Essays on the Minimum Wage Effects in a Low-wage Labor Market

by

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Contents

List of Figures

List of Tables

Acronyms

2SLS	Two-Stage Least Squares
BRS	Benard, Redding, and Schott
GSO	General Statistics Office
HHI	Herfindahl–Hirschman Index
ILO	International Labor Organization
IV	instrumental variable
JSCs	joint-stock companies
LFS	Labor Force Survey
LLCs	limited liability companies
MCL	marginal cost of labor
MOLISA	Ministry of Labor, Invalids and Social Affairs
MRP	marginal revenue product
NMWR	New Minimum Wage Research
NWC	National Wage Council
OWE	own-wage employment elasticity
SEM	structural equation modelling
SMEs	small- and medium-sized enterprises
SOEs	state-owned enterprises
TFP	total factor productivity
VES	Vietnam Enterprises Survey
VHLSS	Vietnam Household Living Standard Survey

Chapter 1

Introduction

1.1 Motivation and Country Background

New Zealand adopted the world's first national minimum wage in 1894. Since then, there have been debates regarding the minimum wage effect on employment among legislators, academicians, progressives, and international organizations. Some have argued that higher minimum wages will force firms to reduce their employment and create involuntary unemployment, whereas others have cited empirical evidence showing negligible employment effects in many countries. Despite the controversy, minimum wage legislation has been widely adopted and applied worldwide. In 2020, the International Labor Organization (ILO) reported that over 90% of their member states applied at least one form of minimum wage laws (ILO, 2020, p. 60). According to the Global Wages Report 2020–21, around 19% of all wage workers in 72 countries received equal to or less than the minimum wage levels in their countries (ILO, 2020, p. 66). Over the last decade, the discussions on minimum wage have become increasingly intense world over because several countries have imposed this policy for the first time (e.g., Germany, Malaysia, Myanmar, etc.) and many others have raised their minimum wages to considerable levels. In their report, the ILO showed that over half the countries in the world adjusted their minimum wages every two years during the 2010s; and about three-quarters of the countries raised their minimum wages during this period (ILO, 2020).

The authorities worldwide intend to protect vulnerable workers by setting a minimum

wage, regulating social security contributions, ensuring safety, and establishing health standards, among other things. However, these laws raise the costs of hiring employees and may induce enterprises to violate them, especially in developing countries where the informal sector is large. As a result, workers may have to bear the cost rather than just remain the recipients, and formal employment may be displaced by informal employment. This dissertation aims at understanding how employers and employees are affected by minimum wage regulations in a low-wage labor market characterized by several institutional issues. The huge informal sector along with imperfect enforcement influences the ways in which firms respond to minimum wage changes, and thus, labor market outcomes. Given the availability of two comprehensive data sets, namely Vietnam Enterprises Survey (VES) and Labor Force Survey (LFS), and changes in the minimum wage, this dissertation takes the Vietnamese labor market as a case study and examines the effects of minimum wage on workers and employers alike.

In Vietnam, the term of *"minimum wage"* was first defined as *"the amount determined by the government for a non-professional worker who lives alone to cover their daily cost of living in a given area"* in Decree No. 29-SL (March 12, 1947).[1] Along with economic development, the concept has been adjusted several times to meet the basic needs of workers and their families. In the current system, the government applies two separate wage floors to the private and public sectors. The *base salary* covers government/state officials, public servants, and all employees who receive salaries from the state budget. The *regional minimum wage* (*minimum wage*) is applied to workers in the private sector, who work under labor contracts in line with the Labor Code. The wage must be greater than the minimum wage by at least 7% for skilled laborers who have completed vocational training courses.

The minimum wage coverage has changed over time since its implementation in 1995. It was originally applied to workers in foreign firms and agencies, and international organizations. In 2009, the government expanded the minimum wage coverage to the domestic sector. However, the initial minimum wage applied to workers in the domestic sector was lower in order to to protect domestic firms from foreign competitors. In Octo-

[1]An initial form of the Labor Code in Vietnam (in Vietnamese: *"Sắc lệnh của Chủ tịch Chính phủ Việt Nam Dân chủ Cộng hòa số 29 ngày 12 tháng 3 năm 1947"*).

ber 2011, under pressure from the World Trade Organization's accession agreement, the minimum wage applied to domestic firms was raised to catch up with the one applied to their foreign counterparts (D. T. Nguyen et al., 2017). This resulted in a sharp minimum wage hike and changed the shape of the labor market entirely. The 2009–2011 period can be considered the minimum wage reform period in Vietnam.

In 2013, the government formed the National Wage Council (NWC) comprising representatives of three parties: Workers, employers, and the government. The NWC holds several meetings each year for minimum wage negotiations among the three parties. The Council proposes minimum wage adjustments based on the basic needs of workers and their families, and the national socio-economic conditions. Since 2013, the government has raised the minimum wage annually despite its high levels relative to the mean and median wages in the labor market.

The minimum wage reform and subsequent hikes clearly raise concerns over their impacts on labor market outcomes. On the one hand, one may worry that higher minimum wages affect vulnerable workers negatively and push them to the informal sector. Formal employment may decline whereas informal employment may increase in response to higher minimum wages. On the other hand, one may argue that higher minimum wages will raise the labor costs for the firm, thus leading to lower survivability and profitability, especially for small- and medium-sized enterprises (SMEs). They may consequently reduce their employment and may not be able to expand their business. This dissertation addresses both issues by examining the effects of the minimum wage reform on firm-level responses and of subsequent hikes on labor market outcomes. It discusses the minimum wage reform and subsequent hikes in detail in the corresponding chapter.

1.2 Literature Review

Since the birth of the *New Minimum Wage Research (NMWR)*,[2] economists have conducted an enormous number of empirical studies on minimum wage in most parts of the

[2]The NMWR refers to a sequence of papers presented in the *"New Minimum Wage Research Conference"* at Cornell University in November 1991, and articles published in the Industrial and *Labor Relations Review (ILR Review)* during the 1990s.

world. This section reviews the literature with an emphasis on studies set in developing countries and/or presenting new aspects of minimum wage research. Owing to the countless number of studies, this section categorizes empirical studies by the minimum wage effects to be estimated in each paper (i.e., employment, wage and wage-related, and other non-employment effects). This structure allows us to follow the key points of minimum wage discussions over the last few decades.

1.2.1 Employment Effect

The employment effect has always been at the center of minimum wage debates. Opponents argue that a higher minimum wage will destroy the jobs of those who are at the bottom of the wage distribution ladder. By citing empirical evidence, proponents argue that raising minimum wages does not necessarily lower employment. Since the 1990s, the literature on the employment effect has expanded exponentially in developed and developing countries.

In the US, early minimum wage studies relied on time-series data and found negative employment elasticities ranging from -0.1 to -0.3 (Brown, Gilroy, and Kohen, 1982). However, the NMWR triggered a sequence of debates over the employment effect of increases in the minimum wage. Card and Krueger (1995) challenged the traditional view that an increase in the minimum wage predictably leads to a decrease in employment. They concluded that increases in the minimum wage did not affect employment among low-wage workers adversely.[3] Card and Krueger have tried to convince readers at least *"On the value of testing the implications of standard economic theory."* As they noted, the theoretical model that researchers apply should take into account other characteristics of the labor market, such as the spike in the wage distribution, rather than predictions of the standard competitive model (Card and Krueger, 1995, p. 397).[4] Brown (1999, p. 2130) emphasized the importance of using *"degree of impact"* measures (i.e., the proportion of "affected workers" or wage increases needed to meet the new minimum wage) rather than

[3]See Card and Krueger (1995, pp. 66–9, 101–2) for criticisms on their articles and authors' responses, and Neumark and Wascher (2007, pp. 14–7) for a detailed discussion on these papers.

[4]Card and Krueger's conclusion has received attention from labor economists on both sides. Detailed comments can be found in Brown et al. (1995).

the *"relative minimum wage"* index that was used in the literature.

Neumark and Wascher (2007) provided updated evidence in the late 1990s and early-mid 2000s. By reviewing a large number of panel data studies, they concluded that longer panel data estimates on employment effect (including both state and time variations in minimum wage) were more likely to be statistically and significantly negative, whereas that of short panel data or studies that examined state-specific minimum wage changes in a particular industry were zero or positive (Neumark and Wascher, 2007, p. 166). They raised concerns over whether the findings in Card and Krueger (1995) were valid as their latter analyses may not have captured the full effects of minimum wage changes. They criticized the inadequacy of the natural experiment approach and the interpretation of its results. They argued that the standard competitive model does not provide enough employment effect expectations of minimum wages in a narrow industry (Neumark and Wascher, 2007, p. 167).

Updated empirical evidence of the employment effect in developed countries can be found in several recent literature surveys. Belman and Wolfson (2014) reviewed and discussed empirical studies over two decades after the NMWR. Wolfson and Belman (2019) summarized 37 studies in the US spanning over 15 years since the early 2000s and pointed out the shift in the estimated employment elasticity from the interval [-0.3, -0.1] to [-0.13, -0.07]. Neumark and Shirley (2022) concentrated on minimum wage studies in the US and criticized how economists biasedly summarized their review of the same minimum wage literature. Some studies concluded that there was no negative effect, whereas others found a considerably negative effect. Neumark and Shirley (2022) suggested a clear dominance of the negative employment effect estimated in the literature. Dube (2019) reviewed empirical evidence from the US, UK, and other developed countries and measured the own-wage employment elasticity (OWE) to account for discrepancies while comparing estimates across groups and countries.[5] Their findings indicated a muted minimum wage effect on employment. Overall, the minimum wage effect on wages was much higher than that on employment.

[5]OWE is defined by the ratio between employment and wage elasticities (with respect to the minimum wage). It reflects how the employment of a specific group changes with respect to an increase in its own average wage, which is induced by the minimum wage hike.

The number of empirical studies in developing countries has increased drastically, owing to the increasing availability of high-quality data and developments in econometric techniques. For example, Belman and Wolfson (2016) reviewed 25 articles that had been published in English since 2000.[6] Broecke, Forti, and Vandeweyer (2017) and Neumark and Munguía Corella (2021) surveyed 95 studies set in 13 major emerging countries and 61 studies set in developing countries, respectively.

The presence of informal economies makes the minimum wage effect on employment harder to predict in developing countries. Empirical studies often rely on the two-sector model and estimate the effects on formal and informal employment. For example, Nataraj et al. (2014) conducted a meta-analysis using estimates from 17 studies set in low-income countries.[7] The authors found that higher minimum wages led to lower and higher formal and informal employment, respectively. By reviewing and conducting a meta-analysis, Broecke et al. (2017) concluded that minimum wages had little detectable effect on employment in 13 large emerging economies. In some countries, empirical studies were inclined toward a negative employment effect (e.g., Chile, Colombia, Philippines, and Poland). In all other countries, the evidence was rather mixed. In most studies, vulnerable groups like the youth and low-skilled workers tended to be more adversely affected by higher minimum wages. However, Broecke et al. (2017) found clear evidence of reporting bias towards statistically significant negative coefficients.

Taking a different approach, Neumark and Munguía Corella (2021) found that heterogeneity was the key determinant of mixed employment effects in developing countries. They found more negative estimated coefficients in studies on markets with more features of a perfectly competitive market. They considered four features: Targeting the vulnerable groups; usage of data in the formal sector; strong enforcement of the minimum wage policy; and the bindingness of minimum wages.

[6]They identified over 75 articles with the word "minimum wage" in the title, abstract, or keywords in the literature. Over 50 articles were neither available nor written in English.

[7]These countries include Bangladesh, Ghana, Honduras, India, Indonesia, Kenya, Nicaragua, and Zimbabwe.

1.2.2 Wage and Wage-related Effects

Compared to the employment effect, the minimum wage effects on average wage and earnings are far less contentious in developed countries. Belman and Wolfson (2014) found a positive relationships between the minimum and average wage in 37 of 41 minimum wage studies.[8] Dube (2019) pointed out a significantly positive effect of the minimum wage on market wage in developed countries. Belman and Wolfson (2014) found the presence of wage spillover effects in the US (particularly for women) and UK (both sexes). By raising wages of those at the bottom of the wage distribution, minimum wages reduced wage inequality. However, empirical studies showed little effect of the minimum wage on poverty in developed countries. Neumark (2021) raised concerns over the antipoverty efficacy of the minimum wage policy in the US. Given the change in labor market structures, the author argued that minimum wage workers do not necessarily come from poor families. Therefore, raising the minimum wage may bring benefits to nonpoor families and may not be the right instrument to fight poverty and income inequality.

In developing countries, the minimum wage effect on wages becomes more complex because of the huge informal sector and noncompliance issues. The imperfect enforcement may also lower the effectiveness of the minimum wage policy in raising workers' wages. In a dual sector setting, a minimum wage hike would theoretically lead to an increase in labor supply, and thus, depress the market clearing wage in the informal sector. However, empirical studies in Latin American countries have often reported the opposite effect.[9] The imposition of minimum wages has created "spikes" not only in the wage distribution of formal workers but also of informal ones. Raising the minimum wage led to higher wages in the formal and informal sectors alike. The literature often used the term "lighthouse effect" to describe this phenomenon. By applying a matching model to the Brazilian case, Boeri, Garibaldi, and Ribeiro (2011) found that the (endogenous) sorting behavior of workers accounted for at least one-third of the increase in informal

[8]Earlier discussions on the effects of minimum wages on wages, wage distribution, and poverty can be found in Card and Krueger (1995) and Brown (1999).

[9]See Colombia (L. A. Bell, 1997); Brazil (Fajnzylber, 2001; Lemos, 2004, 2009); Costa Rica (Gindling and Terrell, 2005); and Latin American and Caribbean countries (Kristensen and Cunningham, 2006).

workers' wages.[10]

Governments in developing countries refer to the minimum wage as a tool for fighting poverty. In these countries, empirical studies typically found evidence of poverty reduction after minimum wage hikes (see, e.g., Alaniz, Gindling, and Terrell, 2011; del Carpio, Messina, and Sanz-de-Galdeano, 2019; Gindling and Terrell, 2010; Sotomayor, 2021). Gindling (2018) found that minimum wages reduced poverty in most empirical studies in developing countries, although the effect was modest. However, Gindling (2018) posed two main challenges to the minimum wage policy in reducing poverty: The policy legal coverage and informality issues. The minimum wage may not cover all workers, especially the self-employed or family-contributing ones, and even when it does, firms may not pay the minimum wage to their employees in the informal sector.

1.2.3 Non-employment Effects

Given the increasing availability of micro data, minimum wage studies have expanded the target toward non-employment aspects, especially firm-level responses. Since the early 2010s, empirical studies have explored how affected firms respond to large increases in the minimum wage. Draca, Machin, and Van Reenen (2011) discussed three possibilities through which firms could survive after facing negative shocks. Aside from reducing employment, firms may simply pass the cost onto their customers by raising output prices. If the output market is relatively competitive, firms may have to bear a part of the cost and suffer profit losses. The other option is to reduce managerial slack and/or improve productivity. This subsection reviews empirical evidence on outcomes that have been increasingly considered over the last decade. There are certainly other aspects that had been discussed extensively in the past [e.g., fringe benefits or noncash compensation (Card and Krueger, 1995; Clemens, 2021) and human capital (Belman and Wolfson, 2014)]. This dissertation focuses on studies concerning the four following outcomes: Output prices, firm profitability, productivity, and consumption. These outcomes have become the main topics of the minimum wage literature over the last decade.

[10]Adam and Buffie (2020) developed a dynamic general equilibrium model with efficiency wages to explain the puzzle of the minimum wage in developing countries, including the lighthouse effect.

Output Prices

The standard model of the competitive labor market predicts that a binding minimum wage will unambiguously lead to a fall in employment. This prediction relies on the assumption that the output market is perfectly competitive and that firms are thus price takers in this market. The minimum wage then leads to higher prices if and only if it affects all firms in the industry or economy. Earlier studies often estimated the minimum wage effect on price at the economy (consumer price index) or industry-wide level. Lemos (2008) reviewed 16 and studies that examined the price effect at the economy-wide and sectoral levels, respectively. Belman and Wolfson (2014) added two papers in the UK and France.

Recent papers have cast doubt on the perfect competition assumption and tested the pass-through effect of minimum wage on output prices at the firm level. In a comprehensive analysis, Harasztosi and Lindner (2019) examined how Hungarian firms responded to the minimum wage hike in 2000. They found a significant positive effect on total revenue among firms affected by the minimum wage hike and explained it as the consequence of higher output prices. By decomposing the change in firm's labor cost, they concluded that consumers paid almost three quarters of the minimum wage cost. Leung (2021) and Renkin, Montialoux, and Siegenthaler (2022) estimated the price pass-through effect of minimum wages in the retail sector in the US. They found that a 10% increase in the minimum wage led to 0.6–0.8% (Leung, 2021) or 0.36% (Renkin et al., 2022) increases in the grocery store-level price index. Allegretto and Reich (2018) analyzed the output price effect of local minimum wage changes based on Internet-based restaurant menus and found that almost all the increasing costs were passed onto customers in 884 restaurants in San Jose, California.

Firm-level Profitability

Draca et al. (2011) found that firm-level profitability declined significantly after the introduction of the national minimum wage in the UK in 1999. The reduction in profit margin tended to be smaller in industries with relatively low market power (perfect competition). The mechanism was that all firms in a perfectly competitive market could raise

output prices while facing an industry-wide shock (Draca et al., 2011, p. 147). B. Bell and Machin (2018) estimated the minimum wage effect on another profitability measure of publicly listed companies in the UK, namely stock market value. The authors found that employers hiring minimum wage workers faced around 1.3% drop in firm values on the day of announcement and around 2–3% decline after 5 days. These results suggested that the minimum wage announcement affected firms' expected profits negatively before its implementation.

Ruffini (2022) considered the minimum wage effects on nursing facilities in the US and found that they can fully offset the increasing labor costs by generating higher revenue. The revenue increase was largely because private payers were charged higher prices. Therefore, the net income of nursing facilities was not significantly affected by the minimum wage.

In the context of Central European countries, Harasztosi and Lindner (2019), and Babiak, Chorna, and Pertold-Gebicka (2019) and Chorna (2021) examined the relationship between minimum wage and firm profitability in Hungary and Poland, respectively. Harasztosi and Lindner (2019) found a significant drop in accounting profits relative to revenue in the base year among Hungarian firms that had greater exposure to the minimum wage hike. Babiak et al. (2019) reported that minimum wage changes in Poland affected firms' profit margins adversely. Chorna (2021) found a negative but insignificant effect of minimum wage increases on profit margins of Polish firms.

Deng (2017), Long and Yang (2016), and Mayneris, Poncet, and Zhang (2018) added empirical evidence on this strand of literature in a large emerging economy. Using cross-sectional data, Long and Yang (2016) found an insignificant effect of the minimum wage on return to equity of privately-owned enterprises in China. Firms facing negative demand shock, proxied by the market potential index for province exports, tended to experience declines in profit. They argued that firms can fully offset increasing labor costs in the absence of external shocks (by reducing fringe benefits like pension and insurance programs). Using a broader set of firm-level data, Deng (2017) found that the minimum wage affected firms' profit margins (profit-to-sale ratio) negatively. The author found an inverted U-shape of the minimum wage effect across the distribution of profitability. The minimum wage significantly reduced the profits of firms at the lowest five centiles and

at the 40th centile and above. Mayneris et al. (2018) applied the differences-in-difference approach to examine the effects of the 2004 minimum wage reform on various firm-level variables. The authors found that higher minimum wages reduced the survivability of firms in China, but that existing firms exposed to the hike significantly improved their productivity. Therefore, firm profitability measured by profit-to-output ratio remained unaffected after the reform.

Productivity

Facing pressure from higher minimum wages and increased labor cost, firms may improve their labor productivity or operational efficiency. Metcalf (2008) and Riley and Rosazza Bondibene (2017) discussed several channels through which higher minimum wages may lead to higher labor productivity (e.g., capital deepening through labor-capital substitution, worker effort intensification, organizational restructuring, etc.).

Draca et al. (2011) did not find any effect of the minimum wage introduction on firm-level labor productivity in the UK. However, Riley and Rosazza Bondibene (2017) found clear evidence of a positive effect on labor productivity in registered companies in the UK. Their results were robust to different measures of labor productivity: Two measures using gross value added per employee and a simple measure of turnover per employee. They pointed out that changes in labor productivity were associated with increases in total factor productivity (TFP), as suggested by theories of organizational change or efficiency wages, rather than coming from employment reduction or capital-labor substitution. Focusing on the US, Kim and Jang (2019) reported a significantly positive effect of minimum wage increases on labor productivity in the restaurant industry, measured by revenue per employee. This positive effect manifested only in full-service (versus limited) and low-wage (versus high-wage) restaurants and lasted for two years before diminishing.

Mayneris et al. (2018) found a significant effect of the 2004 minimum wage reform on labor productivity of Chinese firms. The gain in labor productivity came partially from better management of inventory and larger capital investment. Hau, Huang, and Wang (2020) found significant improvements in the TFP growth of Chinese manufacturing firms

in response to changes in the minimum wage during the 2002–2008 period. The effect was more pronounced among initially low-TFP firms and private- and foreign-owned enterprises, but no effect was found among state-owned enterprises (SOEs). By extrapolating management data from a sample of 460 firms, the authors found that higher management quality in private and foreign firms accounted for the heterogeneous response in TFP growth. Du and Wang (2020) found that higher minimum wages induced innovation and raised the TFP of industrial firms in China. Innovation and TFP improvements worked as a channel to raise the firm's market power.

Álvarez and Fuentes (2018) presented a different picture of how a sharp minimum wage hike affected firm-level TFP using data from Chilean manufacturing firms. The authors showed that the large change in the minimum wage between 1998 and 2000 led to lower labor productivity and TFP. The effect was larger in firms with a higher share of low-skilled workers or in sectors with higher exposure to the minimum wage hike.

A few studies have tested the minimum wage effect on labor productivity via the worker effort channel. Ku (2022) exploited a rare data set on piece-rate workers to test the minimum wage effect on effort-driven labor productivity. In response to the minimum wage hike in Florida, productivity measured by output per hour of workers in the lower part of productivity distribution significantly increased relative to those in the higher part of the distribution. Using similar data on piece-rate workers, Hill (2018) found the exact opposite effect of the minimum wage on worker-level productivity. The productivity of strawberry pickers (flats per hour) in California declined significantly with the minimum wage level. Hill (2018) then explained this productivity reduction by the loss in incentives of low-wage workers. By observing workers in both establishments experiencing changes and no change in the minimum wage, Coviello, Deserranno, and Persico (2022) examined the effect on worker productivity in a large US retailer. Their results reconciled with the seemingly contradictory findings in two earlier studies. The authors found that higher minimum wages led to significantly higher productivity (measured by sales per hour) with a larger effect among low-type workers, or those who had previously paid the minimum wage level. However, the effect turned negative when workers were monitored less intensely (proxied by the supervisor-to-worker ratio at the store level).

Consumption

The relationship between the minimum wage and consumption has remained relatively less explored in the literature. Yamada (2016) estimated the minimum wage impact on household consumption, which he documented as the better measure of welfare, as well as other labor market outcomes. In assessing the minimum wage changes in Indonesia in the early 1990s, Yamada (2016) found a significant and sizable effect on household earnings distribution but only a small effect on household consumption. He viewed this as an "increased risk to earning" and concluded that raising the minimum wage had no effect in improving consumption inequality in Indonesia. In Thailand, del Carpio et al. (2019) found that minimum wage significantly raised household consumption at the bottom half of the distribution and reduced consumption inequality during the 2000s. Durongkaveroj (2022) found that the 2013-hike in Thailand did not help poor families in terms of household consumption. The minimum wage hike in 2013 led to higher consumption per capita, but only for nonpoor families.

In the US, a few papers have examined the minimum wage effect on consumption, and they did so at an aggregate level. Examining data at the city level, Cooper, Luengo-Prado, and Parker (2020) found that increases in the minimum wage resulted in higher consumption, especially in terms of the quantity consumed. Alonso (2022) exploited a novel data set on retail sales and found that county-level consumption of nondurable goods increased by 0.6% and 0.4% in nominal and real terms in response to a 10% minimum wage hike.

1.2.4 Minimum Wage Studies in Vietnam

In Vietnam, several studies were conducted to evaluate the impacts of minimum wage policy on labor market outcomes. Most of these studies examined the minimum wage effects on firms without considering the workers' side. Of the five studies found in the literature, two assessed the base salary applied to the public sector that was previously used as a benchmark for private domestic firms. The other three restricted their analysis to registered enterprises alone.

C. V. Nguyen (2013) evaluated the employment effect on low-wage workers during the mid 2000s. Using the Vietnam Household Living Standard Survey (VHLSS) in 2004 and 2006, he found that minimum wage hikes led to decreases in the share of formal workers and increases in those of self-employed workers among low-wage workers.[11] However, using VHLSS in the mid-2000s, the author limited his scope to the previous minimum wage system alone. C. V. Nguyen (2017a) examined the effects of the previous minimum wage system on firm profitability and the probability of exiting the market. The author did not find clear-cut evidence that higher minimum wages led to lower profitability or higher probability of closing business in Vietnam.

C. V. Nguyen (2017b) estimated the effects of the new minimum wage system that began from 2009 on firms' employment and investment. Using the VES from 2008 to 2010, he estimated a 1% reduction in registered firms' employment in response to a 10% increase in the real minimum wage. Increases in the minimum wage affected male and uninsured workers more severely. Under this pressure, firms tended to raise their fixed assets to substitute for labor. D. T. Nguyen et al. (2017) showed that rapid increases in the minimum wage led to a decrease in employment in all industries. Labor intensive firms (such as textile and furniture manufacturing) tended to substitute labor by increasing machine investment. D. X. Nguyen (2019) used the same data to estimate the minimum wage effects on manufacturing firms in Vietnam between 2010 and 2015. His findings suggested that manufacturing firms responded to higher minimum wages by raising labor productivity and TFP. Low-wage firms responded more positively to minimum wage changes.

1.2.5 Remarks and Room for Future Research

Over the last decade, the literature on minimum wage in developing countries has expanded in terms of quantity and direction of research. Researchers have been taking advantage of high-quality micro data and experimental-like minimum wage hikes to estimate the effects on various outcomes. Yet, empirical findings on the effects of minimum

[11] Owing to information limitations in the survey, C. V. Nguyen (2013) defined formal workers as those who have jobs in the state sector or private enterprise, and considered all other workers informal.

wage remain inconclusive even within a single country. More importantly, complex realities in developing countries require a better research design to accurately capture the minimum wage effects. This implies that further studies that seek a better understanding of how the minimum wage affects labor market outcomes are still necessary.

At the labor market level, existing studies have not paid much attention to enforcement efforts of the authorities. In developed countries, one may agree to some extent that the minimum wage policy is enforced well. However, this assumption does not hold in many developing countries, where informal economy and informal employment are pervasive. The weak labor inspection system is partially attributable to the imperfect enforcement of the policy. Failing to take this imperfectness into account may result in inaccurately estimating the minimum wage effects on labor market outcomes. A few recent papers have attempted to incorporate imperfect enforcement into minimum wage analysis; however, this issue is still particularly underexplored in the literature.[12]

At the firm-level, several papers have tested the monopolistic power of firms in the output market to see if they can pass the minimum wage cost onto their customers. However, the relationship between the minimum wage and output prices remains underexplored in developing countries owing to limited data availability. This option may not always be feasible for SMEs in developing countries. In the output market, they compete with larger and/or heavily invested foreign firms. Thus, they may not be able to raise output prices in response to a negative shock on the labor cost. The question then becomes how these firms survive in such circumstances. Some empirical studies have tried to address this question by exploring possibilities outlined in the previous subsection but have not found a clear-cut answer. Chapter 4 shows that switching output products is a promising option for manufacturing firms.

In Vietnam, minimum wage studies have focused on registered enterprises so far, but these firms have absorbed around only 70% of the total number of wage workers and have not covered self-employed or family-contributing workers. The remaining wage workers are actively working in the informal sector and many of them work under formal labor contracts, implying that they are legally covered by the law. Chapter 3 discusses the

[12]See discussion on these papers in Chapter 3.

eligibility of these workers to be entitled to employment benefit and the minimum wage policy. The distinction between formality status and policy coverage becomes crucial in assessing the minimum wage effects. Existing studies have not discussed the two phases of the minimum wage evolution in Vietnam (see Section 1.1). Minimum wage changes in each phase may affect firms and labor market outcomes differently (a large and unexpected hike in the first phase versus modest and expected ones in the second phase).

These examples suggest that there is still much room for further research on the minimum wage effects in a low-wage labor market. This dissertation adds up the literature by exploring two new aspects of the minimum wage: Informal employment under enforcement heterogeneity and firm-level product switching response

1.3 Dissertation Outline

The rest of this dissertation is organized as follows.

Chapter 2 extends the theoretical framework of the imperfect market and imperfect enforcement developed by Basu, Chau, and Kanbur (2010) (hereinafter referred to as BCK model). By allowing for two levels of enforcement associated with formal and informal segments, the extended BCK framework points out a possibility of opposite minimum wage effects on employment in the two segments. If the labor market is monopsonitic, enforcement heterogeneity may result in a positive and negative employment effect on the formal and informal segments, respectively. Additionally, this chapter tests the application of the extended BCK model using district-level wage information in Vietnam.

Chapter 3 applies the extended BCK model using district-level panel data in Vietnam. It distinguishes between employment formality and minimum wage coverage, which has not been fully discussed in the literature. By applying the extended BCK framework, this chapter finds a significantly positive effect of the minimum wage on formal employment. An increase in the minimum wage combined with stricter enforcement leads to a higher share of informal workers with written labor contracts. This implies that an appropriate hike with a good enforcement mechanism promotes the formalization of the

workforce.

Chapter 4 utilizes a comprehensive firm-level data set to examine the minimum wage effects on firm sales revenue, its components, and the role of product switching practices. By decomposing firm sales revenue by type of products, this chapter finds that continuing products contribute a large share to the sales revenue growth. However, the sales revenue of continuing products is negatively affected by the minimum wage while newly added products help offset this adverse effect. Empirical findings from this chapter suggest that both manufacturing and non-manufacturing firms in Vietnam could not rely on output price adjustments to respond to the minimum wage shock. Importantly, through product switching, especially adding new products, manufacturing firms can protect their sales revenue from the shock and mitigate the negative employment effect.

Chapter 2

Minimum Wage and Enforcement Heterogeneity: A New Approach

In the literature, theoretical and empirical studies, especially those set in developed countries, have implicitly assumed the perfect enforcement of the minimum wage policy. However, this assumption does not hold in several developing countries, where the informal economy and informal employment are pervasive. Weak labor inspection systems in developing countries result in the imperfect enforcement of the policy. The presence of imperfectness implies that the theoretical framework developed by Basu et al. (2010) may be more appropriate than the traditional competitive and monopsony models in explaining the minimum wage effects. This chapter extends the BCK model by allowing for enforcement heterogeneity across sectors and regions. The rest of this chapter is organized as follows. Section 2.1 reviews the traditional models of the minimum wage, including competitive and monopsonistic models and their variants. Section 2.2 presents the extended BCK model with two levels of imperfect enforcement. Section 2.3 tests the application of the extended model and examines the wage effects in Vietnam.

2.1 Traditional Models of Minimum Wage

2.1.1 The Standard Competitive Model and Its Variants

Traditional views on the minimum wage rely on the standard supply-demand model presented in most microeconomics textbooks. The underlying assumptions are that the labor market is competitive and that workers are homogeneous. Under this setting, the imposition of a minimum wage unambiguously leads to an increase in market wage and a loss in employment, as long as it is set above the market clearing wage (Figure 2.1). The labor supply curve becomes flat at the minimum wage level until it reaches the supply level associated with it, $\ell^s(\overline{w})$. The market equilibrium will be demand-determined in the presence of a binding minimum wage. Brown et al. (1982) noted that if employment increases in the basic demand-supply model, the reduction in employment owing to the minimum wage can take the form of lower employment growth rates.

<Insert Figure 2.1>

The standard model assumes that the minimum wage law covers all workers in the labor market. However, a large number of workers earn less than the minimum wage, especially in developing countries, suggesting that the two-sector model would be more appropriate. Welch (1974), Mincer (1976), and Gramlich (1976), among others, proposed and analyzed this type of model to assess minimum wage impacts. Welch's model allows different equilibrating wages in the two sectors. Workers who previously had a job in the covered sector can move to the uncovered sector or quit the labor market if they are displaced, whereas those in the uncovered sector cannot go to the covered sector after the imposition of a minimum wage. Therefore, a minimum wage hike unambiguously leads to a decrease (an increase) in employment in the covered (uncovered) sector. Thus, this model predicts a fall in total employment as the employment loss in the covered sector exceeds the gain in employment in the uncovered sector.

Models presented by Gramlich (1976) and Mincer (1976) assume that workers can choose freely between the two sectors. The wage in the uncovered sector then clears the market and equals the expected wage in the covered sector (i.e., covered-sector wage times the probability of being employed in the covered sector). This equilibrium wage

can rise or fall after a minimum wage hike, but the total employment always falls. In the presence of a minimum wage, less labor is demanded in both sectors if the market wage increases and less labor is supplied if the market wage decreases (as some workers stay unemployed in the covered sector). Brown et al. (1982) modified the Gramlich-Mincer model by allowing workers searching for covered jobs while working in the uncovered sector. Their modification raises the possibility of a positive effect on total employment as the relative efficiency of searching can reduce the employment loss and unemployment in the covered sector.

Both classical and two-sector models impose a homogeneous labor assumption. However, minimum wage may have different impacts on relatively low-skilled workers whose earnings are near the minimum wage level, and those who receive higher wage. In the simplest heterogeneous labor model, a minimum wage hike raises the price of unskilled workers relative to skilled ones. Thus, the employment of unskilled labor will necessarily fall while that of skilled labor may or may not rise, depending on the cross-substitution effect between both groups of workers. Total employment relies on the substitution between unskilled workers and non-labor inputs. If unskilled workers can be replaced easily by non-labor inputs, meaning that they are good substitutes for each other, total employment will decline after an increase in the minimum wage. Similarly, models with continuous labor skills predict a negative employment effect among those workers who possess marginal product less than the minimum wage level (see, e.g., Card and Krueger, 1995; Brown, 1999).

Another set of models has incorporated the output market condition into the labor market framework, given the increasing availability of micro data. Models on the competitive labor market predict the employment effect based on the assumption that the output market is also perfectly competitive. Thus, firms are price takers in this market. If firms have market power in setting output prices, they may pass the increasing cost onto their customers. In such cases, the negative employment effect will be less severe (Clemens, 2021; Boeri and van Ours, 2021).[13]

[13]By analyzing the standard competitive model, Clemens (2021) also discussed other firm-level non-employment responses such as noncash compensation or job attributes. Depending on how firms respond, minimum wage may have different employment effects.

2.1.2 Traditional Monopsony and Models of the Imperfect Labor Market

In the traditional monopsony model, the so-called monopsonist faces an upward-sloping labor supply schedule and has significant control over wages. To maximize profit, the monopsonist sets wage rates at a level where the marginal revenue product (MRP) of labor equals the marginal cost of labor (MCL) (see Figure 2.2). In the absence of a minimum wage, both market wage and employment (w^{so}, ℓ^m) are below the equilibrium levels in a competitive labor market (w^*, ℓ^*). The imposition of a minimum wage within the range of w^{so} and w^* unambiguously raises the wage and employment relative to the initial equilibrium. On the lines of the competitive case, the minimum wage results in a piecewise MCL curve, which is flat at the minimum wage level. However, the MCL in the monopsony case becomes perfectly inelastic or vertically-sloped, at the employment supply level associated with the minimum wage, $\ell^s(\overline{w})$. As long as the minimum wage is lower than the competitive equilibrium wage (w^*), a hike has positive effects on employment and wage. Continuing to raise the minimum wage above w^* will result in employment loss as in the competitive market case.

<Insert Figure 2.2>

The pure monopsony model hypothetically assume a single employer in the labor market, which is not practical in reality. However, if there is more than one employers but they can collude in setting wages, the resulting equilibrium will be similar to the monopsony case. Card and Krueger (1995) discussed several monopsony models in which firms are wage-setters rather than wage-takers. On the lines of the traditional monopsony model, these settings lead to the same conclusion of the positive wage and ambiguous employment effects.[14]

Even when there is an infinite number of employers, the labor market may have monopsonistic features if market frictions in favor of employers exist. Burdett and Mortensen (1998) developed a model of search frictions and argued that unemployment inefficiency may arise because of the monopsony power that accrues to wage-setting em-

[14]See also Boeri and van Ours (2021) for a recent discussion on imperfect labor markets.

ployers. Therefore, a binding minimum wage will reduce inefficient unemployment while raising the wages of all workers (Burdett and Mortensen, 1998, p. 259). Based on this, Manning (2003) developed a model of oligopsony in which firms can influence their employment by varying the intensity of their recruitment activity. Manning (2003) presented generalized models of monopsony and oligopsony, which consider the general equilibrium. However, he noted that "a low level of the minimum wage does not necessarily raise employment in an oligopsonistic labor market" and the employment effect should primarily be an empirical question (Manning, 2003, p. 347).

2.2 Minimum Wage and Enforcement Heterogeneity

All models discussed in the previous section rely on the assumptions that firms strictly comply with the law and the authorities are capable of enforcing it. However, these assumptions often fail in developing countries because of their weak labor inspection systems. The imperfect enforcement of the law may result in lower policy effectiveness by enabling some employers not to comply with the law. The presence of imperfectness implies that the recent theoretical framework developed by Basu et al. (2010) may be more appropriate than the traditional competitive and monopsony models in explaining the minimum wage effects. The original BCK model considers the coexistence of compliant and noncompliant employers under the monopsony and imperfect enforcement assumptions. The degree of enforcement may differ across sectors or regions, resulting in heterogeneous minimum wage effects. This section extends the BCK model by allowing for heterogeneity at the enforcement level. The extension in this study considers the employment and wage effects of the minimum wage in each labor market segment.[15]

2.2.1 Initial Settings

Consider an employer hiring employees from a population of $\mathcal{L}$ heterogeneous workers and having control over wages and employment in this population. The employer's associated revenue is given by $R(\ell) = (a - b\ell/2)\ell$, where ℓ is the number of hired workers, and

[15]For readers' convenience, the same notation as in the original paper is used as far as possible.

parameters $a > 0$ and $b > 0$ captures labor productivity and the diminishing marginal product. This implies the following inverse labor demand:

$$R_\ell(\ell) = a - b\ell \equiv w^d(\ell)$$

Assume that $\mathcal{L}$ heterogeneous workers supply one unit of labor each with a wage of w. Workers differ by their employment mobility cost, $t \in [0, T]$, that is the cost of finding or switching jobs, and are distributed uniformly along this interval. The utility of an employed worker is the difference between their wage and mobility cost, $u(t, w) = w - t$. The uniform reservation utility of all workers is given by $\overline{u} \geq 0$. At a given wage offer, workers agree to work if their utility exceeds the reservation utility, $u(t, w) \geq \overline{u}$, or $w - \overline{u} \geq t$. The labor supply schedule is the sum of all individuals who are willing to work at the given wage offer, $\ell^s(w) = (w - \overline{u})\mathcal{L}/T$. Accordingly, the implied inverse labor supply is as follows:

$$w^s(\ell) \equiv \overline{u} + \tau\ell, \qquad \tau \equiv T/\mathcal{L}$$

Under the competitive condition, the market equilibrium is the intersection of the labor demand and supply curves $\{w^*, \ell^*\}$:

$$\ell^* = \{\ell | w^d(\ell) = w^s(\ell)\} = \frac{a - \overline{u}}{b + \tau}, \quad w^* = w^d(\ell^*) = w^s(\ell^*) = \frac{\tau a + b\overline{u}}{b + \tau} \tag{2.1}$$

The equilibrium exists if and only if the reservation utility does not exceed the labor productivity parameter, that is, $a > \overline{u}$. Let us consider the case when the market is less than full in terms of employment ($\ell^* < \mathcal{L}$), which is driven by a sufficiently high level of mobility cost: $T > a - \overline{u} - b\mathcal{L}$.

Let $W(\ell) \equiv w^s(\ell)\ell$ be the total labor cost, and $W_\ell(\ell) = \partial W(\ell)/\partial\ell = \overline{u} + 2\tau\ell$ be the associated marginal cost of labor. In the monopsony case, the market equilibrium $\{w^{so}, \ell^o\}$ and w^{do}, which is the intersection between the MCL and MRP, are as follows:

$$\begin{gathered} \ell^o = \underset{\ell}{\operatorname{argmax}}[R(\ell) - W(\ell)] = \frac{a - \overline{u}}{b + 2\tau} \leq \ell^* \\ w^{so} = w^s(\ell^o) = \frac{\tau a + (\tau + b)\overline{u}}{b + 2\tau} \leq w^*, \qquad w^{do} = w^d(\ell^o) = \frac{2\tau a + b\overline{u}}{b + 2\tau} \geq w^* \end{gathered} \tag{2.2}$$

In the absence of mobility cost (i.e., $\tau = 0$), monopsonistic and competitive markets'

equilibria coincide. Strict inequalities occur whenever there is a strictly positive mobility cost $\tau > 0$. This leads to a lower level of employment when compared to the competitive equilibrium (i.e., $\ell^o < \ell^*$) and those workers who face the highest mobility cost will be unemployed.

2.2.2 Two Levels of Imperfect Enforcement

Let us consider a case where the government imposes a wage floor of $\overline{w}$ and conducts inspection with a likelihood of λ. Basu et al. (2010) assumed that all employers face the same probability of being inspected. This study assumes two market segments with different levels of enforcement attributable to the cost and complexity of the inspection process: High enforcement, λ_{hi} is close to 1; and low enforcement, λ_{lo} is far less than 1.[16] The division of the labor market can be between the formal and informal sectors or between the highly and less inspected regions. Employment and wage paid decisions of employers belonging to each segment are:

$$\{\ell_h^m(\overline{w}, \lambda_{hi}), w_h^m(\overline{w}, \lambda_{hi})\} \quad \text{and} \quad \{\ell_l^m(\overline{w}, \lambda_{lo}), w_l^m(\overline{w}, \lambda_{lo})\},$$

where subscripts hi and lo denote high and low enforcement levels, respectively. If an employer, either low or highly inspected, decides not to comply with the law and inspection takes place, a compensation of $\overline{w} - w^m(\overline{w}, \lambda)$ will be transferred to the worker. However, a fraction of $1 - \sigma \in (0, 1]$ of the transfer will be used for the settlement process as transaction cost. Imperfect enforcement implies the explicit dependence of workers' wages on the enforcement intensity. Employers are classified into over, exact, and noncompliance groups.

This study assumes no mobility of workers across sectors (formal to informal and vice versa) owing to employment benefit constraints. To participate in the formal market segment, workers are required to contribute 8%, 1.5%, and 1% of their monthly salary for social, health, and unemployment insurance, respectively, and thus, receive lower wages

[16] In developing countries, the weak labor inspection system and lack of government capacity result in imperfect enforcement. The presence of the informal sector and differences in government priorities cause enforcement heterogeneity across sectors and regions. For example, the government may implement and enforce labor policies more strongly in economic centers and/or on registered firms.

in the short run. Employers also face higher labor costs when they hire formal workers with a total contribution that is equivalent to 21.5% of workers' salary to these insurance systems. Therefore, employers and employees have incentives to stay at their current market segment. Unless the gain from higher wages is sufficiently large, informal workers will not move to this segment, marginally, and pay for social security. Similarly, once workers participate in the social security system, they should have no incentive to give up all benefits voluntarily and join the informal market segment.[17]

2.2.3 Minimum Wage Thresholds

Labor Supply

The maximal labor supply corresponding to the minimum wage is denoted as $\overline{\ell} = \ell^s(\overline{w}) = (\overline{w} - \overline{u})/\tau$. Given λ (either λ_{hi} or λ_{lo}), the expected utility of a worker facing a sub-minimum wage offer is:

$$\mathrm{E}u(w, t, \overline{w}, \lambda) = (1 - \lambda)w + \lambda\left[w + \sigma(\overline{w} - w)\right] - t = (1 - \lambda\sigma)w + \lambda\sigma\overline{w} - t$$

where $w + \sigma(\overline{w} - w)$ and w are worker's income with and without inspection, respectively and $\lambda\sigma$ is the transaction cost adjusted by enforcement intensity. On the lines of the initial setting, workers take the offer if $\mathrm{E}u(w, t, \overline{w}, \lambda) = \overline{u}$. The labor and inverse labor supply schedules adjusted for imperfect enforcement then become:

$$\overline{\ell}^s(w, \overline{w}, \lambda) = \frac{(1 - \lambda\sigma)w + \lambda\sigma\overline{w} - \overline{u}}{\tau} = \ell^s(w) + \frac{\lambda\sigma}{\tau}(\overline{w} - w) \geq \ell^s(w) \tag{2.3}$$

$$\overline{w}^s(w, \overline{w}, \lambda) = \frac{\overline{u} + \tau\ell - \lambda\sigma\overline{w}}{1 - \lambda\sigma} = w^s(\ell) + \frac{\lambda\sigma}{1 - \lambda\sigma}\left[w^s(\ell) - \overline{w}\right] \leq w^s(\ell) \tag{2.4}$$

for a noncompliant employer with $w \leq \overline{w}$ and $\ell \leq \overline{\ell}$. The corresponding enforcement-adjusted labor supply is lower in the less enforced segment at a given minimum wage level, $\overline{\ell}^s(w, \overline{w}, \lambda_{lo}) \leq \overline{\ell}^s(w, \overline{w}, \lambda_{hi})$.[18] For a compliant employer, the labor and inverse

[17] See also Section 3.1

[18] This is similar to Basu et al. (2010, p. 250) who noted that *"either an increase in, $\overline{w}$ or an increase in λ further increases labor supply at given subminimum wage level, w"*.

labor supply remain $\ell^s(w)$ and $w^s(\ell)$, regardless of the enforcement level.

