Essays on Self-employment, the Gig Economy, and Labor Market Policy

Kisan Choi

A dissertation
submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

University of Washington

2025

Reading Committee:
Fabio Ghironi, Chair
Brian Greaney
Andrei Zlate

Program Authorized to Offer Degree:
Economics

University of Washington

Abstract

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Chair of the Supervisory Committee:
Paul F. Glaser Professor Fabio Ghironi
Department of Economics

What options are available to a worker who loses their job today? For many, self-employment provides an alternative source of income in the absence of wage employment. The recent rise of digital labor platforms has introduced a new form of self-employment—commonly referred to as "gig work"—characterized by immediate and flexible access to income-generating opportunities. A decade ago, most such platforms were virtually nonexistent; today, they account for a sizable share of labor market activity, particularly among lower-income workers. Despite growing attention, the aggregate effects of gig work remain insufficiently understood. This dissertation aims to fill this gap by developing a macroeconomic model and analyzing how the expansion of gig work reshapes economic outcomes and policies.

Chapter 1 examines gig work as a novel form of self-employment that offers insurance against labor market risk. I develop a quantitative model that captures distinct characteristics of gig jobs—such as low entry barriers, high flexibility, and relatively low earnings—and calibrate it to replicate key patterns in the U.S. labor market. The results show that the availability of gig work reduces unemployment, particularly benefiting low-skilled and low-wealth individuals. Welfare improves, especially for unemployed workers who are ineligible for unemployment insurance, as gig work provides an alternative form of income support. However, aggregate productivity declines due to a shift of labor into the low-productivity

sector. Transition dynamics reveal a trade-off: while gig work cushions the rise in unemployment during economic downturns, it also slows recovery. Policymakers should consider this trade-off when considering how to regulate gig work.

Building on these insights, Chapter 2 investigates how the availability of fallback self-employment—especially flexible gig work—alters the effectiveness of labor market policies. I evaluate five key policy instruments: unemployment insurance (UI), firing costs, worker bargaining power (unionization), hiring subsidies, and job-matching efficiency improvements. Counterfactual simulations reveal that policy effects vary significantly depending on whether fallback work is available and how workers transition across occupations. Gig work amplifies the effects of UI benefit changes, mitigates the adverse impact of higher firing costs and stronger bargaining power, and reduces the effectiveness of active labor market programs. These effects operate primarily through gig work's role as an insurance mechanism and a substitute for unemployment. These findings highlight the importance of designing labor market policies that account for the growing prevalence of flexible employment arrangements.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Table Number | Page

ACKNOWLEDGMENTS

My time during doctoral study was both challenging and deeply rewarding. Returning to academia after a long break from college definitely had its hurdles, as I worked to get back into the rhythm of study and research. The COVID-19 pandemic then added another layer of difficulty, making it often hard to stay focused. I am truly grateful to the many people who helped me navigate these challenges and regain my academic footing.

First and foremost, I would like to express my sincere gratitude to my advisor, Fabio Ghironi. His guidance, insight, and steady encouragement were invaluable throughout this journey. I especially appreciate his patience as I found my way in developing my ideas and worked through early, sometimes imperfect, results.

I am also very grateful to Brian Greaney. His teaching equipped me with essential technical tools and introduced me to many valuable references. The core idea for my dissertation actually started as a proposal in one of his lectures, and I thank him for that inspiration and his ongoing support.

I also want to thank Dr. Andrei Zlate. Despite his demanding schedule, he generously gave his time and thoughtful advice during our remote meetings. His dedication and encouragement really made a difference and left a lasting impression on me.

My heartfelt thanks go to my colleagues and friends; your camaraderie and support have made this doctoral path not only more manageable but also significantly more meaningful. Above all, this achievement would have been impossible without my family–thank you for your unwavering support and steadfast belief in me.

DEDICATION

To Ahra and Jigu

Chapter 1

HETEROGENEITY IN SELF-EMPLOYMENT: EFFECT OF THE INTRODUCTION OF THE GIG ECONOMY

1.1 Introduction

This chapter examines the effects of the "gig economy" on labor market and welfare outcomes at the aggregate level. The rise of digital labor platforms, such as Uber and DoorDash, has significantly transformed the landscape of employment. The emergence of the gig economy, a new form of self-employment characterized by relatively low entry costs, has created new opportunities for income generation, particularly during periods of unemployment. As noted by Jackson (2022), many American workers have been turning to gig jobs as a means to navigate unemployment spells. Furthermore, data from the Survey of Consumer Finances highlight a growing polarization in self-employment across income percentiles, with a marked increase in low-earning self-employment in recent years.[1] Empirical studies suggest that this rise in low-earning self-employment is linked to the emergence of the gig economy (Boeri et al., 2020; Henley, 2022).

Although gig work is classified as a form of self-employment, it has unique features that differentiate it from traditional self-employment. The barriers to entry for gig work are relatively low, as participants do not require substantial initial investments and can quickly access job opportunities through digital platforms. This allows individuals to generate income during adverse economic conditions and effectively serves as insurance against negative income shocks. As a result, individuals with lower skill levels, financial constraints, and higher earning risks—who may have previously pursued traditional self-employment or

[1] Surveys from 2016 and 2019 show that the self-employment rate for the bottom 10% of income percentiles is noticeably higher than its long-run average (24% versus 18.4%, respectively).

remained unemployed—may be better off by opting for gig work. From the perspective of firms, gig employment influences job creation decisions by affecting labor market conditions and profitability.

To analyze these dynamics, I construct a quantitative model of the macro-economy that captures the empirical characteristics of different forms of self-employment and allows me to examine the effects of the gig economy on labor markets and welfare. The model accounts for agents' heterogeneity in productivity and wealth, along with labor market risks that drive transitions between employment statuses. Specifically, the model incorporates earning risks from idiosyncratic productivity shocks and labor market shocks in an incomplete market framework akin to the Bewley-Huggett-Aiyagari (BHA) model. To fully understand the labor market effects of the gig economy, I merge the BHA framework with a search-and-matching model of the labor market in the tradition of Diamond, Mortensen, and Pissarides (DMP). Calibration to U.S. data shows that the model successfully captures the observed selection patterns into gig employment or traditional self-employment (characterized by higher entry costs and less frequent opportunities), the concentration of gig employment within the lower-earning segments of the income distribution, and transitions across various labor market statuses.

Comparing the results of the model with gig employment to those of a version without it reveals that the advent of the gig economy reduces the unemployment rate, particularly benefiting low-skilled and asset-poor individuals drawn to gig work as an alternative income source. Moreover, workers employed by firms (i.e., not self-employed) experience wage increases, as the option of gig work strengthens their bargaining position. However, these higher wages reduce the surplus from new matches, leading firms to post fewer job vacancies. Welfare analysis shows that the gig economy generates gains across all demographic groups, especially for the unemployed ineligible for unemployment insurance. These gains stem primarily from the gig sector's role as an insurance mechanism, mitigating income risks associated with productivity shocks and labor market frictions. However, as more workers shift into lower-productivity gig employment, aggregate output declines.

To understand how these effects unfold over time, I examine the model's transition dynamics following two shocks: the introduction of gig work and a temporary adverse aggregate productivity shock. The opening of the gig sector generates an immediate reallocation of unemployed and constrained workers into gig work, reducing unemployment and raising short-run output. Over time, however, the shift toward lower-productivity occupations leads to a gradual decline in aggregate output and investment. In recessions, gig work softens the rise in unemployment by absorbing displaced workers—a "soft landing" effect—but also slows recovery as labor remains in the gig sector with limited search intensity. These dynamics highlight a trade-off: while gig work enhances income smoothing and flexibility in downturns, it can dampen long-run productivity growth.

These findings have important implications for regulating gig work. The model suggests that gig jobs help workers during downturns by providing a quick way to earn income. However, they may reduce job search and shift workers into a lower-productivity sector. Policymakers should weigh the short-term benefits against potential long-term costs when considering how to regulate the gig economy.

Related Literature This study relates to research on heterogeneous self-employment and selection mechanisms. Levine and Rubinstein (2017) categorizes self-employed individuals as incorporated or unincorporated, explaining their motivations. Recent studies emphasize the role of labor market risks in this selection process; for example, Poschke (2024) links these risks to cross-country differences in occupational composition, while Garcia-Cabo and Madera (2019) finds that lifetime earnings risk influences entry into self-employment. Herreño and Ocampo (2023) further examines subsistence self-employment under unemployment risk and financial frictions. This study contributes to the literature by presenting a distinct selection mechanism for a new type of self-employment characterized by uninsurable earnings risks and labor market frictions, using a dynamic general equilibrium model.

This paper also relates to studies on the welfare implications of self-employment. Research by Quadrini (2000) and Cagetti and De Nardi (2006) quantifies how financial frictions distort firm scale and contribute to wealth concentration through occupational choice models. Lee (2021) finds that self-employment incurs higher welfare costs during business cycles due to its inherent volatility. Recent studies have examined self-employment policies and their welfare outcomes (Humphries, 2021; Herreño and Ocampo, 2023), extending the literature by addressing distributional implications. This study investigates the welfare implications of a new form of self-employment for the overall economy, as well as for groups with varying skill levels and wealth.

Furthermore, this study contributes to the literature on the economic effects of the gig economy. Empirical studies have identified various benefits of gig work, such as increased productivity (Cramer et al., 2016) and greater economic surplus (Chen et al., 2019), primarily due to improved labor matching and flexibility. Koustas (2018) and Jackson (2022) show that gig work can help participants manage income fluctuations and address unemployment by providing flexible job opportunities that offset income losses. To my knowledge, this study is the first to analyze the general equilibrium effects of the gig economy by examining labor market dynamics.

The rest of the chapter is organized as follows. Section 1.2 summarizes the empirical characteristics of gig work. Section 1.3 introduces a general equilibrium model of occupational choice with labor market frictions. Section 1.4 presents the model's calibration and validation. Section 1.5 analyzes the effects of gig work on labor market and welfare outcomes. Section 1.6 examines the transition dynamics following the introduction of gig work and an aggregate productivity shock. Section 1.7 concludes with policy implications.

1.2 Empirical Characteristics

1.2.1 Data

This section summarizes the empirical characteristics of gig work, distinguishing it from traditional self-employment. Common household and labor force surveys—such as the U.S. Current Population Survey (CPS)—often fail to capture recent developments in self-employment, as noted by Abraham et al. (2021) and OECD et al. (2023).

To address these limitations, I use microdata from the *Survey of Household Economics and Decisionmaking* (SHED), an annual survey conducted by the Federal Reserve Board since 2013.[2] Since 2016, SHED has included targeted questions on gig work, allowing for analysis of both the demographic and financial characteristics of gig workers, as well as their employment trajectories over time.

I construct two datasets from SHED. First, to capture a comprehensive view of gig work participation, I use pooled cross-sectional data from 2016–2019.[3] This dataset includes 53,934 respondents and is used to analyze labor market status and worker characteristics. Second, to examine employment transitions, I construct a panel by linking individuals across two consecutive survey years.[4] The resulting panel dataset includes 10,607 individuals. All analyses apply the Federal Reserve's official sampling weights.

1.2.2 Characteristics of Gig Workers

Between 2016 and 2019, 34.5% of the U.S. labor force engaged in gig activities during the survey period of each year. The SHED defines gig work broadly to include various forms of alternative income-generating activities, such as house cleaning, childcare, property rental, delivery, and ridesharing. This broad definition captures a wider range of nonstandard work arrangements beyond traditional employment contracts or formal self-employment, making

[2] Possible alternatives include administrative data such as Schedule C from U.S. federal income tax returns. However, shifts in reporting behavior complicate the accurate measurement of self-employment income (Garin et al., 2022). The Bureau of Labor Statistics conducted a one-time survey on electronically mediated work in 2017, but it only captured online-based gig workers who reported such work as their main job. In Europe, the 2017–2018 COLLEEM survey covers 15 countries and includes platform work, making it broadly comparable to SHED (Pesole et al., 2018). More recently, Eurostat piloted a digital platform labor module in the 2023 EU Labour Force Survey.

[3] Beginning in 2020, major revisions to SHED narrowed the scope of gig work questions, limiting comparability across years.

[4] SHED re-interviews a subset of respondents for up to three years. However, due to sample attrition in the third wave, I focus on two-year panels: 2016–2017, 2017–2018, and 2018–2019.

it especially useful for macroeconomic analysis.[5]

I classify gig workers into three groups based on their primary motivation: *primary gig workers*, *secondary gig workers*, and *others*. Primary gig workers report gig activities as their main source of income. Secondary gig workers engage in gig work to supplement other income or support household finances. The remaining group pursues gig activities for purposes such as skill development or personal interest. Primary gig workers make up 5.7% of the labor force, while secondary gig workers account for 17.7%.

Table 1.1: Gig Work Participation Rate (%)

	All Gig Workers	Primary Gig	Secondary Gig	Other
Among labor force	34.5	5.7	17.7	11.1
Among all adults	29.6	4.5	14.2	10.9

Note: Based on pooled data from 2016–2019.

Despite being a smaller group, primary gig workers exhibit distinct demographic and economic profiles compared to other gig workers and the traditionally self-employed. As shown in Table 1.2, they tend to be younger and are less likely to hold a college degree.

Economically, primary gig workers are more vulnerable. Over one-third (37.1%) report annual incomes below $15,000—more than twice the share among secondary gig workers (18.4%) and substantially higher than among the non-gig self-employed (15.2%). They also experience higher rates of job loss (14.8%) and credit denial (41.4%) relative to other groups.

Figure 1.1 further illustrates that primary gig workers are concentrated at the lower end of both the income and wealth distributions. In contrast, secondary gig workers resemble traditional self-employed individuals and paid employees in their financial profiles. Based on these differences, the remainder of this study focuses primarily on the characteristics and labor market dynamics of primary gig workers.

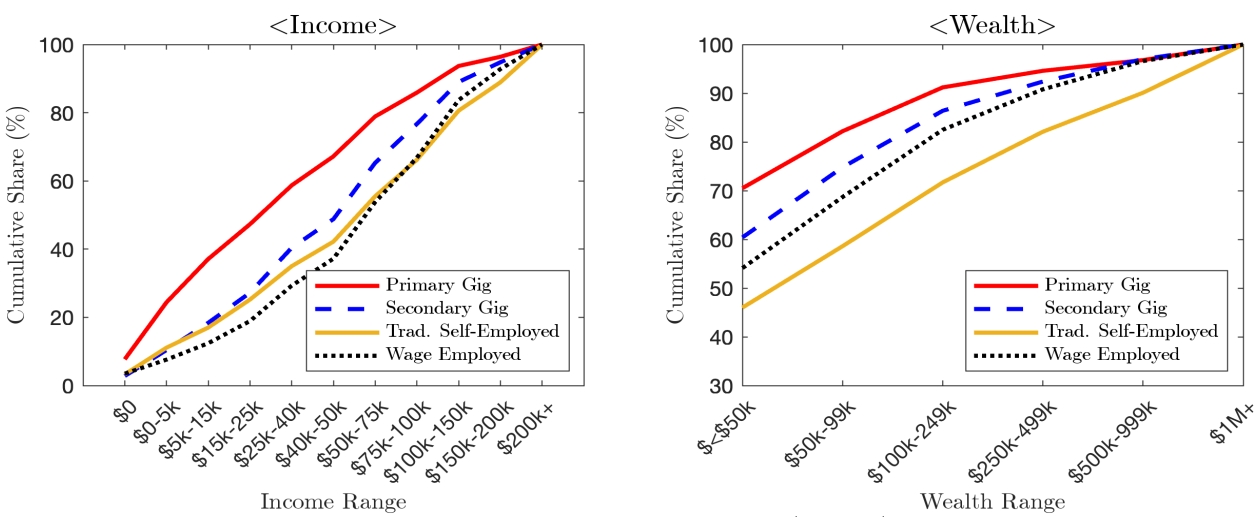
[5] Definitions of the gig economy vary across studies and surveys. Narrower definitions typically focus only on digitally mediated services via online platforms or mobile apps. For example, a survey by the Bureau of Labor Statistics found that just 1% of the U.S. workforce was engaged in electronically mediated work in 2017.

Table 1.2: Demographic and Economic Characteristics

	Primary Gig	Secondary Gig	Self-employed[2]	Labor Force
Demographic Characteristics				
Age (mean)	37.8	40.0	51.6	42.8
Higher Education[1] (%)	22.5	38.8	38.4	38.3
Female Share (%)	50.1	50.7	46.0	48.9
Economic Outcomes				
Income in Past Year $\leq \$15,000$ (%)	37.1	18.4	15.2	16.0
Job Loss in Past Year (%)	14.8	6.9	3.5	5.7
Credit Turn-Down (%)	41.4	30.9	14.1	23.7
Multiple Jobs (%)	26.8	31.8	10.6	14.8
Gig Hours > 20 in Past Month (%)	50.1	32.2	5.2	1.8

[1] Bachelor's degree or higher.
[2] Self-employed individuals who are not classified as primary or secondary gig workers.

Figure 1.1: Income and Wealth Distribution of Gig Workers



Note: The horizontal axis represents income and wealth (savings) intervals as specified in the survey.

1.2.3 Determinants of Gig Work Participation

To identify factors associated with participation in gig work, I estimate weighted logistic regressions. The model is specified as:

$$\begin{aligned}\text{logit}\,(P(GigP_i = 1)) = \beta_0 + \beta_1\,\text{Age}_i + \beta_2\,\text{Female}_i + \beta_3\,\text{College}_i \\ + \beta_4\,\text{Income}_i + \beta_5\,\text{JobLoss}_i + \beta_6\,\text{CreditDenial}_i + \gamma_t\,\text{Year}_i + \epsilon_i\end{aligned}$$

where $GigP_i = 1$ if individual i identifies gig work as their primary job. The regressions apply survey weights and include year fixed effects.

The results, shown in Table 1.3, indicate that *younger individuals* and those *without a college degree* are significantly more likely to rely on gig work as their main source of income. There is a strong negative gradient with income: higher-income individuals are substantially less likely to report primary gig work. Furthermore, both *recent job loss* and *credit denial* are positively and significantly associated with gig reliance, underscoring the role of gig work as a fallback option in response to employment or financial shocks. Year fixed effects suggest a decline in primary gig participation in 2019 relative to earlier years, possibly reflecting improved labor market conditions.

1.2.4 Reclassification of Employment Status

In standard labor market classifications, primary gig workers may be reported as wage employees, self-employed, or unemployed.[6] Among primary gig workers, approximately 60% are classified as paid employees, 26% as self-employed, and 14% as unemployed (Table 1.4). These patterns are consistent with prior research highlighting the ambiguity and potential misclassification of gig workers' employment status (Abraham et al., 2021; Bracha & Burke, 2021, 2023).

[6] Some gig workers also report being out of the labor force, as gig tasks may be performed by retirees, students, or homemakers. This study focuses on individuals in the labor force, consistent with the model's exclusion of labor force participation decisions.

Table 1.3: Logistic Regression: Likelihood of Being a Primary Gig Worker

Variable	**Model 1**	**Model 2**	**Model 3**
Age	-0.027***	-0.013**	-0.012*
	(0.005)	(0.005)	(0.005)
Gender: Female	0.038	-0.049	-0.039
	(0.119)	(0.122)	(0.122)
Education: College or More	-0.748***	-0.383**	-0.295*
	(0.118)	(0.134)	(0.134)
Income Categories			
15k–40k		-0.901***	-0.919***
		(0.171)	(0.173)
40k–75k		-0.972***	-0.907***
		(0.181)	(0.183)
75k–150k		-1.359***	-1.182***
		(0.182)	(0.190)
150k or Higher		-1.634***	-1.487***
		(0.277)	(0.278)
Experience of Job Loss			0.983***
			(0.194)
Experience of Credit Denial			0.451**
			(0.137)
2017	-0.050	-0.084	-0.041
	(0.176)	(0.176)	(0.177)
2018	-0.016	-0.050	0.025
	(0.172)	(0.174)	(0.173)
2019	-0.606***	-0.665***	-0.605***
	(0.173)	(0.175)	(0.174)
Constant	-1.315***	-0.959***	-1.397***
	(0.273)	(0.274)	(0.298)
Number of Observations	10,523	10,523	10,523
Pseudo R^2	0.036	0.063	0.082

Notes: Coefficients are reported with standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The regression includes three specifications: (1) baseline demographics, (2) adds income categories, and (3) includes indicators of economic hardship.

Table 1.4: Reported Employment Status of Gig Workers (%)

	All Gig	Primary	Secondary	All Labor Force
Paid Employment	76.3	59.9	79.2	82.6
Self-Employment	18.0	26.0	16.8	12.4
Unemployment	5.7	14.1	4.0	4.9

Note: Based on pooled data from 2016–2019.

To address this ambiguity, I redefine employment status by introducing primary gig work as a distinct category. After reclassifying the 5.7% of the labor force identified as primary gig workers, the share of paid employment decreases by 3.4 percentage points, while self-employment and unemployment shares fall by 1.5 and 0.8 percentage points, respectively (Table 1.5). These shifts align with findings from Bracha and Burke (2023), who show that employment-to-population ratios would be understated if gig work is not separately identified.[7]

Table 1.5: Employment Status Composition (%)

	Current	New	Difference
Paid Employment	82.6	79.2	-3.4
Traditional Self-Employment	12.4	10.9	-1.5
Unemployment	4.9	4.1	-0.8
Gig Employment (Primary)	–	5.7	5.7

Note: Numbers represent the share of each employment status within the labor force (in percent).

[7]Bracha and Burke (2023) report that the employment-to-population ratio would have been 0.25 to 1.1 percentage points higher during 2015–2022 under conservative assumptions.

1.2.5 *Transition Rates*

Table 1.6 presents quarterly transition rates between employment statuses.[8] The results show that unemployed individuals (U) are more likely to transition into gig work (S_G) than into paid employment (E) or traditional self-employment (S_T), as indicated by the last column of the table. This suggests that primary gig work is often taken up by individuals following job loss, potentially as a short-term income source, rather than by salaried employees transitioning for better opportunities.

Moreover, gig workers exhibit the lowest persistence rate across all employment categories, with only 66% remaining in gig work the following period. This highlights the flexibility and fluidity of gig work relative to other employment types.

Table 1.6: Transition Rates Between Employment Statuses (%)

		$(t+1)$			
		E	S_T	U	S_G
(t)	E	97.5	0.8	0.5	1.2
	S_T	3.7	91.2	0.1	5.0
	U	19.2	4.1	68.4	8.3
	S_G	23.0	4.9	6.1	66.0

Note: Rates converted from annual to quarterly frequency.

1.3 Model

This section presents a structural model to examine the effects of introducing a new type of self-employment—primary gig work—into the economy. The model builds on the framework developed by Krusell et al. (2010), which integrates the Bewley–Huggett–Aiyagari (BHA) incomplete markets setting with the Diamond–Mortensen–Pissarides (DMP) search-

[8] The SHED data are recorded on an annual basis, which may not fully capture the short-duration nature of gig work. For example, Uber drivers exhibit high turnover and typically work only part of the year—on average, about three months (Mishel, 2018). I convert annual rates to a quarterly frequency to match the model's time period.

and-matching framework.[9] A key extension is the addition of occupational transitions, allowing individuals to move across employment, unemployment, and two distinct forms of self-employment.[10]

1.3.1 Environment

Demographics and Preferences Time is continuous, and the economy is populated by a unit mass of infinitely lived individuals. Agents are heterogeneous along three dimensions: productivity (z), asset holdings (a), and employment status (o). Workers are risk-averse and derive utility $u(c_{i,t})$ from consumption. Labor is supplied inelastically. For notational simplicity, the individual index i and time subscript t are omitted unless necessary.

Occupational Transitions The employment status o takes one of five values: paid employment (E); traditional self-employment (S_T); gig self-employment (S_G); unemployment with unemployment insurance (UI) benefits (U_Y); and unemployment without benefits (U_N). Figure 1.2 summarizes the occupational flows. Transitions across these states are governed by labor market frictions.[11]

- **Job destruction:** Employed workers lose their jobs at the exogenous rate λ_E, becoming unemployed with (U_Y) or without (U_N) UI eligibility.

- **Job finding:** Workers in U_Y, U_N, S_T, or S_G may find paid employment at rates

$$\begin{cases} f(\theta), & \text{if unemployed,} \\ \eta_j\, f(\theta), & \text{if in self-employment sector } j \in \{T, G\} \end{cases}$$

[9] Bardoczy (2017) provides a continuous-time version of the Krusell et al. (2010) model.

[10] The modeling of self-employment follows an approach similar to Herreño and Ocampo (2023).

[11] Rates with a tilde ($\tilde{\lambda}$) denote the Poisson arrival rates of opportunity shocks; untilded rates represent exogenous shocks. In λ_o, the subscript o indicates the origin state.

where $f(\theta)$ is the job-finding rate, which depends on market tightness θ. Self-employed individuals search less intensively and thus face a discounted rate $0 < \eta_j < 1$.

- **Self-employment entry and exit:** Unemployed workers may enter S_T or S_G at rate $\tilde{\lambda}_{U_j}$, regardless of UI status. Self-employed firms in sector j terminate exogenously at rate λ_{S_j} or endogenously at rate $\tilde{\lambda}_{S_j}$, returning workers to unemployment without benefits (U_N).

- **UI expiration:** Benefit recipients (U_Y) lose eligibility at rate λ_U and move to U_N.

To isolate the core mechanism driving selection from unemployment into traditional versus gig self-employment, the model abstracts from direct transitions between these two forms of self-employment. This simplification is supported by empirical evidence in Section 1.2, which shows that flows from traditional self-employment into gig work are quantitatively small relative to entries from unemployment.

Additionally, I model match separations as exogenous Poisson shocks, consistent with the canonical search-and-matching framework (Mortensen & Pissarides, 1994). Under this assumption, all exits are involuntary, simplifying the analysis of firms' vacancy-posting decisions in response to improvements in workers' outside options. A version of the model with endogenous separations is examined as a robustness exercise.[12]

Production Technology Production takes place in two types of firms: corporate firms and self-employed firms.

Corporate Firms: A continuum of risk-neutral corporate firms operates competitively, with each firm maintaining a single job position. Each position generates output according

[12] This ensures that all separations are involuntary and retains analytical tractability, allowing me to isolate how an improved worker outside option (gig work) affects equilibrium tightness and vacancy creation through the free-entry condition. Introducing endogenous separations would give firms a second margin of adjustment (via a firing threshold), which is addressed in Appendix B. The qualitative mechanism remains unchanged.

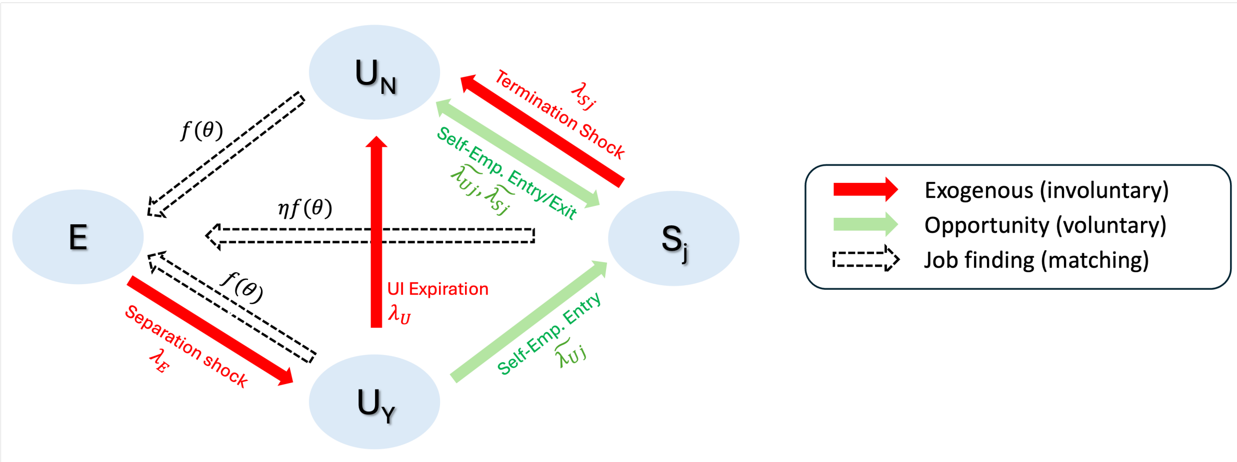


Figure 1.2: Occupational Transitions

Note: Red arrows indicate exogenous transitions; green arrows show voluntary opportunity-based transitions; dashed black arrows represent job-finding flows governed by matching frictions. S_j denotes either traditional (S_T) or gig self-employment (S_G). Rates with a tilde ($\tilde{\lambda}$) denote Poisson arrival rates of opportunity shocks; untilded rates represent exogenous shocks. In λ_o, the subscript o indicates the origin state.

to the per-worker production function

$$y(z,k) = z\,f(k), \quad f'(k) > 0, \quad f''(k) < 0$$

where z denotes the idiosyncratic productivity of the worker, which evolves stochastically via a Markov process.

Self-Employed Firms: Self-employed workers operate without hiring and differ in their production technologies:

$$y_j(z,k) = e_j(z)\,f_j(k), \quad f_j'(k) > 0, \quad f_j''(k) < 0, \quad j \in \{T, G\}$$

Here, T refers to the traditional self-employment sector and G to the gig sector. The function $e_j(z)$ is increasing in z and captures how a worker's productivity affects efficiency in sector

j. Self-employed workers face a collateral constraint on capital:

$$k \leq \zeta\, a, \quad \zeta \in (0, 1]$$

where a denotes asset holdings.

