sectors have high regulatory barriers to entry, such as licensing rules, which hinder workers from entering new professions without a license. The prevalence of the informal sector, where labour mobility is generally low, is another contributing factor. While the informal sector can provide immediate employment opportunities, the lack of access to skill upgrading due to the inadequate training system means that informal workers cannot compete in the formal sector.

Labour mobility also significantly affects the trade-off between economic output and equality. A higher (lower) trade-off between the two represents a higher (lower) cost of rising output by causing inequality to worsen (improve) due to the disproportionate increase. Higher labour mobility can lead to a better aggregate output if workers can move into more productive occupations. As workers move to occupations that offer higher income and better working conditions, the overall income distribution can become more equitable. This is a potential benefit of labour mobility, as it can reduce the Gini coefficient, a key measure of income inequality. However, the relationship between labour mobility, output, and inequality is complex and country-specific. It may also lead to more significant income disparities if the mobility is skewed toward a small number of high-paying sectors. Conversely, labour mobility can entrench workers in low-productivity informal sectors, exacerbating income inequality and limiting economic growth. Individual worker may decide to move to a lower productivity occupation because it provides more benefits to them, taking into account their skills and other economic incentives. This has unfavourable aggregate consequences, resulting in lower output and widening inequality.

We develop a heterogeneous agent model with endogenous informality, where informality serves as the equilibrium outcome. Our findings highlight the notable impact of informality on productivity and inequality, emphasising the urgent need to address this issue. The novelty of this paper lies in exploring the aggregate consequences of informality in the context of lower labour mobility using a theoretical framework, thereby broadening the contributions within the literature. We first document the persistence of informality and low labour mobility across occupations using several survey datasets and investigate the characteristics of the labour market. We then develop a general equilibrium framework based on those characteristics, integrating the formal and informal

labour markets within a two-sector economy featuring occupational choice. The labour mobility frictions introduced in the model, combined with individual skill, will determine the labour allocation in each sector endogenously. Workers can choose their occupation as either wage workers or entrepreneurs, depending on their wealth and skill set, and can transition between occupations, reliant on the level of labour mobility friction. As wage workers, they earn wages and pay taxes, while as entrepreneurs, they manage their own production and can operate their businesses formally or informally. Formal entrepreneurs have better access to capital markets, can hire labour and pay taxes, whereas informal entrepreneurs face limited access to capital markets, employ household members as labour and do not pay taxes. By calibrating the model using matched household survey data from Indonesia, we illustrate that the prevalence of informality may lead to an efficiency-equality trade-off; beyond misallocating labour across sectors, it also significantly impacts capital accumulation.

We found that the labour market in a high-informality environment has low mobility, characterised by a low transition rate between the formal and informal sectors. The transition rate from formal to informal workers is higher than vice versa, with the rates remaining low. This pattern has resulted in the prolonged dominance of informal workers. Most informal workers remain on their job due to limited access to training opportunities, hindering their human capital accumulation and making them less competitive in the formal job market. Some may choose to remain due to their skill sets or lack of formal qualifications. Even if workers possess the talents that employers are looking for, some may find it challenging to find the right match for these skills due to informational frictions, which causes some of them to work in the informal sector to get income immediately. The high barrier to entering formal employment also does not help to promote mobility between sectors.

Moreover, the existence of informality results in stifled economic growth and further leads to a trade-off between efficiency and equality, when it exists. Low labour mobilisation between sectors contributes significantly. Low labour mobilisation not only leads to less efficient labour allocation but also less capital accumulation. When labour is mobilised to the formal sector, aggregate capital increases, while it decreases when labour is mobilised to the informal sector, which will have consequences on productivity and output. The lack of access to financial markets for most entrepreneurs has amplified the consequences. Entrepreneurs cannot expand their businesses, which hampers productivity and does not contribute to accumulating aggregate capital in the economy. Labour mobilisation affects inequality differently, depending on the sector-specific shocks. When the trade-off exists, higher labour mobility will lower this trade-off.

Related literature. Our study is related to literature that documents the informality. Several studies have discussed the benefits and challenges of informal employment. Study

by [Perry et al. \(2007\)](#) and [World Bank \(2010b\)](#) argued that informal employment can offer unique benefits, which are attractive to some types of workers, such as autonomy and flexibility. Informal employment provides opportunities for some types of workers not absorbed in the formal sector, as studied by [OECD and ILO \(2019\)](#). Informal jobs can also serve as a stepping stone for workers wanting to transition to the formal sector or to build their small enterprises, according to [Perry et al. \(2007\)](#). Female workers in the informal sector have a small level of dissatisfaction compared to their formal counterparts, based on a study from [World Bank \(2010b\)](#). More flexible working hours, significantly lower number of hours, and more significant opportunities to find new jobs for informal female workers than formal workers are why women prefer informal work. On the other side, informal workers face low incomes, irregular incomes, and poor working conditions ([ILO \(2002\)](#) and [ILO \(2013\)](#)). An analysis using worker-level data shows that informal workers are paid less than formal workers, which primarily reflects that informal workers tend to be less skilled and inexperienced, which shows the difference in productivity as suggested by the [World Bank \(2019\)](#). A study by [Pritadrajati, Kusuma and Saxena \(2021\)](#) found that workers with experience in informal types of self-employment have lower future earnings.

There is extensive literature documenting the aggregate consequences of informality, which mostly discusses the impact on either output or distribution. Several papers have discussed the relationship between informality and low output levels, such as the study by [Porta and Shleifer \(2014\)](#), which found that the informal sector has a low productivity level, leading to low per capita incomes. Using data from over 100 developing economies, [Bose, Capasso and Wurm \(2012\)](#) stated that higher informality is associated with low financial development, investment, and productivity. Their study shows the importance of the relationship between the financial and real sectors, where informal workers can only afford to get a few loans or loans at high interest rates, reducing investment and productivity. In another study, [Ordóñez \(2014\)](#) argues that a significant informal sector is related to weak policy effectiveness and the government's ability to generate fiscal revenue using Mexican data. The existence of the informal sector causes distortions in the economy that have an impact on reducing the country's potential revenue, capital accumulation and Total Factor Productivity (TFP) and ultimately reduce output. Furthermore, [Loayza \(2018\)](#) states that informal productivity only counts between 25 and 75 percent of total labour productivity in the economy, and firms or workers may decide to participate in the informal sector if access to public services is limited and not worth the taxes they pay. Another study by [Chong and Gradstein \(2007\)](#) revealed that countries with high levels of informality will have high levels of inequality, especially in countries with weak institutions. Our study is also related to the study by [Hsieh and Klenow \(2009\)](#), who shows that misallocating resources can potentially reduce TFP due to the presence of an informal sector with low productivity in the manufacturing sector. This situation results

in economic inefficiency and will also exacerbate income inequality.

This study closely related to the literature about low labour mobility in high informality settings, presents findings with significant implications. The study by [ILO \(2023\)](#) using labour market trajectories (LMT) showed deficient labour mobility between sectors in Indonesia, with the transition change mainly towards an increasing share of informal self-employment. Worker tends to stay in their field of work and have little probability of transitioning, a situation attributed mainly to the rigidity of the hiring regulations. Another study by [Pratomo and Manning \(2022\)](#) also shows the low transition of workers to the formal sector in Indonesia. The most significant contribution to formal workers comes from new entrants and the movement within the formal sector, while the transition from informal to formal worker is minimal. The workers who previously worked in the informal sector generally have little chance of transitioning to the formal sector and have a high chance of transitioning within the informal sector, indicating an ‘informality trap’. These findings underscore the urgent need to address the issues of low labour mobility and informality in Indonesia.

Our study takes a different approach, using a heterogeneous agent general equilibrium model, to contribute to the literature on how informality affects output and inequality simultaneously under low labour market mobility conditions. We build the model using the characteristics of an economy dominated by informal workers, in which workers have different assets and skills, both working and managerial. Workers optimally choose jobs that provide the best-expected utility, whether as wage workers or entrepreneurs, where they experience uninsurance income shocks. The counterfactual analysis is conducted by comparing the baseline economy with high restrictions on labour mobility with the benchmark economy where labour can move more freely between occupations. This study complements the literature on the macroeconomic consequences of informality in the settings of minimal labour mobility, a condition not addressed in other studies.

The remainder of this paper is organised as follows. Section 3.2 provides an overview of Indonesia’s labour market conditions. Section 3.3 explains the construction of the model used in the paper. Section 3.4 presents the model’s calibration, while Section 3.5 showcases the baseline results. Section 3.6 reports the analysis results using the model, and Section 3.7 outlines the sensitivity analysis. Section 3.8 concludes. The appendices contain additional information and results.

3.2 Informality and employment segregation

Indonesia is a developing country with a dominant portion of informal workers, which counted for 57.94% between 2017-2021, and it makes for an interesting case study. More than 90% of entrepreneurs in Indonesia are self-employed without permanent workers,

which falls into the category of informal workers. Only less than 10% are self-employed with permanent workers, referred to as employers, and fall into the category of formal workers¹. The high share of informal workers is in line with the low tax revenue and limited productivity faced by Indonesia. Informal entrepreneurs run a business at a low cost since they do not pay taxes, which leads to lower tax revenue. Still, on the other hand, they will have trouble borrowing due to tighter borrowing constraints and high interest rates caused by high monitoring costs. The limited access to formal financing impacts their ability to invest in their businesses and the human capital, such as education and training, which can limit their potential productivity. This will hinder output growth and tax revenue.

This section discusses the stylised facts related to employment segregation, informality and entrepreneurship in Indonesia. This study uses the National Labour Force Survey (SAKERNAS), the National Socioeconomic Survey (SUSENAS) and the Indonesia Family Life Survey (IFLS) for empirical analysis. SAKERNAS is a survey that reflects labour behaviour down to the provincial level published by the Indonesian Statistics Agency (BPS). Respondents in this survey are individuals above 15 years old, with a total of almost 778 thousand respondents in 2021. We use the survey to understand the proportion of each labour type. SUSENAS collects primary data on community welfare, including education, health, fertility or family planning, migration, labour, and population data by age, sex, and marital status. This survey is representative of the population in Indonesia and has more than 300 thousand respondents in 2021. We will analyse the source of financing for entrepreneurs using this data. IFLS is a longitudinal household survey that contains vital information on Indonesian individuals and households, including consumption, income, assets, education, migration, labour market outcomes, and other demographic variables. The latest survey period of 2014 contains over 70,000 individuals and around 16,000 households, with recontact rates for all rounds of the survey period of 87.8%. In this study, we use four waves of IFLS in 1993, 2000, 2007 and 2014, and we can elaborate on the transition pattern of individuals between those seven-year gaps, which is crucial for understanding the long-term trends in employment and entrepreneurship in Indonesia.

The share of paid workers and entrepreneurs has mostly stayed the same in recent years,

¹We use the exact definition of formal-informal workers by the Indonesian Statistics Agency (BPS), which is based on employment status in their primary occupation following the International Conference of Labor Statistics (ICLS-13) from the International Labour Organization (ILO). Formal workers include workers who are employees or self-employed with the assistance of permanent workers, while the rest are informal workers.

The latest definition of formal-informal employment based on ICLS-17, apart from looking at employment status, also looks at economic units, contributions to social security, entitlement to and benefits from paid annual leave, and entitlement to and benefits from paid sick leave. In this study, we refer to ICLS-13, which is only based on employment status, to maintain a consistent definition for the entire survey period since the old period survey has no complete variable to determine the new definition of the formality of workers.

which shows the low levels of labour market mobility in Indonesia. Paid workers are labourers who work and do not face business risks, including wage workers, freelancers and family workers². In comparison, entrepreneurs are labourers who build their businesses and are involved in risky projects, including self-employed and employers³. In 2017, the share of paid workers was 62.71%, and there was only a slight change to 61.42% in 2021. Even in the COVID-19 pandemic period, the shares of paid workers and entrepreneurs have not changed much, as shown in Figure 3.1. Informational frictions and higher barriers to entry in a particular sector are two main reasons to explain this. These high barriers lead to a phenomenon known as labour hoarding activity, where firms retain their existing workforce rather than hiring new employees, contributing to the lack of labour mobilisation, especially for firms in the contact-intensive industry during the COVID-19 pandemic, as a study by [Ardiyono \(2022\)](#) has shown.

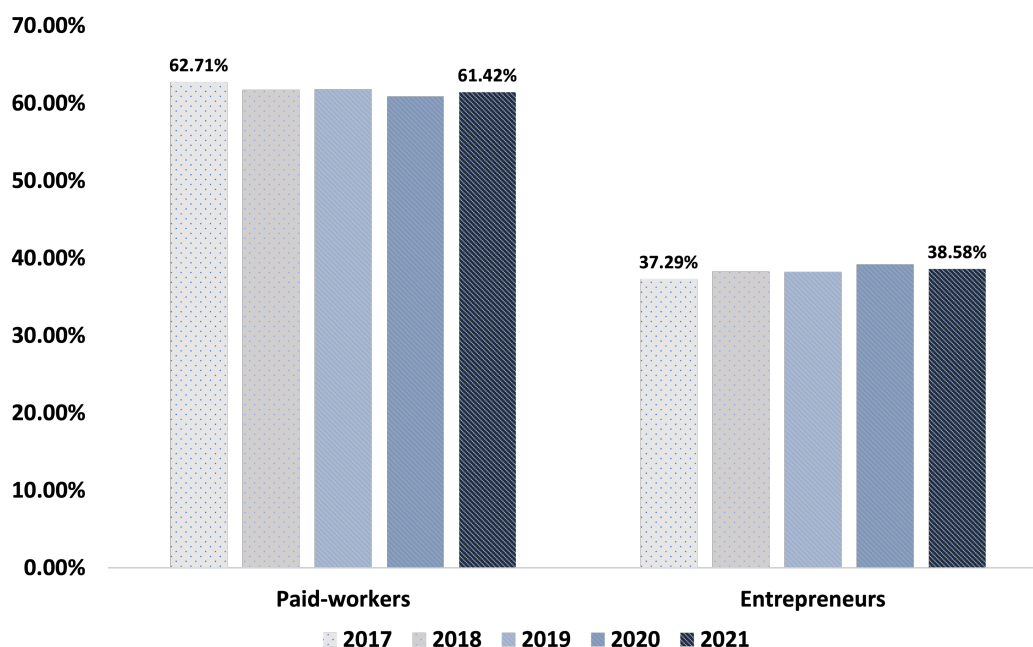


Figure 3.1: The Proportion of Paid Workers and Entrepreneurs

Note: the calculation is based on SAKERNAS, the representative survey of Indonesia's labour force, for the period 2017-2021. Paid workers are labourers who receive wages and do not face business risks, while entrepreneurs are involved in risky projects for their own businesses.

²A wage worker is someone who permanently works for another person or agency/office/company and receives a wage/salary in the form of both goods and money. A freelancer is someone who works for another person/institution (more than one employer in the last month) in the form of a household business or non-household business on a fee-for-service basis by receiving wages or rewards in the form of money or goods, either on a daily or piecework payment system. A family worker is someone who helps other people in business without receiving a wage or salary, either in the form of money or goods.

³Self-employed is someone who works or does business by taking economic risks, including not returning the production costs incurred in the business context, either working alone without help from any workers or getting help from unpaid or non-permanent workers. An employer is a person engaged in business with the assistance of a permanent worker/paid employee who is engaged in business at their own risk and employs at least one permanent paid worker/employee. The definition relies on the Indonesia Statistics Agency (BPS).

Furthermore, entrepreneurs and wage workers are the two dominant workers in the country, accounting for 76% of total workers in Indonesia. Entrepreneurs are the most dominant type of worker, accounting for 38.58% of total workers, and almost 92% are informally self-employed. Informal self-employed are entrepreneurs who work alone or with the help of non-permanent workers. Only around 8% of entrepreneurs who are formal employers do business with the help of permanent workers. Meanwhile, the share of wage workers, the most dominant among paid workers, is 37.46%, which is lower than the share of entrepreneurs but slightly higher than that of informal self-employed entrepreneurs (see Table 3.1). The trend of proportions slightly changed over the years for each type of worker, especially during the COVID-19 period, where the wage workers' proportion decreased, followed by a slight increase for self-employed, while the proportion of employers remained the same. Once the social restriction is lifted after the pandemic, the proportions of workers tend to return to their initial rate before the pandemic. Based on this situation, the model will include three types of workers: wage workers, employers (formal entrepreneurs) and self-employed (informal entrepreneurs).

Table 3.1: Share of Different Types of Workers

Panel A - Paid-workers

	All	Family Workers + Freelancers	Wage Workers
Fraction of the workforce (all)	61.42%	23.96%	37.46%

Panel B - Entrepreneurs

	by type		
	All	Self-employed	Employers
Fraction of the workforce (all)	38.58%	35.48%	3.09%
Fraction of the entrepreneurs		91.98%	8.02%

Note: the calculation is based on SAKERNAS August 2021. A family worker is a person who works without pay in an economic enterprise operated by other members of the family, relatives or neighbours. Freelancers are defined as someone who works for another person/employer/institution that is not permanent (more than one employer in the last month). A wage worker is a person who works permanently for another person or agency/office/company by receiving a wage. Self-employed are labourers who work or do business at their own risk, either on their own or using unpaid labourers/workers and/or non-permanent labourers/workers. Employers are defined as workers who operate at their own risk and employ at least one permanent paid worker.

Entrepreneurs dominate the labour market in Indonesia as the middle-class population grows rapidly. The increase in the middle class increases the domestic demand, incentivising workers to run their businesses and become entrepreneurs. Lack of employment opportunities due to limited job market information or tight requirement entry are some reasons for some workers to become entrepreneurs. Besides, some

people have better managerial skills to run a business than being a paid worker. The survey by [GEM \(2016\)](#) shows that many Indonesians have a high intention to engage in entrepreneurial activities, with a high percentage of 18-64-year-old individuals interested in starting a business. Most entrepreneurs, unfortunately, are running without any permanent workers, which do not contribute to employment. Their inability to grow their business and employ permanent employees can be caused by a lack of skills and access to capital, or other frictions. Only around 3% of entrepreneurs are able to employ permanent workers. Encouraging employers to grow is an important task to promote productivity and employment.

Our research, which meticulously analyses the behaviour of individual workers in making job transitions between occupations, has revealed a significant insight. As depicted in Table 3.2, the data shows low mobility in labour transitions. We have used the IFLS individual panel data, spanning over twenty years, for individuals in their prime age, between 25 and 55, who were surveyed for at least two consecutive periods. We are tracking each individual's occupation across survey periods. The findings are striking: only 14% of informal entrepreneurs transitioned as wage workers, 82.42% chose to remain as informal entrepreneurs, and 3.58% transitioned to formal entrepreneurs. The asymmetric transition is evident, with a higher proportion of wage workers transitioning to informal entrepreneurs, accounting for 20.25%, and almost 60% of formal entrepreneurs transitioning to informal ones. This thorough analysis has revealed the dominant share of informal self-employment in Indonesia's labour market. This finding carries significant implications for labour economics and workforce development.

Table 3.2: Transition Probability

	Wage Workers	Informal Entrepreneurs	Formal Entrepreneurs
Wage Workers	78.61%	20.25%	1.14%
Informal Entrepreneurs	14.00%	82.42%	3.58%
Formal Entrepreneurs	12.17%	59.35%	28.49%

Note: the calculation is based on IFLS for the period 1993-2014. The respondents between the ages of 25 and 55 were surveyed for at least two consecutive survey periods to produce an unbalanced panel. The initial employment is in the row, and the subsequent employment is in the column. Workers who initially worked as wage workers have a 78.61% chance to remain as wage workers in the next period, a 20.25% chance to transition to informal entrepreneurs, and a 1.14% chance to transition to formal entrepreneurs.

The low level of labour market mobility is also evident for different initial earnings levels and ages, as shown in Figure 3.2. We use earnings and income interchangeably, where we define earnings as equal to wage for wage workers and to profit of the business activity for entrepreneurs. Using the same data, we collect the proportion of different types of occupational transition between wage workers and entrepreneurs, where the individuals

are grouped by their initial earnings and age. There are several important points; first, the portion of labour transitioning between wage workers and entrepreneurs is shallow for all earnings levels and all ages. Second, the transition proportion has a downward trend as earnings increase, which is contributed by the low opportunity cost for labour with low earnings to make the transition and get higher as the earnings increase. This behaviour occurs in all age groups. Third, the transition ratio from wage workers to entrepreneurs is consistently higher than the transition from entrepreneurs to wage workers for all earnings deciles, creating asymmetry. Similar patterns are also evident for workers with different characteristics, whether they work in urban areas, are male, or have high skills. These patterns not only confirm but also underline the significance of Indonesia's low labour mobility for all workers of different ages and earnings, providing a strong validation of our research. This study's construction of the theoretical framework will not account for different ages as the trend is similar across ages.

These trends are unique and differ from those in other countries, like the Brazilian economy, which has a transition ratio from informal to formal increases as earnings increase, as a study by [Gomes, Iachan and Santos \(2020\)](#). In Brazil, a better-paid informal worker is more likely to transition to formal employment. Furthermore, the transition ratio from informal to formal is consistently higher than the other way around in Brazil, as per a study by [Engbom et al. \(2021\)](#), which contrasts with conditions in Indonesia. Understanding these dynamics is crucial for shaping labour policies. We can also look at it differently, where informal workers in Indonesia do not open up competitive opportunities for entering the formal sector. A study by [Pratomo and Manning \(2022\)](#) also confirmed that labour mobility within the formal sector is dominant, with only a tiny proportion of informal workers able to transition into the formal sector. The dominance of informal workers, coupled with the low employment mobility of workers and its consequences on macroeconomic variables, is a topic that has yet to be touched upon, and this paper will contribute to the literature on this issue, highlighting its significance and relevance.

To support the development of the entrepreneurs, the Indonesian government has provided credit support programs for micro, small and medium enterprises (MSME), mainly through the Kredit Usaha Rakyat (KUR) program in the form of interest subsidies. The KUR program, which has a loan limit of up to USD 35,000 with a 3%-6% annual interest rate, is distributed as working capital and investment loans. In 2021, the Government disbursed the total interest subsidy, which amounted to USD 2.7 billion and covered more than 7.5 million debtors. The KUR program has the most extensive coverage of loan limits and offers the lowest interest rate compared to all other programs. The program aims to support the MSMEs to grow their business and contribute more to GDP and employment. This program could ease some of the burden for the informal workers, which is the lack of access to financial markets. Regrettably, most informal self-employed still

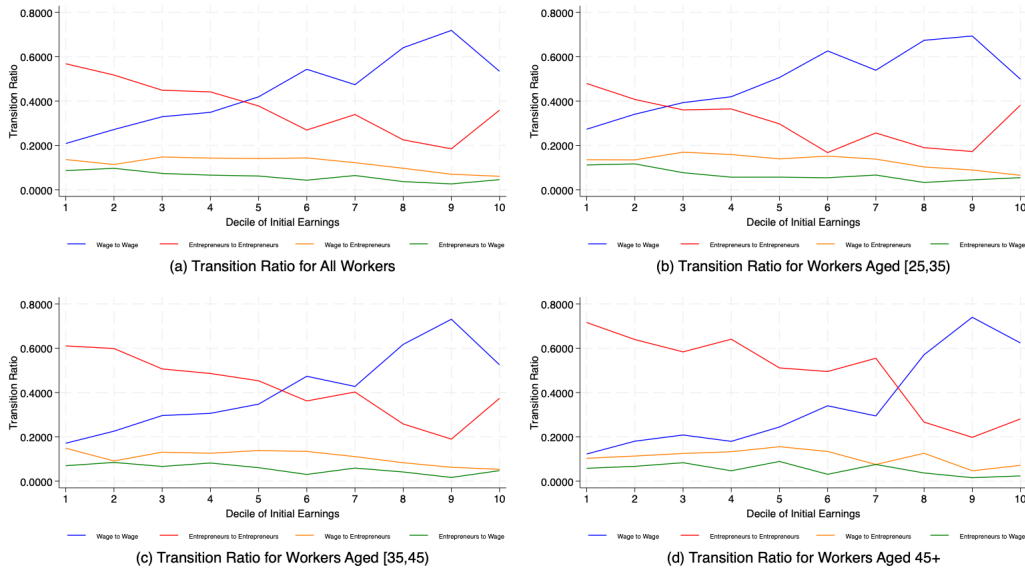


Figure 3.2: Labour Transition for Different Initial Earnings and Age

Note: the top left figure represents the occupational transition ratio by earnings decile for all workers. The top right figure is for young labourers aged 25-35, the bottom left is for middle-aged labourers aged 35-45, and the bottom right is for old labourers aged more than 45.

run their businesses using their assets, reflected in the low access to credit from banks. Using SUSENAS, only around 12% of the informal self-employed have access to bank credit loans or only half of that is experienced by formal entrepreneurs, as seen in Figure 3.3. This financing already includes government credit assistance for MSMEs channelled through the banks, contributing around half of the total financing. Without any financial assistance program from the Government, the number of informal self-employed who have ever experienced a bank loan will be much lower. This result aligns with a study by [ADB \(2011\)](#) using surveys in major cities in Indonesia, which shows that only around 10% of informal businesses have access to bank loans. A study by [Alberola and Urrutia \(2020\)](#) also argued that the informal sector is excluded from the financial market, and another study by [Ohnsorge and Yu \(2022\)](#) showed that firms that come from developing countries with a high portion of informality have around 75% of their investment coming from internal finance.

3.3 Model

The model in this study is designed to mirror the micro and macro conditions in Indonesia, drawing from three primary surveys to establish the theoretical framework and calibration values. It represents formal workers through wage workers and formal entrepreneurs and informal workers through informal entrepreneurs, Indonesia's most prevalent type of worker. We constructed a simple heterogeneous general equilibrium model for the

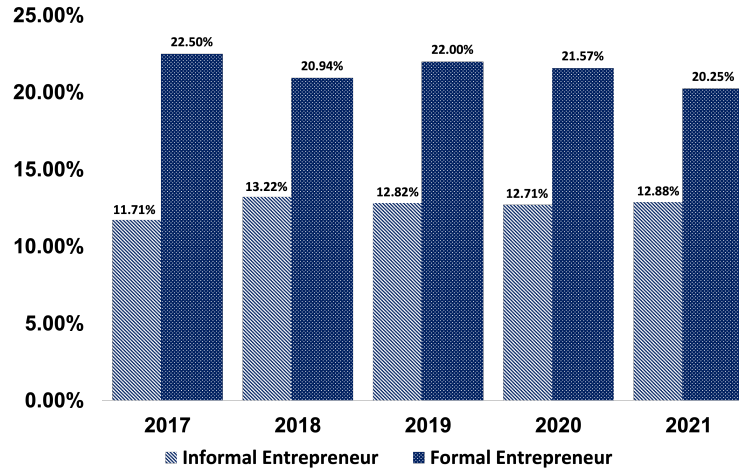


Figure 3.3: Bank Financing for Entrepreneurs

baseline, following [Aiyagari \(1994\)](#), and incorporated different working and managerial skills. Workers vary in wealth, working, and managerial skills and can only choose one occupation that offers them the highest expected utility. In the baseline model, labour mobility has a high restriction, and workers cannot switch between occupations freely in the event of specific sector shocks. We then do the counterfactual analysis by varying the degree of restriction in labour mobility, allowing labour to move between occupations more freely in response to shocks, and evaluate the macroeconomic implications.

3.3.1 Endowment

Individuals are infinitely lived and endowed with labour productivity e , representing efficiency units per unit of work hours or, in this study, working skills. They face idiosyncratic productivity shock, which causes them to have either low, e_1 , or high productivity, e_2 . They are also endowed with entrepreneurial ability θ , which is drawn from a set $\Theta = \{\theta_f, \theta_{in}\}$. The parameter θ governs how productive the agent can operate the business, given capital and labour inputs. Individuals keep the same business idea as in the previous period with probability π_θ or draw a new idea with probability $1 - \pi_\theta$.

Agents can either supply labour for a wage in the labour market or become entrepreneurs to run a business of their own. As in [Quadrini \(2000\)](#), an entrepreneur in our model is the owner of an enterprise and combines his managerial ability and efforts with employed capital and labour for production. Entrepreneurs can manage only one entrepreneurial business at a time.

3.3.2 Preference

Individuals choose a sequence of consumption c_t to maximise their expected discounted utility

$$\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{1-\sigma} \right], \quad (3.1)$$

where β is the time discount factor and $\beta \in (0, 1)$.

3.3.3 Production sector and technology

The economy has two production sectors: corporate and entrepreneurial. The corporate sector is populated by larger firms, while entrepreneurial sector consists of entrepreneurial households involved in risky projects. The corporate sector consists of competitive firms with an identical Cobb-Douglas production function

$$Y_t = F(K_t, H_t) = AK_t^\alpha H_t^{1-\alpha}, \quad (3.2)$$

where K and H are the capital and efficient labour used for production in this sector, A and $\alpha \in (0, 1)$ are the productivity parameter and the capital share, respectively. Factor prices are determined competitively by the marginal product for each production input. Capital depreciates at a constant rate, δ .

Entrepreneurs own a production technology and operate in either formal (f) or informal (in) sector. Similar to the study by [Erosa, Fuster and Martinez \(2022\)](#), the entrepreneur firms have a similar production function as follows

$$q_j(\theta_j, k_t, n_t) = \theta_j (k_t^\rho n_t^{1-\rho})^\gamma, \quad (3.3)$$

where $j \in \{f, in\}$ is production sector; θ_j is entrepreneurial ability; k is capital; n is efficiency units of labor employed in the firm; $\rho, \gamma \in (0, 1)$ are the parameters that determine the input share of capital and the span-of-control parameter, respectively. Capital depreciates at a constant rate δ after the production. Note that a higher entrepreneurial ability θ implies a higher level of output both on average and at the margin for a given level of factor inputs. Formal entrepreneurs manage their production by hiring the optimal number of employees to maximise profits. In contrast, informal entrepreneurs with lower productivity can only afford to hire fewer than the optimal number of workers, as they typically employ household members as labour.

3.3.4 Government

The government raises tax revenues to finance its lump-sum transfer, T . A balanced budget is imposed every period. The government taxes capital gain and payroll at a constant rate, τ^k and τ^l . The model is closed by assuming that the tax revenue funds a public transfer, T , to each entrepreneur, who are mostly low-income workers. We define

$T_t = \psi w_t H_t$, where ψ is exogenous proportion of wH , which is the total effective labour income. We let the payroll tax rate, τ^l , being endogenous to guarantee the balance budget.

3.3.5 Market structure

An entrepreneurial firm's activities are tied up with the owner's decisions and constrained by his characteristics, including entrepreneurial ability, available assets, access to the capital market and taxes. The capital used by an entrepreneur with a unit of assets, in sector j , is limited by the collateral constraint $k_t \leq \lambda_j a_t$, where $\lambda_j \geq 1$ is the degree of credit frictions faced by the entrepreneur. If $\lambda_j = 1$, it corresponds to be self-financed, while $\lambda_j > 1$ corresponds to more access to the capital market. The degree of credit friction is higher for the formal entrepreneur, $\lambda_f > \lambda_{in}$.

3.3.6 Household problem

The occupation of each agent is pre-determined from the previous period. There are two types of occupation: wage workers (ω) and entrepreneurs, which are split into formal entrepreneurs (f) and informal entrepreneurs (in) such that $o_t \in O = \{\omega, f, in\}$. At the beginning of each period, idiosyncratic shocks are realised. Given these shocks, wage workers and entrepreneurs with assets a and realised labour productivity e and entrepreneurial ability θ make decisions to maximise the present discounted utility in Eq. 3.1. In addition to making consumption and saving decisions, an entrepreneur also chooses the labour and capital used in his business. Then production takes place, followed by factor payments. Wage workers and formal entrepreneurs pay an income tax, capital tax, able to grow their assets and gather the capital from the market, while informal workers are not paying any taxes, not able to grow their assets and consume part of their disposable assets as the capital as consequences of not included in the financial market.

Let x_t be a state vector $x_t = (e_t, a_t, \theta_t)$, i.e. labour productivity e_t , asset holdings a_t , and entrepreneurial ability θ_t . There are two households problems for wage workers and entrepreneur. Let $V^\omega(x_t)$ and $V^s(x_t)$ denote the value functions of a wage worker and a entrepreneur, respectively.