Expected Profit and Labor Cost

The employer's expected profit is as follows:

$$\mathrm{E}\pi(\ell) = \max_{\ell} R(\ell) - (1-\lambda)\overline{w}^s(\ell, \overline{w}, \lambda) - \lambda \max\{\overline{w}, \overline{w}^s(\ell, \overline{w}, \lambda)\}\ell \tag{2.5}$$

where the expression $\max\{\overline{w}, \overline{w}^s(\ell, \overline{w}, \lambda)\}$ indicates the cost per worker conditional on inspection. This cost per worker will be lower than the minimum wage for a noncompliant employer, regardless of segment, $\max\{\overline{w}, \overline{w}^s(\ell, \overline{w}, \lambda)\} = \overline{w}^s(\ell, \overline{w}, \lambda) < \overline{w}$. Replacing the adjusted inverse labor supply schedule in Equation (2.4) yields:

$$\begin{aligned}
\mathrm{E}\pi(\ell) &= \max_{\ell} R(\ell) - (1-\lambda)\overline{w}^s(\ell, \overline{w}, \lambda) - \lambda\overline{w}\ell \\
&= \max_{\ell} R(\ell) - (1-\lambda)\left\{ w^s(\ell) + \frac{\lambda\sigma}{1-\lambda\sigma}\left[w^s(\ell) - \overline{w}\right]\right\}\ell - \lambda\overline{w}\ell \\
&= \max_{\ell} R(\ell) - \frac{1-\lambda}{1-\lambda\sigma} w^s(\ell)\ell - \frac{\lambda(1-\sigma)}{1-\lambda\sigma}\lambda\overline{w}\ell \\
&= \max_{\ell} R(\ell) - (1-\psi)W(\ell) - \psi\overline{w}\ell
\end{aligned}$$

where the weight attached to the cost of paying the minimum wage, $\psi = \frac{\lambda(1-\sigma)}{1-\lambda\sigma}$, is monotonically increasing in the enforcement intensity and lies between zero and unity. The expected labor cost is as follows:

$$(1-\psi)W(\ell) + \psi\overline{w}\ell \tag{2.6}$$

For a compliant employer, the expected labor cost remains:

$$W(\ell) \tag{2.7}$$

By combining (2.6) and (2.7), the expected total and marginal costs of labor are as follows:

$$\mathrm{E}\overline{W}(\ell, \overline{w}, \lambda) = \begin{cases} (1-\psi)W(\ell) + \psi\overline{w}\ell & \text{if } \ell < \bar{\ell} \\ W(\ell) & \text{otherwise} \end{cases} \tag{2.8}$$

$$\mathrm{E}\overline{W}_\ell(\ell,\overline{w},\lambda)=\begin{cases}(1-\psi)W_\ell(\ell)+\psi\overline{w} & \text{if } \ell<\overline{\ell}\\ W_\ell(\ell) & \text{otherwise}\end{cases} \tag{2.9}$$

Given the minimum wage $\overline{w}$, expected marginal costs of labor are illustrated in Figure 2.3. The expected MCL function, $\mathrm{E}\overline{W}_\ell(\cdot)$, is increasing and piecewise continuous in ℓ. As λ is closer to 1 (and ψ closer to 1), $\mathrm{E}\overline{W}_\ell(\cdot)$ becomes more elastic at $\overline{W}$ for $\ell \leq \overline{\ell}$ (and perfectly elastic if minimum wage is fully complied with, $\lambda = 1$). The expected MCL facing less inspected employers are steeper than that facing highly inspected ones (for $\ell \leq \overline{\ell}$). Types of employers differ only by the enforcement intensity parameter λ. Therefore, they face the same labor supply curve, $w^s(\ell)$, and the expected MCL in the upper part.

<Insert Figure 2.3>

Minimum Wage Thresholds

In the previous section, two minimum wage thresholds were noted: w^{so} and w^{do}. Similar to the BCK setting, $\overline{W}(\lambda)$ is defined as the endogenous threshold that divides the labor market equilibria into three groups that lies on the left, right, and exactly where the expected MCL truncates. With a binding minimum wage (i.e., $\overline{w} > w^{so}$), a noncompliant employer will choose the number of workers at a point where the MRP exceeds MCL:

$$R_\ell(\ell)-(1-\psi)W_\ell(\ell)-\psi\overline{w}\geq 0 \Leftrightarrow a-b\overline{\ell}\geq(1-\psi)(\overline{u}+2\tau\overline{\ell})+\psi\overline{w}$$

using $\overline{\ell}=(\overline{w}-\overline{u})/\tau$ and $w^*=(\tau a+b\overline{u})/(\tau+b)$, the condition becomes:

$$\begin{aligned}
a-b\frac{\overline{w}-\overline{u}}{\tau} &\geq (1-\psi)(2\overline{w}-\overline{u})+\psi\overline{w}\\
\Leftrightarrow b\overline{w}+\tau\overline{w}(2-\psi) &\leq (\tau a+b\overline{u}(+\tau\overline{u}(1-\psi)\\
\Leftrightarrow \overline{w} &\leq \frac{w^*(\tau+b)+\tau\overline{u}(1-\psi)}{\tau(2-\psi)+b}\\
\Leftrightarrow \overline{w} &\leq \frac{w^*[\tau(2-psi)+b]+\tau w^*(1-\psi)+\tau\overline{u}(1-\psi)}{\tau(2-\psi)+b}\\
\Leftrightarrow \overline{w} &\leq w^*-\frac{\tau(1-\psi)}{\tau(2-\psi)+b}(w^*-\overline{u})
\end{aligned}$$

By definition, the endogenous threshold, $\overline{W}(\lambda)$, should "give the largest minimum wage that can be applied without triggering non-compliance" (Basu et al., 2010, p. 258). Given the employer's characteristics and enforcement intensity, $\overline{W}(\lambda)$ can be defined as follows:

$$\overline{W}(\lambda) = w^* - \frac{\tau(1-\psi)}{\tau(2-\psi)+b}(w^* - \overline{u}) \quad (< w^* < w^{do}) \tag{2.10}$$

This endogenous threshold depends on enforcement level given the worker's wage reservation and employer's characteristics. As λ tends to 1 (and accordingly ψ to 1), $\overline{W}(\lambda)$ tends to w^*. Given two levels of enforcement, there exist two other minimum wage thresholds lying between the unregulated (w^{so}) and competitive (w^*) wages. Accordingly, there are two corresponding endogenous minimum wage thresholds: $\overline{W}(\lambda_{lo}) < \overline{W}(\lambda_{hi})$ and two expected MCLs, with the steeper one being for a less inspected segment.

<Insert Figure 2.4>

Let us return to the definition of maximal labor supply corresponding to a given enforcement level. In the original model, BCK define the maximal labor supply corresponding to the minimum wage $\overline{w}$ because they considered only one level of enforcement. Given the enforcement heterogeneity, this study defines the maximal labor supply corresponding to a given enforcement level as follows:[19]

$$\overline{\ell}_\lambda = \ell^s\left[\overline{W}(\lambda)\right] = \frac{\overline{W}(\lambda) - \overline{u}}{\tau}$$

The maximal labor supply in the less inspected segment will be lower than that in the highly inspected one: $\overline{\ell}_{\lambda lo} < \overline{\ell}_{\lambda hi}$. In the extension in this study, both minimum wage endogenous threshold and maximal labor supply corresponding to enforcement level depend on the demand factor, reflected by w^*, $\overline{u}$, and parameter b in Equation (2.10). This implies that each demand curve corresponds to a set of minimum wage thresholds and maximal labor supplies (Figure 2.4).

[19]In the case of homogeneous enforcement, the definition, in this study, of maximal labor supply corresponding to a given enforcement level will be the same as BCK's definition corresponding to a given minimum wage level: $\overline{\ell} \equiv \overline{\ell}_\lambda$.

2.2.4 Market Equilibria

The corresponding labor market equilibria can be divided into four categories: (i) over-compliance, (ii) exact compliance; (iii) exact compliance for highly inspected employers but noncompliance for less inspected ones; and (iv) noncompliance for both types of employers. Figure 2.5 graphically illustrates these four cases.

<Insert Figure 2.5>

Overcompliance in Both Segments, $\overline{w}_1 < w^{so}$

Employers over-comply with the law when the minimum wage is lower than the unregulated equilibrium wage. Therefore, the corresponding market equilibrium is independent of a change in minimum wage policy for both segments:

$$\begin{aligned} \ell^m_{hi,1}(\overline{w}, \lambda_{hi}) &= \ell^m_{lo,1}(\overline{w}, \lambda_{lo}) = \ell^o_1 \\ w^m_{hi,1}(\overline{w}, \lambda_{hi}) &= w^m_{lo,1}(\overline{w}, \lambda_{lo}) = w^{so} \end{aligned} \tag{2.11}$$

An increase in the enforcement intensity only leads to a higher endogenous threshold and higher maximal labor supply corresponding to the enforcement with no effect on labor market outcomes.

Exact Compliance in Both Segments, $w^{so} \leq \overline{w}_2 < \overline{W}(\lambda_{lo})$

As the minimum wage exceeds the unregulated threshold (w^{so}), it starts affecting labor market outcomes. As long as it is below the lower endogenous threshold, $\overline{W}(\lambda_{lo})$, all employers continue to pay exactly the minimum wage level. Therefore, the imposition of a minimum wage creates a *supply-constrained* labor market, and the corresponding equilibrium employment is determined by the intersection between the MRP and expected MCL:

$$\begin{aligned} \ell^m_{hi,2}(\overline{w}, \lambda_{hi}) &= \ell^m_{lo,2}(\overline{w}, \lambda_{lo}) = \overline{\ell}_2 \\ w^m_{hi,2}(\overline{w}, \lambda_{hi}) &= w^m_{lo,2}(\overline{w}, \lambda_{lo}) = \overline{w} \end{aligned} \tag{2.12}$$

The elasticities of equilibrium employment and wage with respect to a change in the

minimum wage are all positive. As employers already strictly comply with the minimum wage, increasing the enforcement parameter further has no impact on equilibrium.

Exact Compliance in the Highly Enforced Segment and Noncompliance in the Less Enforced Segment, $\overline{W}(\lambda_{lo}) \leq \overline{w}_3 < \overline{W}(\lambda_{hi})$

When the minimum wage lies between the two endogenous thresholds, a hike will have different impacts on two segments. The market equilibrium is still *supply-constrained* in the highly inspected segment and purely determined by the supply side. An increase in the minimum wage leads to higher employment and higher wages in this segment:

$$\ell^m_{hi,3}(\overline{w}, \lambda_{hi}) = \overline{\ell}_3 \quad \text{and} \quad w^m_{hi,3}(\overline{w}, \lambda_{hi}) = \overline{w} \tag{2.13}$$

In the less inspected segment, labor market outcomes are determined by both supply and demand schedules. Less inspected employers choose the number of workers to maximize their profit:

$$\ell^m_{lo,3}(\overline{w}, \lambda_{lo}) = \{\ell | R_\ell(\ell) = (1 - \psi_{lo})(\overline{u} + 2\tau\ell) + \psi_{lo}\overline{w}\}$$

Replacing $R_\ell(\ell) = a - b\ell$ and doing algebra yields the following employment at equilibrium:

$$\ell^m_{lo,3}(\overline{w}, \lambda_{lo}) = \ell^o + \frac{\psi_{lo}}{2\tau(1 - \psi_{lo}) + b}(w^{do} - \overline{w}) \tag{2.14}$$

where ℓ^o and w^{do} are given in the setting section. As employers in the less inspected segment become noncompliant, increases in the minimum wage affect employment negatively. Raising the enforcement effort will rotate the first part of the MCL, among these less inspected employers, downward. A sufficient increase in λ may transform the less inspected segment into a highly inspected one and lead to positive employment effects from a minimum wage hike. This observation offers an important policy implication as an appropriate hike combined with higher enforcement efforts may lead to the formalization of employment in developing countries, where informal employment (less inspected) is pervasive.

Fitting $\ell^m_{lo,3}(\overline{w}, \lambda_{lo})$ from Equation (2.12) into Equation (2.4) yields the equilibrium wage paid by less inspected employers:

$$w^m_{l,3}(\overline{w}, \lambda_{lo}) = \overline{w} - \left[1 + \frac{\tau\psi_{lo}}{2\tau(1-\psi_{lo}) + b}\right] \frac{\overline{w} - \overline{W}(\lambda_{lo})}{1 - \lambda_{lo}\sigma} < \overline{w} \tag{2.15}$$

As $\overline{w} > \overline{W}(\lambda_{lo})$, the equilibrium wage is below the minimum wage. In the BCK setting, $\partial w^m(\overline{w}, \lambda)/\partial\overline{w} \leq 0$ as $\overline{W}(\lambda)$ is independent of $\overline{w}$. This is rather unusual as empirical studies have often found positive effects on wages, regardless of the employment effect. BCK explains this with the composition effect of a minimum wage hike that moves the clusters of employers upward, thus the combined wage effect is ambiguous (Basu et al., 2010, pp. 257–258). In this extension, this study argues that wage elasticity may turn positive if a worker's reservation utility is increasing in $\overline{w}$, which is reasonable in developing countries as such workers often look at the formal market for reference. Under this assumption, wages can increase or decrease after a minimum wage hike, depending on workers' expectations. If the adjustment in their reservation wages is sufficiently large, the equilibrium wage will rise. The next subsection discusses this in detail.

Noncompliance in Both Segments, $\overline{W}(\lambda_{hi}) \leq \overline{w}_4$

Once the minimum wage exceeds the higher endogenous threshold, $\overline{W}(\lambda_{hi})$, market equilibrium is determined by supply and demand schedules for both employer types:

$$\begin{aligned}
\ell^m_{hi,4}(\overline{w}, \lambda_{hi}) &= \ell^o + \frac{\psi_{hi}}{2\tau(1-\psi_{hi}) + b}(w^{do} - \overline{w}) \\
w^m_{hi,4}(\overline{w}, \lambda_{hi}) &= \overline{w} - \left[1 + \frac{\tau\psi_{hi}}{2\tau(1-\psi_{hi}) + b}\right] \frac{\overline{w} - \overline{W}(\lambda_{hi})}{1 - \lambda_{hi}\sigma} \\
\ell^m_{lo,4}(\overline{w}, \lambda_{lo}) &= \ell^o + \frac{\psi_{lo}}{2\tau(1-\psi_{lo}) + b}(w^{do} - \overline{w}) \\
w^m_{lo,4}(\overline{w}, \lambda_{lo}) &= \overline{w} - \left[1 + \frac{\tau\psi_1}{2\tau(1-\psi_{lo}) + b}\right] \frac{\overline{w} - \overline{W}(\lambda_{lo})}{1 - \lambda_{lo}\sigma}
\end{aligned} \tag{2.16}$$

In this case, employment effects are negative in both segments whereas wage effects can either be positive or negative, based on adjustments in workers' reservation wages.

2.2.5 The Puzzling Wage Effect Under Noncompliance

In the noncompliance case, the market equilibrium wage unambiguously falls after a minimum wage hike if other factors are fixed. However, this prediction seems unrealistic in developing countries as most minimum wage studies have pointed out the positive wage and wage distributional effects in formal and informal employment segments (see, e.g., Lemos, 2004; Gindling and Terrell, 2005; Boeri et al., 2011). This subsection offers two potential modifications for the noncompliance case by which the wage effect can be consistent with the data observed. It discusses the second channel given its relevance to the situation in Vietnam.

First, let us assume that in addition to compensation, the employer has to pay a penalty that is increasingly severe as the gap between the actual and minimum wage widens. The increasing penalty forces an employer to raise the actual wage to avoid being penalized. However, higher penalties reduce the employer's expected MRP, and thus, the equilibrium wage. The total effect of a minimum wage hike depends on the scales of these effects. If the former effect dominates, the wage will rise after an increase in the minimum wage.[20] By contrast, if the penalty is relatively smaller than the benefit of noncompliance, the wage effect becomes negative. In Vietnam, noncompliant employers are suspended for 1 to 3 months and penalized increasingly based on the number of workers involved.[21] Therefore, this scheme supports the assumption of increasingly severe penalty and the possibility of positive wage effects in the noncompliance case.

Second, assuming that workers expect and demand higher wages every time the minimum wage rises. This assumption implies that the reservation utility of a worker is not constant but a function of the minimum wage.[22] In such case, the reservation utility of

[20]For example, in an extreme case, the penalty becomes unbearable for the employer (i.e., business closure) if the gap between the actual and minimum wage exceeds a certain level. In response to a minimum wage hike, the employer will raise the actual wage to keep the gap below this level.

[21]Decree No. 88/2015/ND-CP on amending a number of articles of the Decree No. 95/2013/ND-CP dated August 22, 2013 of the Government on penalties of administrative violations in labor, social insurance, and overseas manpower supply by contract. `http://www.molisa.gov.vn/en/Pages/Detail-document.aspx?vID=651`

[22]In Vietnam, the government raised the minimum wage annually following its introduction in 2009. The government approves the minimum wage schedule several months ahead of implementation and announces it through several channels (e.g., media, official documents to local governments). Therefore, workers expect a higher minimum wage annually and may adjust their reservation utility accordingly.

a worker takes the following form: $\overline{u} = \overline{u}(\overline{w})$. This function should diminishingly increase in $\overline{w}$ (i.e., $\partial\overline{u}/\partial\overline{w} \geq 0$ and $\partial^2\overline{u}/\partial\overline{w}^2 \leq 0$). Reservation utility is strictly increasing if the minimum wage is binding and zero otherwise. Let us further assume that $\partial\overline{u}/\partial\overline{w} \leq 1$, as it is not realistic for a worker to expect a higher change in reservation utility than that in the minimum wage, especially in a noncompliance setting. In the simplest form, $\overline{u}$ is a linear function of $\overline{w}$ with a positive slope of less than or equal to 1.

The analysis in this section is applicable for wages in highly and less inspected segments under the noncompliance situation. The equilibrium wage is given by:

$$w^m(\overline{w}, \lambda) = \overline{w} - \left[1 + \frac{\tau\psi}{2\tau(1-\psi)+b}\right] \frac{\overline{w} - \overline{W}(\lambda)}{1-\lambda\sigma}$$

As $\overline{w} > \overline{W}(\lambda)$, the equilibrium wage is below the minimum wage. The elasticity of wage with respect to the minimum wage is:

$$\frac{\partial w^m(\overline{w}, \lambda)}{\partial \overline{w}} = 1 - \left[1 + \frac{\tau\psi}{2\tau(1-\psi)+b}\right] \frac{1 - \partial\overline{W}(\lambda)/\partial\overline{w}}{1-\lambda\sigma}$$

As the endogenous threshold is independent of $\overline{w}$, the wage elasticity with respect to minimum wage is unambiguously negative. In the extended framework, increments in the minimum wage may affect the endogenous threshold by raising workers' reservation wages. The equilibrium wage increases if and only if:[23]

$$\begin{aligned}
1 - \left[1 + \frac{\tau\psi}{2\tau(1-\psi)+b}\right] \frac{1 - \partial\overline{W}(\lambda)/\partial\overline{w}}{1-\lambda\sigma} &\geq 0 \\
\Leftrightarrow \left[1 + \frac{\tau\psi}{2\tau(1-\psi)+b}\right]^{-1} (1-\lambda\sigma) &\geq 1 - \partial\overline{W}(\lambda)/\partial\overline{w} \\
\Leftrightarrow \frac{[2\tau(1-\psi)+b](1-\lambda\sigma)}{[2\tau(1-\psi)+b]+\tau\psi} &\geq 1 - \partial\overline{W}(\lambda)/\partial\overline{w} \\
\Leftrightarrow \partial\overline{W}(\lambda)/\partial\overline{w} &\geq \frac{\lambda\sigma[2\tau(1-\psi)+b]+\tau\psi}{[2\tau(1-\psi)+b]+\tau\psi} \qquad (2.17)
\end{aligned}$$

Replacing $\overline{W}(\lambda)$ from Equation (2.10) and w^* from Equation (2.1) to Equation (2.17)

[23]The nominator and denominator of all expressions are positive. No such extreme case is assumed as both λ and σ are equal to unity, so that all expressions and transpositions are valid.

above yields the following:

$$\begin{aligned}
\frac{b[\tau(2-\psi)+b]+\tau^2(1-\psi)}{[\tau(2-\psi)+b](\tau+b)} \times \partial\overline{u}/\partial\overline{w} &\geq \frac{\lambda\sigma[2\tau(1-\psi)+b]+\tau\psi}{\tau(2-\psi)+b} \\
&\Leftrightarrow \partial\overline{u}/\partial\overline{w} \geq \frac{\{\lambda\sigma[2\tau(1-\psi)+b]+\tau\psi\}(\tau+b)}{b\tau+b^2+b\tau(1-\psi)+\tau^2(1-\psi)} \\
&\Leftrightarrow \partial\overline{u}/\partial\overline{w} \geq \frac{\lambda\sigma[\tau(1-\psi)+b]+\lambda\sigma\tau(1-\psi)+\tau\psi}{b+\tau(1-\psi)} \\
&\Leftrightarrow \partial\overline{u}/\partial\overline{w} \geq \lambda\sigma + \frac{\lambda\sigma\tau(1-\psi)+\tau\psi}{\tau(1-\psi)+b} \equiv \overline{\phi}(\lambda,\sigma) \quad (\geq 0)
\end{aligned} \tag{2.18}$$

Equation (2.18) implies that if the change in workers' reservation wages with respect to the minimum wage is sufficiently large, a minimum wage hike will lead to higher wages even in the case of noncompliance. Let us consider two extreme cases.

In the first case, there is no transaction cost on transferring the compensation when inspection takes place: $\sigma = 1$, $\psi = 0$. The expression on the right-hand side of Equation (2.18) becomes $\lambda + \frac{\lambda\tau}{b+\tau}$ and is larger than unity if and only if $\lambda > \frac{b+\tau}{b+2\tau}$. In the second case, the government strictly enforces the law: $\lambda = 1$, $\psi = 1$. The right-hand side of Equation (2.18) becomes $\sigma + \frac{\tau}{b}$ and is larger than unity if and only if $\sigma > \frac{b-\tau}{b}$.

Unless both λ and σ are close to unity, or both extreme cases take place, the right-hand side of Equation (2.18) will be strictly less than unity. Hence, there exists a threshold $\overline{\phi}(\lambda,\sigma)$ that lies between zero and unity. If the worker's wage reservation response to a minimum wage hike surpasses this threshold, the hike will have a positive effect even in the noncompliance case. In the case of developing countries with imperfect enforcement, wage effects are likely to be positive. Section 2.3 tests the wage and distributional effects.

2.2.6 Two-level Imperfect Enforcement: Comparative Statics

Enforcement heterogeneity in the extended BCK framework allows the minimum wage to have heterogeneous employment effects on labor market segments based on its level relative to all thresholds (Figure 2.6). Above the higher endogenous threshold $\overline{W}(\lambda_{hi})$, increments in the minimum wage affect employment in both segments negatively. From w^{so} to $\overline{W}(\lambda_{lo})$, a hike raises employment in both segments. Between the two endoge-

nous thresholds, an additional increase continues to have a positive effect in the highly inspected segment owing to the higher maximal labor supply, but negatively affects employment in the less inspected segment because of the higher expected MCL. The impacts of a stricter enforcement level, given increase in the government effort, may vary across regions and market segments.

<Insert Figure 2.6>

Using information from Equations (2.11)–(2.16), Table 2.1 summarizes the direction of wage effects within different ranges of the minimum wage. A non-binding minimum wage has no impact on wages, whereas a binding level below the first endogenous threshold affects wages in both segments positively. Between both endogenous thresholds, raising the minimum wage will lead to higher wages for workers in the highly inspected segment. The effect can be positive or negative for workers in the less inspected segment based on their reaction in the reservation utility. Above the higher endogenous threshold, the minimum wage effects on wages may or may not have the same direction on workers, based on how quickly and largely workers response to the minimum wage change in each segment.

<Insert Table 2.1>

2.3 The Wage Effects in Vietnam

In both competitive and monopsonistic models, a binding and well-enforced minimum wage should reshape the wage distributions and result in all wages above or equal to the statutory level (see, e.g., Card and Krueger, 1995; Maloney and Mendez, 2004). Although minimum wage studies have often found a spike in the market wage distribution near the wage floor, they also found a nonnegligible fraction of workers receiving less than the minimum wage. This is especially true in developing countries, where governments only enforce the law weakly. In the case of Vietnam, the minimum wage changes the shape of wage distributions (Figure 2.7). Wage distributions of formal and informal workers have similar spikes on the right of the minimum wage levels.[24] Between 2015 and 2018, there

[24]This study defines workers as formal if their employers pay the mandatory social security for them. In accordance with the Labor Code, formal workers are covered by the minimum wage policy. With in

was no relationship between the distribution of income received by family-contributing and self-employed workers. This implies that the minimum wage was binding on both formal and informal workers and was irrelevant to other types of workers.

<Insert Figure 2.7>

Noncompliance existed in both formal and informal segments of the labor market and was higher in the latter.[25] In all segments, a portion of the wage distribution lies to the right of the red vertical line, where the worker's actual wage is equal to the minimum wage. In the informal-contracted (covered) segment, a larger share of workers received less than the minimum wage level when compared to the formal one. This observation supports the hypothesis on imperfect enforcement and enforcement heterogeneity in Vietnam.

Another significant implication from Figure 2.7 is that the wage distribution becomes more skewed over time, implying that the minimum wage becomes an important input when employers and workers negotiate the wage. Workers may see the minimum wage as a benchmark when they set expectations for reservation wage.

2.3.1 Model Specifications

This section estimates the minimum wage effects on average wage, and wage percentiles and gaps in each labor market segment (i.e., formal, informal-contracted, and informal-uncontracted). Because of data limitations, this study uses the worker's total monthly income as a proxy for wage.[26] Data are collected from the LFS between 2013 and 2018,

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the informal sector, workers are covered by the minimum wage policy if they work under labor contracts (informal-contracted) and uncovered otherwise (informal-uncontracted). See detailed discussion on the interaction between formality status and minimum wage coverage in Sections 3.1 and 3.2.

[25]In Vietnam, the noncompliance issue arises from two main sources: (i) asymmetric bargaining power and weak employment protection system, and (ii) mutual agreement between employers and employees. First, Appendix 3B in Chapter 3 shows that all labor market segments in Vietnam have friction features of monopsony, with a higher degree in the formal one. Thus, employers have more power in setting wages and may threaten workers in some cases. Combined with weak employment protection (proxied by imperfect enforcement), workers may not report noncompliance issues to the authorities. Second, as employers and workers have incentive not to form a formal employment relationship (see Sections 2.2 and 3.1), they may agree to put the minimum wage law aside and set a lower wage rate.

[26]Income decomposition (wage, over-time, and non-wage income) was only available from the Vietnam LFS 2013 to 2016. In the last two rounds, the data contained only information on the total income of worker. Using shorter panel for 2013–2016 did not change the main conclusion.

and aggregated at the district level. The baseline specification is as follows:

$$\ln Y_{rt} = \beta \cdot \ln MW_{rt} + X_{rt} \cdot \delta' + c_r + f_t + u_{rt}$$

where the subscripts r and t indicate district and time, respectively. Y_{rt} indicates the average wage, wage percentiles, and wage gaps at district r in year t, respectively. MW_{rt} denotes the real minimum wage deflated by the provincial consumer price index. X_{rt} indicates a vector of control variables: supply and demand shifters. Supply shifters are the proportions as the percentage of the total population of the following: (i) those who are below 15 years old, between 15 and 19, between 20 and 24, and older than 60; (ii) females; (iii) those who live in an urban area; (iv) workers who never went to school, who finished secondary, high school, vocational school, university, and higher education (not limited to employees). Demand shifters include the share of public sector employment and share of manufacturing workers within the province, except for district r (not limited to employees). c_r and f_t are district and year fixed effects, respectively. The idiosyncratic error term is u_{rt}.

The extended BCK framework predicts that changes in enforcement level may affect market equilibrium as well as the way employers respond to a minimum wage hike. This section estimates the enforcement effect by allowing for enforcement heterogeneity across districts. The main model specification is as follows:[27]

$$\ln Y_{rt} = \beta \cdot \ln MW_{rt} + \gamma_0 \cdot enforce_{rt} + \gamma_1 \cdot enforce_{rt} \cdot \ln MW_{rt} + X_{rt} \cdot \delta' + c_r + f_t + u_{rt}$$

where $enforce_{rt}$ is the proxy for enforcement intensity. Other variables remain the same as the baseline specification. Tables 2.2 and 2.3 presents the estimated coefficients from the baseline and main specifications, respectively.

[27]See Sections 3.2 and 3.3 for detailed discussions on the regional enforcement heterogeneity and enforcement dummy construction, respectively.

2.3.2 The Minimum Wage Effects

The formal segment presented only weak evidence of the minimum wage effect on the average wage with a coefficient of 0.18 and a standard error of 0.162. The mixture of low- and highly paid workers within this segment is likely to be the source of the insignificant coefficient. The minimum wage improves the wages of low-wage workers significantly with a higher effect at the lower wage deciles. A 10% increase in the minimum wage raises wages of workers in the two lowest wage deciles by around 5%. The size of the minimum wage effect declines as the wage rises and becomes insignificant at the median wage level. Given the declining effect, the minimum wage significantly reduced wage gaps between low- and high-wage workers in the formal segment. In the informal-contracted segment, where the average wages are lower, this study observed a significant wage effect. The average wage in this segment increased by 2.73% in response to a 10%-hike. The minimum wage raised the wage of lowest-wage workers in this segment and reduced wage inequality.

<Insert Table 2.2>

Aside from the wage effects in the two covered segments, Table 2.2 shows the spillover effect of the minimum wage on the wages received by informal-uncontracted workers, who are not protected by the law. The minimum wage pushed the whole wage distribution of informal-uncontracted workers upward with statistical significance at all wage deciles. This is reasonable as informal-uncontracted workers earn far less than other contracted (covered) workers and is in line with evidence of the lighthouse effect found in developing countries (especially Latin American countries, see, e.g., Gindling and Terrell, 2005; Boeri et al., 2011).

Overall, higher minimum wages led to higher wages in all segments, which is consistent with predictions from the extended BCK framework. The minimum wage reduced wage inequalities significantly both within and between segments.

2.3.3 The Enforcement Effects

In Table 2.3, coefficients on the enforcement intensity dummy demonstrate the wage differentials between highly and less inspected districts, whereas coefficients on the interaction term indicate the additional effect of an increase in the minimum wage in highly inspected districts.

<Insert Table 2.3>

In the formal segment, enforcement coefficients are positive but far from statistically significant. Thus, the formal segment may be at the exact compliance state, where enhancing enforcement level further does not affect labor market outcomes. Table 2.3 shows no evidence that minimum wage hikes have additional wage effects in highly inspected districts. These results are consistent with the effects on formal employment found in Chapter 3.

In the informal-contracted segment, enforcement intensity matters to both average wage and wage distribution. Higher enforcement level significantly improves the average wage and pushes up the wage distribution of informal-contracted workers with higher effect at lower wage deciles. Higher minimum wages produce a negative impact on wages of informal-contracted workers in highly inspected districts (coefficient on the interaction term). This may suggest that workers' response in terms of reservation wage is insufficient to demand a higher wage from a noncompliant employer, $\partial\overline{u}/\partial\overline{w} < \phi(\lambda_{lo}, \sigma)$. This piece of evidence supports the hypothesis posed in Chapter 3 that the informal-contracted segment is in a state of noncompliance.

Similar to the minimum wage effect, weakly significant effects of a higher enforcement level were found at higher wage percentiles in the informal-uncontracted segment. Directions of the wage effects are similar to those that were found in the informal-contracted segment, suggesting that the two segments can be substitutes for each other. As workers in both segments are quite similar in terms of characteristics, they may take others' wages as an indication while negotiating wages with their employers.

2.4 Conclusion

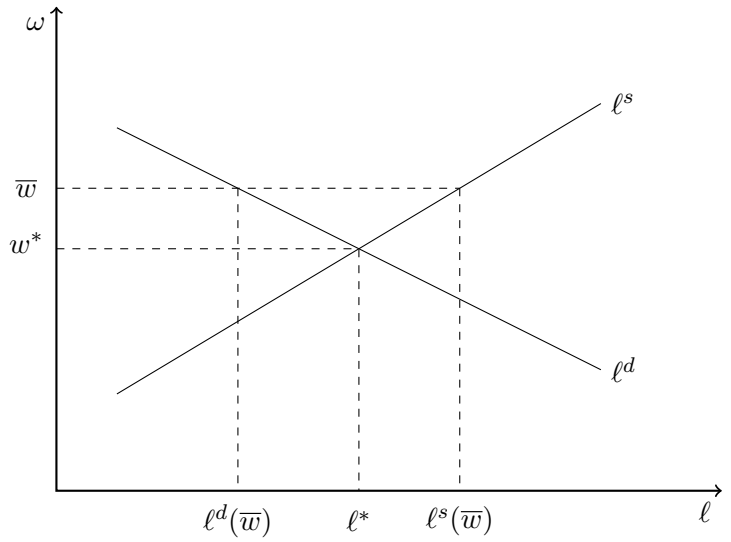
This chapter extends the BCK model and considers the enforcement heterogeneity in a monopsonistic labor market. By allowing for two levels of enforcement associated with the formal and informal segments, this study points out two corresponding endogenous thresholds beyond which increases in the minimum wage will have a negative employment effect. This raises the possibility of opposite employment effects in the two segments if the minimum wage lies between the two endogenous thresholds. In such cases, a minimum wage hike will result in a positive and negative employment effect on the formal and informal segments, respectively.

When the minimum wage passes an endogenous threshold and employment declines, the BCK model predicts a negative wage effect because of imperfect enforcement and noncompliance issue. However, this is not usually observed in developing countries. This chapter theoretically explains the positive wage effect in noncompliance case by taking into account responses in workers' expectation. If all workers respond to a minimum wage hike by raising their wage reservation sufficiently, the wage effect will be positive even in case of noncompliant employers.

Using data from the LFS, this chapter finds that the extended BCK framework is well-suited in explaining the minimum wage and enforcement effects on average wages, wage distributions and gaps in the case of Vietnam. Raising minimum wage leads to higher wages of workers in all segments, especially those who at the lower wage distribution, and reduces wage inequalities within and between segments. A higher enforcement level has no effect but a positive effect on wages in the formal and informal segments, respectively. This suggests that the labor market in Vietnam is characterized by an exact compliance and noncompliance states in the formal and informal segments, respectively. A minimum wage hike may reduce informal employment and raise formal employment. Chapter 3 will examine the minimum wage effect on employment in each segment.

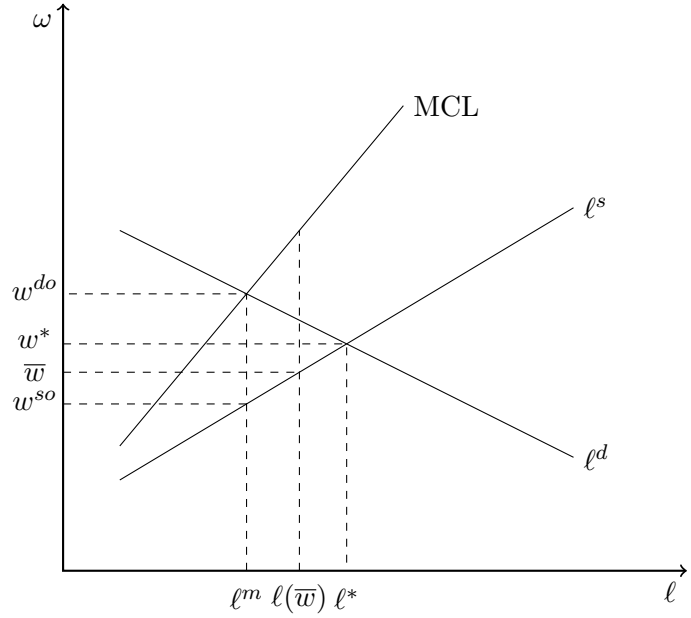
Figures

FIGURE 2.1.—THE MINIMUM WAGE IN A COMPETITIVE LABOR MARKET



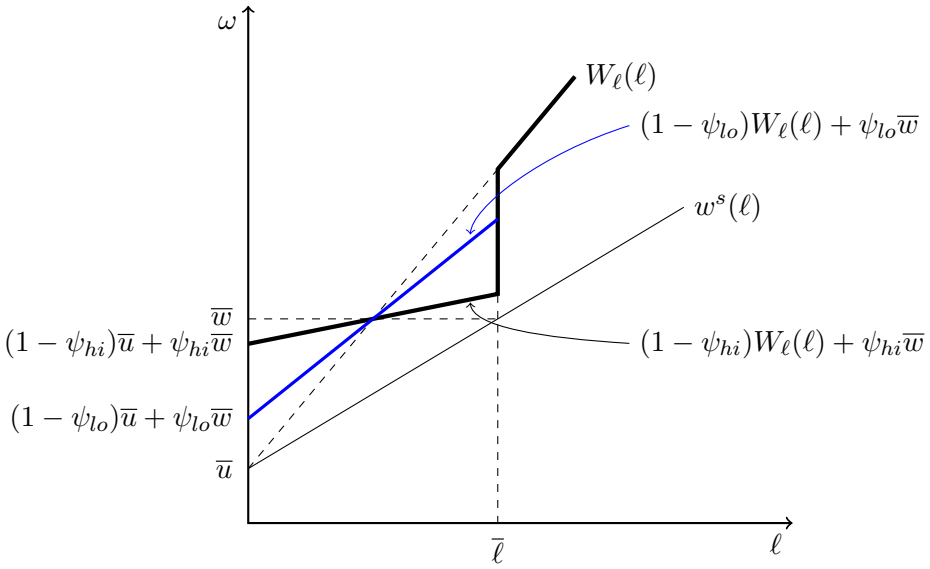
NOTES.—This figure illustrates the minimum wage under a perfectly competitive labor market. ℓ^s and ℓ^d are labor supply and demand, respectively. The market equilibrium in the absence of a minimum wage is (w^*, ℓ^*). $\overline{w}$ denotes the minimum wage. $\ell^s(\overline{w})$ and $\ell^d(\overline{w})$ denote the supply of and demand for labor at the minimum wage level, respectively.

FIGURE 2.2.—THE MINIMUM WAGE IN A MONOPSONISTIC LABOR MARKET



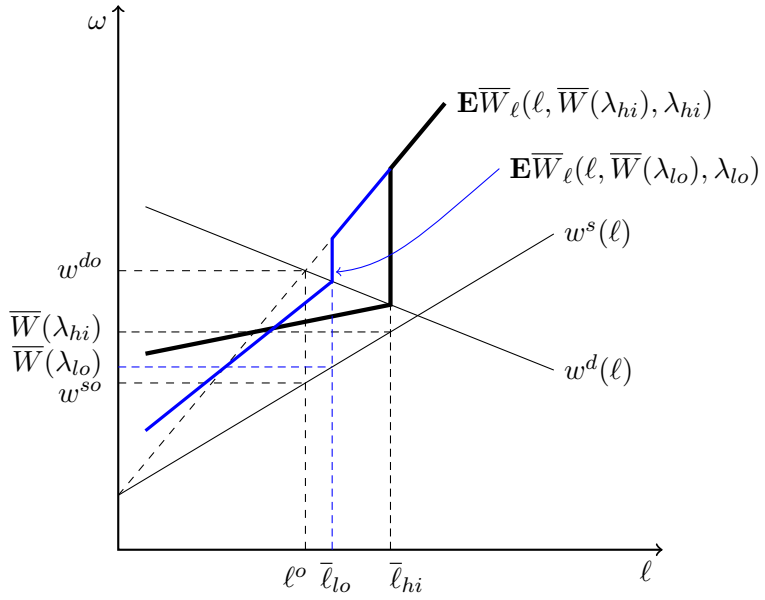
NOTES.—This figure illustrates the minimum wage under a monopsonistic labor market. ℓ^s and ℓ^d are labor supply and demand, respectively. MCL is the marginal cost of labor curve. The market equilibrium in the absence of a minimum wage is characterized by wage paid by firm (w^{so}), the associated marginal cost of labor (w^{do}), and the equilibrium employment (ℓ^m). $\overline{w}$ and $\ell(\overline{w})$ denote the minimum wage and employment at the minimum wage level, respectively.

FIGURE 2.3.—EXPECTED MARGINAL COST OF LABOR UNDER ENFORCEMENT HETEROGENEITY



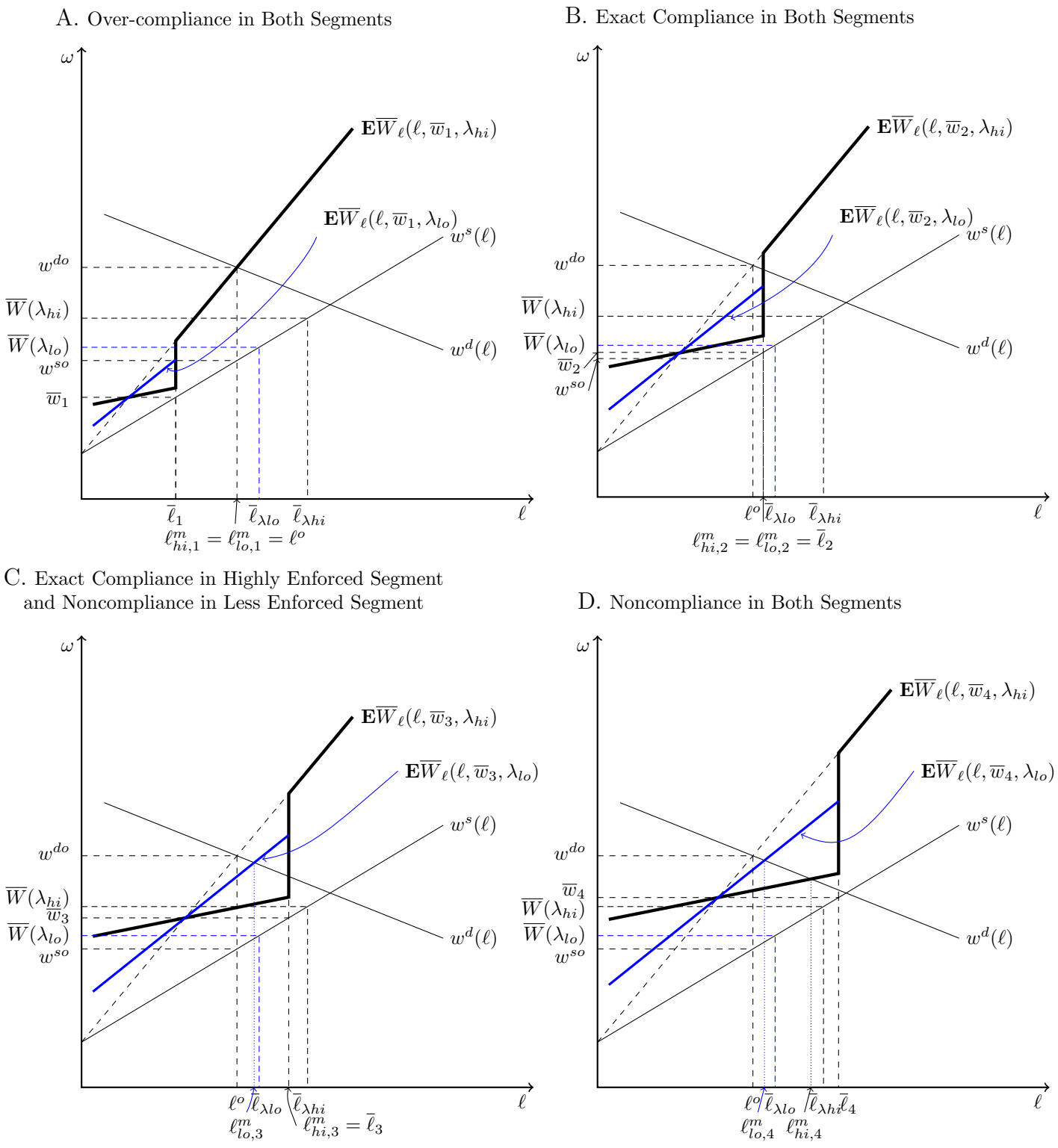
NOTES.—This figure illustrates the two expected MCL curves associated with two levels of imperfect enforcement. $\overline{u}$ and $\overline{w}$ are the worker's reservation and minimum wages, respectively. ψ_{lo} and ψ_{hi} are the weights attached to the cost of paying the minimum wage facing less and highly inspected employers, respectively. $w^s(\ell)$ is the inverse labor supply. $W_\ell(\ell)$ is the MCL in the absence of a minimum wage. The three-piece bold curves are the expected MCL associated with employers in the less (blue) and highly inspected segment (black).