Labor Market Corporate firms post vacancies, and individuals not in paid employment search for jobs in the labor market. They are randomly matched according to an aggregate matching function:

$$M(u, s_j, v) = \chi(u + \sum_{j \in T,G} \eta_j s_j)^{\psi} v^{1-\psi} \tag{1.1}$$

The number of matches depends on the matching efficiency ($\chi > 0$), the total number of job vacancies (v), and the total job search effort, given by $(u + \sum_{j \in \{T,G\}} \eta_j s_j)$, where u is the unemployment rate and s_j is the share of self-employed workers in sector j. Self-employed workers are assumed to be less efficient in searching or to allocate less time to job search, contributing only a fraction $\eta_j \in (0, 1)$ of the search effort of the unemployed. Labor market tightness is defined as the ratio of vacancies to total search effort:

$$\theta = \frac{v}{u + \sum_{j \in T,G} \eta_j s_j} \tag{1.2}$$

Therefore, the probability that a vacancy finds a worker is given by

$$q(\theta) = \frac{M(u, s_j, v)}{v} = \chi \theta^{-\psi}$$

and the probability that a job seeker finds a job is

$$f(\theta) = \frac{M(u, s_j, v)}{u + \sum_{j \in T,G} \eta_j s_j} = \chi \theta^{1-\psi}$$

Asset Market Following Aiyagari (1994), markets are incomplete. Workers partially insure against labor-market and productivity risks by allocating their wealth between two assets: capital, k (a production input), and equity, p (a claim on corporate firm profits). A no-arbitrage condition equates the net return on capital, $r-\delta$, to the dividend yield on equity, $\frac{d}{p}$, where δ denotes the depreciation rate, d the dividend, and p the equity price. Each worker's total asset holdings are defined as

$$a = s(k)\,k + s(p)\,p \tag{1.3}$$

where $s(\cdot)$ denotes the portfolio weight on each asset, allowing a to serve as a single state variable. Agents face a borrowing constraint, $\underline{a}$.

1.3.2 Workers' Problem

The value function $W_o(a,z)$ denotes the expected discounted utility of an individual in occupational state o, holding assets a and productivity z.

Paid Employment The Hamilton–Jacobi–Bellman (HJB) equation for a paid-employed worker is

$$\begin{aligned} \rho\, W_E(a,z) = {} & \max_c u(c) + \partial_a W_E(a,z)\,\dot{a} + \lambda_E\big[W_{U_Y}(a,z) - W_E(a,z)\big] \\ & + \partial_z W_E(a,z)\,\mu(z) + \tfrac{1}{2}\,\partial_{zz} W_E(a,z)\,\sigma^2(z) \\ \text{s.t.} \quad & \dot{a} = (1-\tau)\,w(a,z) + (r-\delta)\,a - c, \quad a \geq \underline{a} \end{aligned} \tag{1.4}$$

After-tax labor income is $(1-\tau)\,w(a,z)$, where τ denotes a flat labor-income tax. Asset returns net of depreciation are $(r-\delta)\,a$. Job separation occurs at an exogenous rate λ_E. The productivity process has drift $\mu(z)$ and volatility $\sigma(z)$.

Unemployment The HJB equation for an unemployed agent in state U_k ($k \in \{Y, N\}$) is

$$\begin{aligned}\rho\, W_{U_k}(a,z) = \max_c u(c) + \partial_a W_{U_k}(a,z)\,\dot{a} + f(\theta)\big[W_E(a,z) - W_{U_k}(a,z)\big] \\ + \mathbb{1}_{k=Y}\,\lambda_U\big[W_{U_N}(a,z) - W_{U_k}(a,z)\big] + \sum_{j\in\{T,G\}} \tilde{\lambda}_{U_j}\,\max\{W_{S_j}(a,z) - W_{U_k}(a,z), 0\}\end{aligned} \tag{1.5}$$

$$\text{s.t.}\quad \dot{a} = (1-\tau)\,B_k(z) + (r-\delta)\,a - c, \quad a \geq \underline{a}$$

Flow income during unemployment is given by:

$$B_Y(z) = \min\{b\,\hat{w}(z),\ \bar{B}\}, \quad B_N = b_0$$

where b is the UI replacement rate, $\hat{w}(z)$ the average wage for productivity z, $\bar{B}$ the UI cap, and b_0 the flat social-security benefit.[13] Productivity z remains fixed during unemployment spells. UI eligibility expires at rate λ_U. Job finding in the paid-employment sector occurs at a rate $f(\theta)$. With arrival rate $\tilde{\lambda}_{U_j}$, unemployed workers receive an opportunity to enter self-employment in sector $j \in \{T, G\}$.

Self-Employment The HJB equation for a self-employed agent in sector $j \in \{T, G\}$ is

$$\begin{aligned}\rho\, W_{S_j}(a,z) = \max_c u(c) + \partial_a W_{S_j}(a,z)\,\dot{a} + \lambda_{S_j}\big[W_{U_N}(a,z) - W_{S_j}(a,z)\big] \\ + \tilde{\lambda}_{S_j}\,\max\{W_{U_N}(a,z) - W_{S_j}(a,z), 0\} + \eta_j\, f(\theta)\big[W_E(a,z) - W_{S_j}(a,z)\big] \\ + \partial_z W_{S_j}(a,z)\,\mu(z) + \tfrac{1}{2}\,\partial_{zz} W_{S_j}(a,z)\,\sigma^2(z)\end{aligned} \tag{1.6}$$

$$\text{s.t.}\quad \dot{a} = (1-\tau)\,\pi_j(z,k) + (r-\delta)\,a - c, \quad a \geq \underline{a}$$

$$\pi_j(z,k) = \max_{0\leq k\leq \zeta\, a} y_j(z,k) - r\,k$$

[13] Using average wages avoids tracking individual wage histories, reducing computational complexity (e.g., Setty and Yedid-Levi (2021)).

Self-employed workers earn profits $\pi_j(z,k)$ by optimally choosing capital k subject to the collateral constraint $k \leq \zeta\, a$. Exogenous business termination occurs at rate λ_{S_j}, sending the worker to unemployment without benefits (U_N). Opportunity-driven exits happen at rate $\tilde{\lambda}_{S_j}$, likewise returning the worker to U_N. At rate $\eta_j f(\theta)$, the self-employed worker may also match with a paid-employment job.

1.3.3 Corporate Firm's Problem

The value of a filled job for a corporate firm, $J(a,z)$, satisfies the following HJB equation:

$$\begin{aligned}(r-\delta)\, J(a,z) = \; & y(z,k) \;-\; w(a,z) \;-\; r\,k + \;\partial_a J(a,z)\,\dot{a} + \;\lambda_E\big[V - J(a,z)\big] \\ & + \;\partial_z J(a,z)\,\mu(z) + \tfrac{1}{2}\,\partial_{zz} J(a,z)\,\sigma^2(z)\end{aligned} \tag{1.7}$$

where $y(z,k) - w(a,z) - rk$ is the flow profit from the match, net of labor and capital costs. The state variable a enters because the worker's savings decision, $\dot{a}$, can affect future wages $w(a,z)$. Matches dissolve exogenously at rate λ_E, at which point the firm obtains the value of a vacancy, V.

The value of maintaining a vacancy, V, is given by

$$\begin{aligned}(r-\delta)\, V = \; & -\;\xi + q(\theta) \iint \Omega(a,z)\,\big[J(a,z) - V\big]\, da\, dz, \qquad (1.8)\\ \Omega(a,z) = \; & \frac{d_U(a,z) \;+\; \sum_{j\in\{T,G\}} \eta_j\, d_{S_j}(a,z)}{u + \sum_{j\in\{T,G\}} \eta_j\, s_j}\end{aligned}$$

where ξ is the per-vacancy posting cost and $q(\theta)$ the matching rate. The function $\Omega(a,z)$ is the weighted density of job seekers—unemployed (d_U) and self-employed (d_{S_j})—in the pool, with u and s_j their respective mass. Under free entry, firms post vacancies until $V = 0$.

1.3.4 Wage Setting

Wages are determined by Nash bargaining, as in standard search-and-matching models:

$$w(a,z) \;=\; \arg\max_{w} \big[\widetilde{W}_E(w,a,z) - W_{U_Y}(a,z)\big]^{\psi} \big[\widetilde{J}(w,a,z) - V\big]^{1-\psi} \tag{1.9}$$

The worker's outside option is the value of receiving UI benefits, $W_{U_Y}(a,z)$, as in Mortensen and Pissarides (1994). It is assumed that this outside option applies uniformly to new hires from self-employment and from UI-non-eligible unemployed workers, since wages are negotiated after match formation and $W_{U_Y}(a,z)$ represents the relevant fallback for all.

A key advantage of the continuous-time setup is that it yields a closed-form expression for the negotiated wage in terms of value and policy functions (derivation in the Appendix D). The optimal wage $w^*(a,z)$ can be written as

$$w^*(a,z) = \psi \, \frac{S_{\text{firm}}}{1 - \partial_a J(a,z)\,(1-\tau)} - (1-\psi)\, \frac{S_{\text{worker}}}{\partial_a W_E(a,z)\,(1-\tau)} \tag{1.10}$$

where

$$\begin{aligned} S_{\text{firm}} &= y(z,k) - r\,k + \partial_a J(a,z)\big[(r-\delta)\,a - c_E(a,z)\big] + \partial_z J(a,z)\,\mu(z) + \tfrac{1}{2}\,\partial_{zz} J(a,z)\,\sigma^2(z) \\ S_{\text{worker}} &= u\big(c_E(a,z)\big) - \rho\, W_{U_Y}(a,z) + \partial_a W_E(a,z)\big[(r-\delta)\,a - c_E(a,z)\big] \\ &\quad + \partial_z W_E(a,z)\,\mu(z) + \tfrac{1}{2}\,\partial_{zz} W_E(a,z)\,\sigma^2(z) \end{aligned}$$

The function $w^*(a,z)$ balances the firm's surplus S_{firm} against the worker's surplus S_{worker}. Unemployment insurance benefits raise the worker's outside option, thereby increasing their bargaining power and putting upward pressure on wages. A higher bargaining power parameter ψ increases the worker's share. Wages also depend on asset holdings because higher a increases a worker's continuation value outside the match via returns on savings. In particular, larger assets raise $\partial_a W_E(a,z)$, the marginal value of wealth, strengthening the worker's bargaining position and leading to higher negotiated wages, as discussed in Krusell et al.

(2010).

The denominators $1-\partial_a J(a,z)\,(1-\tau)$ and $\partial_a W_E(a,z)\,(1-\tau)$ serve as adjustment factors that align after-tax marginal values: $\partial_a W_E(a,z)$ is the marginal utility of wealth to the worker, while $1-\partial_a J(a,z)$ captures the marginal cost of a transfer to the firm, net of its effect on future wages.

1.3.5 Distribution of Workers

Let $d_o(a,z)$ denote the joint density of asset holdings a and productivity z in occupational state $o \in \{E, U_Y, U_N, S_T, S_G\}$. In steady state ($\dot{d}_o = 0$), the Kolmogorov–Forward equations become

$$
\begin{aligned}
0 &= -\partial_a\big[\dot{a}_E(a,z)\,d_E(a,z)\big] - \lambda_E\,d_E(a,z) + f(\theta)\,d_{U_Y}(a,z) + \eta\,f(\theta)\,d_{S_G}(a,z)\\
&\quad - \partial_z\big[\mu(z)\,d_E(a,z)\big] + \tfrac{1}{2}\,\partial_{zz}\big[\sigma^2(z)\,d_E(a,z)\big]\\
0 &= -\partial_a\big[\dot{a}_{U_N}(a,z)\,d_{U_N}(a,z)\big] - \Big[f(\theta) + \sum_{j\in\{T,G\}} \tilde{\lambda}_{U_j}\Phi_{U_N S_j}(a,z)\Big]\,d_{U_N}(a,z)\\
&\quad + \sum_{j\in\{T,G\}} \big[\lambda_{S_j} + \tilde{\lambda}_{S_j}\,\Phi_{S_j U_N}(a,z)\big]\,d_{S_j}(a,z) + \lambda_U\,d_{U_Y}(a,z)\\
0 &= -\partial_a\big[\dot{a}_{U_Y}(a,z)\,d_{U_Y}(a,z)\big] - \Big[f(\theta) + \sum_{j\in\{T,G\}} \tilde{\lambda}_{U_j}\Phi_{U_Y S_j}(a,z)\Big]\,d_{U_Y}(a,z) + \lambda_E\,d_E(a,z)\\
0 &= -\partial_a\big[\dot{a}_{S_T}(a,z)\,d_{S_T}(a,z)\big] - \big[\eta_T f(\theta) + \lambda_{S_T} + \tilde{\lambda}_{S_T}\Phi_{S_T U_N}(a,z)\big]\,d_{S_T}(a,z)\\
&\quad + \tilde{\lambda}_{U_T}\sum_{k\in\{Y,N\}} \Phi_{U_k S_T}(a,z)\,d_{U_k}(a,z) - \partial_z\big[\mu(z)\,d_{S_T}(a,z)\big] + \tfrac{1}{2}\,\partial_{zz}\big[\sigma^2(z)\,d_{S_T}(a,z)\big]\\
0 &= -\partial_a\big[\dot{a}_{S_G}(a,z)\,d_{S_G}(a,z)\big] - \big[\eta_G f(\theta) + \lambda_{S_G} + \tilde{\lambda}_{S_G}\Phi_{S_G U_N}(a,z)\big]\,d_{S_G}(a,z)\\
&\quad + \tilde{\lambda}_{U_G}\sum_{k\in\{Y,N\}} \Phi_{U_k S_G}(a,z)\,d_{U_k}(a,z) - \partial_z\big[\mu(z)\,d_{S_G}(a,z)\big] + \tfrac{1}{2}\,\partial_{zz}\big[\sigma^2(z)\,d_{S_G}(a,z)\big]\\
1 &= \sum_{o\in\{E,U_Y,U_N,S_T,S_G\}} \int\!\!\int d_o(a,z)\,\mathrm{d}z\,\mathrm{d}a
\end{aligned} \tag{1.11}
$$

Here $\Phi_{U_k S_j}(a,z)$ and $\Phi_{S_j U_k}(a,z)$ denote the decision rules for entering and exiting self-employment, respectively, conditional on receiving an opportunity shock.

1.3.6 Equilibrium

A stationary equilibrium consists of the following: the value functions $W_o(a, z)$ and consumption policies $c_o(a, z)$ for each occupational state $o \in \{E, U_Y, U_N, S_T, S_G\}$; the self-employment entry and exit decision functions $\Phi_{U_k S_j}(a, z)$ and $\Phi_{S_j U_k}(a, z)$; the corporate firm value function $J(a, z)$; the capital demands $k(z)$ for corporate firms and $k_T(z)$, $k_G(z)$ for self-employed firms; the steady-state joint density $d_o(a, z)$ over assets and productivity; and the equilibrium prices—wage w, interest rate r, equity price p, and labor-income tax rate τ. These objects satisfy:

1. Worker optimization. Given (w, r, p, τ, θ), the value and policy functions solve the HJB equations (1.4)–(1.6). The optimal consumption rule is

$$c_o(a, z) = \big(u'\big)^{-1}\big(\partial_a W_o(a, z)\big)$$

and the self-employment capital demands satisfy

$$k_j(a, z) = \arg \max_{0 \leq k \leq \zeta\, a} \{y_j(z, k) - r\, k\}, \quad j \in \{T, G\}$$

2. Firm optimization. Given $(w, r, \tau, \theta, d_o)$, the corporate HJBs (1.7) and (1.8) hold with the free-entry condition $V = 0$. The corporate capital demand solves

$$k(z) = \arg \max_{k \geq 0} \{y(z, k) - w(a, z) - r\, k\} \tag{1.12}$$

3. The wage schedule $w(a, z)$ satisfies the Nash-bargaining solution (1.10).

4. Asset market clearing.

$$\iint \big[k(z)\, d_E + k_T(z)\, d_{S_T} + k_G(z)\, d_{S_G}\big]\, da\, dz + p = \sum_o \iint a\, d_o(a, z)\, da\, dz$$

5. Total dividends equal aggregate corporate profits net of vacancy costs:

$$d = \int\int \left[y(z,k) - w(a,z) - r\,k\right] d_E(a,z)\, da\, dz - \xi\, v$$

6. Government budget balancing. Labor-income tax revenues finance UI and social-security benefits:

$$\tau \int\int \left[w(a,z)\, d_E + \pi_T(z,k)\, d_{S_T} + \pi_G(z,k)\, d_{S_G}\right] da\, dz = (1-\tau) \int\int \left[B_Y\, d_{U_Y} + B_N\, d_{U_N}\right] da\, dz$$

7. Stationarity of distributions. The density $d_o(a,z)$ satisfies the steady-state Kolmogorov–Forward equations 1.11.

The model must be solved numerically, as its equilibrium conditions form a system of nonlinear equations with no closed-form solution. A detailed description of the numerical algorithm is provided in the Appendix A.

1.4 Calibration

To address data limitations related to the gig sector and to separately identify parameters governing the traditional sector, I adopt a two-stage calibration procedure. In the first stage, I abstract from gig work entirely and match key labor market and traditional self-employment moments using data from the Current Population Survey (CPS) and the Survey of Consumer Finances (SCF) for the pre-2014 period.[14] In the second stage, I introduce the gig sector while holding fixed the parameters calibrated in the first stage. I then calibrate the gig-specific parameters using SHED data, as constructed in Section 1.2[15]

[14] Although the CPS and SCF are extensive and reliable, they do not distinguish gig workers. In recent years, digital labor platforms have blurred the boundaries between employment categories (OECD, 2019), making these datasets unsuitable for jointly calibrating parameters for both types of self-employment.

[15] This approach assumes that the fundamental parameters governing traditional self-employment and aggregate labor market frictions remain unchanged following the expansion of the gig economy.

1.4.1 Preferences

Preferences are represented by a CRRA utility function,

$$u(c) = \frac{c^{1-\gamma}}{1-\gamma}$$

with $\gamma = 1.5$ as in Attanasio (1999). Time is discounted at a rate $\rho = 4\%$ per annum (1% per quarter). The idiosyncratic productivity process for z[16] is chosen to match the persistence and variance estimated in Floden and Lindé (2001).

1.4.2 Production Technology

In the corporate sector, output per match is given by

$$y(z, k) = z\, k^{\alpha}$$

where the capital share is set to $\alpha = 0.3$, consistent with standard macroeconomic practice.

In the self-employment sector, indexed by $j \in \{T, G\}$, the production function is specified as

$$y_j(z, k) = \varepsilon_j\, z^{\theta}\, k^{\nu_j}$$

where ν_j captures the self-employed worker's span of control and relative capital intensity, and ε_j determines the scale of production. The parameter θ governs how individual productivity z translates into output efficiency.

[16] Specifically, log productivity follows an Ornstein–Uhlenbeck process, the continuous-time analogue of an AR(1) process:

$$d \log z_t = -\tilde{\rho}_z \log z_t\, dt + \sigma_z\, dW_t \tag{1.13}$$

where $\tilde{\rho}_z$ measures persistence, σ_z denotes volatility, and W_t is a standard Brownian motion.

1.4.3 Self-employment

Two self-employment sectors—traditional ($j = T$) and gig ($j = G$)—are calibrated to reflect empirical differences in productivity, capital intensity, turnover, and job-search behavior. While parameters are jointly calibrated to replicate sector-specific moments, each parameter is primarily identified by a key empirical target (Table 1.8).

For traditional self-employment, the model is first solved without the gig sector. The production scale parameter $\varepsilon_T = 1.23$ is calibrated to match the median income ratio of traditional self-employment (S_T) to paid employment (1.19) in the SCF. The capital-intensity exponent $\nu_T = 0.26$ is based on Midrigan and Xu (2014),[17] while the entry rate $\tilde{\lambda}_{U_T} = 0.15$ targets a 5.2% transition rate from unemployment to self-employment. The exogenous exit rate $\lambda_{S_T} = 0.06$ matches a 2.7% transition rate from self-employment to unemployment, based on CPS data.[18] Endogenous exit is normalized to $\tilde{\lambda}_{S_T} = 0$, and search effort is set to $\eta_T = 0$, reflecting the limited job-search activity and low voluntary exit among traditional self-employed workers. The collateral constraint parameter $\zeta = 1.86$ is calibrated to match the SCF debt-to-equity ratio among self-employed individuals. Finally, the productivity elasticity $\theta = 1.25$ is chosen to replicate a 16% income share of self-employment among the top 20% of earners.

For the gig sector, lower productivity $\varepsilon_G = 1.11$ is chosen to match the median income ratio of gig to paid employment (0.45) observed in SHED. The capital-intensity exponent $\nu_G = 0.14$ is calibrated to match the proportion of gig workers holding less than \$50,000 in wealth, consistent with the low capital requirements of gig work.[19] Rapid turnover is captured by high entry and exit opportunity rates, $\tilde{\lambda}_{U_G} = \tilde{\lambda}_{S_G} = 12$, targeting a 5.7% share

[17] Midrigan and Xu (2014) specify a production function $y = z\,(k^{\alpha} l^{1-\alpha})^{\hat{\nu}}$ with $\alpha = 0.3$ and $\hat{\nu} = 0.85$, implying $\nu_T \approx 0.26$.

[18] Transition rates are constructed using monthly CPS Outgoing Rotation Group data for individuals aged 16–64, covering the years 1994–2013, extracted from IPUMS-CPS (Flood et al., 2024).

[19] According to SHED cross-sectional data, 71% of gig workers hold less than \$50,000 in wealth, compared to 54% of paid employees and 46% of traditional self-employed individuals. Empirical studies also show that most digital platform tasks require minimal equipment and are highly labor-intensive (e.g., Horton et al., 2017).

of workers who report gig work as their primary income source.[20] The exogenous termination rate $\lambda_{S_G} = 0.85$ is set to match a 6.1% transition rate from gig work to unemployment, while the gig search effort parameter $\eta_G = 0.10$ is calibrated to replicate a 23.0% transition rate from gig to paid employment.

1.4.4 Labor Market

Labor market parameters are calibrated to match U.S. labor market flows and institutional features. Parameters governing matching frictions follow Shimer (2005). The matching elasticity ϕ and workers' bargaining power ψ are both set to 0.72. Matching efficiency is set to $\chi = 1.79$, which replicates a 45% monthly job-finding rate. Exogenous separations occur at a rate $\lambda_E = 0.105$, consistent with a 3.4% monthly separation rate. The vacancy posting cost $\xi = 0.327$ is calibrated to yield a steady-state labor market tightness of $\theta = 1$.

Unemployment insurance (UI) replaces a fraction $b = 0.45$ of pre-tax earnings and expires after 26 weeks, corresponding to a hazard rate of $\lambda_U = 0.45$, in line with U.S. UI policy. The maximum weekly benefit is capped at $\bar{b} = 1.0$, representing 50% of the mean wage, as in Setty and Yedid-Levi (2021).[21] Unemployed individuals who are ineligible for UI receive a flat social assistance transfer of $b_0 = 0.1$, equivalent to a 5% replacement rate under U.S. safety net programs.

1.4.5 Results

Table 1.9 compares the model's predictions for employment shares and transition rates with those observed in the SHED data. The model closely replicates the occupational distribution: gig self-employment accounts for 5.7% of the labor force (as targeted), traditional

[20] With a quarterly model period, $\tilde{\lambda} = 12$ implies an average waiting time of one week, consistent with onboarding practices on major platforms. For example, background checks and vehicle inspections for ride-hailing services are typically completed within a week.

[21] Setty and Yedid-Levi (2021) calculate this based on state-level maximum UI benefits for the years 2000–2009.

Table 1.7: Calibration: Preference and Labor Market

	Parameter	**Value**	**Source / Target**
Preferences and technology			
γ	CRRA curvature	1.5	Attanasio (1999)
ρ	Discount rate	0.01	Annual discount rate, 4%
α	Capital share	0.3	Standard literature
δ	Depreciation	0.017	Investment-output ratio, 20%
ρ_z	Idiosyncratic productivity persistence	0.978	Floden and Lindé (2001)
σ_z^2	Idiosyncratic productivity volatility	0.103	Floden and Lindé (2001)
Labor market and policy			
ϕ	Elasticity of job matching	0.72	Shimer (2005)
ψ	Worker's bargaining power	0.72	Shimer (2005)
χ	Matching efficiency	1.79	Monthly job-finding rate, 45%; Shimer (2005)
λ_E	Exogenous job separation	0.105	Monthly job separation rate 3.4%; Shimer (2005)
ξ	Vacancy posting cost	0.327	Labor market tightness (θ) = 1
b	Unemployment benefit replacement rate	0.45	45% replacement rate (U.S.)
λ_U	Rate of arrival for UI expiration	0.45	26 weeks (U.S.)
$\bar{b}$	Maximum UI benefit	1.0	50% of mean wage; Setty and Yedid-Levi (2021)
b_0	Social security (UI ineligible)	0.1	5% replacement rate (U.S.)

Table 1.8: Calibration: Self-employment

	Parameter	**Value**	**Source / Target**
Traditional self-employment			
ε_T	Production scale for S_T	1.23	S_T to E median income ratio (SCF), 1.19
ν_T	Capital intensity for S_T	0.26	Midrigan and Xu (2014)
$\tilde{\lambda}_{U_T}$	S_T entry decision arrival	0.15	U to S_T transition rate (CPS), 5.2%
$\tilde{\lambda}_{S_T}$	S_T exit decision arrival	0	Normalization
λ_{S_T}	S_T exogenous termination	0.06	S_T to U transition rate (CPS), 2.7%
η_T	Search efforts for S_T	0	Normalization
Gig self-employment			
ε_G	Production scale for S_G	1.11	S_G to E median income ratio, 0.45
ν_G	Capital intensity for S_G	0.14	S_G under \$50k wealth (SHED), 71%
$\tilde{\lambda}_{U_G}$	($= \tilde{\lambda}_{S_G}$), S_G entry/exit decision arrival	12	S_G share (SHED), 5.7%; weekly arrival
λ_{S_G}	S_G exogenous termination	0.85	S_G to U transition rate (SHED), 6.1%
η_G	Search efforts for S_G	0.1	S_G to E transition rate, 23.0%
ζ	Collateral constraint for self-employment	1.86	Debt-to-equity ratio (SCF)
θ	Productivity relevance to efficiency	1.25	Self-emp. share for top 20% income (SCF), 16%

self-employment 9.3% (vs. 10.9% in the data), paid employment 80.8% (79.2%), and unemployment 4.2% (4.1%).

Gross flows into and out of self-employment are also well matched. Specifically, the model predicts an 11.3% transition rate from unemployment into gig work and a 69.8% gig retention rate, compared with 8.3% and 66.0% in the data. For traditional self-employment, the $U \to S_T$ entry rate and the S_T retention rate are 5.2% and 94.3%, respectively, versus 4.1% and 91.2% in the SHED.

However, the model underestimates transition rates between self-employment types. It predicts a 0.6% transition rate from S_G to S_T and 1.7% from S_T to S_G, whereas the empirical rates are 4.9% and 5.0%. This discrepancy stems from the model's abstraction: all movements between self-employment types occur indirectly via unemployment, rather than through direct transitions.

Figure 1.3 illustrates two key distributional patterns for gig workers. The left panel plots the ratio of gig to paid employment across earnings deciles. The model (solid blue line) replicates the downward slope observed in the SHED data (dashed red line), indicating that gig participation is concentrated among lower-income individuals. The right panel displays the joint distribution of gig workers over asset holdings and productivity, showing that gig work is disproportionately undertaken by financially constrained, low-productivity individuals.

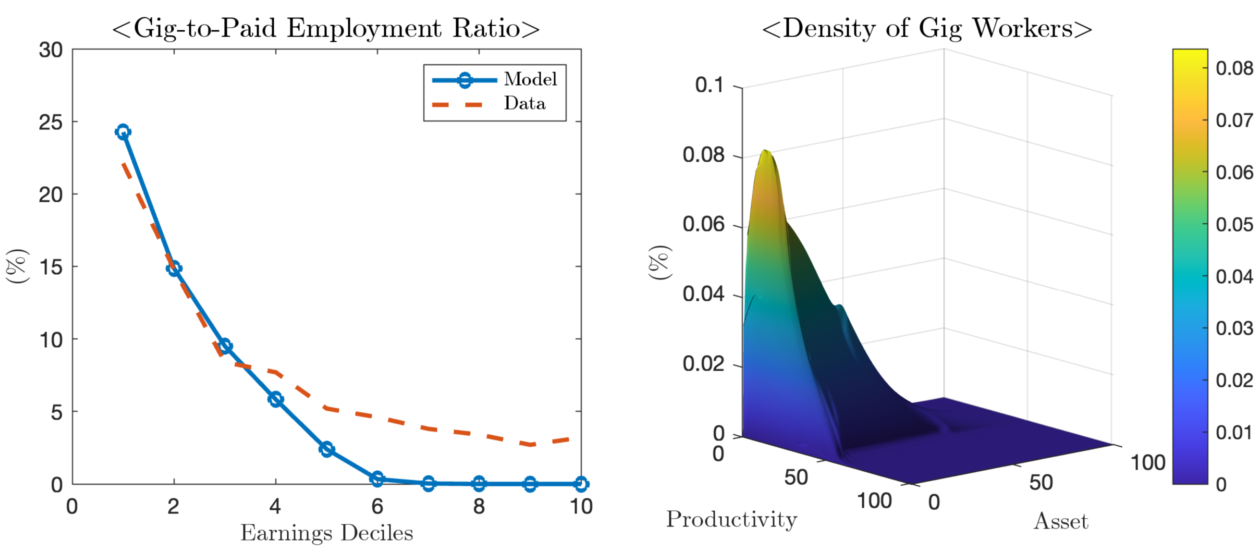
1.5 Effects of Introducing the Gig Economy

This section conducts a quantitative analysis to evaluate the impact of the gig economy on labor market outcomes and macroeconomic aggregates. To do so, I compare two calibrated versions of the model: the "pre-gig model," which excludes gig work, and the "gig model," which incorporates gig employment options.