Wage worker. Each wage worker inelastically supplies labour, which is normalised to unity, and the labour services provided by each agent are simply his efficiency units $\bar{n}_t = 1 \cdot e_t$. They are making decisions for the optimum allocation of consumption, c_t , and next period asset, a_{t+1} , to maximise the value function. They will receive the interest gain from their asset with interest rate r . They need to pay the labour tax and capital gain tax, τ^l and τ^k , respectively, as well as the fixed cost ζ that captures entry barriers to enter

this occupation. The higher the entry cost, the more challenging it is for workers to secure formal jobs, as illustrated by the long selection process, high administrative requirements, and specific skills required, so it takes time to find a suitable job. The dynamic program problem is given by

$$V^w(x_t) = \max_{c_t, a_{t+1}} \{u(c_t) + \beta \mathbb{E}[V^w(x_{t+1})]\}, \quad (3.4)$$

subject to

$$\begin{aligned} c_t + a_{t+1} &= (1 - \tau^l) w_t \bar{n}_t + (1 + (1 - \tau^k) r_t) a_t - \zeta, \\ c_t \geq 0; a_t \geq 0. \end{aligned} \quad (3.5)$$

Formal entrepreneur. Formal entrepreneurs use their own labour services, also hire external labour from the labour market and obeying the regulations. They are making the optimum decision about the number of labour and capital needed to maximise their income, and then to decide the optimum consumption, c_t , and next period saving, a_{t+1} , to maximise their value function. They are able to access the financial market to obtain the capital needed and to grow their asset with interest r . The dynamic program problem for the formal entrepreneur is given by

$$V^f(x_t) = \max_{c_t, a_{t+1}} \{u(c_t) + \beta \mathbb{E}[V^f(x_{t+1})]\}, \quad (3.6)$$

subject to

$$c_t + a_{t+1} = \pi^f(x_t), \quad (3.7)$$

$c_t \geq 0$, and $a_{t+1} \geq 0$. Equation 3.7 is a formal entrepreneur's flow budget constraint and π^f is the net-of-tax income available to the entrepreneur after the production, factor payments, income tax payment, and it is determined as follows

$$\pi^f(x_t) = \max_{k_t, n_t} \{q_f(\theta_f, k_t, n_t) - (r_t + \delta) k_t - (1 + \tau^l) w_t n_t\} + (1 + (1 - \tau^k) r_t) a_t + T, \quad (3.8)$$

subject to $k_t \leq \lambda_f a_t$, where n_t is the labour supply, τ^l is a payroll tax, and τ^k is a capital tax.

Informal entrepreneur. Informal entrepreneurs are self-employed, do not hire external workers, do not pay taxes, and do not have access to the financial market. They use their own labour supply in their own business. Informal entrepreneurs make decisions about the

optimum capital for their informal firms as well as optimum allocation for consumption and the next period's asset. Due to lack of access to the financial market, they are unable to grow their asset and part of it is used as capital to run the business. The dynamic program problem for the informal entrepreneur is given by

$$V^{in}(x_t) = \max_{c_t, a_{t+1}} \{u(c_t) + \beta \mathbb{E}[V^{in}(x_{t+1})]\}, \quad (3.9)$$

subject to

$$c_t + a_{t+1} = \pi^{in}(x_t), \quad (3.10)$$

where $c_t \geq 0$, and $a_{t+1} \geq 0$. Equation 3.10 is an entrepreneur's flow budget constraint and π^{in} is the net-of-tax income available to the entrepreneur after the production and factor payments, and it is determined as follows

$$\pi^{in}(x_t) = \max_{k_t} \{q_{in}(\theta_{in}, k_t, \tilde{n}) - (r_t + \delta)k_t - w_t \tilde{n}\} + (a_t - k_t) + T, \quad (3.11)$$

subject to $k_t \leq \lambda_{in} a_t$ and $n_t \geq \tilde{n}_t$. Note that, $\tilde{n}_t$ is the own labour supply of informal entrepreneur, which is less than the optimum allocation when the entrepreneurs are able to hire their desired number of labourers to optimise profit.

3.3.7 Occupational choice

We use the occupational choice feature that enables workers to move between occupations in response to the shocks. The worker chooses the occupation that will maximise their value function as follows

$$o_t = \begin{cases} w & \text{if } V_t^w = \max \{V_t^w, V_t^f, V_t^{in}\} \\ f & \text{if } V_t^f = \max \{V_t^w, V_t^f, V_t^{in}\} \\ in & \text{if } V_t^{in} = \max \{V_t^w, V_t^f, V_t^{in}\}. \end{cases} \quad (3.12)$$

3.3.8 Stationary equilibrium

At the beginning of each period, agents are heterogeneous in three dimensions summarised by a state vector $g = (a, p(o), o)$, where a is the asset holding, $p(o)$ is productivity by wage-worker or entrepreneurial ability, and o is the occupational choice. Let $a \in \mathbb{A} = \mathbb{R}_+$, $p \in \mathbb{P} = \{e_1, e_2, \theta_{in}, \theta_f\}$ and $o \in \mathbb{O} = \{w, in, f\}$. Also denote by $g \in \mathbb{G} = \mathbb{A} \times \mathbb{P} \times \mathbb{O}$ the entire state space. An equilibrium consists of prices $\{r, w\}$, allocations of workers,

government budget, value functions and the distribution of agents over the state space $\mathbb{G}$ given by $\Phi(g), g \in \mathbb{G}$, such that

1. Given the prices and the government tax system, the allocations solve the above-described maximisation problem for a household in each state.
2. Corporate firms solve the profit maximisation problem.
3. The factor prices determined by

$$r = \alpha AK^{(\alpha-1)} H^{(1-\alpha)} - \delta, \quad (3.13)$$

$$w = (1 - \alpha) AK^\alpha H^{-\alpha}, \quad (3.14)$$

where K and H are total capital in the economy and efficient labour employed in the corporate sector, respectively.

4. The government budget is balanced

$$\sum_{o \neq w} T(g) = \sum_a \sum_p \sum_o \tau_l w_l(g) + \tau_k r a(g). \quad (3.15)$$

5. Capital, labour and goods markets clear, and aggregates are given by

$$K = \sum_a \sum_p \sum_{o \neq in} a(g) \Phi(g), \quad (3.16)$$

$$H = \sum_a \sum_p \sum_{o=\{w\}} H(g) \Phi(g), \quad (3.17)$$

$$C = \sum_a \sum_p \sum_o c(g) \Phi(g). \quad (3.18)$$

6. The distribution Φ is time-invariant. The law of motion for the distribution of agents over the state space $\mathbb{S}$ satisfies $\Phi = R_\Phi(\Phi)$, where R_Φ is a one-period transition operator on the distribution.

The algorithm used to compute the stationary equilibrium is described in Appendix B.7.

3.4 Calibration of baseline economy

This section presents the calibration strategy and shows the calibration results for the baseline economy. The model has individual heterogeneity regarding labour productivity,

entrepreneurial skills, and assets. Entrepreneurs make their production, both as employers and as self-employed, and have two different abilities. Wage workers will receive wages that depend on their productivity and asset earnings as their income.

Preference. The coefficient of the relative risk aversion, σ , is set to 2, following a study by [Lie \(2021\)](#). The discount factor, β , is set to 0.98 such that the economy attains the aggregate capital-output ratio of around 3.80 in the stationary equilibrium.

Corporate technology. In this sector, we normalise the TFP to unity. The capital share on output, the capital depreciation rate, and the labour income share to GDP following the study by [van der Eng \(2009a\)](#) and [van der Eng \(2009b\)](#), who analysed these issues between 1950 and 2007. The calibration on this study uses the average value of those variables from 2000 until 2007 to catch the latest condition of the Indonesian economy, where capital income share and depreciation rate are 0.46 and 0.08, respectively.

Worker productivity. The worker faces two productivity levels that affect their income for simplicity, defined as high and low productivity, where the average productivity is normalised to one. The logarithm of labour income, η , is assumed to follow the AR(1) process and approximate the process by a Markov transition matrix with two grid points, following [Tauchen \(1986\)](#). The process is given as

$$\ln \eta_t = \rho \ln \eta_{t-1} + \varepsilon_{\eta,t}, \quad (3.19)$$

where $\varepsilon_{\eta,t} \sim N(0, \sigma_\eta^2)$. To calibrate the parameters of the equation, we are using the longitudinal survey with a span of more than 20 years and analysing the earnings for the wage workers and determining the pattern of the distribution, as we can see in Figure 3.4. We then analyse for each individual their initial real earnings as well as their subsequent real earnings and do the estimation⁴. The AR(1) coefficient, ρ , the residual standard deviation, σ_η , are set to 0.96 and 0.12 respectively, following the estimation result in Table B.2 and Table B.3. We then adjusted the value of m , the maximum distance from standard deviation, to match with the target value of Gini ratio from the data.

Entrepreneurial ability. We assume the ratio of parameters on capital and labour in the entrepreneur technology are the same as in the corporate sector. There are two nodes for the entrepreneurial ability that refers to informal entrepreneurs or self-employed who have low ability, and formal entrepreneurs or employers who have high ability. Entrepreneurs have the probability of switching their sector between self-employed and employer. The transition matrix for the entrepreneurial ability following the panel data IFLS is shown in Table 3.3. This table is produced using the same method as

⁴The panel data (IFLS) have a seven-year gap between survey waves, so we need to calculate their yearly subsequent earnings using the assumption that they experienced the same increasing rate every year for their earnings.

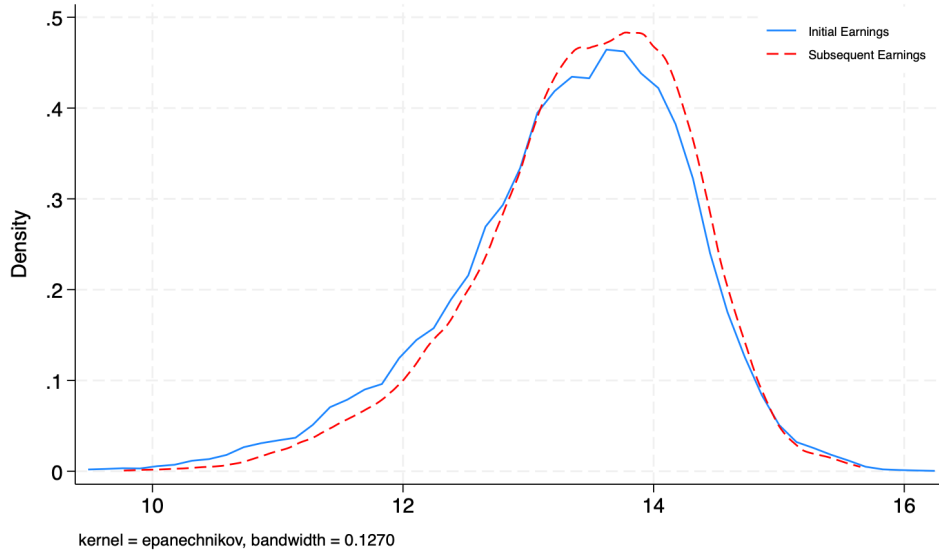


Figure 3.4: The Distribution of Log Earnings of Wage Workers

the table in section 3.2, but this time only between entrepreneurs. The transition between different types of entrepreneurs is low, where almost 96% of the self-employed remain in their sector, while only 4% of them transition as employers, and there are more than 67% of employers who transition to self-employed. This pattern caused the number of self-employed workers to be dominant in the economy. The calibration of entrepreneurial ability based on the differences in the productivity between formal and informal firms in the developing countries, following works by [Amin and Okou \(2020\)](#), where the productivity of informal entrepreneurs were lower than the formal one. We set the span of control for entrepreneur technology, γ , as 0.1, and the number of labour in the technology for informal entrepreneurs, $\tilde{n}$, as 0.01, to match with the Gini ratio and the dispersion of the tail distribution of the data.

Table 3.3: Transition Probability for Entrepreneurs

	Informal Entrepreneurs	Formal Entrepreneurs
Informal Entrepreneurs	95.84%	4.16%
Formal Entrepreneurs	67.57%	32.43%

Government. The capital tax, τ^k , is 15% following the final income tax for interest on bonds. We adjusted the lumpsum transfer amount by calibrated ψ to match the following target in the equilibrium: the ratio of income tax to tax revenue. In this model, income tax relies solely on payroll tax.

Market structure. We put credit friction for informal entrepreneurs, λ_{in} , equal to one, as their business is self-financed. Formal entrepreneurs have better access to credit by letting them have a bigger credit friction, λ_f , equal to two, following data that shows

formal entrepreneurs are twice as likely to get credit. The calibration of the model can be seen in Table 3.4.

Table 3.4: Parameters of the Model

Variable	Parameters	Value	Note
Discount factor	β	0.98	To match the capital-output ratio
Capital share on output	α	0.46	van der Eng (2009a) , van der Eng (2009b)
Relative risk aversion	σ	2	Lie (2021)
Depreciation of capital	δ	0.08	van der Eng (2009a) , van der Eng (2009b)
Fraction of lumpsum transfers	ψ	0.165	To match ratio of income tax over the tax revenue
Capital tax	τ_k	0.15	Following the regulation
Credit friction for informal entrp.	λ_i	1	Alberola and Urrutia (2020) , ADB (2011)
Credit friction for formal entrp.	λ_f	2	To capture the degree of access with financial markets
The fixed cost for wage-workers	ζ	0.025	To match the proportion between type of workers
Labour supply for informal entrp.	$\tilde{n}$	0.01	To match the Gini coefficient
Control parameter	γ	0.10	To match the dispersion of tail distribution

3.5 Baseline

The model is able to provide a similar result with some key data, as we can see in Table 3.5. The share of workers is targeted to match the survey result of SAKERNAS, where the proportion of wage workers among the two main types of workers, wage workers and entrepreneurs, amounted to 49.27%. Formal and informal entrepreneurs have proportions of 46.67% and 4.06%, respectively⁵. The capital-output ratio is obtained by extending the capital stock level from the study of [van der Eng \(2009a\)](#) with the capital law of motion using the Incremental Capital Output Ratio of Indonesia following the study of [Listiyanto and Pulungan \(2021\)](#). In this study, the income tax only consists of payroll tax, and the proportion of income tax to tax revenue is obtained from the audited data of the fiscal agency using 2022 value. The Gini ratio and the distribution value were retrieved from the National Socioeconomic Survey (SUSENAS) which surveyed around 300 thousand households for each survey wave to produce representative data up to district/city level⁶.

The baseline model's indicator values are similar to those of several key variables compared to the data. The labour share for each sector in the baseline model resembles the data, as does the capital-output ratio and Gini coefficient. The level of dispersion between the higher and lower income group distribution is also able to mimic the data. However, the income tax of the model somehow still misses the target moment.

⁵We are using SAKERNAS 2021, which was published in August 2021, and the definition of formality following the definition used by the Indonesia Statistics Agency (BPS) that depends on the employment status.

⁶We are using SUSENAS 2021, which was published in March, and calculate the Gini using the expenditure approach, following the same methodology used by the Indonesian Statistics Agency (BPS).

Table 3.5: Calibration Results for Baseline Economy

Target	Data	Model
Share of wage workers	49.27%	49.10%
Share of informal self-employed	46.67%	46.98%
Share of formal employers	4.06%	3.92%
Capital-output ratio	3.80	3.76
Income tax/tax revenue	48.01%	48.27%
Gini coefficient	0.38	0.38
Dispersion (P90/P10)	5.05	5.04

The baseline model, with a marginal propensity to consume (MPC) between 0.25 and 0.30, suggests a significant consumption response to indirect general equilibrium feedback from income increases. The heterogeneous agent approach used in this study’s theoretical framework can capture the portion of workers with low income who use almost all of their income for consumption or hand-to-mouth. These workers have a large MPC that cannot be captured using the representative agent model, in which consumption is mainly driven by direct intertemporal substitution decisions, resulting in a lower MPC. The contribution of the direct intertemporal effect to consumption for the representative agent model is more than 90%, so the impact of the indirect feedback is less than 10%, leading to a low MPC, based on [Kaplan, Moll and Violante \(2018\)](#). Figure 3.5 shows the MPC of the baseline model for various fiscal incentives in the form of capital tax reduction that will increase the income of workers exposed to the tax. Every 1 unit increase in income will increase consumption by around 0.25-0.30 units. This number could be more significant if all agents were exposed to the tax, but by construction, informal workers do not pay taxes, so they do not experience an increase in income. Regrettably, these workers are the ones with high MPC due to low income. Due to informality, not all agents are exposed to the same fiscal tools, and only some of the agents pay taxes.

3.6 Experiments

This section quantifies the aggregate consequences of informality in the setting of low labour mobility. The analysis uses counterfactuals with various degrees of restrictions on labour mobility to understand its implications on macroeconomic variables and distribution. The experiment compared pre-shock and after-shock equilibrium variables for five degrees of restriction. We have two different productivity shock experiments on different employment sectors to understand the variation of its implications. We start with a shock to the productivity of the corporate sector, which is a possible real-life scenario because this sector has more accessible access to capital and thus becomes more productive—followed by a positive shock to the productivity of entrepreneurs. While this scenario is rare due to limited access to capital for entrepreneurs, it is essential to analyse

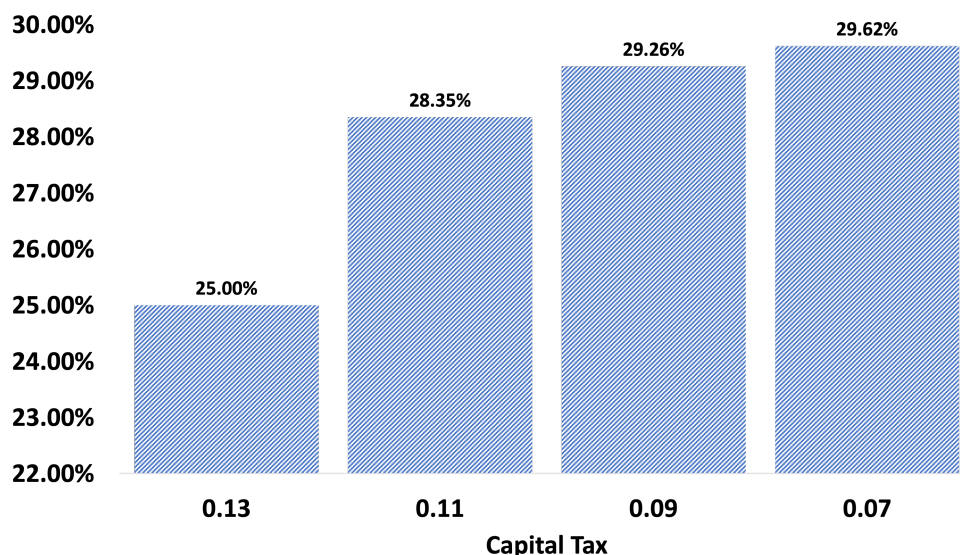


Figure 3.5: Marginal Propensity to Consume

Note: Marginal propensity to consume (MPC) is calculated by first increasing income by lowering the capital tax and then calculating the ratio between the increase in consumption and the increase in income. All calculations are done using the baseline, with capital tax 0.15 as the reference.

the different implications compared to other sectors. This is particularly interesting as there is a view that policies should be made to support this sector in growing faster.

The experiments will be done by increase the productivity by 10% for each sector. The shock magnitude matches the data, indicating that overall productivity rose by 9.23% in 2024 compared to 2010. While we cannot precisely measure each sector's contribution to this productivity gain, it is most likely driven by the corporate sector due to its ability to expand businesses and access resources more effectively. Both sectors experience the same shock magnitude for comparability.

3.6.1 Productivity shocks on the corporate sector

An increase in productivity in the corporate sector results in an increase in wage workers' income, incentivising entrepreneurs to move jobs. The labour movement encourages a more efficient allocation, where workers can move to more productive jobs. In aggregate, this condition will benefit the economy because it increases aggregate productivity along with improvement on workers' income. However, it is interesting to analyse whether labour mobilisation improves inequality or productivity gains in specific sectors worsen inequality. This quantitative issue will be discussed in this subsection to determine which force is more dominant, whether the inequality-reducing worker mobilisation channel or the inequality-increasing productivity channel. It is also interesting to know the spillover effect of productivity increase on the corporate sector. In addition to the productivity

increase of existing workers, the increase in output is also due to the additional number of workers in this sector, which in turn increases the capital, which is also an important factor of production.

A 10% increase in productivity can increase output almost by 22% in restricted labour mobility, and the output further escalates with reduced restrictions on labour mobility, as shown in Figure 3.6. Labour mobility with fewer frictions, which accounted for only 20% of initial entry costs, can increase the share of wage workers from 49% of total workers in the baseline to more than 55% (a 5.66% increase), whereas the economy with full entry costs can increase the share only to 53% (a 4.28% increase from the baseline). These workers who make this transition play a crucial role in the productivity surge as they were previously engaged in low-productivity occupations. Moreover, their transition also contributes to increased capital accumulation as they now have better access to financial markets. Labour mobility also leads to improved fiscal space, where the tax base increases and the number of transfer beneficiaries decreases. This leads to a decrease in the endogenous labour tax rate and increases disposable income, which in turn leads to greater consumption and saving. This result confirms the importance of the transition between occupations as one of the determinants of economic growth, which is consistent with the studies conducted by [McCaig and Pavcnik \(2015\)](#) and [Herrendorf, Rogerson and Valentinyi \(2014\)](#).

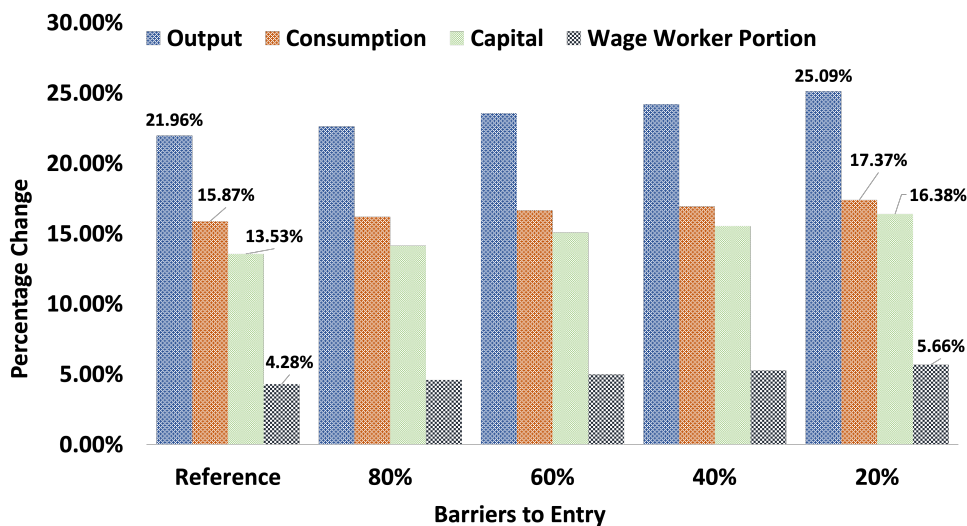


Figure 3.6: Changes in Aggregate Variables by Varying Entry Costs

Increased productivity in the corporate sector results in increased inequality, which is evident from the increase in the Gini coefficient, as shown in the first column of Table B.4. This suggests that the inequality-increasing productivity channel is more dominant than the inequality-reducing worker mobilisation channel. Transitioning workers into high-productivity occupations can reduce the income gap with higher income groups. However, it is still unable to compensate for the widening income gap due to productivity differences

between wage workers and entrepreneurs. Productivity improvements in the corporate sector have different impacts on the two tail distributions. The lower-tail dispersion, (P_{50}/P_{10}) , shows an improvement, suggesting that the lower-income group can catch up with the middle-income group. In contrast, the upper-tail dispersion, (P_{90}/P_{50}) , shows a widening, suggesting that the middle-income group cannot catch up with the higher-income group. Meanwhile, the total dispersion, (P_{90}/P_{10}) , is improving, which indicates that the lower-income group is able to catch up with the higher-income group.

While this experiment indicates a rise in the Gini coefficient associated with higher labour mobility, it concurrently demonstrates that output increases at a more pronounced rate than the rise in the Gini coefficient when the level of restrictions diminishes. This observation underscores the pivotal role that labour mobility plays in alleviating the trade-off between efficiency and equality, as evidenced in the final column of Table B.4. A higher ratio of percentage changes in output (delta output) relative to changes in the Gini coefficient (delta Gini) suggests that output is escalating more rapidly with each incremental rise in the Gini coefficient. In segmented economies characterised by varying productivity levels, disparities may arise when productivity strengthens in high-productivity sectors. Nevertheless, increased labour mobility has the potential to mitigate these adverse effects by enhancing the effectiveness of the inequality-reducing channel of worker mobilisation. Moreover, insufficient labour mobility results in the misallocation of resources, impacting not only labour but also capital, which leads to diminished outputs and a heightened trade-off between efficiency and equality.

Table 3.6: Changes in the Distribution

Cost	Δ Gini	$\Delta P_{90}/P_{10}$	$\Delta P_{90}/P_{50}$	$\Delta P_{50}/P_{10}$	$\Delta Output/\Delta Gini$
0.025	0.015	-0.092	0.141	-0.330	15.14
0.020	0.015	-0.083	0.143	-0.327	15.28
0.015	0.015	-0.067	0.142	-0.315	15.69
0.010	0.015	-0.057	0.145	-0.312	15.80
0.005	0.016	-0.145	0.115	-0.308	16.09

Note: change in Gini, overall dispersion (P_{90}/P_{10}), upper-tail dispersion (P_{90}/P_{50}) and lower-tail dispersion (P_{50}/P_{10}) are in percentage differences, while delta output is defined as the percentage change of output level between pre-shock and post-shock equilibrium.

The experiment demonstrating a 10% decrease in productivity within the corporate sector is detailed in appendix B.9. In this experiment, both the output and the proportion of wage workers are observed to decline. As restrictions on labour mobility are eased, the implications associated with reduced productivity are diminished.

3.6.2 Productivity shocks on the entrepreneurial sector

Increased productivity for entrepreneurs will increase income for informal and formal entrepreneurs. It is interesting to analyse whether productivity increases can improve inequality and contribute significantly to aggregate output. Increased productivity for entrepreneurs is expected to close the income gap with workers in more productive sectors. Still, on the other hand, with low productivity, it is also important to discuss whether the impact is significant. How each income group behaves in the face of a productivity shock will also be examined.

A 10% increase in productivity results in a disproportionately small increase in output of merely 0.10%, as illustrated in Figure 3.7. This low increase in output can be attributed to the initially low productivity levels and the absence of a spillover effect. Due to these low initial productivity conditions, a significant number of entrepreneurs belong to the low or medium-income brackets and exhibit a heightened marginal propensity to consume. Consequently, they allocate a substantial portion of their additional income toward consumption, which is observed to be 3.17% higher. This behaviour implies a reduced share of savings from their additional income and inhibits capital accumulation within the economy. The scarce savings, coupled with limited access to financial markets, further hinder the growth of capital accumulation, which experiences only a 0.22% increase. Low capital accumulation in the economy hampers the availability of capital, which is an important variable in output growth, especially for the corporate sector. Hence, the advantages of productivity enhancements predominantly benefit the entrepreneurial sector only, without extending to other sectors, thereby constraining their overall impact on aggregate output. These results are similar across different entry costs.

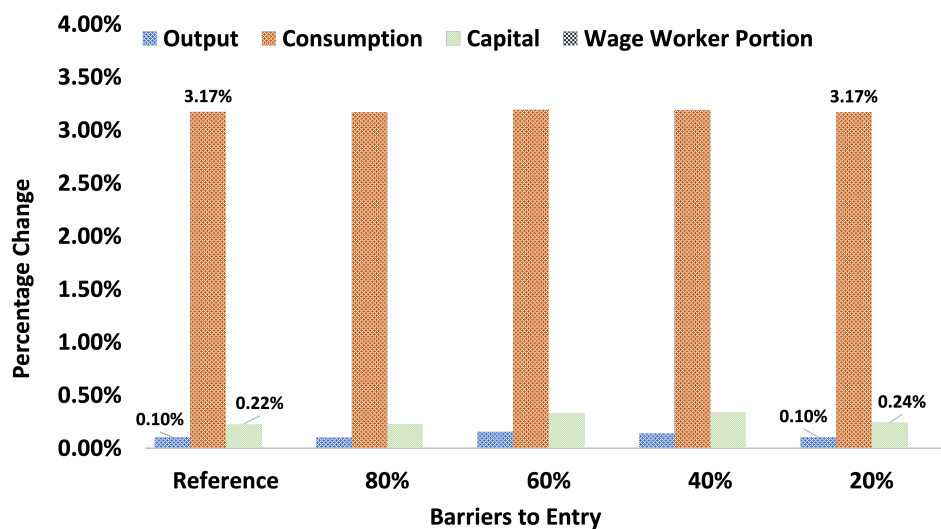


Figure 3.7: Changes in Aggregate Variables by Varying Entry Costs

Productivity improvements increase entrepreneurs' income and reduce inequality. Although the increase in productivity, it cannot incentivise wage workers to transition to

entrepreneurship, resulting in minimal labour mobility. The lack of labour mobility means that the improvement in inequality does not change much for different mobility costs, as shown in Table 3.7. The very low initial productivity for entrepreneur skill, based on the calibration results, does not provide sufficient benefits for wage workers to transition, even with a 10% increase in productivity. A larger productivity increase is needed to encourage labour mobility. It is also possible to increase the initial productivity, but changing the baseline will cause some indicators to be far from the data. The middle-income group can catch up with the higher-income group, as seen from the reduced dispersion between the two. On the other hand, the lower-income group is increasingly lagging behind the middle-income group, which indicates a concerning trend-the benefits of productivity increases are only felt by certain groups, especially by entrepreneurs with relatively higher productivity. Meanwhile, the total dispersion widens, indicating a widening gap between the lower and higher-income groups.

The combination of increased output and decreased inequality is the ideal policy outcome. There is no trade-off between efficiency and equality in this experiment, characterised by a negative number, which means that an increase in output is followed by a decrease in the Gini coefficient. However, it is essential to note that the significance level is minimal due to the isolation of the impact of productivity increase in their sector only, as illustrated in the last column of Table 3.7. The low spillover causes the increase in output to be disproportionately equal to the increase in productivity. Still, it is crucial to consider how to achieve this and the opportunity cost if the government wants to pursue such a policy.

Table 3.7: Changes in the Distribution

Cost	Δ Gini	$\Delta^{P90/P10}$	$\Delta^{P90/P50}$	$\Delta^{P50/P10}$	$\Delta Output / \Delta Gini$
0.025	-0.008	0.235	-0.070	0.317	-0.13
0.020	-0.008	0.238	-0.066	0.308	-0.12
0.015	-0.008	0.238	-0.065	0.305	-0.19
0.010	-0.008	0.239	-0.063	0.299	-0.17
0.005	-0.008	0.148	-0.088	0.292	-0.13

Note: change in Gini, overall dispersion (P90/P10), upper-tail dispersion (P90/P50) and lower-tail dispersion (P50/P10) are in percentage differences, while delta output is defined as the percentage change of output level between pre-shock and post-shock equilibrium.

3.7 Robustness

This section examines the robustness of the primary model by adjusting the capital tax parameter from 15% to 10%. An analysis will be conducted to evaluate the model's

response to this modification by comparing the baseline results along with the outcomes of the two preceding experiments. Adjusting the capital tax to a rate of 10% is not uncommon, as investment gains on government bonds are subject to taxation at this rate. This stands in contrast to the predominant capital gains, which are taxed at a rate of 15%.

A decrease in capital taxation leads to an enhancement in output, capital, and consumption. The reduction in taxation serves to stimulate an increase in capital accumulation within the economy, which rises by 1.01%, consequently resulting in an output increase of 0.48%. This surge in output is subsequently accompanied by a growth in consumption of 0.16%, as illustrated in Figure 3.8. The Gini coefficient demonstrated stability with minimal variation, reflecting a decrease of 0.003.