FIGURE 2.4.—THE EXTENDED BCK MODEL AND MINIMUM WAGE THRESHOLDS



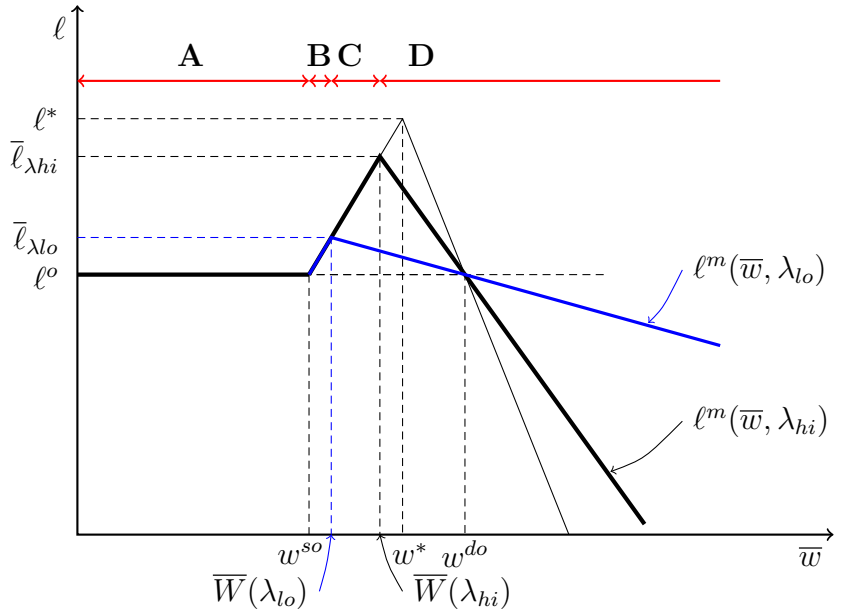
NOTE.—This figure plots two endogenous minimum wage thresholds under the theoretical framework of imperfect enforcement in a monopsonistic labor market. $w^d(\ell)$ is the inverse labor demand. $\mathbf{E}\overline{W}_\ell$ is the expected MCL. w^{do}, w^{so}, and ℓ^o are the MRP, wage paid, and employment at equilibrium in the absence of a minimum wage, respectively. $\overline{w}$ is minimum wage. λ_{lo}, λ_{hi}, $\overline{W}(\lambda_{lo})$, $\overline{W}(\lambda_{hi})$, $\overline{\ell}_{lo}$, and $\overline{\ell}_{hi}$ denote low and high enforcement, their corresponding endogenous minimum wage thresholds, and their corresponding maximal labor supplies, respectively. These two endogenous thresholds are independent of the minimum wage level so that they are pre-determined.

FIGURE 2.5.—MINIMUM WAGE UNDER THE EXTENDED BCK MODEL



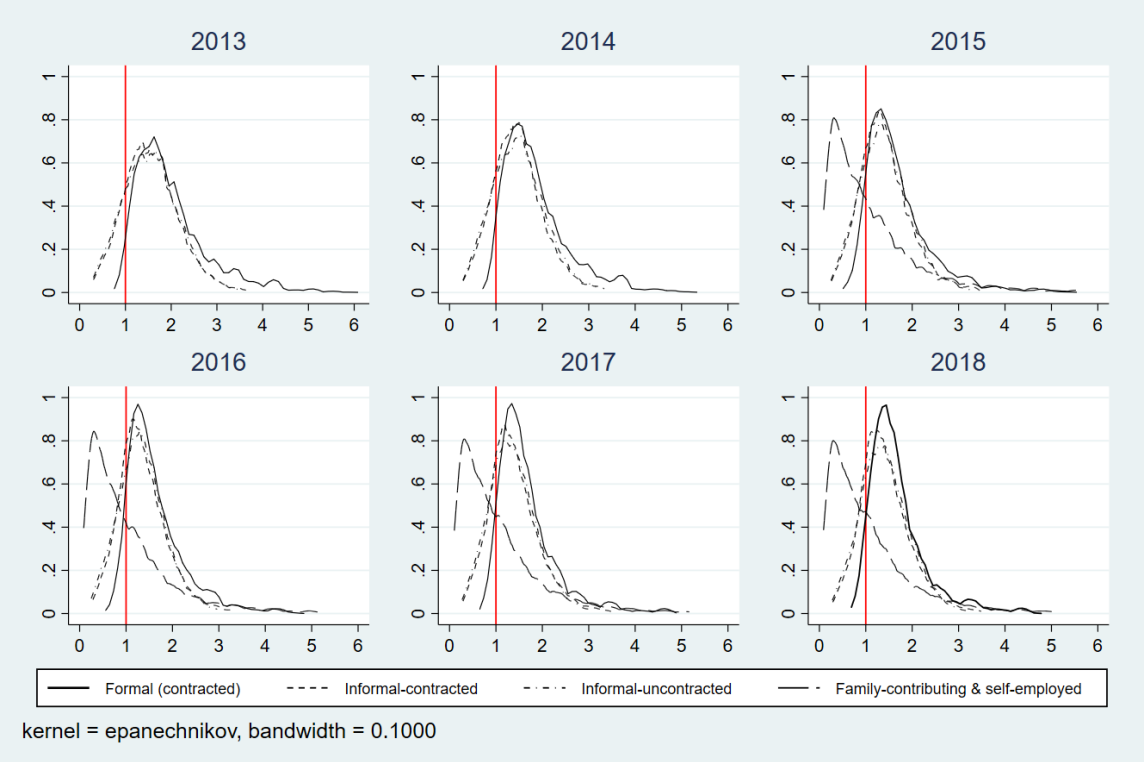
NOTE.—This figure illustrates four cases produced by the position of the minimum wage relative to all thresholds under the assumptions of a monopsonistic labor market and two levels of enforcement.

FIGURE 2.6.—EMPLOYMENT EFFECTS UNDER THE EXTENDED BCK MODEL



NOTE.—This figure plots the employment effect of an increase in the minimum wage corresponding to four cases depicted in Figure 2.5. Based on the position of the minimum wage relative to all thresholds, a hike may have different effects on employment in each segment.

FIGURE 2.7.—WAGE-TO-MINIMUM WAGE RATIO DISTRIBUTIONS



NOTES.—This figure plots the distributions of wage-to-minimum wage ratio for each type of employment from 2013 to 2018. The red vertical line indicates the wage level that is equal to the minimum wage. Data is plotted using Kernel density estimation. The data is winsorized at 1% in each tail for each group and are weighted by the sampling weights. Monthly income data for farm-household and self-employed workers have only been available since 2015. Author's calculation using data from the Vietnam LFS.

Tables

Table 2.1.—Minimum Wage Effect on Wages at Varying Enforcement Levels

	High enforcement	Low enforcement
$\overline{w} < w^{so}$	No change	No change
$w^{so} < \overline{w} < \overline{W}(\lambda_{lo})$	Positive	Positive
$\overline{W}(\lambda_{lo}) < \overline{w} < \overline{W}(\lambda_{hi})$	Positive	Positive if $\partial\overline{u}/\partial\overline{w} \geq \phi(\lambda_{lo}, \sigma)$ Negative if $\partial\overline{u}/\partial\overline{w} < \phi(\lambda_{lo}, \sigma)$
$\overline{W}(\lambda_{hi}) < \overline{w}$	Positive if $\partial\overline{u}/\partial\overline{w} \geq \phi(\lambda_{hi}, \sigma)$ Negative if $\partial\overline{u}/\partial\overline{w} < \phi(\lambda_{hi}, \sigma)$	Positive if $\partial\overline{u}/\partial\overline{w} \geq \phi(\lambda_{lo}, \sigma)$ Negative if $\partial\overline{u}/\partial\overline{w} < \phi(\lambda_{lo}, \sigma)$

TABLE 2.2.—MINIMUM WAGE EFFECTS ON AVERAGE WAGE, WAGE DISTRIBUTION, AND WAGE GAPS

Dep. Var.	Formal		Informal-contracted		Informal-uncontracted	
	coeff.	S.E.	coeff.	S.E.	coeff.	S.E.
10^{th} percentile	.523**	(.214)	.880***	(.288)	.630***	(.214)
20^{th} percentile	.508***	(.179)	.465**	(.223)	.567***	(.181)
30^{th} percentile	.471***	(.175)	.190	(.189)	.529***	(.158)
40^{th} percentile	.399**	(.174)	.123	(.168)	.545***	(.152)
50^{th} percentile	.250	(.169)	.197	(.142)	.647***	(.138)
60^{th} percentile	.192	(.169)	.273*	(.143)	.583***	(.128)
70^{th} percentile	.165	(.163)	.274*	(.141)	.657***	(.131)
80^{th} percentile	.164	(.181)	.232	(.145)	.577***	(.142)
90^{th} percentile	.075	(.220)	.228	(.176)	.563***	(.148)
Mean	.218	(.162)	.273**	(.138)	.575***	(.131)
$50^{th}/10^{th}$ ratio	–.035	(.022)	–.107***	(.038)	.013	(.039)
$90^{th}/10^{th}$ ratio	–.057	(.038)	–.106**	(.048)	.005	(.044)
$50^{th}/20^{th}$ ratio	–.034**	(.016)	–.038	(.024)	.023	(.031)
$70^{th}/20^{th}$ ratio	–.045**	(.019)	–.028	(.029)	.026	(.033)
$90^{th}/20^{th}$ ratio	–.057*	(.030)	–.034	(.035)	.014	(.035)

NOTE.—*** $p < .01$, ** $p < .05$, * $p < .1$. Two-way fixed effects regressions (year and district). Robust standard errors in parentheses, clustered at the district level. The table displays only coefficients on minimum wage variables. Data are from the LFS between 2013 and 2018. Control variables include shares of population age below 15, 15–19, 20–24, and above 60 years; shares of illiterates, secondary, high, and vocational school, university, and higher education graduates; urban population; share of public sector employment; share of employment in manufacturing workers in other districts within the province (not limited to employees); and log of the number of registered firms in industries with the highest labor-accident rates in the previous year.

TABLE 2.3.—MINIMUM WAGE AND ENFORCEMENT EFFECTS ON WAGE, WAGE DISTRIBUTION, AND WAGE GAPS UNDER ENFORCEMENT HETEROGENEITY

Dep. Var.	Formal						Informal-contracted						Informal-uncontracted					
	lrMW		enforce		lrMW*enforce		lrMW		enforce		lrMW*enforce		lrMW		enforce		lrMW*enforce	
	coeff.	S.E.	coeff.	S.E.	coeff.	S.E.	coeff.	S.E.	coeff.	S.E.	coeff.	S.E.	coeff.	S.E.	coeff.	S.E.	coeff.	S.E.
10^{th} percentile	.533**	(.218)	.067	(.421)	–.008	(.054)	.998***	(.289)	1.325**	(.552)	–.173**	(.071)	.631***	(.217)	–.057	(.555)	.008	(.072)
20^{th} percentile	.541***	(.181)	.330	(.376)	–.043	(.048)	.561**	(.221)	1.029**	(.402)	–.134**	(.052)	.582***	(.183)	.100	(.448)	–.012	(.058)
30^{th} percentile	.506***	(.177)	.218	(.347)	–.027	(.045)	.241	(.189)	.540	(.372)	–.070	(.048)	.550***	(.159)	.173	(.365)	–.022	(.047)
40^{th} percentile	.418**	(.176)	.120	(.338)	–.015	(.044)	.195	(.171)	.720**	(.346)	–.093**	(.045)	.559***	(.152)	.171	(.321)	–.023	(.042)
50^{th} percentile	.266	(.172)	.118	(.330)	–.015	(.043)	.252*	(.146)	.605*	(.340)	–.079*	(.044)	.684***	(.139)	.345	(.299)	–.044	(.039)
60^{th} percentile	.209	(.172)	.169	(.337)	–.022	(.044)	.310**	(.147)	.451	(.338)	–.059	(.044)	.639***	(.129)	.478*	(.282)	–.061*	(.037)
70^{th} percentile	.195	(.167)	.227	(.345)	–.028	(.044)	.312**	(.146)	.489	(.328)	–.065	(.042)	.705***	(.134)	.436	(.270)	–.056	(.035)
80^{th} percentile	.205	(.189)	.397	(.399)	–.051	(.052)	.287*	(.150)	.672**	(.332)	–.089**	(.043)	.626***	(.142)	.504*	(.279)	–.066*	(.036)
90^{th} percentile	.127	(.232)	.482	(.465)	–.062	(.060)	.279	(.178)	.610*	(.364)	–.080*	(.047)	.621***	(.148)	.537*	(.316)	–.069*	(.041)
Mean	.256	(.168)	.361	(.336)	–.046	(.043)	.324**	(.142)	.594**	(.299)	–.078**	(.039)	.620***	(.131)	.448*	(.261)	–.058*	(.034)
$50^{th}/10^{th}$ ratio	–.034	(.023)	.007	(.043)	–.001	(.006)	–.118***	(.039)	–.130*	(.078)	.017*	(.010)	.018	(.039)	.058	(.072)	–.008	(.009)
$90^{th}/10^{th}$ ratio	–.052	(.039)	.051	(.070)	–.007	(.009)	–.120**	(.049)	–.148	(.100)	.019	(.013)	.012	(.045)	.084	(.096)	–.011	(.013)
$50^{th}/20^{th}$ ratio	–.036**	(.017)	–.025	(.034)	.003	(.004)	–.045*	(.024)	–.070*	(.042)	.009*	(.005)	.026	(.031)	.042	(.045)	–.006	(.006)
$70^{th}/20^{th}$ ratio	–.046**	(.020)	–.012	(.041)	.002	(.005)	–.037	(.029)	–.090*	(.052)	.012*	(.007)	.030	(.033)	.052	(.058)	–.007	(.008)
$90^{th}/20^{th}$ ratio	–.055*	(.031)	.018	(.062)	–.002	(.008)	–.042	(.035)	–.082	(.066)	.011	(.009)	.020	(.036)	.068	(.071)	–.009	(.009)

NOTE.—*** $p < .01$, ** $p < .05$, * $p < .1$. Two-way fixed effects regressions (year and district). Robust standard errors in parentheses, clustered at the district level. The table displays only coefficients on minimum wage variables. Data are from the LFS between 2013 and 2018. Control variables include shares of population age below 15, 15–19, 20–24, and above 60 years; shares of illiterates, secondary, high, and vocational school, university, and higher education graduates; urban population; share of public sector employment; share of employment in manufacturing workers in other districts within the province (not limited to employees); and log of the number of registered firms in industries with the highest labor-accident rates in the previous year.

Chapter 3

Minimum Wage and Informal Employment at Varying Enforcement Levels

3.1 Introduction

In the field of labor economics, minimum wage has been one of the most enduring topics because empirical studies have continuously found contradicting evidence regarding employment effects (see, e.g., Card and Krueger, 1995; Brown, 1999; Neumark and Wascher, 2007). Recently, a growing number of empirical studies in developing countries have examined the minimum wage effects on both the formal and informal sectors (see the recent literature surveys on emerging and developing economies: Broecke et al., 2017; Belman and Wolfson, 2016; Neumark, 2021).[28] However, the *informality* of employment has not been fully discussed, and the legal *coverage* of the minimum wage has been usually used as the source of identification of the effects (i.e., uncovered workers are regarded as informal).

[28]The definition of formality/informality differs across countries. Researchers may use different definition depending on their purposes. This study defines formality as having mandatory employment benefits, specifically, social security contribution. If a firm, either registered or small unregistered one, hires a worker without paying any employment benefits, it creates an employment relationship in the informal segment. This does not mean the firm operates in an underground economy because its business is legally accepted. Owing to this definition, monopsony exists among Vietnamese firms in the formal and informal segments alike (see Appendix 3B).

Several studies have attempted to examine the effects in a two-sector setting; however, they only considered one dimension (either formality or coverage) or assumed that the two terms were identical. This is not always the case in many developing countries.[29] [30]

This study identifies the minimum wage effects on a two-by-two-dimensional labor market, i.e., a market with the interplay between formality and coverage (formal versus informal in addition to covered versus uncovered). If an economy includes a large informal sector, the effects of a minimum wage hike become more complex when the coverage of the policy involves in this setting, and one should carefully look at each employment segment. In a developing country, employers within the covered sector can easily hire informal workers and negotiate with them not to pay for social security or any other employment benefits. In such cases, employers can avoid payroll taxes and their workers can receive relatively higher wages instead of a lower wage and participation in the social security system.[31] Therefore, the distinction between formality and legal coverage plays a crucial role in assessing the minimum wage effects in developing countries.[32]

The *imperfect enforcement* of the law may affect such interplay, resulting in lower policy effectiveness, by inducing some employers not to comply with the law. Imperfect enforcement is more common in developing countries because of weaker labor inspection

[29]For example, Comola and De Mello (2011) defined informal workers as non-salaried workers in Indonesia. Magruder (2013) regarded full-time workers as formal and self-employed workers as informal in Indonesia. Part-time workers could be either formal or informal. Kim (2019) defined private or government workers as formal sector workers and self-employed and unpaid family workers as informal sector workers. Carneiro (2004), Lemos (2009), and Jales (2018) used a signed labor contract card as a definition of formal employment. Jales (2018) explicitly stated that formality status (by having a signed labor contract) can guarantee access to employment benefits (e.g., unemployment insurance and severance payments). In their recent meta-analysis, Neumark (2021) used the two terms interchangeably. One study that is close to my work is Groisman (2016), who categorized salaried (covered) workers into formal and informal groups using social security records. However, the minimum wage in Argentina technically covers all workers 18 years old and older, so the formality definition is not applicable among uncovered workers, which is different from the Vietnamese case.

[30]Rani, Belser, Oelz, and Ranjbar (2013) indicated that minimum wages typically cover both formal and informal wage workers when reviewing the coverage in 11 developing and emerging countries. They reviewed the minimum wage systems during the mid and late 2000s, and that were outdated in the case of Vietnam.

[31]For example, Vietnam's social security system requires contributions of 10.5% of salary from the employee and 21.5% of salary from the employer. Therefore, both sides have incentives to not pay social security: cost reduction for employers and actual wage gains for employees.

[32]In some countries, wage earners, who are uncovered by the minimum wage law, may exist. These workers clearly respond differently to minimum wage hikes than do self-employed or unpaid ones.

systems.[33] However, empirical studies often ignore the role of law enforcement when examining the minimum wage effects.[34] The presence of imperfectness implies that the recent theoretical framework developed by Basu et al. (2010) may be more appropriate than the traditional competitive and monopsony models in explaining the minimum wage effects. The original BCK model considers the coexistence of compliant and noncompliant employers under the monopsony and imperfect enforcement assumptions. Because the government's effort in enhancing the law may differ across sectors and regions, this study extends the BCK model by allowing for the heterogeneity of enforcement. Thus, the labor market is characterized by two endogenous thresholds, based on which the minimum wage effect on market outcomes may differ across segments.

In Vietnam, the government applies a minimum wage system typical of the systems used in many other developing countries. The government categorizes all second-tier administrative units (hereinafter referred to as districts)[35] into four groups and increases the corresponding minimum wages annually (see Appendix 3A). The real minimum wage increased by 50% from 2013 to 2018, keeping the relative levels compared to the mean and median wages at above 60% as shown in Figure 3.1. By law, the minimum wage system covers all workers who work under a labor contract. However, it ignores a large number of workers who do not have a written contract. When formality is defined by mandatory employment benefits, many informal workers who should be covered by the minimum wage legislation remain. In reality, they do not seem to be. This feature of minimum wage coverage naturally generates a two-by-two setting of the labor market in

[33]Kanbur and Ronconi (2018) found that the numbers of labor inspectors and labor inspections per worker rose rapidly with country income level.

[34]A few exceptions include Dinkelman and Ranchhod (2012) and Soundararajan (2019), but they considered only a small fraction of the labor market and assumed no heterogeneity in enforcement by sector within a location. Using a cross-country panel, Munguía Corella (2019) analyzed the heterogeneous effects of the minimum wage with respect to the degree of enforcement and found negative employment effects in countries with stronger enforcement. However, his paper used the *de jure* punishment as a proxy for enforcement level and implicitly assumed no variation in enforcement level within a country. In their meta-analysis, Neumark (2021) merely touched the enforcement issue using the same measurement as that of Munguía Corella (2019). Given the huge informal sector in developing countries, the assumption of homogeneous enforcement by location in these papers is unlikely to match that in reality. Additionally, the competitive market theory that the latter two papers relied on may not hold for all developing countries because the degree of search frictions may differ substantially across countries. Thus, monopsonistic features may be stronger in some countries than in the others.

[35]In Vietnam, administrative units are divided into three tiers: (i) municipality and province; (ii) urban district, provincial city, town, and rural district; and (iii) ward, township, and commune.

Vietnam. Using data from the Labor Force Survey (LFS), this study found that employment in the formal sector increased following minimum wage annual hikes. Meanwhile, no disemployment effects were found in the informal sector, regardless of coverage status. This study then incorporated the regional heterogeneity in enforcement and found that that further enforcing the law had no additional but mixed effects on formal and informal employment, respectively. The mixed effects on informal employment depended on labor contract status of workers.

<Insert Figure 3.1>

This chapter contributes to the minimum wage literature in several ways. First and foremost, it extends the theoretical framework of imperfect enforcement that can be applied in other developing countries with similar institutional settings. Second, it clearly distinguishes between the formality status of workers and minimum wage coverage, and examines the effects on each employment segment. The minimum wage may even affect covered workers differently if they differ by their formality status. Additionally, this study contributes to the literature by providing empirical evidence on a newly touched aspect of the minimum wage: law enforcement. Empirical evidence from this study expands the existing literature in developing countries in general and in Vietnam in particular.[36]

The remainder of this chapter is organized as follows. Section 3.2 describes the institutional setting of a two-by-two-dimensional labor market and discusses the enforcement heterogeneity in Vietnam. Section 3.3 and 3.4 introduces the extended BCK model and explains econometric strategy, model specifications, and data used in the paper, respectively. Section 3.5 presents empirical results and robustness checks. Section 3.6 summarizes the main findings and concludes this chapter.

[36]In Vietnam, few papers have assessed the minimum wage effects without considering the imperfect enforcement. They mainly focused on employment and labor substitution in registered enterprises (C. V. Nguyen, 2017b,a; D. T. Nguyen et al., 2017; D. X. Nguyen, 2019). Their disregard of informal employment, not to mention uncontracted workers, could potentially bias their estimates as registered firms cover only around 70% of total wage workers, who are potentially subject to the law.

3.2 Institutional Settings

This section discusses institutional settings in Vietnam and provides the country background and prerequisites necessary for understanding the framework applied in this chapter. The actual data used in this section will be explained in detail in Section 3.4.2.

3.2.1 Employment Categorization

This study divides all employees by their formality and labor contract status as shown in Table 3.1.[37] This two-by-two categorization allows us to estimate the effects of a minimum wage on labor market outcomes more precisely. First, the *formality status* of workers is defined by participation in the social security system. If workers' mandatory social insurance is paid by their employers, they are considered to have a formal job. Second, *contracted workers* are defined as those who work under a written contract or are seasonal workers with a verbal, short-term contract. They are legally subject to the minimum wage law in accordance with Vietnam's Labor Code 2012. The formal-uncontracted group is undefined because social security contribution is legally attached to labor contract. Thus, the minimum wage covers all contracted workers, regardless of their formality status, but it leaves informal-uncontracted workers uncovered.

<Insert Table 3.1>

As indicated in Table 3.1, wage earners account for nearly one-third of total employment, which is lower than that in other developing countries in the region.[38] Importantly, more than half of these workers still work informally without employment benefits. The sizable share of informal-contracted workers highlights the importance of the two-by-two

[37]This study considers only employees or wage workers as they are the main target of the minimum wage policy. Public servants are subject to the government's base salary schedule. Employees in SOEs are subject to the minimum wage, but managers in these enterprises are excluded because their salaries are regulated by the government. By nature of the law, employers and nonwage workers (i.e., self-employed and unpaid family contributing workers) are excluded from the sample.

[38]According to data from the ILO databases (ILOSTAT), employees (including unpaid ones) account for 40.0% of the total employment in Vietnam between 2013 and 2018. Meanwhile, the shares are 60.3%, 52.9%, 48.0%, and 47.9% in the Philippines, China, Indonesia, and Thailand, respectively. In high-income countries, nearly 90% of the total number of employed individuals are employees. Source: Data series coded *EMP_TEMP_SEX_STE_NB_A* from `https://ilostat.ilo.org/data/`, accessed on October 28, 2021.

setting as the coverage does not necessarily guarantee employment benefits in developing countries.[39] Figure 3.2 illustrates the time trends of these employment categories as shares of total employment. Both total and formal employees significantly increased during the period considerd in this study. Within the informal sector, the share of contracted workers decreased whereas the share of uncontracted ones increased in the later years.

<Insert Figure 3.2>

3.2.2 Enforcement Heterogeneity

In the literature, theoretical models implicitly assume that the law is well enforced, reflected by the horizontal marginal cost of labor/labor supply at the minimum wage level (up to the corresponding maximal labor supply). However, this is not the case in developing labor markets and the enforcement level may vary across sectors and regions. Without controlling the enforcement effort, empirical results may not reflect the true effects of a minimum wage. This study allows for two types of enforcement heterogeneity: by region and by sector.

By region, data on the enforcement effort, which is measured by the number of inspections at the provincial level, come from governmental reports conducted by the Vietnam Ministry of Labor, Invalids and Social Affairs (MOLISA). Although these data cover a broader set of policies than the minimum wage, they still provide useful information regarding the degree of enforcement in each province. As the enforcement data are at the provincial level whereas the minimum wage is set at the district level, this study imposes a strong assumption that all districts within a province face the same inspection probability. Figure 3.3 illustrates the number of inspections and real minimum wage applied in each district-year cell. As each province includes districts in more than one minimum wage group, there are sufficient variations of minimum wages within a province. This implies that there should be no correlation between the inspection level and variance of minimum wage within a province. This enforcement independence allows us to identify

[39]In Vietnam, informal workers defined by social security receives much less in nonwage benefits than formal workers in Vietnam. For example, more than 90% of formal workers was entitled to paid leaves/holidays while this ratio was only around 15% among informal-contracted workers and less than 5% among informal-uncontracted workers. Data from the LFS 2013–2014, in which information about other employment benefits was available.

its impact on the minimum wage effect.

<Insert Figure 3.3>

As the inspection data do not distinguish between the formal and informal sectors, this section utilizes the data on wages paid to differentiate the enforcement intensity in each sector.[40] As shown in Figure 3.4, the noncompliance rate, which is defined as the proportion of wage workers receiving less than minimum wage, is nonnegligible in both formal and informal sectors. In most provinces, the share of formal workers receiving less than the statutory wages ranges from 0% to 7.5% (in the 95^{th} percentile). Meanwhile, approximately 5–30% of informal workers are paid less than the minimum wage, regardless of their coverage status. A simple t test indicates no difference in the means of noncompliance rates between informal-contracted and -uncontracted workers. The higher noncompliance rate in the informal sector implies a lower enforcement level in this sector.

<Insert Figure 3.4>

The identification that uses wages paid can be confirmed through two pieces of additional evidence. First, the depth of violation, defined as the percentage shortfall of violated workers' wages compared to the minimum wage, is significantly higher among informal workers. Among submininum wage earners, formal and informal workers receive 14.7% and 30% below the minimum wage level, respectively. When the compliance rate was calculated along with the literature, the huge difference remains between formal and informal employers as shown in Table 3.2. In the formal sector, the compliance rate, defined as the proportion of workers earning exactly the minimum wage compared to workers earning the minimum wage or less, is twice as high as that in the informal sector.[41] Both indicators suggest that imperfect enforcement persists at a higher degree in the informal sector than in the formal sector.

<Insert Table 3.2>

[40]Using data on over 2,000 firms from the Vietnam Small and Medium Enterprises Survey (SME Survey) provided by the United Nation University World Institute for Development Economics Research (UNU-WIDER), Figure 3.C3 shows that that formal firms (defined by paying social security for their employees) received a significantly higher number of inspection visits. This implies that enforcement level varies considerably across the formal and informal sectors.

[41]See Bhorat et al. (2013) for the definition of the depth of the violation and Ashenfelter and Smith (1979) for the definition and discussion of the compliance rate.

Second, Chapter 2 found similar patterns using wage distributions of different groups (Figure 2.5). Wage distributions for all types of employees have a similar shape with a positive kurtosis value. Spikes in these wage distributions appear on the right-hand side of the vertical line, implying a binding minimum wage, and a majority of workers receive just above the minimum level.[42] Wage distributions indicate a larger portion of informal workers, when compared to formal ones, received less than the statutory wage level, regardless of whether they are covered by the minimum wage policy. These observations support the identification strategy that the formal sector receives substantially higher inspection intensity than the informal sectors.

3.3 Theoretical Framework

To examine the minimum wage effects on labor market outcomes in Vietnam, this chapter extends the BCK model, which considers the law imperfect enforcement in a monopsonistic labor market.[43] The original BCK model introduces a stochastic enforcement mechanism, that is, a firm is inspected with a certain probability determined by the government enforcement effort, and if found to be paying below minimum wage, it will be penalized. Owing to the imperfect enforcement issue, this assumption is more realistic than the traditional monopsony model when applied in a developing labor market. As Chapter 2 explains the framework in detail, this chapter keeps this theoretical section as brief as possible.

As noncompliance remains a big issue among developing countries, the BCK model is well suited to assessing their minimum wage policies. In Vietnam, the labor market can be divided into two segments regarding enforcement: (i) formal employment with a high enforcement level and (ii) informal employment with a low enforcement level. Enforcement heterogeneity across districts allows us to identify the highly inspected and

[42]Teulings (2003) found that minimum wages significantly affect the wage distribution, as reflected in the spikes at the minimum wage level. He pointed out that decreases in the minimum wage contributed to most of the increase in wage inequality in the US in the 1980s.

[43]Using the LFS database and applying Manning (2003)'s methodology, this study found a significant degree of monopsony in the Vietnamese labor market. This implies that the BCK model is applicable in terms of market imperfection (see detailed discussion in Appendix 3B).

less inspected regions. This study introduces two different enforcement levels into the BCK model and analyzes the mechanism by which enforcement alters the minimum wage effects.

3.3.1 Two Levels of Imperfect Enforcement

In the original BCK model, the government imposes a minimum wage of $\overline{w}$ and conducts inspections with a likelihood of λ. If the government does not fully enforce the law ($\lambda < 1$), employers may not be penalized even if they do not comply with the law. The possibility of not being inspected induces some employers to set the wage below the statutory level, which maximizes their expected profits. Thus, the expected MCL is upward sloping when employment is below the maximum labor supply associated with the minimum wage ($\ell < \bar{\ell}$).[44] Chapter 2 shows that the slope of the MCL curve depends on the inspection probability or enforcement intensity (see Figure 2.2 and Basu et al., 2010, p. 253). If the government fully enforces the law ($\lambda = 1$), the model becomes the standard monopsony model, and the MCL is horizontal within the range considered. Meanwhile, the expected MCL and MCL in the absence of a minimum wage are identical if the government completely ignores the enforcement process ($\lambda = 0$).

In the standard monopsony model, the wage actually paid to workers (w^{so}) is deviated from the wage level that is equal to the MRP in the absence of the minimum wage (w^{do}). The government can then raise the minimum wage up to the competitive equilibrium wage without employment loss (in fact, it leads to an employment gain). In the absence of full compliance, the BCK model shows that the employment effect may turn negative even before reaching the competitive equilibrium wage. BCK identified this turning point, $\overline{W}(\lambda)$, as an endogenous minimum wage threshold, which depends on enforcement intensity and is lower than the competitive equilibrium wage.[45]

[44]Chapter 2 expresses how to derive the the MCL associated with each segment and depicts them in Figure 2.1. Because the derivation of the MCL is similar to that in the original model, this chapter does not present it.

[45]The endogenous threshold "gives the largest minimum wage that can be applied without triggering non-compliance" (Basu et al., 2010, p. 258) and "divides labor market equilibria into those that are to the right, left, or exactly at the point where the expected marginal cost of labor schedule truncates" (Basu et al., 2010, p. 251). The endogenous threshold is the wage that employers are willing to pay given a MRP schedule. Therefore, each demand curve will be associated with a set of minimum wage

This study assumes two market segments with different levels of enforcement due to the cost and complexity of the inspection process: (i) high enforcement, λ_{hi} is close to 1; and (ii) low enforcement, λ_{lo} is far less than 1. There are two corresponding endogenous minimum wage thresholds: $\overline{W}(\lambda_{lo}) < \overline{W}(\lambda_{hi})$ and two expected MCLs, with the steeper one being for a less inspected segment (see Figure 2.2). The maximal labor supply corresponding to enforcement is also lower in the less enforced segment, $\overline{\ell}_{\lambda lo} < \overline{\ell}_{\lambda hi}$.[46] The division of the labor market could be between formal and informal sectors or between highly inspected and less inspected districts.

3.3.2 Comparative Statistics

The resulting two-level enforcement heterogeneity produces the following four cases, which are reflected by the position of the minimum wage relative to all thresholds (see Figure 2.3 in Chapter 2).

(A) Overcompliance, $\overline{w}_1 < w^{so}$ (Figure 2.5A). Employers over-comply with the law because the minimum wage is not binding (lower than the unregulated equilibrium wage). The corresponding market equilibrium is independent of a change in minimum wage policies (i.e., the minimum wage level and probability of inspection).

(B) Exact compliance in both segments, $w^{so} \leq \overline{w}_2 < \overline{W}(\lambda_{lo})$ (Figure 2.5B). As the minimum wage exceeds the threshold of unregulated benchmark, it starts affecting labor market outcomes. As long as it is below the lower endogenous threshold, $\overline{W}(\lambda_{lo})$, all employers continue to pay exactly the minimum wage level. Therefore, the imposition of a minimum wage creates a *supply-constrained* labor market, and the corresponding equilibrium employment is determined by the intersection between the MRP and expected MCL. An increase in the minimum wage shifts the MCL to the right and raises both wages and employment in the market. As employers already strictly comply with the minimum wage, enhancing enforcement intensity λ has no impact on the equilibrium.

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thresholds.

[46]Note that the maximal labor supply corresponding to enforcement level ($\overline{\ell}_{\lambda}$) is different from the maximal labor supply corresponding the minimum wage level introduced in the original BCK model ($\overline{\ell}$). In this extension, the maximal labor supply corresponding to a given enforcement level is the highest amount of labor supplied to the firm given its characteristics and the enforcement level. See detail of the technical notes in Chapter 2.

(C) Exact compliance in the segment with strict enforcement and noncompliance in the segment with low enforcement, $\overline{W}(\lambda_{lo}) \leq \overline{w}_3 < \overline{W}(\lambda_{hi})$ (Figure 2.5C).[47] When the minimum wage lies between the two endogenous thresholds, a minimum wage hike can have different effects on the two segments. The market equilibrium is still *supply-constrained* in the highly inspected segment and is purely determined by the supply side. An increase in the minimum wage leads to higher employment in this segment. Conversely, employment starts to decline as minimum wage passes the lower endogenous threshold. Labor market outcomes are determined by both supply and demand schedules. A minimum wage hike will negatively affect employment in the less inspected segment.

(D) Noncompliance in both segments, $\overline{W}(\lambda_{lo}) < \overline{W}(\lambda_{hi}) \leq \overline{w}_4$ (Figure 2.5D). Once the minimum wage exceeds the higher endogenous threshold, $\overline{W}(\lambda_{hi})$, the labor market equilibrium is now determined by supply and demand schedules in both segments. Further increases in the minimum wage raise the expected MCL and shift the upward-sloping part of the MCL curve to the left relative to the labor demand curve. Employment in both segments falls in response to a minimum wage hike.[48] In the case of noncompliance, enhancing enforcement may have different effects on market equilibrium depending on the demand side. It may first have a positive employment effect on noncompliant firms with high productivity (Figure 2.5D) because it flattens the expected MCL. The effect turns negative when the government raises the minimum wage above marginal productivity ($\overline{w} > w^{do}$).[49] The extent to which enforcement intensity affects the labor market outcomes then depends on the firm's productivity distribution. A higher wage distribution of formal employment partly implies that formal firms are more productive and less affected by increases in enforcement intensity. This effect may be canceled out if extremely low-

[47]Because the endogenous threshold in the less inspected sector is lower, there is no such case of exact compliance in this segment and noncompliance in the strictly enforced segment.

[48]The main difference between the BCK model and standard monopsony model is the threshold above which a minimum wage hike starts having adverse effects on employment. In the standard model, this threshold coincides with the competitive equilibrium wage, whereas in the BCK model, this starting point is endogenous and is below the competitive equilibrium wage because of the imperfect enforcement. Their model implies that an increase in the minimum wage can have a negative employment effect even when it is strictly less than the competitive equilibrium wage. By allowing noncompliance, increases in the minimum wage enables more employers not to comply with the with the law. Thus, equilibrium wage can further fall below the minimum wage level.

[49]Note that the first piece of the expected MCL rotates around the (fixed) intersection between the minimum wage level and MCL in the absence of the minimum wage. Given a minimum wage level, an increase in the enforcement intensity results in a clockwise rotation of the line around this intersection.

productivity firms and low-productivity firms coexist.

In summary, enforcement heterogeneity in the extended framework allows the minimum wage to have different effects on labor market segments depending on its level relative to all thresholds (see Figure 2.4). Above the higher endogenous threshold, $\overline{W}(\lambda_{hi})$, increases in the minimum wage negatively affect employment in both segments. From w^{so} to $\overline{W}(\lambda_{lo})$, a minimum wage hike raises employment in both segments. Between the two endogenous thresholds, a further increase continues to have a positive but a negative effects in the highly inspected and less inspected segments, respectively. The impacts of stricter enforcement may vary across regions and market segments in this case.

3.4 Empirical Strategy and Data

3.4.1 Model Specifications

As predicted by the theoretical framework, a minimum wage hike may have different effects on employment in each segment due to enforcement heterogeneity across sectors. To empirically analyze these effects, this study estimates the following baseline specification using the fixed effects and data aggregated at the district level:

$$Y_{rt} = \beta \cdot \ln MW_{rt} + X_{rt} \cdot \delta' + c_r + f_t + u_{rt}$$

where the subscripts r and t indicate district and time, respectively. Y_{rt} indicates dependent variables that are the shares of all employees, formal (contracted) workers, informal-contracted workers, and informal-uncontracted workers. MW_{rt} denotes the real minimum wage deflated by the provincial consumer price index. X_{rt} indicates a vector of control variables: supply and demand shifters. Supply shifters are the proportions as the percentage of the total population of the following: (i) those who are below 15 years old, between 15 and 19, between 20 and 24, and older than 60; (ii) females; (iii) those who live in an urban area; (iv) workers who never went to school, who finished secondary, high school, vocational school, university, and higher education (not limited to employees). Demand shifters include the share of public sector employment and share of manufactur-

ing workers within the province, except for district r (not limited to employees). c_r and f_t are district and year fixed effects, respectively. The idiosyncratic error term is u_{rt}.

The extended BCK theory predicts that changes in enforcement level may affect market equilibrium as well as the manner in which employers respond to a minimum wage hike.[50] If the change suffices to alter the equilibrium state, the minimum wage may have the opposite effects on employment in the highly and less inspected regions. To consider this effect, this study introduces the enforcement dummy and its interaction with the minimum wage. The parameter γ_1 below captures the additional effect of minimum wage hikes in districts with higher enforcement intensity:[51]

$$Y_{rt} = \beta \cdot \ln MW_{rt} + \gamma_0 \cdot enforce_{rt} + \gamma_1 \cdot enforce_{rt} \cdot \ln MW_{rt} + X_{rt} \cdot \delta' + c_r + f_t + u_{rt}$$

where $enforce_{rt}$ is the proxy for enforcement intensity. Other variables remain the same as the baseline specification.

3.4.2 Data

This study utilizes the Vietnam's LFSs, which have been conducted annually by the General Statistics Office of Vietnam (GSO) since 2007. However, owing to the nonavailability of information on informality status and labor contracts, this study focuses only on the surveys from 2013 to 2018. This is coincidentally the period after the formation of the NWC.[52] Each LFS round contains approximately 750–830 thousand observations, representing the whole population. Although the LFSs are representative at the provincial

[50]For example, if the labor market is in the noncompliance state, the enforcement variable may have a nonzero effect on employment with the direction depending on the demand side. Low-productivity (noncompliant) employers may respond negatively to an increase in enforcement intensity. High-productivity ones can still hire more workers to maximize their profits. Increases in enforcement intensity affect the supply side of the market (expected MCL) and may alter the state of market equilibrium (from exact compliance to noncompliance).

[51]One may concern that the enforcement dummy reflects only enforcement intensity on formal firms without having any impacts on informal ones. Although the data provided by the MOLISA cannot distinguish the number of visits at each types of firms, it can be used as a proxy for both types of firms. Inspections at a registered (formal) firms may send a signal to neighboring informal ones. As shown in Figure 3.C3, informal firms encountered a smaller but non-negligible number of labor policy inspections.

[52]Since 2013, the government has been raising the minimum wage annually based on the NWC's proposal, which consists of three parties: the MOLISA, General Confederation of Labor (employee side), and representatives of employers at the central level.

level, there are still sufficiently large numbers of observations at the district level. The average number of observations per district-year cell is approximately 1,200 on average. The final panel consists of 4,014 data points. Table 3.3 shows the summary statistics for the main variables used in this chapter.

<Insert Table 3.3>

This study uses data from the MOLISA mentioned in Section 3.2.2 to construct the dummy for enforcement intensity. First, the enforcement intensity is defined as the number of inspections divided by the population size of the working age group in each province, which captures the potential minimum wage inspection coverage.[53] Second, this study transforms the continuous enforcement intensity into a discrete variable because the number of inspections covers not only minimum wage policy but other policies conducted by the MOLISA as well. Dividing the sample into certain groups can also avoid misinterpreting the results. The median value of the enforcement intensity each year is used as thresholds to divide the sample into two groups: highly and less inspected. Section 3.5.3(d) checks the sensitivity of the enforcement dummy using other denominators and a time-invariant threshold.

The sample representativeness may be an issue for estimations as indicated by a large number of districts that have a zero share of formal employment (Figure 3.5A). Under-sampling wage workers in the LFSs could potentially bias the estimated effect on formal employment toward zero. However, the data may reflect the true situation as these districts are mainly in mountainous and rural areas, where agriculture is the primary sector. To test this hypothesis, this study merges neighboring districts within each province to increase the representativeness of the data.[54] These districts expose the same set of provincial policies, so combining them into one "district" can increase the sample size without interfering with the nature of district variables. The number of districts decreases from 669 to 458, and the average number of observations in each district-year

[53]The working age group comprises of people between 15 and 59 years old, excluding those with disabilities. Figure 3.C4 in the Appendix illustrates the distributions of the enforcement intensity from 2013 to 2018.