Table 1.9: Employment Share and Transition Rates

	Model	Data (SHED)
Employment Share		
Gig Self-employment (S_G)	5.7%	5.7%
Traditional Self-employment (S_T)	9.3%	10.9%
Paid Employment (E)	80.8%	79.2%
Unemployment (U)	4.2%	4.1%
Transition Rates from/to Gig SE		
S_G to U	6.2%	6.1%
S_G to S_T	0.6%	4.9%
S_G to E	23.4%	23.0%
U to S_G	11.3%	8.3%
S_T to S_G	1.7%	5.0%
E to S_G	1.4%	1.2%
S_G to S_G (Retention)	69.8%	66.0%
Transition Rates from/to Traditional SE		
S_T to U	1.8%	0.1%
S_T to E	2.2%	3.7%
U to S_T	5.2%	4.1%
E to S_T	0.3%	0.8%
S_T to S_T	94.3%	91.2%

Figure 1.3: Distribution of Gig Workers



Note: Shares by earnings decile for data are estimated using information on total employment counts within survey-defined income intervals.

1.5.1 Labor Market Response

Table 1.10 presents key labor market indicators under both model scenarios, illustrating how the inclusion of gig work alters labor market dynamics. Introducing gig work reduces the overall unemployment rate by 0.8 percentage points, from 5.0% to 4.2%. The share of UI-ineligible unemployed falls from 1.3% to 1.1%, and UI-eligible unemployment declines from 3.7% to 3.1%. These shifts suggest that gig employment provides an alternative source of income for individuals who might otherwise face extended periods of joblessness.

This finding is consistent with Jackson (2022), who show that gig work can serve as a temporary income strategy during prolonged job searches.[22]

Table 1.10: Effects of the Gig Economy on Labor Market and Macro Outcomes

	Pre-Gig Model	**Gig Model**	**Difference**
Employment Status			
Unemployment Rate	5.0%	4.2%	-0.8pp
UI Ineligible	1.3%	1.1%	-0.2pp
UI Eligible	3.7%	3.1%	-0.6pp
Paid Employment Share	84.4%	80.8%	-3.6pp
Self-Employment Share	10.6%	9.3%	-1.3pp
Gig Employment Share	0.0%	5.7%	5.7pp
Labor Market			
Job Finding Rate	45.0%	44.5%	-0.5pp
Vacancies	100.0	92.6	-7.4%
Labor Market Tightness	100.0	95.7	-4.3%
Average Wage	100.0	102.7	2.7%
Median Wage	100.0	107.0	7.0%
Macro Outcomes			
Output per Worker	100.0	99.2	-0.8%
Aggregate Consumption	100.0	100.2	0.2%
Assets	100.0	99.0	-1.0%

Figure 1.4 depicts shifts in occupational shares by asset and productivity levels. The

[22] Katz and Krueger (2019) also find that digital platforms tend to attract individuals facing barriers to stable employment.

decline in unemployment is concentrated among low-skilled and asset-poor individuals, who are more inclined to enter gig work. However, the very poorest groups participate less often, likely because of the capital requirements (e.g., vehicle ownership) needed to engage in gig activities. Moreover, gig work entrants draw partly from traditional self-employment, causing the self-employment rate to decrease from 10.6% to 9.3%. Figure 1.5 shows that this reduction is most pronounced among poorer and lower-skilled agents. In the rigid labor market, these individuals might otherwise resort to subsistence self-employment; gig work provides a more accessible income source while they continue to search for standard jobs. A smaller number of job seekers, combined with a reduction in posted vacancies, leads to a lower share of paid employment.

Wages rise in the gig model because gig work provides an outside option that strengthens workers' bargaining power. Figure 1.6 shows that workers in the low-productivity, low-asset region—those most likely to switch into gig work—experience the largest reduction in Nash surplus from traditional matches compared to the pre-gig environment. As a result, they negotiate higher wages. Moreover, the composition of job seekers and incumbent workers shifts toward higher-productivity individuals (Figure 1.7), as lower-productivity workers remain in gig work and exert less search effort. Consequently, both average and median wages increase, by 2.7% and 7.0%, respectively.

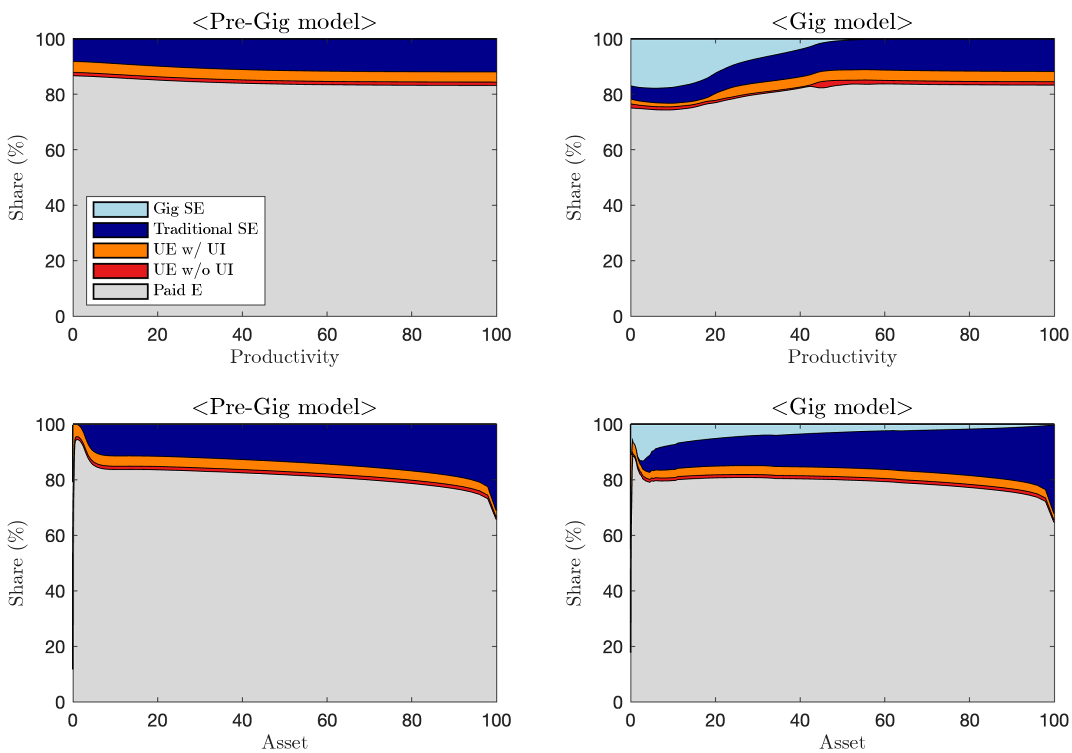
Higher negotiated wages reduce the discounted value of a job match, prompting firms to post 7.4% fewer vacancies in the paid employment sector. As a result, overall labor market tightness declines by 4.3%, since the reduction in vacancies outweighs the decline in aggregate search effort.[23]

Aggregate consumption increases by 0.2%, driven by the additional income-generating opportunities provided by gig work. In contrast, output per worker declines by 0.8%, reflecting a shift in labor allocation from high-productivity corporate jobs to lower-productivity gig work. Asset accumulation also falls by 1.0%, as workers reduce precautionary savings in

[23] Bracha and Burke (2023) note that labor market tightness based on official statistics may be overstated, as gig economy participation is not captured in standard surveys.

response to the more readily available fallback income from gig employment.[24]

Figure 1.4: Share of Employment Status by Productivity and Asset



1.5.2 Welfare

Welfare is assessed using the consumption-equivalent (CE) measure, computed at the individual level for assets and productivity, then aggregated over the pre-gig stationary distribution. For an individual in state o with assets a and productivity z, the CE satisfies

$$W_o^{NG}\big((1 + CE_o(a,z))\, C_o^{NG}(a,z)\big) = W_o^G\big(C_o^G(a,z)\big) \tag{1.14}$$

[24]The effect on aggregate assets reflects two offsetting mechanisms. On the one hand, gig work offers low-productivity workers additional income, potentially increasing their savings. It may also encourage saving to cover entry costs (e.g., purchasing a car for ride-hailing). On the other hand, more financially secure workers reduce precautionary savings, given the availability of fallback income. The net effect depends on the capital intensity of the gig sector: higher capital intensity increases the savings required for participation.

Figure 1.5: Self-employment Share by Productivity and Asset

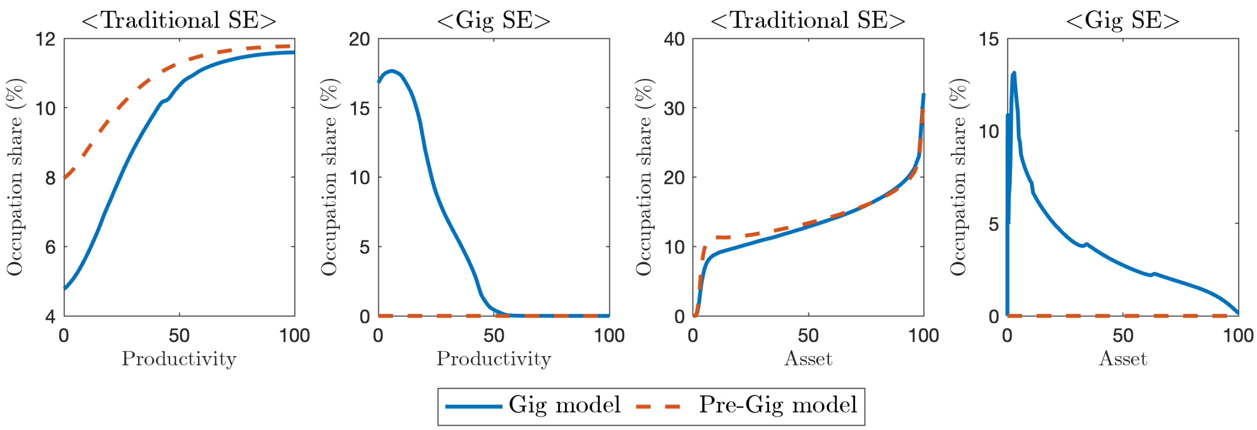


Figure 1.6: Changes in Wage and Worker Surplus

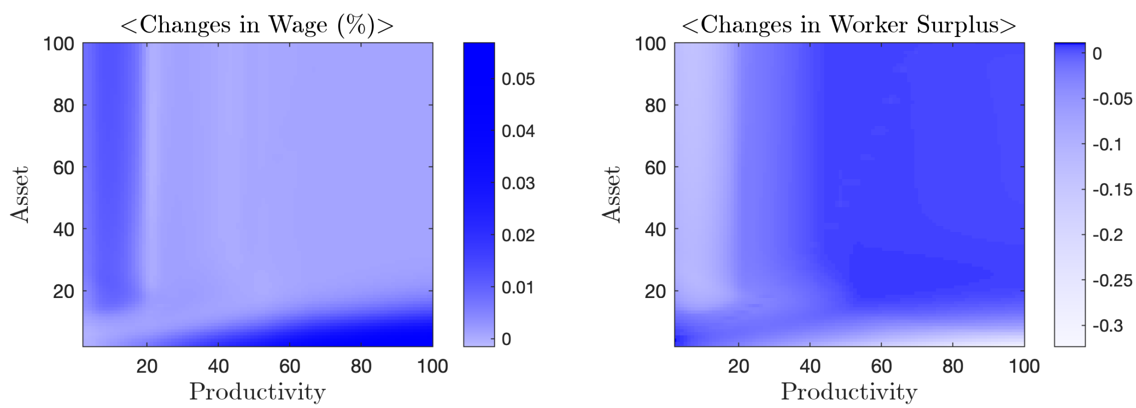
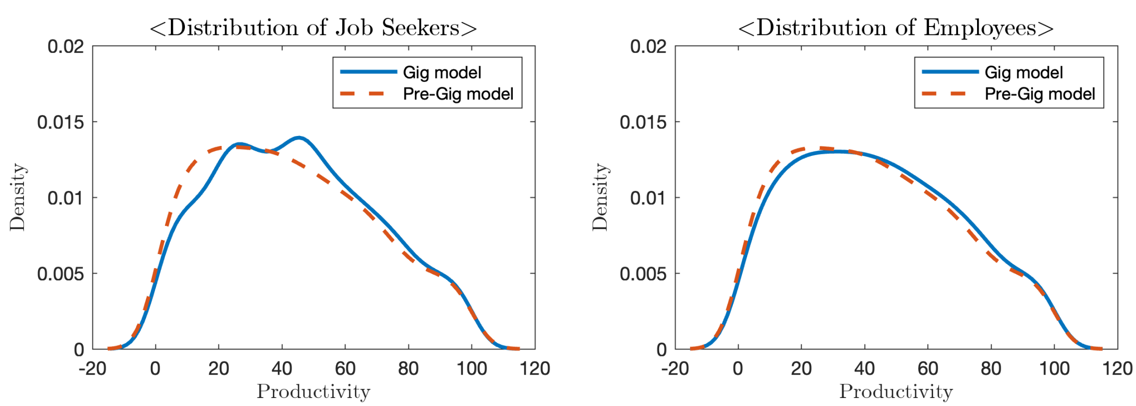


Figure 1.7: Density of Job Seekers and Employees



where W_o denotes the value function in employment status o, and C_o is the corresponding consumption policy. Superscripts NG and G refer to the pre- and post-gig economies, respectively. Given the CRRA utility, one can solve for

$$CE_o(a,z) = \left(\frac{W_o^G(a,z)}{W_o^{NG}(a,z)}\right)^{1/(1-\gamma)} - 1$$

Aggregate welfare is then

$$\overline{CE} = \sum_{o\in\{E,S_T,U_N,U_Y\}} \iint d_o^{NG}(a,z)\, CE_o(a,z)\, da\, dz \tag{1.15}$$

where $d_o^{NG}(a,z)$ is the stationary density in the pre-gig model.

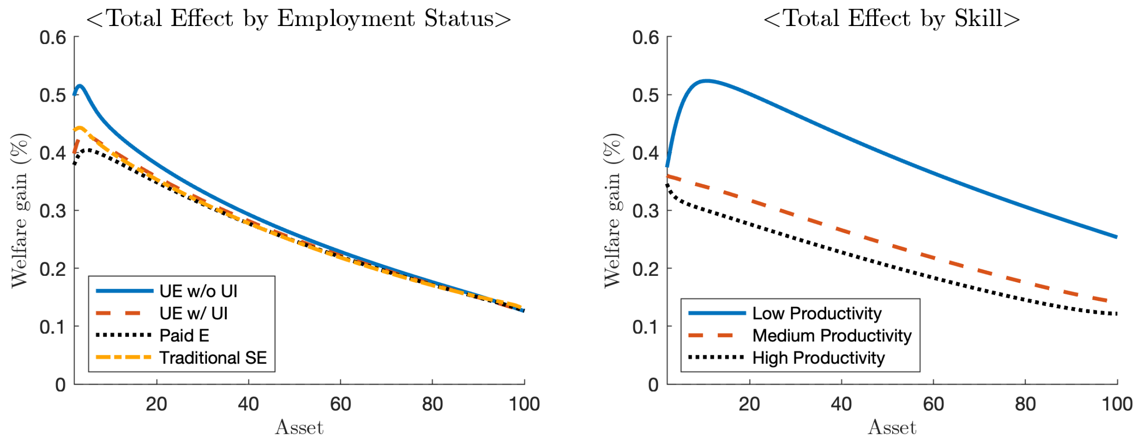
Introducing the gig economy yields a modest aggregate welfare gain of 0.33%. Table 1.11 disaggregates this gain by demographic group. All groups benefit, with particularly large gains for low-skilled (0.41%) and low-asset (0.39%) individuals. By employment status, the greatest improvement accrues to UI-ineligible unemployed workers (0.38%).

Table 1.11: Welfare Gains from the Introduction of Gig Economy (%)

	Productivity			**Assets**			All
	Low	Medium	High	Poor	Medium	Wealthy	
Unemployment - UI ineligible	0.52	0.34	0.25	0.48	0.38	0.27	0.38
Unemployment - UI eligible	0.44	0.32	0.26	0.41	0.36	0.26	0.35
Paid Employment	0.41	0.32	0.26	0.39	0.35	0.26	0.33
Traditional Self-employment	0.42	0.30	0.24	0.40	0.33	0.24	0.33
All	0.41	0.32	0.25	0.39	0.35	0.26	0.33

[1] Welfare is assessed as a consumption equivalent, expressed in percentage terms, for each state and aggregated based on the pre-gig distribution.
[2] The classifications for productivity and asset groups are as follows: Low/Poor represents the bottom 33% of the distribution, Medium, 34% to 66%, and High/Wealthy, top 33%.

Figure 1.8: Welfare effect by Asset Levels



1.5.3 Decomposing the Welfare Effects of Gig Work

To quantify the channels through which gig work affects welfare, I decompose the total general equilibrium effect into four components: insurance, labor market, tax, and interest rate effects, following the approach of Mukoyama (2013) and Setty and Yedid-Levi (2021).

The *insurance effect* captures the value of having gig work as a fallback option, independent of general equilibrium adjustments. In this counterfactual, wages, interest rates, and job-finding probabilities are held fixed at their pre-gig levels, isolating the welfare gains from added flexibility. As shown in the top-left panel of Figure 1.9, the insurance gain is largest for UI-ineligible unemployed individuals and low-asset households, groups most exposed to income volatility and most likely to engage in gig work. These gains are particularly pronounced among low-skilled individuals (Figure 1.10), confirming the redistributive and insurance-enhancing role of gig work. Quantitatively, the insurance effect accounts for a 0.22% welfare gain, representing approximately two-thirds of the total welfare improvement.

The *labor market effect* is assessed by allowing wages and labor market tightness to respond endogenously (top-right panel). This component typically yields modest welfare losses, primarily driven by reduced vacancy postings and lower job-finding probabilities in the paid employment sector. However, these losses are partially offset by higher negotiated wages resulting from improved worker outside options.

The *tax effect* reflects welfare gains stemming from a decline in government UI expenditures as the unemployment rate falls (bottom-left panel). Holding pre-gig transfers fixed, this reduction allows for a cut in the flat labor-income tax, thereby raising after-tax consumption. Since low-asset households derive a larger share of income from labor (or UI) and have a higher marginal utility of consumption, they experience the largest welfare gains from the tax effect.

The *interest rate effect* captures the residual general equilibrium adjustment. As more workers transition into less capital-intensive gig activities, aggregate capital demand falls, lowering the equilibrium interest rate. This shift redistributes wealth from capital owners to workers, generating welfare gains for low-asset households but losses for wealthier individuals (bottom-right panel of Figure 1.9).

Table 1.12 summarizes the contribution of each channel. While the insurance effect is the dominant driver of welfare gains, partial offsets arise from labor market adjustments. Overall, the largest net benefits accrue to unemployed, low-skilled, and asset-poor individuals.

Table 1.12: Welfare Gains by Decomposition (% Consumption Equivalent)

Group	Insurance	Labor Market	Tax	Interest Rate
By Employment Status				
UI-ineligible Unemployed	0.27	-0.03	0.11	0.02
UI-eligible Unemployed	0.23	-0.03	0.12	0.02
Paid Employment	0.22	-0.03	0.11	0.02
Self-Employment	0.23	-0.02	0.11	0.00
By Productivity Group				
Low	0.28	-0.03	0.12	0.05
Medium	0.21	-0.03	0.11	0.02
High	0.17	-0.02	0.11	0.00
By Asset Level				
Poor	0.24	-0.03	0.13	0.06
Medium	0.23	-0.02	0.12	0.03
Wealthy	0.20	-0.02	0.10	-0.02
Overall Average	**0.22**	**-0.03**	**0.11**	**0.02**

Note: Low/Poor represents the bottom 33% of the distribution, Medium, 34% to 66%, and High/Wealthy, top 33%.

Figure 1.9: Welfare Effect by Employment Status

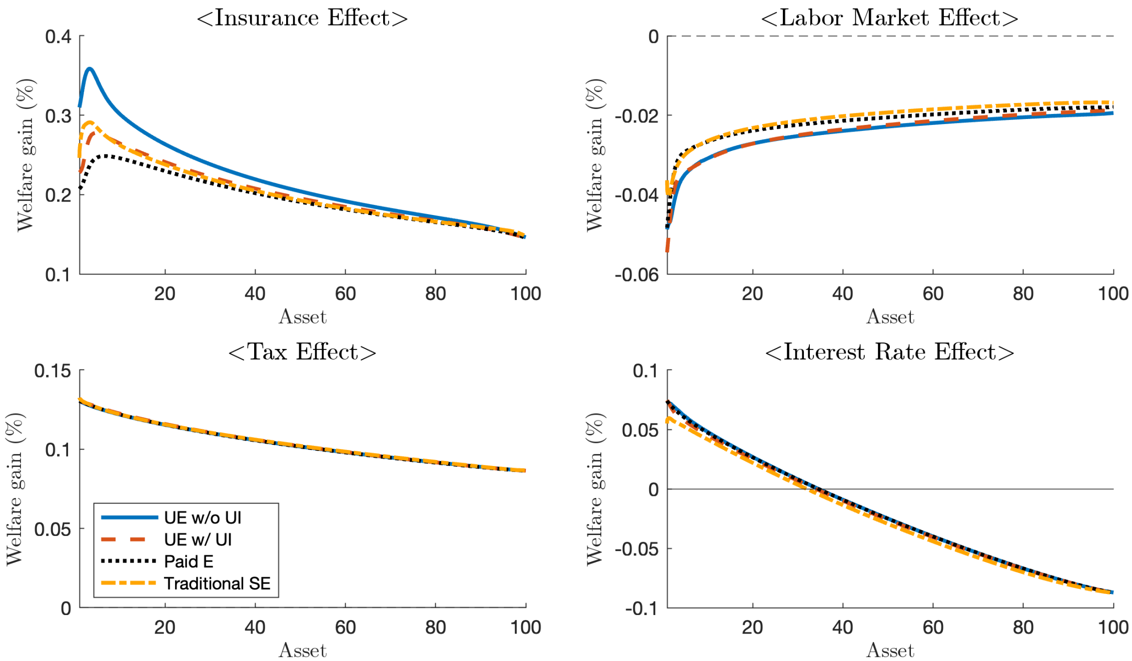
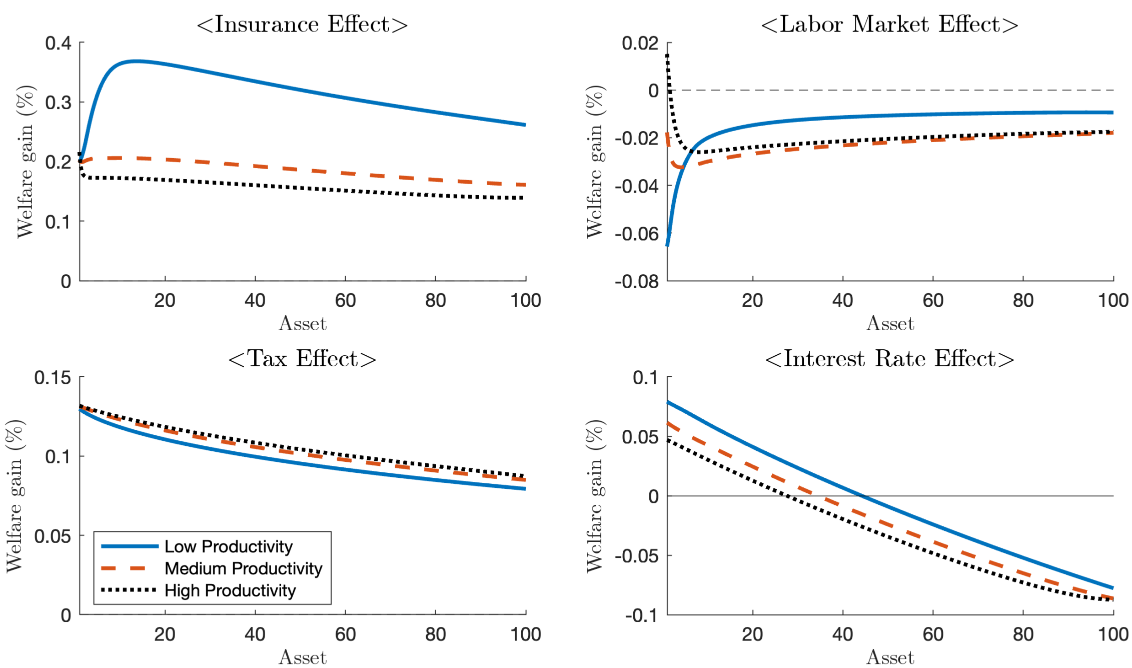


Figure 1.10: Welfare Effect by Productivity



1.5.4 Robustness: Endogenous Match Separation

To assess the robustness of the baseline findings, I introduce an endogenous separation margin in which job matches receive an additional Poisson shock at rate $\tilde{\lambda}_E$ (see Appendix B for details). When such a shock occurs, the firm may choose to dissolve the match by paying a firing cost F, or the worker may opt to exit. Since the firm's continuation value $J(a, z)$ is monotonic in productivity z for each asset level a, firms optimally set a productivity cutoff $z^*(a)$, below which $J(a, z) < F$ and the match is terminated. This mechanism concentrates separations and unemployment among low-productivity workers.

Introducing gig work under this specification yields results consistent with the baseline: unemployment declines and aggregate welfare improves. However, the channels of adjustment differ. Firms respond to the improved outside option for workers by raising the productivity threshold at which they choose to pay the firing cost and dissolve marginal matches. This selective pruning leads to the elimination of only the lowest-surplus relationships, allowing firms to retain a greater share of productive matches.

As a result, the reduction in vacancy postings is smaller than under the baseline with purely exogenous separations. Because more high-surplus matches are preserved, the decline in average surplus per match is less severe, which in turn moderates the rise in bargained wages. The smaller drop in vacancies—relative to the decline in unemployment—results in a tighter labor market and higher job-finding rates for the unemployed. Consequently, overall welfare gains exceed those in the exogenous benchmark, as workers benefit from improved matching conditions and stronger labor market performance.

Finally, it is worth noting that the measured size of the gig economy in this analysis may overstate the effect of its introduction. The baseline estimate of 5.7% for primary gig workers reflects a broad definition that includes any non-wage income from informal or flexible work arrangements. However, not all of these workers are newly created by digital platforms. Some resemble pre-existing personal service or informal workers who now rely on mobile or online tools to access opportunities more efficiently. Even if narrower definitions, such as digital platform-mediated work, capture a smaller population, the mechanisms highlighted in the model remain relevant. In that sense, the results can be interpreted more broadly as capturing the welfare and labor market implications of technological improvements in matching workers to flexible income-generating opportunities.

1.6 Transition Dynamics

This section analyzes how the economy adjusts over time in response to two types of shocks: (i) the unexpected introduction of gig work at $t = 0$, and (ii) an adverse aggregate productivity shock in the post-gig environment.

1.6.1 Dynamics Following the Introduction of Gig Work

At $t = 0$, the economy experiences a one-time, unanticipated introduction of gig work: the arrival rates to the gig sector are set to their calibrated steady-state values, and the model is then solved under perfect foresight to trace the deterministic transition from the pre-gig equilibrium to the new one.[25] Figures 1.11 display the resulting labor market and macroeconomic dynamics.

Immediately after $t = 0$, unemployed workers reallocate into gig work to secure income, causing the unemployment rate to fall by approximately one percentage point within the first month, while gig employment rises by a similar margin. This rapid adjustment reflects the weekly arrival rate of gig-entry opportunities.[26] Over the following quarters, some traditional self-employed agents—particularly those with low productivity or limited assets—also shift into gig work. Because exits from traditional self-employment occur exogenously at a slower rate, these transitions happen gradually: workers first become unemployed, then re-enter the labor force through gig work.

The paid employment share declines over the first five quarters as labor reallocates toward gig work and labor market frictions adjust. Two forces drive this decline: (i) a reduced pool

[25] See Boppart et al. (2018) for a discussion of perfect foresight transition dynamics.

[26] A robustness check shows that reducing the arrival rate delays and attenuates the fall in unemployment.

of job seekers lowers firms' job-filling rates on impact, and (ii) improved worker outside options raise bargained wages, reducing the surplus from each match. In response, firms cut vacancy postings sharply. As tightness adjusts, vacancies partially recover.[27]

Aggregate output and consumption rise initially, driven by the reallocation of unemployed workers into gig activities, which generate higher income than unemployment benefits. However, as the occupational distribution shifts toward the lower-productivity gig sector, both output and consumption gradually decline. Capital accumulation also falls, reflecting both the shift away from capital-intensive sectors (paid employment and traditional self-employment) and a reduction in precautionary savings.

Overall, the transition highlights a key trade-off: while flexible gig work accelerates short-term stabilization, it weakens job creation incentives and gradually shifts production toward lower-productivity occupations in the long run.