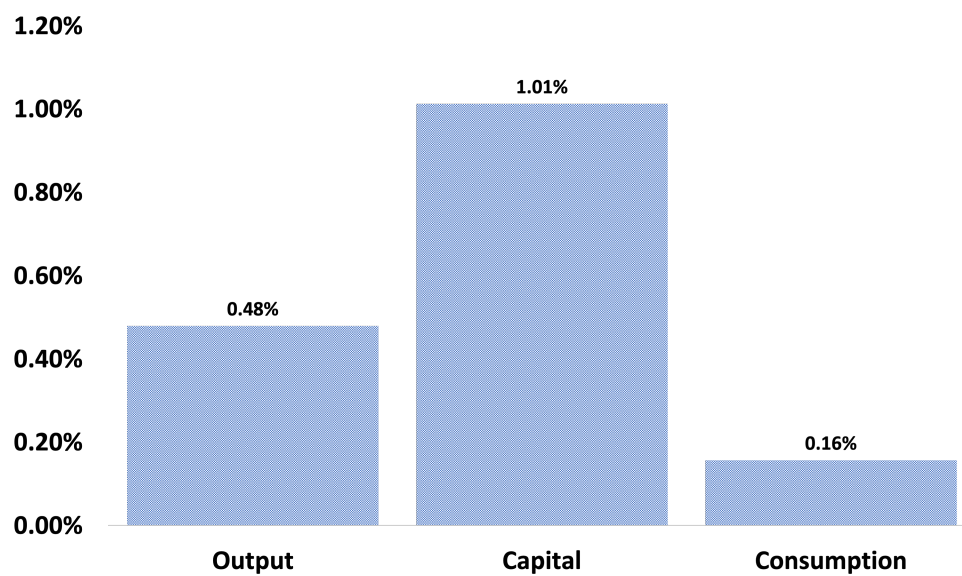


Figure 3.8: Percentage Changes in Aggregate Variables

Improvements in productivity within the corporate sector yield effects akin to those observed in the primary analysis, albeit with a greater magnitude. A 10% enhancement in productivity can elevate output by nearly 27% under conditions of restricted labour mobility. Furthermore, output amplifies further as restrictions on labour mobility diminish, as illustrated in Figure 3.9. Labor mobility, characterised by diminished frictions, can increase the proportion of wage workers from 49% of total workers in the baseline scenario to over 56%. The workers who undertake this transition are instrumental in the subsequent surge in productivity and the accumulation of capital, as they gain enhanced access to financial markets. Additionally, labour mobility contributes to an expansion of fiscal space, characterised by an augmentation of the tax base and a reduction in the number of beneficiaries of transfers. This dynamic results in a decrease in the endogenous labour tax rate while simultaneously increasing disposable income, which subsequently promotes greater consumption and savings.

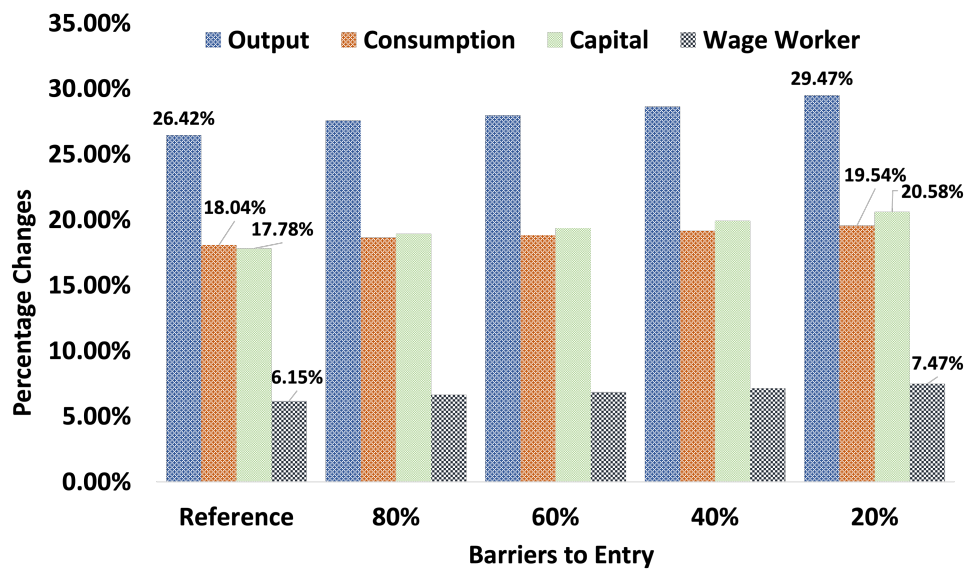


Figure 3.9: Changes in Aggregate Variables by Varying Entry Costs

The implications of heightened productivity within the corporate sector demonstrate a similar inequality trend as outlined in the primary analysis. Augmented productivity within this sector correlates with escalating inequality, as evidenced by the rise in the Gini coefficient presented in the first column of Table 3.8. The channel through which productivity contributes to inequality remains more pronounced than the channel of worker mobilisation that ostensibly mitigates inequality. Transitioning workers to high-productivity roles has the potential to decrease the income gap with higher income groups; however, it fails to adequately address the expanding income disparity that arises from productivity differentials between wage workers and entrepreneurs. Enhancements in productivity across the corporate sector exhibit varying effects on the two tail distributions. The lower-tail dispersion (P^{50}/P_{10}) reflects a slight improvement, indicating that the lower-income group may be progressing toward parity with the middle-income group. Conversely, the upper-tail dispersion (P^{90}/P_{50}) reveals an expansion, underscoring the inability of the middle-income group to bridge the gap with their higher-income counterparts. Furthermore, the analysis demonstrates that output increases at a disproportionately greater rate than the Gini coefficient when the level of restrictions is relaxed, which is consistent with the findings of the primary analysis.

Table 3.8: Changes in the Distribution

Cost	Δ Gini	$\Delta^{P90/P10}$	$\Delta^{P90/P50}$	$\Delta^{P50/P10}$	$\Delta Output / \Delta Gini$
0.025	0.015	0.454	0.142	-0.004	18.22
0.020	0.015	0.441	0.141	-0.009	19.14
0.015	0.015	0.453	0.140	0.002	18.89
0.010	0.015	0.443	0.139	-0.001	19.59
0.005	0.015	0.441	0.139	-0.001	20.05

Note: Change in Gini, overall dispersion (P90/P10), upper-tail dispersion (P90/P50) and lower-tail dispersion (P50/P10) are in percentage differences, while delta output is defined as the percentage change of output level between pre-shock and post-shock equilibrium.

An increase of 10% in entrepreneurial productivity results in a disproportionately minimal rise in output of merely 0.06%, as depicted in Figure 3.10, aligning with the findings from the primary analysis. This minimal increase in output can be attributed to the initially low productivity levels and the absence of a spillover effect. Given these low initial productivity conditions, a considerable number of entrepreneurs fall within the low to medium-income brackets and exhibit an elevated MPC. Consequently, they allocate a significant portion of their additional income towards consumption, which is observed to be 3.14% higher. This behaviour suggests a diminished share of savings from their additional income, which subsequently inhibits capital accumulation within the economy. The limited savings, combined with restricted access to financial markets, further obstruct the growth of capital accumulation, which sees only a 0.20% increase. Low capital accumulation within the economy adversely affects the availability of capital, a crucial variable for output growth, particularly within the corporate sector.

The implications of increased productivity within the entrepreneurial sector reflect a similar trend of inequality, as outlined in the primary analysis. Improvements in productivity elevate the income of entrepreneurs while concurrently diminishing inequality. However, the rise in productivity fails to provide sufficient incentives for wage workers to transition into entrepreneurship, resulting in limited labour mobility. The absence of labour mobility signifies that the enhancement in inequality remains relatively unchanged across various mobility costs, as presented in Table 3.9. The middle-income group exhibits a capacity to converge towards the higher-income group, as evidenced by the diminished dispersion between the two categories. Conversely, the lower-income group is increasingly falling behind the middle-income group, which indicates a troubling trend—the advantages of productivity increases are primarily experienced by specific groups, particularly entrepreneurs with comparatively higher productivity. Simultaneously, the overall dispersion is expanding, signifying a growing divide between the lower-income and

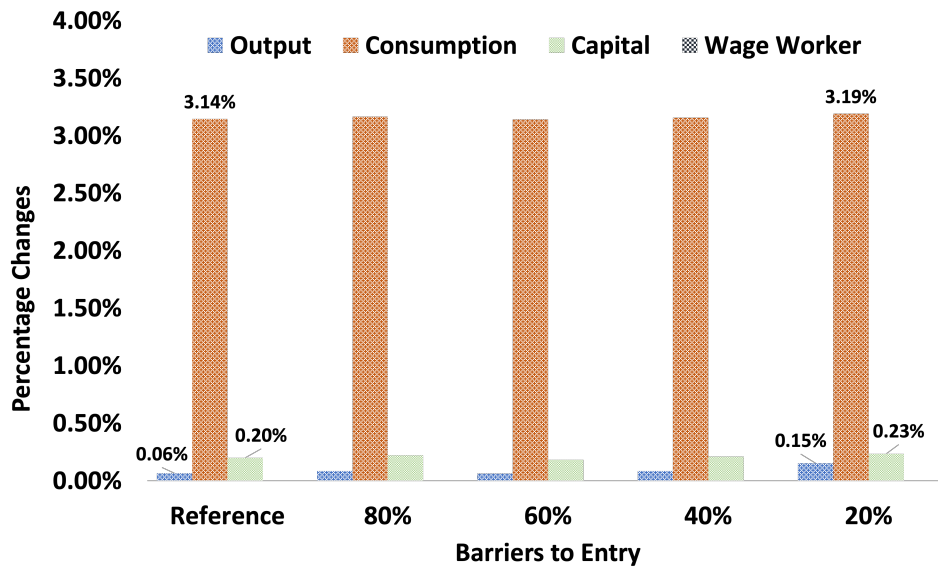


Figure 3.10: Changes in Aggregate Variables by Varying Entry Costs

higher-income groups.

Table 3.9: Changes in the Distribution

Cost	Δ Gini	$\Delta^{P90/P10}$	$\Delta^{P90/P50}$	$\Delta^{P50/P10}$	$\Delta Output / \Delta Gini$
0.025	-0.008	0.212	-0.064	0.285	-0.08
0.020	-0.008	0.199	-0.065	0.278	-0.11
0.015	-0.008	0.204	-0.065	0.280	-0.08
0.010	-0.008	0.191	-0.066	0.273	-0.10
0.005	-0.008	0.184	-0.066	0.267	-0.18

Note: Change in Gini, overall dispersion (P90/P10), upper-tail dispersion (P90/P50) and lower-tail dispersion (P50/P10) are in percentage differences, while delta output is defined as the percentage change of output level between pre-shock and post-shock equilibrium.

3.8 Conclusion

Informality is a phenomenon that generally occurs in developing countries, with an average informal share of employment of 39.4% between 2008 and 2018. This is much higher than in developed countries, only 14.4% during the same period. High informality is positively correlated with low GDP per capita and high inequality. The low level of productivity in informal activities results in low income levels and income growth, resulting in a wide income gap with workers in the formal sector who have higher productivity. Low productivity and high inequality are two major challenges developing countries face, exacerbated by low labour mobility between sectors.

We develop a heterogeneous agent general equilibrium framework that integrates the formal and informal labour markets within a two-sector economy featuring occupational choice, where informality serves as the equilibrium outcome. We contribute to the literature on how informality affects output and inequality simultaneously under conditions of low labour market mobility. Our model is built using the characteristics of an economy dominated by informal workers, where workers possess different assets and skills—both working and managerial—that determine the endogenous allocation of labour in the economy. Workers will optimally select the job that offers the best expected utility, whether as a wage worker, formal entrepreneur, or informal entrepreneur. The analysis is conducted with a counterfactual scenario of varying degrees of restrictions on labour mobility. This study complements the literature on the macroeconomic consequences of informality, particularly under minimal labour mobility, a condition that other studies have not addressed.

We found that the labour market in Indonesia has a low mobility and asymmetric transition, characterised by a low transition rate between the formal and informal sectors. The transition rate from formal to informal workers is higher than vice versa, with the rates remaining low. This pattern has resulted in the dominance of informal workers in Indonesia. The high informational friction and high barrier to entering formal employment are some of the reasons that shape the market. Most informal workers have limited access to training opportunities, hindering their human capital accumulation and making them less competitive in the formal job market. They may choose to remain as informal workers due to their skill sets or lack of formal qualifications. Even if workers possess the talents that employers are looking for, some may find it challenging to find the right match for these skills due to the minimum labour market information, which causes some of them to work in the informal sector to get income immediately.

Furthermore, the presence of informality hinders economic growth by impeding capital accumulation and keeping aggregate productivity low, while also contributing to inequality through productivity differences between the two sectors. Insufficient labour mobilisation between sectors plays a significant role. The frictions causing low labour

mobilisation result in inefficient labour allocation and hinder capital accumulation, leading to resource misallocation. When labour shifts to the formal sector, overall capital increases; conversely, it decreases when labour moves to the informal sector, affecting productivity and output. The lack of access to financial markets for most entrepreneurs exacerbates these challenges. Entrepreneurs are unable to expand their businesses, which restricts productivity and fails to contribute to the accumulation of aggregate capital.

Markup and Misallocation in Developing Country: Evidence from Indonesia

4.1 Introduction

The behaviour of firms serves as a pivotal determinant of productivity and output levels. Decisions undertaken by firms relating to innovation aimed at improving product quality, penetrating new markets with novel products, or disengaging from existing markets notably affect the distribution of markups among firms. There are many studies on the relationship between markups and misallocation, which subsequently affect aggregate productivity and the labour share of income ([Epifani and Gancia \(2011\)](#), [Edmond, Midrigan and Xu \(2023\)](#), [Liang \(2023\)](#), [Peters \(2020\)](#)). This paper aims to analyse how firm-level markups contribute to resource misallocation among firms within an economy. It emphasises the importance of examining the connection between markup, misallocation, productivity, and the share of labour income, taking into account the inherent differences between firms, particularly foreign and domestic ones.

The competition among firms plays a significant role in shaping allocative efficiency and markups, which are defined as the disparity between the selling price and the marginal cost. The primary objective of each firm is to maximise profit by enhancing productivity related to existing products and increasing their markups. Firms may also pursue entry into new product markets to boost sales or choose to exit particular markets to optimise resource allocation. Over time, firms generally invest in productivity improvements and subsequently elevate their markups. As firms continue to produce the same product, their markups are likely to increase as they mature. Conversely, when firms commence production in new markets and engage in processes of creative destruction, the markups may initially remain low, as achieving efficiency necessitates time and they must contend with other firms operating within the same market. The entry of new competitors presents challenges for existing firms in sustaining their markups, primarily due to the intensified

competition. These two forces—the markup-increasing effect of innovation by firms and the markup-reducing impact of creative destruction—collectively shape the equilibrium distribution of markups.

Prior literature has primarily focused on intra-firm dynamics related to technological improvements that influence aggregate productivity. The study conducted by [Hsieh and Klenow \(2009\)](#) elucidated that market distortions lead to misallocation, wherein inputs are inefficiently distributed between firms, consequently impeding aggregate productivity. Such distortions may manifest as intricate policies governing market entry, which prevent production inputs from being utilised by more efficient firms, as the firms are unable to replace less efficient competitors within the market. [Hsieh and Klenow \(2009\)](#) study assessed the extent of misallocation affecting TFP in developing economies, where such distortions are more pronounced, yet it did not delve into the sources of the misallocation. Recent research endeavours have sought to partially identify the sources of misallocation, particularly emphasising the role of markups in influencing these inefficiencies. The relationship among markup, misallocation, and aggregate productivity, arising as an endogenous consequence of firms' responses to market competition, will be further explored in this paper.

The global markup has exhibited a steady upward trend, rising from approximately 1.1 in 1980 to 1.6 in 2016, as noted in the study conducted by [De Loecker and Eeckhout \(2018\)](#). The evolution of markup is particularly evident across different regions; developed economies tend to experience a more significant increase in markup compared to developing nations, which also follow an upward trend, albeit at a lower rate. A higher markup corresponds to a reduced labour share of income, as sales growth does not proportionally align with increases in input prices. This discrepancy engenders distributional impacts due to the variation in markup levels among firms. Firms with elevated markups may possess diminished incentives to expand and innovate, leading to less demand for capital and labour allocation for these firms and resulting in a diversion of resources towards less efficient firms.

This paper study the importance of analysing the relationship between markup, misallocation, productivity, and the share of labour income, considering the inherent differences between firms, specifically foreign and domestic ones. It revisits the work conducted by [Peters \(2020\)](#) by broadening the scope to include two types of firms, domestic and foreign, rather than just one. This paper provides a preliminary exploration of potential channels through which the key parameters in [Peters \(2020\)](#) model might illuminate the new empirical findings regarding the formation of markup distributions. Our aim is to identify the most significant channels contributing to the disparities observed between these two types of firms.

Foreign firms benefit from greater access to technology due to their receptiveness to

technology transfer opportunities through foreign direct investment, which results in higher productivity levels. By operating on a larger scale, foreign firms are able to reduce unit costs and achieve economies of scale. Furthermore, foreign firms are predominantly integrated within global value chains, granting them enhanced access to efficient, high-quality, and reliable global suppliers. In contrast, domestic firms generally face limited access to technology transfer, and their restricted participation in global supply chains hampers their ability to engage with efficient suppliers. Additionally, the majority of domestic firms primarily serve the local market; as a result, they operate at smaller economies of scale and are unable to significantly lower their unit costs.

Domestic firms typically surpass foreign firms in quantity; nevertheless, their productivity is comparatively lower and more diverse. In contrast, foreign firms demonstrate superior and more concentrated productivity despite their lesser numbers. The degree of productivity disparity within the product market influences the distribution of markups and the extent of misallocation. The distinct behaviours and dynamics of these two types of firms, particularly in developing nations characterised by limited technological advancement and the frictions arising from structural, regulatory, and market-related barriers that restrict the proportion of foreign firms within the economy, present a strong foundation for analysis.

The initial section of this paper presents stylised facts derived from the data. We utilise firm-level panel data derived from Indonesia. As a developing country, distortions exist that hinder the capacity of established firms to penetrate new markets, of nascent enterprises to enter the marketplace, and of existing companies to innovate in the products they offer. Possible contributing factors include protracted and costly business approval procedures, limited technological capabilities, as well as insufficient access to financial markets. The relationships among variables are established through data analysis, which facilitates the construction of a theoretical framework and the calibration of the model to align with the empirical data. The dataset is available on an annual basis from 1990 to 2015, thereby enabling a comprehensive examination of firm dynamics over an extended period.

The analysis enables us to gain an understanding of the mechanisms that differentiate the behaviour of foreign firms from domestic firms in the formation of markup distributions, as well as the associated macroeconomic implications. Our findings indicate that older firms generally exhibit higher markups, particularly among foreign entities, suggesting their capacity to establish a more substantial disparity between product prices and marginal costs. Moreover, firms with elevated productivity levels tend to command higher markups, predominantly seen in foreign firms that exhibit significantly greater markups, thereby reflecting their capability to produce goods at lower costs while retaining competitiveness among high-productivity operations. Additionally, net employment growth diminishes in

response to rising markups, highlighting the negative repercussions of markup increases and underscoring the necessity for a thorough analysis of this phenomenon.

The mechanism underlying the formation of markup distribution among firms is examined utilising the theoretical framework from [Peters \(2020\)](#), predicated on an imperfectly competitive product market model, wherein firms engage in Bertrand competition. Within this framework, firms establish prices with variable markups, taking into account their productivity levels and the competition inherent in each product market they occupy. Each firm exhibits distinct productivity levels pertaining to the various goods it produces, and possesses the discretion to either pursue innovations for its current goods or to diversify into additional product markets. Incumbent firms encounter competition from both established enterprises that initially serve different product markets and new entrants that have recently commenced operations, enabling the processes of market entry and exit. This scenario engenders a phenomenon of creative destruction, wherein more efficient firms supplant their less productive counterparts. The framework is grounded in the firm-based model of Schumpeterian growth, wherein creative destruction plays an essential role in economic dynamics, and the distribution of markups is determined endogenously.

We examine the primary mechanism through which foreign firms achieve higher markups compared to domestic firms, utilising comparative analysis to evaluate the calibration parameters and outcomes for each type of firm. Given the inherent distinctions between foreign and domestic firms, the outcomes and structural parameters of the model differ significantly, which will be analysed comprehensively within this paper. The framework is capable of explicitly modelling three critical channels in markup formation: the own-innovation channel, the product expansion channel (incumbent creative destruction), and the market entry channel (new firms' creative destruction). In this section, we identify the essential channel that most significantly contributes to the disparities between the firms, which is the creative destruction channel for new entrants.

The next section will assess the aggregate consequences by calculating the convolution of two markup Pareto distributions, pertaining to both domestic and foreign firms, to derive the new aggregate distribution. The tail parameter of the new aggregate Pareto distribution enables us to quantify the average markup, the dispersion of markup, the aggregate misallocations, and the labour share of income. This approach provides valuable insights into the aggregate consequences at varying levels of market integration in a straightforward manner, even though it has limitations for not considering the constraints of the labour market. Our findings indicate that a markedly lower equilibrium entry rate for foreign firms results in higher and more dispersed markups, with adverse implications for greater misallocation in TFP and a reduced labour share of income. Relaxing entry barriers for foreign firms can lower both average markups and their dispersion, reducing TFP misallocation and mitigating labour share losses. These effects

are particularly pronounced when foreign firms operate across multiple markets rather than being restricted to a few.

Related literature. This paper addresses various literature that explore the dynamics of firm markups. Significant variations in markups can be observed across different sectors and among firms within the same sector, as substantiated by the research conducted by [De Loecker et al. \(2016\)](#). Their investigation, which employed quantity-based measures to ascertain markups, demonstrates that these variations are pivotal in evaluating the efficacy of trade liberalisation policies. The global markup has exhibited a steady increasing trend since 1980, evident across various regions, as suggested by [De Loecker and Eeckhout \(2018\)](#), which involved the extraction of firm data from 134 countries. Utilising data from publicly traded firms, [Diez, Leigh and Tambunlertchai \(2018\)](#) showed similar results, indicating that markups have increased since 1980, particularly in advanced economies. This paper contributes to the literature by elaborating on the evolution of markups in Indonesia, a developing country that is more exposed to various challenges that adversely affect business operations, investment or expansion than advanced countries.

This paper is also associated with the literature concerning the heterogeneity of markups among firms. [De Loecker and Warzynski \(2012\)](#) identifies discrepancies in markups across firms operating in different markets, revealing that firms engaged in export markets tend to command higher markups than those operating solely within the domestic market. By entering the export market, firms have the potential to enhance their markups. A similar conclusion is suggested by [Bellone et al. \(2014\)](#), which indicates that exporters experience higher markups, demonstrating that the quality-enhancing channel predominates over the price-depressing channel in the context of global competition. Utilising data from Japanese manufacturing firms, [Kato \(2014\)](#) shares this perspective, noting that exports are associated with significant productivity and markup premiums that vary across markets. Employing the Bertrand competition model within an open economy, [De Blas and Russ \(2015\)](#) contends that trade liberalisation may elevate markups for incumbent exporters; however, this effect might be mitigated if these exporters originate from countries characterised by relatively lower technological advancements, and thus compete against exporters from nations with superior technology. Furthermore, [Diez, Fan and Villegas-Sanchez \(2021\)](#) identifies that the markups of publicly listed firms are higher than those of their private counterparts across a wide range of sectors. This paper contributes to the literature by analysing the markups of two distinct types of firms, domestic and foreign-owned, which have inherent differences. Foreign enterprises typically benefit from economies of scale, as they serve a wider global market and are more deeply integrated into the global value chain, thereby affording them greater access to suppliers and markets, while domestic firms generally focus exclusively on the domestic market and lack integration with the global value chain.

This paper makes a substantial contribution to the discourse surrounding markups and resource misallocation. The research conducted by [Liang \(2023\)](#) demonstrates that markups exert a significant influence on resource misallocation, primarily through an indirect effect that restricts the reallocation of resources toward more productive firms. Furthermore, markups contribute to misallocation, and their elimination has the potential to elevate TFP by 15% in the United States, as indicated by a study conducted by [Baqae and Farhi \(2019\)](#). Additionally, the investigation by [Edmond, Midrigan and Xu \(2023\)](#) suggests that misallocation attributable to markups leads to a decrease of between 1% and 3% in gross-output productivity and a reduction of 2% to 6% in value-added productivity. It is essential to emphasise that their study also underscores the vital importance of efficient resource allocation in improving welfare, thereby highlighting the necessity of addressing misallocation within economic policy frameworks. Moreover, research conducted by [Epifani and Gancia \(2011\)](#) indicates that markup heterogeneity may negatively impact welfare in the context of trade liberalisation and restrictions on firm entry. Welfare is likely to improve when restrictions on firm entry are minimal, and domestic industrial policies further contribute to a more effective allocation of resources across sectors. A study conducted by [Hsieh and Klenow \(2009\)](#) evaluates the misallocations observed in specific developing countries by analysing the dispersion of revenue productivity among firms and determining its contribution to overall aggregate productivity. Building on the theoretical framework grounded in the firm-based Schumpeterian growth model, this paper contributes to the literature by endogenising the markup distribution and examining its implications for misallocation in an economy comprising two types of firms.

The literature concerning both domestic and foreign firms is significantly pertinent to our research. The study conducted by [Un \(2015\)](#) illustrates that domestic firms experience a competitive disadvantage in innovation when compared to foreign firms, primarily due to the limited transfer and integration of knowledge among employees. The research by [Perez-Batres and Eden \(2008\)](#) posits that domestic firms incur additional costs in adapting their business strategies to compete with foreign counterparts following the implementation of liberalisation policies in Mexico. Domestic firms are required to adhere to new regulations and institutional frameworks, having previously faced competition solely from domestic entities due to governmental market protectionism. Furthermore, another study by [Chang and Park \(2012\)](#) contends that domestic firms struggle to compete in industries characterised by extreme market heterogeneity, owing to deficiencies in marketing capabilities. In contrast, foreign firms possess extensive knowledge and research into consumer demand and utilise more efficient distribution systems. According to [Meyer and Peng \(2020\)](#), the disparities between foreign and domestic firms are particularly pronounced in emerging economies, attributable to unstable and inconsistent institutional pressures that may hinder effective responses from firms. Different firms

may experience varying pressures as they engage with distinct stakeholders. In more stable environments, one can observe a convergence of behaviours among firms. This paper extends the analysis of domestic and foreign-owned firms across various indicators, including markups, productivity, firm age, and net employment growth, to better understand their implications for macroeconomic variables.

This paper makes notable contributions to the existing literature in several respects. Firstly, we emphasise the importance of analysing the behaviour of intrinsic differences among firms in forming the markups, particularly between foreign and domestic firms, a topic that has not been previously addressed. Secondly, we integrate two types of heterogeneous firms within an endogenous markup framework, thereby extending the investigation initiated by [Peters \(2020\)](#). Our enhancement of their model involves the introduction of two distinct categories of firms, foreign and domestic, and the utilisation of relatively recent data to substantiate the findings and effectively calibrate the model. Thirdly, our study clarifies the significant disparity between the theoretical model and empirical data regarding the markup-driven misallocation of TFP and labour share of income identified in previous research. Furthermore, a model incorporating two types of heterogeneous firms proves more effective in assessing the macroeconomic implications of markup variations, particularly in the presence of frictions that accentuate the disparities among firms.

The remainder of this paper is structured as follows. In Section 4.2, we discuss the data and methodological approaches employed in this study to measure the markup, as well as the analysis of the evolution of markup, alongside other related variables, elaborate upon the relevant facts, and propose potential mechanisms for markup formation. In Section 4.3, we introduce our theoretical framework model that aligns with the facts presented in the preceding section, enabling us to measure the aggregate consequences of markup on misallocation and labour share of income. Section 4.4 documents the outcomes of testing the theoretical framework against the data as well as the results of simulation exercises. Finally, Section 4.5 provides a summary of the findings.

4.2 Empirical analysis

4.2.1 Data and methodology

Data. This study utilises Indonesian annual panel data pertaining to the manufacturing industry from 1990 to 2015¹. The census data encompasses large and medium-scale

¹The survey was conducted by delivering questionnaires to all large and medium-scale manufacturing firms recorded in the Indonesian Statistic Agency (BPS) directory. The directory is updated every year and is done in two stages. In the first stage, BPS searched and matched lists of firms' names and addresses from other agencies (Ministry of Industry, Ministry of Trade, Ministry of Labour and Transmigration, and other relevant agencies) with the previous year's directory. Firms not listed in the directory were checked

manufacturing enterprises employing 20 or more. It is important to note that small and household-scale industries are excluded from this survey. The dataset features variables such as the number of firms and employees, expenditures on personnel, energy consumption, utilised fuels, input costs, output value, value-added, as well as sales and purchases of fixed capital goods. Although it does not encompass all industries within the country, the data aligns with our primary research focus, particularly as medium- and large-scale firms are at the forefront of innovation and the establishment of markups. Conversely, the majority of small and household-scale industries typically exhibit minimal engagement in innovation and often face stagnation due to constraints related to raw materials, guidance and training, alongside traditional challenges such as access to capital and partnerships, as examined in the study by [BPS \(2023\)](#).

The extended duration of the survey data has resulted in varied industrial classifications divided into three distinct regimes. The timeframe from 1990 to 1998 employed the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 2; the subsequent period from 1999 to 2009 utilised ISIC Revision 3, while the period thereafter adhered to ISIC Revision 4. To maintain consistency, classifications were transitioned to ISIC Revision 4, resulting in the exclusion of certain previous industry classifications from the manufacturing sector in the analysis. Between 1990 and 2015, the dataset comprised over 560,000 observations, of which 93% were domestic firms, as illustrated in Figure 4.1. The categorisation is predicated on the predominant proportion of capital ownership, wherein domestic firms are characterised as those with the majority of capital held by the central government, local government, or the national private sector. Conversely, foreign firms are defined as those whose capital ownership is primarily held by foreign entities. The economic census of 2006 substantially augmented the count of newly registered firms within the survey, particularly domestic firms, thereby resulting in anomalous firm entry rates present in the data.

The employee distribution exhibits a rightward skew, indicating that the majority of firms employ a number of workers that is below the average. On average, each firm employs 194 workers; however, the median number is considerably lower at 45. Both categories of firms demonstrate comparable characteristics, with domestic firms presenting a notably higher skewness than their foreign counterparts. Foreign firms, boasting an impressive average

in the field to determine whether they could be included in the directory. Then, in the second stage, BPS had to analyse firms that had not completed the annual industrial survey and determine whether or not the firms were still active. In case active firms are not filling out the survey or are known as non-responding firms, estimation is done to have a complete figure. Estimating the existing non-responding firms is conducted using information obtained from their historical productivity growth (value added per labour). At the same time, the other variables are estimated by measuring the ratio between variables of the other responding firms. Meanwhile, the new non-responding firms are estimated using a ratio approach of variables from responding firms in the same industry classification. The industrial classification of a firm is determined based on its main production, the commodity produced with the greatest value. If the firm produces two or more types of commodities with the same value, the main production is the commodity produced with the largest quantity.

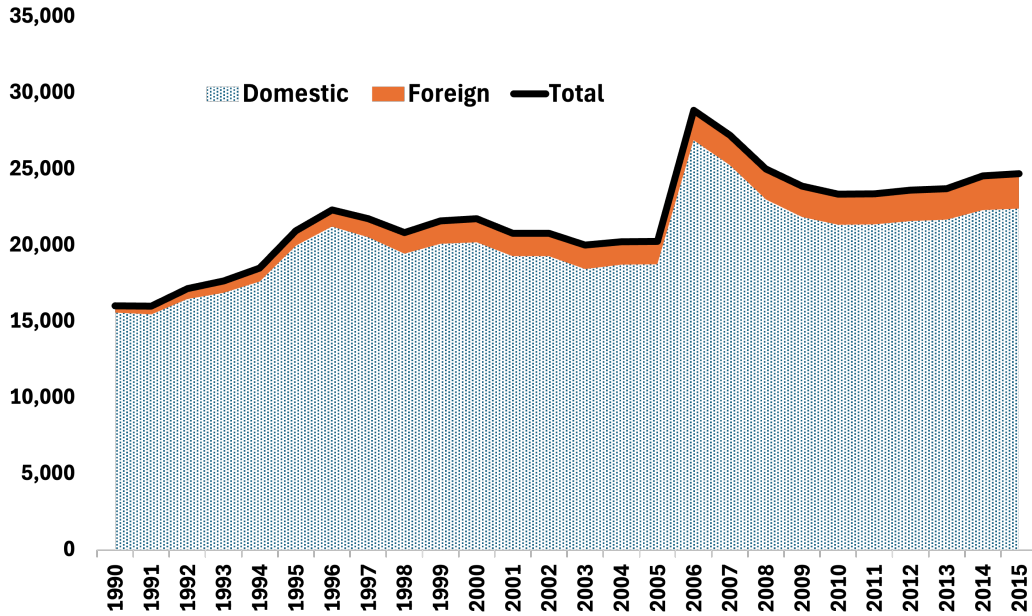


Figure 4.1: Number of Firms

employment figure of 556 workers, significantly contribute to job creation, accounting for nearly 20% of total employment despite representing only 7% of all firms. In contrast, half of domestic firms employ fewer than 41 employees, which is substantially lower than the employment of up to 217 workers among foreign firms, as illustrated in Table 4.1. Furthermore, less than 15% of domestic firms employ 217 or more workers. Sales generated by foreign firms constitute over 30% of total sales, highlighting their crucial role in enhancing output. Conversely, domestic firms contribute to 70% of total sales from 93% of all firms, indicating contrasting productivity levels between the two types of firms.