[54]Specifically, this study merged two or three districts that have a small number of observations and remain in the same minimum wage category over the period 2013–2018. Merged districts usually have historical and geographical relation with each other (e.g., nearby districts or districts separated in the past).

cell increases to over 1,700. The second method to check for this data weakness is to restrict the sample to districts that have a 2.5–20% share of public servants. Because the public sector should account for a stable share of district employment, this criterion helps eliminate over- and under-sampled districts. Figures 3.5B and 3.5C illustrate employment distributions using the merged and restricted samples. Both panels present a similar spike in formal employment at the origin of the x-axis. This confirms the hypothesis that the data are sufficiently representative at the district level, and the large share of zero formal employment reflects the fact in mountainous and rural areas. The robustness of the main sample will be discussed in Section 3.5.3(c).

<Insert Figure 3.5>

3.4.3 Identification Threads

First, although fixed-effects estimation can eliminate the bias caused by any correlation between time-invariant unobserved factors and the minimum wage, other unobserved time-varying variables may also be correlated with the minimum wage. If the minimum wage is adjusted based on districts' living standards that are correlated with labor market outcomes, it may reflect existing characteristics of the districts other than the policy. The initial model specification may encounter an endogeneity problem. In Vietnam, the central government adjusts minimum wages based on the whole country's economic conditions, implying that the endogeneity issue is less severe in district-level specifications. To address the endogeneity concern, this study introduces two instrumental variables (IVs): the lagged minimum wage and minimum wage grouping dummies.[55] Although the lagged minimum wage conveys more information regarding the minimum wage, the grouping dummies contain useful information that can be complementary to the former instrument. The grouping dummies let us know which districts are in the same category

[55]In the literature, researchers have frequently raised the question of whether a minimum wage lagged effect should be taken into account. The literature shows different views on this issue (see, e.g., Brown et al., 1982, p. 496; Neumark and Wascher, 2007, p. 27). In Vietnam, owing to the adjustment process, minimum wage hikes are likely to have only short-term effects. Since 2009, the government has raised the minimum wage annually and has announced the change at least two months before its effective date. The NWC has publicly informed regarding the negotiation process among employers, employees, and government representatives several months before the announcement. Thus, it is reasonable to assume that all labor market participants can anticipate the hike and quickly adjust their plan.

and which districts experience an upgrade in status (from the less developed group to the more developed one). Section 3.5.3(b) applies the Two-Stage Least Squares (2SLS) estimator with each of these IVs as well as with both of them.

Second, the variations in enforcement across provinces may not be completely random if the MOLISA may choose where to visit based on provincial/districts' economic conditions. If the factors that affect MOLISA's decisions are unobservable or omitted, this raises another endogeneity concern to estimates obtained from the baseline and main model specifications.[56] This chapter addresses this issue by adding the number of registered firms in key industries in the previous year. This is a valid control given the fact that MOLISA has set up annual inspection plans largely based on the number of enterprises in these industries in each province.[57] This implies that controlling for the number of registered firms in key industries can partial out the nonrandom part of the enforcement variable. This issue is discussed in Section 3.5.3(d).

3.5 Empirical Results

3.5.1 Formal and Informal Employment

Table 3.4 reports the minimum wage effects on the shares of employees, formal, and informal employment, respectively.[58] The baseline estimation in Panel A found no disemployment effects on the share of employees, implying that the predictions of the competitive model fail in this case. The minimum wage has different impacts on contracted work-

[56]Each year, the MOLISA conducts inspections based on a pre-announced campaign, which indicates a specific theme (e.g., textiles, construction, mining, etc.). Enterprises in the sector of the inspection themes will receive more attention and higher visit probabilities from labor inspectors. This procedure is suitable for the assumption of imperfect enforcement in the extended BCK framework, that is: Firms presumably know about the probability of being inspected (the λ parameter). See more on the inspection system and procedure at `https://www.ilo.org/global/topics/safety-and-health-at-work/country-profiles/asia/vietnam/WCMS_150920/lang--en/index.htm` (accessed on October 28, 2021).

[57]Key industries include industries with the highest rates of labor accidents: manufacturing, mining, construction, and transportation.

[58]As the minimum wage is set on a monthly basis in Vietnam one may concern that raising it may raise working hours required by employers. Table 3.D3 in the Appendix shows that minimum wage neither affects the average working hour nor total working hour.

ers, depending on their formality status. While formal employment increases, informal-contracted employment remains unaffected. Column 4 shows no evidence of minimum wage effects on informal-uncontracted employment. This implies that the increase in the share of wage workers is primarily driven by the change in formal employment.

<Insert Table 3.4>

Panel B incorporated enforcement variables and found significant differences in the enforcement effect across market segments. In the formal segment, the positive employment effect suggests that this segment may be at the exact compliance state. In Column 2, enforcement intensity produces neither enforcement effects (the dummy variable) nor additional minimum wage effects (the interaction term). The formal segment is unaffected by an enhancement in law enforcement, which is consistent with the theoretical prediction.

As no employment effect was found in the informal-contracted segment, this segment could be at the early noncompliance state, where the minimum wage is slightly above the lower endogenous threshold. Minimum wage hikes may have a relatively small negative effect on employment (if any at all). Although the minimum wage itself does not affect the informal-contracted sector, its interaction with the enforcement dummy presents a significantly positive coefficient. As predicted by the extended BCK model, if the minimum wage is close to the endogenous threshold or if the change in enforcement intensity is sufficiently large, stricter enforcement will transform the labor market state from noncompliance toward the exact compliance state.[59] In such cases, minimum wage hikes will lead to higher employment. Estimates in Column 3 show that informal-contracted employment in highly inspected districts responds positively to minimum wage hikes. A 10% increase in the minimum wage raises the share of informal-contracted workers by 0.26 percentage points in these districts.

However, if the market is at the noncompliance state that can be transformed to the exact compliance state, the endogenous threshold must lie below the minimum wage level (Figure 2.5C). Thus, a stricter enforcement level should raise the equilibrated employment (positive γ_0). Results from Column 3 do not support this prediction, and informal-

[59]In Chapter 2, the minimum wage effects on market wages support that the formal and informal-contracted segments are at the exact compliance and noncompliance states, respectively.

contracted employment is significantly lower in highly inspected districts. The main reason could be that policy enforcement affects not only the MCL but also the MRP or demand for this type of worker. Although not presented in the theoretical framework, this study assumes that employers facing a low enforcement level (who hire informal-contracted workers) have an outside option in response to increases in the enforcement level. As in the case of Vietnam, once employers and workers agree to put employment benefits aside, they can also agree to put labor contracts aside (see Section 3.1).[60] This leads to a lower demand for informal-contracted relative to informal-uncontracted workers in highly inspected districts.

Table 3.4 found that informal-uncontracted employment is a partial substitution for informal-contracted one. Enforcement dummy and the interaction term affect the labor market in the opposite way between informal-contracted and -uncontracted segments. Informal-contracted (-uncontracted) employment is significantly lower (higher) in highly enforced districts. Minimum wage hikes lead to a lower share of informal-uncontracted workers in districts with higher enforcement levels. The opposite effects between the enforcement dummy and interaction term imply that an appropriate hike combined with a higher enforcement degree can formalize the labor market without imposing negative employment effects.

In the literature, the minimum wage coefficient is often interpreted using the means of dependent variables as they measure the share of employment. In Table 3.4, a 10% minimum wage hike results in approximately 1.27 percentage points in the formal employment ratio, which can be translated into a nearly 12.8% increase in formal employment, assuming that total employment is unchanged. This magnitude is far from the usual employment elasticity found in developing countries, although the specifications differ across studies. By reviewing 746 estimates from 28 studies on 7 emerging economies,

[60]In the extended framework presented in Chapter 2, workers are assumed to stick to their segments (i.e., formal and informal). Within the informal segment, workers can move freely between the contracted and uncontracted segments. Figure 3.C5 indicates a huge difference in the educational attainment between formal and informal workers. The average educational attainment of informal-contracted workers is higher than that of informal-uncontracted ones, but is far less than that of formal ones. Thus, workers can switch more easily within the informal segment but not between the informal and formal ones. However, this switching imposes a higher risk for employers because even temporary jobs with a duration of less than three months require at least a verbal contract while jobs with a duration longer than a month require social security contribution. Hence, only if benefits outweigh the risk, will the employer switch to informal-uncontracted workers.

Broecke et al. (2017) showed that most estimates fall in the range from –0.6 to 0.2 or a –6% to 2% change in employment in response to a 10% minimum wage hike. Because the employment ratio varies considerably across districts (Figure 3.5), the traditional way of interpreting the results may lead to the exaggeration of the minimum wage effects in Vietnam. This strikingly high effect may be due to the fact that a large number of districts have extremely low levels of formal employment, thus, low mean values of dependent variables. Another possibility is that lower minimum wage effects in other developing countries might come from the potential bias due to a missing enforcement mechanism. Nevertheless, the change in the formal employment ratio should be preferred when interpreting the minimum wage effect in Vietnam.

3.5.2 Other Types of Employment

As Table 3.4 indicates no significant effects on informal employment, employment flows of other types should be considered. Table 3.5 reports the minimum wage effects on the shares of inactive workforce, and family-contributing and self-employed workers, respectively. Inactive people are defined as those who are in the working age group (15–59 years old) and are able to work but choose not to. This group comprises of two main types of people: students/apprentices and housewives/househusbands, which accounted for nearly 90% of the inactive. Table 3.5 reports three definitions of inactive workforce, which address the concern that some people (e.g., high school and undergraduate students) may work but report as not working.

<Insert Table 3.5>

The share of inactive workforce significantly declines, implying that parts of these workers joined the labor market after minimum wage increases. The result is robust to all measures of the "inactive" workforce, thus, confirms no evidence of misreporting working status. Table 3.5 also shows that family-contributing, defined as those who work for their families without receiving any wages, and self-employed workers were not affected by the minimum wage. The estimated effects on the shares of family-contributing and self-employed workers are negative but insignificant at the conventional level.

Figure 3.C5 in the Appendix found that educational attainment of inactive workers

is closer to that of formal workers than other nonwage ones (i.e., family-contributing and self-employed). The share of inactive workforce with a high school degree and above is even higher than that of informal workers. This suggests that the inactive group seems to be more flexible and capable of doing a formal job. Thus, minimum wage hikes induce these workers, but not self-employed or family-contributing ones, to join the labor market.

3.5.3 Robustness Checks

This subsection checks the robustness of the main results in terms of several concerns and identification threads. All robustness checks, reported in Tables 3.6–3.9, show consistent employment effects of minimum wage hikes on each labor market segment.

(a) Employment in Registered Firms

The previous subsection utilizes the information from the employee side, represented in the LFS. One might think that employees may not honestly report their contract status and social security status. This study uses data from the employers' side, the VES conducted annually by the GSO, to addresses this concern.[61] Employees of registered firms can be regarded as contracted workers, and the VES allows us to identify the numbers workers insured (formal) or uninsured (informal-contracted) by social security.

<Insert Table 3.6>

Table 3.6 presents estimates using specifications that are similar to those in the main analysis. Similar to the main results, this study does not find any evidence of a disemployment effect on total employment in registered firms. Although the estimated coefficients are insignificant, they imply possibly positive and negative effects on formal and informal-contracted employment, respectively. The estimated effect on uninsured employment is smaller and close to zero, which is consistent with the findings using

[61]The VES covers all registered firms with more than a certain number of employees and a sample of smaller firms. The size threshold depends on each survey year and the province where the firm is located (e.g., 100, 50, and 20 employees for firms in Hanoi and Ho Chi Minh City, in other industrial provinces, and in the remaining provinces). Although the GSO interviews only a sample of smaller firms, they still provide the list of these firms with general information on employment. This implies that the VES is technically a census, covering all workers in registered firms.

the LFS data. The share of insured workers in registered firms or the share of formal employment significantly increases with the minimum wage. These results confirm that minimum wage hikes led to formalization of the labor workforce in Vietnam.

(b) 2SLS Regression

Table 3.7 addresses the endogeneity concern by using the 2SLS estimator with different sets of IVs. The minimum wage effect on formal employment is smaller when using minimum wage grouping as IVs. This implies that the estimated minimum wage effects in the previous section may reflect variations in the district characteristics across groups. However, this study focuses on identifying the minimum wage effects on different labor market segments rather than estimating the effect magnitudes. Both minimum wage and enforcement effects are consistent with the main analysis. This confirms the robustness of the main results to the endogeneity issue.

<Insert Table 3.7>

(c) Sample Representativeness Issue

As discussed in Section 3.4.2, one might be concerned that the sample may not sufficiently represent the population because the number of observations in some district-year cells is small. Table 3.8 checks this sample representativeness issue. The regressions use either merged or restricted samples support the main results, implying that the district-level data are robust to the representativeness issue. As shown in Table 3.8, minimum wage hikes lead to increases in formal employment. Minimum wage coefficients are insignificant and small in informal employment regressions.[62] In Panel A, coefficients on enforcement variables lose their significance but the signs remain unchanged. Panel B presents consistent enforcement effects in the informal sectors.

<Insert Table 3.8>

[62]This study obtains similar conclusions when using the sample with only nonzero values of formal employment in Appendix Table 3.D4.

(d) Sensitivity of Enforcement Dummy

Table 3.9 presents the results of sensitivity checks using different proxies for enforcement intensity. The first two panels show the estimated coefficients using total population and employment as the denominator in the first step, respectively.[63] The results are reasonably consistent with the main results presented in Table 3.4.

<Insert Table 3.9>

Panel C reports the estimates when using the enforcement dummy with a time-invariant thresholds (i.e., mean value of the whole period). Although the coefficients in Column (3) became insignificant, they remain the same direction with the main results. The sudden change in the number of inspections in 2018 may have caused this issue.[64] Nevertheless, results in other columns confirm the enforcement effects found in 3.4.

3.6 Conclusion

This chapter examines the employment effects of minimum wages in a developing country with a large informal sector and heterogeneity in the policy enforcement effort. Given the data structure, employment is categorized by social security (formality) and labor contract status (policy coverage). The baseline specification identifies minimum wage effects on each labor market segment, whereas the main specification incorporates the enforcement effects. The main results support the hypothesis that the labor market has monopsonistic features, which has been increasingly acknowledged among labor economists.[65] Minimum wage hikes were associated with increases in the share of wage workers in

[63]This study does not consider the number of registered firms as a candidate for two reasons: (i) it may causes endogeneity issues as the authorities may inspect more frequently at provinces with higher numbers of registered firms (see Section 3.4.3); and (ii) it does not cover all wage workers, including those who work in the informal sector, who should be the subject of the minimum wage policy (see Section 1.2).

[64]During the period 2013–2018, the MOLISA has almost doubled the number of inspections at the end of the period. This makes the time-invariant threshold less appropriate as the district's cross variation in enforcement disappears. Meanwhile, the time variation in enforcement intensity can be captured by year fixed effects.

[65]The job search model developed by Burdett and Mortensen (1998, p. 267–68) suggested that "employment increases with the minimum wage, even though atomistic wage competition, not classic monopsony in the formal sense of one buyer, characterizes the market structures."

Vietnam during the 2013–2018 period. A higher minimum wage induced the inactive to participate in the labor market.

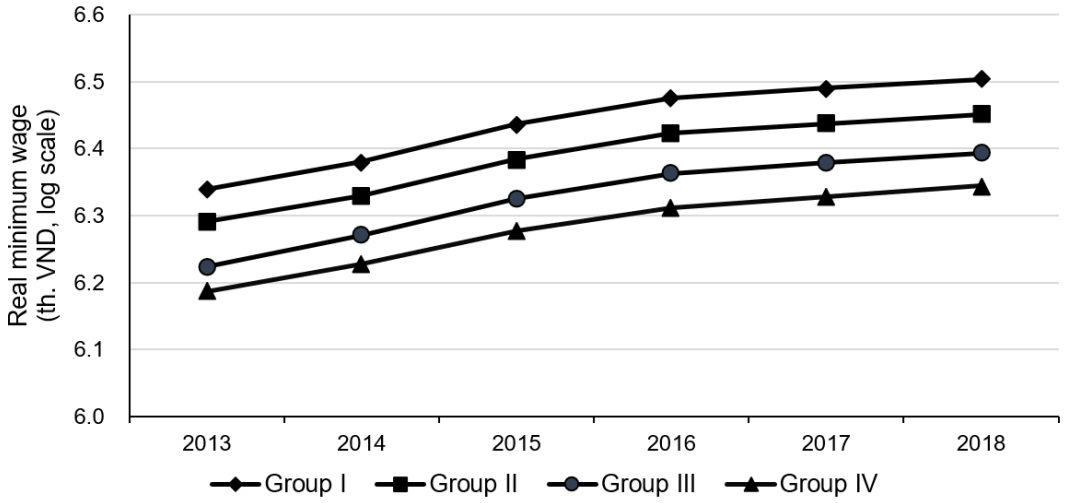
This study highlights the importance of enforcement intensity in the labor market. First, the minimum wage effects varied across sectors with different levels of enforcement (formal: high and informal: low). Formal employment significantly increased, whereas informal employment remained unaffected by the minimum wage. Second, higher enforcement intensity produced mixed effects on the informal market, depending on the agreement between employers and employees. Firms in districts with higher enforcement levels initially demanded more for informal and uncovered workers, but minimum wage hikes led to lower and higher informal-uncontracted and -contracted employment, respectively. Empirical results from this study suggest that an appropriate hike combined with enforcement can promote workforce formalization without imposing adverse employment effects.

The main results are robust to the sensitivity of the enforcement dummy, representativeness of the data, and endogeneity concern. Nevertheless, this study considers the aggregated labor market outcomes in recent periods alone. The early period—when the minimum wage was initially formed in Vietnam—and its effects on individual participants (e.g., firms and households) are left for future study.

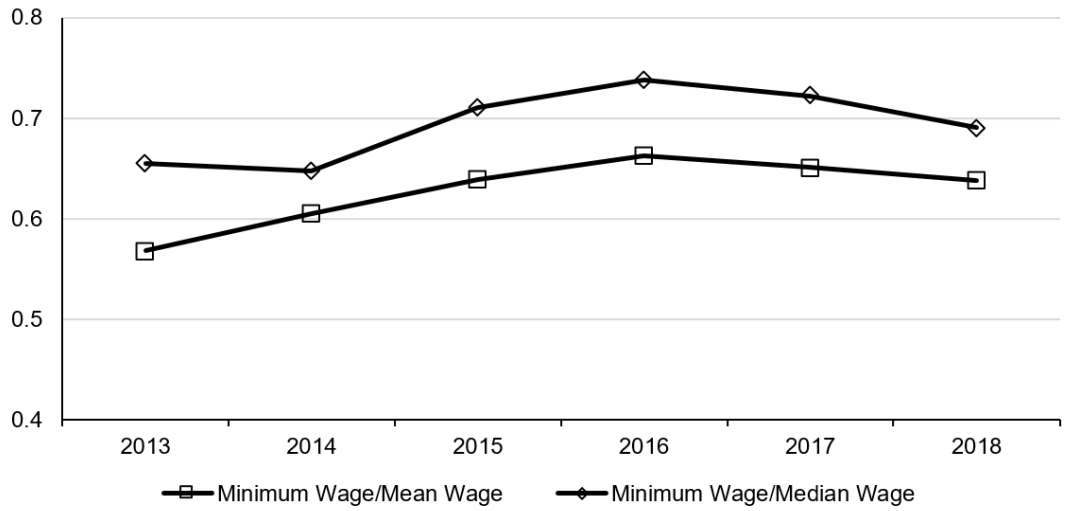
Figures

FIGURE 3.1.—REAL AND RELATIVE MINIMUM WAGES

A. Real Minimum Wage

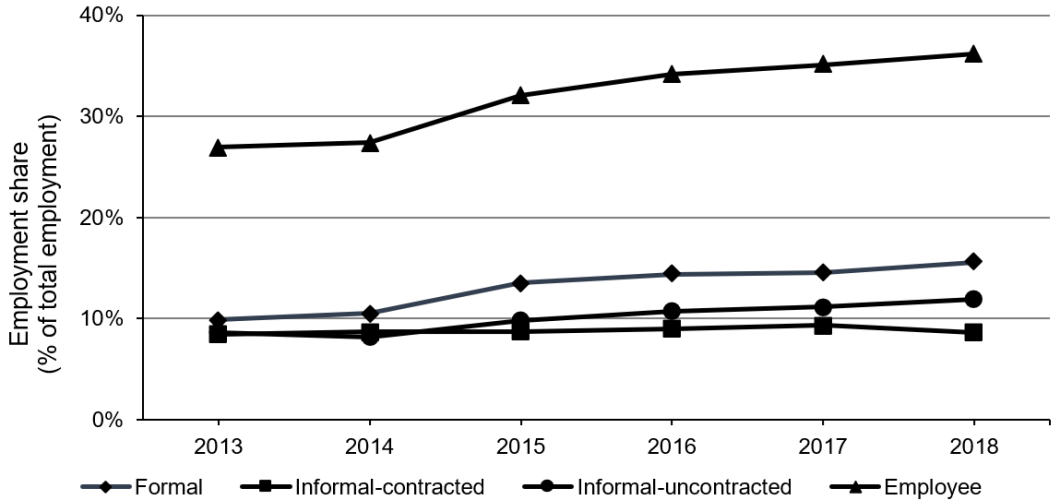


B. Relative Minimum Wage



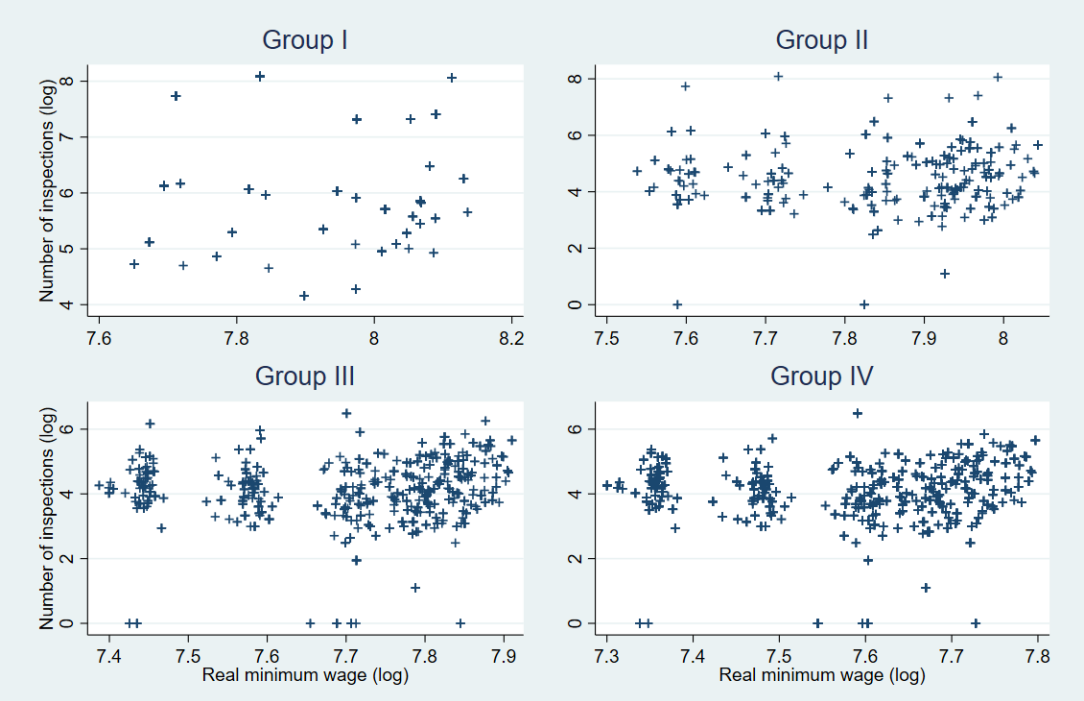
NOTES.—This figure plots the log of real minimum wage (deflated by provincial consumer price index) in Panel A and the relative minimum wage in Panel B. The minimum and mean wage are the average wages faced/received by workers in four groups, weighted by the sampling weights. Data cover employees in nonstate sectors. Author's calculation from the LFSs and corresponding minimum wage provisions.

FIGURE 3.2.—EMPLOYMENT TREND BY TYPE



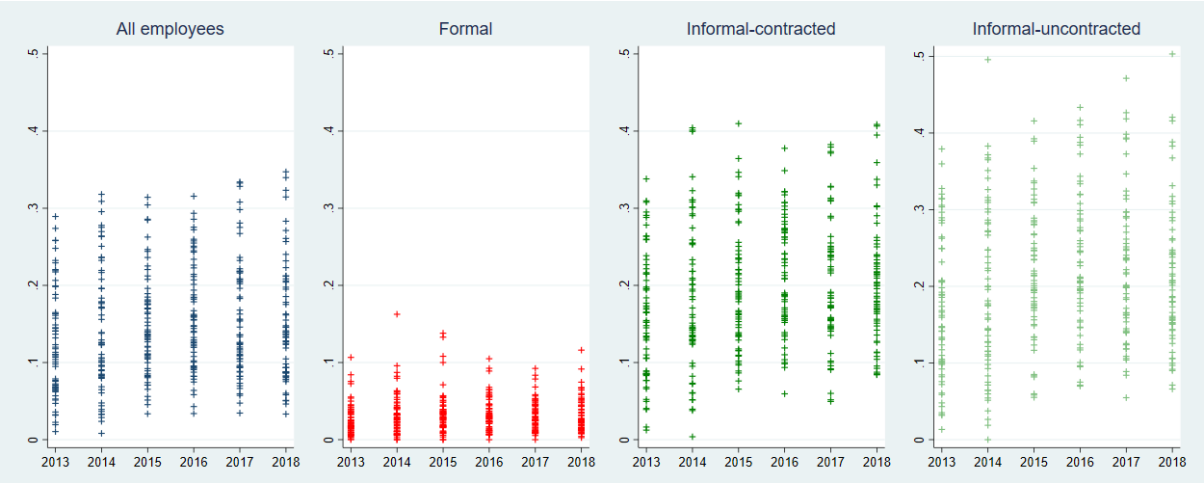
NOTES.—This figure plots the trends of employment by formality status and contract status. Author's calculation from the LFSs. Data cover employees in nonstate sectors and are weighted by the sampling weights.

FIGURE 3.3.—NUMBER OF INSPECTIONS BY MINIMUM WAGE GROUP



NOTES.—This figure plots the number of inspections in log by four minimum wage groups. Each observation represents data for one district-year cell. The x-axis is the minimum wage in log form, deflated by provincial consumer price index. The y-axis indicates the number of inspections in log form. Because of the lack of data, the number of inspections is assumed to be the same for all districts within a province each year. The total numbers of inspections are 8156, 8557, 6484, 6396, 6258, and 12654 in respective years from 2013 to 2018. Data on the number of inspections from the MOLISA.

FIGURE 3.4.—MINIMUM WAGE NONCOMPLIANCE RATE



NOTES.—This figure plots the noncompliance rate, which is defined by the share of workers earning less than the minimum wage level. Each observation represents the proportion of subminimum wage workers for one province in one year. Author's calculation from the LFSs. The data are winsorized at 1% in each tail for each group and are weighed by the sampling weights. Total number of provinces: 63.

FIGURE 3.5.—DISTRIBUTIONS OF DISTRICT EMPLOYMENT BY TYPE

A. Full Sample

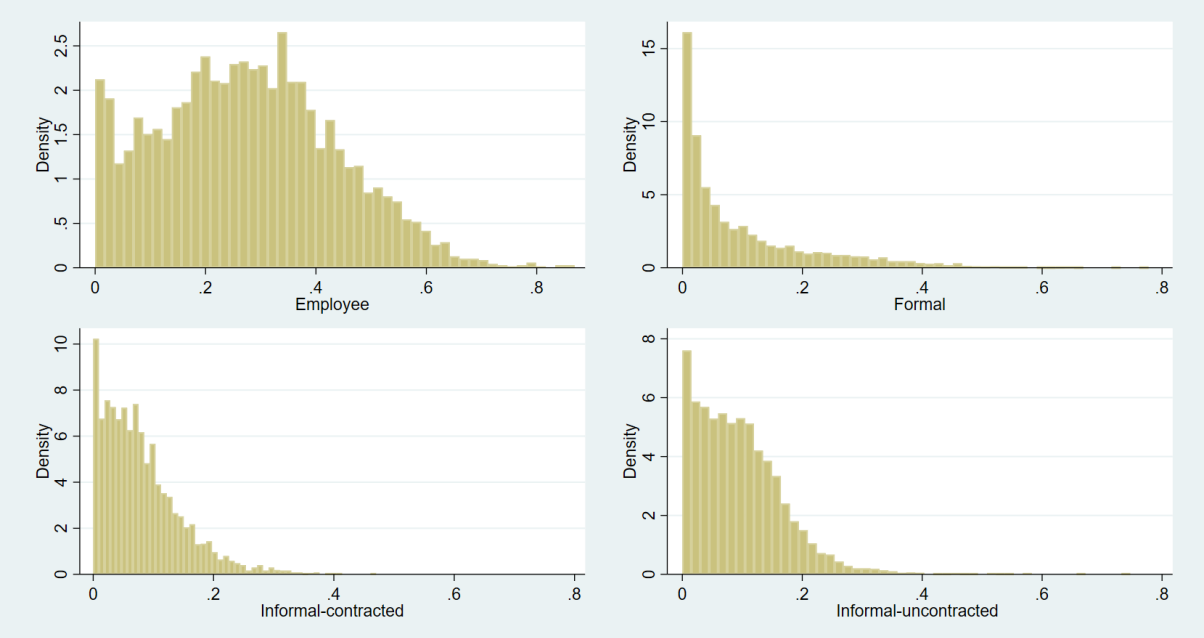
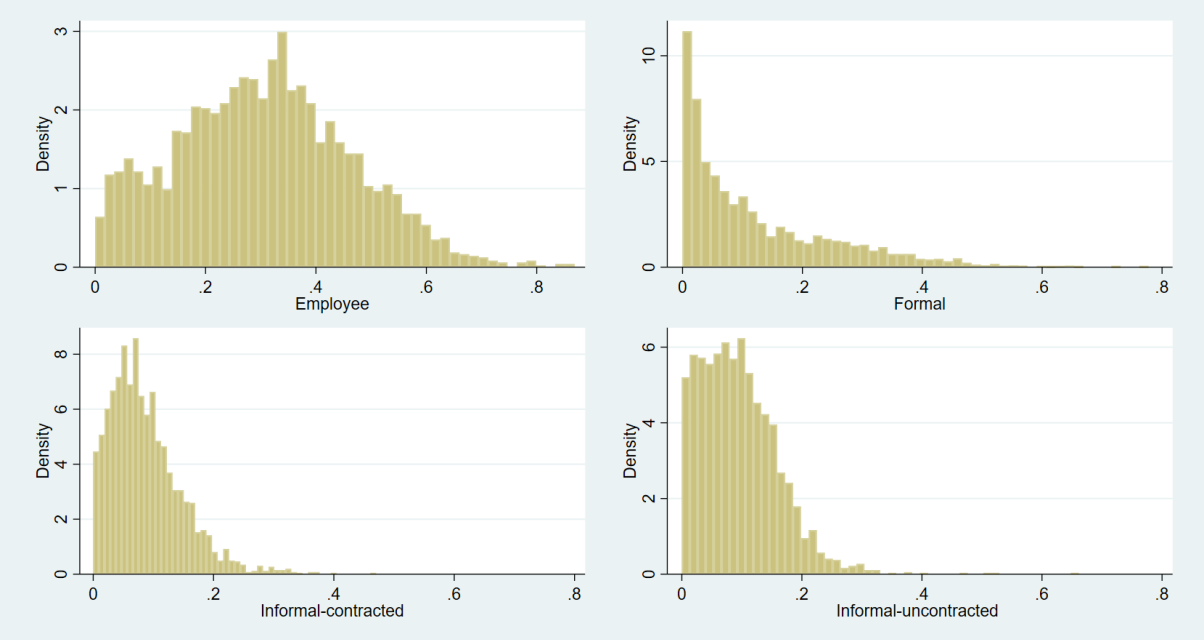
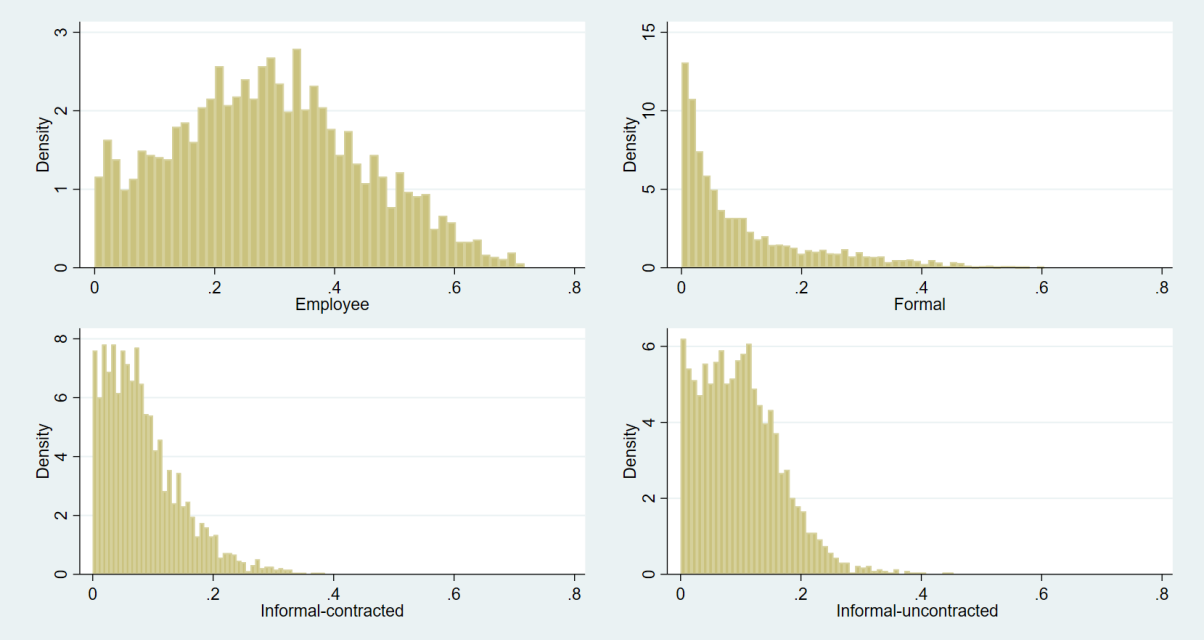


FIGURE 3.5.—DISTRIBUTIONS OF DISTRICT EMPLOYMENT BY TYPE (CONT.)

B. Merged Sample



C. Restricted Sample



NOTE.—This figure plots the distributions of different types of employees as proportion to total employment in three samples. Observations are at the district-year level.

Tables

TABLE 3.1.—TWO-BY-TWO DIMENSIONAL EMPLOYMENT MATRIX

	Contracted	Uncontracted
Formal	13.08	
Informal	8.80	10.09

NOTES.—Numbers are the average shares in total employment during the 2013–2018 period (%). The data cover employees in nonstate sectors from the LFSs. Data are weighted by the sampling weights. The formal-uncontracted group is undefined.

TABLE 3.2.—MINIMUM WAGE VIOLATION INDEX

	Noncompliance rate	Depth of violation	Compliance rate	Adjusted compliance rate
All employee	.158	.259	.290	.237
Formal	.063	.147	.479	.440
Informal-contracted	.217	.271	.252	.196
Informal-uncontracted	.228	.290	.223	.165

NOTES.—The data cover employees in nonstate sectors from the Vietnam LFSs between 2013 and 2018, weighted by the sampling weights. Depth of violation is the average wage shortfall of subminimum wage earners (Bhorat et al., 2013). The compliance rate is defined as $C = \eta/(\eta + \pi)$, where π is the number of subminimum wage earners and η is the number of workers earning [1–1.1] times the minimum wage level, see Ashenfelter and Smith (1979) for the formal definition. Because the minimum wage in Vietnam is set on a monthly basis, the upper bound of 10% accounts for the measurement error and the fact that the minimum wage is 7% higher for trained and skilled labor. The adjusted compliance rate takes into account the fraction of workers earning the minimum wage level in the absence of the law. Monthly income of farm-household and self-employed workers from 2015 to 2018 were used as a proxy.

TABLE 3.3.—SUMMARY STATISTICS OF DISTRICT-LEVEL VARIABLES

	Obs.	Mean	Std. Dev.	Min	Max
Real MW (1,000 VND, log scale)	4,014	7.677	.188	7.300	8.136
Enforcement dummy	4,014	.500	.500	0	1
Number of observations	4,014	1,169	684	145	5,846
Number of employment observations	4,014	666	371	81	3,206
Employment variables (% of total employment):					
Employee	4,014	.275	.160	0	.868
Formal	4,014	.100	.116	0	.778
Informal-contracted	4,014	.080	.065	0	.470
Informal-uncontracted	4,014	.095	.074	0	.747
Inactive	4,014	.085	.044	0	.264
Supply shifters (% of total population):					
Age below 15	4,014	.246	.045	.103	.474
Age 15–19	4,014	.071	.019	.014	.166
Age 20–24	4,014	.066	.022	0	.226
Age 60+	4,014	.122	.044	.006	.296
Illiterates	4,014	.041	.051	0	.354
Primary school grads	4,014	.221	.097	0	0.534
Secondary school grads	4,014	.310	.111	.074	.739
High school grads	4,014	.146	.079	0	.475
Vocational school grads	4,014	.068	.041	0	.336
Undergraduates & graduates	4,014	.071	.066	0	.548
Urban population	4,014	.380	.330	0	1
Female population	4,014	.508	.020	.400	.589
Demand shifters (% of total employment if not specify):					
Public sector employment	4,014	.091	.062	0	.512
Manufacturing employment	4,014	.138	.087	.008	.477
Number of registered firms in key industries (lagged, log)	4,014	4.340	1.369	0	8.525
Minimum wage group 1	4,014	.103	.304	0	1
Minimum wage group 2	4,014	.112	.316	0	1
Minimum wage group 3	4,014	.239	.427	0	1
Minimum wage group 4	4,014	.546	.498	0	1

NOTE.—Each observation is one district-year cell. The panel is balanced with 669 districts spanning over the 2013–2018 period.

Table 3.4.—Effects on Formal and Informal Employment

	Employee	Formal	Informal	
			contracted	uncontracted
	(1)	(2)	(3)	(4)
Panel A. Baseline Specification				
lrMW	.071	.119***	.043	–.089
	(.052)	(.038)	(.057)	(.059)
R-squared	.911	.938	.675	.689
Within R-sq	.049	.115	.024	.043
Panel B. With Enforcement Dummy				
lrMW	.083	.127***	.026	–.068
	(.051)	(.037)	(.058)	(.059)
enforce	.074	.048	–.197***	.221***
	(.099)	(.062)	(.075)	(.084)
lrMW*enforce	–.009	–.006	.026***	–.029***
	(.013)	(.008)	(.010)	(.011)
R-sq	.911	.938	.676	.690
Within R-sq	.050	.117	.027	.046
Mean of DV	.275	.100	.080	.095
Observations	4,014	4,014	4,014	4,014
No. of districts	669	669	669	669

Notes.—*** $p < .01$, ** $p < .05$, * $p < .1$. Two-way fixed-effects regressions (year and district). Standard errors in parentheses, clustered at the district level. The table displays only coefficients on minimum wage and enforcement variables. Data are from the LFS between 2013 and 2018. Control variables include shares of population age below 15, 15–19, 20–24, and above 60 years; shares of illiterates, secondary, high, and vocational school, university, and higher education graduates; urban population; share of public sector employment; share of employment in manufacturing workers in other districts within the province (not limited to employees); and log of the number of registered firms in industries with the highest labor-accident rates in the previous year.

TABLE 3.5.—EFFECTS ON OTHER TYPES OF EMPLOYMENT

	Inactive			FCW	Self-employed
	(1)	(2)	(3)	(4)	(5)
lrMW	-.043***	-.033**	-.032**	-.037	-.057
	(.016)	(.014)	(.013)	(.055)	(.060)
R-squared	.893	.895	.862	.795	.746
Within R-sq	.268	.140	.067	.085	.090
Mean of DV	.085	.051	.037	.187	.421
Observations	4,014	4,014	4,014	4,014	4,014
No. of districts	669	669	669	669	669

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. Two-way fixed-effects regressions (year and district). Standard errors in parentheses, clustered at the district level. The table displays only coefficients on minimum wage variable. Data are from the LFS between 2013 and 2018. Dependent variables in columns are shares of inactive workforce as percentage of total population (Column 1–3), of family-contributing (FCW, Column 4) and self-employed workers as percentage of total employment (Column 5), respectively. Regressions in column (1) include all inactive people, whereas Columns (2) and (3) exclude students/apprentice with secondary school diploma and below, and all students, respectively. Control variables include shares of population age below 15, 15–19, 20–24, and above 60 years; shares of illiterates, secondary, high, and vocational school, university, and higher education graduates; urban population; share of public sector employment; share of employment in manufacturing workers in other districts within the province (not limited to employees); and log of the number of registered firms in industries with the highest labor-accident rates in the previous year.

TABLE 3.6.—EFFECTS ON REGISTERED FIRMS' EMPLOYMENT

Dependent variables	Minimum wage coefficient	
	(1)	(2)
Log of total employment	.422	.332
	(.260)	(.260)
Log of insured employment	.629	.436
	(.492)	(.489)
Log of uninsured employment	–.093	–.125
	(.247)	(.246)
Share of insured employment	.221**	.189**
	(.095)	(.095)
District fixed effects	YES	YES
Year fixed effects	YES	YES
District characteristic controls	NO	YES
Demand side controls	YES	YES
Observations	4,014	4,014
Number of districts	669	669

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. All estimates are the coefficients of the log of real minimum wage. Standard errors are in parentheses, clustered at the district level. Data are from the VES, aggregated at the district level. Enforcement variables are also included. Demand side control variables include lags of following variables: the average profit-to-sales ratio, number of registered firms, and number of registered firms in industries with the highest labor-accident rates. District characteristic controls refer to variables from the LFS used in the main analysis.

TABLE 3.7.—ROBUSTNESS CHECK: 2SLS REGRESSIONS

	Employee	Formal	Informal	
			contracted	uncontracted
	(1)	(2)	(3)	(4)
Panel A. lagged MW as IV				
lrMW	.094	.176***	–.009	–.069
	(.077)	(.058)	(.091)	(.097)
enforce	.094	.060	–.204***	.235***
	(.102)	(.065)	(.078)	(.090)
lrMW*enforce	–.012	–.007	.027***	–.031***
	(.013)	(.008)	(.010)	(.012)
R-sq	.050	.116	.026	.046
First-stage tests:				
Wald F statistic	49.4	49.4	49.4	49.4
Panel B. lagged MW and MW group dummies as IVs				
lrMW	.060	.105**	–.048	.003
	(.056)	(.050)	(.078)	(.071)
enforce	.078	.040	–.206***	.241***
	(.101)	(.063)	(.077)	(.088)
lrMW*enforce	–.010	–.005	.027***	–.031***
	(.013)	(.008)	(.010)	(.011)
R-sq	.050	.117	.025	.044
First-stage tests:				
Wald F statistic	467.3	467.3	467.3	467.3
Hansen J (p-value)	.273	.222	.070	.054

NOTE.—*** $p < .01$, ** $p < .05$, * $p < .1$. 2SLS regressions with two-way fixed effects (year and district). Standard errors are in parentheses, clustered at the district level. The table displays only coefficients on minimum wage and enforcement variables. Data are from the LFS between 2013 and 2018. Number of districts: 669; number of observations: 4,014. Dependent variables are employment as percentage of total employment. Control variables include shares of population age below 15, 15–19, 20–24, and above 60 years; shares of illiterates, secondary, high, and vocational school, university, and higher education graduates; urban population; share of public sector employment; share of employment in manufacturing workers in other districts within the province (not limited to employees); and log of the number of registered firms in industries with the highest labor-accident rates in the previous year.