1.6.2 Effects of an Aggregate Productivity Shock

I next consider a one-time, temporary negative aggregate productivity shock at $t = 0$, after which productivity gradually returns to its baseline. Specifically,

$$A_t = (A_0 - 1)\, e^{-bt} + 1$$

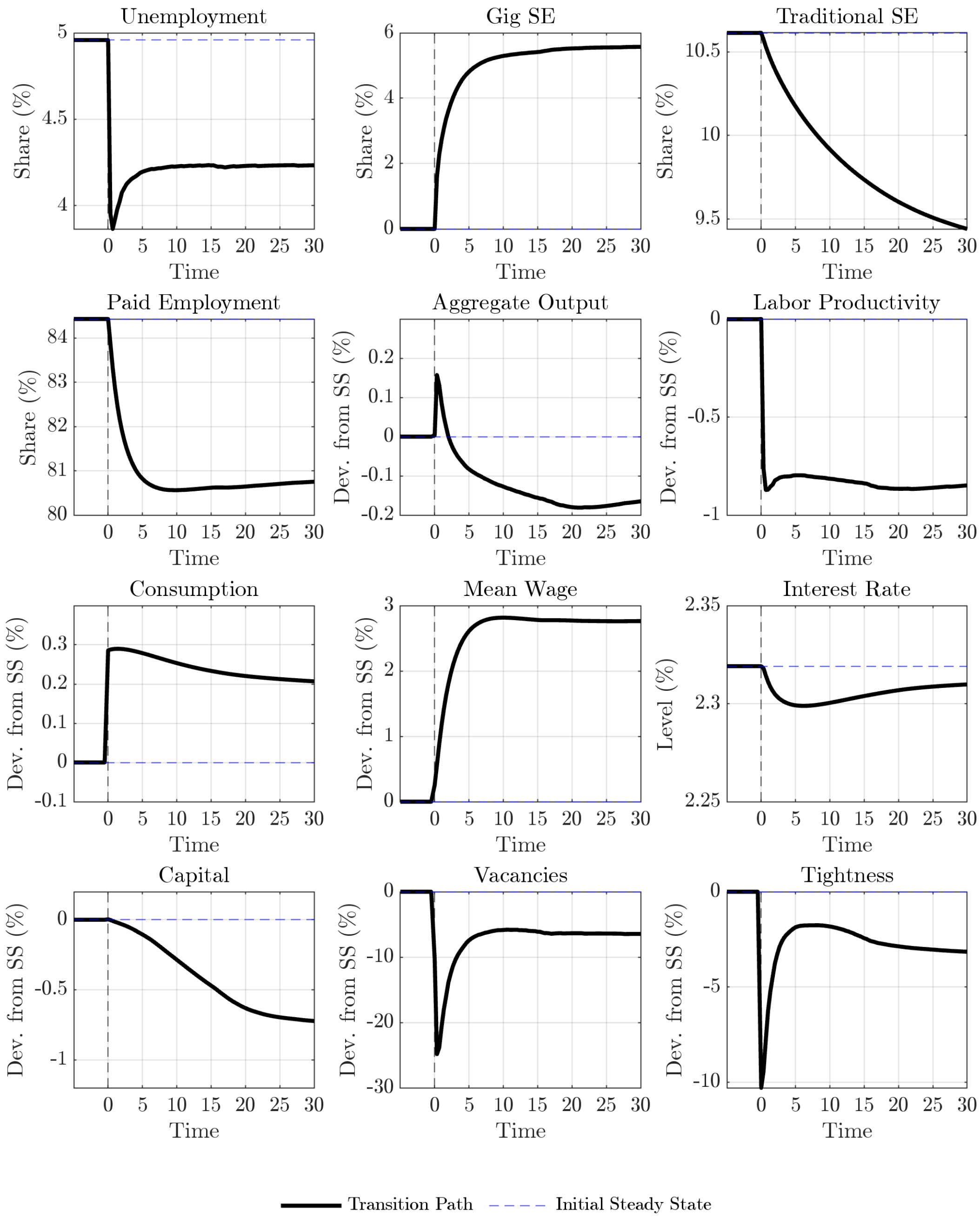
with $A_0 = 0.95$ and decay rate $b = 0.5$, implying an initial 5% decline that dissipates over several quarters.[28] Figure 1.12 displays the impulse responses of key labor market and macroeconomic variables.

As in standard search-and-matching models, the negative productivity shock reduces firms' surplus from matches, leading to a sharp decline in vacancy creation and job-finding

[27]If vacancy posting incurred an upfront cost, the initial decline in vacancies would be smaller, and the subsequent recovery would be slower.

[28]In this experiment, aggregate productivity A_t enters the production functions multiplicatively—$y(z, k) = A_t\, z\, f(k)$ for corporate firms and $y_j(z, k) = A_t\, e_j(z)\, f_j(k)$ for self-employed firms—while the steady-state calibration sets $A = 1$.

Figure 1.11: Transition Dynamics: Gig Economy Introduction



rates $f(\theta)$. Labor market tightness contracts, and paid employment falls accordingly. However, the availability of gig work helps cushion these frictions: many newly unemployed individuals—especially those with low assets or productivity—reallocate to the gig sector, dampening the rise in overall unemployment and moderating the decline in paid employment. Traditional self-employment also increases modestly as a fallback, though to a lesser extent than gig work, since it is more attractive to wealthier or higher-productivity agents. As aggregate productivity recovers, these flows gradually reverse, and the labor market returns to its pre-shock state.

Aggregate output falls by approximately 0.8% on impact, and the equilibrium interest rate declines in response to reduced capital demand. Output eventually recovers in line with productivity, but both remain below their pre-shock steady-state paths for an extended period due to the persistent reallocation of labor toward lower-productivity sectors.

Figure 1.13 compares these responses to a counterfactual model without gig work. In the absence of gig opportunities, the rise in unemployment is steeper and the fall in paid employment is deeper, as displaced workers must rely solely on traditional self-employment or unemployment insurance. In contrast, with gig work available, the labor market absorbs displaced workers more quickly, reducing the peak in unemployment and softening the downward pressure on wages. However, the recovery of paid employment is slower in the gig economy model, as a segment of the labor force remains in gig work with limited search intensity, even after conditions improve.

These dynamics illustrate a "soft landing" mechanism enabled by gig work during downturns: it enhances short-run stabilization by smoothing labor market flows and absorbing displaced workers. At the same time, it may impose a drag on the recovery, as some labor remains locked in low-productivity occupations. The net welfare impact of gig work under cyclical shocks thus hinges on the trade-off between improved stabilization during recessions and the frictions in reallocating labor back to higher-productivity sectors during recovery.

Figure 1.12: Impulse Responses to an Adverse Aggregate Productivity Shock

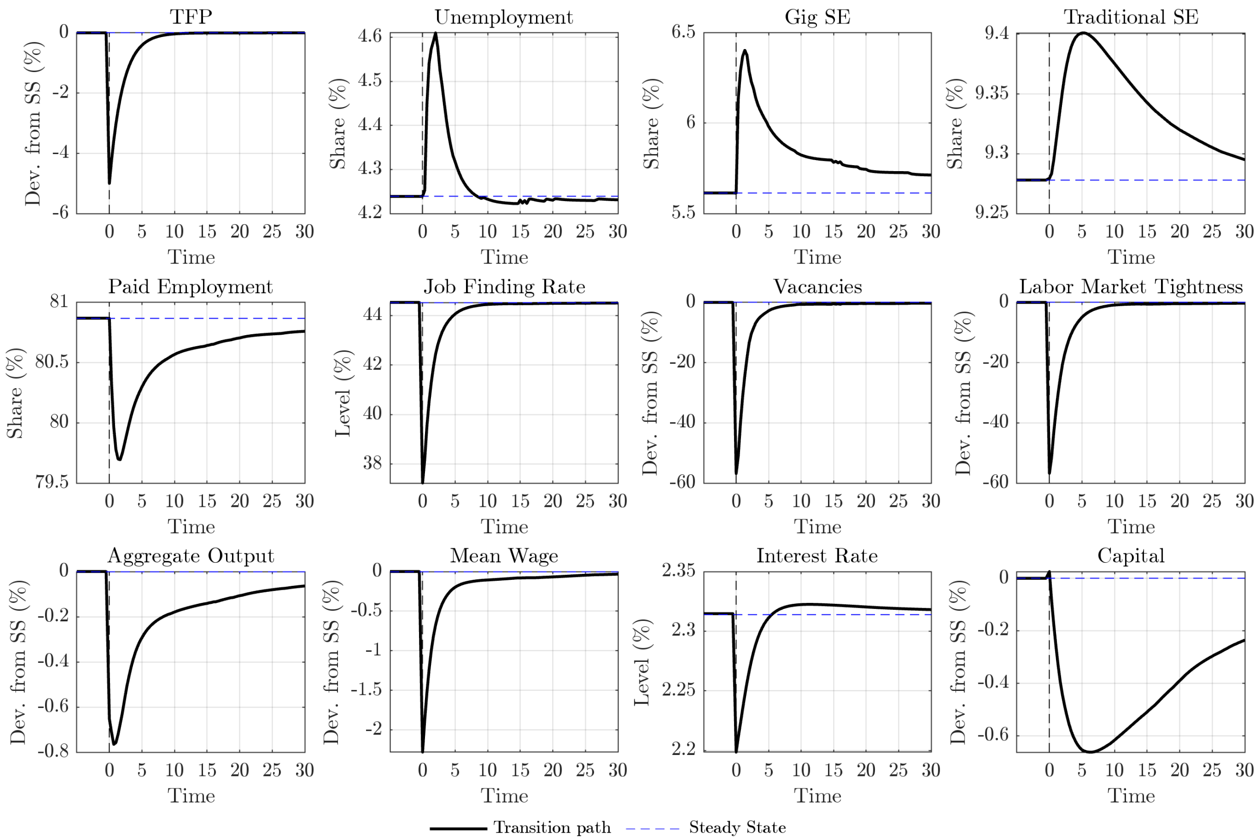
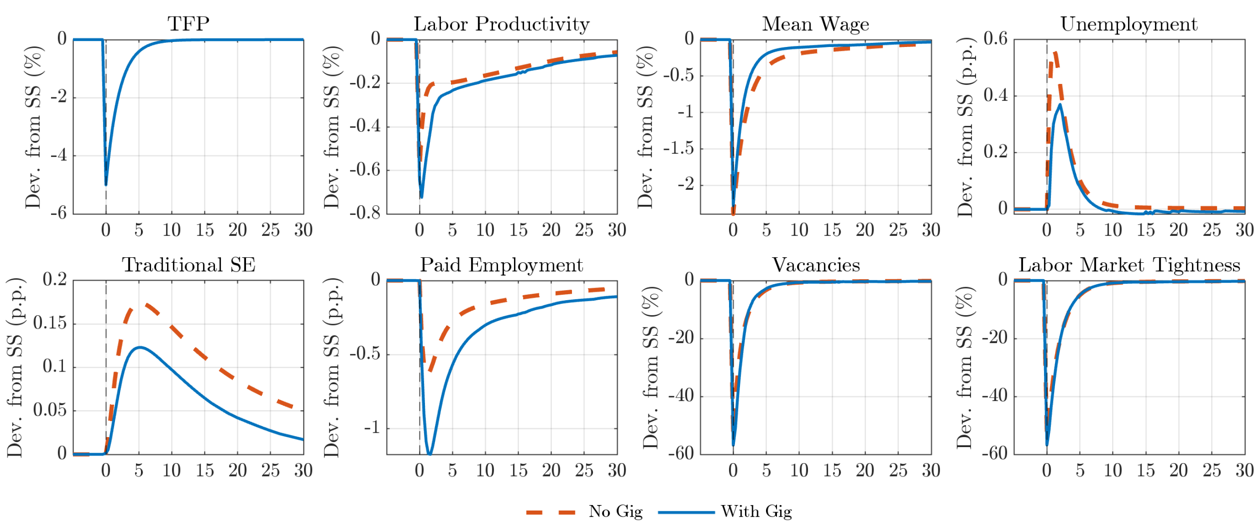


Figure 1.13: Impulse Response Comparison: With and Without Gig Sector



1.7 Conclusion

This chapter examines self-employment in a frictional labor market, focusing on gig work as an emerging form of self-employment. Using a quantitative model of employment transitions and labor market dynamics, I show that gig work mitigates labor market risks, especially for low-skilled and asset-poor individuals. The model is calibrated to key features of the U.S. labor market using a range of data, including microdata from the Survey of Household Economics and Decisionmaking (SHED).

The introduction of gig employment reduces overall unemployment and crowds out some traditional self-employment, particularly low-income, necessity-driven activities. Simultaneously, it weakens job creation incentives in the paid employment sector and contributes to a shift toward lower-productivity occupations. Integrating gig work into the economy raises aggregate welfare—primarily through improved income insurance and higher wages—with the largest gains accruing to economically vulnerable groups. These gains are partially offset by labor reallocation away from high-productivity sectors.

The model's transition dynamics reinforce these steady-state results. Following a negative aggregate productivity shock, gig opportunities provide a "soft landing" by enabling the rapid reallocation of displaced workers. However, these opportunities also slow the recovery of paid employment and output, as some workers remain in gig work with limited search intensity even as economic conditions improve.

These findings have important implications for regulating gig work. The model highlights the value of gig work as a fallback option, particularly during downturns, for absorbing displaced workers and smoothing income fluctuations. In the long run, however, widespread reliance on gig work may reduce aggregate productivity and weaken job search incentives. Policymakers must carefully weigh these trade-offs when designing regulatory frameworks, recognizing both the short-term insurance value and the potential long-term reallocation costs of the gig economy.

Chapter 2

LABOR MARKET POLICY AND SELF-EMPLOYMENT

2.1 Introduction

Labor market policies—such as unemployment insurance (UI) and dismissal regulations—are designed to provide income support and protect jobs. While the effects of such policies have been extensively studied, less is known about how they interact with self-employment options. When workers have access to alternative sources of income, their responses to policy incentives may shift. For instance, UI offers financial stability during job loss, but so can self-employment, particularly as a fallback. In such environments, policies that appear effective in standard models may yield different results.

The rise of platform-based or gig work has added further complexity. With its ease of access, low startup costs, and flexible schedules, gig work strengthens the role of fallback employment. This development deepens the interaction between labor market policies and self-employment, raising new questions: Do traditional labor policies continue to function as intended when alternative income-generating opportunities are widely accessible?

To explore these questions, this study develops a structural macroeconomic model with incomplete markets and occupational choice. The model incorporates search and matching frictions and treats self-employment as a fallback activity accessible only from unemployment, rather than as a high-return entrepreneurial activity. The government implements five labor market policies: (i) unemployment insurance, (ii) firing costs, (iii) worker bargaining power (e.g., through unionization), (iv) hiring subsidies, and (v) programs that improve job-matching efficiency.

The model is calibrated to U.S. labor market data from the *Current Population Survey* (CPS) and the *Survey of Household Economics and Decisionmaking* (SHED). It distinguishes between traditional self-employment—characterized by higher persistence and fixed costs—and flexible self-employment (e.g., gig work), which features low entry and exit barriers, high turnover, and lower earnings. Counterfactual simulations examine the effectiveness of policies across three environments: one without self-employment (as in most standard models), one with traditional self-employment, and one with flexible self-employment.

Simulation results indicate that the presence and type of self-employment significantly impact policy outcomes. First, UI reforms have amplified effects when flexible self-employment is available. Reducing UI generosity leads displaced workers to shift into gig work, sharply lowering unemployment and raising aggregate welfare. Conversely, generous UI crowds out gig work, increasing unemployment and fiscal costs. Second, protective policies—such as higher firing costs or stronger worker bargaining power—raise unemployment in standard models, but their negative effects are mitigated when fallback work absorbs displaced workers. Third, active labor market policies—such as hiring incentives and matching efficiency improvements—are effective in traditional settings but less impactful when flexible self-employment is widespread. Favorable labor market conditions reduce reliance on self-employment, weakening its insurance function.

To evaluate cost-effectiveness, the model compares policies at equivalent fiscal cost. In a standard labor market without self-employment, active labor market programs (ALMPs) dominate protective policies. However, when self-employment—especially of the flexible type—is available, the welfare ranking becomes less clear. At low spending levels, matching programs remain the most efficient. At higher spending levels, policies that strengthen worker bargaining power deliver unexpectedly large welfare gains, driven by lower unemployment and higher wages supported by stronger outside options.

These findings have important implications for the design of labor market policy. Reforms that overlook structural changes in the labor market—such as the expansion of gig work—risk misestimating their effects. For example, deregulation through reduced firing costs or weaker bargaining power may yield smaller welfare gains when fallback employment is readily available. In contrast, modest reductions in UI generosity combined with targeted

ALMPs may yield larger welfare gains by balancing income support with improved employment access. Future research should explore policy packages and interaction effects more systematically to identify effective reform strategies in evolving labor markets.

Related Literature This research contributes to the literature on the economic effects of labor market policies. A large body of theoretical and empirical work examines the impacts of various instruments, including unemployment insurance (UI) (e.g., Baily, 1978; Chetty, 2006; Mortensen and Pissarides, 1994) and firing restrictions (e.g., Hopenhayn and Rogerson, 1993; Lazear, 1990). More directly, it relates to a strand of research emphasizing labor market risk under incomplete insurance environments (e.g., Krusell et al., 2010; Mukoyama, 2013; Setty and Yedid-Levi, 2021; Alvarez and Veracierto (2001)). For example, Krusell et al. (2010) analyze UI in a general equilibrium model with incomplete markets and search frictions, finding that greater UI generosity discourages firm entry, partially offsetting its consumption-smoothing benefits—results consistent with this study. Regarding firing restrictions, Lalé (2019) shows that stricter severance policies reduce job creation and lower welfare due to a decrease in vacancy postings.

However, much of the existing literature abstracts from self-employment as an occupational choice, despite its growing relevance in modern labor markets. An exception is Audoly (2025), who incorporate self-employment into their model, though their focus is on designing UI benefits for the self-employed. In contrast, this study explicitly models self-employment as a fallback option available to the unemployed and reevaluates policy effects in this broader occupational setting. Similarly, Gaillard and Kankanamge (2023) develop a model with occupational choice under incomplete markets, showing that generous UI discourages self-employment entry due to the lack of insurance in that sector. These findings align with this paper's insight that fallback work—particularly flexible self-employment—can significantly alter the employment and welfare impacts of labor market policy.

While much of the prior literature evaluates a single policy instrument in isolation, this study contributes by examining a broad set of labor market tools—UI, firing costs, bargaining power, hiring subsidies, and matching programs—within a unified general equilibrium framework. This approach facilitates a comprehensive evaluation of reform packages, a topic increasingly emphasized by international institutions (e.g., IMF, 2016; Budina et al., 2023; Campos et al., 2025). For example, Cacciatore and Fiori (2016) study the macroeconomic effects of labor and product market deregulation, finding short-run recessionary effects but long-run gains. This paper builds on the existing literature by incorporating self-employment into policy analysis and reassessing traditional tools in environments where alternative income sources are available.

Lastly, this study contributes to the growing literature on gig work as a fallback employment option. Jackson (2022) provides empirical evidence that many workers turn to gig work following unemployment, using it as a temporary source of income. Despite the rising importance of platform-based work, few studies examine its interaction with labor market policies; notably, Jackson et al. (2025) find that extensions of unemployment insurance during the COVID-19 crisis reduced gig work participation. This paper fills that gap by analyzing how the availability of alternative work options affects both the effectiveness and the distributional consequences of standard labor market interventions.

The remainder of the chapter is organized as follows. Section 2.2 presents the structural model with policy instruments. Section 2.3 describes the calibration. Section 2.4 presents the main policy results. Section 2.5 concludes.

2.2 Model

2.2.1 Preferences

Time is continuous, and the economy consists of a unit mass of infinitely lived workers. Workers are heterogeneous in productivity (z), asset holdings (a), and employment status (o). Idiosyncratic productivity (z) follows a continuous-time Markov process. Workers are risk-averse and derive utility $u(c)$ from consumption. Labor is supplied inelastically.

2.2.2 Occupational Transitions

A worker may occupy one of three mutually exclusive employment statuses: paid employment (E), self-employment (S), or unemployment (U). To allow for more nuanced policy analysis, the unemployment state is further divided into UI-eligible (U_Y) and UI-ineligible (U_N) unemployment. UI benefits expire after a certain period, and only workers with prior paid employment are eligible to receive them.

Transitions from an employment status (o) are governed by two sources: (i) exogenous shocks that lead to involuntary separations, arriving at a Poisson rate λ_o, and (ii) endogenous choice opportunities, arriving at a Poisson rate $\tilde{\lambda}_o$. For instance, paid employees (E) face job destruction shocks at rate λ_E, while self-employed workers (S) face business termination shocks at rate λ_S. Voluntary job-switching opportunities—such as quitting or starting a business—arrive at rates $\tilde{\lambda}_E$ and $\tilde{\lambda}_S$, respectively.

Self-employment is accessible only from unemployment. This assumption emphasizes the role of self-employment as a fallback option rather than a competing employment sector, consistent with the focus of this paper. Transitions into paid employment must occur through a frictional labor market. Figure 2.1 illustrates these occupational transitions.

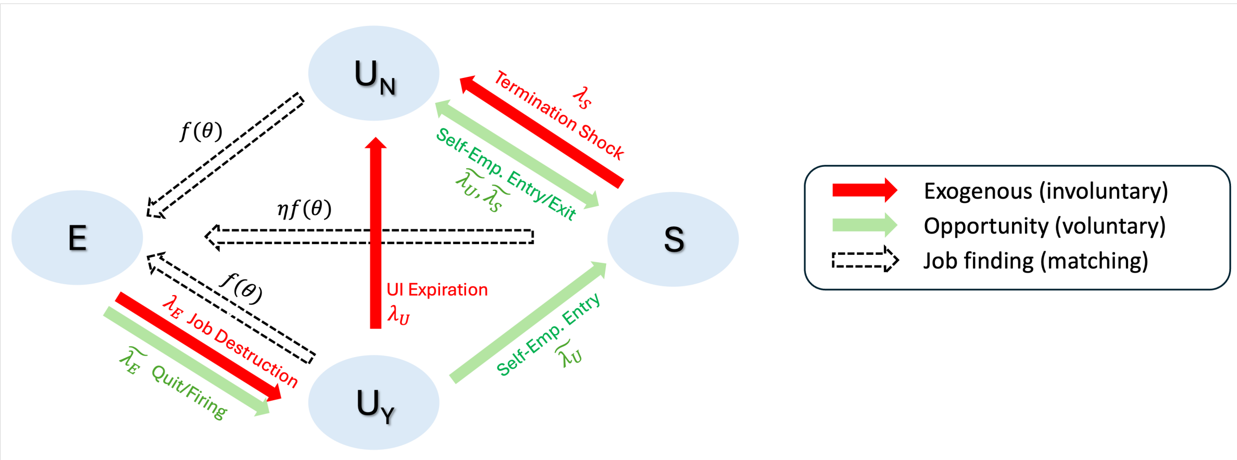
2.2.3 Labor Market

Firms post vacancies to hire workers for paid employment. Consistent with the standard search-and-matching framework, matches between job seekers and vacancies occur via an aggregate matching function:

$$M(u, s, v) = \chi(u + \eta s)^{\psi} v^{1-\psi} \tag{2.1}$$

where u denotes the share of unemployed workers, s the share of self-employed workers, and v the number of vacancies posted by firms. Self-employed individuals search for paid employment with reduced intensity, discounted by a factor $\eta \in [0, 1]$. The parameter χ captures the efficiency of the matching process, and $\psi \in (0, 1)$ denotes the matching elasticity.

Figure 2.1: Occupational Transitions



Note: Red arrows indicate exogenous transitions; green arrows show voluntary opportunity-based transitions; dashed black arrows represent job-finding flows governed by matching frictions. Rates with a tilde ($\tilde{\lambda}$) denote Poisson arrival rates of opportunity shocks; untilded rates represent exogenous shocks. In λ_o, the subscript o indicates the origin state.

Labor market tightness is defined as the ratio of vacancies to effective job seekers:

$$\theta = \frac{v}{u + \eta s}$$

Accordingly, the job-finding rate for workers is given by $f(\theta) = \chi\theta^{1-\psi}$, and the job-filling rate for firms is $q(\theta) = \chi\theta^{-\psi}$.

2.2.4 Production

Consumption goods are produced in two sectors: (1) corporate firms employing paid workers, and (2) own-account self-employed businesses. A continuum of risk-neutral corporate firms each maintains a job position and hires a worker. Output from a firm-worker match depends on the per-worker capital input k and the hired worker's idiosyncratic productivity z, following a concave production function:

$$y(z, k) = zf(k), \quad f'(k) > 0, \quad f''(k) < 0$$

implying diminishing returns to capital per worker.

Self-employed workers operate their businesses using their own capital and productivity. Output in self-employment is given by:

$$y_s(z,k) = e(z)f_s(k), \quad f_s'(k) > 0, \quad f_s''(k) < 0$$

where $e(z)$ is increasing in z, reflecting the impact of productivity on production efficiency. Self-employment production incurs a fixed flow cost κ. $e(z)$ and κ differentiate traditional self-employment from flexible self-employment in the model calibration. Capital use in self-employment is constrained by a collateral condition based on asset holdings:

$$k \leq \zeta a, \quad \zeta \in (0,1]$$

reflecting limited access to external financing.

2.2.5 Government Policy

The government implements labor market policy through five instruments: unemployment insurance (UI), firing costs, worker bargaining institutions (e.g., labor unions or collective agreements), and two types of active labor market policies (ALMPs).

Unemployment Insurance (UI) Workers dismissed from paid employment are eligible for UI benefits for a limited duration. The benefit level is defined as:

$$B_Y = \min\left\{b\,\hat{w}(z), \bar{B}\right\} \tag{2.2}$$

where $b \in [0,1]$ is the UI replacement rate, and $\hat{w}(z)$ denotes the average wage for workers with productivity z.[1] The term $\bar{B}$ sets an upper bound on UI benefits. Unemployed individ-

[1] Using average wages avoids tracking individual wage histories, reducing computational complexity. This approach follows the literature; see, e.g., Setty and Yedid-Levi (2021).

uals who are ineligible for UI receive a flat social assistance benefit $B_N = b_0$. UI expenditures are financed through taxes levied on labor income and self-employed firm profits.

Firing Costs Firing costs represent regulatory frictions that impose monetary penalties on firms for terminating employment relationships. These costs capture legal, administrative, and reputational burdens associated with dismissal and are modeled as a fixed payment F incurred by firms upon separation, following Cacciatore and Fiori (2016).

Unionization Under Nash bargaining, the match surplus is split between the worker and the firm according to their relative bargaining power, which captures institutional features such as unionization or collective agreements. Higher worker bargaining power shifts a larger share of the surplus toward employees, raising wages, but reduces firms' residual surplus and may dampen their incentives to post vacancies.

Active Labor Market Policies (ALMPs) Two types of ALMPs are considered. The first is a hiring subsidy, modeled as a per-match transfer s paid to firms upon creating a new job match, consistent with Mortensen and Pissarides (1999). This subsidy lowers the effective cost of posting vacancies and enters the firm's free-entry condition. The fiscal cost of hiring subsidies is given by:

$$A_s(s) = s \cdot q(\theta) \cdot v$$

where $q(\theta)$ is the job-filling probability and v denotes the number of vacancies, capturing the equilibrium cost of subsidized hiring.

The second ALMP type aims to improve job-matching efficiency through programs such as training, placement services, or mobility support. These interventions are modeled as exogenous increases in the matching efficiency parameter χ in the aggregate matching function, with fiscal cost:

$$A_m(\chi) = \hat{A} \cdot \left(\frac{\chi - \chi_0}{\chi_0} \right)^2$$

where χ_0 is the baseline matching efficiency, and $\hat{A}$ is a scaling coefficient. The quadratic specification reflects increasing marginal costs of enhancing matching efficiency. Both ALMPs are financed through taxes on labor income and profits from self-employed firms.

2.2.6 Asset Market

Workers partially insure themselves against productivity and labor market risks by saving in two types of assets: physical capital, which is used in production, and equity, which yields firm dividends. A no-arbitrage condition ensures equality between the return on capital, $r - \delta$, and the return on equity, $\frac{d}{p}$, where d denotes dividends and p denotes the equity price. Therefore, total asset holdings can be expressed as:

$$a = s(k)k + s(p)p \tag{2.3}$$

where $s(\cdot)$ represents portfolio weights. Consequently, a serves as a single state variable capturing the worker's total asset holdings.

2.2.7 Worker's Problem

The worker's problem is characterized by a set of Hamilton–Jacobi–Bellman (HJB) equations, one for each employment state.

Paid Employment (E) A worker in paid employment earns wage income $w(a, z)$, experiences involuntary job separations at rate λ_E, and receives voluntary quit opportunities at rate $\tilde{\lambda}_E$. The corresponding HJB equation is:

$$\begin{aligned}\rho W_E(a,z) = \max_c\ & u(c) + \partial_a W_E(a,z)\,\dot{a} + \lambda_E\left[W_{U_Y}(a,z) - W_E(a,z)\right] \\ & + \tilde{\lambda}_E \max\left\{W_{U_Y}(a,z) - W_E(a,z),\, 0\right\} + \mu(z)\,\partial_z W_E(a,z) + \tfrac{1}{2}\sigma^2(z)\,\partial_{zz} W_E(a,z)\end{aligned} \tag{2.4}$$

subject to:

$$\dot{a} = (1-\tau)\, w(a,z) + (r-\delta)\, a - c, \quad a \geq \underline{a}$$

where τ denotes the labor income tax rate. Asset holdings must satisfy the borrowing constraint $a \geq \underline{a}$.