Table 4.1: Firms' Size and Sales

Domestic Firms				Foreign Firms			
Mean	P50	Skewness	Sales share	Mean	P50	Skewness	Sales share
167	41	38.03	0.7	556	217	9.05	0.3

Methodology. The methodology used in this study to measure the markups follows [De Loecker and Warzynski \(2012\)](#), where we will exploit the growth of markup using the production function approach. Firms, y_f , make production with a level of productivity, q_f . The firm only uses l unit of labour to make goods:

$$y_f = q_f l_f. \quad (4.1)$$

Let the firm be a price-taker in the input market, with the input price w , and they choose

the optimal labour from the cost-minimisation problem subject to $y_f(l_f) = q_f l_f = y$. The Lagrangian of the problem can be written as

$$\mathcal{L} = w l_f + \lambda (y - y_f(l_f)), \quad (4.2)$$

then the optimal level of labour needed is given by the following first order conditions:

$$\frac{\partial \mathcal{L}}{\partial l_f} = w - \lambda \frac{\partial y_f}{\partial l_f} = 0 \iff w = \lambda \frac{\partial y_f}{\partial l_f}, \quad (4.3)$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = y - y_f(l_f) = 0 \iff y_f(l_f) = y. \quad (4.4)$$

Then we can rearrange Equation 4.3 and multiply both side of $p l_f / y_f$, where p is the market price, to gather

$$\frac{w p l_f}{\lambda y_f} = \frac{\partial y_f}{\partial l_f} \frac{p l_f}{y_f} \iff \frac{p}{\lambda} = \frac{\partial y_f}{\partial l_f} \frac{l_f}{y_f} \frac{p y_f}{w l_f}. \quad (4.5)$$

Since λ is the marginal cost, then we can define markup, μ_f , as the ratio between the market price over the marginal cost:

$$\mu_f = \frac{p}{\lambda} \iff \mu_f = \alpha_{l,f} \frac{1}{s_{l,f}} = \alpha_{l,f} s_{l,f}^{-1}, \quad (4.6)$$

where $\alpha_{l,f} = \frac{\partial y_f / y_f}{\partial l_f / l_f}$, is the output elasticity of labour, and $s_{l,f} = \frac{w l_f}{p y_f}$ is the firm's labour share. Since labour is the only input for the production process, the output elasticity of labour is one. When the price is equal to the marginal cost, labour's output elasticity will be equal to labour's share, but in imperfect competition, a markup creates the difference between output elasticity and labour's share. Physical output y_f might contain unanticipated shocks and measurement errors that could bias the markup estimate. Hence, [De Loecker and Warzynski \(2012\)](#) propose to adjust y_f with the measurement error $\hat{\varepsilon}_{ft}$ gathered from below regression

$$\ln y_{ft} = \beta_l \ln l_{ft} + \beta_k \ln k_{ft} + \beta_{ll} (\ln l_{ft})^2 + \beta_{kk} (\ln k_{ft})^2 + \beta_{lk} \ln l_{ft} \ln k_{ft} + \omega_{ft} + \varepsilon_{ft}, \quad (4.7)$$

where k_{ft} and ω_{ft} are the capital asset and productivity of firm f at time t , respectively. First, we need to obtain the expected output, ϕ_{ft} , and calculate the unobserved productivity, ω_{ft} , using the regressions below:

$$\ln y_{ft} = \phi_{ft}(l_{ft}, k_{ft}, w_{ft}) + \varepsilon_{ft}, \quad (4.8)$$

$$\phi_{ft} = \beta_l \ln l_{ft} + \beta_k \ln k_{ft} + \beta_{ll} (\ln l_{ft})^2 + \beta_{kk} (\ln k_{ft})^2 + \beta_{lk} \ln l_{ft} \ln k_{ft} + \omega_{ft}. \quad (4.9)$$

Hence

$$\omega_{ft} = \hat{\phi}_{ft} - \beta_l \ln l_{ft} - \beta_k \ln k_{ft} - \beta_{ll} (\ln l_{ft})^2 - \beta_{kk} (\ln k_{ft})^2 - \beta_{lk} \ln l_{ft} \ln k_{ft}. \quad (4.10)$$

Since our data only provides the revenue, we then will replace the physical output with the price-adjusted revenue, re_{ft} , following [Peters \(2020\)](#). Hence, we do the following regression to obtain $\hat{\varepsilon}_{ft}$:

$$\ln re_{ft} = \phi(l_{ft}, k_{ft}, \omega_{ft}) + \varepsilon_{ft}. \quad (4.11)$$

We then have the corrected labour share that has eliminated any variation in the labour's share that comes from variation in output outside the $\phi(l_{ft}, k_{ft}, \omega_{ft})$, defined as

$$s_{l,ft} = \frac{wl_{ft}}{re_{ft}/\exp(\hat{\varepsilon}_{ft})}. \quad (4.12)$$

Once we measure the firm's labour share, then we can do the below regression based on Equation 4.6

$$\ln s_{l,ft}^{-1} = \ln \mu_{ft}. \quad (4.13)$$

Let $\ln \mu_{ft} = \hat{\mu}_{ft}$ since we only need to measure the growth of markup, not the level itself. We then measure the markup from the residual of below regression

$$\ln s_{l,ft}^{-1} = \delta_s + \delta_t + \hat{u}_{ft}, \quad (4.14)$$

where δ_s is the 4-digit industry classification fixed effects and δ_t is the year fixed effects.

4.2.2 Empirical results

This paper conducts an analysis of firms that entered the market after 1990 in order to gain a clearer understanding of the age of these firms. Firms that were already respondents in 1990 are likely to have existed prior to that year, which complicates the analysis of firm

age. We utilised data up to the year preceding 2006 to mitigate the influence of anomalous firm dynamics resulting from the census. The economic census of 2006 significantly increased the number of new firms recorded in the survey, leading to anomalous entry rates and notable exit rates for several subsequent years.

Fact 1 *The distribution of markups for foreign firms has a higher mean, is more dispersed and has a thicker tail distribution than domestic firms.*

The markup distribution, defined as the differential between production costs and selling prices, typically exhibits a rightward skew and a thick-tailed distribution in contrast to a normal distribution. This asymmetric distribution signifies that a greater number of firms possess markups that are below the mean, with the median value falling short of the mean value. The mean exceeds the median due to its susceptibility to the influence of firms positioned at the higher end of the distribution. Additionally, the distribution is characterised by a thick tail, denoting the existence of firms with markup values significantly above the mean. Foreign firms are represented by a curve to the right of that of domestic firms, indicating higher average markups, with a mean of 0.63 compared to -0.05 for domestic firms, as illustrated in Figure 4.2. The skewness of the markups of foreign firms is less pronounced, at 0.37, which is lower than 0.70 for domestic firms, suggesting a relatively even distribution of firms across positions above or below the mean. Nevertheless, foreign firms demonstrate a greater dispersion in their markups, with a variance value of 1.3, which is higher than 0.96 for domestic firms, indicating increased variation and a lack of clustering around the mean. The tail distribution of foreign firms is thicker, with a kurtosis of 6.3, higher than 4.8 for domestic firms, reflecting a heightened probability of encountering firms with markups that deviate substantially from their average.

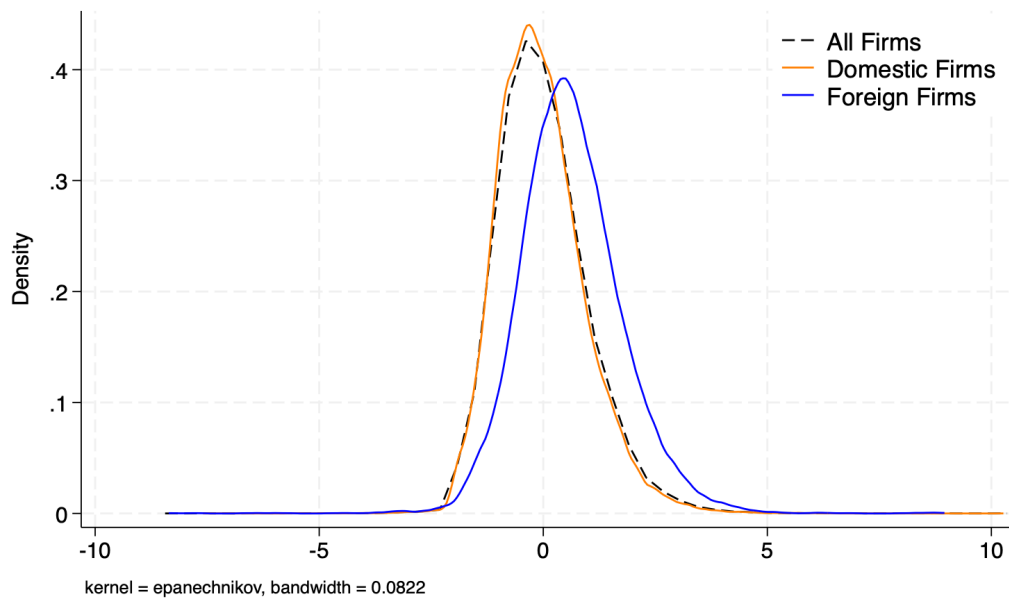


Figure 4.2: Distribution of Markups

Fact 2 *Firms with a long production life generally have a higher markup than younger firms.*

Markups exhibit a direct correlation with the age of firms. Firms that have been operational for over one year, also referred to as surviving firms, are able to elevate their markups up to 11% higher than those of newly established firms within the market, particularly for firms that have been producing for a duration of 14 years. Both foreign and domestic enterprises demonstrate similar behavioural patterns; however, our analysis identifies that foreign firms achieve higher markups, especially within the initial nine years of production, as illustrated in Figure 4.3. The elevated markups of foreign firms are evidenced by the distribution curve being positioned to the right of that of domestic firms. This observation indicates that foreign firms possess critical factors enabling them to sustain higher markups, such as enhanced access to technology or more efficient production processes resulting from their integration into the global supply chain, which constitutes a fundamental distinction from domestic firms.

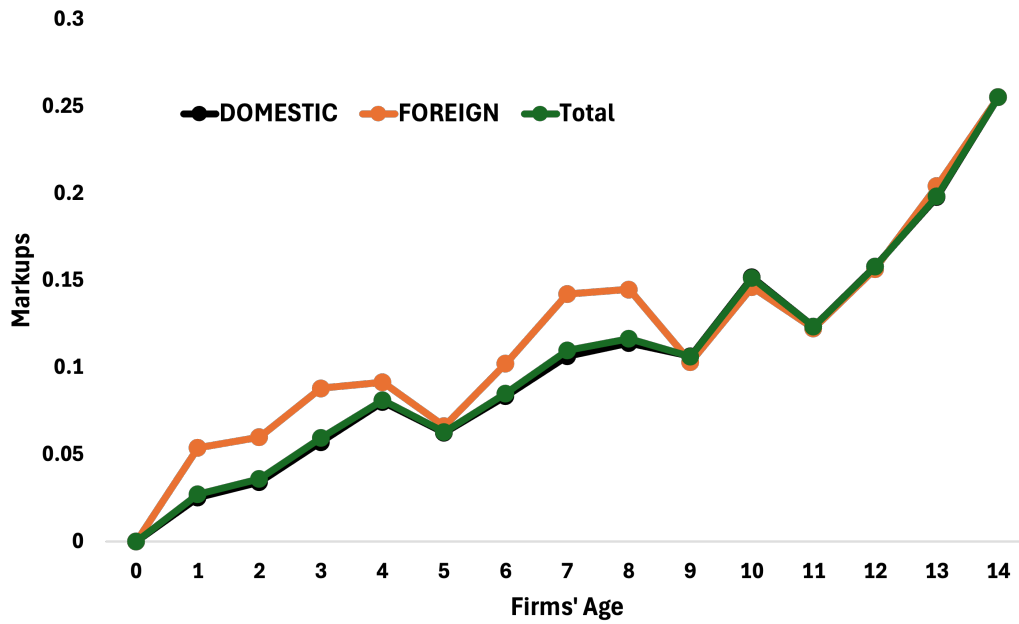


Figure 4.3: Markups by Firms' Age

Note: Calculated by measuring the average markups for surviving firms for each age cohort relative to the markups of entering firms. The markups of five-year-old firms are 5% higher than those of new entrants.

Fact 3 *Productivity increases as the firm ages, and foreign firms have higher productivity than domestic firms for every age level.*

Productivity, defined as the value added per unit of labour, exhibits a positive correlation with the age of firms, indicating that firms tend to enhance their productivity as they mature. Older firms are able to gain more productivity due to the accumulated knowledge from staying in the business for longer, which enables them to perform better business practices and a wider network. In comparison to their domestic counterparts, foreign firms demonstrate significantly higher productivity levels, exceeding the productivity of domestic firms by over threefold across all age categories, as illustrated in Figure 4.4. Moreover, this productivity disparity expands as firms age, reaching its peak by the tenth year. This phenomenon is primarily driven by the differential rates of productivity acceleration between the two types of firms, wherein domestic firms experience growth at a comparatively slower pace. Variations in productivity acceleration can be attributed to disparities in firms' capabilities and competitive environments. The decisions made by firms regarding innovation, as well as their investment levels, are influenced not only by internal factors but also by the actions of their market competitors. Indeed, competition serves as a catalyst, motivating firms to persist in their innovative efforts and strive for market leadership. Conversely, the observed decline in productivity among foreign firms after a decade can be attributed to the limited representativeness of data owing to the reduced number of firms in this category.

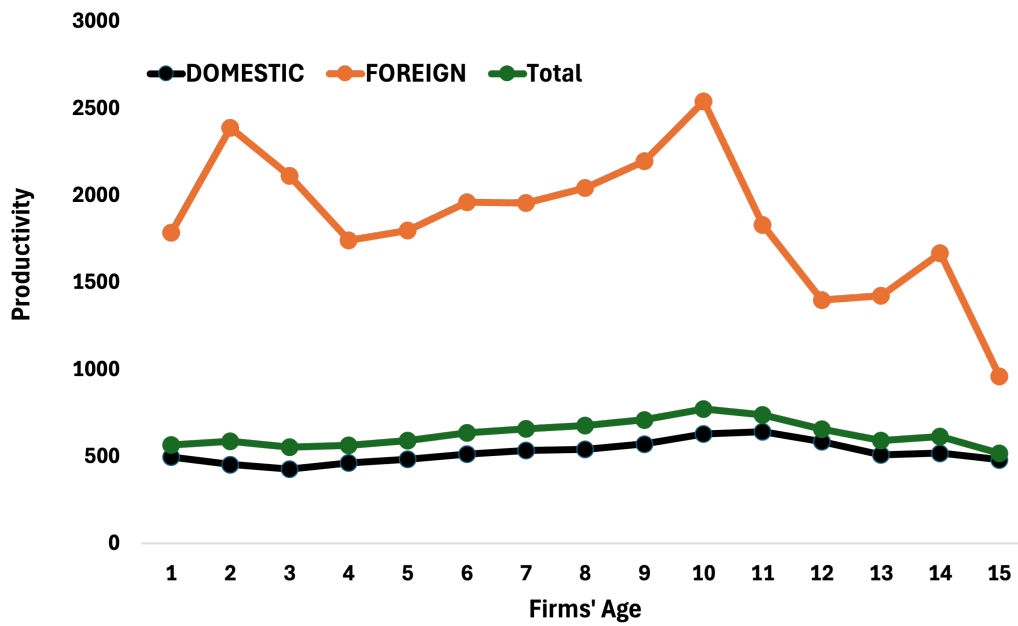


Figure 4.4: Productivity and Firm Age

Fact 4 *The higher the productivity of a firm, the higher its markup.*

Markup levels and productivity are fundamentally interconnected, with an observed increase in markups corresponding directly to rising productivity levels. This conclusion is derived from the preceding observations, where both markups and productivity tend to rise with age. Firms exhibiting high productivity are capable of producing goods at reduced production costs, thereby augmenting the margin between sales price and production cost, all while sustaining competitive viability. This heightened efficiency empowers firms to engage in competitive pricing strategies and enhances their market influence. Generally, foreign firms maintain higher markups compared to domestic firms across various productivity levels, as illustrated in Figure 4.5. While foreign firms possess substantial market power, their current stagnant market share, comprising merely 7% of total firms, indicates that these two categories of firms may be targeting divergent product markets or experiencing barriers to entry within the domestic market.

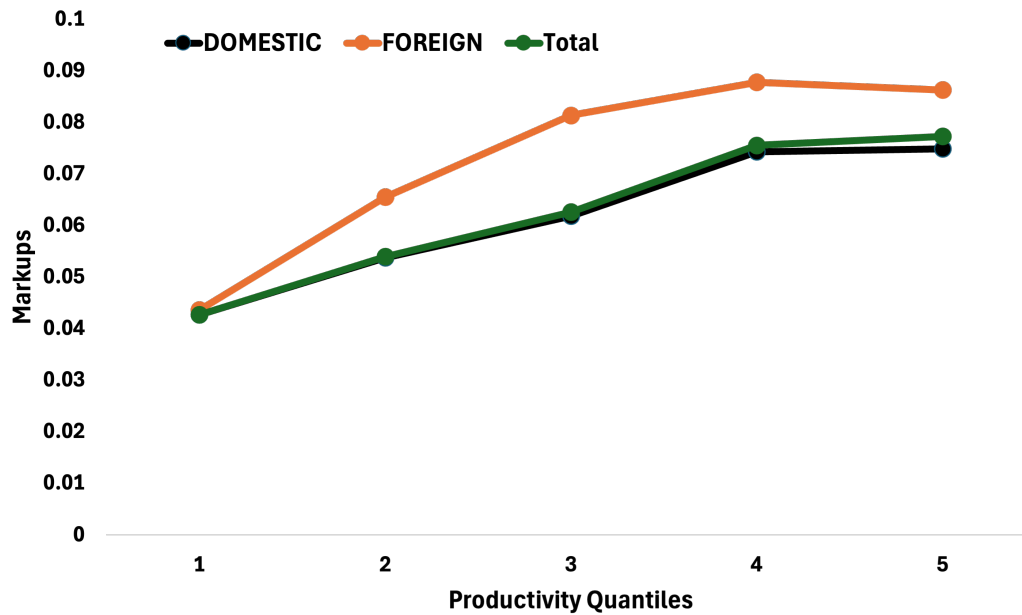


Figure 4.5: Markups and Productivity

Fact 5 *Net employment growth is reduced as firms get older.*

Net employment growth exhibits a gradual decline as firms mature. Newly established firms are capable of rapidly increasing net employment as they endeavour to solidify their presence in the market and expand their operations. In contrast, established firms typically maintain a standardised production process and experience more stable growth rates. The reduction in net employment growth can be attributed to a corresponding decline in job creation, whereas job destruction remains relatively constant across firms of varying ages, as illustrated in Figure 4.6. Firms that have been operational for one year demonstrate an average net employment growth of nearly 20%, with the top 10% achieving growth exceeding 45%. Conversely, firms that have been in operation for 14 years experience an average net employment growth that diminishes to only 1%, with the top 10% of firms exhibiting growth of approximately 14%.

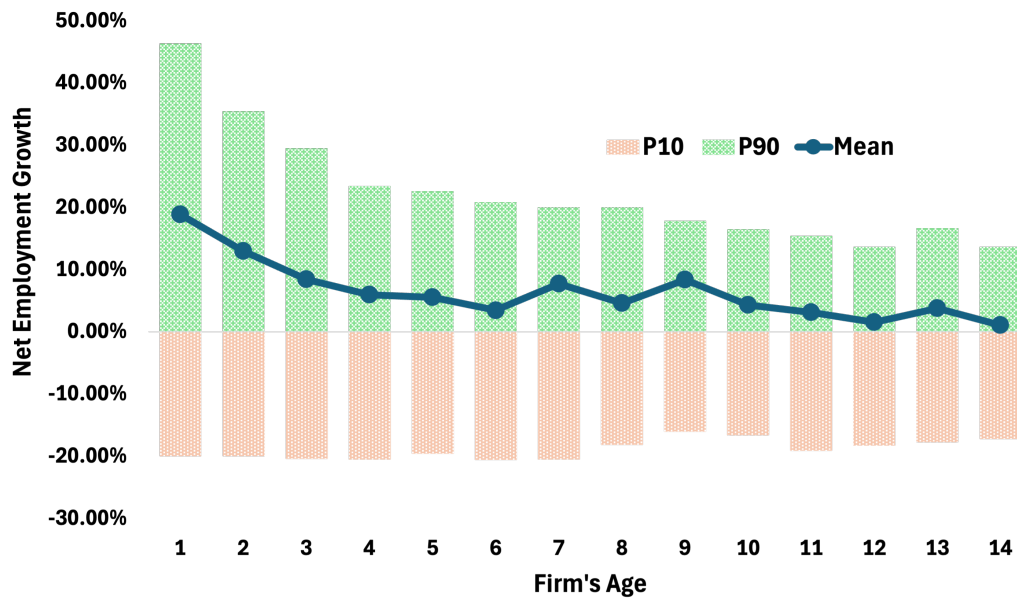


Figure 4.6: Net Employment Growth for Surviving Firms

Fact 6 *Markup is inversely proportional to net employment growth, mainly in firms at the distribution end.*

Net employment growth exhibits an inverse relationship with markups, particularly noticeable at the upper end of the distribution. Firms characterised by elevated markups typically experience diminished net employment growth, as illustrated in Figure 4.7. This finding corroborates the implications derived from the preceding two observations concerning the relationship between firms' age, net employment growth, and markups. Firms with substantial markups demonstrate heightened efficiency, which subsequently influences their labour requirements in production processes. Furthermore, foreign firms consistently outpace domestic firms in markups across all net employment growth groups, thereby affirming earlier findings regarding the preeminence of foreign firms in terms of markups and productivity.

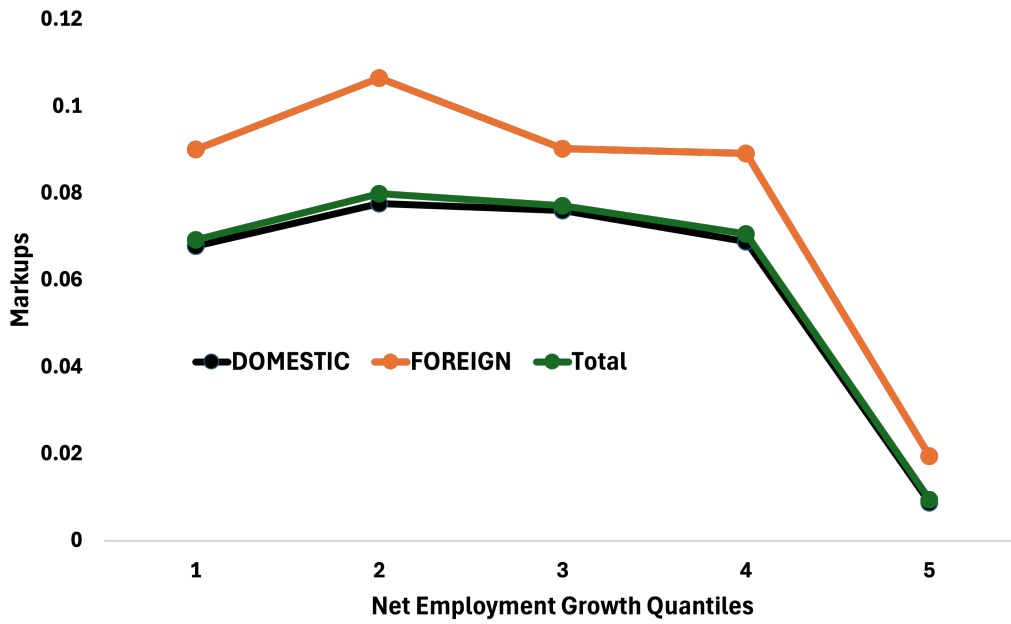


Figure 4.7: Markups and Net Employment Growth

4.2.3 Potential mechanism

The distribution of markups for foreign firms is characterised by a higher level, greater dispersion, and a more pronounced tail distribution compared to their domestic counterparts, as referenced in Fact 1. Various determinants can influence the formation of markups, which may be affected by the capabilities of the company or by external conditions. Firms with a longer production history typically report higher markups than those with a shorter operational tenure. This observation implies that older firms, due to their enhanced capabilities, may exhibit distinct pricing behaviours or cost structures relative to younger firms, as noted in Fact 2.

The advancing age of firms is directly proportional to their accumulated knowledge and their capacity to produce more efficiently within the markets in which they have operated over many years. It is imperative for firms to innovate in order to maintain competitiveness in the market over an extended duration, thereby rendering older firms more productive than their newer counterparts, as evidenced in Fact 3. As firms accumulate knowledge, they can optimise production through improved resource allocation and market strategies, allowing them to reduce their unit costs. High-productivity firms are positioned to establish a more significant markup due to their ability to generate a substantial disparity between marginal costs and selling prices without compromising competitiveness, as indicated in Fact 4. This scenario underscores the critical importance of proprietary innovation as a fundamental avenue for establishing markup distribution.

Foreign firms exhibit a more pronounced evolution of markups compared to domestic firms, particularly during the initial nine years of production. This phenomenon suggests a

more rapid accumulation of knowledge within foreign enterprises, resulting in a significant markup disparity when contrasted with new domestic firms. Additionally, it is pertinent to note that foreign enterprises attract a substantial proportion of foreign direct investment toward their capital formation. The technology transfer associated with such investments facilitates a quicker accumulation of knowledge and the establishment of higher markups. Furthermore, foreign enterprises typically benefit from economies of scale, as they cater to a wider global market and are more deeply integrated into the global value chain, affording them enhanced access to suppliers and markets. These factors constitute intrinsic distinctions that set foreign enterprises apart from domestic firms, which generally focus exclusively on the domestic market and lack integration with the global value chain.

The dynamics of employment present an intriguing subject for observation, particularly concerning corporate behaviour. Newly established firms typically experience significant net employment growth during their initial phase of production, although this growth tends to diminish with time, as noted in Fact 5. Mature firms are capable of executing the production process with greater efficiency, thereby enabling them to augment production with only a marginal increase in labour, as highlighted in the previous observation. Furthermore, firms that demonstrate high productivity are likely to exhibit the lowest net employment growth, as referenced in Fact 6.

The competitive landscape within the product market significantly influences the distribution of markups. An increase in market competition can prevent the productivity disparities among firms from widening, thereby sustaining the markup levels. The presence of competition motivates market leaders to persist in their innovation efforts to protect their markup, while other companies strive to innovate in their pursuit of market leadership, ultimately contributing to an enhancement in aggregate productivity. Enhanced competition may arise from the phenomenon of creative destruction, which can occur through the entry of new firms into the product market or through the expansion of existing firms into alternative product markets, fostering entry and exit dynamics. Through creative destruction, less productive enterprises are supplanted by more productive ones, resulting in a more efficient allocation of resources. This process of creative destruction is propelled by a firm's strategic decision to enter the market, taking into account existing frictions and potential costs associated with market entry.

As a developing country, Indonesia encounters various challenges that adversely affect business operations. Despite the ongoing improvements in its ease of doing business ranking, several critical indicators remain insufficiently ranked. The substantial costs associated with disputes, the duration required for their resolution, and apprehensions regarding the quality of the judicial process contribute to the obstacles faced by businesses seeking to invest or expand. Indonesia is positioned at 139 out of 190 countries in terms of contract enforcement, as derived from the aforementioned indicators in the

2020 Ease of Doing Business report. Additional challenges are evident in the number of procedures investors must navigate to establish a business, along with the considerable time required to acquire final licensing documents. In relation to this indicator, Indonesia holds the 140th position concerning the initiation of new businesses, as illustrated in Figure 4.8.

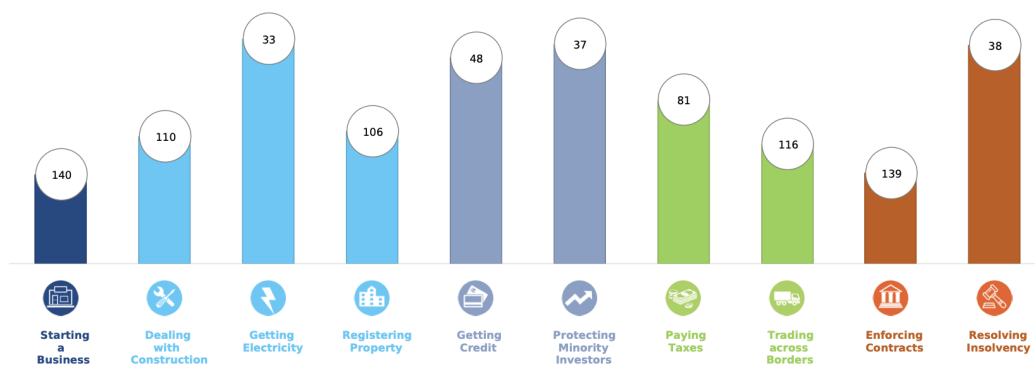


Figure 4.8: Indonesian Rank of Ease of Doing Business Components

Source: Ease of Doing Business 2020, World Bank.

Restrictions on foreign direct investment remain considerable, as evidenced by the Foreign Direct Investment (FDI) restriction index compiled by the Organisation for Economic Cooperation and Development (OECD) for Indonesia. Despite a noticeable decline in the obstacles to FDI entry since the year 2000, the level of restriction persists at a relatively high rate, as illustrated in Figure 4.9. With an index score of 0.347 in 2020, Indonesia experiences greater restrictions compared to its peer countries, including Vietnam at 0.13, Thailand at 0.268, Malaysia at 0.257, India at 0.207, and China at 0.214. Such high levels of friction impede FDI inflows, consequently limiting access to technology and innovation through technology transfer, thereby negatively affecting productivity. Employment opportunities are also impacted, both directly and indirectly, as the establishment of new industries and their supporting sectors is obstructed by insufficient inward investment. The frictions present will ultimately influence the allocation of markups, the misallocation of resources, productivity levels, and employment outcomes.

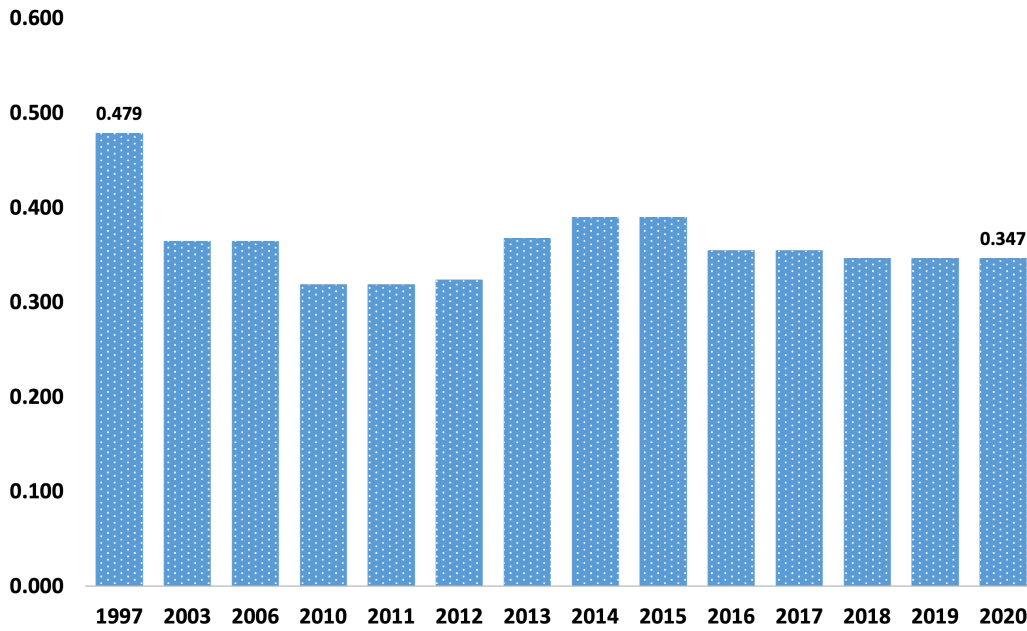


Figure 4.9: FDI Restrictiveness Index

Source: Organisation for Economic Co-operation and Development (OECD). Measure: 0 is open and 1 is closed.