TABLE 3.8.—ROBUSTNESS CHECK: MERGED AND RESTRICTED SAMPLES

	Employee	Formal	Informal	
			contracted	uncontracted
	(1)	(2)	(3)	(4)
Panel A. Merged Sample				
lrMW	.076	.128***	.019	–.069
	(.054)	(.044)	(.062)	(.057)
enforce	.007	.040	–.148*	.111
	(.101)	(.072)	(.080)	(.086)
lrMW*enforce	–.000	–.005	.019*	–.014
	(.013)	(.009)	(.010)	(.011)
R-squared	.934	.948	.682	.699
Within R-sq	.058	.131	.043	.037
Mean of DV	.307	.125	.087	.095
Observations	2,748	2,748	2,748	2,748
No. of districts	421	421	421	421
Panel B. Restricted Sample				
lrMW	.125**	.135***	.005	–.014
	(.058)	(.047)	(.046)	(.050)
enforce	.108	.095	–.193**	.201**
	(.113)	(.080)	(.091)	(.090)
lrMW*enforce	–.014	–.012	.026**	–.026**
	(.015)	(.010)	(.012)	(.012)
R-sq	.918	.937	.679	.688
Within R-sq	.057	.125	.029	.044
Mean of DV	.288	.105	.084	.099
Observations	2,526	2,526	2,526	2,526
No. of districts	458	458	458	458

NOTE.—*** $p < .01$, ** $p < .05$, * $p < .1$. Two-way fixed-effects regressions (year and district). Standard errors in parentheses, clustered at the district level. The table displays only coefficients on minimum wage and enforcement variables. Data are from the LFS between 2013 and 2018. Dependent variables are employment as percentage of total employment. Control variables include shares of population age below 15, 15–19, 20–24, and above 60 years; shares of illiterates, secondary, high, and vocational school, university, and higher education graduates; urban population; share of public sector employment; share of employment in manufacturing workers in other districts within the province (not limited to employees); and log of the number of registered firms in industries with the highest labor-accident rates in the previous year.

TABLE 3.9.—ROBUSTNESS CHECK: ENFORCEMENT INTENSITY MEASURES

	Employee	Formal	Informal	
			contracted	uncontracted
	(1)	(2)	(3)	(4)
Panel A. Total population as denominator				
enforce	.073	.044	–.162**	.189**
	(.098)	(.061)	(.075)	(.084)
lrMW*enforce	–.009	–.005	.021**	–.024**
	(.013)	(.008)	(.010)	(.011)
Panel B. Total employment as denominator				
enforce	.070	.035	–.144*	.177**
	(.098)	(.061)	(.074)	(.083)
lrMW*enforce	–.009	–.004	.019*	–.023**
	(.013)	(.008)	(.010)	(.011)
Panel C. Time-invariant threshold (whole period's mean value)				
enforce	.221**	.068	–.099	.245***
	(.095)	(.059)	(.073)	(.077)
lrMW*enforce	–.029**	–.009	.013	–.032***
	(.012)	(.008)	(.009)	(.010)

NOTE.—*** $p < .01$, ** $p < .05$, * $p < .1$. Two-way fixed-effects regressions (year and district). Standard errors are in parentheses, clustered at the district level. The table displays only coefficients on enforcement variables. Data from LFS 2013 to 2018. Number of districts: 669; number of observations: 4,014. Dependent variables are employment as percentage of total employment. Control variables include shares of population age below 15, 15–19, 20–24, and above 60 years; shares of illiterates, secondary, high, and vocational school, university, and higher education graduates; urban population; share of public sector employment; share of employment in manufacturing workers in other districts within the province (not limited to employees); and log of the number of registered firms in industries with the highest labor-accident rates in the previous year.

Appendices to Chapter 3

3A Minimum Wage System and Adjustment Procedures

Currently, the Vietnamese government sets four minimum wage levels corresponding to four groups of districts (Figure 3.C1). The first minimum wage group consists of the most developed and industrialized districts, whereas the fourth group includes the least developed, rural, and mountainous districts. Variations in the minimum wage come from two sources: (i) a hike in each group and (ii) an upgrade in the district's categorization from one group to another. Each year, the government adjusts the minimum wage levels based on proposals made by the NWC. The proposed changes in the minimum wages are the outcome of negotiations between three parties, which fulfill the basic needs of workers and their families, and the socioeconomic conditions (Figure 3.C2). Upgrading the category of a district is proposed by the local government and is relatively rare in the period of study. Specifically, less than 1.5% of districts were upgraded during the period 2013–2018. Given the centrally adjusted mechanism, minimum wage changes in Vietnam may be correlated with the economic development of the whole country but are likely to be exogenous to a district's economic conditions.

3B Degree of Monopsony in Vietnam

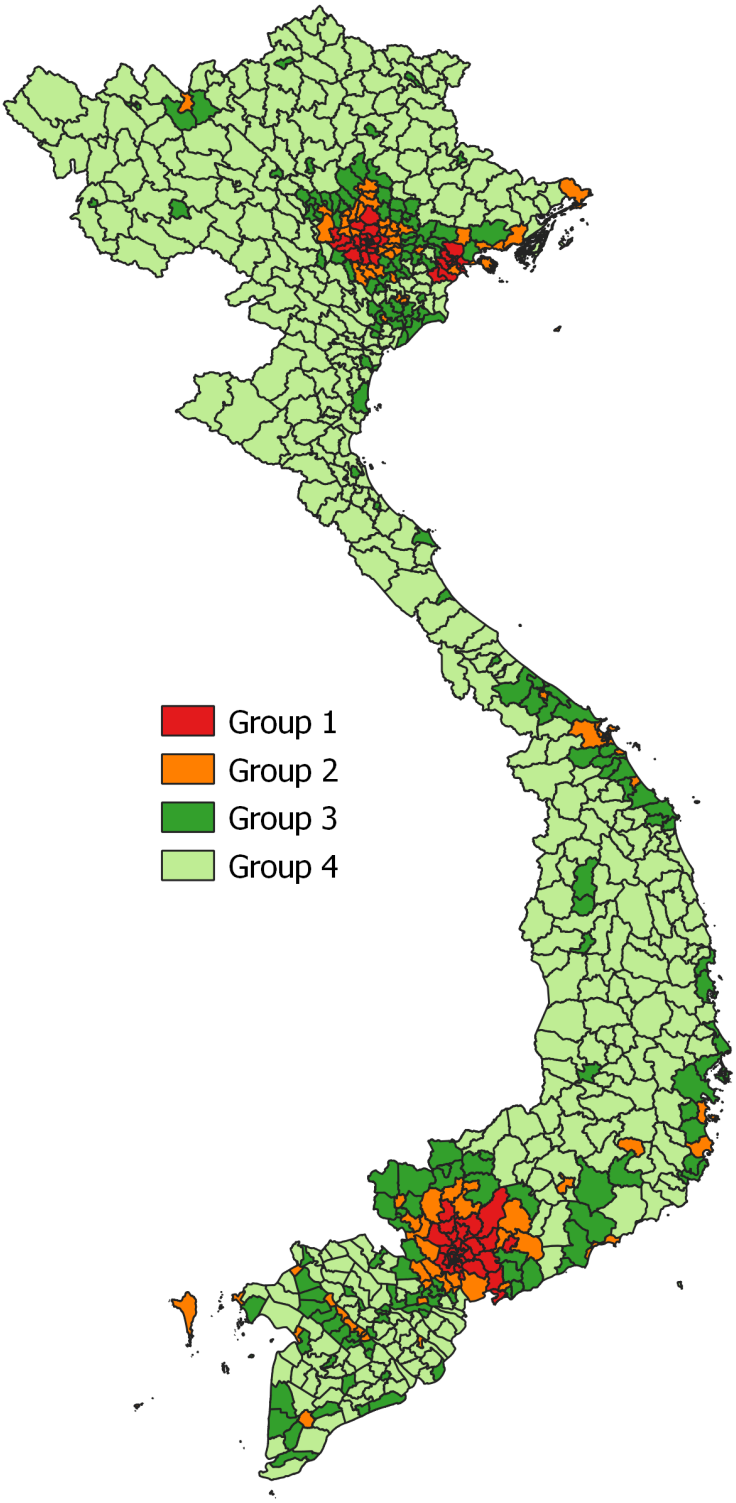
This study relies on the assumption that the Vietnamese labor market possesses monopsonistic features. Following Burdett and Mortensen (1998) and Manning (2003), Table 3.D1 measures the degree of monopsony generated by search frictions. A higher fraction of new recruits from nonemployment indicates a higher degree of search frictions or monopsony features. However, the monopsony model is not the only model that predicts a positive employment effect of the minimum wage on (formal) employment. For example, Magruder (2013) found that a higher minimum wage in Indonesia created a higher demand for local products, which, in turn, led to an increase in formal employment and a decrease in informal employment. His results favored the big push theory over the monopsony model.

Unfortunately, the numbers of new recruits from the LFS are insufficient to estimate the proxy for monopsony at the district level. This Appendix section estimates the Herfindahl–Hirschman Index (HHI) to measure employment concentration at the district level using data from the VES. The HHI ranges from 0.002 to 0.923 with a median value of 0.063. Table 3.D2 checks whether the employment effects found in the main analysis can be attributable to the monopsonistic power of employers. The sample was divided into high and low levels of employment concentration based on the HHI. The results indicate no difference in effects on formal employment by monopsony degree. Meanwhile, minimum wage negatively affects informal-contracted employment in districts with a higher level of monopsony. This is consistent with the main findings. As the current minimum wage is above the endogenous threshold in the informal-contracted segment, higher monopsony degree should lead to a more significantly negative effect.

Columns (4) and (5) of Table 3.D2 show that the minimum wage has no effect on the share of family contributing or self-employed workers, which were regarded as informal employment in Magruder (2013). The differences in geographical characteristics and institutional settings may be the main reasons for the choices of the appropriate theoretical framework in Magruder (2013). While Indonesia consists of several islands and the minimum wage is set by local authorities, in Vietnam, districts are closely connected and the minimum wage is set centrally by the government. This suggests that the positive effect on formal employment in Vietnam is supported by the monopsonistic labor market rather than by big push hypothesis.

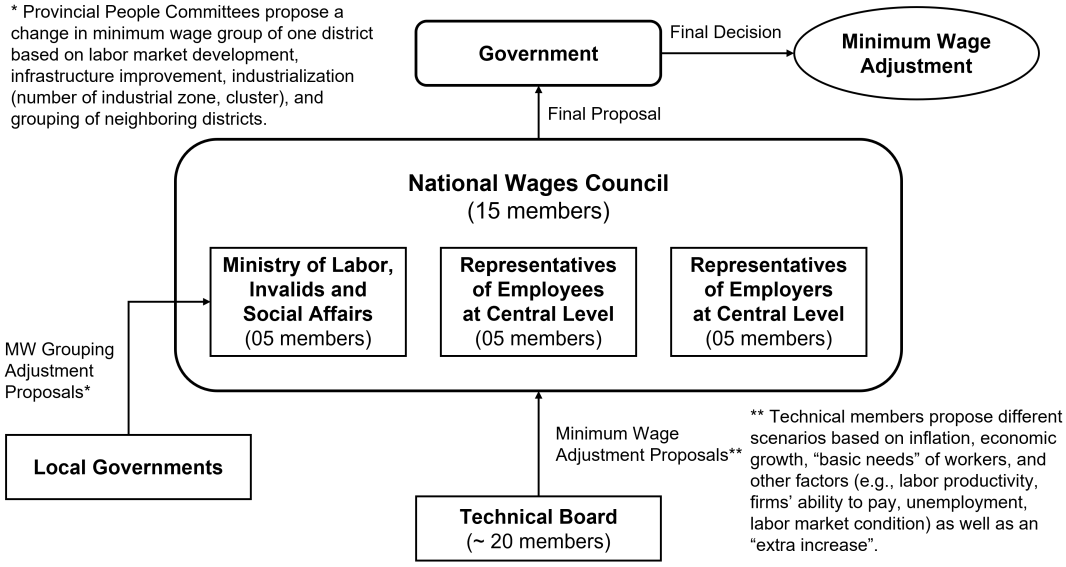
3C Additional Figures

FIGURE 3.C1.—MINIMUM WAGE GROUPING BY DISTRICT IN 2018



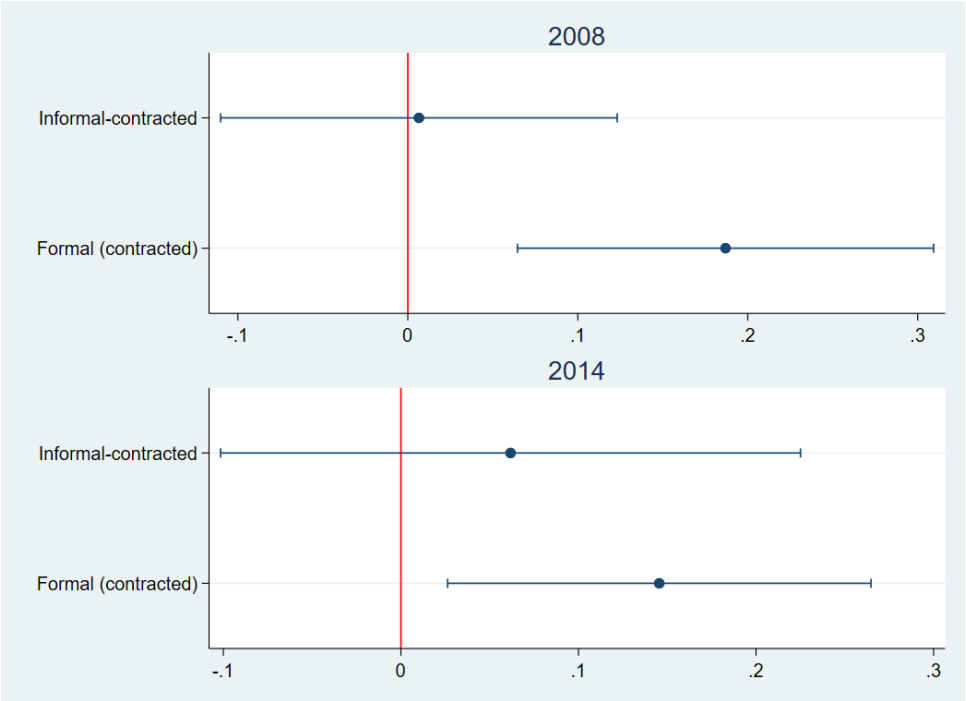
NOTES.—This figure plots the geographic distribution of minimum wage groups in Vietnam. Group 1 includes most developed districts, located mainly in the two economic centers: Hanoi and Ho Chi Minh city. Meanwhile, Group 4 includes the least developed districts.

FIGURE 3.C2.—MINIMUM WAGE ADJUSTMENT PROCEDURES



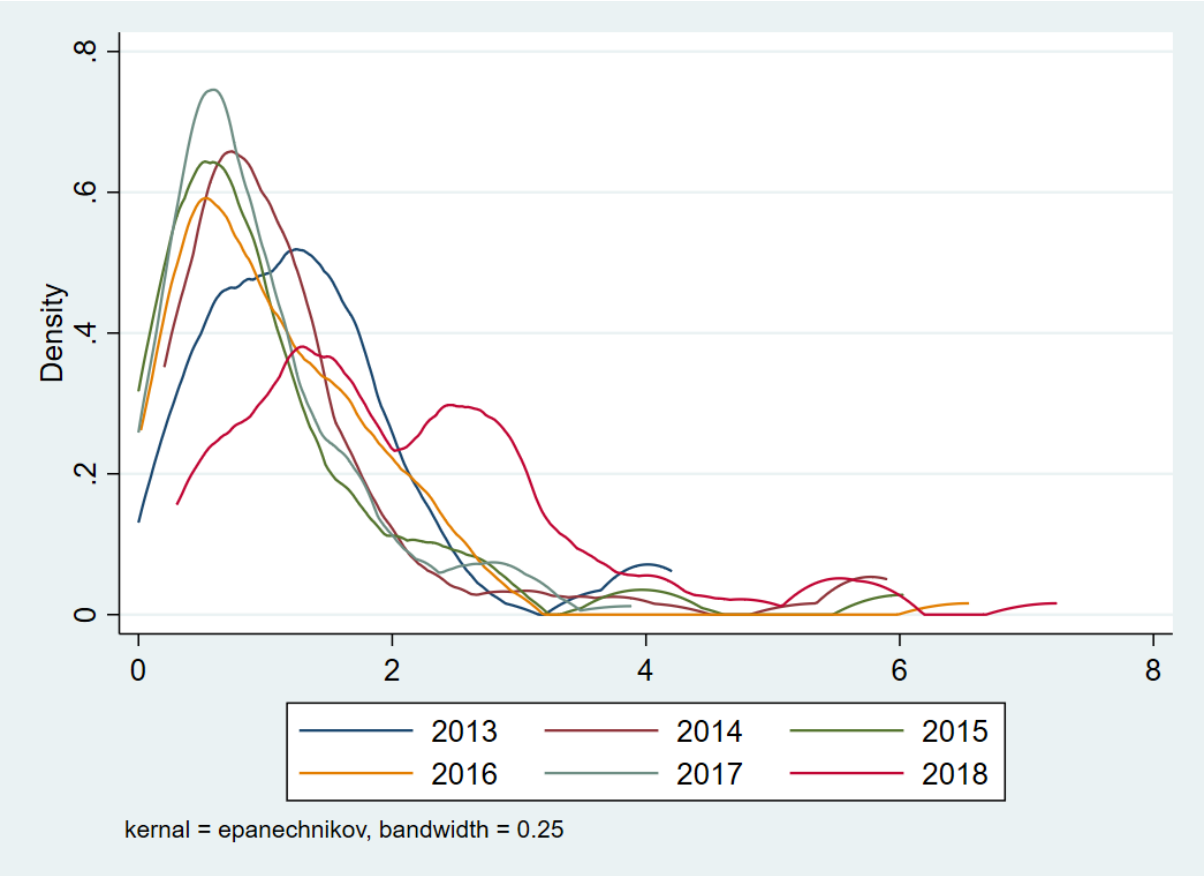
NOTES.—This figure illustrate the minimum wage adjustment process in Vietnam, updated from D. T. Nguyen et al. (2017).

FIGURE 3.C3.—PROBABILITY OF BEING INSPECTED: MANUFACTURING SMES



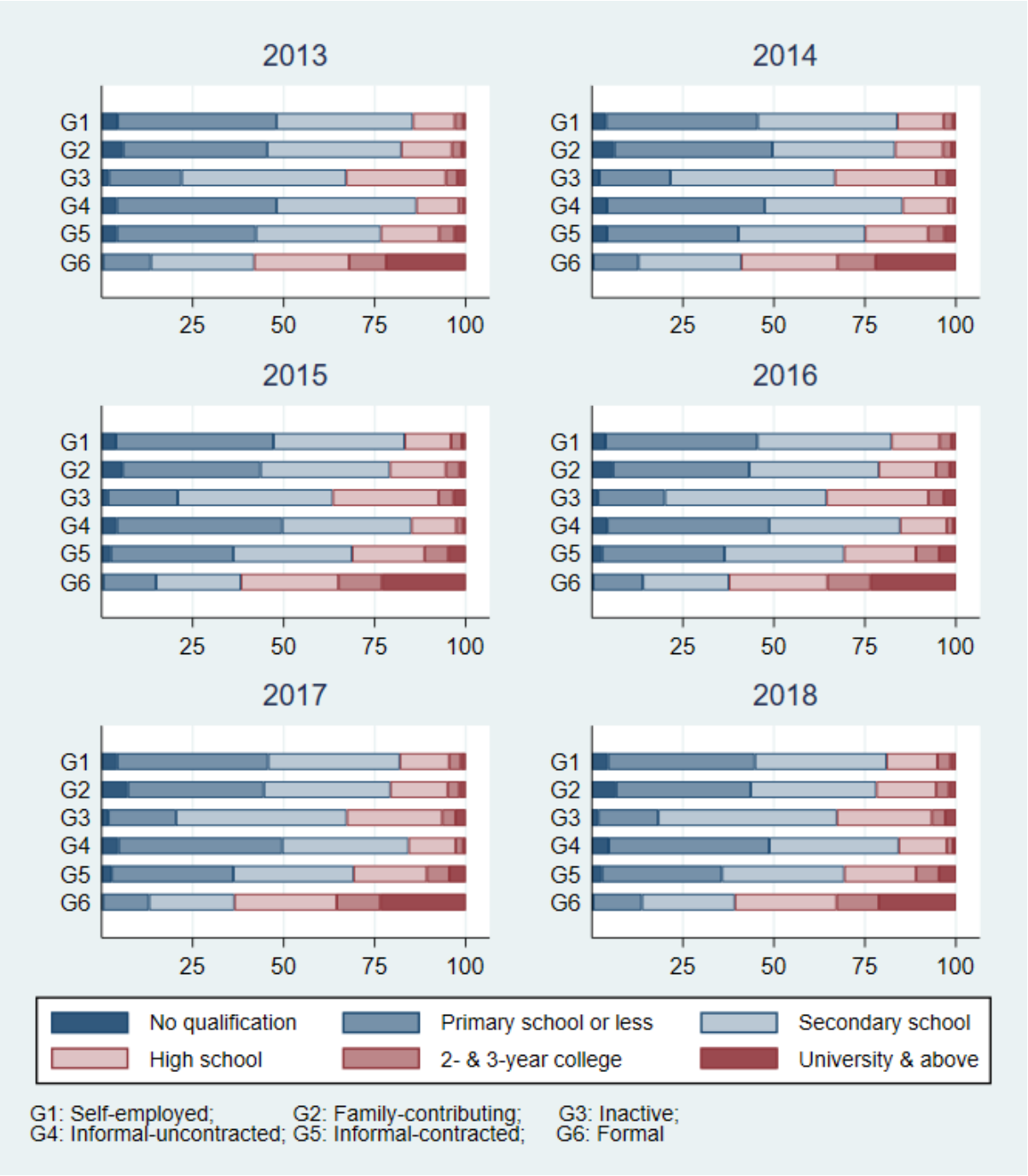
NOTES.—The reference group is informal-uncontracted firms. Linear probability estimation was used, controlling for firm's legal type and industry, and district fixed effects. Data from the Vietnam SME Survey, conducted by UNU-WIDER in collaboration with the Central Institute for Economic Management (CIEM, Vietnam), the Institute of Labour Science and Social Affairs (ILSSA, Vietnam), and the Development Economics Research Group (DERG) at the University of Copenhagen. Details of the survey can be found at `https://www.wider.unu.edu/database/viet-nam-sme-database`. The numbers of observations are 2,108 (SME 2008) and 2,037 (2014). The share of inspected firms were 35.7%, 51.9%, and 73.8% among informal-uncontracted, informal-contracted, and formal firms in SME 2008, respectively. These figures were 18.6%, 37.3%, and 48.0% in SME 2014.

FIGURE 3.C4.—KERNEL DENSITY ESTIMATION: NUMBER OF INSPECTIONS PER 10,000 WORKING-AGED PEOPLE



NOTES.—This figure plots densities of the number of inspections per 10,000 working-aged people (15–59 years old, excluding people with disabilities) at the province level. Population data are from the LFS between 2013 and 2018, weighted by the sampling weights.

Figure 3.C5.—Share of Workers by Educational Attainment



Notes.—This figure plots shares of workers by educational attainment for each type of employment: Self-employed, family-contributing, inactive, informal-uncontracted, informal-contracted, and formal workers, respectively. Data are from the LFS 2013–2018, weighted by sampling weights.

3D Additional Tables

TABLE 3.D1.—FRACTIONS OF NEW RECRUITS FROM NONEMPLOYMENT

	2014	2015	2016	2017	2018
Fractions of recruits from nonemployment					
Formal	.53	.48	.49	.43	.43
Informal-contracted	.58	.50	.49	.47	.46
Informal-uncontracted	.52	.46	.46	.39	.43
Excluding seasonally (temporarily) laid off/waiting for jobs					
Formal	.43	.42	.42	.39	.38
Informal-contracted	.41	.39	.38	.40	.38
Informal-uncontracted	.34	.31	.33	.29	.30
Number of observations					
Formal	2,063	3,701	3,321	3,342	3,940
Informal-contracted	6,172	8,086	7,094	6,605	6,283
Informal-uncontracted	3,106	4,215	3,854	3,891	4,236

NOTES.—Data from new recruits (job tenure less than 1 year) in the LFSs between 2014 and 2018, weighted by the sampling weights.

TABLE 3.D2.—EMPLOYMENT EFFECTS BY MONOPSONY POWER

	Formal	Informal		Family	Self-employed
		contracted	uncontracted	contributing	
	(1)	(2)	(3)	(4)	(5)
lrMW	.124***	.041	–.080	–.074	–.032
	(.037)	(.058)	(.059)	(.058)	(.062)
lrMW*dHHI	.005	–.033**	.026*	–.012	.012
	(.011)	(.014)	(.015)	(.020)	(.021)
R-sq	.938	.677	.691	.796	.747
Within R-sq	.117	.031	.047	.089	.094
Mean of DV	.100	.080	.095	.187	.421
Observations	4,014	4,014	4,014	4,014	4,014
No. of districts	669	669	669	669	669

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. Two-way fixed effects regressions (year and district). Robust standard errors in parentheses, clustered at the district level. The table displays only coefficients on minimum wage variables. Data are from LFS 2013 to 2018. Dependent variables are employment as percentage of total employment. Control variables include shares of population age below 15, 15–19, 20–24, and above 60 years; shares of illiterates, secondary, high, and vocational school, university, and higher education graduates; urban population; share of public sector employment; share of employment in manufacturing workers in other districts within the province (not limited to employees); and log of the number of registered firms in industries with the highest labor-accident rates in the previous year.

TABLE 3.D3.—MINIMUM WAGE EFFECTS ON WORKING HOURS

Dependent variable (log)	Employee	Formal	Informal	
			contracted	uncontracted
	(1)	(2)	(3)	(4)
Average working hours (actual)	.067	–.021	.078	.054
	(.060)	(.068)	(.082)	(.077)
Total working hours (actual)	–.253	.035	.493	–.939
	(.379)	(.586)	(.673)	(.750)
Total working hours (usual)	–.272	.071	.444	–.956
	(.385)	(.593)	(.677)	(.744)
Observations	3,985	3,794	3,905	3,916
Number of districts	667	652	656	658

NOTE.—*** $p < .01$, ** $p < .05$, * $p < .1$. Two-way fixed effects regressions (year and district). Robust standard errors in parentheses, clustered at the district level. The table displays only coefficients on minimum wage. Data are from the LFSs between 2013 and 2018. Dependent variables are district-level actual and usual working hours during the last 7 days. Control variables include shares of population age below 15, 15–19, 20–24, and above 60 years; shares of illiterates, secondary, high, and vocational school, university, and higher education graduates; urban population; share of public sector employment; share of employment in manufacturing workers in other districts within the province (not limited to employees); and log of the number of registered firms in industries with the highest labor-accident rates in the previous year.

TABLE 3.D4.—ROBUSTNESS CHECK: NONZERO SAMPLE

	Employee	Formal	Informal	
			contracted	uncontracted
	(1)	(2)	(3)	(4)
lrMW	.129**	.113***	.050	–.032
	(.051)	(.041)	(.058)	(.057)
enforce	.079	.056	–.160**	.179**
	(.098)	(.070)	(.081)	(.084)
lrMW*enforce	–.010	–.007	.021**	–.023**
	(.013)	(.009)	(.010)	(.011)
R-sq	.912	.934	.665	.671
Within R-sq	.056	.118	.030	.047
Mean of DV	.303	.118	.087	.098
Observations	3,312	3,312	3,312	3,312
No. of districts	552	552	552	552

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. Two-way fixed effects regressions (year and district). Robust standard errors in parentheses, clustered at the district level. The table displays only coefficients on minimum wage and enforcement variables. Data are from the LFSs between 2013 and 2018. Dependent variables are employment as percentage of total employment. Control variables include shares of population age below 15, 15–19, 20–24, and above 60 years; shares of illiterates, secondary, high, and vocational school, university, and higher education graduates; urban population; share of public sector employment; share of employment in manufacturing workers in other districts within the province (not limited to employees); and log of the number of registered firms in industries with the highest labor-accident rates in the previous year.

Chapter 4

Minimum Wage, Firm Revenue, and the Role of Product Switching

4.1 Introduction

Since the early history of labor economics, the minimum wage has always been an important yet controversial topic. Labor economists and policymakers have long debated for the pros and cons of this policy.[66] Recently, the minimum wages has received significant attention the world over because several countries have imposed their minimum wage policy for the first time (e.g., Germany, Malaysia, Myanmar, etc.,) and many others have raised their minimum wages to considerable levels.[67]

Given the increasing availability of comprehensive firm-level data in many countries, researchers are now shifting their minimum wage studies toward non-employment responses of affected firms, especially output prices, to better capture its welfare effect.[68] Using firm-product level data in Vietnam, this study touches a new aspect of minimum

[66] An extensive amount of work has concentrated on the employment effect of the minimum wage, especially among teenage workers, who are arguably the most affected group (see, for example, Card and Krueger, 1995; Brown, 1999; Neumark and Wascher, 2007; Neumark and Munguía Corella, 2021)

[67] According to the Global Wages Report 2020–21 (ILO, 2020), over half the countries adjusted their minimum wage once every two years during the 2010s. Additionally, about three quarters of countries raised their minimum wages in this period.

[68] See Clemens (2021) for a detailed discussion on the mechanism underlying of non-employment response and a review of relevant empirical studies in the literature.

wage: The product switching response and its role in enhancing firms revenue. Specifically, this chapter first estimates the minimum wage effect on firm's revenue and trace the source of revenue response at the product level. Second, I examine the indirect effect of the minimum wage on manufacturing firms through the product switching channel, which is extended from the theoretical framework developed by Bernard, Redding, and Schott (2010) (BRS). Traditional assessments of the minimum wage effect on output prices may be misleading if they fail to account for product switching. The current study finds that nearly half the manufacturing firms in Vietnam add and drop products each year and these practices are partly affected by the minimum wage. Newly added products contribute to nearly half the the revenue growth in a four-year window. This emphasizes the importance of product switching in the manufacturing sector.

In the literature, the standard model of the competitive labor market predicts that a binding minimum wage will unambiguously lead to a fall in employment. This prediction relies on the assumption that the output market is perfectly competitive; and that therefore, firms are price takers in this market. The minimum wage then leads to higher prices if and only if it affects all firms in the industry or economy. Earlier studies often estimated the minimum wage effect on price at the economy (consumer price index) or industry-wide level [see Lemos (2008) for a review on the price effect of the minimum wage]. However, recent papers have cast doubts on this perfect competition assumption and tested the pass-through effect of the minimum wage on output prices at the firm level. Leung (2021) and Renkin et al. (2022) both estimated the price pass-through effect in the retail sector in the US. They found that a 10% increase in the minimum wage led to 0.6–0.8% (Leung, 2021) or 0.36% (Renkin et al., 2022) increases in the grocery store-level price index. Harasztosi and Lindner (2019) examined how Hungarian firms responded to the minimum wage hike in 2000. They found that total revenue increased significantly among firms affected by the minimum wage hike and explained this effect by response in output prices. However, without taking into account product switching responses, one may omit a subset of firms that completely change their product mix after a minimum wage shock. If the firm's decision to change product mix is correlated with the minimum wage, estimates on the constructed firm-level price index may not fully

capture the minimum wage effect.[69]

The shift from employment toward non-employment responses indeed reflects that the minimum wage policy is more than just an instrument that regulates the standard wage. The minimum wage may affect social welfare of those who are at the bottom of the income distribution. By decomposing the change in labor cost relative to revenue, Harasztosi and Lindner (2019) found that consumers bear almost three-quarters of the minimum wage cost in Hungary. MaCurdy (2015) and Neumark (2021) discussed the antipoverty efficacy of the minimum wage policy in the US. Another set of studies considered the effect on consumption a welfare indicator at the household level (Yamada, 2016) or the regional level (Alonso, 2022).

The minimum wage literature presents a limited number of papers that directly estimate the minimum wage effects on the total revenue of firms and none of them decompose the revenue effect by its components. One possible explanation is that theories often predict an unambiguous revenue effect if firms do not have market power in setting output prices.[70] The ambiguity arises when firms can adjust their output prices. In this case, the minimum wage may affect output quantity and prices in the opposite direction, implying an ambiguous effect on revenue.[71] Owing to this ambiguity, only a few recent papers have examined and estimated the price and revenue effects (see, e.g., Harasztosi and Lindner, 2019; Leung, 2021). However, these and other papers using firm-level data only discussed how firms responded to the minimum wage shock by adjusting their output prices or switching inputs. By utilizing product-level data, this study argues that switching outputs is a promising option for manufacturing firms. The extent to which firms can set output prices is probably controversial but it is less likely that SMEs in developing countries can compete with large or foreign enterprises by raising output prices. Therefore, analyzing the minimum wage effects on revenue and its components can shed new light

[69]Leung (2021) and Renkin et al. (2022) estimated the minimum wage effect on the store-level price indices in the retail sector, whereas Harasztosi and Lindner (2019) considered the effect on firm-level Laspeyres price index in the manufacturing sector.

[70]For example, raising the minimum wage reduces employment in a competitive (labor) market, and output quantity and revenue given fixed output prices. Similarly, the monopsony model predicts an increase in employment in response to a moderate minimum wage hike. Output quantity and revenue should increase in this case if output prices are fixed.

[71]See Aaronson and French (2007) for a detailed discussion on the minimum wage effects on employment and output prices in both perfectly competitive and monopsonistic labor markets.

on how we understand the mechanism underlying the firm's decision in a low-wage labor market.

In practice, product switching is a common strategy and is proven to be frequent among manufacturing firms. For example, 54% of manufacturing firms in the US conducted product switching between 1987 and 1997 (Bernard et al., 2010). This was smaller at 33% in Japan in the preceding financial crisis between 1998 and 2003 (Kawakami and Miyagawa, 2013). In Brazil, manufacturing exporters who changed their product mix accounted for over 80% of the total exports to the world (Timoshenko, 2015). In Vietnam, around 70% of the manufacturing firms added new product(s) and/or dropped old ones during the 2010–2016 period. This implies that in addition to the commonly known strategies (i.e., reducing employment, improving labor productivity, and raising output price), manufacturing firms may respond to minimum wage hikes by changing their product portfolio (i.e., dropping less and adding new profitable products). This study tests this hypothesis and examines the indirect effect of a sharp minimum wage hike on firm outcomes via the product switching channel.

This chapter contributes to the literature in several ways. First, it adds new empirical evidence to the growing literature on the non-employment response of firms. It directly estimates the minimum wage effect on firms' revenue and traces the source of revenue response. After the minimum wage reform in 2011, manufacturing and non-manufacturing firms in Vietnam did not, or would not be able to, rely on output price adjustments. Second, this study highlights the importance of product switching as a means of responding to the minimum wage shock. It found that the minimum wage significantly raised the probability of changing product portfolio among manufacturing firms. As predicted by the BRS theoretical framework, manufacturing firms that changed their product portfolio experienced better outcomes in the medium and longer run, especially in terms of sales revenue. Empirical findings from this study suggest that through product switching, manufacturing affected by the minimum wage can improve their sales and partially mitigate the disemployment effect. These pieces of empirical evidence contribute to the literature by revealing an under-studied mechanism by which firms, or at least manufacturing firms, respond to a sharp minimum wage hike. In the output market, firms facing a minimum wage hike may choose to raise their output prices or switch

to other products that give them greater profitability. Whereas Harasztosi and Lindner (2019) and other recent papers focused on pricing behavior, this study provides a complementary analysis on product switching behavior. Third, this study contributes to the product switching literature by exploiting an exogenous shock to firm-level productivity. Given the increasing globalization and its subsequent demand shocks, studies have often considered product switching behaviors of exporting firms.[72] This strand of literature lacks a focus on the effect of an exogenous firm-level productivity shock on firm choices.[73]

The rest of this chapter is organized as follows. Section 4.2 discusses the minimum wage reform in 2011. Section 4.3 introduces the data used in this study and defines the minimum wage treatment. Section 4.4 examines the minimum wage effects on firm sales revenue and its components, including the quantity and price effects. Section 4.5 discusses how the minimum wage reform affects firm product switching behavior. This section also estimates the indirect effect of the reform on firms' later outcomes through the product switching channel. Finally, Section 4.6 concludes this chapter.

4.2 The Minimum Wage Reform in Vietnam

In Vietnam, the government reformed the minimum wage system in 2011, which serves as an interesting case study for understanding the effects minimum wage on firm-level adjustments. In the pre-reform period, the minimum wage was applied only to foreign-related firms (i.e., foreign firms and joint stock companies between foreign and Vietnamese investors). For domestic private firms, the government used the base salary applied to the public sector as a benchmark. This salary was extremely low when compared to the minimum wage applied to foreign firms and the average wage in the domestic sector.[74]

[72]For example, Ma, Tang, and Zhang (2014) and Wu, Li, and Zhao (2022) focused on Chinese exporters whereas Timoshenko (2015) studied Brazilian ones. Bernard and Okubo (2016) explored the product switching behavior of manufacturing firms in Japan over the business cycle but were also aware of the lack of an exogenous shock at the firm level to identify changes in product adding and dropping.

[73]One study that is close to this paper is Álvarez and Navarro (2017), who examined the effect of minimum wage on the creation and destruction of products. However, their model specification was not backed by a strong theoretical framework and their usage of the minimum wage level as a treatment variable did not reflect an exogenous shock on firm-level productivity.

[74]Depending on various factors (e.g., rank, class, etc.), public and civil servants receive the base salary multiplied with a multiplier ranging from 1.35 to 8.40. The classification is stated in

The reform resulted in a sharp increase in the minimum-to-average wage paid by domestic firms, which were previously not subject to any minimum wages. This generated an exogenous shock on the labor cost facing domestic firms that were paying lower than the minimum wage.

In 2009, the government took the first step in the reform process and categorized all districts, or second-tier administrative units, into four groups and applied different levels of minimum wage.[75] The initial minimum wage was set differently for the domestic and foreign sectors.[76] From 2009 to 2011, the minimum wage was raised faster for domestic firms to catch up with that for foreign firms. In October 2011, the final step was taken place with a sharp increase in the minimum wage for domestic private enterprises. Both domestic and foreign sectors were then subject to the same minimum wage levels. Although the reform began in 2009, the first few hikes did not change the labor market structures significantly and were merely sufficient to compensate inflation (Figure 4.1). In contrast, the final hike in October 2011 completely reshaped the market by raising the minimum wage relative to the average and median wages.

<Insert Figure 4.1>

Figure 4.1 shows that the minimum-to-average income of workers in registered enterprises increased from less than 30% before to nearly 50% after the 2011-hike. The change in the (imputed) minimum-to-median wage or the Kaitz index was even more striking, from around 35 to 65%. This sharp increase in the minimum wage allows us to examine its effects on firm performance and adjustments.

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the Decree of Government No. 204/2004/ND-CP of December 14, 2004. The English translation can be found at: `https://luatminhkhue.vn/en/decree-of-government-no-204-2004-nd-cp-of-december-14th--2004--on-salary-regime-for-cadres--public-servants--officials--and-armed-force-personnel.aspx` (accessed on January 29, 2023)

[75]Chapter 3 discusses the geographical variations in the minimum wage. In this chapter, registered firms in the base sample located their factories before the reform, so that geographical variations can be treated as exogenous to them.

[76]The government pioneered the new minimum wage system in 2008 by applying a slightly higher level than the base salary for firms in Hanoi and Ho Chi Minh City, two economic centers in Vietnam.

4.3 Data and Minimum Wage Treatment

4.3.1 The Vietnam Enterprise Survey

This study utilizes large-scale establishment data, the VES, which is conducted annually by the GSO. The VES covers all registered firms with employment size above a certain threshold, which varies across provinces and generally increases over time. For smaller enterprises, a sample of 10–20% of firms were chosen for the survey. For the rest of the registered firms, the GSO creates a list and collects basic information such as legal type, total employment, and industry.

The VES comprises of a main module for all firms and specific modules for firms in different industries. This study examines the minimum wage effects using the *Main* and following specific modules: *Industrial Production* (Manufacturing), *Accommodation Business*, and *Construction*. The sampling criteria and details of each module are provided in Tables 4.G1 and 4.G2. The VES is an appropriate data set for analyzing the minimum wage effects on firm-level responses given its scale and objects. Legally registered enterprises, objects of the VES, are among the main targets of the minimum wage policy and are usually better at complying with the policy than are informal employers.

This study focuses on firms that that existed between 2008 and 2010 as they had experienced the whole reform, from the initial step in 2009 to the final hike in 2011.[77] Firms in the agriculture sector and firms providing services related to the state (e.g., national defense, public security, etc.,) are excluded. To improve the data quality, this study also excludes the following sets of firms: Firms with an average employment size below five employees before the hike, and firms belong to both the top and bottom 1% employment and revenue growth during the 2008–2010 period. Firms in both the top and bottom 1% experienced more than 500% increase and 80% drop in revenue and/or employment during the pre-reform period. This study further drops firms with an average labor cost below 80% of the current minimum wage each year before the hike because

[77]This paper selects firms that were surveyed in all rounds in the pre-reform period and drops firms with missing values in labor, wage/income, and revenue at any time during the 2008–2010 period.

they were not likely to comply with the law after the hike.[78] These restrictions reduce the impact of outliers and do not substantially affect the main results. For manufacturing firms, this study removes outliers that had extreme price or quantity growth, using data from the *Industrial Production* module (5% of observations in each tail). These firms experienced over 5 times increase or decline in price or quantity components relative to revenue growth (Section 4.4). These observations did not indicate the same product over time, though they had the same product code.

Additionally, this study omits irrelevant firms in the base sample. It excludes pure SOEs and collectives owing to the differences in wage settings. The wage scheme of SOEs with 100% state capital is heavily regulated by the local and central governments whereas collectives, which comprise of many individuals, are not a legal type of enterprise. Collectives usually hire non-casual workers for a short period of time (e.g., 1–2 days to 1–2 weeks) and pay them a lump-sum payment.

The final sample covers around 29,300 registered firms with total employment of around 4 million (the universe of firms in 2010 include around 286,300 registered firms with total employment of nearly 10 million). Around one-third of the base sample is manufacturing firms. Table 4.1 reports the statistical summary of main variables in the pre-reform period.

<Insert Table 4.1>

4.3.2 Defining the Minimum Wage Treatment

Given the data structure, this study defines the minimum wage treatment using the firm's average wage bill. The minimum wage binding dummy takes the value of 1 if, during the pre-reform period (2008–2010), the firm paid an average income per paid worker less 1.1 times the new minimum wage in October 2011, and 0 otherwise.[79] However, using

[78]Since the noncompliance and imperfect enforcement issues are not the main target, they are acknowledged but are not addressed in this chapter. Chapter 3 discusses the minimum wage effect under different levels of enforcement in Vietnam.

[79]Parameter 1.1 captures the measurement error and the fact that a firm wage bill in the VES includes both wage, bonuses, and the like. Other thresholds are considered to check for the robustness of this parameter.

the average wage to define minimum wage treatment raises concerns over its coverage. If heterogeneity in labor force structure exists (i.e., different share of minimum wage workers), the binding dummy may not be appropriate because "binding" firms may include high-wage workers, and "non-binding" firms include low-wage ones. Ideally, the share of exposed or affected workers should be used as the minimum wage treatment [e.g., at the state level (Card, 1992); or at the firm-level (Harasztosi and Lindner, 2019)]. However, the firm-level measure of the "fraction affected" requires an employer-employee matched data set, which is usually unavailable in many developing countries.

To overcome this issue, Draca et al. (2011) used the firm's average wage to define minimum wage treatment and verified its validity by pointing out a strong negative correlation between a firm's average wage and share of workers being paid less than the minimum wage level. In Vietnam, the VES in 2009 provided additional information on employment and wage bill by four types of employees: Managers, professionals, manufacturing workers, and administrative/service staffs. Appendix 4A shows that low-wage firms had an extremely high share of workers affected by minimum wage. This implies that the binding dummy used in this study can represent firms that were truly affected by the minimum wage reform.