Unemployment (U_Y, U_N) Unemployed workers receive benefits $B_k(z)$ based on their eligibility status $k \in \{Y, N\}$. They search for paid employment with arrival rate $f(\theta)$, and can transition to self-employment with arrival rate $\tilde{\lambda}_U$. UI eligibility expires at rate λ_U.[2] The HJB equation is:

$$\begin{aligned} \rho W_{U_k}(a,z) = \max_c\ & u(c) + \partial_a W_{U_k}(a,z)\, \dot{a} + f(\theta)\left[W_E(a,z) - W_{U_k}(a,z)\right] \\ & + \mathbb{1}_{k=Y}\, \lambda_U \left[W_{U_N}(a,z) - W_{U_k}(a,z)\right] + \tilde{\lambda}_U \max\left\{W_S(a,z) - W_{U_k}(a,z),\, 0\right\} \end{aligned} \tag{2.5}$$

subject to:

$$\dot{a} = (1-\tau)\, B_k(z) + (r-\delta)\, a - c, \quad a \geq \underline{a}$$

Self-Employment (S) Self-employed workers earn profits $\pi_s(z,k)$, experience business termination shocks at rate λ_S, and receive opportunities to transition to unemployment at rate $\tilde{\lambda}_S$. Additionally, they search for wage employment at reduced intensity $\eta f(\theta)$. The corresponding HJB equation is:

$$\begin{aligned} \rho W_S(a,z) = \max_c\ & u(c) + \partial_a W_S(a,z)\, \dot{a} + \lambda_S \left[W_{U_N}(a,z) - W_S(a,z)\right] + \tilde{\lambda}_S \max\left\{W_{U_N}(a,z) - W_S(a,z),\, 0\right\} \\ & + \eta f(\theta)\left[W_E(a,z) - W_S(a,z)\right] + \mu(z)\, \partial_z W_S(a,z) + \tfrac{1}{2}\sigma^2(z)\, \partial_{zz} W_S(a,z) \end{aligned} \tag{2.6}$$

[2] Productivity is assumed to remain fixed during unemployment.

subject to:

$$\dot{a} = (1-\tau)\,\pi_s(z,k) + (r-\delta)\,a - c, \quad a \geq \underline{a} \tag{2.7}$$

$$\pi_s(z,k) = \max_{k_s \leq \zeta a} \{y_s(z,k) - \kappa - r\,k\} \tag{2.8}$$

2.2.8 Firm's Problem

Value of a Filled Job The value of a filled job, denoted $J(a,z)$, represents the present discounted value of profits from employing a worker with productivity z and asset holdings a. A job match may terminate either through an exogenous separation shock, arriving at rate λ_E, or through an endogenous termination opportunity, arriving at rate $\tilde{\lambda}_E$.[3] Firms incur a firing cost F when choosing to terminate matches endogenously.

The value function satisfies the following Hamilton–Jacobi–Bellman (HJB) equation:

$$\begin{aligned}(r-\delta)J(a,z) = {} & y(z,k) - w(a,z) - rk + \partial_a J(a,z)\dot{a} \\ & + \lambda_E\,[V - J(a,z)] + \tilde{\lambda}_E \max\{V - F - J(a,z),\, 0\} \\ & + \mu(z)\partial_z J(a,z) + \tfrac{1}{2}\sigma^2(z)\partial_{zz} J(a,z)\end{aligned} \tag{2.9}$$

where $y(z,k)$ denotes output from the production function, and $w(a,z)$ is the wage paid to the worker. Firms choose capital input k by solving a static profit-maximization problem.

Value of a Vacancy Vacant positions incur posting costs ξ and are filled at a rate $q(\theta)$. Firms receive a hiring subsidy s upon filling vacancies. The value of a vacancy, denoted V, satisfies:

$$(r-\delta)V = -\xi + s + q(\theta)\int_z \int_a \omega(a,z)\,[J(a,z) - V]\,da\,dz \tag{2.10}$$

[3]Hence, firms initially maintain matches, deciding to dismiss workers only after observing productivity over time, or workers quit after assessing job fit. This captures a realistic evaluation period for match quality.

where the matching weight $\omega(a,z)$ combines unemployed and self-employed job seekers, defined as:

$$\omega(a,z) = \frac{d_U(a,z) + \eta d_S(a,z)}{u + \eta s}$$

Free Entry Condition Firms post vacancies until the expected value of a vacancy is driven to zero. In equilibrium:

$$V = 0 \tag{2.11}$$

2.2.9 Wage Determination

Wages in the corporate sector are determined through Nash bargaining between firms and workers. Let $\widetilde{W}_E(w,a,z)$ denote the continuation value of an employed worker earning wage w, and let $\widetilde{J}(w,a,z)$ represent the firm's value from a filled job at that wage. The worker's outside option is the value of unemployment with UI eligibility, $W_{U_Y}(a,z)$, while the firm's outside option is the value of a vacancy net of expected firing costs, $V - F$. Match surplus is divided according to the worker's bargaining power $\psi \in (0,1)$, resulting in the wage that solves:

$$w(a,z) = \arg\max_w \left(\widetilde{W}_E(w,a,z) - W_{U_Y}(a,z)\right)^{\psi} \left(\widetilde{J}(w,a,z) - (V-F)\right)^{1-\psi} \tag{2.12}$$

The equilibrium wage depends on the worker's productivity z, asset holdings a, and prevailing labor market tightness, as all these factors shape the surplus available to each party.[4]

The total surplus from a job match can be expressed as:

$$S(a,z) = \frac{W_E(a,z) - W_{U_Y}(a,z)}{\partial_a W_E(a,z) \cdot (1-\tau)} + \frac{J(a,z) - (V-F)}{1 - \partial_a J(a,z) \cdot (1-\tau)}$$

where $\partial_a W_E$ and $\partial_a J$ are the marginal value of assets to the worker and firm, respectively.

[4] A full derivation of the equilibrium wage appears in Appendix D.

These terms serve as adjustment factors, converting utility and profit flows into consumption-equivalent units.

Match continuation is determined as follows:

$$\Phi_E(a,z) = \begin{cases} 1 & \text{if } S(a,z) > 0 \\ 0 & \text{otherwise.} \end{cases}$$

Policy Linkages Labor market policies influence surplus sharing and equilibrium wages through their effects on outside options and labor market tightness. A higher replacement rate in unemployment insurance increases the worker's fallback value $W_{U_Y}(a,z)$, strengthening their bargaining position and leading to higher wages. Higher firing costs F reduce the firm's outside option by increasing the cost of separations, which weakens the firm's bargaining position. However, these costs may also discourage firms from posting vacancies and limit future wage growth.

An increase in the worker's bargaining weight ψ shifts the match surplus toward workers, resulting in higher negotiated wages. Policies aimed at improving labor market functioning influence wages indirectly. For instance, hiring subsidies reduce the effective cost of posting vacancies, encouraging job creation and increasing labor market tightness, which in turn improves the worker's bargaining position. Similarly, improvements in matching efficiency raise both job-finding and vacancy-filling rates. The resulting wage effect depends on how the gains from faster matching are distributed between firms and workers.

2.2.10 Stationary Equilibrium

A stationary equilibrium consists of value functions $\{W_o(a,z), J(a,z), V\}$, policy functions for consumption and occupational choice, a wage function $w(a,z)$, aggregate prices (r,p), tax rate τ, capital demands $k(z)$ and $k_s(z)$, and stationary distributions $\{d_o(a,z)\}_{o\in\{E,S,U_Y,U_N\}}$, satisfying the following conditions:

1. Given prices and job-finding rate $f(\theta)$, individuals solve their respective HJB equations

for each employment status $o \in \{E, S, U_Y, U_N\}$, choosing optimal consumption $c_o(a, z)$ and self-employment capital $k_s(z)$:

$$c_o(a, z) = u'^{-1}\left(\partial_a W_o(a, z)\right), \tag{2.13}$$

$$k_s(z) = \arg\max_{k \le \zeta a} \{y_s(z, k) - rk\} \tag{2.14}$$

2. Corporate firms choose capital $k(z)$ to maximize profits, given wages and the rental rate:

$$k(z) = \arg\max_{k} \{y(z, k) - w(a, z) - rk\} \tag{2.15}$$

Firms' value functions $J(a, z)$ and V satisfy their respective HJB equations, and the free entry condition ensures zero expected vacancy profits:

$$q(\theta) \int \int \omega(a, z) J(a, z)\, da\, dz = \xi - s, \tag{2.16}$$

where matching weights are defined as $\omega(a, z) = \frac{d_U(a,z) + \eta d_S(a,z)}{u + \eta s}$.

3. Wages $w(a, z)$ are determined via Nash bargaining as in Equation (2.12).

4. Total firm asset demand equals aggregate household savings:

$$\int \int [k(z) d_E(a, z) + k_s(z) d_S(a, z)]\, da\, dz + p = \sum_{o} \int \int a\, d_o(a, z)\, da\, dz \tag{2.17}$$

5. Aggregate dividends to equity holders satisfy:

$$d = \int \int [y(z, k(z)) - w(a, z) - rk(z)]\, d_E(a, z)\, da\, dz - (\xi - s)v, \tag{2.18}$$

with the no-arbitrage condition:

$$\frac{d}{p} = r - \delta$$

6. Tax revenues finance UI benefits and ALMP spending according to the government budget constraint:

$$\begin{aligned}\tau \int\int & [w(a,z)d_E(a,z) + \pi_s(z,k_s(z))d_S(a,z)]\,da\,dz \\ &= \int\int [B_Y(z)d_{U_Y}(a,z) + B_N d_{U_N}(a,z)]\,da\,dz + A_s(s) + A_m(\chi) \end{aligned} \tag{2.19}$$

7. Aggregate Resource Constraint: Define gross output Y as:

$$Y = \int\int y(z,k(z))\,d_E(a,z)\,da\,dz + \int\int y_s(z,k_s(z))\,d_S(a,z)\,da\,dz$$

and aggregate consumption C and investment I as:

$$C = \sum_{o\in\{E,S,U_Y,U_N\}} \int\int c_o(a,z)\,d_o(a,z)\,da\,dz, \quad I = \delta\int\int [k(z)d_E(a,z) + k_s(z)d_S(a,z)]\,da\,dz$$

The total separation rate is:

$$\Lambda = \lambda_E + \tilde{\lambda}_E \frac{\int\int \Phi_E(a,z)d_E(a,z)\,da\,dz}{e}$$

with employment share $e = \int\int d_E(a,z)\,da\,dz$. Goods-market clearing requires:

$$Y = C + I + \xi v + A_s(s) + A_m(\chi) + F\Lambda e$$

8. The distributions $d_o(a,z)$ for each employment state reflect agents' optimal decisions and satisfy the Kolmogorov Forward Equation (KFE).

2.3 Calibration

The model is calibrated at a quarterly frequency to match key features of the U.S. labor market and the empirical patterns of self-employment. Two distinct parameterizations are used for the self-employment sector: one representing traditional self-employment and the other capturing flexible self-employment, such as gig work. Parameters for traditional self-employment are calibrated using data from the *Current Population Survey* (CPS) and the *Survey of Consumer Finances* (SCF) over the period 1994–2013, prior to the widespread emergence of digital labor platforms. For flexible self-employment, the calibration draws on data from the *Survey of Household Economics and Decisionmaking* (SHED) for the years 2016–2019, which includes detailed information on gig work and related activities.[5]

General labor market parameters are calibrated using the traditional self-employment scenario, which reflects the long-run features of the U.S. labor market. Tables 2.1 and 2.2 report the parameter values used in the model.

Preferences and Technology The utility function follows the standard CRRA form, $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$, with the coefficient of relative risk aversion set to $\gamma = 1.5$. The discount rate ρ corresponds to an annual real interest rate of 4%. Idiosyncratic productivity z evolves according to an Ornstein–Uhlenbeck process in logs, with persistence and variance calibrated following Floden and Lindé (2001).

Production in the corporate sector is specified as $y(z, k) = zk^{\alpha}$, with capital elasticity $\alpha = 0.3$, consistent with standard macroeconomic calibrations. In the self-employment sector, output is given by $y_s(z, k) = e(z)k^{\nu}$, where $\nu = 0.26$ captures span-of-control frictions and decreasing returns to capital.[6] The efficiency term $e(z) = \varepsilon z^{\theta}$ captures productivity's effect on output and is parameterized separately for traditional and flexible self-employment.

Two Types of Self-Employment Flexible self-employment is modeled to reflect high transition rates, lower earning profiles, and higher job-search activity, consistent with empirical data. To ensure accurate analysis and fair comparison between traditional and flexible

[5] I constructed a dataset from the SHED microdata to track employment transitions. Due to changes in survey questions after 2020, this was not possible beyond 2019. See Chapter 1, Section 1.2, for further details.

[6] This value aligns with Midrigan and Xu (2014), who use a nested production function $y = z(k^{\alpha}l^{1-\alpha})^{\eta}$. With $\alpha = 0.3$ and $\eta = 0.85$, the implied capital elasticity is approximately $\alpha \cdot \eta \approx 0.26$.

self-employment, traditional self-employment is set to represent small businesses or necessity-driven entrepreneurship, explicitly excluding high-income entrepreneurs.

Traditional self-employment features lower entry and exit rates ($\tilde{\lambda}_S = 0.17$) and no active job search ($\eta = 0$). Flexible self-employment has significantly higher entry and exit rates ($\tilde{\lambda}_S = 12$),[7] and higher termination rates ($\lambda_S = 0.6$).[8] These parameters match transition rates from CPS data (traditional) and SHED data (flexible).

Parameters for productivity scaling ($\varepsilon = 1.32, 1.06$) and fixed costs ($\kappa = 0.05, 0$) are calibrated to match the size of self-employment and its concentration at the lower end of the income distribution, reflecting its role as a fallback against unemployment. The traditional type matches SCF data, and the flexible type matches SHED data. Although estimating the precise share of traditional self-employment as a fallback is challenging, for comparability, its size is set similarly to the gig economy share in SHED data (5.7%), close to the unincorporated self-employment share in CPS (6.0%). An upper bound on self-employment profits, capped at 150% of the average wage, is imposed to reflect its fallback role. This constraint typically binds for high-productivity individuals in the top 20% of the income distribution.

Matching and Transitions The matching efficiency parameter, χ, is calibrated to achieve a monthly job-finding rate of 45%, consistent with Krusell et al. (2010). Vacancy posting cost ξ is set to yield labor market tightness of unity, following Shimer (2005). The exogenous job separation rate is calibrated to 0.088, matching the average U.S. unemployment rate of 6.2% (CPS data, 1994–2013). Voluntary quits and firing opportunities arrive monthly at a rate of $\tilde{\lambda}_E = 3$.

Labor Market Policy Unemployment insurance (UI) parameters reflect the institutional features of the U.S. system: a replacement rate of $b = 0.45$, benefit duration of 26 weeks

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[7] This high arrival rate corresponds to weekly job opportunities, reflecting practical industry norms such as rideshare applications.

[8] Higher termination rates reflect empirical findings that gig workers have more volatile incomes than traditional workers (Farrell & Greig, 2016).

(implying a hazard rate of $\lambda_U = 0.45$), and a maximum benefit cap equal to 50% of mean wages. Worker bargaining power is set to $\psi = 0.72$ following Shimer (2005). Firing costs and hiring subsidies are initially set to zero and introduced later in counterfactual experiments.[9]

For matching efficiency programs, the fiscal cost is modeled as $A_m = \hat{A} \cdot \left(\frac{\chi - \chi_0}{\chi_0}\right)^2$. The scaling coefficient $\hat{A}$ is calibrated so that spending 0.2% of GDP on ALMP generates a 12% increase in χ, consistent with empirical estimates from major labor market reforms.[10]

Results Table 2.3 reports labor market outcomes and employment compositions for models that include either traditional or flexible self-employment. Transition patterns across occupations reflect the inherent differences in flexibility between these two types of self-employment. In particular, the model with flexible self-employment exhibits higher entry and exit rates, lower retention, and a correspondingly lower unemployment rate.

While both models show self-employment concentrated among lower-income and lower-productivity individuals, the lower fixed costs and easier entry and exit in the flexible self-employment environment attract greater participation from low-productivity workers. As a result, the decline in unemployment in the flexible model is largely driven by a reduction in the number of low-productivity individuals remaining unemployed (see Figure 2.2). The higher density of low-productivity individuals in flexible self-employment also reallocates relatively higher-productivity workers to the paid employment sector. This compositional shift raises average productivity among the employed, which in turn leads to fewer job separations (as fewer matches fall below firms' productivity thresholds), modestly higher average wages, and improved vacancy posting values.

Discussion These results compare economies in which only one type of self-employment is available. Introducing flexible self-employment into an economy that already features tradi-

[9]This baseline reflects the absence of mandatory severance pay and the relatively low levels of employment protection and ALMP spending in the U.S. compared to other OECD countries.

[10]Fahr and Sunde (2009) estimate that Germany's Hartz reforms increased matching efficiency by 11% to 15%, with ALMP expenditures rising by 0.1% to 0.2% of GDP. Setting the cost at 0.2% of GDP and targeting a 12% improvement in χ implies $\hat{A} \approx 0.5Y$, where Y denotes quarterly GDP in model units.

Table 2.1: Calibration

	Parameter	Value	Source / Target
Preferences and Technology			
γ	CRRA coefficient	1.5	Attanasio (1999)
ρ	Discount rate	0.01	Annual rate = 4%
α	Capital share (corporate)	0.3	Standard macro calibration
ν	Capital share (self-employment)	0.26	Midrigan and Xu (2014)
ζ	Collateral constraint	1.86	Debt-to-equity ratio (SCF)
δ	Depreciation rate	0.017	Implies 20% annual depreciation
ρ_z	Productivity persistence	0.978	Floden and Lindé (2001)
σ_z^2	Productivity variance	0.103	Floden and Lindé (2001)
Labor Market			
χ	Matching efficiency	1.79	45% monthly job-finding, Shimer (2005)
ξ	Vacancy posting cost	0.315	Calibrated for $\theta = 1$
ϕ	Matching elasticity	0.72	Shimer (2005)
λ_E	Exogenous job separation rate	0.088	Matches 6.2% unemployment (CPS)
$\tilde{\lambda}_E$	Endogenous separation arrival	3.0	Monthly arrival
Policy Instruments			
b	UI replacement rate	0.45	U.S. policy
λ_U	UI expiration rate	0.45	Corresponds to 26 weeks
$\bar{b}$	Max UI benefit	1.0	50% of mean wage
b_0	Social assistance (UI ineligible)	0.1	5% replacement
ψ	Worker bargaining power	0.72	Shimer (2005)
F	Firing cost	0	Baseline (U.S.)
s	Hiring subsidy	0	Baseline (U.S.)
$\hat{A}$	ALMP fiscal cost scaling	0.5	0.2% of GDP for 12% gain in χ

Table 2.2: Self-employment Sector Calibration

Parameter		Value	Source / Target
Traditional Self-employment			
$\tilde{\lambda}_S$	Entry/exit opportunity rate	0.17	U-to-SE rate: 4.7% (CPS)
λ_S	Termination rate	0.08	SE-to-U rate: 3.6% (CPS)
ε	Productivity scale	1.32	Unincorporated SE share (CPS): 6.0%
θ	Productivity relevance	1.18	Same as flexible case
κ	Fixed costs	0.05	SE share for bottom 20%: 12.2% (SCF)
η	Search effort while self-employed	0	Normalized
Flexible Self-employment			
$\tilde{\lambda}_S$	Entry/exit opportunity rate	12	Weekly arrivals; Gig share: 5.7% (SHED)
λ_S	Termination rate	0.6	Gig-to-U rate: 6.1% (SHED)
ε	Productivity scale	1.06	Gig-to-E median income ratio: 0.45 (SHED)
θ	Productivity relevance	1.18	Gig share for bottom 20%: 15% (SHED)
κ	Fixed costs	0	Normalized
η	Search effort while gig-employed	0.13	Gig-to-E transition: 23.0% (SHED)

Note: Calibration targets for traditional self-employment are based on unincorporated self-employment data from the Current Population Survey (CPS), 1994–2013. Gig economy estimates are based on the Survey of Household Economics and Decisionmaking (SHED), 2016–2019.

tional self-employment would induce further compositional adjustments that could amplify or dampen the patterns observed here.[11]

2.4 Policy Analysis

This section analyzes the effects of five key labor market policies: (1) unemployment insurance (UI), (2) firing costs, (3) labor unionization (modeled via workers' bargaining power), (4) hiring subsidies, and (5) improvements in matching efficiency. For each policy, I conduct counterfactual experiments by varying the relevant parameter and solving for the new equilibrium.[12]

The analysis is carried out across three distinct labor market environments: (i) a model

[11] The current analysis does not model the transitional dynamics or interactions that would arise if flexible self-employment were added to an economy already featuring traditional self-employment.

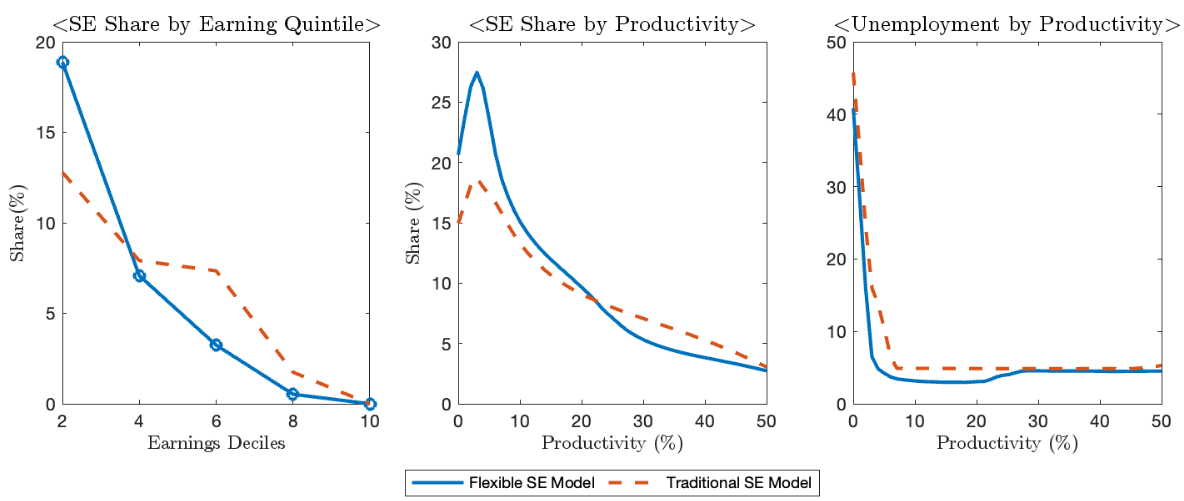
[12] The interest rate is held fixed at its baseline value in all policy experiments. Allowing it to adjust would have minimal quantitative effects but would significantly increase computational complexity.

Table 2.3: Model Results

	Model with Traditional SE	Model with Flexible SE
Occupation Share		
Unemployment	6.2%	5.2%
Paid Employment	87.8%	89.1%
Self-employment	6.0%	5.7%
Transition Rates into/out of self-employment		
U to S	4.5%	10.8%
S to U	3.8%	5.9%
S to E	4.8%	23.1%
S to S	91.4%	71.0%
Labor Market Outcomes[1)]		
Vacancy	100.0	103.1
Tightness	100.0	109.6
Job Separation Rate	100.0	95.4
Job Finding Rate	100.0	101.9
Mean Wage	100.0	100.4

1) Values from the traditional self-employment model = 100

Figure 2.2: Model Results: Self-employment Share



without self-employment,[13] (ii) a model with traditional self-employment, and (iii) a model with flexible self-employment (i.e., gig work). The first model serves as a conventional benchmark, reflecting standard heterogeneous-agent search-and-matching frameworks. The second model illustrates how including traditional self-employment modifies policy outcomes. The third model captures the additional implications of gig work, particularly its role as a fallback option in response to changes in labor market policies.

Welfare is evaluated using a consumption-equivalent measure. For each individual, I compute the consumption level that would make them indifferent between the baseline and counterfactual scenario, conditional on their initial asset holdings and productivity state. These individual measures are then aggregated using the stationary distribution from the baseline model to ensure comparability across policy experiments.

To clarify the mechanisms behind the total welfare effects, I adopt a decomposition strategy similar to Mukoyama (2013). The first component—the insurance effect—captures the direct utility impact of the policy, holding wages, job-finding rates, and taxes fixed. The second component—the labor market effect—reflects welfare changes arising from adjustments in labor market conditions, including vacancies, tightness, and wages, with taxes held constant. The third component—the fiscal effect—captures the welfare consequences of adjustments in the income tax rate required to balance the government budget when all other prices and labor market variables are allowed to respond.

2.4.1 Unemployment Insurance (UI)

The UI replacement rate parameter b is varied from 20% to 80%, consistent with the range observed across OECD countries. Lower replacement rates (20–30%) reflect policies in countries such as Australia and the United Kingdom, while higher rates (70–80%) correspond to systems in Luxembourg, the Netherlands, and Portugal.[14] Each counterfactual is evaluated

[13] The detailed model specification appears in Appendix E.

[14] Source: OECD unemployment benefits data, defined as the share of previous income received after two months for a single person.

relative to the baseline U.S. configuration, which assumes a replacement rate of 45%.

Labor Market Responses Reducing the UI replacement rate decreases unemployment in all model environments, whereas increasing it leads to higher unemployment (Figure 2.3). Labor market tightness and vacancy postings respond inversely to UI generosity: lower benefits raise tightness by reducing firms' expected wage costs and encouraging vacancy creation; higher benefits depress tightness through weaker incentives to hire. These dynamics are consistent with standard predictions from search-and-matching theory.[15]

The magnitude of these responses varies across environments. In the flexible self-employment model, a reduction to 20% lowers the unemployment rate by approximately 2 percentage points relative to the 45% baseline. In contrast, increasing the replacement rate to 80% raises unemployment by 2.7 percentage points. The traditional self-employment and no self-employment models respond more modestly, with corresponding changes of about –0.8 and +2.0 percentage points, respectively.

These differences highlight the role of flexible self-employment as an effective fallback for dismissed workers. When UI is reduced, unemployed workers face lower income and greater long-term risk. Many respond by substituting into flexible self-employment to smooth consumption. As a result, the self-employment rate rises sharply under lower UI generosity in the flexible model, unlike in the traditional self-employment model. Greater participation by low-productivity individuals in flexible work raises the average productivity of remaining job seekers. Flexible self-employment effectively serves as an outside option, raising the mean wage through improved bargaining positions and shifting the productivity distribution toward higher values. These effects are absent in the other two models. Increasing UI has the opposite effect, reducing entry into flexible work and increasing unemployment.

Welfare Effects Welfare responses to UI policy reflect the trade-off between insurance provision, labor market efficiency, and fiscal costs. Lowering the replacement rate from

[15] See Krusell et al. (2010) and Mukoyama (2013).

45% to 30% weakens income protection but improves job-finding rates and reduces the tax burden. In the flexible self-employment model, these labor market and fiscal gains more than offset the reduction in insurance value, resulting in a welfare improvement of +0.3%. The welfare gains are smaller in the traditional and no self-employment models, each yielding +0.1% (Figure 2.4). The presence of flexible work helps mitigate the welfare loss from weaker insurance by enabling income smoothing through fallback employment, while also amplifying gains through improved wages and lower taxes.

Conversely, raising the replacement rate to 60% reduces welfare across all environments: –0.4% in the flexible self-employment model and –0.1% in the other two. Although higher UI offers stronger insurance, these benefits are outweighed by lower job-finding rates, increased fiscal costs, and adverse changes in the job-seeker pool that reduce average wages. When fallback employment is available, these negative labor market effects are more pronounced, making UI expansions less effective or even detrimental in terms of aggregate welfare.

These effects are heterogeneous across the population. Low-productivity, asset-poor, and currently unemployed individuals benefit less from UI cuts and are less harmed by UI expansions. This pattern reflects their greater reliance on UI benefits for consumption smoothing.

2.4.2 Firing Costs

The firing cost parameter F is varied from 10% to 70% of the average monthly wage of the lowest-productivity workers, relative to the baseline U.S. case of zero. These values broadly correspond to dismissal costs observed across OECD countries.[16] For example, in countries with strong employment protection such as Portugal and the Netherlands, severance pay after two years of tenure—approximately the average job duration in the model—ranges from 0.7 to 0.8 months of wages, while no severance pay is legally required in the United

[16] In this model, firing costs are modeled as firm-side penalties and are not transferred to workers. Modeling severance payments as one-time transfers to workers has minimal impact on aggregate outcomes due to the infinite-horizon structure.