4.3 Theoretical framework

This section discusses the theoretical model used to explain the evolution of markups and their consequences on misallocation, employment, and aggregate growth. We utilise the model from [Peters \(2020\)](#), which we found can explain the behaviour at the firm level as described in the preceding section. The theory is based on the firm-based model of Schumpeterian growth, where creative destruction plays an important role in economic growth. The model also features imperfect product markets, where firms compete Bertrand-style with non-competitive pricing and endogenous markups. Both domestic and foreign firms operate under the same framework, and we will do a comparative analysis to evaluate the calibration parameters and outcomes for each type of firm to comprehend the primary channels through which the firms differ in forming the markup.

Subsequently, we assess the aggregate implications of these firms by calculating the convolution of two markup Pareto distributions, pertaining to both domestic and foreign firms, to derive the new aggregate distribution. This methodology permits us to ascertain the tail parameter of the new aggregate Pareto distribution, thereby enabling us to quantify the average markup, the dispersion of markup, the aggregate misallocations, and the labour share of income. It is important to note that this approach does not consider the constraints of the labour market; however, it still provides valuable insights into the aggregate consequences at varying levels of market integration in a straightforward

manner.

4.3.1 Preferences

There are infinitely homogeneous households and they supply the labour inelastically. They consume final goods c_t with preferences

$$U = \int_{t=0}^{\infty} e^{-\rho t} \ln(c_t) dt. \quad (4.15)$$

At any t , the total quantity of final goods in the economy is a Cobb-Douglas aggregation of an infinite set of differentiated products $i \in [0, 1]$

$$\ln Y_t = \int_0^1 \ln \left(\sum_{f \in S_{it}} y_{fit} \right) di, \quad (4.16)$$

where y_{fit} denotes the quantity of product i purchased from firm f at time t , and S_{it} represents the group of firms competing in a product market i at time t . Firms in a specific market for product i are perfect substitutes, as illustrated by a linear combination in totalling the quantity. In contrast, different products i and i' are imperfect substitutes.

4.3.2 Production

Firms can produce multiple products, but each firm has a product-specific level of productivity, q_{fi} . A firm uses l_{fi} unit of labour to make a good i

$$y_{fi} = q_{fi} l_{fi}. \quad (4.17)$$

Firms engage in Bertrand competition with other firms selling identical product i . Both the group of competing firms, S_{it} , and firms' productivities, q_{fit} , evolve endogenously through various channels: (i) current producers enhance productivity within their existing markets, (ii) established firms venture into new markets, and (iii) new firms enter the economy.

4.3.3 Static allocations

First, let's examine static allocations where the number of firms and productivity distribution are fixed. In this scenario, firms compete on price, and different brands of the same product i serve as perfect substitutes. Consequently, only the most productive firm

within a product market i will remain active at equilibrium. However, the existence of less efficient competing producers limits the leading firms' ability to impose a substantial markup, leading them to resort to limit pricing. Let q_i represent the productivity of the most efficient firm, while q_i^F denotes the productivity of the second-most efficient firm, known as the follower. The marginal costs for the most efficient firm and the follower are w/q_i and w/q_i^F , respectively. The equilibrium markup for product i is established by the most efficient firm

$$\mu_i = \frac{p_i}{w/q_i} = \frac{w/q_i^F}{w/q_i} = \frac{q_i}{q_i^F}, \quad (4.18)$$

where p_i indicates the limit price in market i , equating to the marginal cost of the follower, and w represents the equilibrium wage. Consequently, the equilibrium markup reflects the productivity advantage over rival firms. Given that various brands of the same product i are perfect substitutes, then the total quantity of good i is determined by the output of the most efficient firm, y_i . Therefore, the total income for market i is represented as $Y = p_i y_i$. This allows us to derive employment and profit at the product level, respectively

$$l_i = \frac{y_i}{q_i} = \frac{1}{q_i} \frac{Y}{p_i} = \frac{1}{q_i} \frac{Y}{w/q_i^F} = \frac{Y}{w\mu_i} = \frac{1}{\mu_i} \frac{Y}{w}, \quad (4.19)$$

$$\pi_i = p_i y_i - w l_i = Y - w \frac{1}{\mu_i} \frac{Y}{w} = \left(1 - \frac{1}{\mu_i}\right) Y. \quad (4.20)$$

Both employment and profit are depend only on the markup μ_i , not on the level of productivity of the most efficient firm, q_i .

Firm-level allocation

Next, we aim to assess the range of products produced by a specific firm, denoted as N_f , with n_f representing the count of these products, indicated by $|N_f|$. This allows us to determine the total employment associated with firm f

$$l_f = \sum_{i \in N_f} l_i = \sum_{i \in N_f} \frac{1}{\mu_i} \frac{Y}{w} = \frac{Y}{w} n_f \frac{1}{n_f} \sum_{i \in N_f} \frac{1}{\mu_i} = \frac{Y}{w} n_f \mu_f^{-1}, \text{ where } \mu_f = \left(\frac{1}{n_f} \sum_{i \in N_f} \frac{1}{\mu_i} \right)^{-1}. \quad (4.21)$$

Here, μ_f represents the firm's markup, calculated as the harmonic mean of the product-level markups for firm f . The equation shows that a firm's size is influenced by two factors: (i) its product variety, n_f , and (ii) its markups, μ_f , holding the number of products fixed.

Aggregate allocation and misallocation

The total mass of production workers can be measured as

$$L_{pt} = \int_f l_{ft} df = \frac{Y_t}{w_t} \int_f \sum_{i \in N_f} \mu_{it}^{-1} df = \frac{Y_t}{w_t} \int \mu^{-1} dG_t(\mu), \quad (4.22)$$

where $G_t(\mu)$ denotes the cross-sectional distribution of markups at time t . This allows us to assess equilibrium wages

$$w_t = \frac{Y_t}{L_{Pt}} \exp \left(\int \ln(\mu^{-1}) dG_t(u) \right) = Q_t \exp \left(\int \ln(\mu^{-1}) dG_t(u) \right), \quad (4.23)$$

where $\ln(Q_t) = \int \ln(q) dH_t(q)$ and $H_t(q)$ is the distribution of productivity q . The aggregate output is given by

$$Y_t = w_t L_{Pt} \frac{1}{\int \mu^{-1} dG_t(\mu)} = Q_t L_{Pt} \frac{\exp \left(\int \ln(\mu^{-1}) dG_t(u) \right)}{\int \mu^{-1} dG_t(\mu)} = Q_t M_t L_{Pt}, \quad (4.24)$$

$$\text{where } M_t = \frac{\exp \left(\int \ln(\mu^{-1}) dG_t(\mu) \right)}{\int \mu^{-1} dG_t(\mu)}. \quad (4.25)$$

The term $Q_t M_t$ represents the total TFP, calculated as the product of the aggregate efficiency index, Q_t , and the degree of misallocation, M_t , caused by market power. It is true that $M_t \leq 1$, achieving equality ($M_t = 1$) only when markups are equalised. Consequently, aggregate TFP is influenced by the variability of markups. A uniform increase in markups does not alter the degree of misallocation, while greater dispersion in markups diminishes aggregate TFP. This mechanism bears a similarity to that presented in [Hsieh and Klenow \(2009\)](#) regarding the measurement of misallocation stemming from the variability in productivity revenue.

Increased markups or elevated monopoly power result in higher profits for firms but lower wages for workers, thereby reducing the labour share of total income. This can be summarised as follows:

$$\Lambda_t = \frac{w_t L_{Pt}}{Y_t} = \frac{Q_t \exp \left(\int \ln(\mu^{-1}) dG_t(u) \right) L_{Pt}}{Q_t L_{Pt} \frac{\exp \left(\int \ln(\mu^{-1}) dG_t(u) \right)}{\int \mu^{-1} dG_t(\mu)}} = \int \mu^{-1} dG_t(\mu). \quad (4.26)$$

The labour share Λ_t is influenced by the level of markups, while M_t is affected by the dispersion of these markups, indicating a singular reliance on markup distribution. Subsequently, we will develop the marginal distribution of markup, $G_t(\mu)$, as an

endogenous result of the firm's decisions, enabling us to assess misallocation, productivity, and the labour share of income.

4.3.4 Dynamics: innovation and creative destruction

A firm operating in the current product market i must make decisions regarding (i) investments for its own innovation, I_{it} , and (ii) expansion into another product market, x_{it} . A new firm could pose a threat to established firms if it enters the market. The overall rate of creative destruction, τ_t , is the sum of the flow rate of new entrant firms, z_t , and the total expansion rates among all existing firms, x_t .

We will elaborate on how the product-specific efficiency evolves. There is a quality-ladder on which a firm's efficiency at producing a product i is ordered. Let r denote a rung on the ladder, while λ signifies the magnitude of proportional efficiency improvement, where $\lambda > 1$ and deterministic. Firm efficiencies are arranged as follows

$$q_{r+1} = \lambda q_r. \quad (4.27)$$

Using the above assumption, we can show the relationship between markups in equilibrium and the efficiency gap between the leading and a follower firm

$$\mu_{it} = \frac{q_{it}}{q_{it}^F} = \frac{\lambda^{r_{it}} q_{i0}}{\lambda^{r_{it}^F} q_{i0}} = \frac{\lambda^{r_{it}}}{\lambda^{r_{it}^F}} = \lambda^{r_{it} - r_{it}^F} = \lambda^{\Delta_{it}}, \quad (4.28)$$

where r_{it} and r_{it}^F refer to the respective rungs on the quality ladder for leading and follower firms, indicating their position relative to the base level of productivity, q_{i0} , in product market i . This means that $\Delta_{it} = r_{it} - r_{it}^F \geq 1$ signifies the productivity advantage that leading firms have in product market i . Therefore, there is a direct relationship between the productivity gap and the equilibrium markup.

Productivity, represented as q_{it} , can improve through three channels: (i) own-innovation, where the current firm producing good i seeks to enhance its monopoly power, (ii) creative destruction by incumbents, where an established firm that initially produces a different good i' decides to venture into product market i , and (iii) creative destruction by new entrants, represented by a new firm entering product market i . Each of these channels boosts current productivity, transitioning from q_{it} to λq_{it} , but they have different implications for markup. The own-innovation channel drives up the markup, as the productivity gap increases from Δ to $\Delta + 1$, resulting in a markup increase by a factor of $\lambda^{\Delta+1}/\lambda^\Delta = \lambda > 1$. In contrast, both creative destruction channels lead to a reduction in markup, as the productivity gap narrows from Δ to 1, causing the markup to decrease by a factor of $\lambda^\Delta/\lambda^1 = \lambda^{\Delta-1}$.

Next, we need to evaluate the rates of own-innovation, creative destruction by incumbents, and entry creative destruction through the resolution of firms' value functions. The state variables for firms include the quality of all their products, $\{q_{it}\}_{i=1}^n$, and the quality gaps of each product, $\{\Delta_{it}\}_{i=1}^n$. Consequently, profits can be defined as

$$\pi_{it} = (1 - \mu_{it}^{-1}) Y = (1 - \lambda^{-\Delta_{it}}) Y_t. \quad (4.29)$$

Profit relies entirely on the productivity gap, Δ_{it} . Therefore, in equilibrium, we can simplify the firms' state variables to n and Δ_{it} , representing the number of products and the productivity gap, respectively. The firms will determine the optimal innovation rate for their existing product, I_i , alongside the expansion rate into new products, x_i , as described by the following value function:

$$\begin{aligned} r_t V_t(n, [\Delta_i]) = & \sum_{j=1}^n \pi_t(\Delta_j) + \dot{V}_t(n, [\Delta_i]) - \sum_{j=1}^n \tau_t \left[V_t(n, [\Delta_i]) - V_t(n-1, [\Delta_i]_{i \neq j}) \right] \\ & + \max_{[x_j, I_j]} \left\{ \sum_{j=1}^n I_j \left[V_t\left(n, [\Delta_i]_{i \neq j}, \Delta_j + 1\right) - V_t(n, [\Delta_i]) \right] \right. \\ & + \sum_{j=1}^n x_j \left[V_t(n+1, [[\Delta_i], 1]) - V_t(n, [\Delta_i]) \right] \\ & \left. - \Gamma([x_i, I_i]; n, [\Delta_i]) w_t \right\} \end{aligned} \quad (4.30)$$

The firm assesses its value through four components. First, it evaluates the total profit flow across all markets. Second, it considers the capital gain resulting from increases in its value function over time. Third, it accounts for losses in several markets due to the endogenous rate of creative destruction, denoted as, τ . Fourth, it examines the value of each option related to self-innovation or expansion into new markets. To ensure a unique solution, we then define the following cost function

$$\Gamma([x_i, I_i]; n, [\Delta_i]) = \sum_{i=1}^n c(I_i, x_i; \Delta_i), \quad (4.31)$$

$$\text{where } c(I, x; \Delta) = \lambda^{-\Delta} \frac{1}{\phi_I} I^\zeta + \frac{1}{\phi_x} x^\zeta, \quad (4.32)$$

where ζ greater than 1 ensures a convex shape for the cost function, while ϕ_I and ϕ_x represent innovation and expansion efficiency, respectively. Potential entrants can access the market with a unitary quality gap, and the free entry condition is as follows

$$V_t(1, 1) \leq \frac{1}{\phi_z} w_t = 0 \text{ with equality if } z > 0, \quad (4.33)$$

where z represents the equilibrium flow rate of entry. This paper concentrates on the scenario where the entry rate is positive, meaning the free entry condition is satisfied with equality. Consequently, the total rate of creative destruction is expressed as

$$\tau_t = z_t + \int_{i=0}^1 x_{it} di. \quad (4.34)$$

4.3.5 The stationary equilibrium

We now describe the stationary equilibrium of the economy, also known as the balanced-growth path. For the labour market to clear, the production labour, L_{Pt} , and research labour, L_{Rt} , must sum to the total labour endowment of one unit, as follows

$$1 = L_{Pt} + L_{Rt} = L_{Pt} + \frac{1}{\phi_z} z_t + \int_{i=0}^1 \left(\frac{1}{\phi_x} x_{it}^\zeta + \lambda^{-\Delta_i} \frac{1}{\phi_I} I_{it}^\zeta \right) di. \quad (4.35)$$

A stationary equilibrium is a set of allocations $[l_{it}, I_{it}, x_{it}, z_t, y_{it}, c_t]_{it}$ and prices $[w_t, r_t, p_{it}]_{it}$ such that (i) all aggregate variables grow at a constant rate, (ii) consumers choose $[y_{it}, c_t]_{it}$ to maximise utility, (iii) firms choose $[I_{it}, x_{it}, p_{it}]$ optimally, (iv) the free-entry condition is satisfied, (v) all markets clear, and (vi) the cross-sectional distributions of markups and firm size are stationary. The stationary equilibrium can be characterised analytically. The stationary equilibrium solutions can be solved analytically for I , τ , x and z , respectively, where we defined the churning intensity variable as the ratio between the creative destruction and own-innovation, $\vartheta = \frac{\tau}{I}$.

$$1 = \Lambda \left(\frac{\lambda}{\lambda - 1} \frac{\zeta}{\phi_I} I^{\zeta-1} (\rho + \vartheta) + \zeta \frac{1}{\phi_I} I^\zeta \right) + \frac{1}{\phi_z} \vartheta I - \left(\frac{\zeta - 1}{\zeta} \right) \left(\frac{\phi_x}{\zeta \phi_z^\zeta} \right)^{\frac{1}{\zeta-1}}, \quad (4.36)$$

$$\frac{1}{\phi_z} = \frac{\zeta}{\phi_I} I^{\zeta-1} + \frac{\zeta - 1}{\phi_I} \frac{I^\zeta}{\rho + \vartheta I} + \frac{1}{\rho + \vartheta I} \left(\frac{\zeta - 1}{\zeta} \right) \left(\frac{\phi_x}{\zeta \phi_z^\zeta} \right)^{\frac{1}{\zeta-1}}, \quad (4.37)$$

$$x = \left(\frac{\phi_x}{\phi_z} \frac{1}{\zeta} \right)^{\frac{1}{\zeta-1}}, \quad (4.38)$$

$$z = \tau - x. \quad (4.39)$$

4.3.6 The cross-sectional distributions of markups

Markups are determined solely by the distribution of quality gaps Δ among products. Consequently, the cross-sectional distribution of markups is entirely defined by $\{v_t(\Delta)\}_{\Delta=1}^{\infty}$, where $v_t(\Delta)$ represents the measure of products with quality gaps Δ at time t . These measures address a series of differential equations

$$\dot{v}_t(\Delta) = \begin{cases} -(\tau + I)v_t(\Delta) + Iv_t(\Delta - 1) & \text{if } \Delta \geq 2 \\ \tau(1 - v_t(1)) - Iv_t(1) & \text{if } \Delta = 1, \end{cases} \quad (4.40)$$

where $\dot{v}_t(\Delta)$ indicates the time derivative. Product i can transition out of state Δ in two ways: either the leading firm innovates, creating a shift to $\Delta + 1$, or a new producer enters the market for product i , causing the gap to shrink to 1. For a product to move to state Δ , it must first be in state $\Delta - 1$ and then witness an increase in productivity from the current frontier at rate I . The state $\Delta = 1$ is unique because, at this point, all products see the replacement of the leading firm by new entrants.

The distribution can be analytically resolved and is completely determined by the two endogenous variables (I, τ) . Let us define

$$\theta = \frac{\ln(1 + \vartheta)}{\ln \lambda}, \text{ where } \vartheta = \frac{\tau}{I}. \quad (4.41)$$

1. The stationary of distribution of markups is given by $G(\mu) = 1 - \mu^{-\theta}$
2. The aggregate misallocation measures are given by

$$M = e^{-1/\theta} \frac{1 + \theta}{\theta} \text{ and } \Lambda = \frac{\theta}{1 + \theta}. \quad (4.42)$$

The distribution of markups reaches equilibrium in a Pareto form, with its shape parameter θ being endogenous and determined by a single statistic: churning intensity ϑ . This statistic indicates how quickly firms are supplanted by new entrants compared to their own innovation efforts. When churning is high, the shape parameter increases, leading to a decrease in both markup heterogeneity and the average markup. Conversely, when churning is minimal, the markup distribution has a fat tail, resulting in a larger average markup and greater dispersion.

The distribution of the number of quality gaps Δ , conditional on the length of time a product has been produced by a particular firm, a_p , follows a Poisson distribution with parameter Ia_p . Therefore, the expected log markup for a product, assuming it has been produced by the same firm for a duration a_p years, can be expressed as

$$E[\ln \mu \mid \text{product age} = a_p] = \ln \lambda (1 + Ia_p). \quad (4.43)$$

It is increasing in age at a rate proportional to I . If not replaced, the markup distribution gradually expands as existing firms enhance productivity to strengthen their monopoly power. As I increases, this accumulation process speeds up.

Products are not produced by the same firm indefinitely. Creative destruction restricts the lifespan of existing firms. As producers in a specific market are replaced at a rate of τ , the likelihood of a product being produced for at least a_p years is expressed as $e^{-\tau a_p}$. The ability of firms to build market power is influenced by the level of creative destruction τ . A high τ indicates that it is uncommon for firms to operate in a particular product market for extended periods.

4.3.7 Markup dynamics for firm-level

Firms maintain a range of products, which allows for a smoother evolution of firm-level markup compared to product-level markup. Established firms typically enjoy higher markups due to their accumulated knowledge and track record of successful innovations. Furthermore, these firms have adequate time to penetrate new markets or relinquish market share to competitors. According to Peters (2020), the average firm-level markup relative to age is expressed as follows

$$E[\ln \mu \mid \text{firm age} = a_f] = \ln \lambda (1 + I \times E[a_p \mid a_f]), \quad (4.44)$$

where

$$E[a_p \mid a_f] = \frac{1}{x} \left(\frac{\frac{1}{\tau} (1 - e^{-\tau a_f})}{\frac{1}{x+\tau} (1 - e^{-(x+\tau)a_f})} - 1 \right) (1 - \phi(a_f) + a_f \phi(a_f)), \quad (4.45)$$

and

$$\phi(a) = e^{-xa} \frac{1}{\gamma(a)} \ln \left(\frac{1}{1 - \gamma(a)} \right) \quad \text{and} \quad \gamma(a) = \frac{x (1 - e^{-(\tau-x)a})}{\tau - x \times e^{-(\tau-x)a}}. \quad (4.46)$$

The evolution of firm-level markup in Equation 4.44 mirrors that of Equation 4.43, but the relationship between firm age, a_f , and product age, a_p , is more intricate. This relationship is influenced by the rate of incumbent expansion, x , and the process of creative destruction, τ . When firms choose to expand into new markets, it indicates that $E[a_p \mid a_f] \leq a_f$. The equation illustrates that the average markup rises with I , while both incumbent expansion, x , and creative destruction, τ , lead to a decrease in markup. A higher rate of expansion, assuming τ remains constant, lowers the markup due to a composition effect, where a smaller portion of sales comes from older products with higher markups, and the majority comes from newer products with lower markups. Conversely, a higher rate of

creative destruction, while keeping x constant, also diminishes markup as firms spend less time building expertise in their markets due to increased turnover.

The share of surviving firms until age a_f defined as

$$S(a_f) = 1 - \frac{\tau}{x} \gamma(a_f). \quad (4.47)$$

According to the formula, a greater rate of incumbent expansion, x , enhances the number of firms that survive at each age. While this expansion rate decreases the average markup for a certain age, it concurrently increases the proportion of older firms, which generally maintain higher markups. In a cross-section view, these two effects will offset each other perfectly. Conversely, a rise in creative destruction causes these two forces to work together. It not only lowers the markup for any particular age but also shifts the distribution towards younger firms that exhibit lower markups.

4.3.8 Sales and employment dynamics

Remember that total sales at the firm level correlate with the number of products, n . Sales and employment do not correlate directly because of average markup. The distribution of markups is influenced solely by the churning intensity, $\vartheta = \tau/I$, while the distribution of sales can be completely defined by the endogenous statistic, x/τ , which represents the share of creative destruction attributed to existing firms. The total number of active firms, F , is defined as follows

$$F = \frac{1 - \frac{x}{\tau}}{\frac{x}{\tau}} \ln \left(\frac{1}{1 - \frac{x}{\tau}} \right). \quad (4.48)$$

The share of aggregate sales accounted for by firms with at most n products, Ω_n , is given by

$$\Omega_n = 1 - \left(\frac{x}{\tau} \right)^n. \quad (4.49)$$

When a significant portion of creative destruction results from incumbent expansions, it indicates a small number of active firms, a large average firm size, and that a considerable amount of output comes from these large firms. Employment relies on both sales and the average markup, leading to the described life-cycle of firm size

$$E[\ln l_f | a_f] - E[\ln l_f | 0] = (1 - \gamma(a)) \sum_{j=1}^{\infty} \ln j \times \gamma(a)^{j-1} - \ln \lambda(I \times E[a_p | a_f]). \quad (4.50)$$

In this context, the first part after the equal sign indicates sales growth, while the second part signifies markup growth. When the channel of firm innovation, I , prevails over their expansion, x , the age profile of markup becomes steeper, leading to a flatter life-cycle employment growth. The rate at which firms raise their markup in relation to their size highlights how significant product expansion is compared to productivity improvements in their current products.

4.4 Simulations

This section presents a comprehensive analysis of the various channels that delineate the evolution of markups between domestic and foreign firms. Simulations utilising diverse parameters are conducted to validate and quantify the significance of each channel. This particular simulation clarifies the most pertinent channel accounting for the evolution of markups in foreign firms, thereby distinguishing them from their domestic counterparts. Two distinct simulations are executed in this section. The first simulation is performed to analyse the case involving a single type of firm, with a calibration of the model to align with the target moments for all firms. The second analysis is conducted for two types of firms—domestic and foreign—wherein the model is recalibrated for each firm type individually. The equilibrium outcomes are subsequently compared to ascertain the channel that most significantly elucidates the differences in markup distribution between foreign and domestic firms. To assess the aggregate implications, the convolution of two Pareto distributions with a correlation coefficient of 67% is calculated to produce a new aggregate Pareto distribution. The baseline employs a correlation derived from the markup correlation across various industrial classifications from 1990 to 2005, examining the relationships between foreign and domestic firms. Furthermore, a complete correlation for counterfactual scenarios is utilised to elucidate market integration, wherein foreign firms exhibit increased interaction with domestic firms within the same market.

For all analyses, we utilise consistent values for two structural parameters. The discount rate, denoted as ρ , is established at 0.05, while the curvature of the cost function, represented by ζ , is set to 2, following [Peters \(2020\)](#). The remaining parameters ($\lambda, \phi_I, \phi_x, \phi_z$) are calibrated to align with the targeted moments. There are four target moments to consider: the markup life-cycle, the employment life-cycle, the entry rate, and aggregate growth. The model yields various equilibrium endogenous outcomes, including the rate of own-innovation on existing products, I , the rate of expansion by incumbents, x , the rate of entry for new firms, z , and the rate of creative destruction, τ .

4.4.1 One type of firm

We calibrate the model to align with the target moments, as detailed in Table 4.2 below. The markup and employment life-cycle moments are based on a seven-year horizon; however, the model possesses the ability to generate a full-duration life-cycle that corresponds with the available data. The aggregate productivity growth parameter has been derived from the smoothed, steady annual growth rate observed over the designated period. Own-innovation currently contributes 38% to the overall growth, whereas creative destruction accounts for 62% of the growth. Specifically, creative destruction driven by incumbents expanding their enterprises contributes nearly 48% to the total growth, while creative destruction associated with new firms entering the marketplace constitutes 14%. A significant innovation step is pivotal in propelling the aggregate productivity growth.

Table 4.2: Moments, Parameters, and Outcomes of the Baseline

Moments		Structural Parameters			Outcomes	
Markup life-cycle	0.1097	ϕ_I	Innovation efficiency	0.2750	I	0.1138
Empl. life-cycle	0.3139	ϕ_x	Expansion efficiency	0.1909	x	0.1408
Entry rate	9.60%	ϕ_z	Entry efficiency	0.6780	z	0.0422
Agg. growth	0.0605	λ	Step size	1.2261	τ	0.1830
		ζ	Cost function	2		
		ρ	Discount rate	0.05		

The model demonstrates a significant capacity to accurately replicate the trends of markup and employment, as illustrated in Figure 4.10. Calibration of the model was conducted utilising the markup and employment moments derived from a singular point within the 7-year time horizon. Surprisingly, it was able to generate dynamics that closely align with the observed data. However, the concluding period of model estimation for markup appears to be underestimated, likely due to the limited number of firms with production exceeding 12 years; consequently, the estimation of markup was predominantly influenced by the actions of a select few firms. A similar observation can be noted in the estimation of employment.

The average markup is documented at a higher rate than the earlier period, standing at 27%. Furthermore, the dispersion across products and firms has also increased, with values of 0.2126 and 0.1627, respectively. This misallocation carries significant implications, reducing TFP by 1.96% and diminishing the labour share of income by 17.53%, as illustrated in Table 4.3. A reduced rate of own-innovation by incumbents, coupled with a greater number of new entrants, does not substantially decrease the markup. Rather, it has increased, attributable to the lesser expansion efforts by incumbents and an elevated innovation step size. Firms can still enhance their markup despite a diminished rate

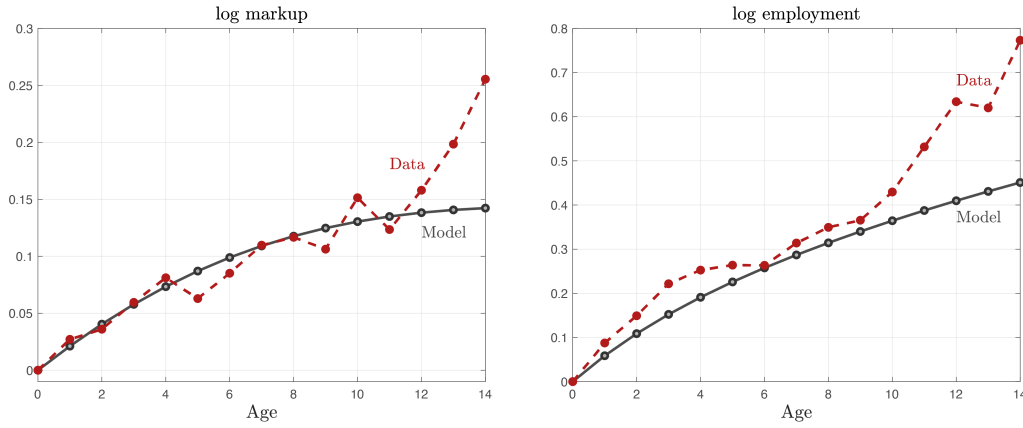


Figure 4.10: The Evolution of Markup and Employment: Model versus Data

of innovation, as higher steps of innovation enable them to achieve greater productivity levels with the same efforts. Additionally, firms' hesitance to expand their operations also contributes to the rising markup. The increased dispersion of markup leads to greater misallocations, consequently resulting in reduced TFP and a lower labour share of income.

Table 4.3: Markups and Misallocation

$E[\mu]$	$\sigma(\ln \mu)$	$\sigma(\ln \mu_f)$	M	Λ
27.00%	0.2126	0.1627	0.9804	0.8247

We then increase the value of each structural parameter by 5% to assess the implications on moments and outcomes, as illustrated in Table 4.4. Enhanced efficiency in own-innovation (ϕ_I) positively influences the rate of own-innovation, enabling firms to broaden the innovation gap with competitors and subsequently augment markups, albeit accompanied by a reduction in employment levels. The rise in the entry rate of new firms into the market is propelled by the considerable opportunities available for firms to innovate and achieve elevated markups, while creative destruction, coupled with the growth rate, experiences an uptick. Improved efficiency in expansion for incumbent firms (ϕ_x) positively correlates with the expansion rate and exerts adverse effects on markups. The decision of firms to expand and to enter new product markets compels them to lower their markups. While business expansion is associated with increased employment, it simultaneously restricts the influx of new firms into the market due to heightened competition. Advancements in efficiency regarding the entry rate (ϕ_z) stimulate new firms to enter the market and dissuade incumbents from expanding. The hesitation of incumbents to broaden their businesses—a phenomenon that diminishes markups—exceeds the reduction in the rate of own-innovation, resulting in an overall increase in markups. Furthermore, an increase in innovation steps (λ) promotes own-innovation, stimulates the entry of new firms into the market, enhances markups, and fosters growth.

Table 4.4: Impacts of Parameter Changes

	Change in			
	ϕ_I	ϕ_x	ϕ_z	λ
<i>Effects on Endogenous Outcomes</i>				
Rate of own-innovation (I)	4.39%	-1.23%	-1.67%	1.32%
Rate of expansion for incumbent (x)	0.00%	4.97%	-4.76%	0.00%
Rate of entry for new firms (z)	2.61%	-9.95%	23.70%	14.22%
Creative destruction (τ)	0.60%	1.58%	1.80%	3.22%
<i>Effects on Equilibrium Moments</i>				
Markups life-cycle	4.28%	-2.83%	-0.55%	5.29%
Employment life-cycle	-1.98%	7.74%	-8.60%	-4.27%
Entry rate	1.35%	-2.92%	9.79%	7.29%
Growth rate	1.98%	0.50%	0.50%	7.11%
<i>Effects on Markup and Misallocation</i>				
The average markup ($E[\mu]$)	3.11%	-2.19%	-2.78%	4.15%
The markup dispersion of products ($\sigma(\ln \mu)$)	2.45%	-1.74%	-2.21%	3.25%
The markup dispersion of firms ($\sigma(\ln \mu_f)$)	2.40%	-4.00%	1.72%	4.30%
Misallocation on TFP (M)	-0.09%	0.06%	0.08%	-0.12%
Labour share of income (λ)	-0.42%	0.30%	0.39%	-0.57%

4.4.2 Two types of firms

The model is calibrated independently for domestic and foreign firms, allowing for observation of the outcomes that notably differentiate between the two types of firms. As demonstrated by the data collected, foreign firms exhibit higher markup life cycles and aggregate productivity rates, as illustrated in Table 4.5. A lower entry rate for foreign firms correlates with the multilayered regulations imposed on foreign investors, whereas the employment life-cycle does not show significant differences between the two groups.