In addition to the above issue, any non-experimental evaluation of treatment effects encounters the identification thread: Changes in outcomes of nonbinding firms may not be treated as counterfactual changes for binding ones. In Vietnam, the minimum wage varied across districts when it was first imposed in 2009 and firms chose their location independently before the reform. Therefore, the binding dummy, which also takes variations in minimum wage across districts into account, is exogenous in this aspect. In another aspect (i.e., the minimum wage hike), the binding dummy is constructed by averaging the wages paid in the pre-reform period from 2008 to 2010. Besides the institutional reason, this construction can help mitigate pre-trend issues if exist (Appendix 4B). Nevertheless, this study tests the pre-reform parallel trend assumption by estimating the outcome changes in 2008–2010, using data from the same control and treatment groups. If this assumption is valid, there would be no significant difference across groups.

4.4 Minimum Wage and Firm Revenue

4.4.1 Revenue Decomposition

Generalized Decomposition

In practice, firms, both manufacturing and non-manufacturing, may diversify and change products to maximize their profit. This study decomposes the total operating (or sales) revenue as the sum of the sales revenue of all products ($V = \sum V_i$). Allowing for changes in the product portfolio, the change in total sales revenue can be expressed as follows:

$$V_1 - V_0 = \sum_i (V_{1,cont} - V_{0,cont}) + \sum_j V_{1,new} - \sum_k V_{0,old}$$

where i, j, and k indicate continuing, newly added, and recently dropped products, respectively. This study defines a product as continuing if it was included in the firm's portfolio in both year 1 and the base year 0. A product is considered newly added if it was produced or sold in year 1 but not in year 0. Recently dropped products refer to those that were produced or sold in year 0 but not in year 1. Relative to the base year, the change in total sales revenue can be decomposed by: (i) sales revenue of continuing products; and (ii) revenue differentials between newly added and recently dropped products:

$$\frac{V_1 - V_0}{V_0} = \frac{\sum_i (V_{1,cont} - V_{0,cont})}{V_0} + \frac{\sum_j V_{1,new} - \sum_k V_{0,old}}{V_0} \tag{4.1}$$

The sales revenue for continuing products can be further decomposed by quantity and price changes (the subscript *cont* has been dropped for simplicity):

$$\begin{aligned} \frac{\sum_i (V_{1,cont} - V_{0,cont})}{V_0} &= \frac{\sum_i (p_1 \times q_1 - p_0 \times q_0)}{V_0} \\ &= \frac{\sum_i (p_1 \times q_1 - p_1 \times q_0)}{V_0} + \frac{\sum_i (p_1 \times q_0 - p_0 \times q_0)}{V_0} \\ &= \frac{\sum_i \frac{q_1 - q_0}{q_0} \times p_1 q_1}{V_0} + \frac{\sum_i \frac{p_1 - p_0}{p_0} \times p_0 q_0}{V_0} \end{aligned} \tag{4.2}$$

In the literature, the second term is often analyzed to estimate the minimum wage effect on output prices (see, e.g., Harasztosi and Lindner, 2019; Leung, 2021; Renkin et al., 2022). However, this component contributes only partly to the minimum wage effect on revenue, and thus, impacts the manner in which firms respond to the shock. Firms may not necessarily pass the cost onto their customers if they switch their product portfolio instead of raising output prices. This section examines the minimum wage effects on quantity and price change components.

Although decomposition in Equations (4.1) and (4.2) can be applied to any type of firm, firm-product level data are often available for manufacturing firms alone. In the VES, the *Industrial Production* module covers all manufacturing firms surveyed in the *Main* module. The data include information on quantity produced and sold, and sales revenue of all products, which enables the decomposition of the minimum wage effect on firm sales revenue. In the non-manufacturing sector, we do not usually observe price information but for two specific sectors, the VES provides data on the volume and value of service provided by firms to their customers. This paper decomposes the revenue effect by quantity and price of firms in these non-manufacturing sectors.

The Case of Manufacturing Firms

In several developing countries, manufacturing industries are often dominated by large or foreign-invested firms. Consequently, domestic firms, especially SMEs, conduct manufacturing activity and industrial processing services to supply intermediate or final products to larger firms. In Vietnam, around 15% of manufacturing firms provide industrial processing services to other firms (Table 4.2), which implies that these firms do not directly sell products in the output market and do not have market power to set output prices. Simply averaging the product unit price may not necessarily reflect the output price in the market if a firm conducts industrial processing services. Given the two types of activity that a manufacturing firm can perform, Equation (4.1) becomes:

$$\frac{V_1 - V_0}{V_0} = \frac{\sum_i \left(V^m_{1,cont} - V^m_{0,cont}\right)}{V_0} + \frac{\sum_j V^m_{1,new} - \sum_k V^m_{0,old}}{V_0} + \frac{V^p_1 - V^p_0}{V_0} \tag{4.3}$$

where superscripts m and p indicate manufactured and industrial processed products,

respectively.[80] In the firm-product level data, both V^m and V^p can be observed (in quantity sold and sales revenue) but V^p does not reflect the sale price of product i set by the firm. Relative to the base year, the change in total sales revenue of manufacturing firms now can be decomposed through the (i) sales revenue of continuing products; (ii) revenue differentials between newly added and recently dropped products; and (iii) revenue from industrial processing services.[81]

<Insert Table 4.2>

Figure 4.2 decomposes the revenue change for manufacturing firms from 2011 to 2014 compared to the base year 2010. On average, continuing products contributed the largest share to firm revenue growth, althought the share declined over time. Newly added products contributed a significant part to the firm revenue growth. In an one-year window, less than a quarter of revenue growth came from the differential between newly added and recently dropped products, but this share increased to nearly 40% in a four-year window.

<Insert Figure 4.2>

4.4.2 Model Specification

This section estimates the minimum wage effects on firm revenue and its components by following the literature (e.g., Draca et al., 2011; Harasztosi and Lindner, 2019). Owing to the lack of an employer-employee matched data set, this study uses the minimum wage binding dummy as the treatment variable. The model specification is as follows:

$$\frac{y_{j,t} - y_{j,2010}}{y_{j,2010}} = \alpha_t + \beta_t Bind_j + \gamma_t X_j + \delta_t D_j + \varepsilon_{jt} \tag{4.4}$$

where subscripts j and t indicate individual firm and year, respectively. Dependent variables include the percentage change in outcome y between year t and 2010. $Bind_j$ is

[80] Changes in processing products are not usually decided by firms, but their clients. Therefore, this study does not decompose the sales revenue of processing products.

[81] The *Industrial Production* module asks the firm to list all their products so that we can track whether the firm drops old or adds new product(s). However, a firm may re-add a product to their production line in year t after one or more years of abolishing it. In such cases, this study treats the product as continuing in year t but recently dropped in year $t-1$.

the minimum wage binding dummy defined in the previous section. The set of control variables, X_i, includes firm age and legal type in 2010, and the average of following outcomes and their squares during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets. To take into account the survey stratification, this study includes the province and two-digit industry fixed effects and cluster the standard errors at the fixed effects level. The set of initial minimum wage group dummies D_j captures its initial geographical variations.

4.4.3 Heterogeneous Revenue Response

Table 4.3 presents the estimated minimum wage effects on total revenue using data from the Main module. Despite the negative employment effect (Appendix 4C), binding firms experienced significantly higher revenue growth in the short- and medium-term (Panel A).[82] However, these increases were driven by non-manufacturing firms (Panel B) whereas the revenue effect among manufacturing firms is insignificant and close to null (Panel C).

<Insert Table 4.3>

Panels D and E divide manufacturing firms into those that completely changed their product portfolio (so that no price and quantity decomposition could be constructed) and that kept at least one product in their portfolio. Firms in these two groups experienced revenue growth differently. Binding firms in the latter group experienced a significant drop in sales revenue when compared to nonbinding ones. This suggests that product switching may play an important role among manufacturing firms.

4.4.4 Revenue Effect Decomposition

Manufacturing Firms

Given the availability of firm-product level data, this study decomposes the minimum wage effect on the total sales revenue and tests whether manufacturing firms in Vietnam

[82] Appendix 4C estimates the employment effects in the short- and medium-term. The sharp minimum wage hike led to lower employment and higher average wage (and labor cost per worker). One may predict that lower employment leads to lower output and revenue if output prices are fixed.

were able to pass their burden onto their customers. Based on Equation (4.3), Table 4.4 reports the minimum wage effects on sales revenue and its components of all manufacturing firms. Table 4.5 focuses on the sub-sample of manufacturing firms that produced at least one continuing product, so that price and quantity components from Equation (4.2) can be constructed. Both tables show the minimum wage effects on the percentage change in each revenue component relative to the total revenue in the base year 2010.

Similar to the previous subsection, estimated coefficients from Table 4.4 indicate an insignificant effect on total sales revenue among affected manufacturing firms. Interestingly, the sales revenue responded to the minimum wage hike differently, depending on the type of product. Despite the fact that continuing products contributed to over half the revenue growth (Figure 4.2), the sales revenue of these products were adversely affected by the minimum wage hike. Relative to non-binding firms, binding firms experience 9.5 percentage points lower in revenue growth of continuing products. The minimum wage effect on the sales revenue of newly added products almost offset the negative effect on sales revenue of continuing products, although the coefficients were insignificant. Industrial processing services did not help firms raise their revenue after the hike. These results suggest that binding firms relied on new products rather than old ones in response to the negative minimum wage shock.

<Insert Table 4.4>

Columns (3) and (4) in Table 4.5 present significant declines in total sales revenue and sales revenue of continuing products among affected firms in the medium-run. Owing to the sample selection strategy, comparing the estimated effect on total sales revenue from Tables 4.4 and 4.5 provides insightful interpretation. The effect turns from almost null (Table 4.4) to (marginally) significantly negative (Table 4.5), implying that firms that did not change their portfolio experienced revenue loss relative to those that did so, especially in the medium-run. This is consistent with the results in Table 4.3.

<Insert Table 4.5>

Although coefficients on price and quantity components are insignificant at the conventional levels, their directions and magnitude are still of use. The decline in sales revenue of continuing products was likely to be caused by the decline in output, given the negative employment effect (see Figure 4.F3). There was no evidence that manufacturing

firms in Vietnam could pass the increasing cost onto their customers by raising output prices.[83] The estimated effect on the price component is positive but far from significant. Meanwhile, the estimated effect on the quantity index is negative and closer to the margin of significance. Appendix 4D decomposes the minimum wage effect on the sales revenue of continuing products by constructing price and quantity indices, instead of price and quantity components presented in Equation (4.2). The construction of this price index is in line with the recent literature mentioned in Section 4.1. The minimum wage hike significantly reduced the quantity index of binding firms, implying that it negatively affected both total employment and output quantity of these manufacturing firms. This is consistent with the field survey finding that almost two-thirds of the firms interviewed could not raise output prices in response to a negative shock to the total operating cost (see Table A1 in the Appendix at the end of this dissertation).

However, the analysis in this subsection is crucially conditional on: (i) surviving manufacturing firms; and (ii) firms that kept at least a subset of the same products. The estimated price and quantity effects reported in Table 4.5 may not fully reflect the minimum wage effect if any two conditions are correlated to the minimum wage hike. As seen in Appendix 4C, the hike led to a significantly higher probability of quitting, but the effect was rather small (1.8 to 3.4 percentage points). The effect cannot be decomposed by quantity and price components for almost half the manufacturing firms because of the changes in their production portfolio. Therefore, the price and quantity analysis presented in this study does not take into account any newly added or recently dropped products. The estimates in this study, and perhaps others estimates on the output price effect, are likely to be biased, possibly upward because firms that remain in a specific product market should have more power in price setting than any newcomers. If this assumption is true, the revenue changes may not come from changes in output price or quantity. Therefore, it is necessary to take product switching into consideration while analyzing the minimum wage effects.

[83]This finding suggests that manufacturing firms in Vietnam do not have sufficient monopolistic power in the output market to raise prices, which is different from the Hungarian case. To the best of the author's knowledge, the literature on monopolistic power of Vietnamese firms has paid more attention on SOEs. Doan and Stevens (2012) shared a similar observation with this study. They assessed the evolution of monopoly by industry in the 2000s and found that monopolistic power, measured by price-cost margin and profit elasticity, were lower and in a declining trend among manufacturing firms.

Non-manufacturing Firms

Tables 4.6 and 4.7 present two pieces of evidence that the minimum wage hike did not result in higher prices in the accommodation business and construction sector. In the base sample, the construction sector accounted for 29% of firms and 46% of employment in all non-manufacturing firms in the base year 2010. Nearly 6% of firms and 4% of employment are in the accommodation business.[84] Another advantage the *Accommodation Business* module is that it covers all registered firms in this sector in all rounds (Table 4.G1).

Table 4.6 shows the minimum wage effects on around 1,000 hotels and accommodation businesses (hotels for short), which accounted for nearly 20% of all registered hotels in 2010. Estimates for all available firms are presented in columns (1)–(3), whereas those for firms available in all years in the post-reform period are reported in columns (4)–(6).

Panels A and B report the minimum wage effects on the average service fee (proxy of output price) and total number of guest-days (output quantity). Coefficients in panel A suggest that binding hotels did not raise their service prices after the minimum wage hike. In the pre-reform period, the negative coefficient in Column (3) implies that the service fee was on a declining trend from 2008 to 2010. However, this trend broke after the hike and in the medium run, the effect on service fee was null or even (insignificantly) negative if anything at all. Binding hotels attracted about 6.5 percentage points more guest-days in the medium run relative to nonbinding hotels. The coefficient is significant at the conventional significance level when the sample was restricted to hotels that were available across all survey rounds after the hike.[85] Thanks to a higher number of guest-days, revenue from accommodation service of binding hotels increased significantly in the medium run, by 9.2 percentage points relative to nonbinding hotels (panel C). These findings confirm that the positive revenue response of firms in this service sector was not triggered by an increase in output prices.

<Insert Table 4.6>

[84] A vast majority of firms and employment concentrated in wholesale and retail services (37% of firms and 22% of employment). However, in the specific module for wholesale and retail firms, there is no information on types and volumes of product sold by firms. Therefore, the minimum wage effect on output prices cannot be estimated.

[85] This sample should suffer less from outliers and provide more precise estimates, although the sample size declines.

This study found robust evidence that firms in the accommodation business reduced other side businesses and focused more on their main business. In panel D, total operating revenue among binding hotels was positively affected by the minimum wage hike only in the restricted sample. The effect was also smaller than that on revenue from the accommodation business. In panel E, the share of revenue from the main business (accommodation) was 1.6–1.9 percentage points higher for binding firms relative to non-binding ones after the hike. This may suggest an analogous type of product switching in the service sector where firms reduce the size of one business and increase that of the other.

Table 4.7 shows the minimum wage effects on the value and volume of construction projects conducted by registered firms in this industry. Construction projects are classified by the GSO with around 50 distinguished types of projects (e.g., urban/rural road, house, department, etc.). However, the firm-project data were only available for four years from 2010 to 2013 in the *Construction* module. To maximize the sample size, this subsection replaces the original binding dummy by dummy using the average wage per paid worker in the base year 2010.

<Insert Table 4.7>

The findings confirm that total operating revenue of construction firms was positively affected by the minimum wage reform. At the project level, there was no evidence that construction firms were able to raise their prices after the minimum wage hike. Both within-firm volume (quantity) and average price (value/volume) of construction projects were not significantly affected by the hike. Positive coefficients in Panels B point toward the possibility that binding firms may respond to the hike by raising their output quantity (proxied by project volume). The change in project value largely comes from a change in volume rather than in price. However, because of data limitations, the regressions in Table 4.7 could control only for firm characteristics in 2010 but not for their past performance. The binding dummy used in Table 4.7 may not fully capture the bindingness of the minimum wage during the whole pre-reform period (2008–2010).

The two examples support the finding that revenue increases among non-manufacturing firms in Vietnam were not caused by output prices, which contradicts the prediction by Harasztosi and Lindner (2019) that firms in the non-tradable sector could raise prices

without losing competitive advantage. How did they manage to do that? One possible explanation is the difference in competitiveness between Vietnamese and Hungarian firms, even in the same non-tradeable sector. Non-manufacturing industries in Vietnam comprise of a large numbers of small firms, thus, have a higher degree of competition. Therefore, firms in these industries are price-takers and cannot adjust their output prices.[86] Another potential explanation is the underlying mechanism that was not examined in Harasztosi and Lindner (2019), namely the product switching behavior of firms in response to the minimum wage hike. Firms may switch their production line toward products that give them more profitability. The next section explores this channel.

4.5 Minimum Wage and Product Switching

4.5.1 Theoretical Consideration

This section relies on the assumption that increases in the minimum wage lead to higher firm productivity and the theoretical framework of product switching proposed by Bernard et al. (2010). As this study focuses on empirical analysis, this section is brief and summarizes the main theoretical reasoning outlined in the BRS model.

First, as pointed out in Chapter 1, firms affected by the minimum wage can improve their productivity through capital deepening (labor-capital substitution), worker effort intensification, organizational restructuring, etc (Metcalf, 2008; Riley and Rosazza Bondibene, 2017). Several studies have found positive effect of minimum wage hikes on various measures of firm productivity, for example, revenue-based labor productivity and TFP (see, e.g., Riley and Rosazza Bondibene, 2017; Mayneris et al., 2018; Hau et al., 2020; Du and Wang, 2020). In the case of Vietnam, D. X. Nguyen (2019) found that value added per employee and TFP increased with the minimum wage among manufacturing firms in Vietnam. In this study, the minimum wage hike in 2011 raised labor productivity, measured by value added per worker, of binding firms by around 25 percentage points

[86] In the in-depth interviewed sample, none of manufacturing firms responded to negative shocks by improving the quantity of product sold, whereas about 22% of non-manufacturing firms tried to raise output quantity. They include 2 education, 1 accommodation, 1 construction-related, and 1 wholesale firms, respectively. See the Appendix to this dissertation.

relative to nonbinding ones (Appendix 4C). This validates the assumption that higher minimum wages led to higher firm productivity and the 2011-hike can be treated as a positive (exogenous) shock to the firm productivity.

Second, the BRS model suggests that product switching contributes to the reallocation of resources within firms toward their most efficient use. The production technology of a firm depends on its productivity, which is a firm-specific factor, and consumer taste, which is a firm-product specific factor. There exists a zero-profit consumer taste cutoff for each product above which the firm will decide to produce that product. This cutoff is negatively correlated with the firm's productivity so that the higher the productivity, the higher the probability that the firm will produce the product. Surviving firms that experience positive shock on productivity can earn higher revenues per existing product and expand their ranges of products (by adding new products).[87] Their model implies that product switching is correlated with the firm outcomes, with net adding (dropping) of products being positively (negatively) correlated. These contemporaneous responses are driven by shocks to firm productivity and firm-product profitability.

Based on the BRS model, the minimum wage may have an indirect effect to firm outcomes through the channel below:

Box 1.—Minimum Wage and Product Switching: Underlying Mechanism

$$\textbf{Minimum wage} \uparrow \xRightarrow[\textbf{firm productivity} \uparrow]{} \textbf{product switching} \Rightarrow \textbf{outcomes} \uparrow$$

In response to the higher minimum wage and increased labor cost, firms improve their productivity, either labor productivity or TFP. Higher productivity allows firms to move toward better and more profitable products and drop old products that were less profitable. These practices improve firm outcomes in later periods.

[87]In their paper, BRS tested the relationship between product switching and several measures of productivity (TFP and output per worker). Thus, the positive effects of the minimum wage on firm's TFP and labor productivity that were established in the literature are valid for this study.

4.5.2 Identification Strategy

To test the aforementioned hypothesis, this section exploits the *Industrial Production* module of the VES from 2010 to 2016. Table 4.8 shows that product switching is prevalent among manufacturing firms. Around 13–15% of manufacturing firms added or dropped product(s) each year in the sample.[88] The share of firms conducting both types of switching increased substantially over time. Relative to the base year 2010, over half the firms added and dropped product(s) after five years, compared to the rate of 30% after one year. The prevalence of product switching implies that one should not ignore this while examining the minimum wage effect on firm-level adjustment, especially output prices.

<Insert Table 4.8>

This section first examines how the minimum wage affect the probability that firms add new product(s) into their portfolio. Following BRS, the model specification is as follows:

$$Add_{j,t} = \alpha_t + \beta_t Bind_j + \delta_t D_j + \varepsilon_{j,t} \tag{4.5}$$

where subscripts j and t indicate individual firm and year, respectively. $Add_{j,t}$ is a binary dummy indicating firms adding new product(s) any time between year t and 2010. This dummy reflects the cumulative probability of adding new products in year t. $Bind_j$ is the minimum wage binding dummy defined in the previous section. The two-digit industry and province fixed effects are controlled. Standard errors are clustered at the fixed-effects level. Minimum wage grouping dummies are also included.

In the original equation, BRS estimated the equilibrium relationship between initial variations in firm productivity on product adding behavior (Bernard et al., 2010, p. 87). However, this study examines the effect of an exogenous shock to firm productivity, which was caused by the minimum wage hike, on the probability of adding/dropping product(s).

[88]Manufacturing products are classified at the finest (8-digit) level (see Appendix 4D). Firms are considered as adding new (dropping old) a product in year t if the product code appear (disappear) in their portfolio in year t compared to that in year $t-1$. For example, if a firm produced chairs made by bamboo or similar materials (code 31001012) and wooden chairs (code 31001019) in 2010. In 2012, it produced wooden chairs and wooden furniture used in kitchen (code 31001022). In this case, products coded 31001019, 31001012, and 31001022 are considered continuing, recently dropped, and newly added products to this firm, respectively.

As long as the binding dummy is uncorrelated with the changes in firm productivity before the hike, controlling initial productivity is not necessary. As pointed out in Appendix 4C, the minimum wage hike raised affected firms' labor productivity without any correlation in the pre-reform period. This implies that the binding dummy used in this study reflects the exogenous shock of the minimum wage hike on product switching behavior through the productivity channel.[89]

In their "dropping" equation, BRS regressed the probability that a product was dropped from the firm's portfolio on firm-product's relative size and age (Bernard et al., 2010, p. 88). However, this study focuses on the firm-level response to an exogenous shock rather than responses at the firm-product level and performs a regression analogous to the "adding" regression as in Equation (4.5). In the BRS model, changes in productivity have asymmetry effects on adding and dropping behavior with higher productivity inducing firms to add products more frequently than to drop products.

The second step involves an assessment of how these responses relate to other outcomes, especially the firm operating revenue and total employment. As Bernard et al. (2010, p. 82) indicated, using net change in product range relates most closely to the predictions of their model. Higher productivity allows firms to expand their product mix, which in turn leads to higher employment and total revenue. However, as this study considers product switching as a means of responding to the minimum wage shock, I use the adding and dropping dummies for consistency with other estimations.[90] The model specification is as follows:[91]

$$\frac{y_{j,t} - y_{j,2010}}{y_{j,2010}} = \alpha_t + \beta_{1,t} Add_{j,t} + \beta_{2,t} Drop_{j,t} + \beta_t Bind_j + \gamma_t X_j + \delta_t D_j + \varepsilon_{jt} \qquad (4.6)$$

where $y_{j,t}$ indicates outcomes (operating revenue/total employment) of firm j at year t. $Add_{j,t}$ ($Drop_{j,t}$) is the product switching dummy, taking a value of 1 if firm j added

[89]The BRS model predicts that multi-product firms are larger than mono-product ones in terms of several characteristics, such as employment, productivity, revenue, etc. A similar pattern was observed in Vietnamese manufacturing firms (see Table 4.G7).

[90]Note that firms may add and drop product(s) simultaneously. In the base sample, the correlation between adding and dropping was 0.732 during the 2011–2016 period. As long as the minimum wage hike is exogenous, this correlation will not affect the estimation of interest.

[91]Regressions using net adding and net dropping dummies yield similar conclusions.

(dropped) any products between year t and 2010, and 0 otherwise. Minimum wage grouping dummies, and province and 2-digit industry fixed effects are included.

In the final step, this section examines the indirect effect of the minimum wage hike on firm outcomes via product switching channel. Specifically, I re-estimate Equation (4.5) and Equation (4.6) using the structural equation modelling (SEM) with the minimum wage binding as an exogenous shock. As noted by Bernard et al. (2010, p. 83), estimates from Equation (4.6) simply capture the equilibrium relationship between endogenous variables: the choice of product mix and firm outcomes. The coefficient β_t only reflects the direct effect of the minimum wage hike on firms' outcomes. Therefore, the SEM estimates allow the decomposition of the minimum wage effect into direct and indirect components.

4.5.3 Empirical Evidence

This section focuses on manufacturing firms that were surveyed in all even years (2010, 2012, 2014, and 2016). This sample selection strategy allows us to compare the effect magnitude over time. All estimates are robust when this restriction are removed and all available observations are used for regression.

Minimum Wage and Product Switching Response

Table 4.9 presents the estimates of Equation (4.5) for both probabilities of adding new and dropping old product(s). As expected, binding firms added new product(s) more frequently than did nonbinding ones in the medium run. Relative to nonbinding firms, the probabilities of adding new product(s) among binding firms were around 9–10 percentage points higher in 2014 and 2016. Firms affected by the minimum wage dropped old product(s) in the longer run (2016) but not in the medium run (2014). However, the size of estimates is smaller than that in adding regressions. These findings are consistent with the prediction from the BRS theoretical framework that an increase in firm productivity leads to an expansion in the range of products.

<Insert Table 4.9>

Regressions in the first two columns can be used to test for the pre-reform parallel trend because it takes the firm time to revise its production plan. Estimates of the probabilities of adding/dropping product(s) between 2012 and 2010 are insignificant at the conventional level. Though not shown in Table 4.9, regressions for 2011 yield coefficients that are statistically insignificant and close to 0,[92] which implies that binding and non-binding firms were indifferent in product switching behavior before the minimum wage hike.

Regressions in even columns control the initial number of products (in year 2010). Similar to BRS, a higher frequency of product switching was found in multi-product firms than in mono-product ones. Firms with one more product in their portfolio in 2010 have around 5–7 and 16–17 percentage points higher and lower probability of adding new and dropping old product(s), respectively.

Although the binding dummy can capture the effect of minimum wage on product switching, it may be endogenous to the firm's decision if firms producing the same type of products were more prone to the shock.[93] Similarly, if the cost of switching products is correlated with the minimum wage, estimated coefficients in Table 4.9 may be biased. Therefore, these firms may add or drop products simultaneously owing to production characteristics (to produce the same product portfolio) rather than the minimum wage shock. Aside from province and industry fixed effects, this study includes product mix fixed effects to capture any factors that were common among firms producing the same initial set of products.[94] This strategy, which was adopted from BRS, helps eliminate any correlation between the minimum wage exposure and product mix characteristics. Additionally, product mix fixed effects can control for any parts of the product switching cost that are correlated with the minimum wage reform. Table 4.10 reports the robustness

[92]Estimates for other years than those shown in the result table can be provided upon request.

[93]One possible explanation for product switching is managerial abilities of the firm's manager. Although this data is not available, Table 4.G8 presents the robustness check that control for age and educational/vocational qualification of the firm's manager/director, which could be attributable to her or him managerial abilities. Educational/vocational qualification of the director had no effect on product switching decision. Firms with older director/manager tend to be more skeptical in adding new product(s), but the effect magnitude is small. The minimum wage effect remain consistent after controlling for characteristics of the firm's director. These results rule out the possibility that product switching was caused by management channel and support the channel presented in the previous section.

[94]To maximize the sample size, product mix fixed effects are defined at one level lower than the manufacturing products themselves (7-digit compared to 8-digit).

check using product mix fixed effects.

<Insert Table 4.10>

As shown in Table 4.10, the estimated coefficients remain consistent with the main finding in the previous table. The minimum wage reform raised probabilities of switching products with a stronger effect on adding new product(s).

Product Switching and Subsequent Firm Outcomes

Table 4.11 reports the relationship between product switching practice and firm outcomes. The results in Panel A suggest that firms adding new products experienced a higher percentage change in total operating revenue. The effect size accumulated from 4.1 percentage points in the short-run to 8.0 percentage points in the longer-run. Firms that dropped products experienced lower growth. However, the coefficient on dropping dummy was smaller and less significant than that of the adding dummy, implying that firms may decide to abolish less profitable products.

<Insert Table 4.11>

Panel B shows that that employment growth was higher among firms that added new products to their portfolio. However, dropping old products was not necessarily associated with employment reduction. My estimates indicate that employment growth was lower among firms that dropped old products. However, this effect becomes insignificant when controlling for the minimum wage binding dummy. Overall, empirical results in Table 4.11 suggest that product switching may improve firm outcomes and help them partially avoid the negative shock of the minimum wage hike. This effect is explored in the following subsection.

Direct and Indirect Effects

Table 4.12 reports the direct and indirect effects of the minimum wage hike on the percentage changes in total sales revenue and employment. This study found significant effects of the reform on the probability of adding new product(s) and the relationship between these practices and firm outcomes in the medium and longer run. Adding new

product(s) was associated with increases in total sales revenue and employment. The minimum wage hike did not affect the total sales revenue of manufacturing firms while having a negative employment effect in the longer run (2016).[95] These findings align with the results from previous regressions.

<Insert Table 4.12>

Table 4.12 confirms the indirect effect of the minimum wage hike. Through product switching, mostly adding new product(s), the minimum wage hike raised total sales revenue of binding firms by 0.54% and 0.47%, when compared to nonbinding ones in 2014 and 2016, respectively. This estimated effect is statistically significant at the 5-percent level, although the size is small relative to the direct effect on revenue of non-manufacturing firms found in Section 4.4 (8–10%). Additionally, Table 4.12 found that product switching partly mitigated the negative employment effect on manufacturing firms. The minimum wage hike indirectly led to a 0.30% increase in employment of binding firms via product switching. However, these indirect effects occurred only in the medium and longer run, which aligns with the prediction based on the underlying mechanism in Box 1.

These pieces of evidence support the earlier hypothesis that manufacturing firms can deal with minimum wage hikes by switching their production toward more profitable products. By doing so, they can partially overcome the negative shock on labor cost and gain better outcomes in later periods. However, the indirect effect on employment accounted for less than 5% of the total effect whereas that on sales revenue was substantial when compared to the direct effect. This suggests that product switching is more important for manufacturing firms in terms of sales revenue than employment when facing a negative shock. The strategy behind the firm's switching decision may be to protect their sales revenue from the shock. While doing so, they were also able to partially offset the negative effect on total employment.

[95]These estimates did not account for the extensive margin of the employment effect as this section focuses on the size effect comparison over time. Appendix 4C found a significantly disemployment effect that accounts for both intensive and extensive margins.

4.6 Conclusion

This chapter estimates the minimum wage effects on firm revenue and its components. Despite the negative employment effect, this study found that firms, especially non-manufacturing ones, were able to raise their revenue after the minimum wage reform. In the manufacturing sector, firms that kept their product portfolio over time were more likely to experience revenue drop than those that switched their products. The change in the sales revenue of continuing products relative to total revenue was 9.5 percentage points lower among binding manufacturing firms relative to nonbinding ones. Empirical results imply that firms in the manufacturing and non-manufacturing sectors did not rely on raising output prices in response to the sharp minimum wage hike. This shows that the analysis focusing only on price response did not fully capture the minimum wage effect on firm behavior.

This chapter then explains the revenue change by exploring a new aspect of the minimum wage that has not been examined in the literature, namely the product switching response. The main findings suggest that manufacturing firms affected by the minimum wage reform switched their product portfolio more frequently than did other firms. After five years following the hike, binding firms were around 10 percentage points higher in cumulative probability of dropping old or adding new product(s) when compared to non-binding ones. The underlying mechanism was that surviving firms were able to cover the fixed cost of producing more profitable products thanks to the higher labor productivity after the reform.

Importantly, empirical findings highlight the important role of product switching in the manner in which manufacturing firms responded to the minimum wage hike. Firms that switched their product mix experienced significantly higher growth in total revenue and employment. This explains that some manufacturing firms managed to raise their operating revenue without losing their competitive advantage as predicted by Harasztosi and Lindner (2019). Estimates from SEM regressions support the hypothesis that product switching is a potential choice for manufacturing firms when facing a negative shock on labor costs. Adding new product(s) induced by the hike significantly improved the binding firm outcomes in the medium and longer run. While the minimum wage reform

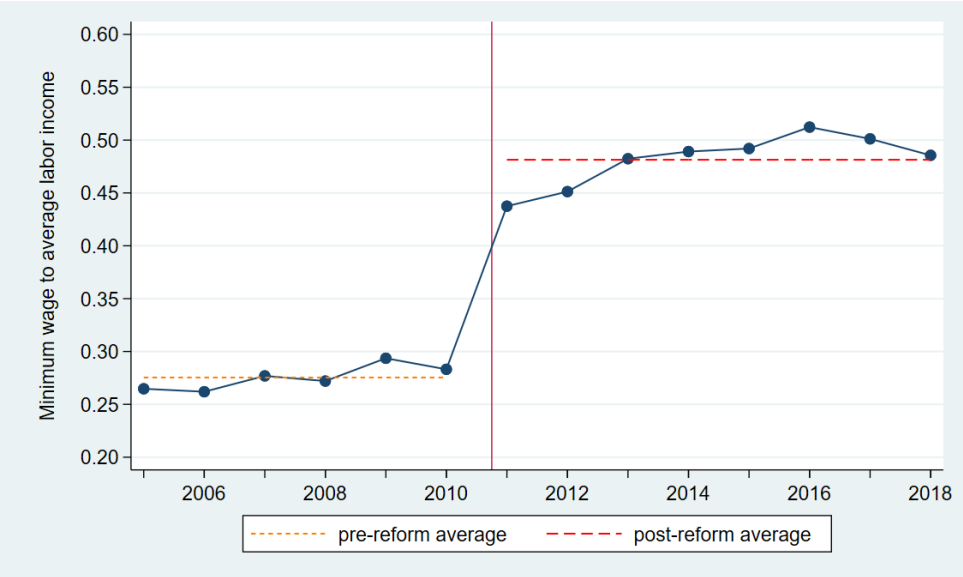
did not directly affect firm revenue, the estimates in this study indicate an indirect effect of 0.5 percentage points. Additionally, product switching helped manufacturing firms mitigate the negative employment effect caused by the reform. However, this indirect effect was relatively small when compared to the total effect on employment, although it was statistically significant at the conventional level.

This study found clear evidence that manufacturing can gain better sales revenue even when their employment is negatively affected by the minimum wage hike. Although this study emphasizes the significant role of product switching, the real situation may become more complex if product quality is involved in the firm decision. Because of data limitations, this study could not track changes in product quality. Firms may either switch to products of a higher quality and price or products that require less labor (so that a higher quantity can be produced). In both cases, firms may raise their sales revenue but the mechanism underlying it may differ. Future research can explore this topic.

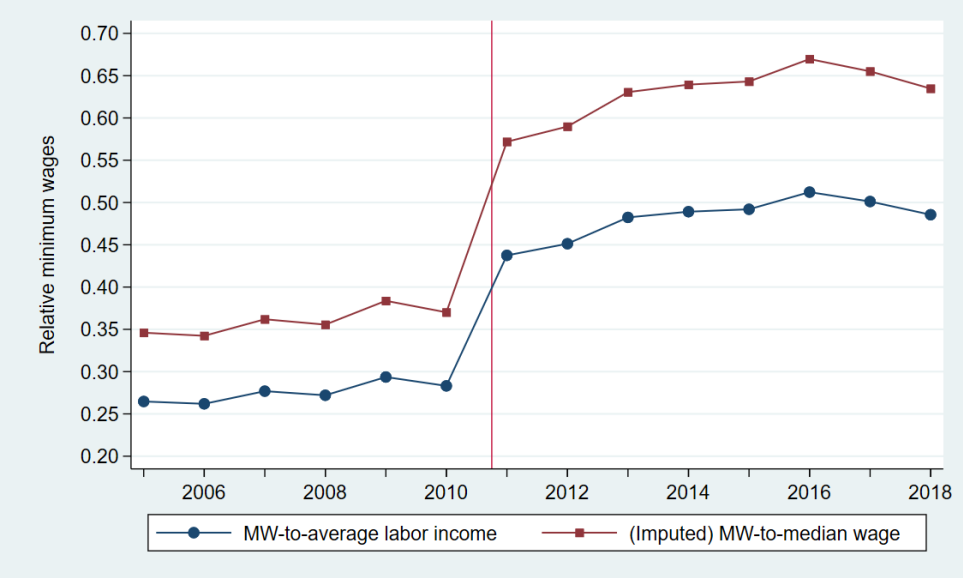
Figures

FIGURE 4.1.—MINIMUM WAGE EVOLUTION IN VIETNAM.

A. Minimum wage-to-average labor income ratio

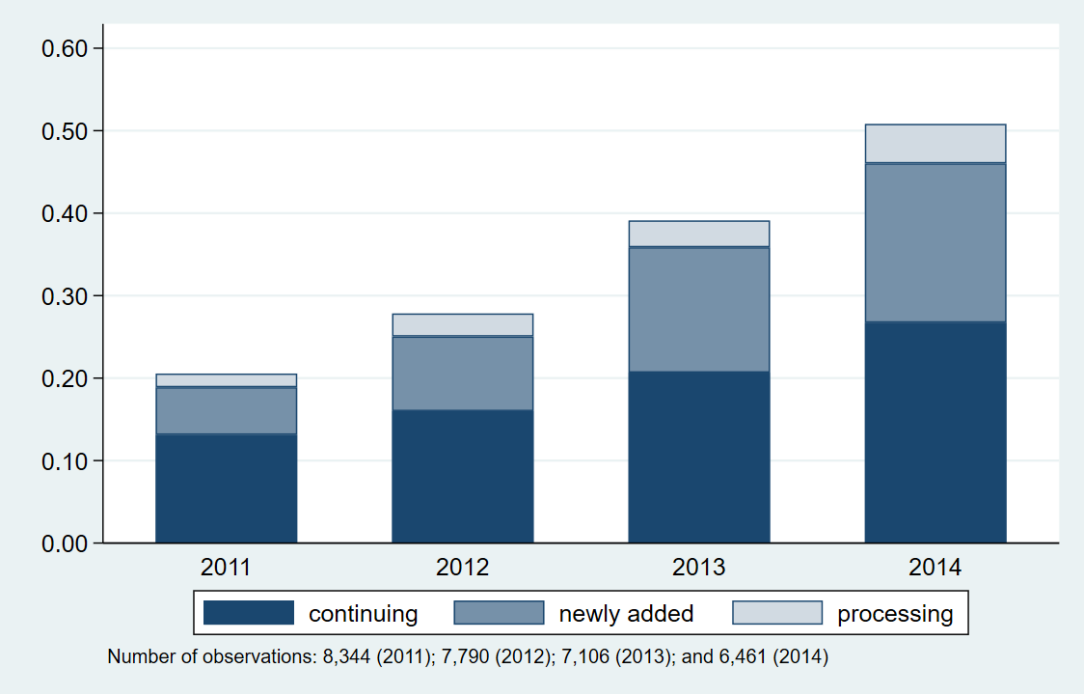


B. Relative minimum wages



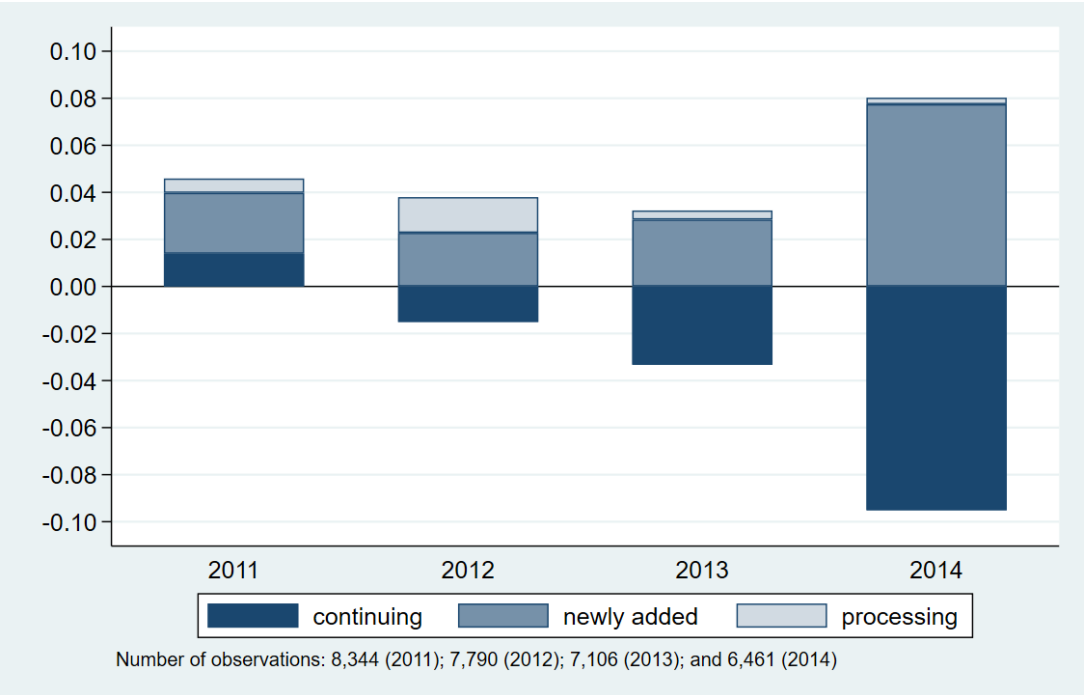
NOTE.—This figure shows the ratio of the minimum wage relative to labor income, which includes wages, bonuses, allowances, and the like. Data from the VES, domestic private sector alone, winsorized by 1% each tail. The red vertical line indicates October 2011, when the final step in the minimum wage reform took place. The weighted average of minimum wage before and after October 2011 was used for 2011. In panel (A), the upper and lower bounds indicate the average ratios before and after October 2011, respectively. Panel (B) adds the imputed Kaitz index (minimum-to-median ratio), using information from the LFS that the wage component accounts for around 90% of total income of workers in the private sector and the median wage ranges from 80 to 90% of the average wage.

FIGURE 4.2.—REVENUE GROWTH DECOMPOSITION



NOTE.—This figure decomposes the changes in total sales revenue between year t and the base year 2010, based on Equation (4.3). All variables are in real terms, deflated by the national consumer price index.

FIGURE 4.3.—REVENUE EFFECT DECOMPOSITION



NOTE.—This figure decomposes the minimum wage effect on total sales revenue by estimating the change in its components relative to total sales revenue in 2010, based on Equation (4.3). Province and two-digit industry fixed effects are included. Control variables include firm age and legal type in 2010, minimum wage group dummies, and the average of following outcomes during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets.

Tables

Table 4.1.—Statistics Summary of Firm-level Characteristics in 2010

	Non-manufacturing	Manufacturing	All
Average wage per paid worker (1,000 VND)	3,076	2,826	2,997
Labor cost per worker (1,000 VND)	3,275	3,105	3,221
Total employment	69.803	251.968	127.520
Total operating revenue (log)	9.182	9.922	9.416
Profitability (profit/revenue)	.018	.013	.016
Labor share (labor cost/revenue)	.184	.190	.186
Wage cost share in total labor cost	.961	.939	.954
Depreciation (depreciation/revenue)	.033	.042	.036
Minimum wage in 2012 (1,000 VND)	1,174	1,236	1,194
Minimum wage bind	.046	.056	.049
Observations	20,033	9,291	29,324

Notes.—The average wage per paid worker and firm outcomes (profitability, wage cost share, labor share, and depreciation) are evaluated during the 2008–2010 period. All variables are deflated by consumer price index.

Table 4.2.—Manufacturing Firms by Activity in 2010 (%)

	All manufacturing firms		Minimum wage sample	
	By number	By market share	By number	By market share
Processing service alone	10.30	2.86	9.75	2.97
Manufacturing alone	84.61	90.64	84.17	89.81
Both	5.09	6.51	6.08	7.22
Observations	28,293	28,293	9,291	9,291

Notes.—Market share is share of total sales revenue in the market. The minimum wage sample indicates the main sample for analyzing the minimum wage effects.