Figure 2.3: Effects of UI Benefits

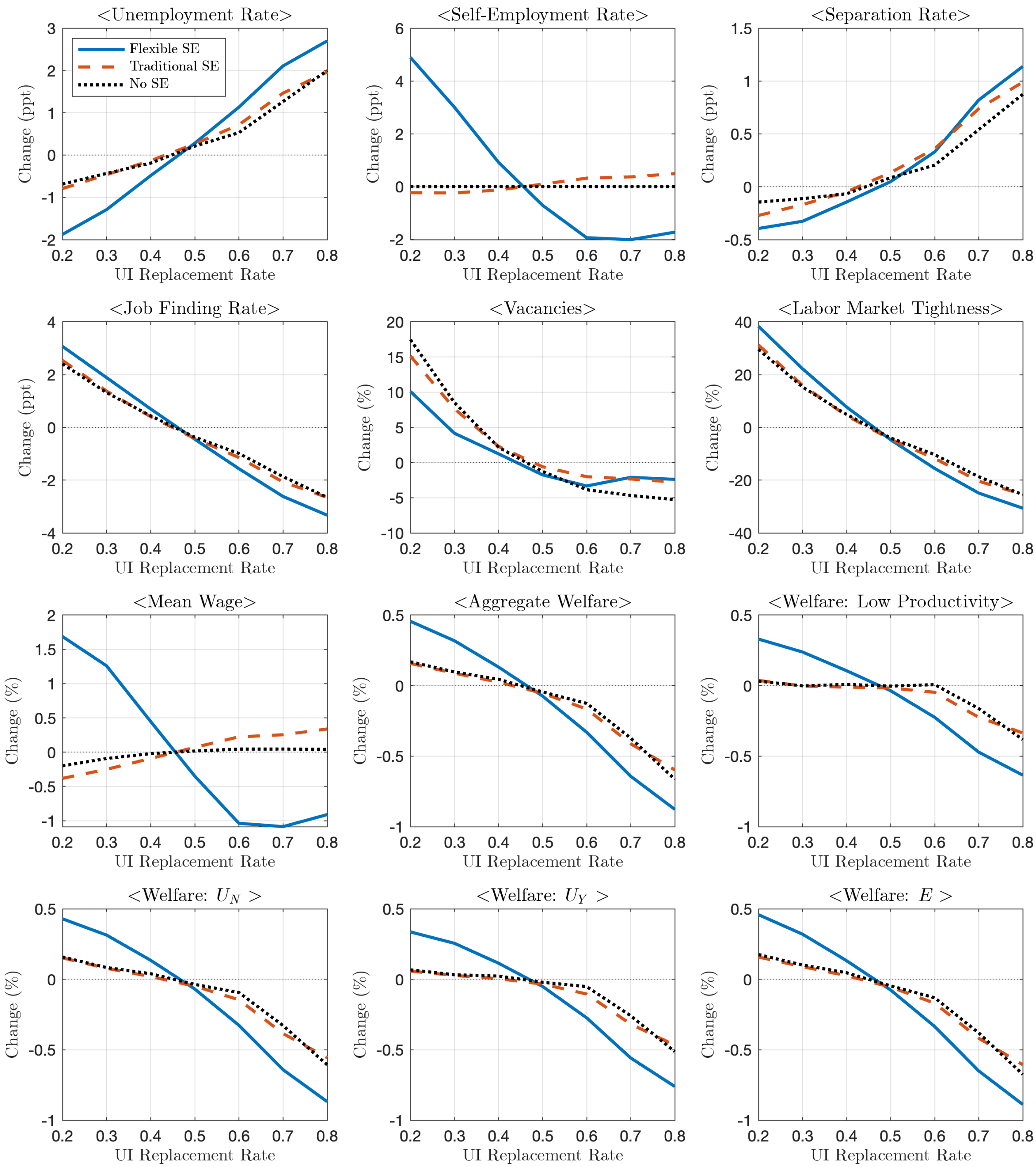
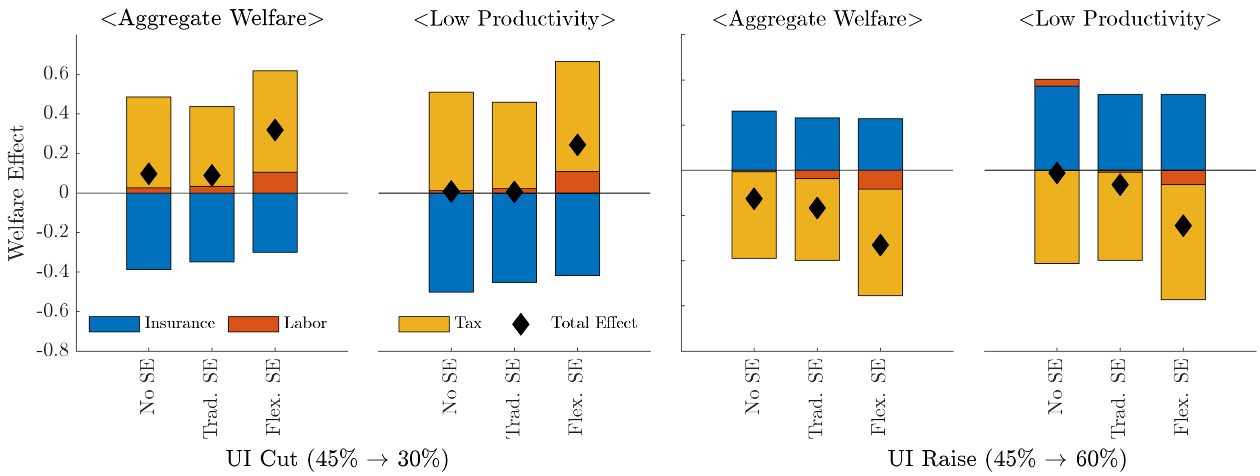


Figure 2.4: Welfare Effects Decomposition: UI



States.[17]

Labor Market Responses Higher firing costs reduce job separations by discouraging firms from terminating marginal matches (Figure 2.5). By lowering the productivity threshold for separation, firms retain more low-productivity workers. However, these costs also reduce the expected surplus from new hires, discouraging vacancy creation. In the absence of fallback employment options, this leads to a reduction in hiring and an increase in unemployment, consistent with predictions from standard search-and-matching models (e.g., Hopenhayn and Rogerson, 1993; Alvarez and Veracierto, 2001).

When self-employment options are available, however, the rise in unemployment is significantly muted. This cushioning effect is driven by increased transitions from unemployment to self-employment. For instance, raising firing costs to 50% of the lowest-productivity wage increases unemployment by 0.7 percentage points in the no-fallback model, but only by 0.3 points in the traditional self-employment model, and a mere 0.1 points in the flexible self-employment model. As vacancies decline, displaced workers can instead become self-

[17] Source: OECD Indicators of Employment Protection (2023), country notes. Available at: https://www.oecd.org/en/data/datasets/oecd-indicators-of-employment-protection.html.

employed, especially in the flexible model, where marginally dismissed workers can transition quickly into gig work.

Moreover, higher firing costs widen the surplus from maintaining a match, which raises negotiated wages. This increase is even more pronounced in models with self-employment, as low-productivity workers are more likely to sort into self-employment, leaving the wage employment pool more concentrated with higher-productivity individuals.

Welfare Effects Firing costs reduce aggregate welfare in all models, though the magnitude of loss varies by environment. For example, with firing costs set at 50% of monthly wages, welfare declines by 0.6% in the no-fallback model, 0.25% in the traditional self-employment model, and only 0.2% in the flexible self-employment model.

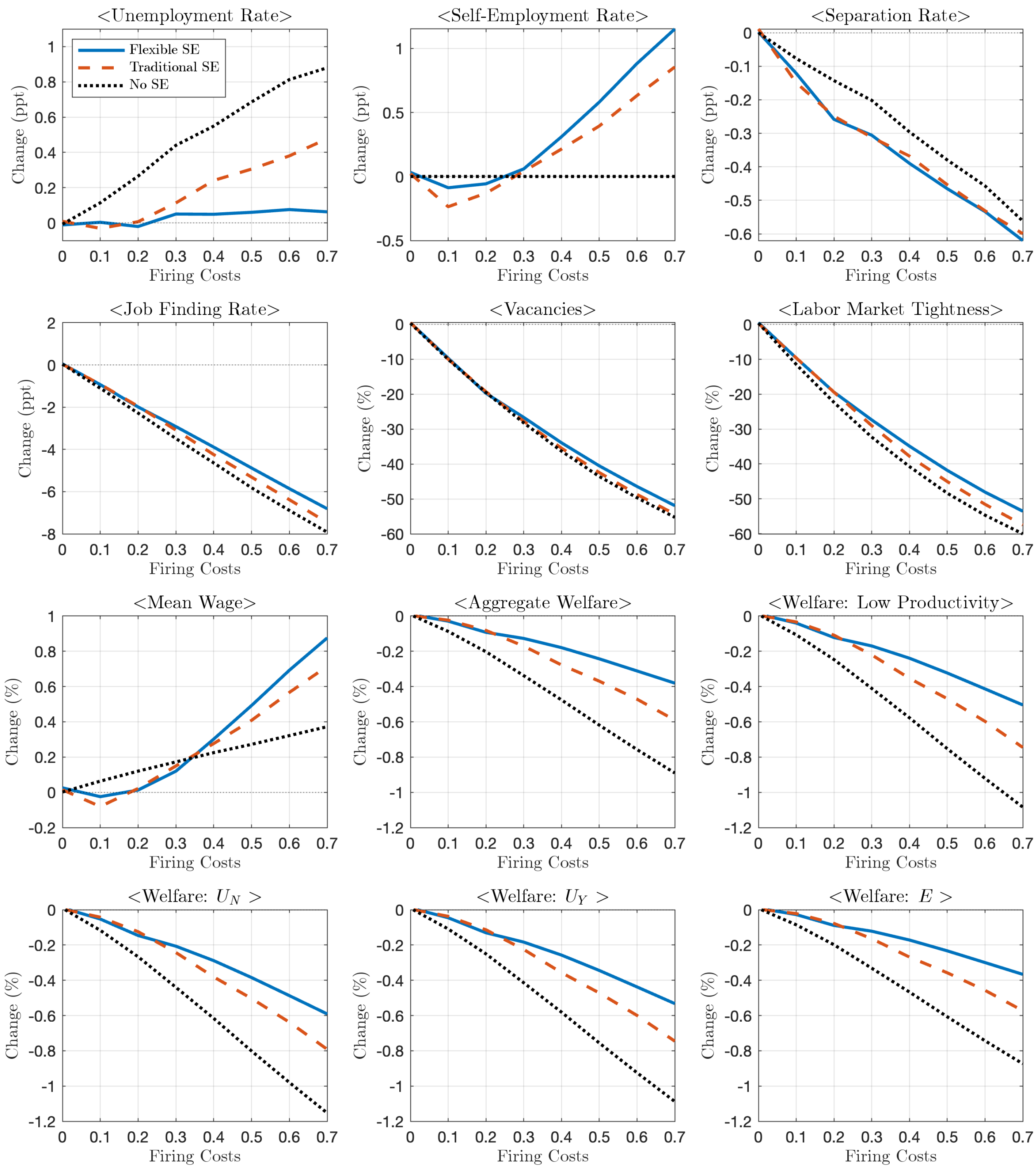
These losses are primarily driven by deteriorating labor market performance, particularly among marginal workers (Figure 2.6). The fiscal burden also rises, as higher unemployment increases UI expenditures, which in turn necessitates higher labor income tax rates to maintain budget balance. The availability of self-employment—especially in its flexible form—helps offset these negative effects by allowing displaced workers to remain economically active, thereby limiting unemployment and easing the fiscal adjustment burden.

2.4.3 Labor Unionization

Workers' bargaining power, ψ, is varied by $\pm 10\%$ from the benchmark value of 0.72, consistent with standard calibrations in the literature.[18] A lower value reflects a more decentralized or weaker bargaining environment, with surplus shared more equally between workers and firms. A higher value represents stronger worker influence, corresponding to unionized or centralized wage-setting institutions. To isolate the effect of bargaining power, the Hosios condition is imposed by setting matching elasticity equal to ψ.

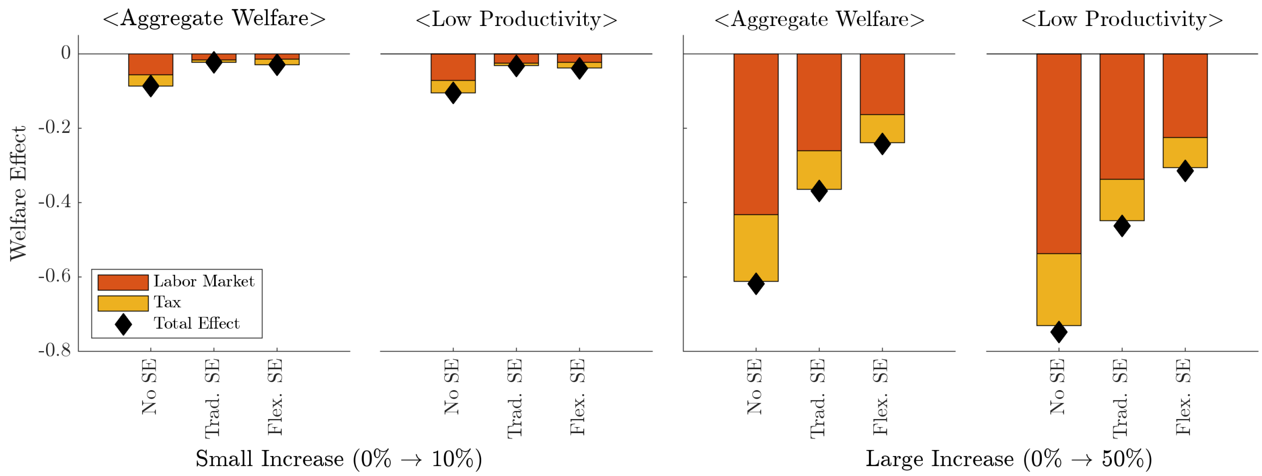
[18] For example, Petrongolo and Pissarides (2001) and Shimer (2005).

Figure 2.5: Effects of Firing Costs



Note: Firing costs are expressed as a fraction of average monthly wage of lowest productivity workers.

Figure 2.6: Welfare Effects Decomposition: Firing Costs



Labor Market Responses Bargaining power directly affects wage determination through Nash bargaining. Lower ψ reduces the worker's share of surplus and leads to lower wages, while higher ψ raises wages.

Unemployment responses vary across environments. In the no-fallback model, a decline in ψ increases firm profits and job creation but also makes firms more selective, raising the productivity threshold for retention. This leads to more separations and a rise in unemployment. In models with self-employment, especially the flexible one, improved job-finding makes self-employment less attractive, leading to lower self-employment participation and modest increases in unemployment.

With stronger bargaining power, the resulting rise in labor costs discourages vacancy creation, pushing up unemployment. However, fallback options help buffer this effect. Transitions from unemployment to self-employment limit the increase in unemployment. This effect is especially pronounced in the flexible model, where unemployed individuals can quickly transition into gig work.

Welfare Effects Welfare outcomes also depend on the labor market environment. In the no-fallback model, reducing ψ improves aggregate welfare, primarily due to stronger job creation and better labor market conditions (Figure 2.8). These gains are especially significant for individuals with low productivity and limited assets.

By contrast, in models with self-employment, the welfare effects of lower bargaining power are less favorable. Wage reductions and higher unemployment offset the benefits from increased vacancy creation. In the flexible self-employment model, increasing bargaining power instead improves welfare, supported by stronger outside options and higher wages. Decomposition shows that a 10% increase in ψ (from 0.72 to 0.80) raises aggregate welfare by 0.1%, driven mainly by labor market effects—lower unemployment and higher average wages. However, these gains are smaller among low-productivity and asset-poor groups, who are more exposed to a lower job finding rate.

2.4.4 Active Labor Market Policy: Hiring Subsidy

The hiring subsidy s is set as a fraction of aggregate output in the baseline economy, ranging from 0.1% to 0.5%. This range captures moderate to more aggressive policy scenarios. Public spending on recruitment incentives typically ranges between 0.01% and 0.1% of GDP in advanced economies as of 2019.[19] The effective fiscal cost of the subsidy, $A_s(s) = s \cdot q(\theta) \cdot v$, remains within the empirical range.

Labor Market Responses By lowering the cost of hiring, subsidies encourage firms to post more vacancies, raising labor market tightness and job-finding rates. These effects grow steadily with the size of the subsidy (Figure 2.9).

Despite stronger matching, unemployment falls only modestly, by less than 0.3 percentage points in the no self-employment model. This limited decline reflects offsetting forces: while job-finding improves, separation rates also increase as firms hire more marginal matches,

[19] Source: OECD Active Labour Market Policies Database, Employment Incentives category. Some programs provide larger subsidies targeted at specific groups or implemented during recessions. For example, the U.S. Work Opportunity Tax Credit (WOTC) offers subsidies amounting to 15–20% of annual earnings for eligible low-wage hires, and France's "zero charges" program covered approximately 12% of wages over one year for minimum-wage workers; see Cahuc et al. (2019). This study examines a general hiring subsidy that is not contingent upon worker type or business cycle conditions.

Figure 2.7: Effects of Changing Worker Bargaining Power

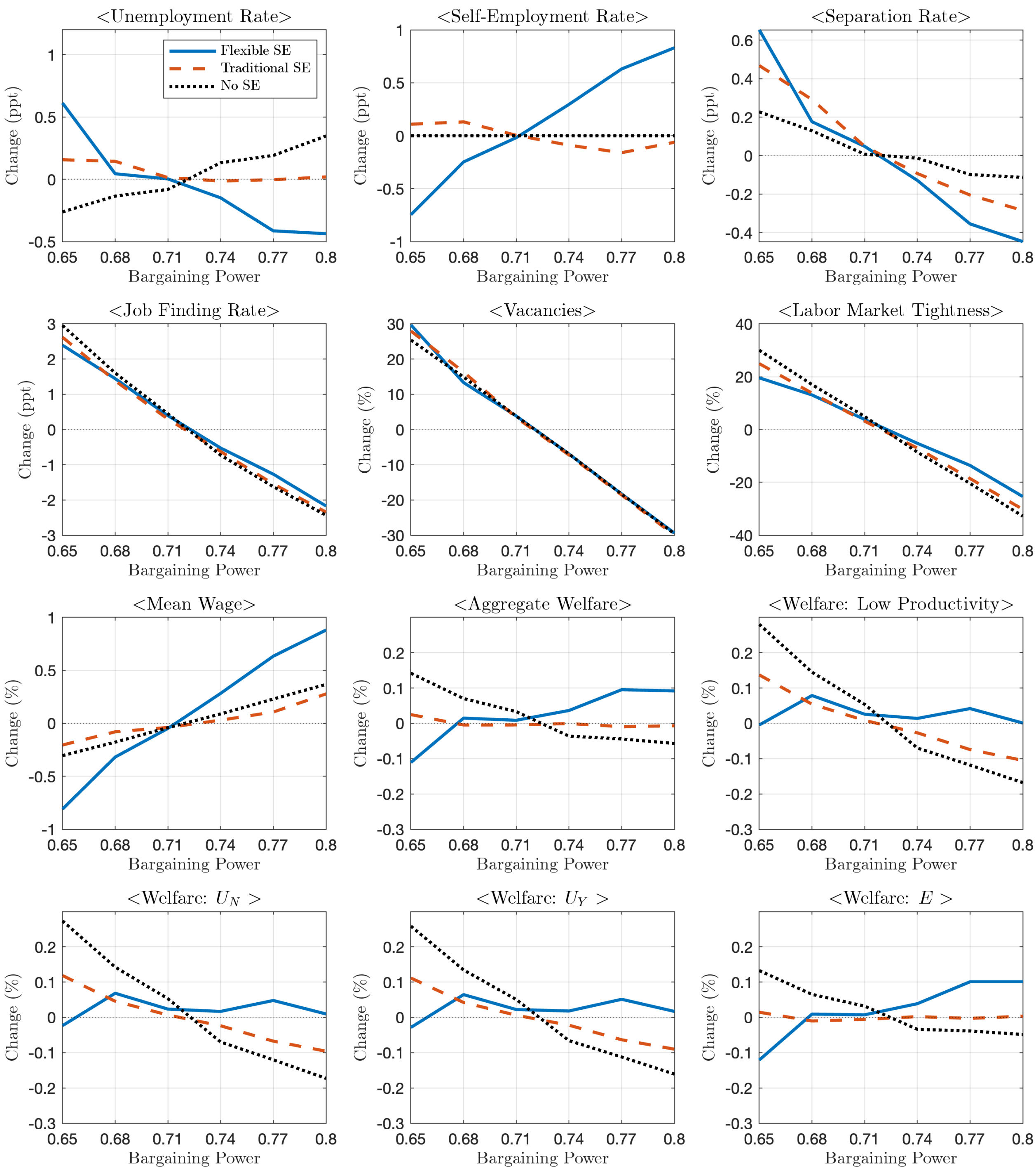
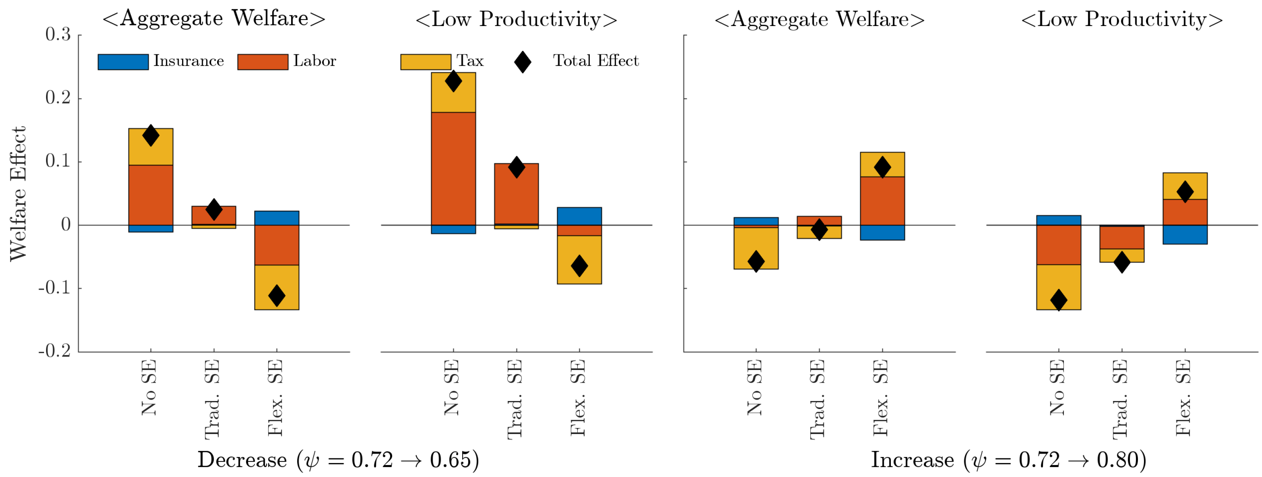


Figure 2.8: Welfare Effects Decomposition: Bargaining Power



which are more likely to dissolve quickly.[20] This finding is consistent with Pissarides and Mortensen (2001), who show that hiring subsidies reduce the duration of unemployment but raise its incidence.

In the flexible self-employment model, the reduction in unemployment is even more muted due to reallocation effects: better conditions in the paid employment sector draw workers away from self-employment. Improved job-finding raises workers' outside options, resulting in higher wages. Meanwhile, some gig workers transition to unemployment, muting the net unemployment effect. In contrast, traditional self-employment exhibits limited response due to entry and exit frictions, so this reallocation is more constrained.

Welfare Effects The welfare effects of hiring subsidies vary depending on the environment. In the model without self-employment, welfare rises with the subsidy due to better job access and reduced unemployment. Decomposition (Figure 2.11) shows that most of the gains stem from improved labor market conditions, though they are partially offset by the fiscal burden.

In models with self-employment, welfare gains are smaller or even negative. Unemploy-

[20] In this model without a match acceptance decision, firms observe worker productivity only after hiring. As such, subsidized hiring may increase short-lived matches.

ment reductions are more limited, and separation rates rise, diluting labor market benefits. However, distributional analysis reveals that vulnerable groups—such as those with low productivity or limited assets—benefit from improved job-finding opportunities.

2.4.5 Active Labor Market Policy: Programs for Efficient Matching

Rather than directly subsidizing hires, this experiment considers a broader policy intervention aimed at improving the overall efficiency of the job-matching process. Specifically, I increase the matching efficiency parameter χ in the aggregate matching function by up to 10% above its baseline value. The upper bound aligns with empirical estimates from large-scale labor market reforms.[21]

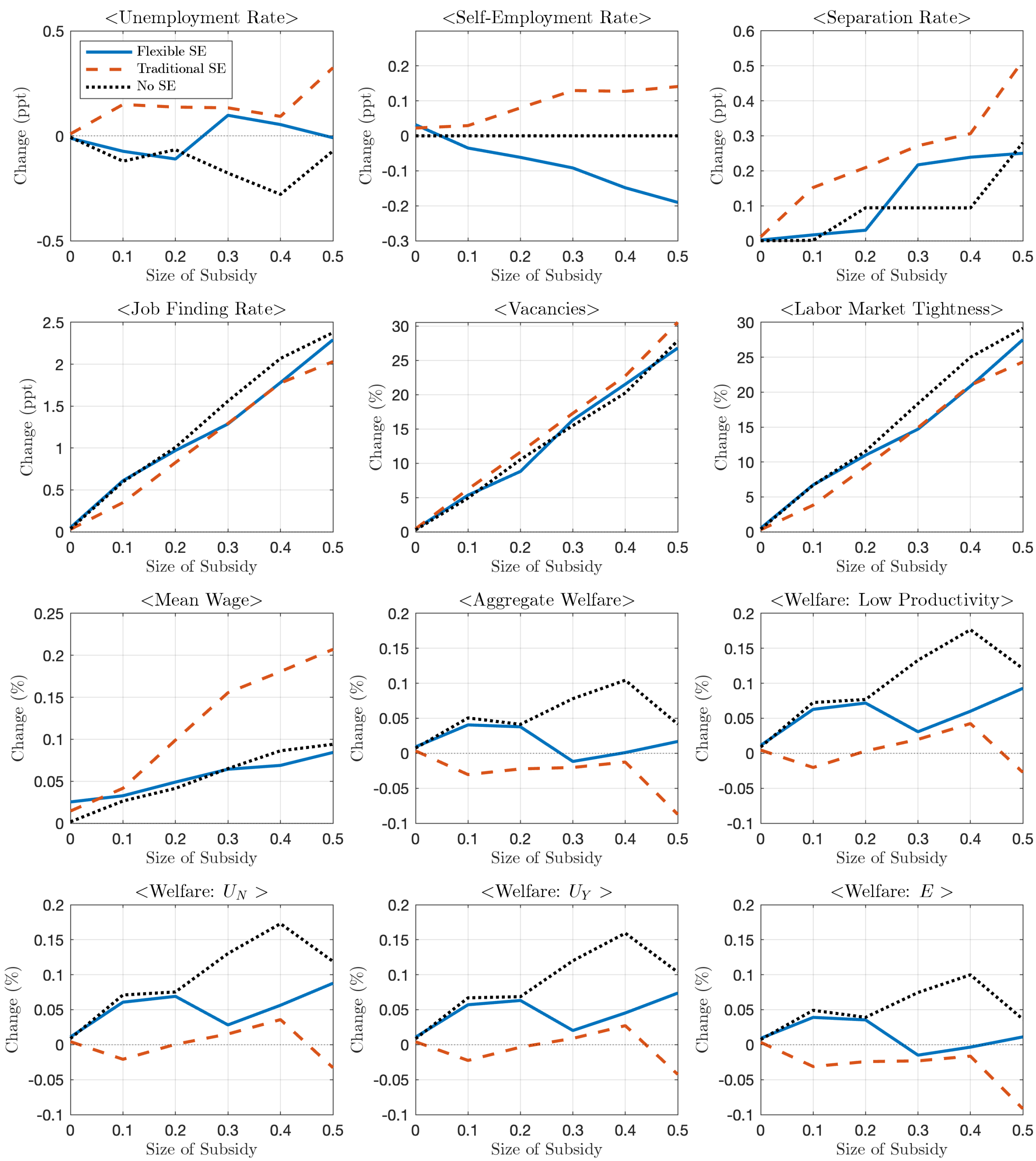
Labor Market Responses Improving matching efficiency raises the rate at which vacancies turn into hires, increasing job-finding rates across all environments (Figure 2.10). However, unlike hiring subsidies, this policy leads to a modest decrease in vacancy postings. Since each vacancy becomes more productive in a more efficient matching environment, the marginal value of creating additional vacancies declines.

In the model without self-employment, improved matching efficiency leads to a moderate reduction in unemployment. In contrast, when flexible self-employment is available, the unemployment response is more muted due to transitions out of self-employment into unemployment. In the traditional self-employment model, limited transitions from self-employment into unemployment, combined with stronger wage pressure, lead to more separations and even a slight increase in unemployment.

Welfare Effects In the model without self-employment, aggregate welfare rises steadily with improved matching, peaking around a 5% increase in χ. These gains are primarily

[21] For instance, Germany's Hartz reforms are estimated to have increased matching efficiency by roughly 11–15% through job placement services, training programs, and institutional improvements. See Fahr and Sunde (2009) for evidence on the impact of the Hartz reforms on matching efficiency.

Figure 2.9: Effects of Hiring Subsidy



Note: Hiring subsidy is expressed as a fraction of aggregate output in the baseline economy.

driven by reduced search frictions and improved job-finding, with the largest benefits accruing to individuals with low productivity. As shown in the right panel of Figure 2.11, most welfare improvements stem from enhanced insurance effects. Better matching shortens unemployment durations—even when tightness remains constant—resulting in smoother consumption and improved risk-sharing. Compared to hiring subsidies, the labor market effects are smaller, resulting in more limited gains from improved employment conditions.

In contrast, welfare gains are often smaller or even negligible in models that include self-employment. Improvements in the labor market are less pronounced, and fiscal costs rise due to the need to cover higher unemployment insurance expenditures. Consequently, the overall net welfare effect is diminished when fallback employment options are available.

2.4.6 Comparison Across Labor Market Policies

Table 2.4 summarizes the effects of the five labor market policies analyzed. Cutting UI generosity, introducing modest hiring subsidies, and improving matching efficiency consistently lower unemployment and raise aggregate welfare. By contrast, increasing UI benefits or raising firing costs tends to raise unemployment and reduce overall welfare. The effects of changes in worker bargaining power are more nuanced: reducing bargaining power boosts job creation and welfare when no fallback employment option exists, but these gains largely vanish when self-employment is available.

These aggregate effects mask important distributional differences. Individuals with low assets or low productivity—who rely more heavily on unemployment insurance and face greater challenges in finding employment—gain less from reduced UI generosity and are more negatively impacted by policies such as higher firing costs or stronger unionization. In contrast, hiring subsidies and improvements in matching efficiency tend to benefit these groups by reducing unemployment durations and improving access to employment opportunities.