Table 4.5: Moments for Different Types of Firms

	Domestic Firms	Foreign Firms
Markup life-cycle	0.1065	0.1422
Employment life-cycle	0.3134	0.3182
Entry rate	0.0969	0.0817
Growth rate	0.0495	0.0742

The equilibrium outcomes indicate a pronounced decline in the entry rate of foreign firms in comparison to their domestic counterparts. The own-innovation channel also experiences a reduction, albeit not as substantial as the entry channel, while the incumbent expansion channel demonstrates an improvement, as illustrated in Table

4.6. The notably significant decrease in the firm's entry rate emerges as the primary channel influencing a higher and more dispersed markup, overshadowing other channels. The channels that reduce markup through diminished own-innovation and increased firm expansion are insufficient to offset the markup-increasing impacts of the lowered entry rate. The contribution of domestic firms' own innovation to aggregate growth is significant, accounting for 45.38%, while the expansion of foreign firms constitutes the primary driver of growth, amounting to 49.50%.

Table 4.6: Structural Parameters and Outcomes for Different Types of Firms

Structural Parameters				Outcomes			
		Domestic	Foreign		Domestic	Foreign	Differences
ϕ_I	Innovation efficiency	0.5006	0.2434	I	0.1521	0.1234	-18.87%
ϕ_x	Expansion efficiency	0.2429	0.1557	x	0.1398	0.1491	6.65%
ϕ_z	Entry efficiency	0.8689	0.5222	z	0.0433	0.0287	-33.72%
λ	Innovation step size	1.1592	1.2794	τ	0.1830	0.1777	-2.90%

An increased and more dispersed markup for foreign enterprises results in a greater misallocation of resources when compared to domestic firms. TFP is now 3.2% lower due to this dispersed markup, which has twice the impact observed in domestic firms, as seen in Table 4.7. A diminished entry rate lessens the likelihood of new firms entering the market to supplant the less efficient ones, thereby exacerbating the productivity gap with the market leader. The presence of less efficient firms within the market significantly elevates both productivity and markup dispersion. Additionally, the labour share for foreign firms has declined by over 20%, a decrease more pronounced than the 15.8% reduction experienced by domestic firms.

Table 4.7: Markup and Misallocation for Different Types of Firms

$E[\mu]$		$\sigma(\ln \mu)$		$\sigma(\ln \mu_f)$		M		Λ	
Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
23.00%	38.14%	0.1870	0.2761	0.1513	0.1962	0.9846	0.9682	0.8425	0.7836

In aggregate, both the average and dispersion of markup have experienced a substantial increase, which is accompanied by a decrease in TFP and the labour share of income. The average and dispersion of markup are now recorded at 29.95% and 0.2305, respectively, marking a significant rise compared to the one-type firm model, which had figures of 27% and 0.2126. This elevated markup results in a greater misallocation, evidenced by a decrease in TFP of approximately 2.28%, which is notably higher than the 1.96% recorded in the one-type firm model, as illustrated in Table 4.8. The labour share of income now stands at a lower value of 18.73%, considerably less than the 17.53%

observed in the one-type model. The introduction of two types of firms, possessing inherent differences, allows for a markup formation that aligns more closely with the findings of [Diez, Leigh and Tambunlertchai \(2018\)](#), which reported a markup range of 20%-35% for emerging Asian countries, and a range of 28%-50% for Indonesia according to the research of [De Loecker and Eeckhout \(2018\)](#). The presence of foreign firms with substantially greater productivity than their domestic counterparts, coupled with more stringent entry restrictions, contributes to the elevated markup and misallocation.

Table 4.8: Aggregate Markups and Misallocation

Two types				One type			
$E[\mu]$	$\sigma(\ln \mu)$	M	Λ	$E[\mu]$	$\sigma(\ln \mu)$	M	Λ
29.95%	0.2305	0.9772	0.8127	27.00%	0.2126	0.9804	0.8247

We subsequently conduct a counterfactual analysis that considers the relaxation of entry barriers for foreign firms and an improved degree of market integration. An anticipated increase in the influx of foreign firms into the market is expected to reduce both the average markup and its dispersion, thereby leading to a decline in TFP and labour share loss attributed to markup-driven misallocation, as illustrated by the black line in Figure 4.11. The enhancement of market competition due to foreign firms generates positive implications for the overall distribution of markups. This emphasises the significance of firm entry into the market in alleviating the adverse effects of markups, underscoring its substantial importance.

We further assume a complete correlation between foreign and domestic firms, signifying that both operate within the same market and exhibit heightened market integration. This enables us to analyse the formation of markups. The average markup and its dispersion decrease across all levels of entry efficiency, resulting in a more pronounced decline in TFP and the labour share lost due to misallocation, as depicted by the red dashed line in Figure 4.11. The significant implications of firm entry into the market become even more substantial when foreign firms are capable of servicing multiple markets rather than being concentrated in a limited number of markets. Permitting foreign firms to operate in the majority of the markets, even in the absence of the relaxation of entry barriers, will yield a comparable level of TFP and labour share lost due to misallocation when entry efficiency is at its peak.

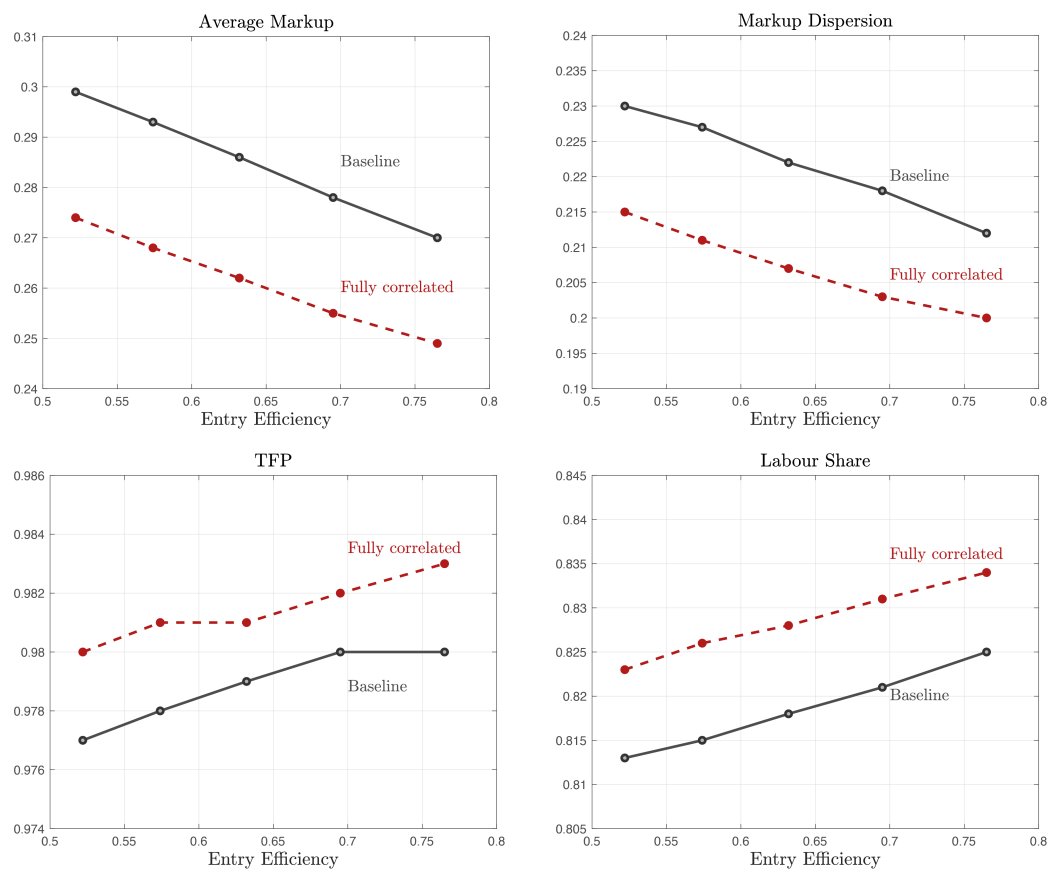


Figure 4.11: Implications of Different Entry Efficiencies

4.5 Conclusion

This paper offers a preliminary exploration of potential mechanisms influencing the formation of the markup distribution through comparative analysis, aiming to identify the most significant channels that contribute to the disparities observed between these firms. Due to their receptiveness to technology transfer opportunities via foreign direct investment, foreign firms enjoy superior access to technology and exhibit higher productivity levels. By operating on a larger scale, foreign entities are capable of diminishing unit costs and attaining economies of scale. Predominantly, foreign firms are integrated within global value chains, thereby benefiting from enhanced access to efficient, high-quality, and reliable global suppliers. In contrast, domestic firms typically experience reduced access to technology transfer, and their limited participation in global supply chains constrains their ability to engage with efficient suppliers. Furthermore, the majority of domestic firms cater exclusively to the local market; consequently, they operate at smaller economies of scale and remain unable to substantially reduce their unit costs. Nonetheless, structural, regulatory, and market-related barriers constrain the proportion of foreign firms within the economy.

We document how markup, firms' age, productivity, and size correlate with each other utilising firm-panel data. Our findings indicate that older firms generally exhibit higher markups, particularly among foreign entities, suggesting their capacity to establish a more substantial disparity between product prices and marginal costs. Moreover, firms with elevated productivity levels tend to command higher markups, predominantly seen in foreign firms that exhibit significantly greater markups, thereby reflecting their capability to produce goods at lower costs while retaining competitiveness among high-productivity operations. Additionally, net employment growth diminishes in response to rising markups, highlighting the negative repercussions of markup increases and underscoring the necessity for a thorough analysis of this phenomenon.

We then investigate the underlying mechanisms through a theoretical model that combines imperfectly competitive product market competition with Schumpeterian growth dynamics. We examine the primary mechanism through which foreign firms achieve higher markups compared to domestic firms. We utilised comparative analysis to evaluate the calibration parameters and outcomes for each type of firm. Our findings indicate that the creative destruction channel associated with new firms substantially influences the differences between foreign and domestic firms. A markedly lower equilibrium entry rate for foreign firms results in higher and more dispersed markups, with adverse implications for higher misallocation in TFP and a reduced labour share of income. Our simulations show that relaxing entry barriers for foreign firms can lower both average markups and their dispersion, thus reducing TFP misallocation and mitigating labour share losses. These effects are particularly pronounced when foreign firms operate

across multiple markets rather than being restricted to a few.

Conclusions

This thesis significantly contributes to the existing body of literature concerning misallocation in developing countries. More specifically, it expands upon the discussions surrounding informality and its aggregate consequences within the context of limited labour mobility, particularly in environments where informality is prevalent. Furthermore, this thesis enriches the discourse on firms' markups and their aggregate implications, particularly when considering the competition between two types of firms characterised by inherent differences. By employing a general equilibrium model, this thesis offers a comprehensive analysis of the effects of informality and markups on the economy. The simulations conducted in this study across various alternative scenarios provide a more nuanced understanding of these topics.

Chapter 2 investigates the dynamics of earnings and risks associated with two distinct sectors—the formal and informal sectors—and their contributions to economic inequality. This study elaborates on the trends in income growth and inequality, as well as sectoral transitions between the formal and informal sectors. Furthermore, the analysis encompasses the notable features of the earnings distributions and changes in earnings for both formal and informal workers, which contribute to the inequality observed within the context of low labour mobility. Additionally, the insurance roles of family, extended family, and social networks have also been examined.

Our research shows that the substantial gap in earnings growth between formal and informal workers significantly exacerbates inequality in Indonesia. Informal workers earn less across all categories compared to their formal peers. Additionally, the transitions between these sectors are marked by asymmetry and rigidity, further entrenching inequality. We also reveal that there are differences in the nature of the earnings shocks for formal and informal workers, which lead to the disparities we observe. While adjustments in household labour market activities can help reduce earnings fluctuations, private transfers within social networks have a more significant impact.

Chapter 3 examines the impact of informality on the allocation of labour and capital within developing countries. This chapter quantitatively measures the effects of informality and low labour mobility on aggregate variables, building upon the findings

presented in the preceding chapter. We document employment segregation and the extent of labour mobility within a persistently informal environment. Furthermore, we develop a heterogeneous agent general equilibrium model that incorporates features of occupational choice relevant to both the formal and informal sectors, where informality serves as the equilibrium outcome.

Our findings indicate that informality hinders output and exacerbates inequality, leading to a trade-off between the two, largely due to limited labour mobility across employment sectors. The frictions causing low labour mobilisation result in inefficient labour allocation and hinder capital accumulation, leading to resource misallocation. When labour transitions into the formal sector, it fosters greater capital accumulation within the economy, enhancing its impact on output. The effects of labour mobility on inequality vary based on specific sectoral shocks. In cases where a trade-off exists—balancing efficiency and equality—greater labour mobility reduces this trade-off. This study highlighted the significance of policies that encourage labour mobility to reduce the costs associated with the misallocation of labour and capital in the economy. Fewer frictions in labour mobility between occupations can enhance resource allocation and improve output and distribution.

Chapter 4 examines the relationship between markup and misallocation and its implications for productivity, employment, and output in developing countries. This study elaborates on the misallocation from the perspective of firms associated with the markup for two types of firms, foreign and domestic, which possess inherent differences. We document significant correlations between markup, firm age, productivity, and size. Furthermore, we investigate the most significant channels contributing to the disparities observed between these firms through a theoretical model that integrates imperfect competition in product markets with Schumpeterian growth dynamics.

Our research indicates that older firms, especially those that are foreign-owned, typically show greater markups, signifying larger price-cost gaps. Likewise, high-productivity firms, particularly foreign ones, achieve higher markups, often associated with slower net employment growth. We have identified that the creative destruction mechanism is vital in explaining the markup differences observed between foreign and domestic firms. The notably lower entry rate for foreign firms contributes to elevated and more varied markups, worsening the misallocation of total factor productivity (TFP) and decreasing the labour income share. Our simulations suggest that easing entry restrictions for foreign firms can reduce both average markups and their variation, thereby lessening TFP misallocation and alleviating labour income share declines. These impacts are especially significant when foreign firms engage in multiple markets instead of being limited to a few. The initiative aimed at minimising market distortions for firms seeking entry into the marketplace facilitates increased competition, which is likely to enhance productivity. This occurs

as more productive firms displace their less efficient counterparts.

While this thesis offers valuable contributions to the existing literature, we acknowledge certain limitations inherent in these studies. Our model relies on a utility framework that is exclusively based on consumption and assumes that individual labour supply is inelastic. It would be beneficial to expand the model to incorporate leisure time as a factor influencing utility, as it likely plays a significant role in individuals' decision-making when reallocating labour across different sectors. Furthermore, our study does not utilise the most recent definition of informality to maintain consistency throughout the study period. It may be advantageous to extend our research to include the latest definition of informality, which encompasses multiple dimensions and is accessible only in relatively short, recent data.

Another significant limitation pertains to the expanding segment of digital gig workers, whose employment arrangements challenge traditional distinctions between formal and informal employment. The proliferation of platform-based work—such as ride-hailing, delivery services, and online freelancing—introduces novel forms of employment that do not conform neatly to conventional classifications employed within our model. Digital gig workers frequently exhibit attributes of both formality and informality: they may operate outside standard employment contracts and social protection systems, yet simultaneously participate in regulated digital platforms that enforce structured rules, ratings, and transaction records. This duality presents conceptual and empirical challenges for accurately capturing their economic behaviour within standard informality frameworks. Additionally, reliable longitudinal data on digital gig workers in Indonesia remain scarce, limiting our capacity to analyse their earnings trajectories, mobility patterns, or productivity contributions over time. Future research may address these shortcomings by incorporating platform labour into the modelling framework, adopting more flexible definitions of employment status, or utilising newly emerging datasets pertaining to digital labour markets.