TABLE 4.3.—MINIMUM WAGE AND HETEROGENEOUS REVENUE RESPONSE

	2012–10 (short-term)		2014–10 (medium-term)		2008–10 (placebo)	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All firms						
MW binding	.063*	.064**	.061*	.051	.050	.037
	(.033)	(.031)	(.036)	(.035)	(.031)	(.032)
Observations	22,634	22,634	18,431	18,431	29,321	29,321
Panel B: Non-manufacturing firms						
MW binding	.088**	.087**	.106**	.104**	.016	.023
	(.044)	(.042)	(.049)	(.043)	(.043)	(.048)
Observations	14,844	14,844	11,970	11,970	20,030	20,030
Panel C: Manufacturing firms						
MW binding	.013	.024	–.020	–.031	.106**	.063
	(.034)	(.041)	(.038)	(.045)	(.042)	(.043)
Observations	7,790	7,790	6,461	6,461	9,291	9,291
Panel D: Manufacturing firms that completely changed product portfolio						
MW binding	–.024	–.016	.044	.041		
	(.031)	(.043)	(.075)	(.083)		
Observations	3,408	3,408	2,974	2,974		
Panel D: Manufacturing firms that kept at least one product in portfolio						
MW binding	.037	.044	–.083**	–.091**		
	(.058)	(.065)	(.033)	(.040)		
Observations	4,382	4,382	3,487	3,487		
Controls	NO	YES	NO	YES	NO	YES
Fixed effects	YES	YES	YES	YES	YES	YES

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. Province and two-digit industry fixed effects are included. Robust standard error in parentheses, clustered at the fixed-effects level, adjusted following Cameron, Gelbach, and Miller (2011) for multi-way clustering. Control variables include firm age and legal type in 2010, minimum wage group dummies, and the average of following outcomes during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets.

Table 4.4.—Revenue Effect Decomposition

	2012–10 (short-term)		2014–10 (medium-term)	
	(1)	(2)	(3)	(4)
Total sales revenue	.010	.023	–.002	–.015
	(.036)	(.039)	(.039)	(.062)
Revenue of continuing products	–.028	–.015	–.097***	–.095***
	(.024)	(.029)	(.011)	(.027)
Revenue of newly added products	.020	.023	.084*	.077
	(.026)	(.029)	(.049)	(.061)
Revenue of processing products	.018**	.015	.011	.003
	(.008)	(.014)	(.015)	(.019)
Observations	7,790	7,790	6,461	6,461
Controls	NO	YES	NO	YES
Fixed effects	YES	YES	YES	YES

Notes.—*** $p < .01$, ** $p < .05$, * $p < .1$. This table reports the minimum wage binding coefficients from estimating the change in total sales revenue and its components relative to total sales revenue in 2010, based on Equation (4.3). Province and two-digit industry fixed effects are included. Robust standard error in parentheses, clustered at the fixed-effects level, adjusted following Cameron et al. (2011) for multi-way clustering. Control variables include firm age and legal type in 2010, minimum wage group dummies, and the average of following outcomes during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets.

TABLE 4.5.—REVENUE EFFECT DECOMPOSITION: PRICE AND QUANTITY EFFECTS

	2012–10 (short-term)		2014–10 (medium-term)	
	(1)	(2)	(3)	(4)
Total sales revenue	.019	.016	–.094***	–.107
	(.055)	(.062)	(.020)	(.067)
Revenue of continuing products	–.001	.001	–.113***	–.133**
	(.044)	(.047)	(.023)	(.060)
Price component	.003	.005	.105	.081
	(.052)	(.077)	(.144)	(.162)
Quantity component	–.004	–.004	–.218	–.214
	(.084)	(.111)	(.154)	(.176)
Observations	4,368	4,368	3,478	3,478
Controls	NO	YES	NO	YES
Fixed effects	YES	YES	YES	YES

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. This table reports the minimum wage binding coefficients from estimating the change in total sales revenue and its components relative to total sales revenue in 2010, based on Equation (4.2) and (4.3). Sample includes firms that kept at least one product from portfolio in year 2010. Province and two-digit industry fixed effects are included. Robust standard error in parentheses, clustered at the fixed-effects level, adjusted following Cameron et al. (2011) for multi-way clustering. Control variables include firm age and legal type in 2010, minimum wage group dummies, and the average of following outcomes during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets.

TABLE 4.6.—MINIMUM WAGE EFFECT ON ACCOMMODATION BUSINESS

	All available firms			Firms available in 2010–14		
	2012–10	2014–10	2008–10	2012–10	2014–10	2008–10
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Average service fee (average expense per guest per day)						
MW binding	.031	–.019	–.125**	–.004	–.007	–.046
	(.065)	(.033)	(.042)	(.087)	(.029)	(.032)
Panel B: Total number of guest-days (output quantity)						
MW binding	–.039	.080	–.023	–.007	.065*	.024
	(.039)	(.050)	(.022)	(.053)	(.031)	(.042)
Panel C: Revenue from accommodation business						
MW binding	–.013	.072	–.041	–.006	.092**	–.032
	(.013)	(.049)	(.073)	(.019)	(.027)	(.042)
Panel D: Total operating revenue						
MW binding	–.041***	.032	–.056*	–.027	.054**	–.014
	(.011)	(.029)	(.027)	(.039)	(.021)	(.028)
Panel E: Share of revenue from accommodation business						
MW binding	.022***	.019**	.002	.019***	.016*	–.010
	(.005)	(.008)	(.014)	(.005)	(.007)	(.007)
Observations	991	838	1,001	708	708	681
Controls	YES	YES	YES	YES	YES	YES
Fixed effects	YES	YES	YES	YES	YES	YES

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. Guests residing during daytime (without staying at night) is counted as half day. Province and two-digit industry fixed effects are included. Robust standard error in parentheses, clustered at the fixed-effects level, adjusted following Cameron et al. (2011) for multi-way clustering. Control variables include firm age, legal type, and minimum wage group in 2010 and the average of following outcomes during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets.

Table 4.7.—Minimum Wage Effect on Construction Firms

	2011–10	2012–10	2013–10
	(1)	(2)	(3)
Panel A: Average price of construction project (1,000 VND/unit)			
MW binding	.073	–.046	.110
	(.118)	(.095)	(.086)
Panel B: Volume of construction project (unit)			
MW binding	–.020	.189	.087
	(.138)	(.124)	(.099)
Panel C: Value of construction project (1,000 VND)			
MW binding	.023	.157*	.163
	(.059)	(.081)	(.115)
Panel D: Total operating revenue			
MW binding	.199**	.368***	.406***
	(.079)	(.108)	(.124)
Number of projects	3,203	2,427	1,988
Number of firms	2,335	1,712	1,425
Fixed effects	YES	YES	YES

Notes.—*** $p < .01$, ** $p < .05$, * $p < .1$. Observations are at the firm-project level in the first three panels and at the firm level in Panel D. Fixed effects include province and construction project in Panel A–C. Province and industry fixed effects are included in Panel D. Robust standard error in parentheses, clustered at the fixed effects level, adjusted following Cameron et al. (2011) for multi-way clustering. Control variables include legal type, firm age, and minimum wage group dummies in 2010.

Table 4.8.—Product Switching: Summary Statistics

	2011	2012	2013	2014	2015	2016
None	.548	.451	.411	.382	.341	.309
Add product(s) only	.058	.072	.073	.075	.085	.078
Drop product(s) only	.067	.068	.064	.061	.059	.051
Both add and drop	.328	.409	.451	.482	.516	.563
Number of firms	8,344	7,790	7,106	6,461	5,329	6,987

Notes.—This table shows the share of manufacturing firms that changed or did not change their product portfolio compared to the base year 2010.

TABLE 4.9.—MINIMUM WAGE AND PRODUCT SWITCHING BEHAVIOR

	2012–10 (short-term)		2014–10 (medium-term)		2016–10 (longer-term)	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Probability of adding new product(s)						
MW binding	.041	.044	.102***	.106***	.090***	.094***
	(.033)	(.032)	(.031)	(.031)	(.021)	(.022)
#of products		.051***		.061***		.066***
	(.010)		(.010)		(.011)	
Mean of DV	.450	.450	.544	.544	.607	.607
Panel B: Probability of dropping old product(s)						
MW binding	.008	.017	.037	.046	.047***	.056***
	(.043)	(.039)	(.034)	(.030)	(.016)	(.010)
#of products	.170***		.170***		.165***	
	(.016)		(.019)		(.022)	
Mean of DV	.447	.447	.527	.527	.575	.575
Observations	5,198	5,198	5,198	5,198	5,198	5,198
Fixed effects	YES	YES	YES	YES	YES	YES

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. Linear probability model is used to capture province and industry fixed effects. Sample include firms exist in all survey rounds of interest (2012, 2014, and 2016). Robust standard error in parentheses, clustered at the fixed effects level, adjusted following Cameron et al. (2011) for multi-way clustering.

TABLE 4.10.—MINIMUM WAGE AND PRODUCT SWITCHING WITH PRODUCT MIX FIXED EFFECTS

	Add new product(s)			Drop old product(s)		
	2012–10	2014–10	2016–10	2012–10	2014–10	2016–10
	(1)	(2)	(3)	(4)	(5)	(6)
MW binding	.039	.078**	.077**	.044	.067	.054*
	(.038)	(.035)	(.029)	(.049)	(.043)	(.031)
Observations	3,995	3,995	3,995	3,995	3,995	3,995
Fixed effects	YES	YES	YES	YES	YES	YES

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. The linear probability model is used to capture province, industry, and product mix fixed effects. Robust standard error in parentheses, clustered at the fixed-effects level, adjusted following Cameron et al. (2011) for multi-way clustering. The numbers of observations in regressions that control for product mix fixed effects are lower (7-digit versus 8-digit) due to a large number of singletons observations (i.e., product mix that had only one firm produce).

TABLE 4.11.—PRODUCT SWITCHING AND FIRM OUTCOMES

	2012–10		2014–10		2016–10	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Change in total operating revenue						
Adding	.038**	.041**	.058***	.064***	.073**	.080**
	(.017)	(.017)	(.017)	(.021)	(.031)	(.034)
Dropping	–.025***	–.021*	–.033	–.030	–.052**	–.053*
	(.006)	(.010)	(.023)	(.024)	(.024)	(.028)
MW binding		.030		.009		–.014
		(.058)		(.049)		(.049)
Panel B: Change in total employment						
Adding	.018	.021	.023*	.034**	.038	.054**
	(.015)	(.018)	(.012)	(.013)	(.022)	(.022)
Dropping	–.019	–.011	–.032*	–.017	–.054**	–.038
	(.016)	(.017)	(.016)	(.021)	(.023)	(.023)
MW binding		–.053		–.048		–.093**
		(.033)		(.047)		(.036)
Controls	NO	YES	NO	YES	NO	YES
Fixed effects	YES	YES	YES	YES	YES	YES
Observations	5,198	5,198	5,198	5,198	5,198	5,198

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. The sample includes firms that exist in all survey rounds of interest (2012, 2014, and 2016). Province and industry fixed effects are included. Robust standard errors are in parentheses, clustered at the fixed-effects level, adjusted following Cameron et al. (2011) for multi-way clustering. Control variables include firm age, legal type, and minimum wage group dummies in 2010 and the average of following outcomes during the 2008–2010 period: profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, depreciation of fixed assets, and export-to-revenue ratio.

TABLE 4.12.—PRODUCT SWITCHING AND FIRM OUTCOMES: EFFECT DECOMPOSITION

	2012–10				2014–10				2016–10			
	Δrev.	Δemp.	adding	dropping	Δrev.	Δemp.	adding	dropping	Δrev.	Δemp.	adding	dropping
	(1)	(1)	(1)	(1)	(2)	(2)	(2)	(2)	(3)	(3)	(3)	(3)
Direct effects												
MW binding	.030	–.053	.041	.008	.009	–.048	.102***	.037	–.014	–.093***	.090***	.047*
	(.049)	(.035)	(.035)	(.036)	(.038)	(.044)	(.037)	(.033)	(.050)	(.036)	(.028)	(.027)
adding	.041**	.021			.064***	.034*			.080***	.054***		
	(.017)	(.016)			(.018)	(.018)			(.030)	(.018)		
dropping	–.021	–.011			–.030	–.018			–.053**	–.039*		
	(.014)	(.018)			(.021)	(.021)			(.023)	(.023)		
Indirect effects												
MW binding	.0015	.0008			.0054**	.0028*			.0047**	.0030**		
	(.0013)	(.0008)			(.0024)	(.0015)			(.0024)	(.0013)		
Fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO
Observations	5,198	5,198	5,198	5,198	5,198	5,198	5,198	5,198	5,198	5,198	5,198	5,198

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. Structural equation modelling (SEM) is used. The sample includes firms that exist in all survey rounds of interest (2012, 2014, and 2016). A set of dummies for province and two-digit industry fixed effects is included. Minimum wage grouping dummies are included in all regressions. Robust standard errors are in parentheses, clustered by province. The employment and revenue equations control for firm age and legal type in 2010 and the average of following outcomes during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets. Robust standard error in parentheses, clustered at the fixed-effects level, adjusted following Cameron et al. (2011) for multi-way clustering.

Appendices to Chapter 4

4A Minimum Wage Treatment Validation

The VES 2009 provides information on labor structure and income by occupation, namely manager, professional, manufacturing, and administrative/service. This study constructs the share of workers affected by the new minimum wage with the assumption that workers in the same job within the firm receive the same wages. The fraction affected is calculated as follows:

$$FA_j = \sum_{k=1}^{4} \left[I(w_{kj,2009} < mw_{2012}) \times s_{kj} \right]$$

where, FA_j is the fraction of affected workers in firm j, and $w_{kj,2009}$ indicates the average wages of workers in occupation k in firm j. The share of workers in each occupation is denoted by s_{kj}. The indicator function $I(\cdot)$ takes a value of 1 if the average wage of occupation k is below the minimum wage after the reform, mw_{2012}, and 0 otherwise.

Figure 4.F1 depicts the relationship between the firm-level fraction of affected workers and average wage per paid worker.[96] The figure shows that firms with lower average wages and that pay more than the median wage have high and low fractions of affected workers, respectively. Although this may not reflect the fraction affected in full, it is still a good proxy for showcasing the relationship between average wage and fraction affected.

4B Averaging the Wage Paid and Pre-trend Issues

Appendix 4A verifies whether the binding dummy using the average wage is valid. However, the question centers on what "average wage" should be used to define the treatment group. The first and natural candidate is the average wage in the year before the hike as in Draca et al. (2011). However, in the case of Vietnam, the minimum wage reform was pioneered in 2008 and began in 2009, although with only minor hikes. Therefore, using the average wage in 2010 alone leads to a declining trend in the average wage in

[96]This is consistent with the observation using the employer-employee matched data on a sample of manufacturing firms, namely the Vietnam SME Survey by UNU-WIDER.

the pre-reform period as low-wage firms in 2008–2009 had raised their wages relative to those in 2010 (Figure 4.F2, panel A).

The second candidate is the average wage in the entire pre-reform period, which is similar to the average fraction affected used in Harasztosi and Lindner (2019). However, this candidate encounters the pre-trend issue in the employment effect. Binding firms using this definition experienced a declining trend in employment (Figure 4.F2, panel B). The reason for this was that firms, especially SMEs, in Vietnam often used unpaid workers. Using the average wage per worker may not accurately indicate low-wage firms if they hired a sizable fraction of unpaid workers.

This study addresses these issues by using the average wage per paid worker during the pre-reform period to define the minimum wage treatment. As depicted in Panel C of Figure 4.F2, the minimum wage treatment used in this study is robust to the pre-trend issue. The common trends in labor cost and employment of binding and nonbinding firms in the pre-reform period were drawn out.

4C Employment and Non-employment Responses

Using firm-level data, this appendix substantially replicates a part of the work done by Harasztosi and Lindner (2019). This section provides new empirical evidence on how firms respond to a sharp minimum wage hike in a developing country.

Effects on Employment and Exit Probability

Table 4.G3 presents the estimated effects on total employment and the probability of exiting the market. In Panel A, Columns (1) and (2) show the immediate effects whereas Columns (3) and (4) show the medium-run effects on total employment. Without controlling the firm's characteristics, the estimates indicate that the total employment of binding firms declined by 12.7% relative to nonbinding ones. Given the data structure, it was possible to include both existing and quit firms in the employment estimation. Estimates in Table 4.G3 include intensive and extensive margins. In the medium run, employment loss of binding firms is larger by 15.6% relative to nonbinding firms.

However, while controlling for firm observable characteristics in Columns (2) and (4), the estimated effects were roughly the same between 2012 and 2014. Firms affected by the minimum wage faced a 10.9% drop in total employment between 2010 and 2012. The percentage change in total employment of binding firms was 11.9% lower than that of nonbinding firms in 2014. This implies that the employment effect of the minimum wage occurred within less than two years from the minimum wage hike and that no further adverse effects of the minimum wage were detected in the medium run.

Columns (5) and (6) explore the percentage change in employment between 2008 and 2010. The results suggest that binding and nonbinding firms experienced similar trends before the reform. Coefficients are close to 0 and insignificant at the 5% level. This is highlighted in the region to the left of the vertical line in Figure 4.F3.

Panel B examines whether the minimum wage hike in 2011 led to an exit decision. As expected, the sharp increase in minimum wage led to a 1.8 percentage points higher in the exit rate of binding firms when compared to nonbinding ones. This effect accumulated to 3.4 percentage points in the medium run (between 2014 and 2010), which is roughly similar in terms of magnitude to those found in a limited number of studies in the literature [1.5% one-year exit rate in the UK (Draca et al., 2011) or 2.2%–4.7% in China (Mayneris et al., 2018)].

Margins of Adjustment

Table 4.G4 reports the minimum wage effects on margins of adjustment, conditional on surviving firms. Although firms that exited the market can be identified, this subsection does not include them because of the sampling stratification. Based on the stratification, all firms above a certain threshold were surveyed whereas only a sample of small firms was surveyed. Thus, one may be concerned the my estimates are subject to sample selection bias. This issue is addressed by comparing estimates using two samples: all firms each year and firms available in all years. If there were no selection bias, there would be no substantial difference in coefficients from two regressions. Table 4.G5 shows the robustness check results, which imply no serious sample selection bias. Adding these firms while a large number of small firms were not chosen in the survey may create

a downward bias if quit decision and minimum wage were positively correlated.[97] As found in the previous subsection, the binding dummy and the probability that a firm will exit the market were positively correlated (see Table 4.G3). Therefore, one may use the estimated exit rate in Table 4.G3 to infer the minimum wage effect that accounts for intensive and extensive margins. For example, the estimate of 34.3% increase in labor cost per worker in Table 4.G4 can be translated into 30.0% while taking the extensive margin into account.

Panel A in Table 4.G4 shows the minimum wage effect on firm-level labor cost per worker. The 2011-hike significantly raised the labor cost of binding firms relative to that of nonbinding firms. This effect increased gradually over time, from 34.3% in 2012 to 36.6% in 2014. This is rather unusual as empirical studies often found an increasing employment effect and a declining wage effect. The reason is that after 2012, the government continued to raise the minimum wage (although at a much lower degree), resulting in higher labor cost facing binding firms. However, the fact that additional disemployment effect after 2012 were not found implies that the labor market in Vietnam has monopsonistic features to some extent, so that only the strikingly hike in 2011 adversely affected firm's employment. This is consistent with the main finding in Chapter 3 that moderate minimum wage hikes in the 2013–2018 period promoted the formalization of the workforce in Vietnam.

In Panel B, percentage changes in total labor cost are significantly higher among firms affected by the minimum wage hike. Similar to the effect on labor cost per worker, empirical results suggest an increasing effect on total labor cost. Compared to nonbinding firms, total labor cost of binding firms was 24.0% and 25.8% higher immediately and three years after the hike, respectively. This implies that the minimum wage hike substantially improved the total earnings of workers in low-wage firms.

Given the considerable gain in operating revenue found in Section 4.4, the firm's profitability is unaffected by the hike. Higher growth in operating revenue helped binding firms offset the increased labor cost. In panel C, all coefficients on the profit-to-revenue

[97]Firms exited the market were included in the employment equation because of the availability of a list of all registered enterprises. Even for those who were not chosen for the survey, the GSO provides information on total employment at the end of the year.

ratio are insignificant in both statistical and economic senses.

This subsection also estimates the minimum wage effect on firm-level labor productivity, which is defined by value added per worker. As reported in Panel D, binding firms experienced around 25 percentage points higher labor productivity growth in the short and medium run.[98] This suggests that these firms adjusted their production toward a more efficient one in response to the hike. Riley and Rosazza Bondibene (2017) drew out a similar finding in the case of registered companies in the UK. They pointed out that changes in labor productivity were associated with increases in total factor productivity, as suggested by theories of organizational change or efficiency wages, rather than coming from employment reduction or capital-labor substitution. Mayneris et al. (2018) found a significant increase in labor productivity among Chinese firms after the minimum wage reform in 2004. In response to the reform, firms improved their management of inventory and raised capital investment, which partially resulted in higher labor productivity. The current study does not focus on improvements in labor productivity. Thus, other measures of labor productivity (e.g., output-based measure, TFP, etc.) are not considered.

4D Effects on Price and Quantity Indices

The *Industrial Production* module contains the firm-product level data of all manufacturing firms. As Table 4.G2 shows, data on the volume and value of each product produced and sold by manufacturing firms were accessible. Manufacturing products are classified by the 8-digit 2010 Manufacturing Product Classification.[99] Around 2,000 distinguished products were produced by at least one firm in VES 2010–2011. This appendix section constructs the Laspeyres price index and a quantity index that is equivalent to the Paasche price index:

$$P_{j,t}^{L} = \frac{\sum_k p_{kj,t} \times s_{kj,2010}}{\sum_k p_{kj,2010} \times s_{kj,2010}}$$

[98] Owing to data limitations, information on firm depreciation occurred during the year were only available in 2011, 2013, and 2014. This variable was proxied by taking the differential between the accumulated depreciation at the end and the beginning of the year. This proxy underestimates firm depreciation if any of fixed assets fully depreciates before the end of the year and the firm sells or liquidates these assets, which is not reflected in the balance sheet. Thus, firms with negative depreciation were dropped. As the depreciation period of fixed assets is uncorrelated with the minimum wage, dropping these observations did not affect the estimates in Table 4.G4.

[99] The list of manufacturing products will be provided upon request.

$$Q^L_{j,t} = \frac{\sum_k q_{kj,t} \times s_{kj,t}}{\sum_k q_{kj,2010} \times s_{kj,t}}$$

where j, k, and t indicate firm, product, and time, respectively. $p_{kj,t}$ is the average sale price of product k at firm j, which is calculated by dividing sale value by sold quantity ($q_{kj,t}$). $s_{kj,t}$ is the revenue share of product k in year t. $P_{j,t}$ and $Q_{j,t}$ are the constructed Laspeyres price and "Paasche" quantity indices of firm j at year t. Both quantity and price indices can only be calculated for firms that produced product k in both year t and 2010. Therefore, the revenue share is also calculated for that subset of products. Thus, $\sum_k s_{kj,2010} = 1$ (for price index) and $\sum_k s_{kj,t} = 1$ (for quantity index). The changes in these indices are calculated by taking the difference between year t and 2010:

$$\Delta P_{j,t} = P_{j,t} - P_{j,2010} \qquad \text{and} \qquad \Delta Q_{j,t} = Q_{j,t} - Q_{j,2010}$$

Table 4.G6 report the effect decomposition using price and quantity indices. There was no evidence that the minimum wage hike led to a higher firm-level price index. The minimum wage reform led to a lower quantity index in the medium-run.

4E Product Switching: Firm and Product Characteristics

This appendix section discusses the characteristics of firms that changed their portfolio and of products that were being switched.

Figure 4.F5 illustrates the proportions of firm switching products by their legal types. Private firms were less likely to changed their product portfolio (adding and dropping) than other types of domestic firms (i.e., joint-stock and limited liability companies). This may suggest that product switching is more common among joint-stock companies (JSCs) and limited liability companies (LLCs), where decisions are made collectively. This pattern was observed in binding and nonbinding firms alike. Foreign firms also changed their products less frequently than domestic JJCs and LLCs in the nonbinding sample, where they were observed sufficiently.

Figures 4.F6 and 4.F7 depict the distributions of firms' age and employment size by their product switching status. Among binding firms, younger and smaller ones switched

products more frequently than their older and larger counterparts. The two figures show no significant difference in age and employment size of nonbinding firms by product switching status. These findings suggest that younger and smaller firms adapt to new products more easily when facing minimum wage shocks.

Figure 4.F8 shows types of products, classified by the 6-digit product code, that were dropped and added the most during between 2010 and 2016. Manufacturing firms tended to switch to products that were similar to their old products (within and between neighboring product categories). For example, binding and nonbinding firms dropped and added wooden furniture (code 310010) simultaneously. Garment products were also frequently dropped (codes 141003 and 141004) and added (codes 141002, 141003, 141004, and 141006) by both types of firms.

Table 4.G9 presents the proportion of newly added products in the same product category, at different level, with at least one of the old products in the base year portfolio. Within-category product switching accounted for around 40%, 65%, and 73% of newly added products at the 6-, 4-, and 2-digit product code categories, respectively.[100] The differentials in the proportions of within-category switching at 6-digit and higher level imply the switching between neighboring categories. Table 4.G9 also indicates that the proportion of within-category product switching is significantly higher among binding than nonbinding firms.

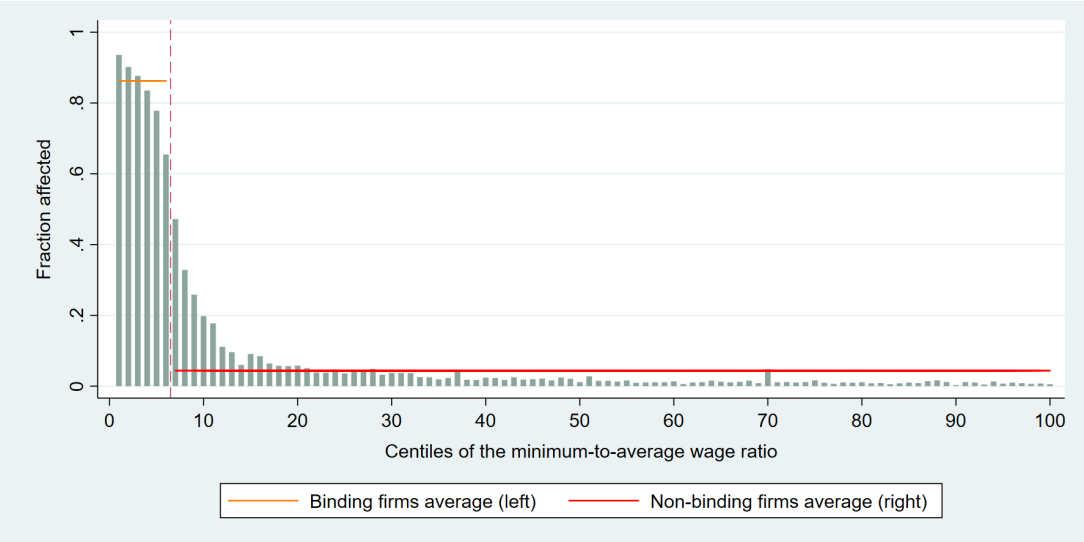
Although data from the *Industrial Production* module and the VES do not provide cost-related information at the product level, evidence from Figure 4.F8 and Table 4.G9 suggest that firms may not necessarily switch to more expensive or capital-intensive products.[101] Firms switch to products that match with their current technology and give them greater profits given demand information at each period.

[100]This suggest that firms were more likely to switch products within their main industry. Replacing total employment and revenue in Table 4.12 by employment in and revenue from the main industry, defined by 5-digit industry code, show similar direct and indirect effects of the minimum wage hike. Additional estimates on employment and revenue in the main industry can be provided upon request.

[101]The average sale prices can be used to construct a price index over time at the firm level, but are extremely noisy when compared across firms. Thus, this study cannot provide a price comparison between products across firms.

4F Additional Figures

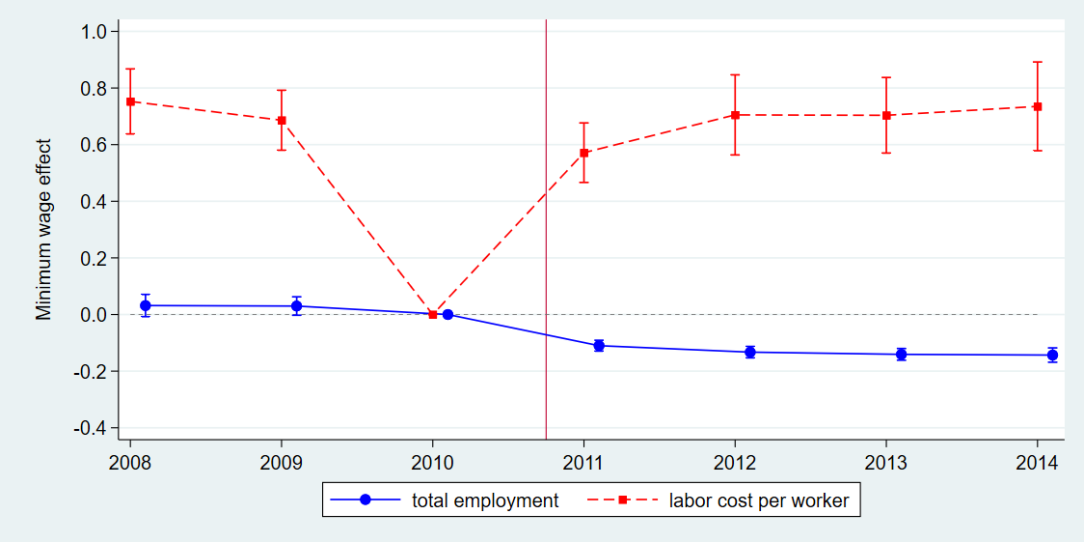
FIGURE 4.F1.—AVERAGE WAGE AND FRACTION AFFECTED IN 2009



NOTES.—The fraction affected is calculated based on wages and share of workers in 4 occupations, data in 2009. Red vertical line indicates the threshold by which this study defines the treatment group (i.e., firms on the left, the real average wage in 2009 below the real minimum wage in 2012). The lower horizontal line indicates the average fraction affected of non-binding firms. The upper horizontal line indicates the average fraction affected of binding firms.

FIGURE 4.F2.—MINIMUM WAGE TREATMENTS AND PRE-TREND ISSUES

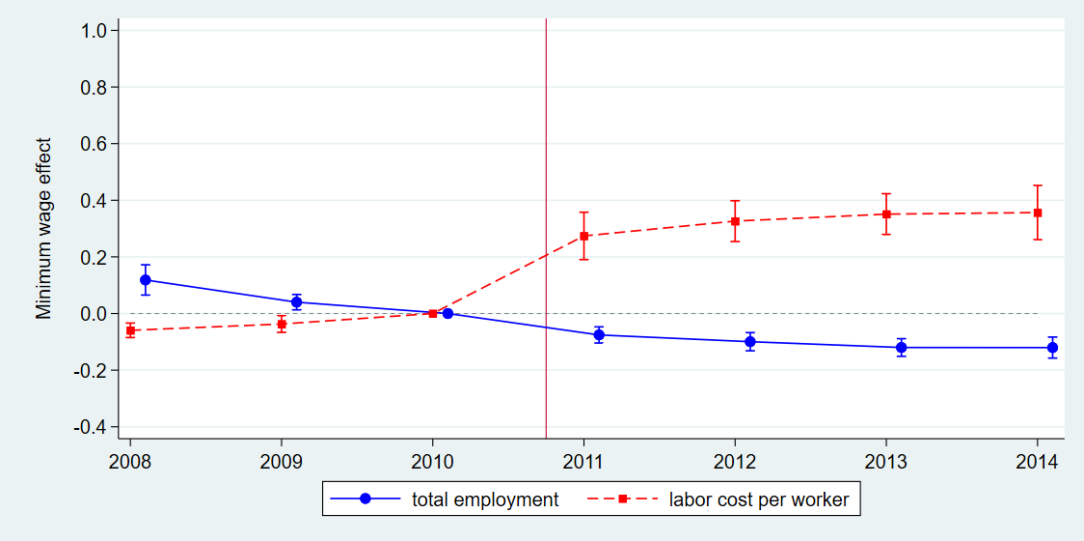
A. Binding Dummy Using Average Wage in 2010



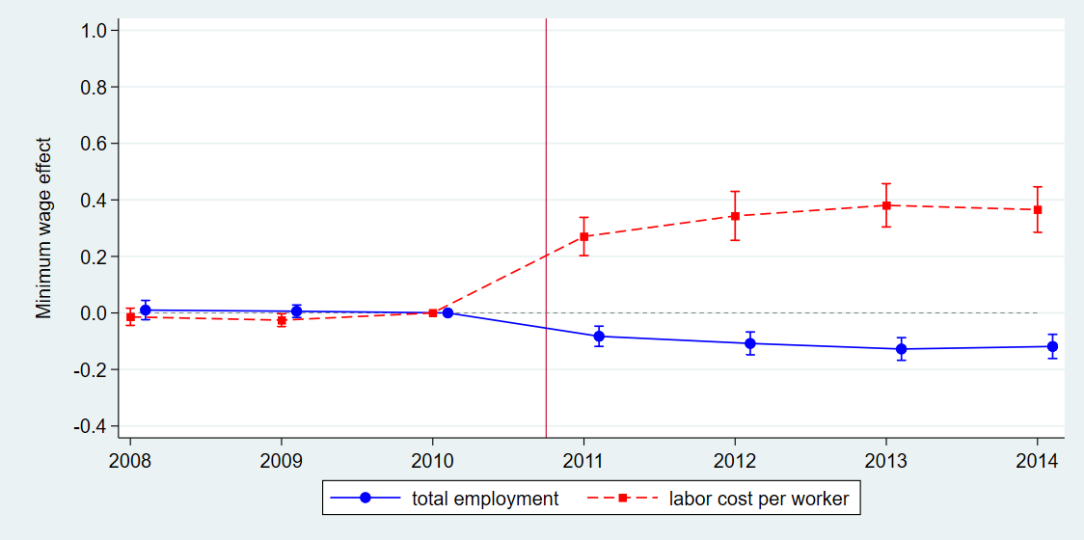
NOTES.—This figure shows the relationship between changes in outcome variables and different minimum wage binding dummies, represented by beta coefficients and its 95 percent confidence intervals from the main equation. In Panel A, the binding dummy is defined using the average wage in 2010. Control variables are included. Province and two-digit industry fixed effects are also included. Robust standard errors are clustered at the fixed-effects level.

FIGURE 4.F2.—MINIMUM WAGE TREATMENTS AND PRE-TREND ISSUES (CONT.)

B. Binding Dummy Using Average Wage in 2008–10

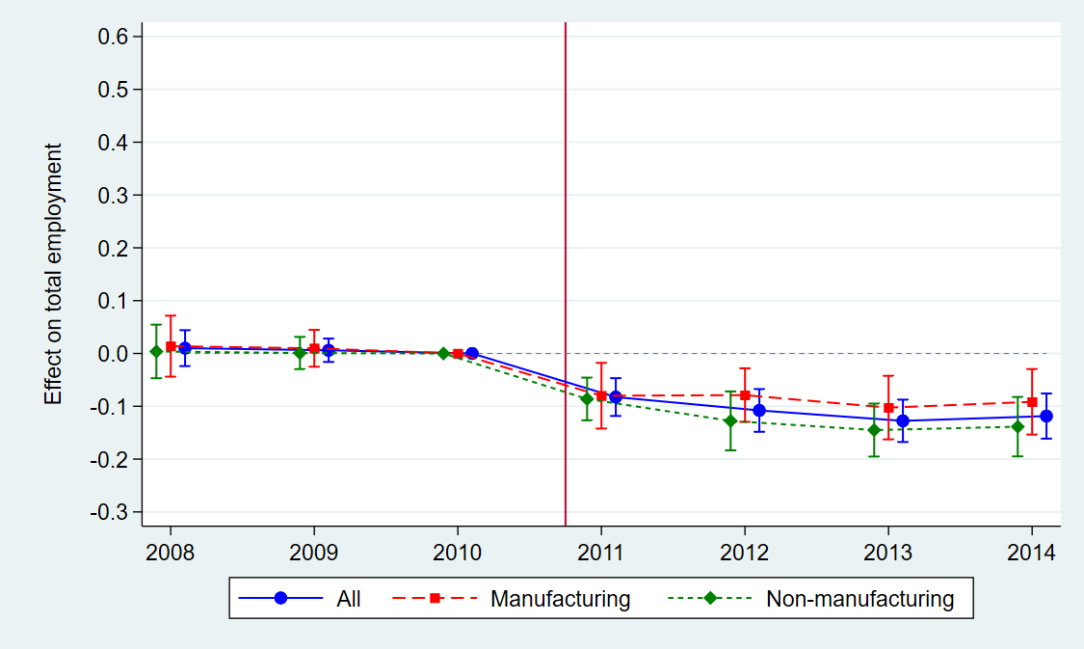


C. Binding Dummy Using Average Wage per Paid Worker in 2008–10



NOTES.—This figure shows the relationship between changes in outcome variables and different minimum wage binding dummies, represented by beta coefficients and its 95 percent confidence intervals from the main equation. In Panel B, the binding dummy is defined using the average wage in the 2008-2010 period. In Panel C, the binding dummy is defined using the average wage per paid worker in the 2008–2010 period. Control variables are included. Province and two-digit industry fixed effects are also included. Robust standard errors are clustered at the fixed-effects level.

FIGURE 4.F3.—MINIMUM WAGE EFFECTS ON EMPLOYMENT



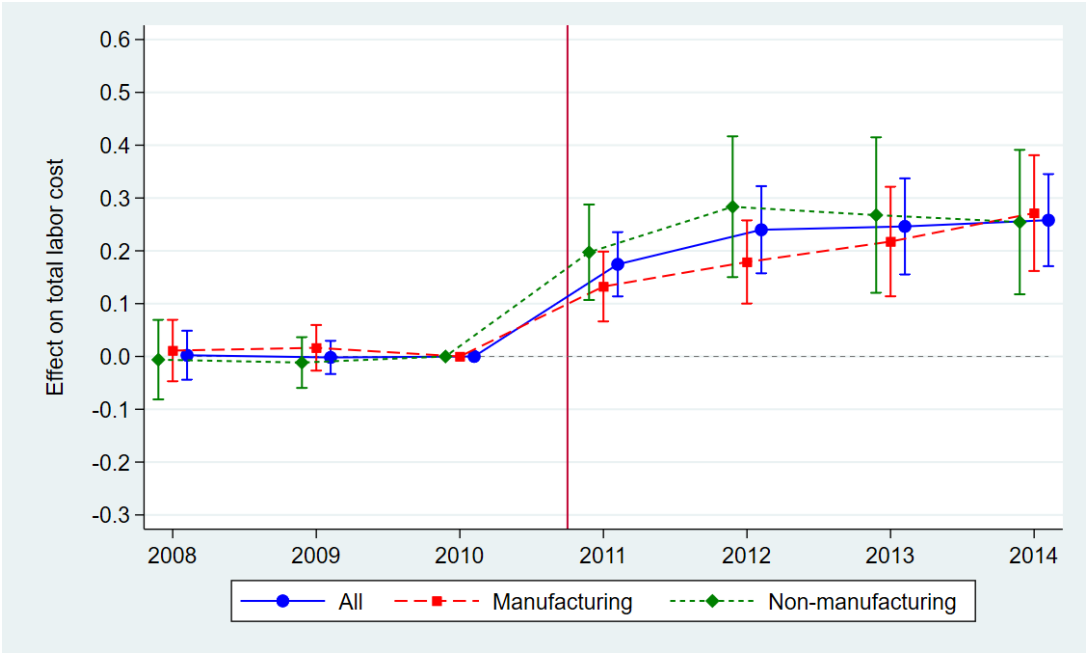
NOTE.—This figure shows the relationship between changes in total employment and the minimum wage binding dummy, represented by beta coefficients and its 95 percent confidence intervals from the main equation. Control variables include firm age and legal type in 2010, minimum wage group dummies, and the average of following outcomes during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets. Province and two-digit industry fixed effects are also included. Robust standard errors are clustered at the fixed-effects level. Firms exit after 2010 are considered to have a 100% drop in total employment.

FIGURE 4.F4.—MINIMUM WAGE EFFECTS ON MARGINS OF ADJUSTMENT

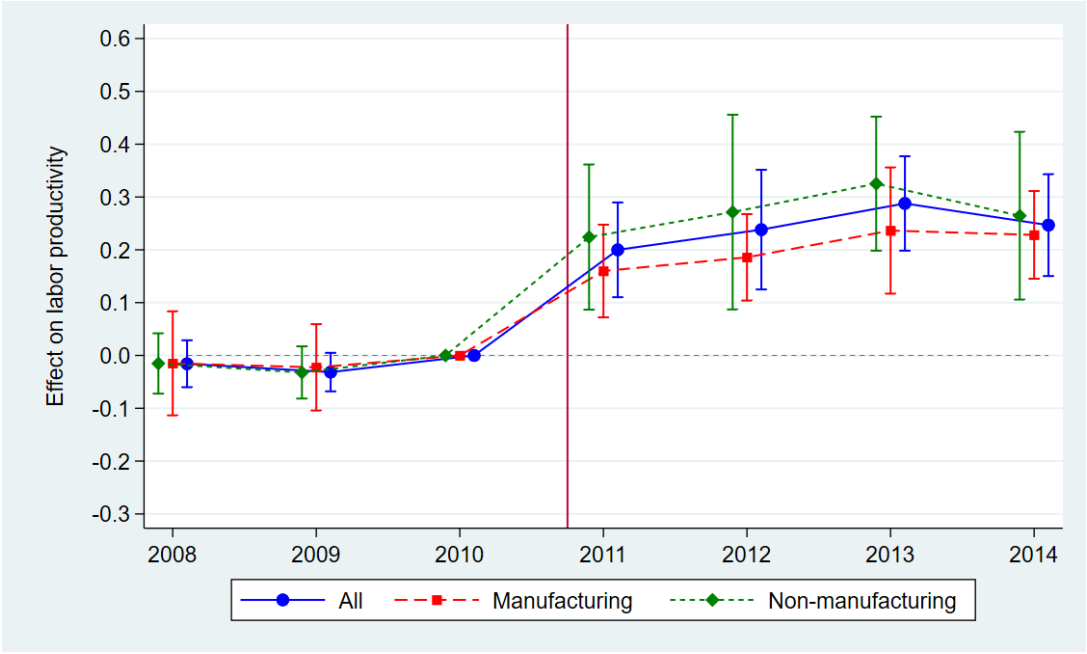
A. Effect on labor cost per worker

FIGURE 4.F4.—MINIMUM WAGE EFFECTS ON MARGINS OF ADJUSTMENT (CONT.)