The presence of flexible self-employment (e.g., gig work) significantly alters the effects of policy:

Figure 2.10: Effects of Matching Efficiency Policy

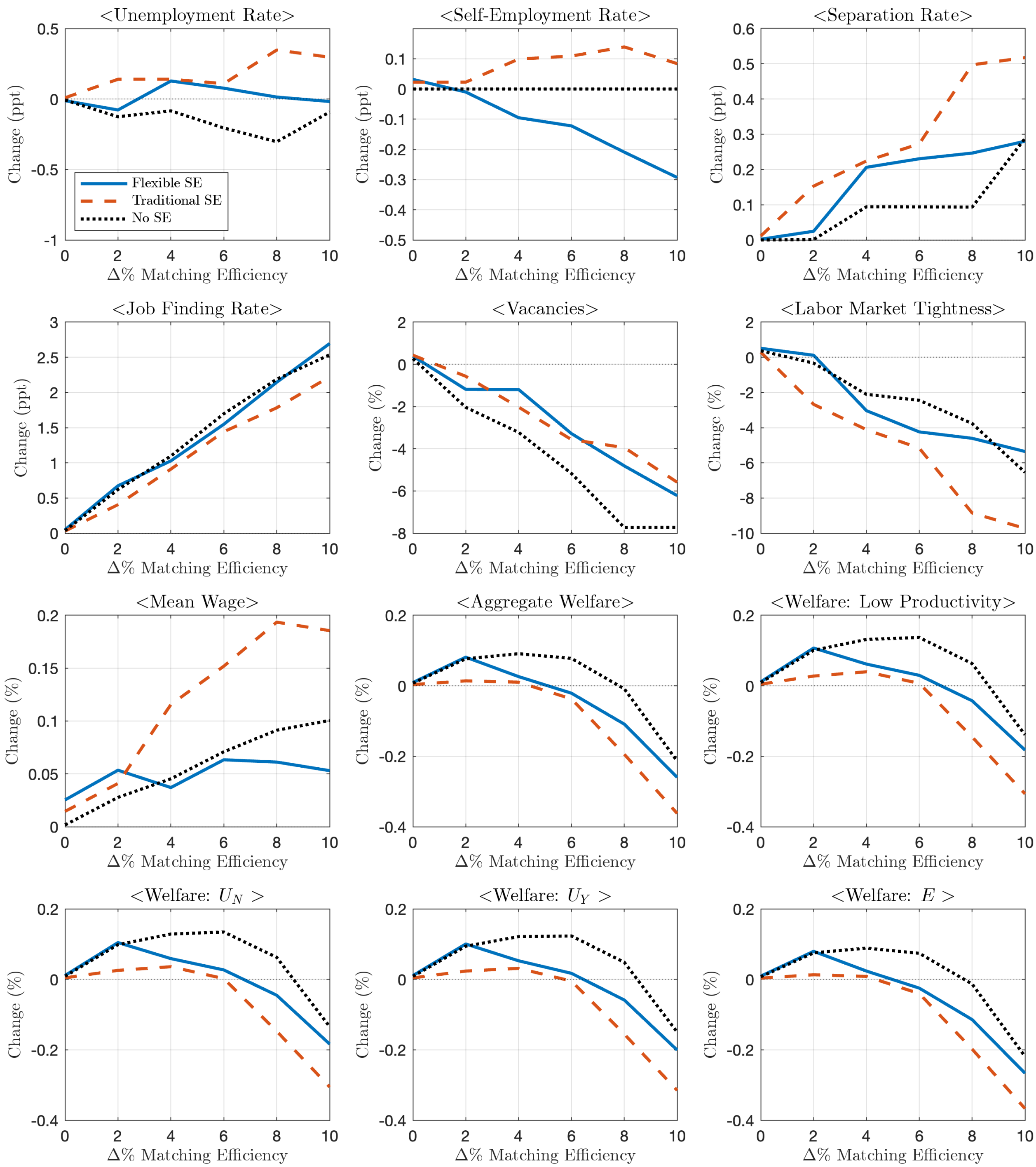
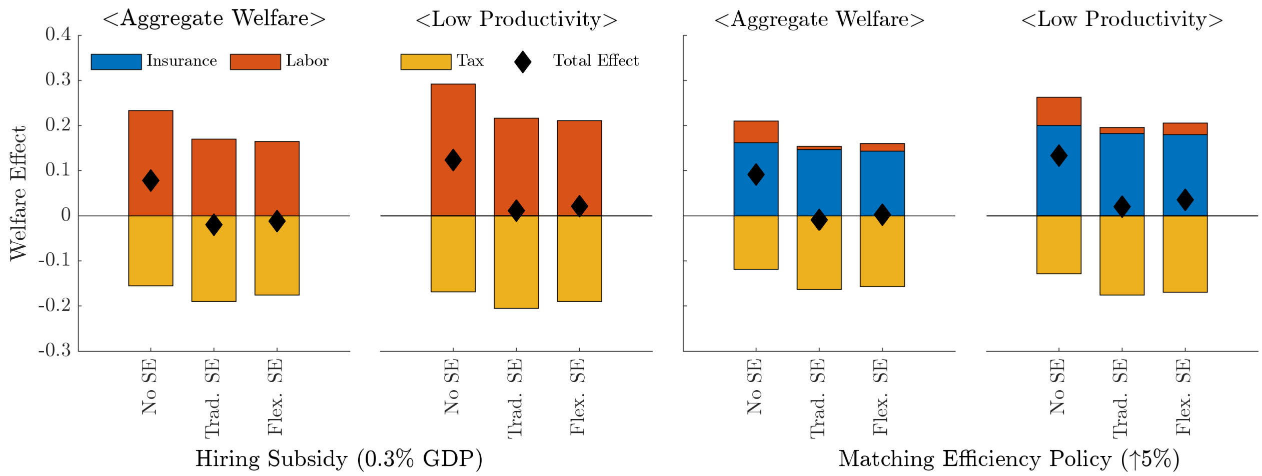


Figure 2.11: Welfare Effects Decomposition: Active Policy



- **Amplifier under UI reform:** When UI generosity is reduced, self-employment increases sharply. This alternative work option absorbs displaced workers, further reducing unemployment and amplifying welfare gains. Conversely, when UI becomes more generous, more individuals exit self-employment and enter unemployment, magnifying welfare losses.

- **Buffer under protective policies:** Higher firing costs or stronger worker bargaining power typically increase unemployment. However, flexible self-employment absorbs some of the displaced workers, softening the rise in unemployment and mitigating associated welfare losses.

- **Dampener under active policies:** Hiring subsidies and matching improvements make paid employment more attractive, drawing workers away from self-employment. This crowds out fallback work, reduces its insurance value, and dampens the incremental welfare gains from active policies.

Cost Effectiveness of Policies When policymakers face budget constraints, cost-effectiveness becomes a critical consideration. Which policies deliver the greatest welfare or employment

Table 2.4: Summary of Labor Market Policy Effects

Policy	Unemp.	Welfare Effects				Role of Flexible	Distributional
		Overall	Insurance	Labor	Fiscal	Self-Employment	Effects
UI cut	$\Downarrow$	$\uparrow$	$\Downarrow$	$\uparrow$	$\Uparrow$	Amplifier	Regressive
UI raise	$\Uparrow$	$\downarrow$	$\Uparrow$	$\downarrow$	$\Downarrow$	Amplifier	Progressive
Higher firing costs	$\Uparrow$	$\Downarrow$	–	$\Downarrow$	$\downarrow$	Buffer	Regressive
Lower bargaining power	$\uparrow$	$\uparrow$	$\uparrow$	$\uparrow$	$\downarrow$	–	Progressive
Higher bargaining power	$\uparrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	Buffer	Regressive
Hiring subsidy	$\downarrow$	$\uparrow$	–	$\Uparrow$	$\downarrow$	Dampener	Progressive
Programs for matching	$\downarrow$	$\uparrow$	$\Uparrow$	$\uparrow$	$\downarrow$	Dampener	Progressive

Note: Arrows indicate the direction and intensity of each policy's effect. $\uparrow/\downarrow$ = moderate increase/decrease; $\Uparrow/\Downarrow$ = strong increase/decrease; "–" denotes negligible or ambiguous effects.
† **Progressive:** lower-productivity/asset-poor group benefits more (or loses less) than the higher group.
‡ **Regressive:** lower group benefits less (or loses more) than the higher group.

gains for a given level of public spending? To address this question, I compare the outcomes of protective policies—such as expanded unemployment insurance, stricter firing regulations, and increased worker bargaining power—with those of active labor market policies (ALMPs), under equivalent fiscal cost scenarios.

The fiscal costs of each policy are defined as:

- **UI:** $G_{UI} = \int\int B_Y(z)\, d_{U_Y}(a,z)\, da\, dz$
- **Firing Costs:** $G_F = F \cdot \left[\lambda_E + \tilde{\lambda}_E \cdot \frac{\int\int \Phi_E(a,z) d_E(a,z)\, da\, dz}{\int\int d_E(a,z)\, da\, dz}\right] \cdot \int\int d_E(a,z)\, da\, dz$
- **Hiring Subsidy:** $G_S = s \cdot q(\theta) \cdot v$
- **Matching Program:** $G_A = \hat{A} \cdot \left(\frac{\chi - \chi_0}{\chi_0}\right)^2$

Each policy is evaluated under the same incremental increase in fiscal expenditure relative to the baseline:

$$\Delta G_{UI} = \Delta G_F = \Delta G_S = \Delta G_A$$

Unionization does not entail direct fiscal costs in the model. To facilitate comparison with other policy instruments, I approximate its cost by identifying the level of firing protection that generates an equivalent reduction in job separation rates. This approach is motivated by the fact that both unionization and firing regulations are intended to stabilize employment by lowering separation margins.[22]

Figure 2.12 and Table 2.5 present the welfare and unemployment effects of each policy under fixed-budget scenarios. In the model without self-employment, all protective policies result in negative welfare effects at any spending level. By contrast, active labor market policies generate positive welfare gains. Among them, matching programs perform best at lower fiscal costs (below 0.04% of GDP), while hiring subsidies become more effective at higher spending levels. However, beyond 0.1% of GDP, diminishing returns set in, and the welfare effects of all policies decline due to rising tax burdens.

When traditional self-employment is available as a fallback option, the differences in welfare outcomes across policies narrow. Active labor market policies yield only modest gains, and the welfare losses from protective policies become smaller. At low spending levels (below 0.03% of GDP), matching programs continue to perform best. At higher levels, unionization and hiring subsidies produce the smallest welfare losses, although no policy yields a positive net gain.

In the environment with flexible self-employment, firing protections become even less harmful, and the welfare losses from UI expansions grow larger. As in the traditional self-employment case, matching programs yield the strongest results at a low fiscal cost, with greater gains than in other environments. At higher spending levels (above 0.03% of GDP), unionization delivers the highest welfare gains, driven by reductions in unemployment and increases in wages.

[22]An alternative approach would be to match unemployment rates across scenarios with varying levels of unionization and firing protection. However, this leads to a less reliable basis for comparison, since unemployment responses vary in direction depending on the policy and environment. In contrast, job separation rates tend to move consistently in the same direction, offering a more stable reference point.

Figure 2.12: Welfare Effects Comparison

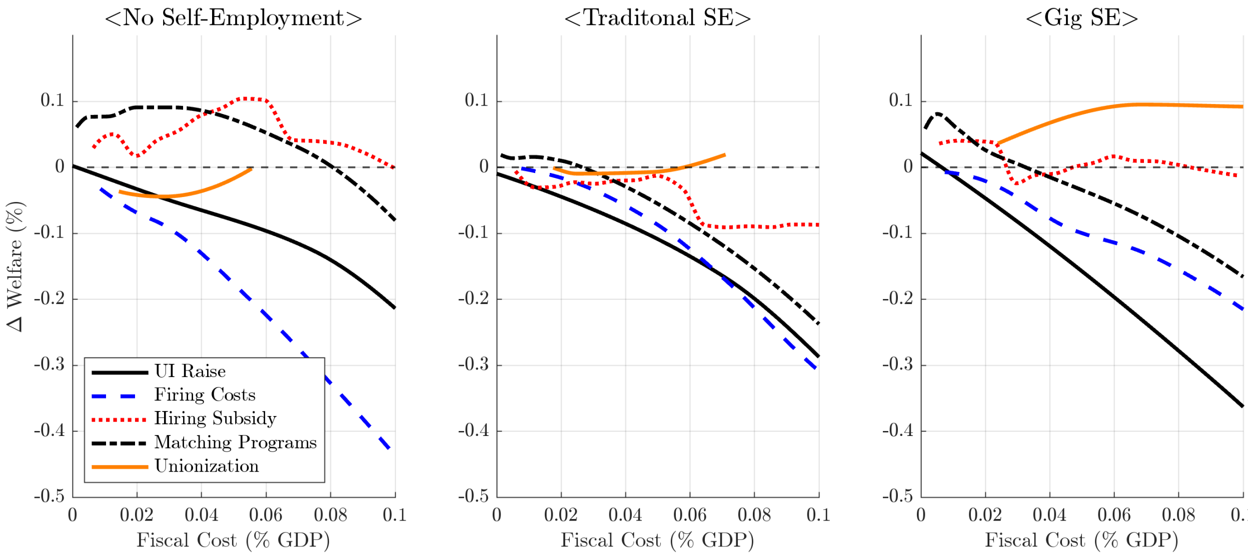


Table 2.5: Fixed-Budget Evaluation

	Budget: GDP 0.03%			**Budget: GDP 0.08%**		
Policy	**No SE**	**Trad. SE**	**Flexible SE**	**No SE**	**Trad. SE**	**Flexible SE**
Welfare (% change in consumption-equivalent)						
UI Raise	-0.05	**-0.07**	**-0.08**	-0.14	-0.20	**-0.28**
Higher Firing Costs	**-0.10**	-0.04	-0.04	**-0.32**	**-0.21**	-0.17
Unionization	-0.05	-0.01	**0.04**	—	**0.02**	**0.10**
Hiring Subsidy	0.05	-0.02	-0.03	**0.04**	-0.09	0.00
Matching Program	**0.09**	**0.00**	0.01	0.00	-0.14	-0.10
Unemployment Rate (pp change)						
UI Raise	**0.22**	**0.27**	**0.30**	**0.52**	**0.72**	**0.86**
Higher Firing Costs	0.03	**-0.03**	-0.01	0.21	**0.01**	0.00
Unionization	0.19	0.00	**-0.19**	—	0.13	**-0.42**
Hiring Subsidy	-0.03	0.14	-0.11	**-0.19**	0.32	-0.01
Matching Program	**-0.08**	0.14	0.10	-0.15	0.15	0.11

Note: Blue = largest welfare gain or greatest unemployment reduction; Red = largest welfare loss or greatest unemployment increase; dashes (—) = not applicable.

2.5 Conclusion

This chapter studies how labor market policies interact with self-employment—especially flexible "gig work"—through a macroeconomic model with search and matching frictions and incomplete markets. By treating self-employment as a fallback option for unemployed workers, the model captures heterogeneity in occupational choices and evaluates five key policy instruments: unemployment insurance, firing costs, worker bargaining power, hiring subsidies, and matching efficiency.

Results show that policy effects depend critically on the type and presence of self-employment. With flexible self-employment, UI reforms have amplified effects: reducing benefits prompts a shift into gig work, lowering unemployment and raising welfare, while generous UI crowds out gig participation, increasing unemployment and fiscal costs. Protective policies—such as firing costs and unionization—raise unemployment in standard models but become less distortionary when fallback work absorbs displaced workers. Active labor market programs remain effective under traditional self-employment but are less impactful when flexible work is widespread.

A comparison of policies at equal fiscal cost reveals that active labor market programs outperform protective measures in the absence of self-employment. However, when fallback options—especially flexible gig work—are present, the welfare ranking shifts. At low spending levels, matching programs remain most efficient. At higher levels, policies that strengthen worker bargaining power yield the largest welfare gains by reducing unemployment and raising wages through stronger outside options.

These findings carry important implications for labor market reform. Institutions such as the IMF and OECD often advocate combining deregulatory measures—such as reducing unemployment benefits, lowering firing costs, or weakening worker bargaining power—with active labor market policies. This study shows that such strategies can be effective in traditional labor markets with limited fallback options. However, it cautions that the growing availability of flexible self-employment—particularly gig work enabled by digital platforms—can significantly alter policy outcomes. Failing to account for these dynamics may lead to overestimating or underestimating the effectiveness of specific interventions. In labor markets where gig work is widespread, a more balanced approach—such as pairing moderate reductions in unemployment insurance with ALMPs like hiring subsidies—may offer better results by enhancing both income support and job access, while reducing regressive distributional effects.

Further research should examine comprehensive reform packages, including the joint effects of labor and product market reforms. This paper evaluates each policy in isolation; however, reforms are often implemented together. Product market reforms, for instance, may complement labor policies by boosting innovation and employment (see IMF, 2016; Budina et al., 2023; Campos et al., 2025).

Finally, the regulation of gig work needs greater attention. Some jurisdictions are reclassifying gig workers as dependent employees, extending access to unemployment insurance and healthcare.[23] While these protections may improve income security, they could also reduce labor market flexibility, introducing trade-offs in the effectiveness of labor policy.

[23]The EU's Platform Work Directive (2024) presumes employment status for many gig workers and extends worker rights. The UK Supreme Court ruled in 2021 that Uber drivers are entitled to minimum wage and holiday pay.

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Appendix A
SOLUTION METHOD

I discretize the asset space a using an unevenly spaced grid that concentrates nodes near the borrowing constraint $a = \underline{a}$, where the curvature of the value and policy functions is highest:

$$\vec{a} = \{a_1, \ldots, a_i, \ldots, a_I\}.$$

Productivity z is discretized using an evenly spaced grid:

$$\vec{z} = \{z_1, \ldots, z_j, \ldots, z_J\}.$$

A.1 Workers' Problem

The workers' problem is solved using the finite difference method described by Achdou et al. (2022). Define $W_{o,ij} = W_o(a_i, z_j)$, for each occupational state $o \in \{E, U_N, U_Y, S_T, S_G\}$. The drift of assets (i.e., savings) is defined as:

$$s_{o,ij} = Y_o(a_i, z_j) + (r - \delta)\, a_i - c_{o,ij} \tag{A.1}$$

where $Y_o(a_i, z_j)$ denotes non-financial income (such as labor income, self-employment profits, or social benefits), depending on occupational status o.

The value functions satisfy the following Bellman equations:

$$
\begin{aligned}
\rho W_{E,ij} &= u(c_{E,ij}) + \partial_a W_{E,ij} \cdot s_{E,ij} + \lambda_E (W_{U_Y,ij} - W_{E,ij}) + \partial_z W_{E,ij} \cdot \mu_j + \frac{1}{2}\partial_{zz} W_{E,ij} \cdot \sigma_j^2 \\
\rho W_{U_N,ij} &= u(c_{U_N,ij}) + \partial_a W_{U_N,ij} \cdot s_{U_N,ij} + f(\theta)(W_{E,ij} - W_{U_N,ij}) \\
&\quad + \lambda_{U_T,ij}(W_{S_T,ij} - W_{U_N,ij}) + \lambda_{U_G,ij}(W_{S_G,ij} - W_{U_N,ij}) \\
\rho W_{U_Y,ij} &= u(c_{U_Y,ij}) + \partial_a W_{U_Y,ij} \cdot s_{U_Y,ij} + f(\theta)(W_{E,ij} - W_{U_Y,ij}) + \lambda_U (W_{U_N,ij} - W_{U_Y,ij}) \\
&\quad + \lambda_{U_T,ij}(W_{S_T,ij} - W_{U_Y,ij}) + \lambda_{U_G,ij}(W_{S_G,ij} - W_{U_Y,ij}) \\
\rho W_{S_T,ij} &= u(c_{S_T,ij}) + \partial_a W_{S_T,ij} \cdot s_{S_T,ij} + \lambda_{S_T,ij}(W_{U_N,ij} - W_{S_T,ij}) + \eta_T f(\theta)(W_{E,ij} - W_{S_T,ij}) \\
&\quad + \partial_z W_{S_T,ij} \cdot \mu_j + \frac{1}{2}\partial_{zz} W_{S_T,ij} \cdot \sigma_j^2 \\
\rho W_{S_G,ij} &= u(c_{S_G,ij}) + \partial_a W_{S_G,ij} \cdot s_{S_G,ij} + \lambda_{S_G,ij}(W_{U_N,ij} - W_{S_G,ij}) + \eta_G f(\theta)(W_{E,ij} - W_{S_G,ij}) \\
&\quad + \partial_z W_{S_G,ij} \cdot \mu_j + \frac{1}{2}\partial_{zz} W_{S_G,ij} \cdot \sigma_j^2
\end{aligned}
\tag{A.2}
$$

where the transition rates are defined as:

$$
\begin{aligned}
\lambda_{U_T,ij} &= \tilde{\lambda}_{U_T} \cdot \mathbb{1}_{\{\Phi_{U_k S_T,ij}=1\}}, \quad k \in \{Y, N\} \\
\lambda_{U_G,ij} &= \tilde{\lambda}_{U_G} \cdot \mathbb{1}_{\{\Phi_{U_k S_G,ij}=1\}}, \quad k \in \{Y, N\} \\
\lambda_{S_T,ij} &= \lambda_{S_T} + \tilde{\lambda}_{S_T} \cdot \mathbb{1}_{\{\Phi_{S_T U_N,ij}=1\}} \\
\lambda_{S_G,ij} &= \lambda_{S_G} + \tilde{\lambda}_{S_G} \cdot \mathbb{1}_{\{\Phi_{S_G U_N,ij}=1\}}
\end{aligned}
$$

where $\Phi_{oo',ij}$ denotes the endogenous decision to transition from state o to o'.

Implicit Update Scheme

The value functions are updated using an implicit method. For example, the update for employment ($o = E$) is given by:

$$\frac{W_{E,ij}^{n+1} - W_{E,ij}^{n}}{\Delta} + \rho W_{E,ij}^{n+1} = u(c_{E,ij}^{n}) + \partial_a W_{E,ij}^{n+1} \cdot s_{E,ij}^{n} + \lambda_E \left(W_{U_Y,ij}^{n+1} - W_{E,ij}^{n+1} \right)$$
$$+ \partial_z W_{E,ij}^{n+1} \cdot \mu_j + \frac{1}{2} \partial_{zz} W_{E,ij}^{n+1} \cdot \sigma_j^2 \tag{A.3}$$

The equations for $o \in \{U_N, U_Y, S_T, S_G\}$ are treated analogously.

Finite Difference Approximation

To approximate the derivatives in a and z, I use forward and backward difference formulas:

$$\partial_a W_{o,ij,F} = \frac{W_{o,i+1,j} - W_{o,ij}}{\Delta a}, \quad \partial_a W_{o,ij,B} = \frac{W_{o,ij} - W_{o,i-1,j}}{\Delta a} \tag{A.4}$$
$$\partial_z W_{o,ij,F} = \frac{W_{o,i,j+1} - W_{o,ij}}{\Delta z}, \quad \partial_z W_{o,ij,B} = \frac{W_{o,ij} - W_{o,i,j-1}}{\Delta z},$$
$$\partial_{zz} W_{o,ij} = \frac{W_{o,i,j+1} - 2W_{o,ij} + W_{o,i,j-1}}{(\Delta z)^2}$$

Optimal consumption at iteration n is computed as:

$$c_{o,ij,B}^{n} = u'^{-1} \left(\partial_a W_{o,ij,B}^{n} \right), \quad c_{o,ij,F}^{n} = u'^{-1} \left(\partial_a W_{o,ij,F}^{n} \right) \tag{A.5}$$

The upwind scheme is applied to the asset drift terms:

$$\partial_a W_{o,ij}^{n+1} \cdot s_{o,ij}^{n} = \partial_a W_{o,ij,B}^{n+1} \cdot (s_{o,ij,B}^{n})^- + \partial_a W_{o,ij,F}^{n+1} \cdot (s_{o,ij,F}^{n})^+$$
$$= \frac{W_{o,ij}^{n+1} - W_{o,i-1,j}^{n+1}}{\Delta a} \cdot (s_{o,ij,B}^{n})^- + \frac{W_{o,i+1,j}^{n+1} - W_{o,ij}^{n+1}}{\Delta a} \cdot (s_{o,ij,F}^{n})^+ \tag{A.6}$$

And similarly for productivity drift:

$$\partial_z W_{o,ij}^{n+1} \cdot \mu_j = \frac{W_{o,ij}^{n+1} - W_{o,i,j-1}^{n+1}}{\Delta z} \cdot \mu_j^- + \frac{W_{o,i,j+1}^{n+1} - W_{o,ij}^{n+1}}{\Delta z} \cdot \mu_j^+ \tag{A.7}$$

Vectorized HJB System

Combining equations (A.3)–(A.6), I obtain the vectorized HJB equation for each occupational state $o \in \{E, U_N, U_Y, S_T, S_G\}$:

$$\begin{aligned}\frac{W_{o,ij}^{n+1} - W_{o,ij}^{n}}{\Delta} + \rho W_{o,ij}^{n+1} = u(c_{o,ij}^n) &+ \Lambda_{o,ij} \cdot W_{o',ij}^{n+1} + x_{o,ij} \cdot W_{o,i-1,j}^{n+1} \\ &+ (y_{o,ij} - \Lambda_{o,ij} + \upsilon_j) \cdot W_{o,ij}^{n+1} + z_{o,ij} \cdot W_{o,i+1,j}^{n+1} \\ &+ \varphi_j \cdot W_{o,i,j-1}^{n+1} + \zeta_j \cdot W_{o,i,j+1}^{n+1}\end{aligned} \tag{A.8}$$

where:

$$x_{o,ij} = -\frac{(s_{o,ij,B}^n)^-}{\Delta a}, \quad z_{o,ij} = \frac{(s_{o,ij,F}^n)^+}{\Delta a},$$

$$y_{o,ij} = -\frac{(s_{o,ij,F}^n)^+}{\Delta a} + \frac{(s_{o,ij,B}^n)^-}{\Delta a},$$

$$\varphi_j = \begin{cases} -\frac{\mu_j^-}{\Delta z} + \frac{\sigma_j^2}{2(\Delta z)^2}, & \text{if } o \in \{E, S_T, S_G\}, \\ 0, & \text{otherwise} \end{cases}, \quad \zeta_j = \begin{cases} \frac{\mu_j^+}{\Delta z} + \frac{\sigma_j^2}{2(\Delta z)^2}, & \text{if } o \in \{E, S_T, S_G\}, \\ 0, & \text{otherwise} \end{cases},$$

$$\upsilon_j = \begin{cases} \frac{\mu_j^-}{\Delta z} - \frac{\mu_j^+}{\Delta z} - \frac{\sigma_j^2}{(\Delta z)^2}, & \text{if } o \in \{E, S_T, S_G\}, \\ 0, & \text{otherwise} \end{cases}$$

Here, $\Lambda_{o,ij}$ is a vector of arrival rates for transitions from occupation o to all other states $o' \neq o$, defined according to the transition structure in the model.

A.2 Linear System Representation

The full system of discretized value functions across all occupational states can be written as:

$$\frac{1}{\Delta}\left(\mathbf{W}_{n+1} - \mathbf{W}_n\right) + \rho\,\mathbf{W}_{n+1} = \mathbf{u}_n + \mathbf{A}^n \cdot \mathbf{W}_{n+1} \tag{A.9}$$

where:

$$\mathbf{W} = \begin{bmatrix} \mathbf{W}_E \\ \mathbf{W}_{U_N} \\ \mathbf{W}_{U_Y} \\ \mathbf{W}_{S_T} \\ \mathbf{W}_{S_G} \end{bmatrix}, \quad \mathbf{u} = \begin{bmatrix} \mathbf{u}_E \\ \mathbf{u}_{U_N} \\ \mathbf{u}_{U_Y} \\ \mathbf{u}_{S_T} \\ \mathbf{u}_{S_G} \end{bmatrix}, \quad \mathbf{A}^n = \mathbf{B}^n + \mathbf{C}$$

Each vector $\mathbf{W}_o$ and $\mathbf{u}_o$ corresponds to a vectorization of the $I \times J$ value and utility matrices for occupation o. The coefficient matrix $\mathbf{A}^n$ consists of two components: $\mathbf{B}^n$, which captures asset-based transitions and occupational switches, and $\mathbf{C}$, which captures productivity diffusion.

The matrix $\mathbf{B}^n$ has the block structure:

$$\mathbf{B}^n = \begin{bmatrix} \mathbf{B}_{EE} & \mathbf{0} & \mathbf{B}_{EU_Y} & \mathbf{0} & \mathbf{0} \\ \mathbf{B}_{U_N E} & \mathbf{B}_{U_N U_N} & \mathbf{0} & \mathbf{B}_{U_N S_T} & \mathbf{B}_{U_N S_G} \\ \mathbf{B}_{U_Y E} & \mathbf{B}_{U_Y U_N} & \mathbf{B}_{U_Y U_Y} & \mathbf{B}_{U_Y S_T} & \mathbf{B}_{U_Y S_G} \\ \mathbf{B}_{S_T E} & \mathbf{B}_{S_T U_N} & \mathbf{0} & \mathbf{B}_{S_T S_T} & \mathbf{0} \\ \mathbf{B}_{S_G E} & \mathbf{B}_{S_G U_N} & \mathbf{0} & \mathbf{0} & \mathbf{B}_{S_G S_G} \end{bmatrix}$$

The matrix $\mathbf{C}$ is block-diagonal and accounts for diffusion in the productivity state:

$$\mathbf{C} = \begin{bmatrix} \tilde{\mathbf{C}} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} & \tilde{\mathbf{C}} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \tilde{\mathbf{C}} \end{bmatrix}$$

Each matrix $\mathbf{B}_{oo}$ is tridiagonal with entries $x_{o,ij}, y_{o,ij}, z_{o,ij}$, and the off-diagonal blocks $\mathbf{B}_{oo'}$ represent occupational transitions and contain arrival rates on their diagonals. The submatrix $\tilde{\mathbf{C}}$ corresponds to the finite-difference approximation of the productivity diffusion operator, built from φ_j, υ_j, and ζ_j.