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Appendix for Chapter 2

A.1 Additional results

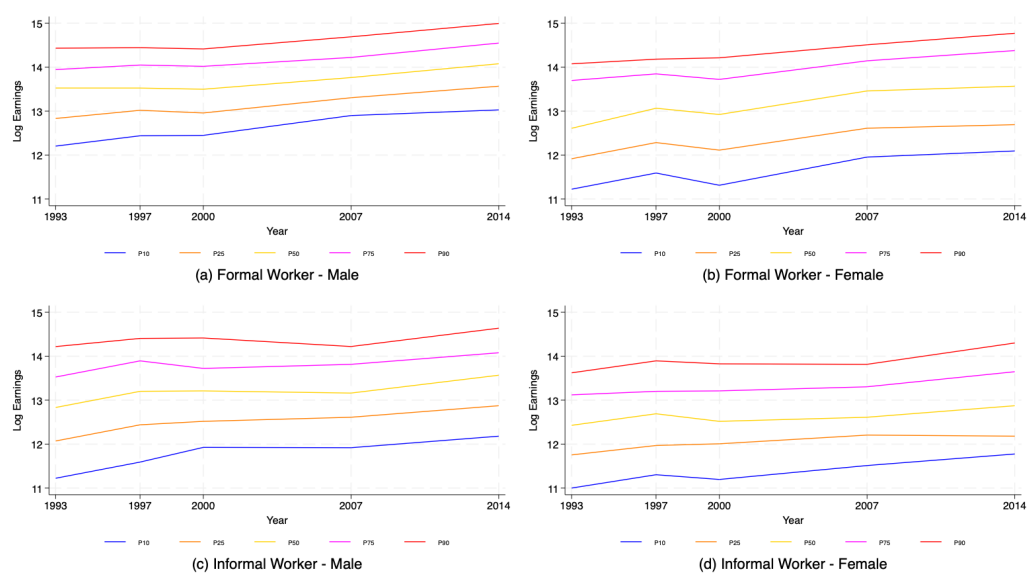


Figure A.1: Earnings Evolution by Sector and Gender - Unbalanced Panel

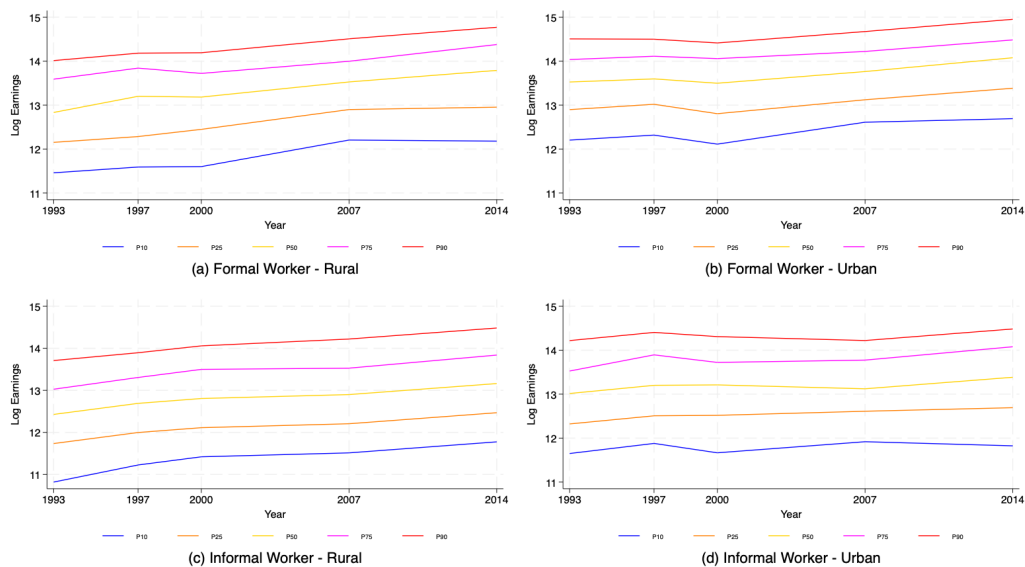


Figure A.2: Earnings Evolution by Sector and Location - Unbalanced Panel

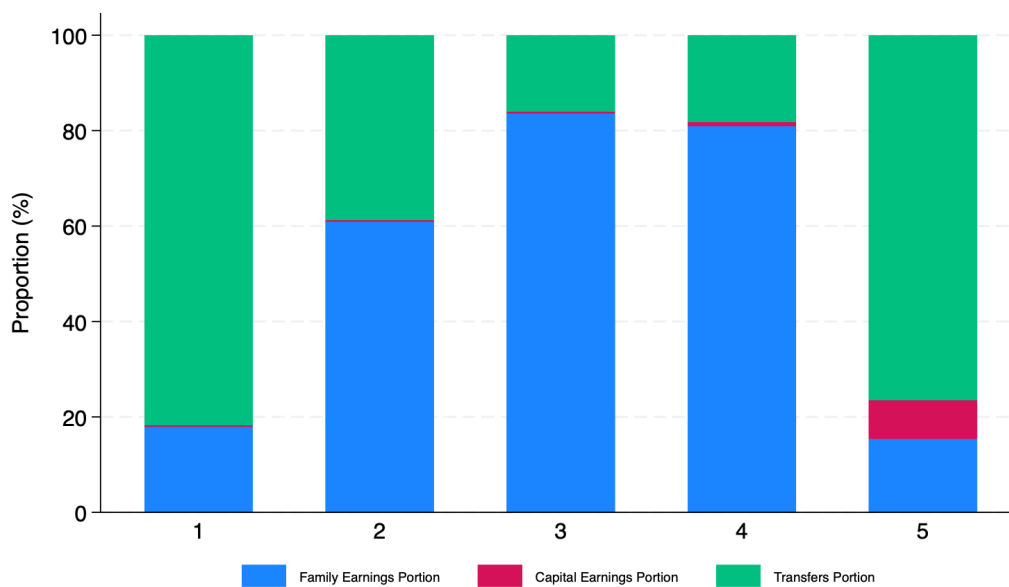


Figure A.3: Earnings Compositions by Earnings Group - Unbalanced Panel

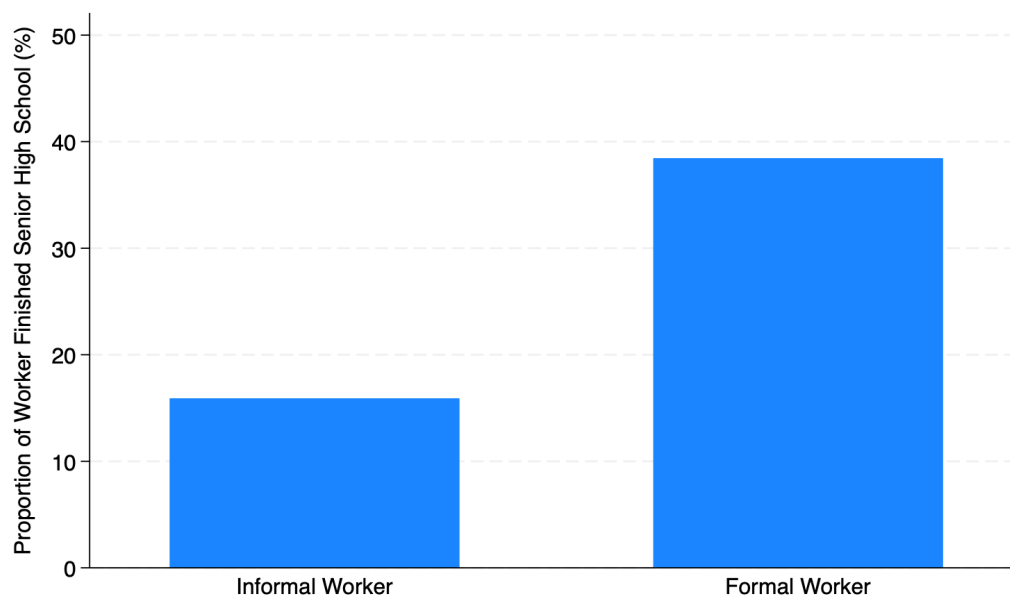


Figure A.4: Education Level by Sector

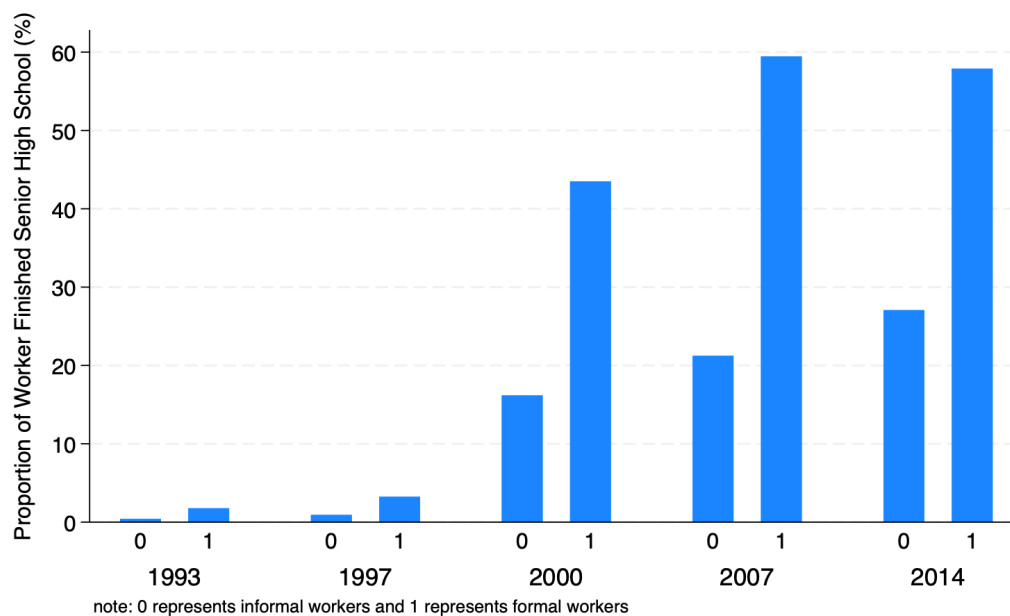


Figure A.5: Education Level by Sector and Year

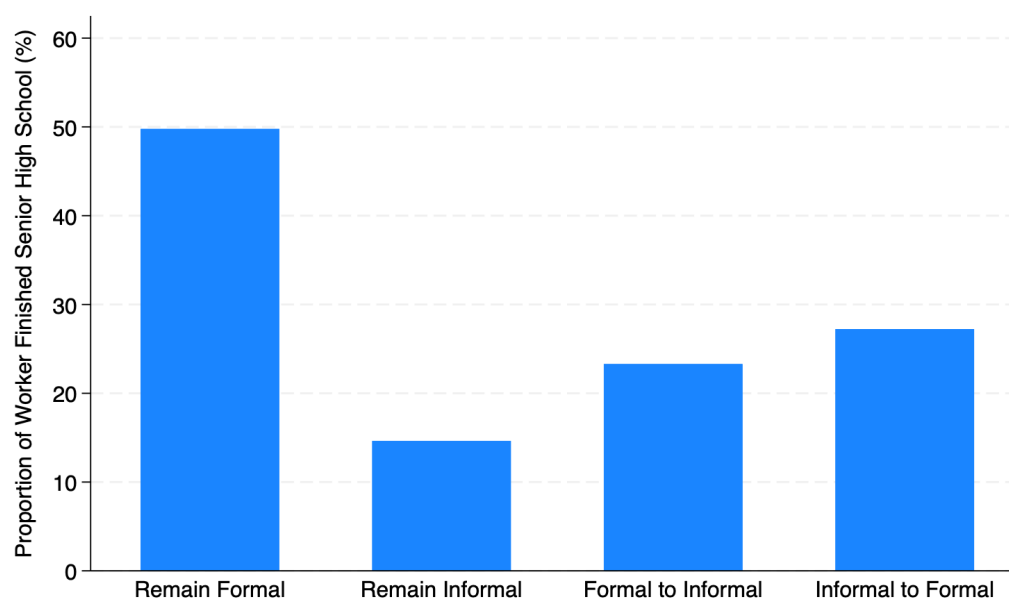


Figure A.6: Education Level by Workers Transitions

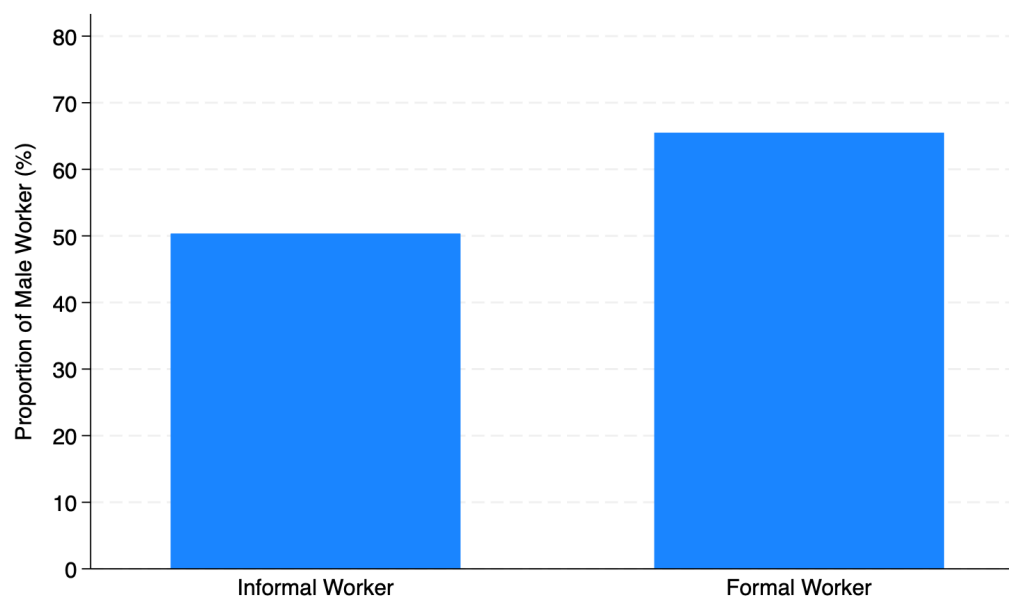


Figure A.7: Gender by Sector

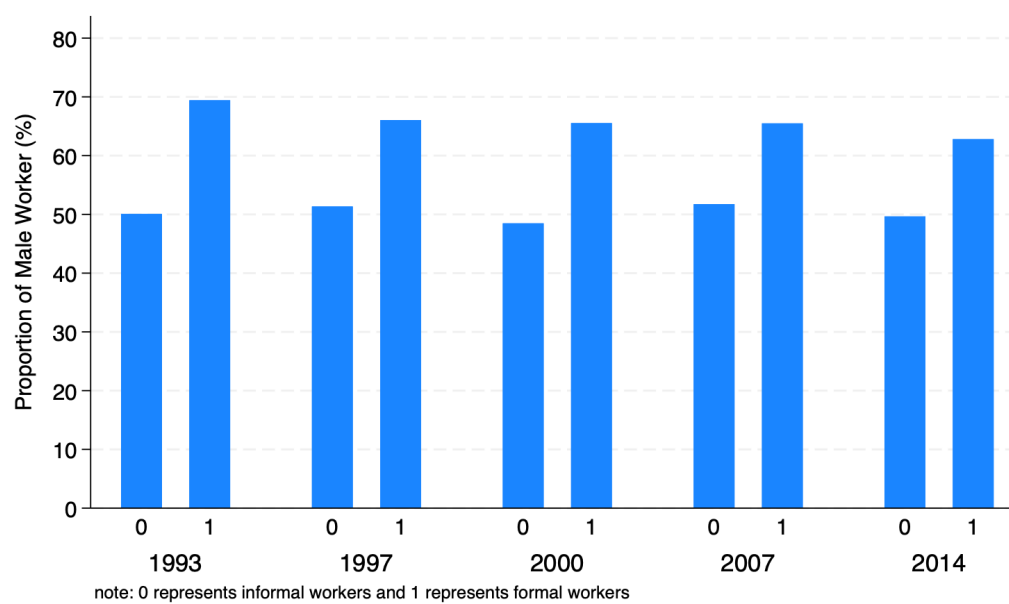


Figure A.8: Gender by Sector and Year

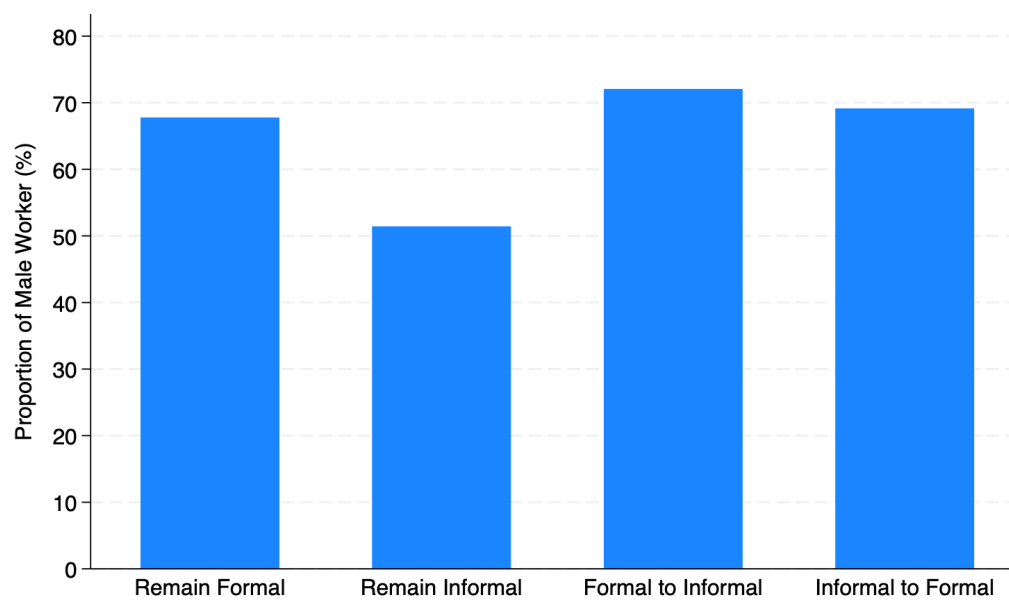


Figure A.9: Gender by Workers Transitions

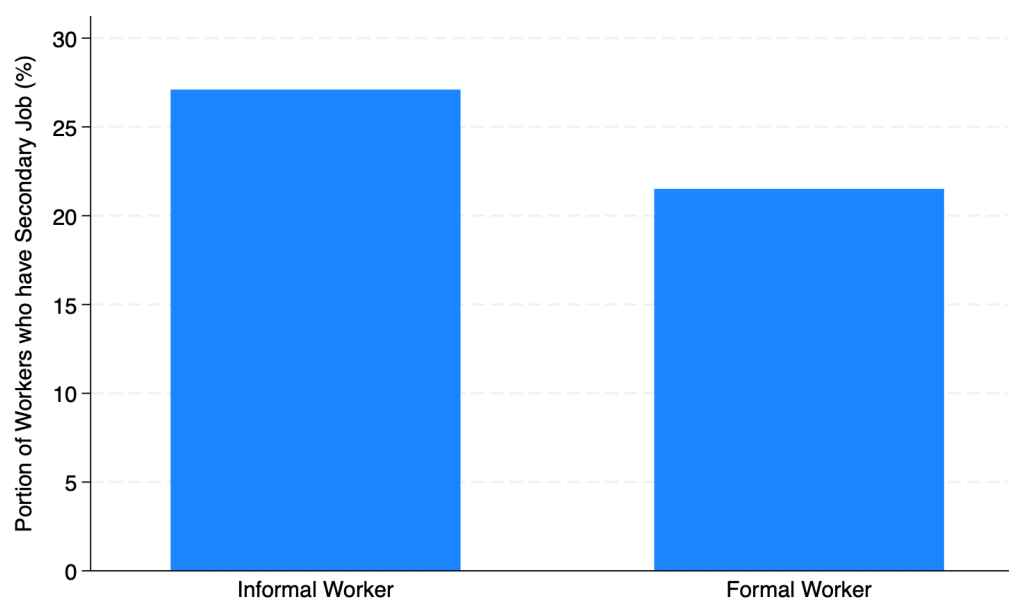


Figure A.10: The Proportion of Workers with Secondary Jobs

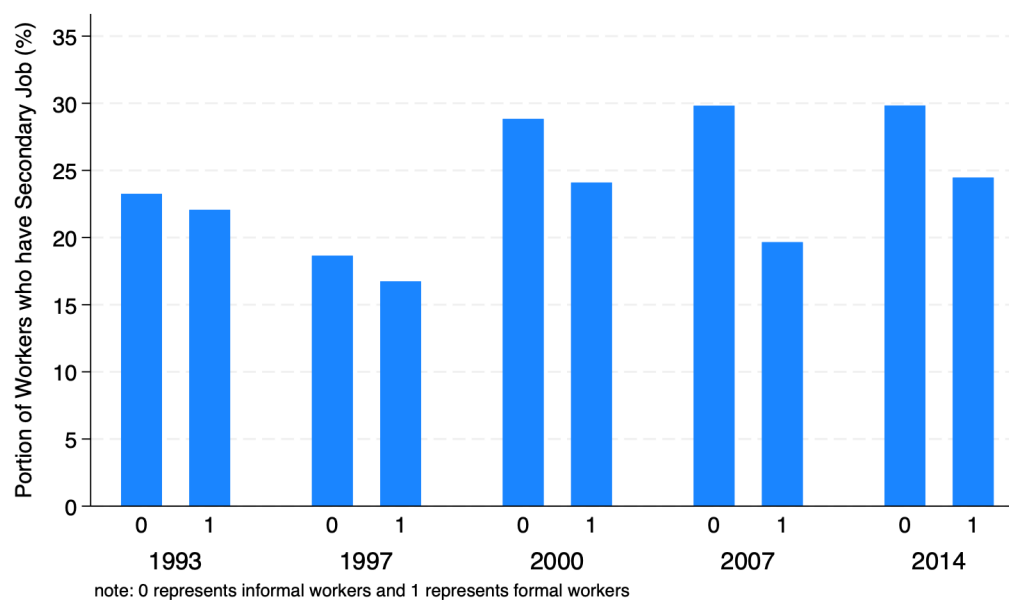


Figure A.11: The Proportion of Workers with Secondary Jobs by Year

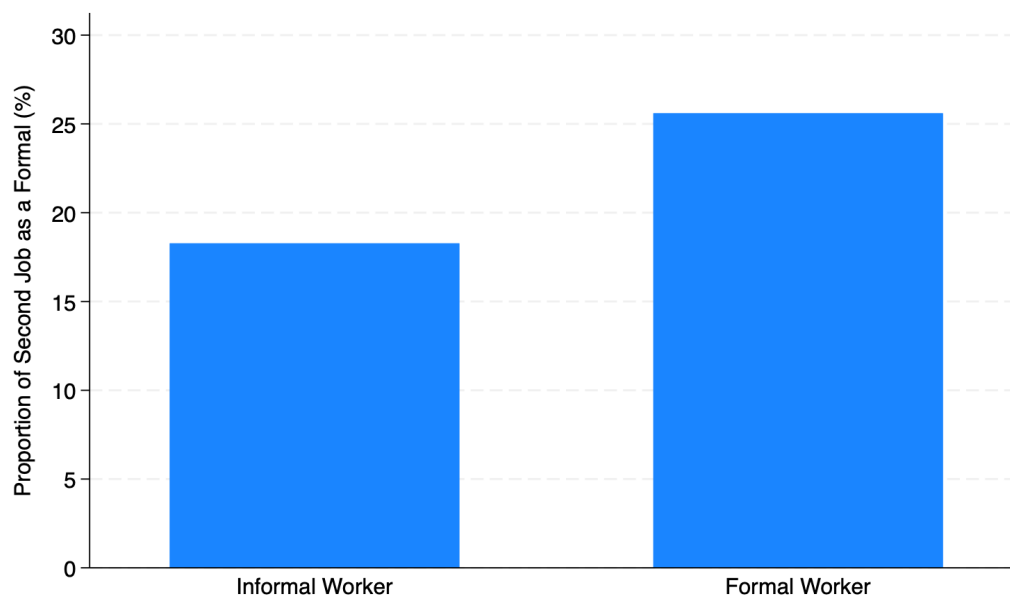


Figure A.12: The Proportion of Secondary Jobs as Formal Workers

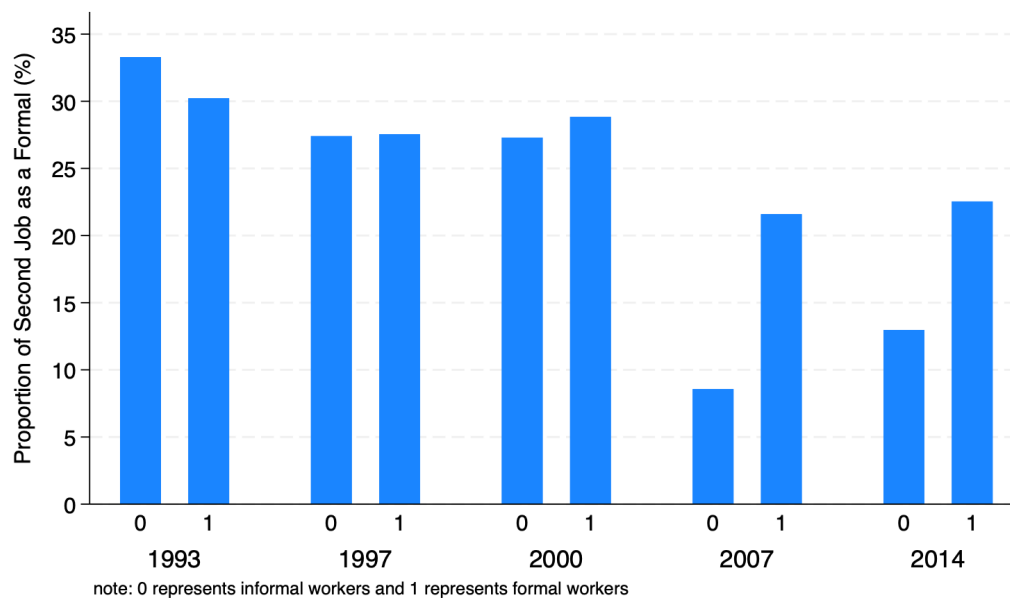


Figure A.13: The Proportion of Secondary Job as Formal Workers by Year

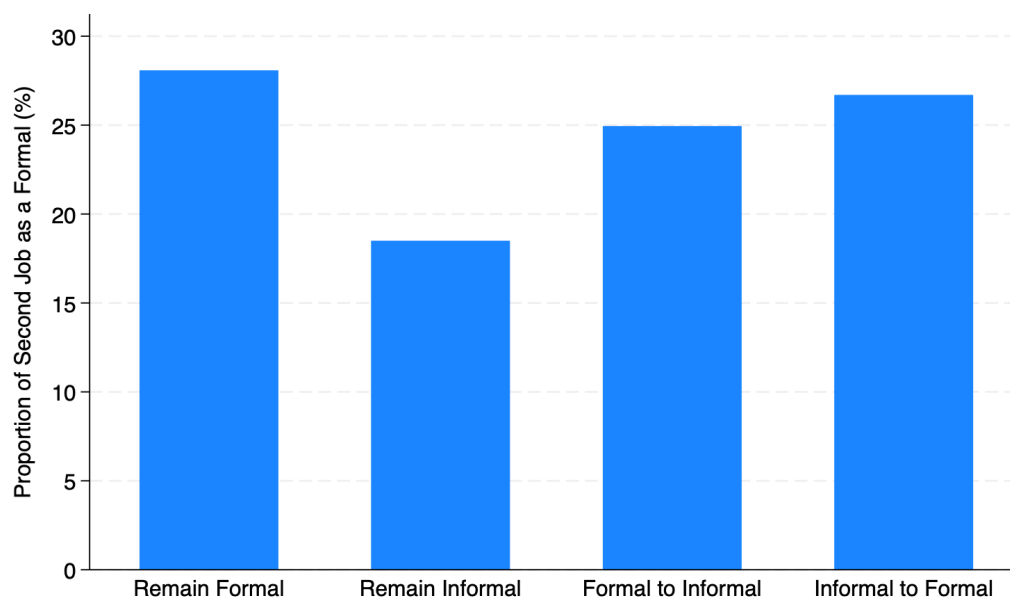


Figure A.14: The Proportion of Secondary Jobs as Formal Workers by Transition



Figure A.15: Earnings Evolution by Sector and Gender - Balanced Panel

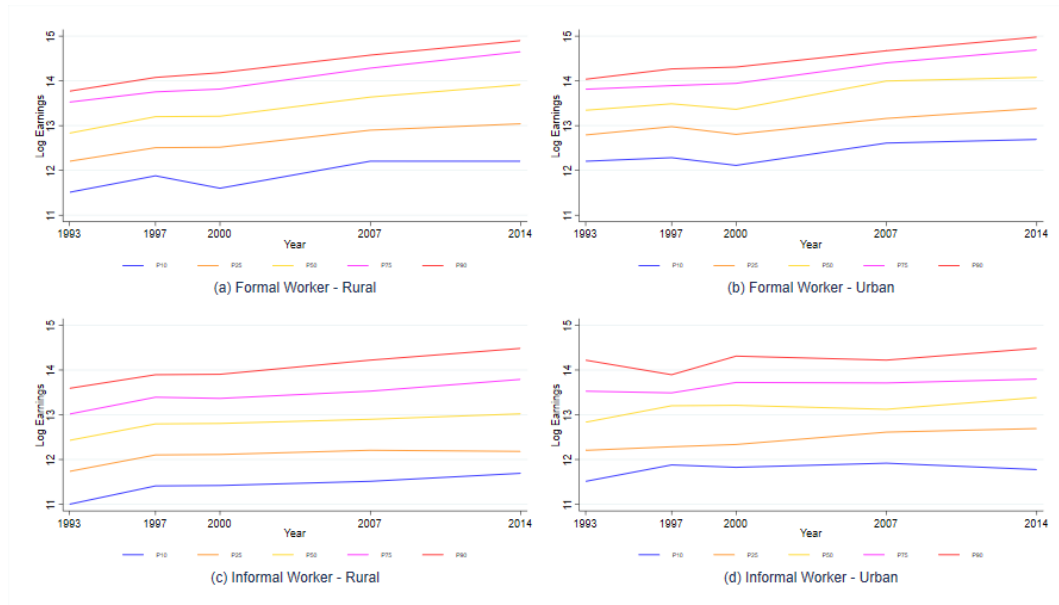


Figure A.16: Earnings Evolution by Sector and Location - Balanced Panel



Figure A.17: Earnings Dispersion by Sector and Gender - Balanced Panel



Figure A.18: Earnings Dispersion by Sector and Location - Balanced Panel

Appendix for Chapter 3

B.1 Capital share and share of labour income to GDP

Table B.1: Key Variables

Year	GDP	Capital Stock	Employment	Educational Attainment	Labour Share
1990	932,355	1,070,367	74,396	4.42	47.0%
1991	980,988	1,206,918	76,137	4.55	47.5%
1992	1,088,305	1,345,078	77,928	4.69	49.6%
1993	1,166,327	1,491,961	79,768	4.82	49.1%
1994	1,255,025	1,665,387	81,660	4.96	52.5%
1995	1,356,565	1,870,200	83,311	5.10	51.3%
1996	1,459,622	2,101,457	85,003	5.24	47.0%
1997	1,525,511	2,342,447	86,738	5.38	43.5%
1998	1,321,365	2,432,764	88,517	5.52	28.4%
1999	1,326,026	2,480,787	90,342	5.66	50.9%
2000	1,389,771	2,550,632	92,059	5.78	46.9%
2001	1,442,985	2,629,659	93,818	5.88	48.1%
2002	1,504,381	2,712,872	95,738	5.97	52.2%
2003	1,577,171	2,788,177	97,689	6.06	56.9%
2004	1,655,517	2,899,091	99,665	6.14	56.9%
2005	1,750,656	3,037,607	101,652	6.23	56.9%
2006	1,847,293	3,172,832	103,635	6.30	56.9%
2007	1,963,974	3,333,858	105,632	6.38	56.9%

Note: calculation based on the study by [van der Eng \(2009a\)](#). GDP and capital stock are in billions of IDR using 2000 prices. Employment is in thousand. Educational attainment is in years.

B.2 Labour proportion



Figure B.1: Labour Proportion for Different Periods

B.3 Productivity

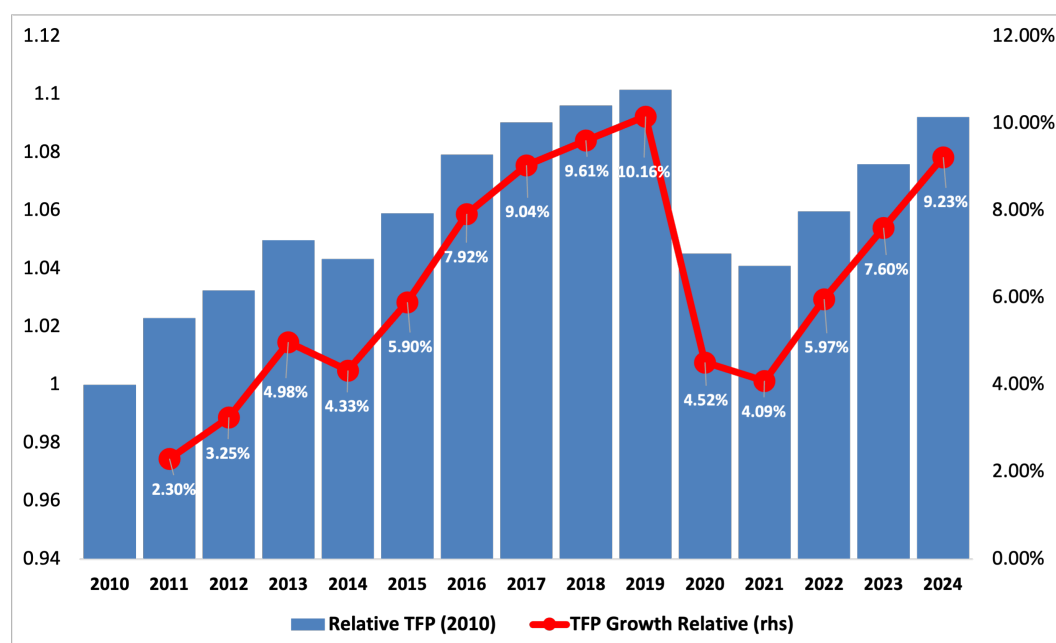


Figure B.2: Total Factor Productivity

B.4 Labour transition

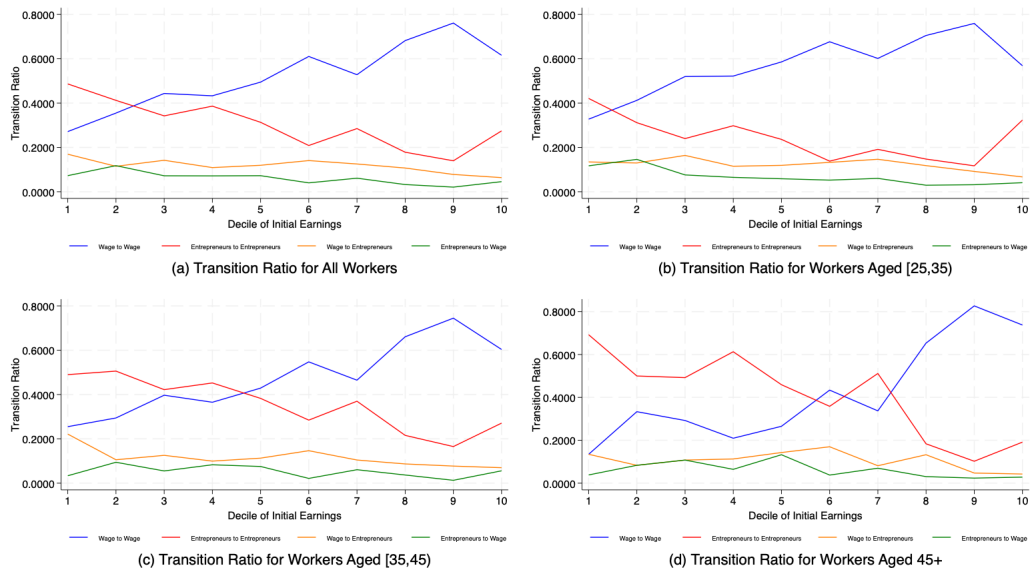


Figure B.3: Labour Transition for Different Initial Earnings and Ages for Urban Area

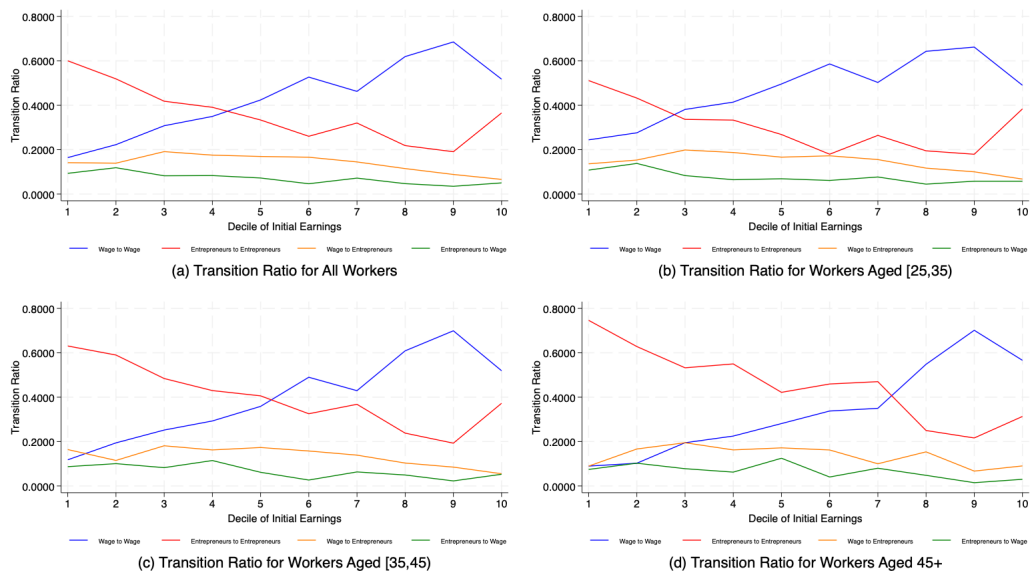


Figure B.4: Labour Transition for Different Initial Earnings and Ages for Male Workers

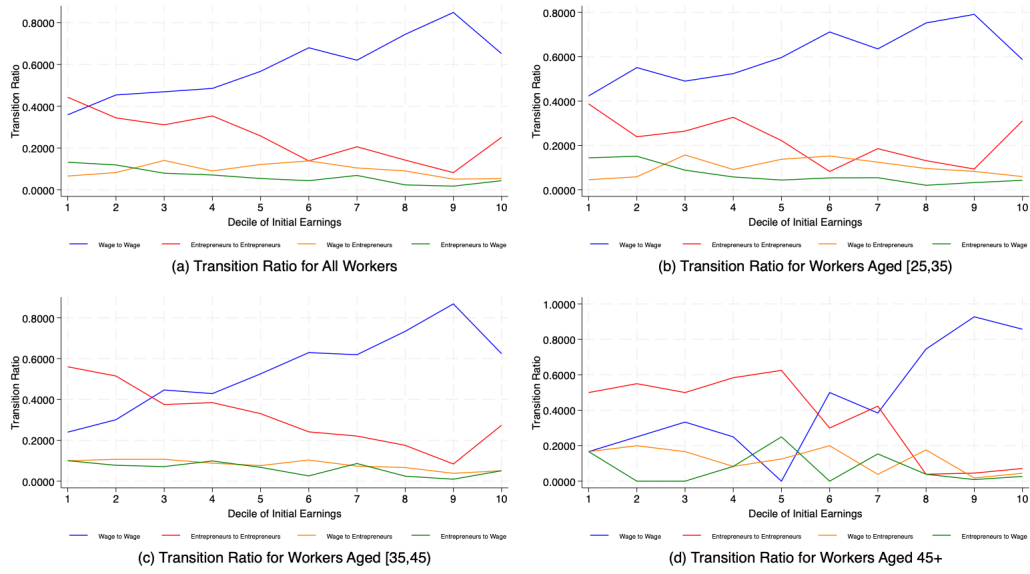


Figure B.5: Labour Transition for Different Initial Earnings and Ages for High-Skill Workers

B.5 Estimation of earnings process on wage workers

Table B.2: Estimation Result on Subsequent Real Earnings

	Coefficient	Std. Error	t	$P > t $
Initial Real Earnings	0.9623264	0.0012524	768.40	0.000
Constant	0.5487007	0.0168122	32.64	0.000

Prob > F = 0.0000, Adjusted R-squared = 0.9868, Root MSE = 0.09698

Table B.3: Summary Statistics of Residuals

	Value
Mean	-0.020
Std. Dev.	0.117
Variance	0.014
Skewness	-0.309
Kurtosis	4.479

B.6 Markov process for e and θ

The Markov process for the labour productivity, e , is given as follows:

$$e \text{ grid} = [0.20 \ 4.28]$$

$$\text{transition matrix} = \begin{bmatrix} 0.96 & 0.04 \\ 0.04 & 0.96 \end{bmatrix}$$

$$\text{stationary distribution} = [0.5 \ 0.5]$$

The Markov process for the entrepreneurial ability, θ , is given as follows:

$$\theta \text{ grid} = [2.25 \ 10.5]$$

$$\text{transition matrix} = \begin{bmatrix} 0.95 & 0.05 \\ 0.60 & 0.40 \end{bmatrix}$$

$$\text{stationary distribution} = [0.92 \ 0.08]$$

B.7 Computational algorithm

Algorithm to solve the model:

1. Set the boundary of assets, a , to make the domain value of the value function compact and discretise stat space $a = \{a_{min}, \dots, a_{max}\}$
2. Guess the initial aggregate capital, K_0 , interest rate, r_0 , and wage, w_0
3. Using the interest rate and wage above, compute the solution of the agent, and iterate forward the value function to obtain the optimal decision rule for asset holding
4. Using the optimal decision rule and the law of motion for the entrepreneurial ideas, iterate over states to get stationary distribution
5. Calculate the new aggregate capital, K , which is the summation of all assets, a . Compute the new factor prices, r and w
6. Repeat the steps above until the differences in aggregate capital K is smaller than the tolerance level

B.8 Income tax proportion

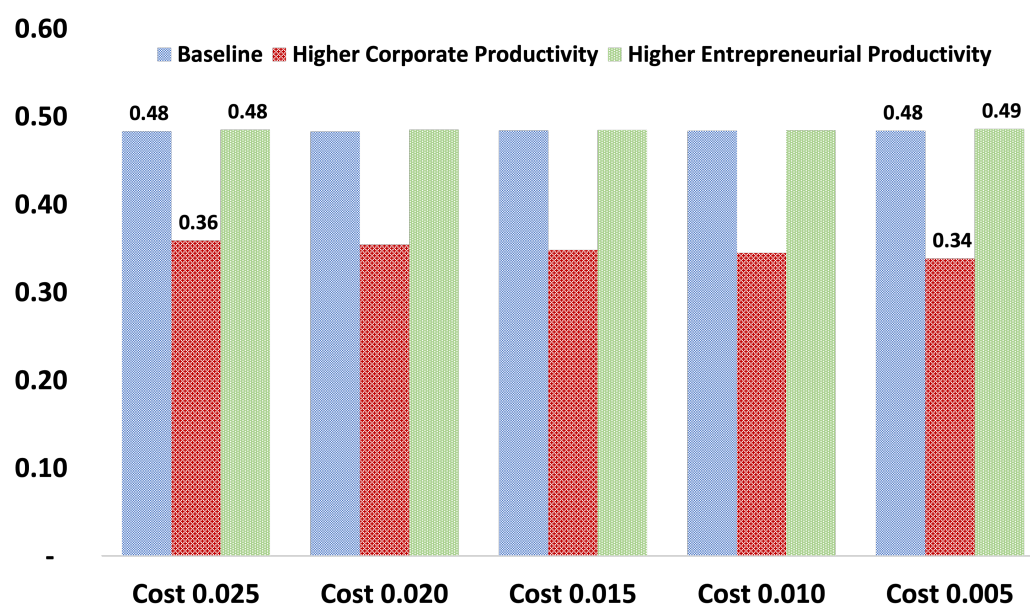


Figure B.6: Income Tax to Tax Revenue by Varying Transitional Costs

B.9 Lower productivity on the corporate sector

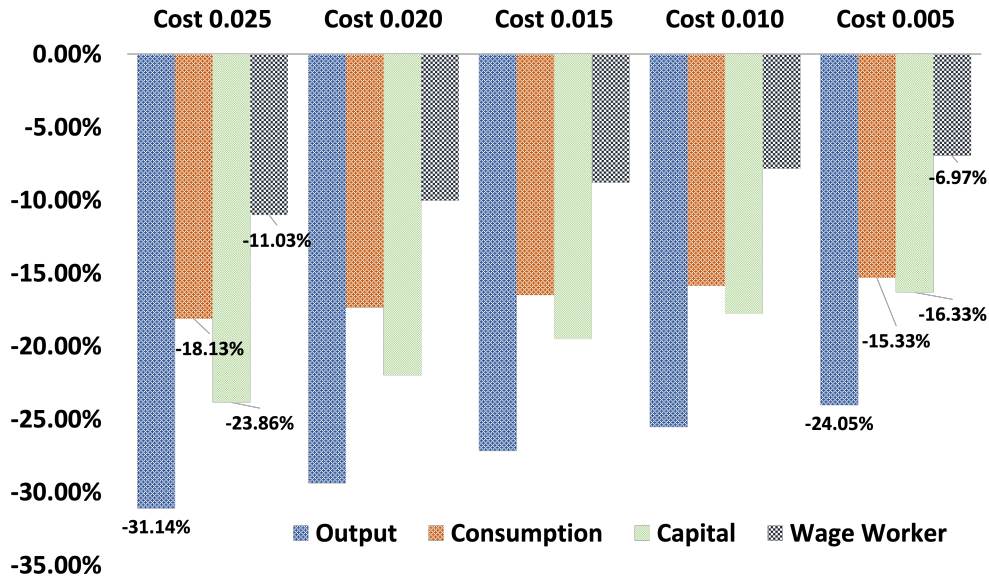


Figure B.7: Changes in Aggregate Variables by Varying Transitional Costs

Note: a 10% reduction in productivity within the corporate sector leads to diminished output and a decreased proportion of wage workers. Wage workers are experiencing a decline in earnings attributable to this decrease in productivity, which subsequently results in lower levels of consumption and savings, thereby leading to a reduction in aggregate capital and output. Furthermore, the proportion of wage workers has diminished by over 11% due to a shift towards entrepreneurship as a means of smoothing consumption. As labour mobility restrictions ease, the implications of reduced productivity lessen. The proportion of wage workers decreases by only 7% when labour mobility friction is at a minimal level, a phenomenon caused by the transition from entrepreneurship back to wage employment. Despite the overall decline in productivity within the corporate sector, some entrepreneurs continue to recognise advantages and make the transition.

Table B.4: Changes in the Distribution

Cost	Δ Gini	$\Delta^{P90/P10}$	$\Delta^{P90/P50}$	$\Delta^{P50/P10}$	$\Delta Output / \Delta Gini$
0.025	-0.035	-0.177	-0.106	0.118	8.97
0.020	-0.034	-0.172	-0.102	0.118	8.75
0.015	-0.031	-0.171	-0.101	0.118	8.80
0.010	-0.029	-0.166	-0.098	0.118	8.88
0.005	-0.027	-0.257	-0.124	0.099	8.97

Note: change in Gini, overall dispersion ($P90/P10$), upper-tail dispersion ($P90/P50$) and lower-tail dispersion ($P50/P10$) are in percentage differences, while delta output is defined as the percentage change of output level between pre-shock and post-shock equilibrium.