B. Effect on total labor cost



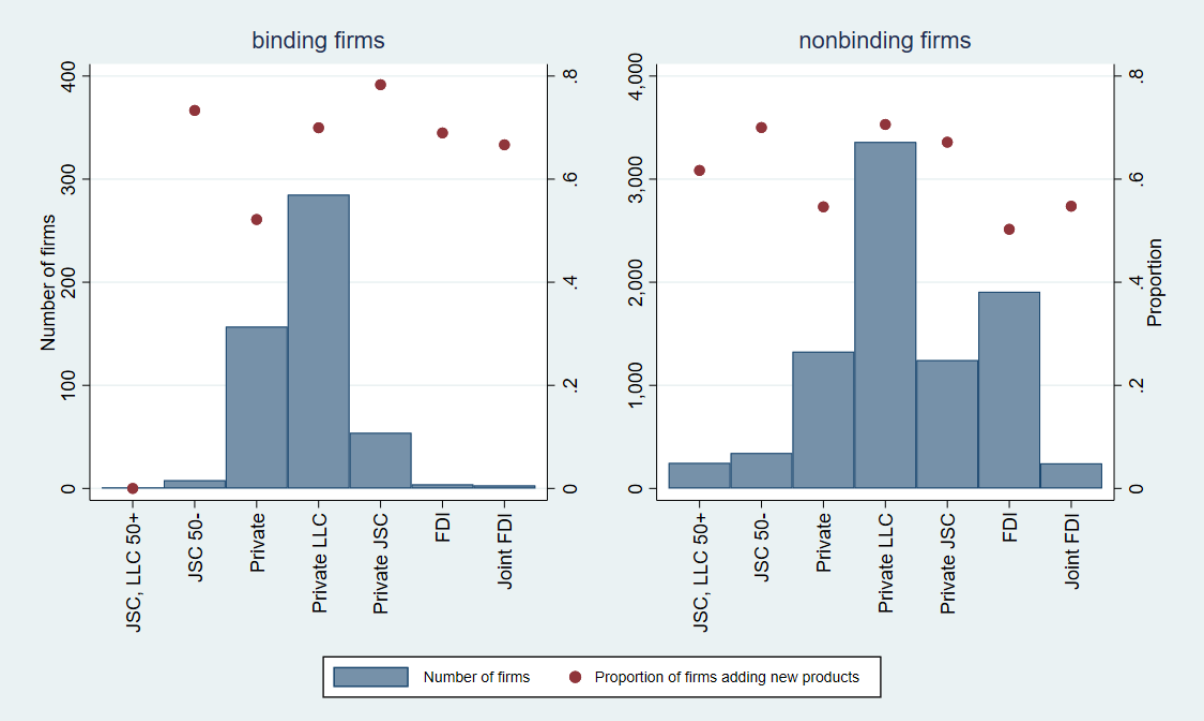
C. Effect on labor productivity



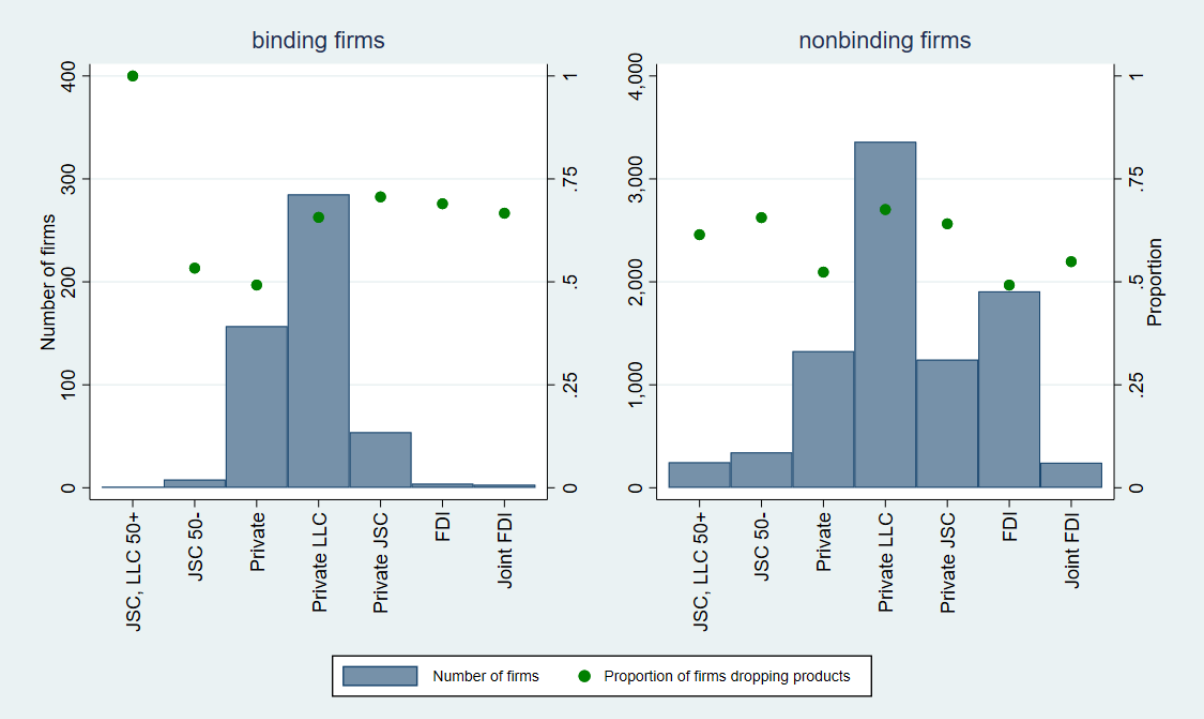
NOTE.—This figure shows the relationship between changes in outcome variables and the minimum wage binding dummy, represented by beta coefficients and its 95 percent confidence intervals from the main equation. Control variables include firm age and legal type in 2010, minimum wage group dummies, and the average of following outcomes during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets. Province and two-digit industry fixed effects are also included. Robust standard errors are clustered at the fixed-effects level. Regressions in all panels do not account for extensive margin (firm's closure decision).

FIGURE 4.F5.—TYPES OF FIRMS SWITCHING PRODUCTS

A. Adding any new products between 2011 and 2016



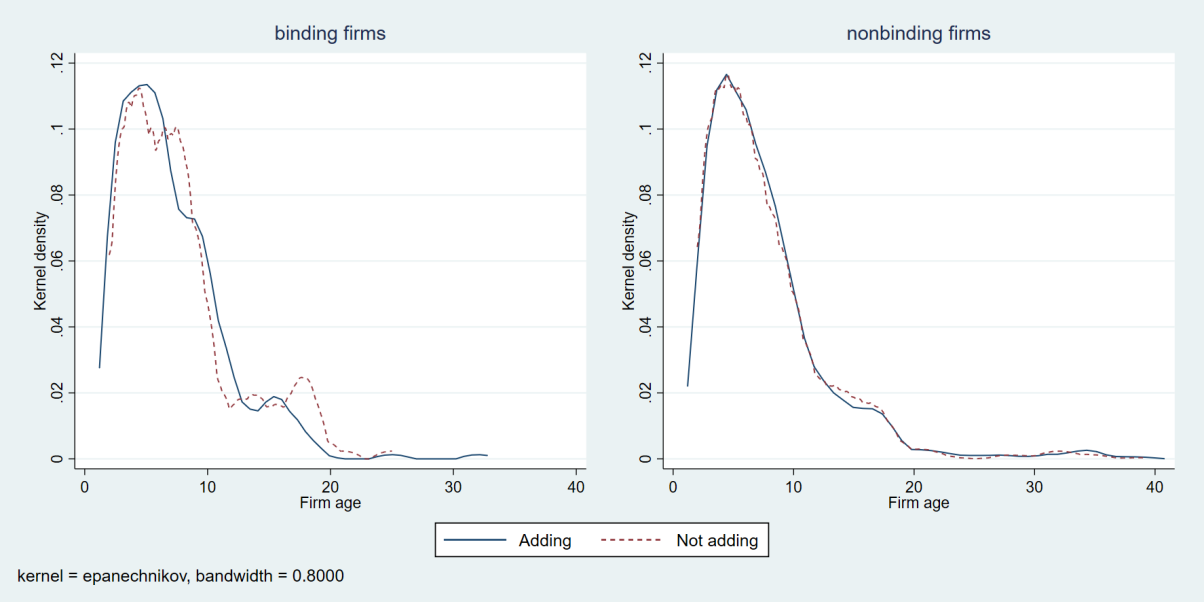
B. Dropping any old products between 2011 and 2016



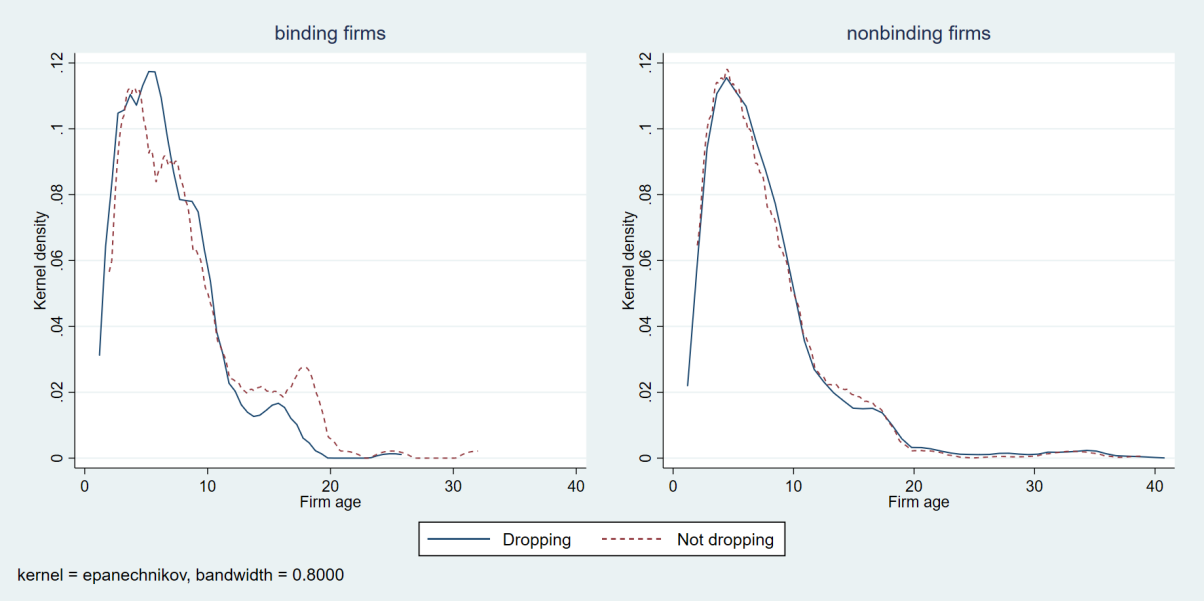
NOTES.—The figure illustrates the proportion of firms adding or dropping products (relative to the base year 2010) by their legal types. JSC, LLC, and FDI refer to joint-stock, limited liability, and foreign-invested companies, respectively. Notations "50+" and "50–" indicate firms with over and less than 50% of state capital, respectively. Sample includes all available firms in 2010.

FIGURE 4.F6.—AGE DISTRIBUTIONS OF FIRMS SWITCHING PRODUCTS

A. Adding any new products between 2011 and 2016



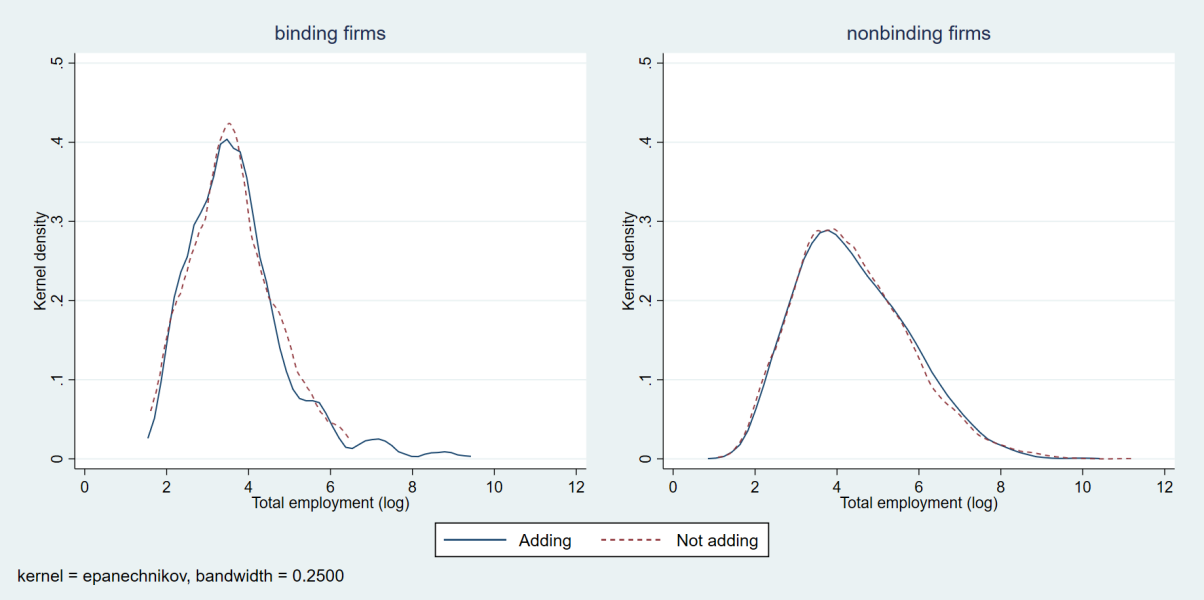
B. Dropping any old products between 2011 and 2016



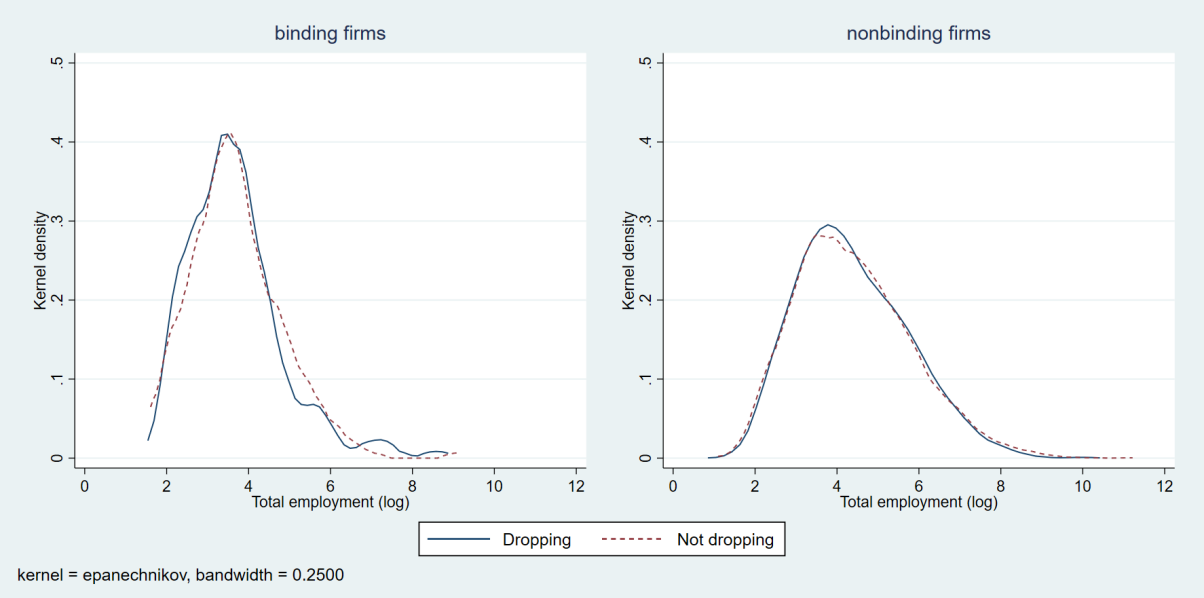
NOTES.—The figure illustrates the kernel density estimates of firm age in 2010 by product switching (relative to the base year 2010) and minimum wage binding status. Firms older than 40 years were excluded to capture better the pattern at the lower tail, where most firms concentrated.

FIGURE 4.F7.—SIZE DISTRIBUTIONS OF FIRMS SWITCHING PRODUCTS

A. Adding any new products between 2011 and 2016



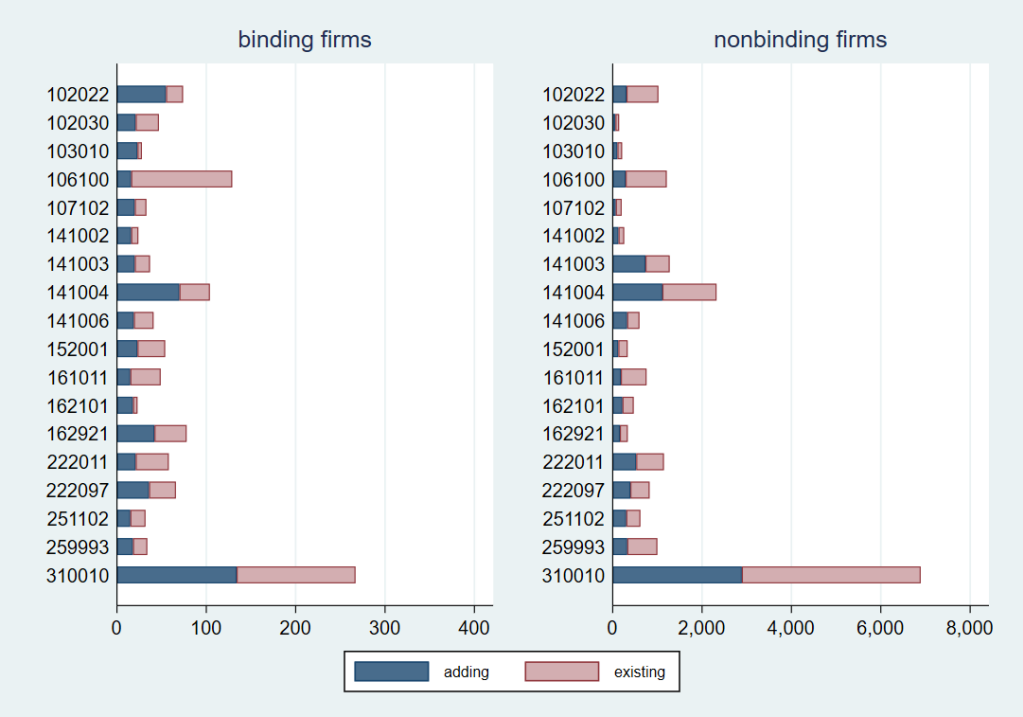
B. Dropping any old products between 2011 and 2016



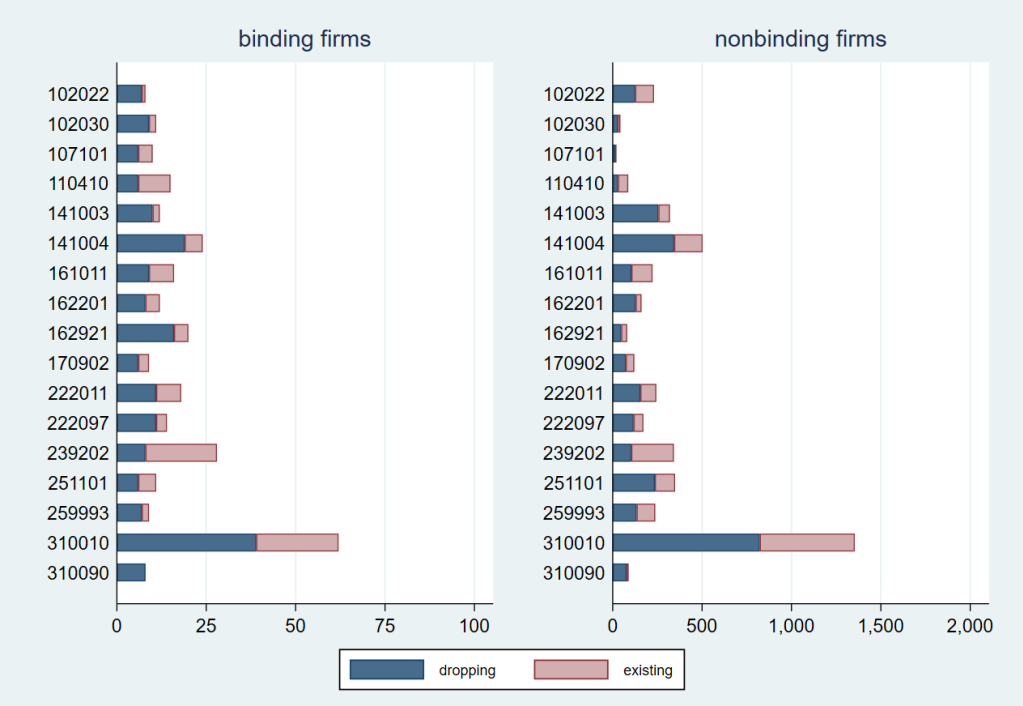
NOTES.—The figure illustrates the kernel density estimates of employment size in 2010 by product switching (relative to the base year 2010) and minimum wage binding status.

FIGURE 4.F8.—TYPES OF PRODUCTS BEING DROPPED AND ADDED

A. Being Added (2011–2016)



B. Being Dropped (2010)



NOTES.—The figure illustrates types of product being added (dropped) the most by binding firms and their nonbinding counterparts, when compared to the portfolio in 2010. "Adding (dropping)" products are defined at the finest (8-digit) level. To maximize the sample size within each type, this figure categorizes products at the 6-digit level. Each firm-year-product cell is counted as one observation. All available firms are included. The 6-digit product codes are as follows:

Product Code	Product Name
102022	Frozen seafood
102030	Salted, dried, and smoked seafood
103010	Canned vegetables and fruits
106100	Milling products and raw flours
107101	Bread and fresh cakes
107102	Preservable cakes
110410	Bottled mineral and purified water
141002	Protective clothes
141003	Knitted outer clothes
141004	Other outer clothes
141006	Specialized clothes and costume accessories
152001	Casual shoes and sandals
161011	Sawn and sliced/peeled (over 6mm) timber
162101	Plywood and sliced (less than 6mm) timber
162201	Wooden construction materials and products
162921	Manufactures of bamboo, straw, and other plaiting materials
170902	Other paper and paperboard products (not elsewhere classified)
222011	Plastic packaging
222097	Other plastic products
239202	Bricks, tiles, paving stones, and baked-clay construction products
251101	Metal structures and parts thereof
251102	Doors, windows and parts thereof made of iron, steel, and aluminum
259993	Other metal products
310010	Wooden beds, cabinets, tables, and chairs
310090	Other beds, cabinets, tables, and chairs

4G Additional Tables

TABLE 4.G1.—VIETNAMESE ENTERPRISE SURVEY: SAMPLING CRITERIA

VES[a]	Firm size threshold[b, c]	Sampling rate	Province exceptions[c]	Industry exceptions[d]
2008	Hanoi (1): **20** HCMC (79): **30**	All provinces: **15%**	**25 provinces:** Ha Giang (2), Cao Bang (4), Bac Kan (6), Tuyen Quang (8), Lao Cai (10), Dien Bien (11), Lai Chau (12), Son La (14), Yen Bai (15), Hoa Binh (17), Lang Son (20), Ha Nam (35), Ninh Binh (37), Quang Tri (45), Phu Yen (54), Ninh Thuan (58), Kon Tum (62), Gia Lai (64), Dak Lak (66), Dak Nong (67), Binh Phuoc (70), Hau Giang (93), Tra Vinh (84), Bac Lieu (95).	Agriculture, Forestry, and Fishing (1, 2, 3) Transportation (49, 50, 51) Accommodation & food services activities (55, 56) Financial, banking, and insurance activities (64, 65, 66)
2009	Hanoi (1) & HCMC (79): **30** Other provinces: 10	All provinces: **15%**	**18 provinces:** Ha Giang (2), Cao Bang (4), Bac Kan (6), Tuyen Quang (8), Lao Cai (10), Dien Bien (11), Lai Chau (12), Son La (14), Yen Bai (15), Hoa Binh (17), Lang Son (20), Phu Yen (54), Ninh Thuan (58), Kon Tum (62), Dak Nong (67), Hau Giang (93), Tra Vinh (84), Bac Lieu (95).	Agriculture, Forestry, and Fishing (1, 2, 3) Transportation (49, 50, 51) Accommodation & food services activities (55, 56) Financial, banking, and insurance activities (64, 65, 66)
2010	Hanoi (1) & HCMC (79): **50** Hai Phong (31), Dong Nai (74), Binh Duong (75): **30** Other provinces: **20**	Hanoi (1) & HCMC (79): **10%** (less than 20 employees) & **20%** (20-49 employees) Other provinces: 20%	**16 provinces:** Ha Giang (2), Cao Bang (4), Bac Kan (6), Tuyen Quang (8), Lao Cai (10), Dien Bien (11), Lai Chau (12), Son La (14), Yen Bai (15), Lang Son (20), Ninh Thuan (58), Kon Tum (62), Dak Nong (67), Hau Giang (93), Tra Vinh (84), Bac Lieu (95).	Agriculture, Forestry, and Fishing (1, 2, 3) Accommodation & food services activities (55, 56) Information & Communication (58-63)

VES[a]	Firm size threshold[b, c]	Sampling rate	Province exceptions[c]	Industry exceptions[d]
2012	Hanoi (1) & HCMC (79): **50** Hai Phong (31), Da Nang (48), Dong Nai (74), Binh Duong (75): **30** Other provinces: **20**	Same as above	Same as above	Transportation (49, 50, 51) Accommodation & food services activities (55, 56) Information & Communication (58-63)
2013	Same as above	Same as above	Same as above	Transportation (49, 50, 51) Accommodation & food services activities (55, 56) Information & Communication (58-63) Waste collection & process (38)
2014	Same as above	Same as above	Same as above	Transportation (49, 50, 51) Accommodation & food services activities (55, 56) Information & Communication (58-63)
2015	Same as above	Same as above	Same as above	Agriculture, Forestry, and Fishing (1, 2, 3) Transportation (49, 50, 51) Accommodation (55) Insurance (65)

NOTES.—Column (2) shows the employment threshold above which all registered firms were chosen for the survey. For the remaining firms with employment below this threshold, the sampling rate are reported in Column (3). In small provinces where the number of registered enterprises is not large (usually less than 1,000), the GSO will survey all firms. The list of province exceptions is provided in Column (4). Depending on the main focus of each survey year, the GSO chooses certain industries to survey all registered enterprises belonging to those industries. Column (5) show the list of industry exceptions each year.

[a] VESs in 2011 and 2016 are census data, and therefore, cover all registered firms; [b] Applied to private firms and stock companies with less than 50% of shares held by the State; [c] Province codes in parentheses; [d]two-digit Vietnam Standard Industrial Classification 2007 codes in parentheses.

Source: Authors' compilation from official Plans for the implementation of enterprise surveys

Table 4.G2.—Vietnamese Enterprise Survey: Details of Specific Modules

Module	Coverage	Observation level	Main information
Main	All firms	Firm level	+ Main characteristics (location at the commune level, legal type, industry, etc.) + Employment and expenses related to labor + Assets and liabilities + Business results + Tax obligation
Industrial Production	Manufacturing firms	Firm-product level	+ Name, code, and unit of all products produced + Volume of each product produced/sold + Value of each product sold
Accommodation Business	Firms providing hotel, camping, and related services	Firm level	+ Number of guest-days served (guest times day) + Net turnover from accommodation business
Construction	Construction firms	Firm-product level	+ Name, code, and unit of all construction work conducted + Volume and value of each construction work conducted

Source: Authors' compilation from official Plans for the implementation of enterprise surveys

TABLE 4.G3.—EFFECTS ON EMPLOYMENT AND EXIT PROBABILITY

	2012–10 (short-term)		2014–10 (medium-term)		2008–10 (placebo)	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Change in firm-level total employment						
MW binding	–.127***	–.108***	–.156***	–.119***	.030*	.010
	(.020)	(.020)	(.020)	(.021)	(.018)	(.017)
Panel B: Probability of exit the market[a]						
MW binding	.026***	.018*	.050***	.034**		
	(.009)	(.009)	(.015)	(.015)		
Observations	29,321	29,321	29,321	29,321	29,321	29,321
Controls	NO	YES	NO	YES	NO	YES
Fixed effects	YES	YES	YES	YES	YES	YES

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. Province and two-digit industry fixed effects are included. Robust standard error in parentheses, clustered at the fixed-effects level, adjusted following Cameron et al. (2011) for multi-way clustering. Control variables include firm age and legal type in 2010, minimum wage group dummies, and the average of following outcomes during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets. Firms exit after 2010 are considered to have a 100% drop in total employment.

[a] Linear probability model is used to capture all fixed effects.

TABLE 4.G4.—EFFECTS ON MARGINS OF ADJUSTMENT

	2012–10 (short-term)		2014–10 (medium-term)		2008–10 (placebo)	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Change in labor cost per worker						
MW binding	.337***	.343***	.370***	.366***	–.001	–.014
	(.045)	(.043)	(.041)	(.040)	(.011)	(.015)
Panel B: Change in total labor cost						
MW binding	.222***	.240***	.244***	.258***	.021	.002
	(.045)	(.041)	(.040)	(.044)	(.025)	(.023)
Panel C: Change in profit-to-revenue ratio						
MW binding	–.000	–.004	–.007	–.011	–.002	–.004
	(.004)	(.004)	(.006)	(.008)	(.004)	(.005)
Panel D: Change in labor productivity (value added per worker)[a]						
MW binding	.249***	.238***	.266***	.247***	–.007	–.016
	(.054)	(.057)	(.049)	(.048)	(.017)	(.022)
Observations	22,634	22,634	18,431	18,431	29,321	29,321
Controls	NO	YES	NO	YES	NO	YES
Fixed effects	YES	YES	YES	YES	YES	YES

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. Province and two-digit industry fixed effects are included. Robust standard error in parentheses, clustered at the fixed-effects level, adjusted following Cameron et al. (2011) for multi-way clustering. Control variables include firm age and legal type in 2010, minimum wage group dummies, and the average of following outcomes during the 2008–2010 period: Profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets.

[a] Value added is defined as the sum of total labor cost, net operating profit, depreciation of fixed assets, interest payment, and production taxes. The number of observations in labor productivity regression are slightly lower because of noises in its components.

TABLE 4.G5.—ROBUSTNESS CHECK: SAMPLE SELECTION BIAS

	2012–10 (short-term)		2014–10 (medium-term)	
	(1)	(2)	(3)	(4)
MW binding	.343***	.339***	.366***	.364***
	(.043)	(.039)	(.040)	(.050)
Sample	All	Restricted	All	Restricted
Observations	22,634	16,034	18,431	16,034
Controls	YES	YES	YES	YES
Fixed effects	YES	YES	YES	YES

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. Dependent variable is percentage change in labor cost per worker. Restricted sample refers to the sample that includes firms appeared in all survey rounds. Province and 2-digit industry fixed effects are included. Robust standard error in parentheses, clustered at the fixed effects level, adjusted following Cameron et al. (2011) for multi-way clustering. Control variables include firm age and legal type in 2010, minimum wage group dummies, and the average of following outcomes during 2008–10 period: profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets.

TABLE 4.G6.—REVENUE EFFECT DECOMPOSITION: PRICE AND QUANTITY INDICES

	2012–10 (short-term)		2014–10 (medium-term)	
	(1)	(2)	(3)	(4)
Revenue of continuing products	–.004	–.003	–.120***	–.138***
	(.036)	(.042)	(.018)	(.044)
Price index	–.016	–.010	.093	.081
	(.033)	(.053)	(.088)	(.094)
Quantity index	.063	.041	–.206**	–.250**
	(.074)	(.079)	(.075)	(.098)
Observations	4,382	4,382	3,487	3,487
Controls	NO	YES	NO	YES
Fixed effects	YES	YES	YES	YES

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. This table reports the minimum wage binding coefficients from estimating the change in price and quantity indices, based on the index construction discussed in Appendix 4D. Sample includes firms that kept at least one product from portfolio in year 2010. Province and 2-digit industry fixed effects are included. Robust standard error in parentheses, clustered at the fixed effects level, adjusted following Cameron et al. (2011) for multi-way clustering. Control variables include firm age and legal type in 2010, minimum wage group dummies, and the average of following outcomes during 2008–10 period: profit-to-revenue ratio, labor share in revenue, share of wage cost in total labor cost, and depreciation of fixed assets.

TABLE 4.G7.—MULTI- VERSUS MONO-PRODUCT FIRM'S CHARACTERISTICS

Firm characteristics	Multi-product	Multi-industry
Total employment	.509***	.570***
	(.097)	(.122)
Total sales revenue	.721***	.922***
	(.140)	(.146)
Labor productivity	.145***	.230***
	(.037)	(.050)

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. The number of observations is 8,854 manufacturing firms in 2010. Of these firms, 26.54% was multi-products firms and 5.51% was multi-industry firms. Results from OLS regressions of log characteristics on a dummy variable indicating whether firm is multi-product or multi-industry (defined by engaging in activities in two industries with different two-digit industry codes). Province and two-digit industry fixed effects are included. Robust standard error in parentheses, clustered at the fixed-effects level, adjusted following Cameron et al. (2011) for multi-way clustering.

TABLE 4.G8.—MINIMUM WAGE AND PRODUCT SWITCHING WITH DIRECTOR CHARACTERISTICS

	Add new product(s)			Drop old product(s)		
	2012–10	2014–10	2016–10	2012–10	2014–10	2016–10
	(1)	(2)	(3)	(4)	(5)	(6)
MW binding	.037	.101***	.095***	.001	.033	.044*
	(.037)	(.031)	(.025)	(.042)	(.032)	(.022)
Director's age	–.001	–.002**	–.002**	–.001	–.001	–.001
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Director's educational/vocational qualification (Base group: No qualification)						
Short-term training	–.001	.007	.014	.017	.019	.043
	(.050)	(.056)	(.047)	(.059)	(.065)	(.058)
Elementary vocational	–.071	–.062	–.076	–.056	–.074	–.082
	(.062)	(.074)	(.083)	(.062)	(.075)	(.082)
Mid-vocational	.035	.059	.061*	.025	.035	.041
	(.041)	(.041)	(.034)	(.042)	(.047)	(.047)
College/vocational college	.049	.068	.069	.047	.045	.071
	(.051)	(.055)	(.044)	(.057)	(.053)	(.050)
Undergraduate	.010	.023	.035	.015	.021	.033
	(.048)	(.053)	(.043)	(.055)	(.062)	(.055)
Graduate	–.000	.027	.043	.004	–.002	.018
	(.071)	(.075)	(.067)	(.069)	(.078)	(.071)
Mean of DV	.452	.547	.611	.450	.529	.577
Observations	4,839	4,839	4,839	4,839	4,839	4,839
Fixed effects	YES	YES	YES	YES	YES	YES

NOTES.—*** $p < .01$, ** $p < .05$, * $p < .1$. The linear probability model is used to capture province and two-digit industry fixed effects. Robust standard error in parentheses, clustered at the fixed-effects level, adjusted following Cameron et al. (2011) for multi-way clustering. The numbers of observations in regressions that control for director's characteristics are lower because that information was available in the VES 2011 alone (census year).

TABLE 4.G9.—WITHIN-CATEGORY SWITCHING: BINDING VERSUS NONBINDING FIRMS

Product category	Nonbinding	Binding	Combined	Difference
6-digit product code	.392	.426	.394	–.034***
4-digit product code	.646	.699	.648	–.053***
2-digit product code	.723	.757	.725	–.034***
Observations	23,796	1,223	25,019	

NOTES.—Within-category product switching is defined as newly added and one of the base products (in portfolio in 2010) are in the same product category (6-, 4-, 2-digit code level). The sample include all available firms during the 2011–2016 period, and observation is at the firm-product level. The last column presents a simple t-test without controlling for firm characteristics. *** $p < .01$, ** $p < .05$, * $p < .1$.

Appendix: In-depth Field Interviews

Purpose of the Field Study

The field study was conducted between September 21, 2022 and October 17, 2022 for better understanding of the minimum wage effects and how firms respond to a negative shock on their labor cost. A total of 52 in-depth interviews were conducted with individuals from registered enterprises in three representative areas: Hanoi (North), Vinh city (Middle), and Ho Chi Minh city (South). Each interview lasted 30–60 minutes with open-ended questions. The open-ended questions focused on but not limited to five aspects: (i) basic characteristics; (ii) constraints for business (such as recruitment, labor cost, competition, etc.,); (iii) firms responses to minimum wage hikes and other business difficulties; (iv) product switching behavior; and (v) labor policy enforcement.

Questionnaires

For each interview, I tried to get as far as possible information related to minimum wage, labor cost, and policy inspection. Depending on the interviewee's openness, they may share all or only partial information on each aspect. For example, some respondents may be reluctant to talk freely about policy enforcement while others may not want to share their wage policy. Additionally, several firms started long after the minimum wage hike in 2011, thus I could not obtain information on their responses. Among some older firms, the respondent may not know well about the 2011-hike. For these firms, I focused on the third set of questions rather than the impact of the 2011-hike. The open-ended questionnaires in English are as follow:

1. **Firm characteristics**

   - Legal type (private, joint stock company, state-owned, etc.,) and year of establishment
   - Type of business (industry)
   - Employment size and employment structure (by educational/vocational level, type of contract)

2. **Overview of firm business**

   - Business outcomes over the last few years
   - Output market (domestic, export, etc.,)
   - Employment growth and recruitment plan
   - Average wage and wage growth schedule (for all employees and by education level)
   - Wage components, and related information

3. **Impact of the minimum wage policy**

   - Are you aware of the minimum wage policy? Is it important to the firm when making business plan?
   - Does the annual minimum wage hike directly affect the firm (labor cost, profit, etc.,)?
   - If yes, how does the firm react to the annual increase in the minimum wage?
   - If there was a sharp increase in the minimum wage (e.g., the government announces that they will increase the minimum wage by 25% from the current level), what are your possible strategies in response to this shock?
     - Any change in employment, recruitment plan?
     - Any change in workers' remuneration (wage and non-wage components, e.g., bonuses, non-wage benefits)?
     - Attempt to improve labor productivity? Attempt to improve production efficiency? If yes, how?
     - Any change in output market (e.g., output prices, sale plan, find other potential market/customer base that gives more profit to the firm)?
     - Any change in production portfolio (e.g., dropping old, unprofitable products; trying new, more profitable products)?
     - Any other strategies?

4. **Impact of the 2011 minimum wage hike (if the firm was established before 2012)**

   In October 2011, the government merged the minimum wages applied to domestic firms and foreign firms, resulting in a sharp increase in the minimum wage for domestic firms. After this hike:

   - Did you change the number of employees and their wage level?
   - Were more workers interested in working for you (in light of higher wages)?
   - How was your business (output, revenue, profitability, etc.,) affected?

- In response to the hike, did you change your business strategy? For example, change in output market (foreign market to local market or vice versa), change in product portfolio, etc.,
- Were you able to raise your output prices? What were the constraints on this matter (market competition, preset contract, etc.,)?
- In your business, were there more firms entering or exiting from the market? Has the market become more competitive in your area since 2011?

5. **General business environment**

   - What are your opinions on the minimum wage policy as well as other regulation on your enterprise?
   - Have you been inspected by local/central regulators on compliance of labor market policies? What are procedures during these events?
   - What were the major regulation change in the past 10 years?
   - (For informal firms) do you wish to formally register your business?

The questionnaires in Vietnamese are as follows:

1. **Thông tin doanh nghiệp**

   - Loại hình đăng ký doanh nghiệp, năm thành lập doanh nghiệp
   - Ngành đăng ký kinh doanh, danh mục sản phẩm/dịch vụ chính
   - Quy mô lao động doanh nghiệp

2. **Hoạt động sản xuất, kinh doanh**

   - Kết quả hoạt động kinh doanh trong những năm qua
   - Thị trường, đối tượng tiêu thụ sản phẩm/dịch vụ chính (bao gồm hoạt động xuất khẩu)
   - Tăng trưởng quy mô lao động, kế hoạch tuyển dụng
   - Chính sách lương, thưởng, phúc lợi, và thông tin liên quan

3. **Ảnh hưởng của chính sách lương tối thiểu**

   - Lương tối thiểu có ảnh hưởng tới các kế hoạch sản xuất, kinh doanh của doanh nghiệp?
   - Doanh nghiệp có chịu anh hưởng trực tiếp của lương tối thiểu tới kết quả hoạt động kinh doanh (VD: chi phí lao động, doanh thu, lợi nhuận)?
   - Nếu có, doanh nghiệp có điều chỉnh gì để giảm thiểu tác động của việc tăng lương tối thiểu hàng năm?
   - Giả định Chính Phủ tăng lương tối thiểu 25%, doanh nghiệp có kế hoạch gì để tránh những tác động tiêu cực từ chính sách này?
     - Thay đổi quy mô lao động, kế hoạch tuyển dụng?
     - Thay đổi quỹ lương, thưởng cho người lao động?
     - Cải thiện năng suất lao động, hiệu quả sản xuất? Nếu có thì bằng cách nào?

- Thay đổi giá bán mặt hàng/dịch vụ sản xuất chính? Thay đổi thị trường tiêu thụ?
- Thay đổi kế hoạch sản xuất, kinh doanh sang các mặt hàng/dịch vụ khác tiềm năng hơn?
- Kế hoạch khác?

4. **Tác động của chính sách lương tối thiểu năm 2011 (đối với doanh nghiệp hoạt động trước 2012)**

   Vào tháng 10/2011, Chính Phủ thay đổi chính sách lương tối thiểu bằng cách sát nhập hai mức lương tối thiểu vùng giữa doanh nghiệp trong nước và doanh nghiệp có vốn đầu tư nước ngoài. Điều này dẫn tới mức tăng lương xấp xỉ 50% của lương tối thiểu áp dụng cho doanh nghiệp trong nước. Sau chính sách này, doanh nghiệp có:

   - Thay đổi về quy mô lao động cũng như mức lương cho lao động?
   - Mức lương mới cao hơn có giúp cho doanh nghiệp thu hút được lao động có chất lượng cao?
   - Chịu ảnh hưởng về doanh thu, lợi nhuận?
   - Thay đổi về chiến lược sản xuất, kinh doanh?
   - Đứng trước rủi ro phá sản do chi phí tăng cao? Thị trường có trở nên cạnh tranh hơn?

5. **Môi trường kinh doanh**

   - Ý kiến của doanh nghiệp về chính sách lương tối thiểu cũng như các chính sách khác đối với doanh nghiệp?
   - Doanh nghiệp đã từng trải qua các cuộc thanh tra, kiểm tra về việc tuân thủ các chính sách lao động? Thông thường, các cuộc thanh tra, kiểm tra tại doanh nghiệp diễn ra theo quy trình nào?
   - Doanh nghiệp có mong muốn thay đổi gì trong chính sách lương tối thiểu không?

Main Findings

Table A1 presents the key summary statistics of the field study.

First, large firms tended to comply with the social security law more strictly than smaller firms. On average, 86% of employment in large firms were insured by social security, compared to 61% employment in smaller firms. The large firms faced a higher burden from social security costs when the government raised the minimum wage. Among firms with over 100 employees, 10 out of 14 felt a moderate-to-severe effect from social security costs associated with the minimum wage. Most small firms found this effect negligible.

Second, large firms were exposed to minimum wage and social security inspections more frequently than smaller firms. For example, only 12% and 45% of all firms answered that they experienced at least one inspection on minimum wage and social security policies, respectively. The proportions of large firms experiencing these inspections were much higher at 46% and 77%. This supports the hypothesis that larger firms that exposed themselves to the authorities (e.g., by complying with social security law) also faced higher enforcement intensity.

Third, other than minimum wage and social security constraints, small and large firms were not different in other constraints such as skilled labor recruitment or competition. Their responses to negative shocks (such as increasing labor cost, the COVID-19 pandemic, severe competition, etc.) were also similar, except for mechanization. Large firms with higher capacity tend to substitute labor with machinery or new technologies, whereas only a small proportion of smaller firms can do so.

Fourth, only one-third of the total number of firms can adjust their output prices while facing negative shocks. Product/industry switching was frequently practiced among all firms in the sample, regardless of their employment size. Firms conducted product-level switching behavior more frequently than industry-level switching behavior. This emphasizes the importance of product switching in firms' business strategy. Thus, this study of product switching can contribute to the literature of industrial organization and minimum wage.

Fifth, the minimum wage policy is weakly enforced in Vietnam, especially among SMEs. None of the small firms were encountered any inspections in minimum wage policy whereas this rate among large firms is nearly 50%. The social security policy is usually attached with the minimum wage policy but not in the other direction. Firms experienced inspections in social security also experienced inspections in minimum wage policy, but the opposite direction was not necessarily true. This observation supports the employment categorization in Chapters 2 and 3.

TABLE A1.—IN-DEPTH INTERVIEW SUMMARY STATISTICS

	All firms		Small firms		Large firms	
	N	Mean	N	Mean	N	Mean
Firm characteristics						
Firm age	52	12.6	38	9.2	14	22
Total employment	52	141.7	38	16.9	14	480.4
Industry: Manufacturing	52	0.38	38	0.32	14	0.57
Industry: Construction and related	52	0.17	38	0.21	14	0.07
Industry: Wholesale and retail	52	0.21	38	0.16	14	0.36
Constraints for business (1: Yes; 0: No)						
Difficulty in recruiting skilled labor	46	0.70	32	0.72	14	0.64
High degree of competition	52	0.77	38	0.76	14	0.79
Increasing labor cost	46	0.89	33	0.85	13	1
Social security cost related to MW hikes	50	0.24	36	0.06	14	0.71
Response to negative shock (1: Yes; 0: No)						
Price adjustment (raise)	42	0.33	29	0.34	13	0.31
Cost minimization	42	0.29	29	0.21	13	0.46
Productivity improvement	42	0.38	29	0.34	13	0.46
Revenue (Quantity) improvement	42	0.12	29	0.10	13	0.15
Product quality improvement	42	0.07	29	0.10	13	0
Mechanization	42	0.12	29	0.07	13	0.23
Product switching (1: Yes; 0: No)						
Switching behavior	51	0.78	37	0.81	14	0.71
Product-level switching	40	0.83	30	0.80	10	0.90
Industry-level switching	40	0.46	30	0.47	10	0.4
Policy enforcement (1: Inspected at least once; 0: None)						
Minimum wage law	50	0.12	37	0	13	0.46
Social security contribution	50	0.42	37	0.30	13	0.77

NOTES.—Small firms are defined as ones with less than 100 employees.

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