The solution to the system (A.9) yields updated value functions $\mathbf{W}_{n+1}$ for all occupations.

A.3 Firms' Problem

The HJB equation for a corporate firm matched with a worker of productivity z_j and asset level a_i is given by:

$$(r-\delta)\, J_{ij} = z_j k_j^{\alpha} - r k_j - w_{ij} + \partial_a J_{ij} \cdot s_{E,ij} - \lambda_E J_{ij} + \partial_z J_{ij} \cdot \mu_j + \frac{1}{2}\partial_{zz} J_{ij} \cdot \sigma_j^2 \qquad \text{(A.10)}$$

The state variable a enters via the savings drift $s_{E,ij}$, which is determined by the worker's optimal policy. The firm earns profit $z_j k_j^{\alpha} - r k_j - w_{ij}$, and the job is destroyed at rate λ_E.

Numerical Implementation

The same finite-difference discretization used for the worker's problem (see equations (A.4)–(A.6)) is applied here to approximate the derivatives of J_{ij}. The resulting discretized system can be written as:

$$\frac{1}{\Delta}\left(\mathbf{J}^{n+1} - \mathbf{J}^{n}\right) + (r-\delta)\,\mathbf{J}^{n+1} = \mathbf{\Pi}^{n} + \mathbf{A}_E^{n} \cdot \mathbf{J}^{n+1} \qquad \text{(A.11)}$$

Here:

- $\mathbf{J}$ is a vectorization of the $I \times J$ matrix J_{ij}
- $\mathbf{\Pi}$ is the profit vector, defined as $\Pi_{ij} = z_j k_j^{\alpha} - rk_j - w_{ij}$
- $\mathbf{A}_E^n$ is the coefficient matrix for the firm HJB, reusing components from the worker's problem:

$$\mathbf{A}_E^n = \mathbf{B}_{EE}^n - \mathbf{B}_{EU_Y}^n + \tilde{\mathbf{C}}$$

The subtraction of $\mathbf{B}_{EU_Y}^n$ reflects the fact that firms lose value when workers transition out of employment into UI-covered unemployment. The diffusion operator $\tilde{\mathbf{C}}$ accounts for stochastic changes in productivity z, identical to its role in the worker's system.

Solving equation (A.11) yields the updated value function $\mathbf{J}^{n+1}$ for all firm-worker matches.

A.4 Stationary Distribution

Let $\mathbf{d}_o$ denote the vector of joint densities over assets and productivity for each occupational state $o \in \{E, U_N, U_Y, S_T, S_G\}$, and define the full distribution vector as:

$$\mathbf{d} = \begin{bmatrix} \mathbf{d}_E \\ \mathbf{d}_{U_N} \\ \mathbf{d}_{U_Y} \\ \mathbf{d}_{S_T} \\ \mathbf{d}_{S_G} \end{bmatrix}$$

The stationary Kolmogorov Forward (KF) equation characterizes the mass-preserving law of motion for the distribution across states. Under the upwind finite-difference scheme described by Achdou et al. (2022), the discretized KF equation takes the form:

$$(\mathbf{A}^n)^\top \cdot \mathbf{d} = \mathbf{0} \tag{A.12}$$

$\mathbf{A}^n$ is the transition matrix used in the HJB system (see equation (A.9)), $(\mathbf{A}^n)^\top$ is its transpose, capturing outflows from each grid point, and $\mathbf{d}$ is the steady-state density vector of size $5 \cdot (I \cdot J)$. Each row of $\mathbf{A}^n$ ensures that the probability flux into a given grid point equals the flux out, accounting for savings behavior, productivity drift, and occupational transitions.

To close the system, a normalization condition is imposed:

$$\sum_o \sum_{i,j} d_{o,ij} \cdot \Delta a \cdot \Delta z = 1$$

ensuring that the total mass of agents in the economy equals one.

The resulting linear system (A.12), together with the normalization constraint, can be solved to obtain the stationary distribution $\mathbf{d}$.

A.5 Numerical Algorithm

The algorithm solves for the equilibrium interest rate $r \in [r_{\min}, r_{\max}]$ using a bisection method. At each iteration $\ell = 0, 1, 2, \ldots$, the following steps are executed:

1. **Firm capital demand:** Given the current guess r_ℓ, compute optimal capital demand for corporate firms as:

$$k(z) = \left(\frac{z\,\alpha}{r_\ell}\right)^{\frac{1}{1-\alpha}}$$

2. **Initial tightness:** Guess an initial value for labor market tightness θ, and compute the job finding rate $f(\theta)$ and job filling rate $q(\theta)$ using the matching function.

3. **Initial tax rate:** Guess an initial value for the labor income tax rate τ.

4. **Initial wage schedule:** Guess an initial wage function $w(a, z)$. I initialize this using a share of the firm's surplus:

$$w(a, z) = \psi \cdot (z\, k^{\alpha} - r\, k)$$

5. **Solve HJBs:** Solve the system of HJB equations for all worker states and for firms using the implicit finite-difference method (see equation (A.9)).

6. **Solve the KF equations:** Given the policy functions, solve the Kolmogorov Forward equations to obtain the stationary joint distribution $d_o(a, z)$ for each occupation o.

7. **Update wages:** Given the updated value functions, recompute the Nash bargaining wage $w(a, z)$ using equation (D.6).

8. **Update market tightness:** Check the free-entry condition (equation (1.8)) and update θ until the vacancy value V is driven close to zero.

9. **Update taxes:** Adjust the tax rate τ to satisfy the government budget constraint (see equation (6)).

10. **Check asset market clearing:** Compute aggregate supply, demand, and excess demand for assets:

    - Aggregate supply:

    $$AS = \int\!\!\int \left[k(z)\, d_E(a, z) + k_{S_T}(a, z)\, d_{S_T}(a, z) + k_{S_G}(a, z)\, d_{S_G}(a, z)\right] da\, dz$$

    - Aggregate demand:

    $$AD = \sum_o \int\!\!\int a \cdot d_o(a, z)\, da\, dz$$

- Excess demand:

$$ED_\ell = AD - AS$$

11. **Update interest rate:** Update the guess for r_ℓ using the bisection rule:

$$\begin{cases} r_{\ell+1} < r_\ell, & \text{if } ED_\ell > 0 \text{ (excess demand)} \\ r_{\ell+1} > r_\ell, & \text{if } ED_\ell < 0 \text{ (excess supply)} \end{cases}$$

Continue until $|ED_\ell|$ is below a specified tolerance.

Appendix B

EFFECTS OF THE GIG ECONOMY INTRODUCTION WITH ENDOGENOUS SEPARATION

This chapter revisits the results from Chapter 1 by modifying the model to incorporate an endogenous separation margin, as introduced in Chapter 2. Specifically, I introduce an additional Poisson separation shock in both the firm's HJB (Equation (1.7)) and the worker's HJB (Equation (1.4)), which are replaced by Equations (2.9) and (2.4), respectively.

Under this extension, once a match is formed through the labor market, the firm and worker re-evaluate the match at a Poisson rate $\tilde{\lambda}_E$, assumed to arrive monthly. At that point, the match may be dissolved if the firm's expected surplus falls below a productivity threshold or if the worker's value from continued employment is lower than their outside option.

As shown in Tables B.1 and B.2, and Figure B.1, the introduction of the gig economy continues to reduce unemployment and raise aggregate welfare. Compared to the case with only exogenous separation, these effects are magnified. This is primarily because gig work benefits constrained and unemployed workers—groups most affected by endogenous separations.

The key difference relative to the exogenous-separation benchmark lies in firms' job creation behavior. Under endogenous separation, the decline in vacancy postings is smaller, as firms can offload low-surplus matches through the separation margin rather than reducing overall hiring. This leads to improved job-finding rates for the unemployed and tighter labor markets overall. As a result, the decomposition of welfare gains also shifts, with labor market channels contributing positively—unlike in the exogenous-only case (Figure B.2).

Figure B.1: Occupation Share by Productivity

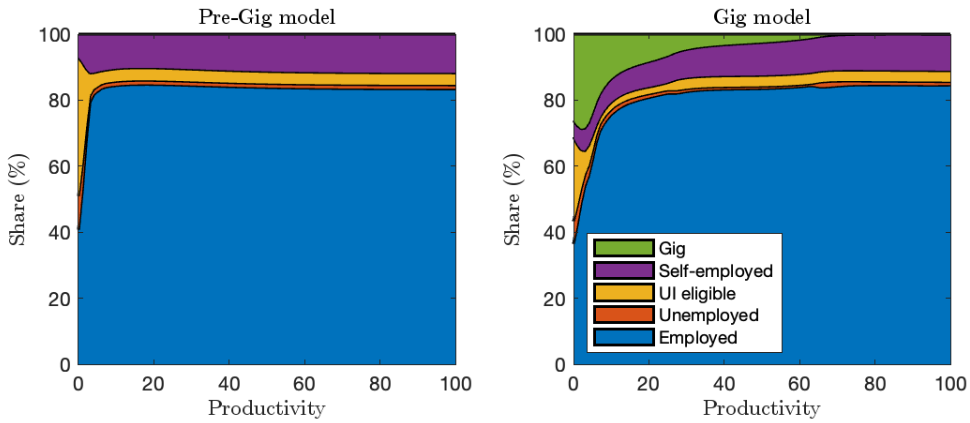


Table B.1: Effects of the Gig Economy on Labor Market and Macro Outcomes

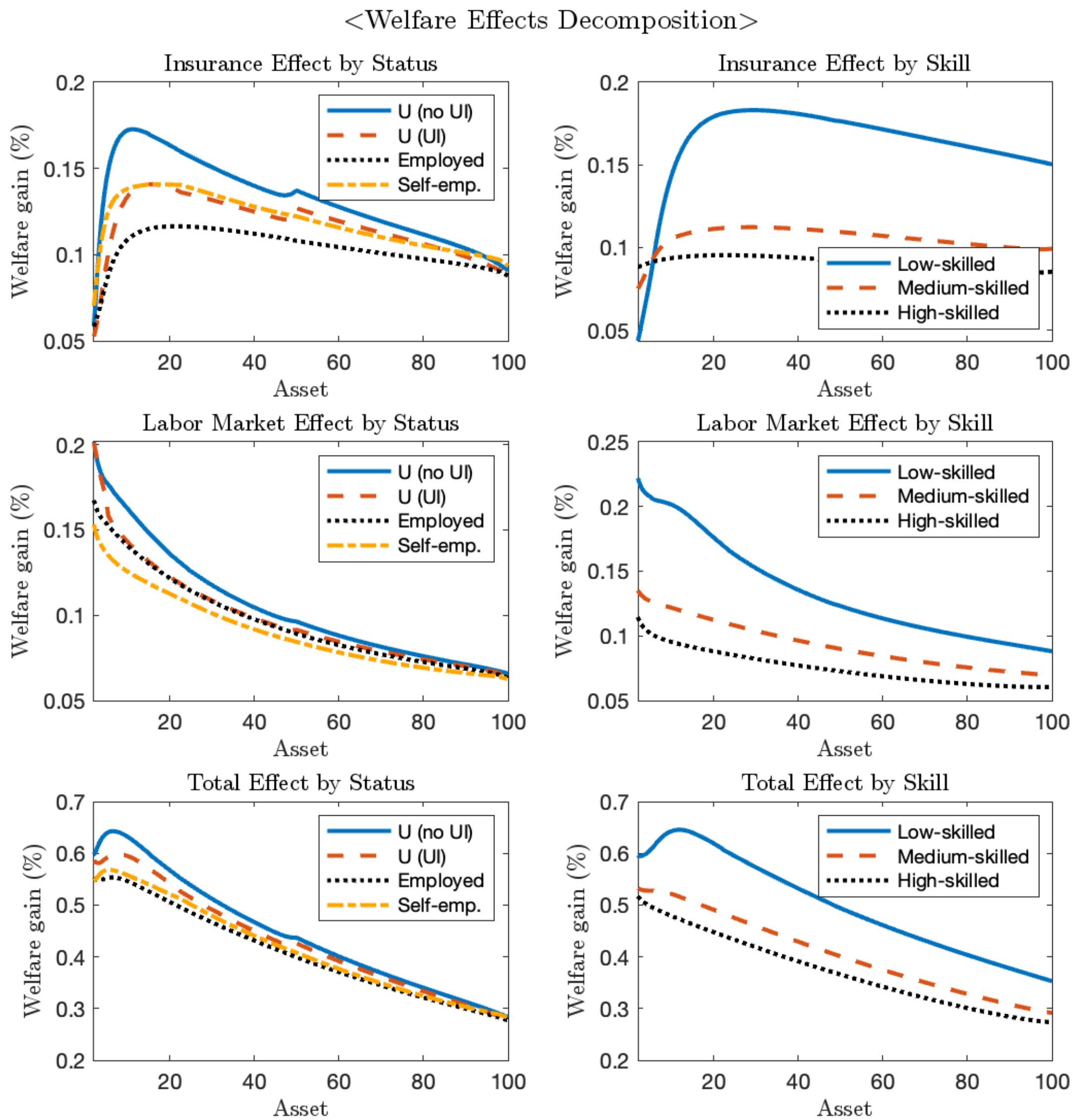
	Pre-Gig Model	**Gig Model**	**Difference (%)**
Unemployment Rate	6.3%	4.6%	-1.7%
UI Ineligible	1.5%	0.9%	-0.6%
UI Eligible	4.8%	3.7%	-1.1%
Paid Employment Share	82.8%	81.2%	-1.6%
Self-Employment Share	10.9%	8.6%	-2.3%
Job Finding Rate	45.0%	46.2%	1.2%
Vacancies	100.0	98.0	-2.0%
Labor Market Tightness	100.0	113.9	13.9%
Average Wage	100.0	102.3	2.3%
Output per Worker	100.0	99.3	-0.7%

Table B.2: Effects of the Gig Economy on Welfare (%)

	Productivity			**Assets**			All
	Low	Medium	High	Poor	Medium	Wealthy	
Unemployment - UI ineligible	0.62	0.57	0.42	0.60	0.56	0.45	0.54
Unemployment - UI eligible	0.59	0.54	0.42	0.58	0.54	0.44	0.52
Paid Employment	0.53	0.46	0.40	0.52	0.47	0.40	0.47
Traditional Self-employment	0.52	0.45	0.39	0.51	0.46	0.39	0.46
All	0.53	0.46	0.40	0.53	0.48	0.40	0.47

[1] Welfare is measured as a consumption-equivalent variation, expressed in percentage terms, for each state and aggregated based on the pre-gig distribution.
[2] The classifications for productivity and asset groups are as follows: Low/Poor = bottom 33%, Medium = 34–66%, and High/Wealthy = top 33%.

Figure B.2: Welfare Effects Decomposition



Appendix C
TRANSITION DYNAMICS

To study transition dynamics, I solve the model in continuous time under perfect foresight, tracking the evolution of value functions, distributions, and aggregate variables over time $t \in [0, T]$, where T is sufficiently large to ensure convergence to a new steady state.

1. Workers Problem

Each value function $W_o(a, z, t)$ now includes a backward time derivative, and all prices and policies can vary over time.

Paid Employment

$$\begin{aligned} -\partial_t W_E(a,z,t) + \rho\, W_E(a,z,t) &= \max_c u(c) + \partial_a W_E(a,z,t)\, \dot{a}(t) \\ &+ \lambda_E \left[W_{U_Y}(a,z,t) - W_E(a,z,t)\right] + \partial_z W_E(a,z,t)\, \mu(z) + \tfrac{1}{2}\, \partial_{zz} W_E(a,z,t)\, \sigma^2(z) \end{aligned} \tag{C.1}$$

Unemployment For $k \in \{Y, N\}$,

$$\begin{aligned} -\partial_t W_{U_k}(a,z,t) + \rho\, W_{U_k}(a,z,t) &= \max_c u(c) + \partial_a W_{U_k}(a,z,t)\, \dot{a}(t) \\ &+ f(\theta_t) \left[W_E(a,z,t) - W_{U_k}(a,z,t)\right] + \mathbb{1}_{k=Y}\, \lambda_U \left[W_{U_N}(a,z,t) - W_{U_Y}(a,z,t)\right] \\ &+ \sum_{j \in \{T,G\}} \tilde{\lambda}_{U_j} \max\left\{W_{S_j}(a,z,t) - W_{U_k}(a,z,t), 0\right\} \end{aligned} \tag{C.2}$$

Self-Employment For $j \in \{T, G\}$,

$$
\begin{aligned}
-\partial_t W_{S_j}(a,z,t) + \rho\, W_{S_j}(a,z,t) = \max_c u(c) + \partial_a W_{S_j}(a,z,t)\, \dot{a}(t) \\
+ \lambda_{S_j} \left[W_{U_N}(a,z,t) - W_{S_j}(a,z,t) \right] + \tilde{\lambda}_{S_j} \max \left\{ W_{U_N}(a,z,t) - W_{S_j}(a,z,t), 0 \right\} \\
+ \eta_j f(\theta_t) \left[W_E(a,z,t) - W_{S_j}(a,z,t) \right] + \partial_z W_{S_j}(a,z,t)\, \mu(z) + \tfrac{1}{2}\, \partial_{zz} W_{S_j}(a,z,t)\, \sigma^2(z)
\end{aligned}
\tag{C.3}
$$

2. Firm Problem

The firm's value function becomes time-dependent:

$$
\begin{aligned}
-\partial_t J(a,z,t) + (r_t - \delta)\, J(a,z,t) = y(z, k_t) - w(a,z,t) - r_t\, k_t \\
+ \partial_a J(a,z,t)\, \dot{a}(t) + \lambda_E \left[V_t - J(a,z,t) \right] \\
+ \partial_z J(a,z,t)\, \mu(z) + \tfrac{1}{2}\, \partial_{zz} J(a,z,t)\, \sigma^2(z)
\end{aligned}
\tag{C.4}
$$

The free-entry condition now pins down time-varying market tightness θ_t through the vacancy value V_t:

$$
(r_t - \delta)\, V_t = -\xi + q(\theta_t) \iint \Omega(a,z,t) \left[J(a,z,t) - V_t \right] da\, dz \tag{C.5}
$$

3. Kolmogorov Forward Equations

Let $d_o(a,z,t)$ denote the density of agents in state o with assets a and productivity z at time t. The distribution evolves forward in time via:

$$
\begin{aligned}
\partial_t d_o(a,z,t) = -\, \partial_a \left[\dot{a}_o(a,z,t) \cdot d_o(a,z,t) \right] - \partial_z \left[\mu(z) \cdot d_o(a,z,t) \right] \\
+ \tfrac{1}{2} \partial_{zz} \left[\sigma^2(z) \cdot d_o(a,z,t) \right] + \text{inflows}_o(a,z,t) - \text{outflows}_o(a,z,t)
\end{aligned}
\tag{C.6}
$$

The structure of inflows and outflows across occupations mirrors the steady-state equations (1.11), but now varies over time.

4. Initial and Terminal Conditions

To solve for transition dynamics, I impose:

- **Initial condition:** The economy starts from a steady-state distribution $d_o(a, z, 0) = d_o^0(a, z)$
- **Terminal condition:** Value functions converge to a new steady state:

$$\lim_{t \to T} \partial_t W_o(a, z, t) = 0, \quad \forall o$$

The model is then solved by iterating backward in time on HJBs and forward in time on KFEs until convergence.

Appendix D
WAGE EQUATION

Wages are determined via Nash bargaining over the surplus from a job match. For a worker with assets a and productivity z, the wage schedule $w(a, z)$ solves:

$$w(a,z) = \arg\max_{w} \left[\widetilde{W}_E(w,a,z) - W_{U_Y}(a,z)\right]^{\psi} \left[\widetilde{J}(w,a,z) - (V - F)\right]^{1-\psi} \quad (D.1)$$

[1]

Imposing the free-entry condition $V = 0$, the first-order condition becomes:

$$\psi \, \frac{\partial_w \widetilde{W}_E(w,a,z)}{\widetilde{W}_E(w,a,z) - W_{U_Y}(a,z)} + (1-\psi)\, \frac{\partial_w \widetilde{J}(w,a,z)}{\widetilde{J}(w,a,z) + F} = 0 \quad (D.2)$$

Envelope Conditions From the worker's HJB equation (Eq. (2.4)) and under the assumption that wage-derivatives of z-terms are negligible,[2]

$$\rho\, \partial_w W_E(w,a,z) = \partial_a W_E(w,a,z)\, \dot{a}_w - (\lambda_E + \tilde{\lambda}_E\, \mathbb{1}_{\{\Phi_E=1\}})\partial_w W_E(w,a,z) \quad (D.3)$$

and from the firm's HJB (Eq. (2.9)),

$$(r-\delta)\, \partial_w J(w,a,z) = -1 + \partial_a J(w,a,z)\, \dot{a}_w - (\lambda_E + \tilde{\lambda}_E\, \mathbb{1}_{\{\Phi_E=1\}})\partial_w J(w,a,z) \quad (D.4)$$

where $\dot{a}_w = (1-\tau) - \partial_w c^E(w,a,z) \to (1-\tau)$ as $\Delta \to 0$.

[1] This formulation allows for both exogenous and endogenous separations. Matches are destroyed at an exogenous rate λ_E, and additionally at an endogenous rate $\tilde{\lambda}_E$, which captures either worker-initiated quits or firm-initiated separations that depend on the continuation value of the match. The firing cost F applies when a firm chooses to end the match voluntarily. In model variants that abstract from these frictions, both $\tilde{\lambda}_E = 0$ and $F = 0$.

[2] I assume $\partial_{zw} W_E(w,a,z)\mu(z) = 0$, $\frac{1}{2}\partial_{zzw} W_E(w,a,z)\sigma^2(z) = 0$, and similarly for J.

Substituting into (D.2), I get:

$$\psi \, \frac{\partial_a W_E(a,z)(1-\tau)}{(\rho + \lambda_E + \tilde{\lambda}_E \, \mathbb{1}_{\{\Phi_E=1\}}) \, [W_E(a,z) - W_{U_Y}(a,z)]} = (1-\psi) \, \frac{1 - \partial_a J(a,z)(1-\tau)}{(\lambda_E + \tilde{\lambda}_E \, \mathbb{1}_{\{\Phi_E=1\}} + r - \delta) \, [J(a,z) + F]} \tag{D.5}$$

Plugging in HJBs Using the HJB expressions for $W_E(a, z)$ and $J(a, z)$, the closed-form wage becomes:

$$\begin{aligned} w^*(a,z) = {} & \frac{\psi}{1 - \partial_a J(a,z)(1-\tau)} \Big[y(z,k) - r\,k + \partial_a J(a,z) \big((r-\delta)a - c^E(a,z) \big) \\ & + \partial_z J(a,z)\,\mu(z) + \tfrac{1}{2}\partial_{zz} J(a,z)\,\sigma^2(z) + (\lambda_E + r - \delta)\,F \Big] \\ & - \frac{1-\psi}{\partial_a W_E(a,z)(1-\tau)} \Big[u(c^E(a,z)) + \partial_a W_E(a,z) \big((r-\delta)a - c^E(a,z) \big) \\ & + \partial_z W_E(a,z)\,\mu(z) + \tfrac{1}{2}\partial_{zz} W_E(a,z)\,\sigma^2(z) - \rho\, W_{U_Y}(a,z) \Big] \end{aligned} \tag{D.6}$$

Wage Schedule During Transition Dynamics During the transition path, the wage function becomes time-varying and includes time derivatives:

$$\begin{aligned} w_t(a,z) = {} & \frac{\psi}{1 - \partial_a J(a,z,t)(1-\tau_t)} \Big[y_t(z,k_t(z)) - r_t\,k_t(z) + \partial_a J(a,z,t) \big((r_t-\delta)a - c_t^E(a,z) \big) \\ & + \partial_z J(a,z,t)\,\mu(z) + \tfrac{1}{2}\partial_{zz} J(a,z,t)\,\sigma^2(z) + (\lambda_E + r_t - \delta)\,F + \partial_t J(a,z,t) \Big] \\ & - \frac{1-\psi}{\partial_a W_E(a,z,t)(1-\tau_t)} \Big[u(c_t^E(a,z)) + \partial_a W_E(a,z,t) \big((r_t-\delta)a - c_t^E(a,z) \big) \\ & + \partial_z W_E(a,z,t)\,\mu(z) + \tfrac{1}{2}\partial_{zz} W_E(a,z,t)\,\sigma^2(z) - \rho\, W_{U_Y}(a,z,t) + \partial_t W_E(a,z,t) \Big] \end{aligned} \tag{D.7}$$

Appendix E
MODEL WITHOUT SELF-EMPLOYMENT

E.1 Worker's Problem

In the absence of self-employment, workers transition between paid employment and unemployment (UI-eligible or ineligible). The worker's problem is characterized by a system of Hamilton–Jacobi–Bellman (HJB) equations.

Paid Employment (E) A worker earns wage income $w(a,z)$, faces a job destruction shock at rate λ_E, and receives a voluntary quit opportunity at Poisson rate $\tilde{\lambda}_E$. The HJB is:

$$\begin{aligned}\rho W_E(a,z) = \max_c u(c) + \partial_a W_E(a,z)\dot{a} + \lambda_E[W_{U_Y}(a,z) - W_E(a,z)] \\ + \tilde{\lambda}_E \max\{W_{U_Y}(a,z) - W_E(a,z), 0\} + \mu(z)\partial_z W_E(a,z) + \tfrac{1}{2}\sigma^2(z)\partial_{zz} W_E(a,z)\end{aligned} \tag{E.1}$$

subject to:

$$\dot{a} = (1-\tau)w(a,z) + (r-\delta)a - c, \quad a \geq \underline{a}$$

Unemployment (U_Y, U_N) Unemployed workers receive benefits $B_k(z)$ depending on UI eligibility $k \in \{Y, N\}$, search for jobs at rate $f(\theta)$, and lose eligibility at rate λ_U. Productivity is assumed fixed during unemployment.

$$\begin{aligned}\rho W_{U_k}(a,z) = \max_c u(c) + \partial_a W_{U_k}(a,z)\dot{a} + f(\theta)[W_E(a,z) - W_{U_k}(a,z)] \\ + \mathbb{1}_{k=Y}\lambda_U[W_{U_N}(a,z) - W_{U_Y}(a,z)]\end{aligned} \tag{E.2}$$

subject to:

$$\dot{a} = (1-\tau)B_k(z) + (r-\delta)a - c, \quad a \geq \underline{a}$$

E.2 Firm's Problem

Corporate firms produce output with capital, choosing optimal capital k upon observing worker productivity z.

Value of a Filled Job The value function $J(a, z)$ satisfies:

$$\begin{aligned}(r-\delta)J(a,z) = {} & y(z,k) - w(a,z) - rk + \partial_a J(a,z)\dot{a} \\ & + \lambda_E[V - J(a,z)] + \tilde{\lambda}_E \max\{V - F - J(a,z), 0\} \\ & + \mu(z)\partial_z J(a,z) + \tfrac{1}{2}\sigma^2(z)\partial_{zz}J(a,z)\end{aligned} \tag{E.3}$$

Value of a Vacancy Vacancies incur posting cost ξ, are filled at rate $q(\theta)$:

$$(r-\delta)V = -\xi + s + q(\theta)\int_z \int_a \omega(a,z)[J(a,z) - V]\, da\, dz \tag{E.4}$$

with $\omega(a, z) = d_U(a, z)/u$.

Free Entry Vacancy creation satisfies: $V = 0$

E.3 Stationary Equilibrium

A stationary equilibrium includes value functions $\{W_o(a, z), J(a, z), V\}$, consumption and wage policies $c_o(a, z), w(a, z)$, asset prices (r, p), tightness θ, tax rate τ, capital demand $k(z)$, and distributions $d_o(a, z)$ for $o \in \{E, U_Y, U_N\}$, such that:

1. Workers solve HJBs given prices and $f(\theta)$, choosing:

$$c_o(a,z) = u'^{-1}\left(\partial_a W_o(a,z)\right)$$

2. Firms choose capital to maximize profits:

$$k(z) = \arg\max_k \{y(z,k) - w(a,z) - rk\}$$

and satisfy the free entry condition:

$$q(\theta) \int \int \frac{d_U(a,z)}{u} J(a,z)\, da\, dz = \xi - s$$

3. Wages are determined via Nash bargaining.

4. Asset market clears:

$$\int \int k(z) d_E(a,z)\, da\, dz + p = \sum_o \int \int a\, d_o(a,z)\, da\, dz$$

5. Aggregate dividends:

$$d = \int \int [y(z,k(z)) - w(a,z) - rk(z)]\, d_E(a,z)\, da\, dz - (\xi - s)v$$

with return condition $\frac{d}{p} = r - \delta$

6. Government budget:

$$\tau \int \int w(a,z) d_E(a,z)\, da\, dz = \int \int [B_Y(z) d_{U_Y}(a,z) + B_N d_{U_N}(a,z)]\, da\, dz + A_s(s) + A_m(\chi)$$

7. Distributions $d_o(a,z)$ satisfy the Kolmogorov Forward Equation.