Appendix for Chapter 4

C.1 Firms evolution

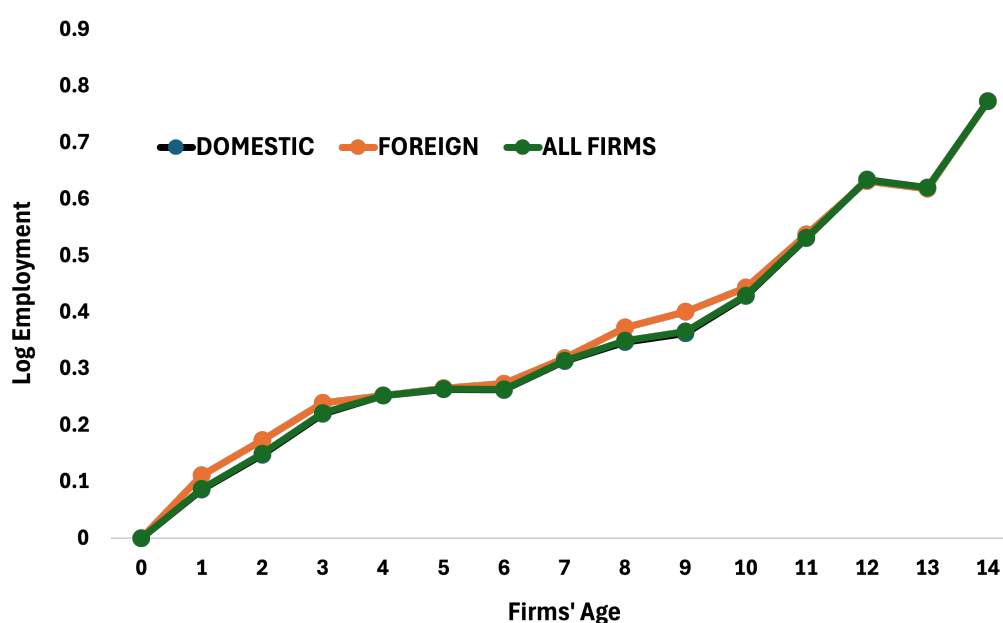


Figure C.1: Employment by Firms' Age

Note: calculated by measuring the average number of employees for surviving firms in each age cohort relative to the employment of the entering firms. The number of employees in five-year-old firms is almost 30% higher than that of new entrants.

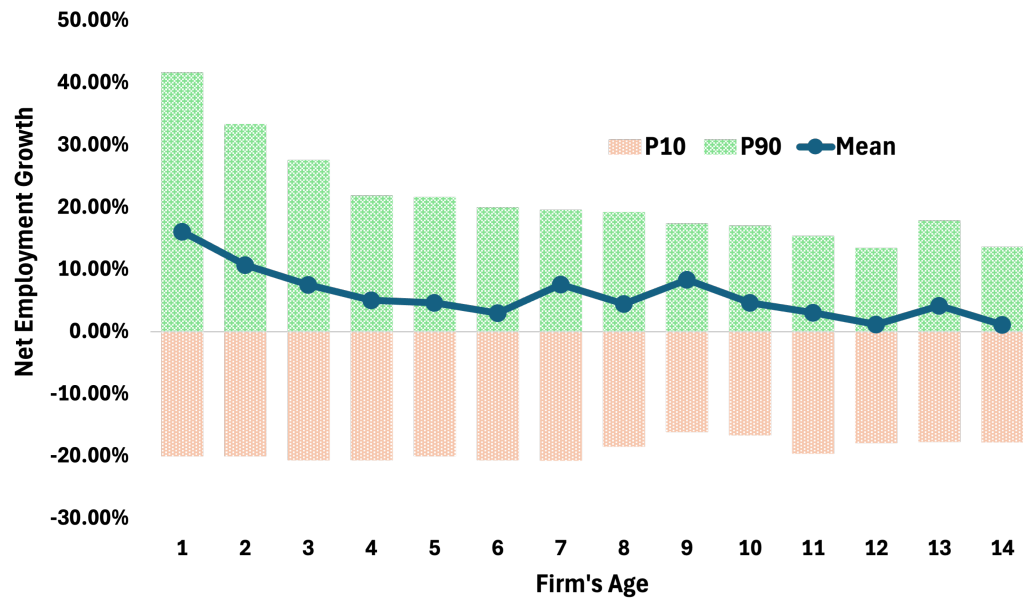


Figure C.2: Net Employment Growth for Domestic Firms

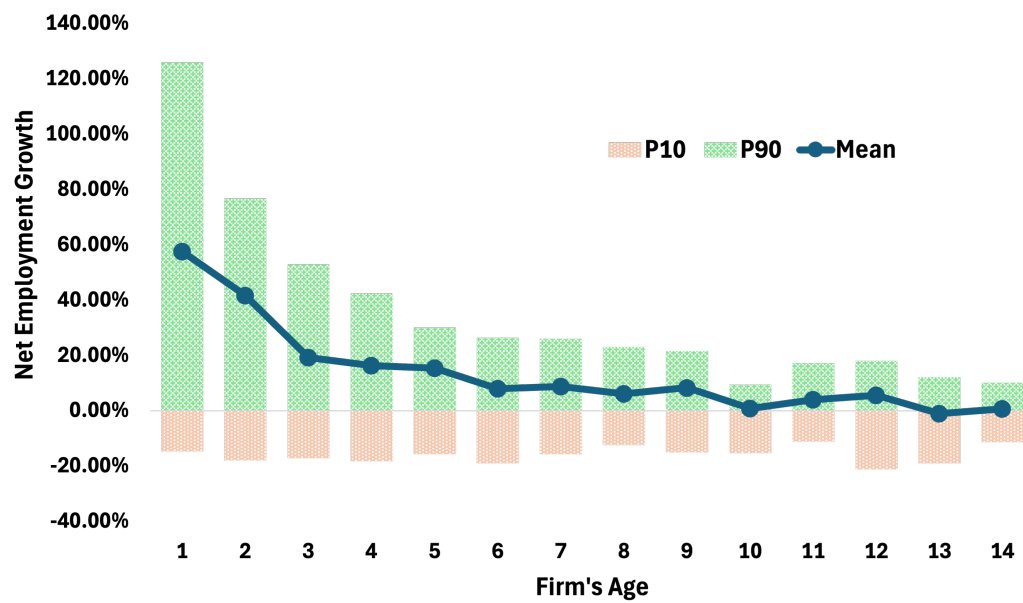


Figure C.3: Net Employment Growth for Foreign Firms

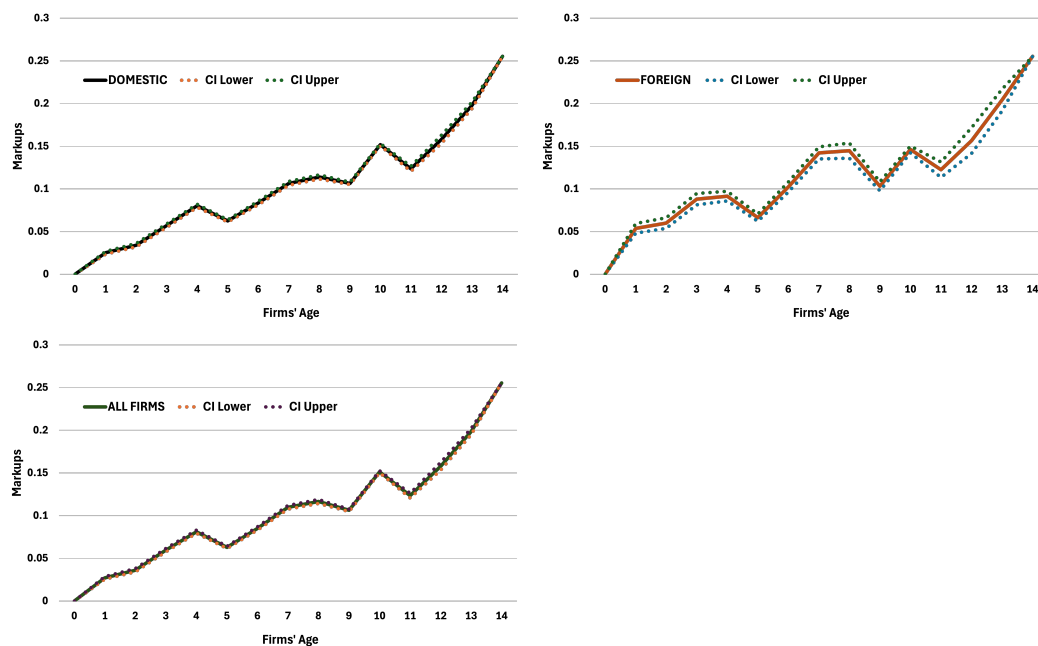


Figure C.4: Markups by Firms' Age

Note: calculated by measuring the average markups for surviving firms for each age cohort relative to the markups of entering firms and utilising a 95% confidence interval.

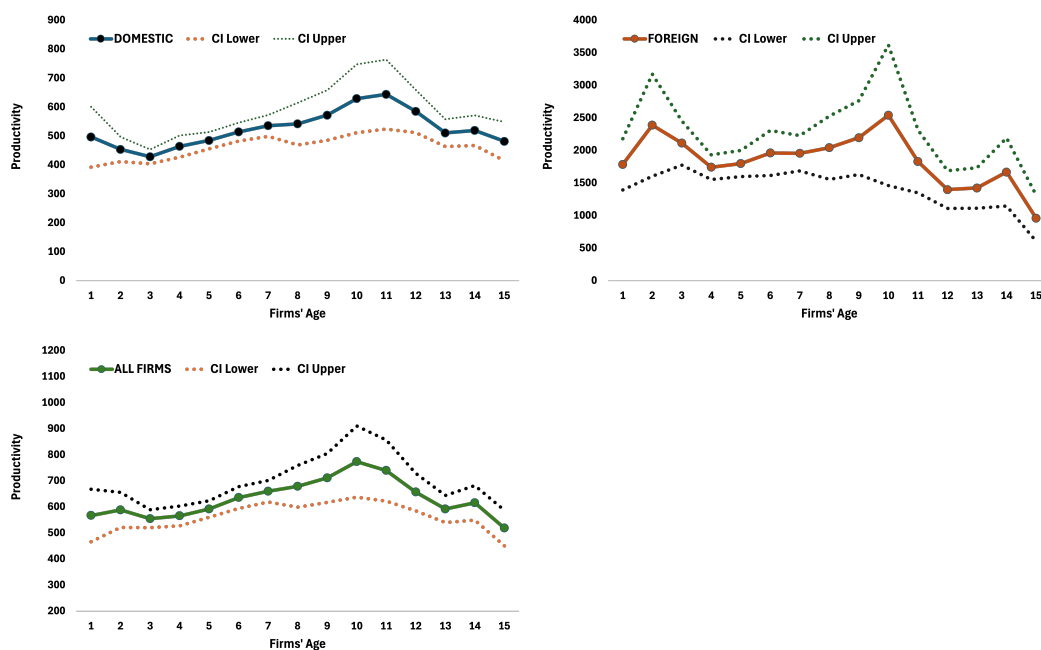


Figure C.5: Productivity and Firm Age

Note: utilising a 95% confidence interval.

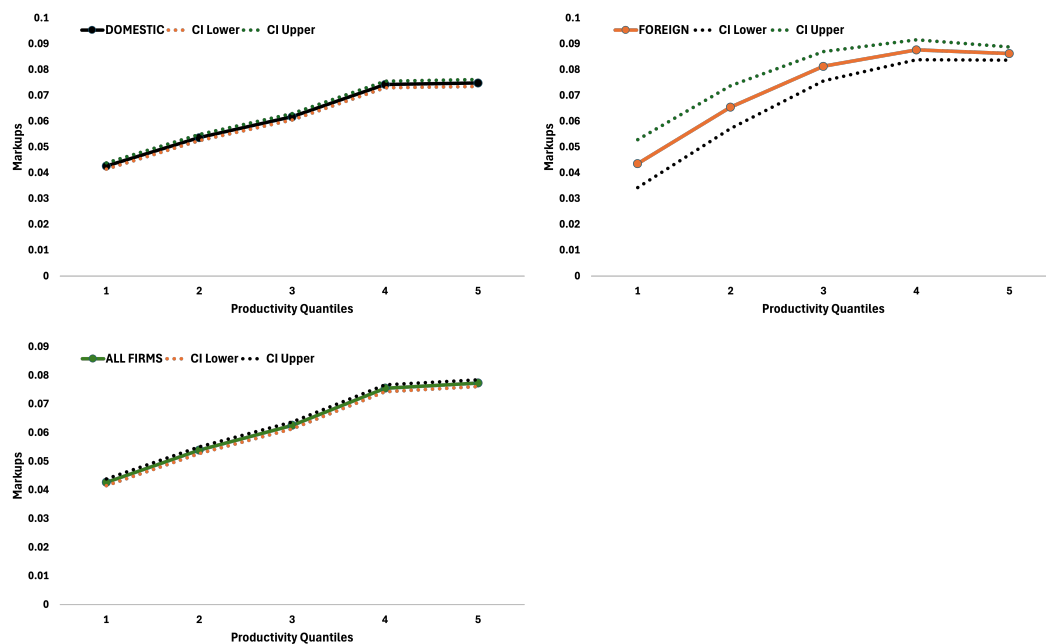


Figure C.6: Markups and Productivity

Note: utilising a 95% confidence interval.

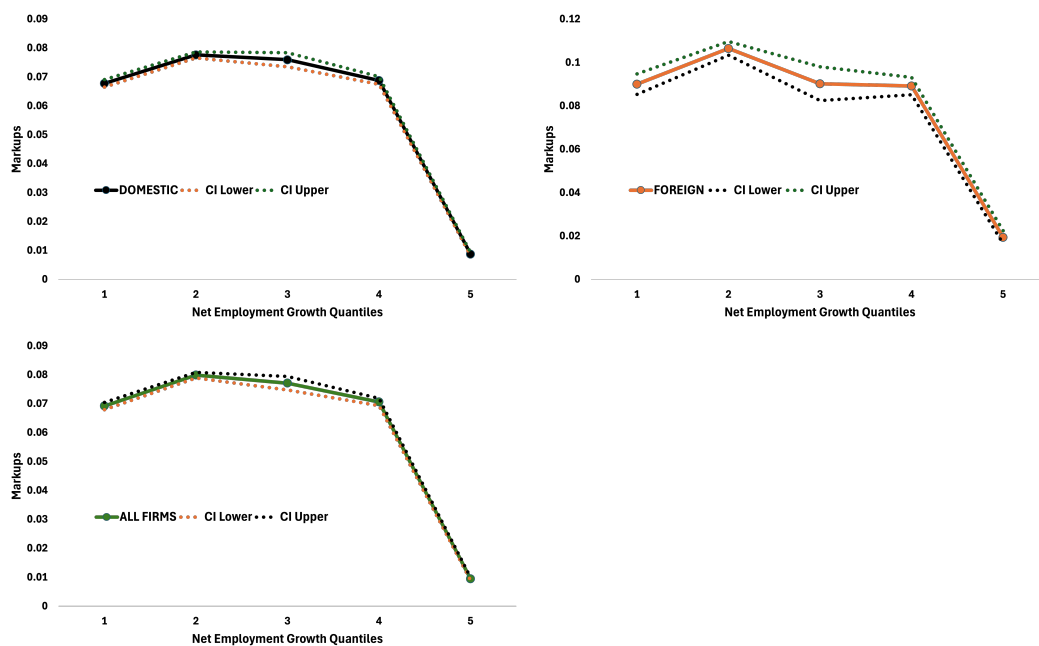


Figure C.7: Markups and Net Employment Growth

Note: utilising a 95% confidence interval.

C.2 Industrial classifications

Table C.1: Average Markup by Two-Digit Industrial Classifications

Classification	Domestic	Foreign
Food	0.2246	1.0610
Beverages	-0.2777	0.4844
Tobacco Products	0.0336	0.1098
Textiles	-0.2691	0.5794
Wearing Apparel	-0.4934	0.0071
Leather	-0.1977	0.1698
Wood	-0.0599	0.4154
Paper	0.3471	0.9402
Printing and Recorded Media	-0.3115	0.7475
Refined Petroleum	0.7420	1.0946
Chemicals	0.3695	1.1202
Pharmaceutical	0.0615	0.6415
Rubber and Plastics	0.2766	0.6441
Non-Metallic Mineral	-0.4258	0.5225
Basic Metals	0.8090	1.1089
Fabricated Metal Products	0.1077	0.7763
Computer and Electronic	0.1345	0.7742
Electrical	0.3369	0.6318
Machinery and Equipment	0.0530	0.6300
Motor Vehicles	0.1487	0.9553
Other Transport	0.1025	0.9597
Furniture	-0.0593	0.2814
Other	-0.1693	0.2770
Repair and Installation	-0.0133	0.3784

Note: classification based on ISIC Revision 4 during the period 1990-2005. The classification needs to be adjusted to ensure consistency for the entire study duration. Initially, ISIC Revision 2 was used for the period 1990-1998, ISIC Revision 3 during 1999-2009, and ISIC Revision 4 afterwards.

C.3 Derivation of value function

Use guess and verify:

$$V_t(n, [\Delta_i]) = V_t^P(n) + \sum_{i=1}^n V_t^M(\Delta_i), \quad (\text{C.1})$$

then

$$\dot{V}_t(n, [\Delta_i]) = \dot{V}_t^P(n) + \sum_{i=1}^n \dot{V}_t^M(\Delta_i), \quad (\text{C.2})$$

$$\begin{aligned} V_t(n-1, [\Delta_i]_{i \neq j}) - V_t(n, [\Delta_i]) &= V_t^P(n-1) + \sum_{i=1}^n V_t^M(\Delta_i)_{i \neq j} - V_t^P(n) - \sum_{i=1}^n V_t^M(\Delta_i) \\ &= V_t^P(n-1) - V_t^P(n) - V_t^P(\Delta_i), \end{aligned} \quad (\text{C.3})$$

$$\begin{aligned} V_t\left(n, \left\{[\Delta_i]_{i \neq j}, \Delta_i + 1\right\}\right) - V_t(n, [\Delta_i]) &= V_t^P(n) + \sum_{i=1}^n V_t^M(\Delta_i)_{i \neq j} + V_t^M(\Delta_i + 1) \\ &\quad - V_t^P(n) - \sum_{i=1}^n V_t^M(\Delta_i) \\ &= V_t^M(\Delta_i + 1) - V_t^M(\Delta_i), \end{aligned} \quad (\text{C.4})$$

$$\begin{aligned} V_t(n, \{[\Delta_i], 1\}) - V_t^P(n, [\Delta_i]) &= V_t^P(n+1) + \sum_{i=1}^n V_t^M(\Delta_i) + V_t^P(1) - V_t^P(n) \\ &\quad - \sum_{i=1}^n V_t^M(\Delta_i) \\ &= V_t^P(n+1) - V_t^P(n) + V_t^P(1). \end{aligned} \quad (\text{C.5})$$

Then substitute back to the value function:

$$\begin{aligned}
r \left[V_t^P(n) + \sum_{i=1}^n V_t^M(\Delta_i) \right] - \dot{V}_t^P(n) - \sum_{i=1}^n \dot{V}_t^M(\Delta_i) &= \sum_{i=1}^n \pi_t(\Delta_i) \\
&+ \sum_{i=1}^n \tau [V_t^P(n-1) - V_t^P(n) - V_t^M(\Delta_i)] \\
&+ \max_{[I_i]} \left\{ \sum_{i=1}^n I_i [V_t^M(\Delta_i + 1) - V_t^M(\Delta_i)] - \sum_{i=1}^n \lambda^{-\Delta_i} \frac{1}{\phi_I} I_i^\zeta w_t \right\} \\
&+ \max_{[x_i]} \left\{ \sum_{i=1}^n x_i [V_t^P(n+1) - V_t^P(n)] - \sum_{i=1}^n \frac{1}{\phi_x} x_i^\zeta w_t \right\}.
\end{aligned} \tag{C.6}$$

Then rearranging using:

$$(i) \quad \pi_t(\Delta) = \pi_t(\Delta) - \pi(1) + \pi(1),$$

$$(ii) \quad X = \sum_{i=1}^n x_i = nx,$$

then we will obtain

$$\begin{aligned}
rV_t^P(n) - \dot{V}_t^P(n) + \sum_{i=1}^n [rV_t^M(\Delta_i) - \dot{V}_t^M(\Delta_i)] &= \sum_{i=1}^n \left\{ \pi_t(\Delta_i) - \pi_t(1) - \tau V_t^M(\Delta_i) \right. \\
&+ \max_{[I_i]} \left\{ \sum_{i=1}^n I_i [V_t^M(\Delta_i + 1) - V_t^M(\Delta_i)] - \sum_{i=1}^n \lambda^{-\Delta_i} \frac{1}{\phi_I} I_i^\zeta w_t \right\} \Big\} \\
&+ n(\pi_t(1)) + \sum_{i=1}^n \tau [V_t^P(n-1) - V_t^P(n)] \\
&+ \max_{[x_i]} \left\{ X [V_t^P(n+1) - V_t^P(n)] - \frac{1}{\phi_x} X^\zeta w_t \right\}.
\end{aligned} \tag{C.7}$$

Now first look for $V_t^P(\Delta_i)$

$$\begin{aligned}
rV_t^M(\Delta) - \dot{V}_t^M(\Delta) &= \pi_t(\Delta) - \pi_t(1) - \tau V_t^M(\Delta) \\
&+ \max_I \left\{ I [V_t^M(\Delta + 1) - V_t^M(\Delta)] - \lambda^{-\Delta} \frac{1}{\phi_I} I^\zeta w_t \right\},
\end{aligned} \tag{C.8}$$

then let they grow at a constant rate, $\dot{V}_t^M(\Delta) = gV_t^M(\Delta)$. Therefore

$$(r - g + \tau) V_t^M(\Delta) = \pi_t(\Delta) - \pi_t(1) + \max_I \left\{ I [V_t^M(\Delta + 1) - V_t^M(\Delta)] - \lambda^{-\Delta_i} \frac{1}{\phi_I} I^\zeta w_t \right\}. \quad (\text{C.9})$$

Use the guess and verify method to find the solution. Let

$$V_t^M(\Delta) = k_t - \alpha_t \lambda^{-\Delta}, \quad (\text{C.10})$$

then we can rearrange

$$\begin{aligned} V_t^M(\Delta + 1) - V_t^M(\Delta) &= k_t - \alpha_t \lambda^{-(\Delta+1)} - k_t + \alpha_t \lambda^{-\Delta} \\ &= \alpha_t \lambda^{-\Delta} - \alpha_t \frac{\lambda^{-\Delta}}{\lambda} \\ &= \alpha_t \lambda^{-\Delta} \left[1 - \frac{1}{\lambda} \right] \\ &= \alpha_t \lambda^{-\Delta} \left[\frac{\lambda - 1}{\lambda} \right]. \end{aligned} \quad (\text{C.11})$$

Then try to find the optimum I with solving the FOC

$$\frac{\partial}{\partial I} \left[I \left(\alpha_t \lambda^{-\Delta} \left[\frac{\lambda - 1}{\lambda} \right] - \lambda^{-\Delta_i} \frac{1}{\phi_I} I^\zeta w_t \right) \right] = 0, \quad (\text{C.12})$$

$$\alpha_t \lambda^{-\Delta} \left[\frac{\lambda - 1}{\lambda} \right] - \frac{\zeta}{\phi_I} \lambda^{-\Delta_i} I^{\zeta-1} w_t = 0, \quad (\text{C.13})$$

$$\alpha_t \lambda^{-\Delta} \left[\frac{\lambda - 1}{\lambda} \right] = \frac{\zeta}{\phi_I} \lambda^{-\Delta_i} I^{\zeta-1} w_t, \quad (\text{C.14})$$

$$I = \left[\frac{\lambda - 1}{\lambda} \frac{\phi_I \alpha_t}{\zeta w_t} \right]^{\frac{1}{\zeta-1}}. \quad (\text{C.15})$$

Remember that $\pi_t = p_t y_t - w_t l_t = Y_t - w_t \frac{1}{\mu} \frac{Y_t}{w_t} = \left(1 - \frac{1}{\mu}\right) Y_t$. Since markup, μ , has one-to-one mapping with the productivity gap, Δ , then we can write $\pi_t = \left(1 - \frac{1}{\lambda^\Delta}\right) Y_t$. Therefore

$$\pi_t(\Delta) - \pi_t(1) = \left(1 - \frac{1}{\lambda^\Delta}\right) Y_t - \left(1 - \frac{1}{\lambda^1}\right) Y_t = \left(\frac{1}{\lambda} - \lambda^{-\Delta}\right) Y_t. \quad (\text{C.16})$$

Coupled with the Euler equation $\rho = r - g$, then we have

$$\begin{aligned}
(\rho + \tau) [k_t - \alpha_t \lambda^{-\Delta}] &= \left(\frac{1}{\lambda} - \lambda^{-\Delta} \right) Y_t + I \left[\frac{\zeta}{\phi_I} \lambda^{-\Delta} I^{\zeta-1} w_t \right] - \lambda^{-\Delta} \frac{1}{\phi_I} I^\zeta w_t \\
&= \left(\frac{1}{\lambda} - \lambda^{-\Delta} \right) Y_t + (\zeta - 1) \frac{1}{\phi_I} I^\zeta w_t \lambda^{-\Delta},
\end{aligned} \tag{C.17}$$

then rearrange

$$k_t - \alpha_t \lambda^{-\Delta} = \frac{1}{\rho + \tau} \left[\frac{1}{\lambda} Y_t \right] - \frac{1}{\rho + \tau} \left[Y_t - \frac{\zeta - 1}{\phi_I} I^\zeta w_t \right] \lambda^{-\Delta}. \tag{C.18}$$

Hence

$$k_t = \frac{1}{\rho + \tau} \left[\frac{1}{\lambda} Y_t \right], \tag{C.19}$$

$$\alpha_t = \frac{1}{\rho + \tau} \left[Y_t - \frac{\zeta - 1}{\phi_I} I^\zeta w_t \right]. \tag{C.20}$$

Then

$$\begin{aligned}
V_t^M(\Delta) &= \frac{1}{\rho + \tau} \left[\frac{1}{\lambda} Y_t \right] - \frac{1}{\rho + \tau} \left[Y_t - \frac{\zeta - 1}{\phi_I} I^\zeta w_t \right] \lambda^{-\Delta} \\
&= \frac{1}{\rho + \tau} \left[\left(\frac{1}{\lambda} - \lambda^{-\Delta} \right) Y_t + \lambda^{-\Delta} \frac{\zeta - 1}{\phi_I} I^\zeta w_t \right] \\
&= \frac{1}{\rho + \tau} \left[\pi_t(\Delta) - \pi_t(1) + (\zeta - 1) \lambda^{-\Delta} \frac{1}{\phi_I} I^\zeta w_t \right].
\end{aligned} \tag{C.21}$$

Therefore

$$\begin{aligned}
V_t^M(1) &= \frac{1}{\rho + \tau} \left[\pi_t(1) - \pi_t(1) + (\zeta - 1) \lambda^{-1} \frac{1}{\phi_I} I^\zeta w_t \right] \\
&= \frac{1}{\rho + \tau} \left[(\zeta - 1) \frac{1}{\lambda} \frac{1}{\phi_I} I^\zeta w_t \right].
\end{aligned} \tag{C.22}$$

Now lets take a look for $V_t^P(n)$. Assume that $V_t^P(n) = nv_t$. It is growing with the constant growth

$$\dot{V}_t^P(n) = gV_t^P(n), \tag{C.23}$$

hence

$$\begin{aligned}
rV_t^P(n) - \dot{V}_t^P(n) &= n\pi_t(1) + \sum_{i=1}^n \tau [V_t^P(n-1) - V_t^P(n)] \\
&\quad + \max_X \left\{ X [V_t^P(n+1) + V_t^M(1) - V_t^P(n)] - \frac{1}{\phi_x} X^\zeta w_t \right\},
\end{aligned} \tag{C.24}$$

$$\begin{aligned}
rV_t^P(n) - gV_t^P(n) &= n\pi_t(1) + \sum_{i=1}^n \tau [(n-1)v_t - nv_t] \\
&\quad + \max_X \left\{ X [(n+1)v_t + V_t^M(1) - nv_t] - \frac{1}{\phi_x} X^\zeta w_t \right\} \\
&= n\pi_t(1) + \sum_{i=1}^n \tau [-v_t] + \max_X \left\{ X [v_t + V_t^M(1)] - \frac{1}{\phi_x} X^\zeta w_t \right\} \\
&= n\pi_t(1) + \tau [-nv_t] + \max_X \left\{ X [v_t + V_t^M(1)] - \frac{1}{\phi_x} X^\zeta w_t \right\},
\end{aligned} \tag{C.25}$$

then

$$(r - g + \tau) V_t^P(n) = n\pi_t(1) + n \max_x \left\{ x [v_t + V_t^M(1)] - \frac{1}{\phi_x} x^\zeta w_t \right\}, \tag{C.26}$$

divide by n to get

$$(\rho + \tau) v_t = \pi_t(1) + \max_x \left\{ x [v_t + V_t^M(1)] - \frac{1}{\phi_x} x^\zeta w_t \right\}. \tag{C.27}$$

Then try to find the optimum x with solving the FOC

$$\frac{\partial}{\partial x} \left[x [v_t + V_t^M(1)] - \frac{1}{\phi_x} x^\zeta w_t \right] = 0, \tag{C.28}$$

$$v_t + V_t^M(1) = \frac{\zeta}{\phi_x} x^{\zeta-1} w_t, \tag{C.29}$$

hence

$$\begin{aligned}
(\rho + \tau) v_t &= \pi_t(1) + x \left[\frac{\zeta}{\phi_x} x^{\zeta-1} w_t \right] - \frac{1}{\phi_x} x^\zeta w_t \\
&= \pi_t(1) + \frac{\zeta}{\phi_x} x^\zeta w_t - \frac{1}{\phi_x} x^\zeta w_t \\
&= \pi_t(1) + (\zeta - 1) \frac{1}{\phi_x} x^\zeta w_t.
\end{aligned} \tag{C.30}$$

Assume that $v_t = \bar{v}w_t$, then

$$(\rho + \tau) \bar{v}w_t = \pi_t(1) + (\zeta - 1) \frac{1}{\phi_x} x^\zeta w_t, \quad (\text{C.31})$$

$$\begin{aligned} \bar{v} &= \frac{1}{\rho + \tau} \left[\frac{\pi_t(1)}{w_t} + \frac{(\zeta - 1)}{\phi_x} x^\zeta \right] \\ &= \frac{1}{\rho + \tau} \left[\frac{\left(\frac{\lambda-1}{\lambda}\right) Y_t}{w_t} + \frac{(\zeta - 1)}{\phi_x} x^\zeta \right]. \end{aligned} \quad (\text{C.32})$$

Hence

$$\begin{aligned} V_t^P(n) &= nv_t \\ &= n\bar{v}w_t \\ &= n \frac{1}{\rho + \tau} \left[\frac{\left(\frac{\lambda-1}{\lambda}\right) Y_t}{w_t} + \frac{(\zeta - 1)}{\phi_x} x^\zeta \right] w_t \\ &= n \frac{1}{\rho + \tau} \left[\pi(1) + \frac{(\zeta - 1)}{\phi_x} x^\zeta w_t \right]. \end{aligned} \quad (\text{C.33})$$

Therefore

$$\begin{aligned} V_t(n, [\Delta_i]) &= V_t^P(n) + \sum_{i=1}^n V_t^M(\Delta_i) \\ &= n \frac{1}{\rho + \tau} \left[\pi(1) + \frac{(\zeta - 1)}{\phi_x} x^\zeta w_t \right] + \sum_{i=1}^n \left(\frac{1}{\rho + \tau} \right) \left[\pi_t(\Delta) - \pi_t(1) + \frac{(\zeta - 1)}{\phi_I} \lambda^{-\Delta} I^\zeta w_t \right] \\ &= \frac{1}{\rho + \tau} \left[\sum_{i=1}^n \pi_t(\Delta) + \frac{n(\zeta - 1)}{\phi_x} x^\zeta w_t + \sum_{i=1}^n \frac{(\zeta - 1)}{\phi_I} \lambda^{-\Delta} I^\zeta w_t \right]. \end{aligned} \quad (\text{C.34})$$