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Analyzing Labor Market Institutions through the Lens of Search-and-Matching Models

Application to International Trade Shocks

Author : Lucas Vandecappelle

Thesis Director : Mathias Hungerbühler

Thesis Reader : Muriel Dejemeppe

Academic Year 2025 - 2026

Master in Economics – 120 credits – Econometrics Focus

Université catholique de Louvain - Economics School of Louvain - Place Montesquieu 3, 1348 Louvain-La-Neuve

Acknowledgment

I would like to thank my supervisor, Professor Mathias Hungerbühler, for his guidance and valuable feedback on the content of this essay, as well as for the inspiration I gathered from him during his lectures. I also thank Professor Muriel Dejemeppe for the time spent reading this paper.

AI has been used for the writing of this paper for language correction/translation. In order to maintain the academic integrity of my work, I followed a critical approach by keeping AI-assisted corrections to a minimum and not fully generating any sentences or paragraphs.

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1 Introduction

Institutions are central to the functioning of labor markets and have been the focus of extensive economic research. This interest is not new. During the 1990s, as millions of workers searched for jobs amid persistently high unemployment in Europe, economists grappled with a fundamental question: were labor market institutions to blame for the crisis? Arguably, current economic conditions and ongoing policy debates suggest that the answer has yet to be fully established. A vast literature emerged to explain cross-country differences in labor market outcomes through differences in labor market institutions. However, this research strategy quickly revealed important empirical limitations. The pattern of institutions differs so substantially across countries that such an across-the-board approach is not sufficient to understand labor market heterogeneities. As the great economist Robert Solow put it: "More often than not we fail to take institutional differences seriously. One model is supposed to apply everywhere and always. Each country is just a point on a cross-section regression, or one among several essentially identical regressions, leaving only grumblers to worry about what is exogenous and what is endogenous, and whether simple parametrizations do justice to real differences in the way the economic mechanism functions in one place or another (Solow, 1986)". This criticism remains highly relevant today and motivates the search for theoretical frameworks capable of incorporating institutional heterogeneity in a more systematic manner.

This paper evaluates the search-and-matching framework as a unifying structural model for analyzing minimum wage, unemployment insurance, and collective bargaining within a tractable theoretical environment. These models are analytically appealing because they provide a realistic representation of labor markets by explicitly incorporating search frictions into the matching process. This feature is particularly important, as the literature has often criticized neoclassical models for their inability to adequately capture the effects of labor market institutions.

Moreover, search-and-matching models can be combined with modern econometric methods, notably the use of exogenous shocks as quasi-natural experiments to identify the causal effects of institutions on labor market outcomes. Following recent developments in macroeconomics, these two approaches can be integrated effectively by combining a structural framework with empirical evidence used for calibration and validation. The purpose of this paper is to examine how search-and-matching models can serve as the theoretical foundation for this broader research agenda. Although the associated econometric methods are of paramount importance, they are deliberately left aside, as the primary objective is to establish the theoretical framework that motivates their application. The choice of the three institutions examined in this paper may appear somewhat arbitrary. To some extent, this is indeed the case. Nevertheless, they were selected because they represent three distinct, economically important, and widely studied categories of labor market institutions.

To compare national labor markets, one of the most compelling sources of exogenous economic shocks is the international environment, particularly trade shocks. These shocks have been studied extensively, both theoretically and empirically, because of the dynamic labor market adjustments they induce. They are also distinct from other types of shocks due to the reallocative nature of international trade. While idiosyncratic shocks may affect individual countries, it is difficult to identify shocks that simultaneously affect the same industries across multiple economies outside the context of international trade. This common source of variation is particularly valuable for empirical analysis, as it facilitates the implementation of econometric methods designed to identify the effects of labor market institutions.

Section 2 reviews the literature on each institution and provides an introduction to their effects. Comparisons between this literature and the predictions of the theoretical model are recurrent throughout the paper. Section 3 introduces the search-and-matching model in a basic form first, to grasp the main elements, and then with extensions and applications allowing the analysis for the institutions. For each of them, a specific review of important applications is provided. Section 4 discusses the need to allow shocks interact with labor market institutions in the literature. Section 5 explores how frictions can be incorporated inside trade models, which is the key theoretical bridge to make use of trade shocks, eventually. Finally, Section 6 advances promising research routes based on the existing evidence.

2 Labor Market Institutions

Labor market institutions are defined as the "systems of laws, norms, or conventions resulting from a collective choice and providing constraints or incentives that alter individual choices over labor and pay." (Boeri & van Ours, 2013). The importance of these institutions reflects the particular characteristics of the labor market. No market is perfectly competitive, and there is substantial evidence that labor markets are particularly prone to imperfections. The persistent failure of the labor market to clear (there is always unemployment and thus, an excess of supply) is one of the most striking illustrations of the labor market's uniqueness (Layard et al., 1991).

The study of labor market institutions expanded considerably during the 1980s and 1990s. Economists tried to understand why Europe was facing a stubbornly high unemployment rate in the aftermath of adverse shocks, from which the OECD non-European countries recovered better. Most of the studies have consisted of cross-country analysis. Nickell (1997) finds that some institutions can indeed be responsible for higher unemployment rate, although identifying the specific institutions responsible proves considerably more difficult. In another article, Nickell (2003) argues that considering Europe as a whole is misleading, as labor market institutions across the continent are heterogeneous. In particular, France, Germany, Italy and Spain seemed to concentrate the "Eurosclerosis". This section reviews the literature on the selected institutions, focusing on empirical evidence and theoretical approaches other than search-and-matching models, which are discussed separately in the following section.

2.1 Unemployment insurance

Unemployment Insurance (UI) is a labor market institution present in numerous developed countries. Although it goes hand in hand with the Active Labor Market Policies (ALMP), this section deliberately ignores the latter. However, it must be said that some effects of UI described can be offset by ALMP, especially its effects on the search intensity.

Among the variables affected by UI, unemployment duration is arguably one of the most important. Early empirical studies started in the end of the 1970s to transition from the neoclassical models to theoretical approaches closer to the job search models. Classen (1977) found that more generous benefits led to an increase in the unemployment spell. However, unemployed workers did not seem to find better paid jobs, seemingly at odds with theoretical predictions. Revealing the uncertainty of the time, Ehrenberg and Oaxaca (1976) did find some support for subsequent higher wages but they didn't seem to fully compensate the additional duration of unemployment. Notably, this paper is among first empirical evaluations explicitly motivated by search theory.

The first wave of empirical studies was constrained by both limited administrative data and identification challenges. Meyer (1990) addressed both issues by combining high-quality administrative data with precise measures of unemployment spells and benefit rules and using a semiparametric hazard estimation approach that avoids restrictive assumptions about duration dependence by allowing the job-finding probability to vary over the unemployment spell. The study focused on male workers from twelve U.S. states over the period 1978–1983 and directly estimates the hazard rate. The findings consisted of three elements: higher UI benefits reduce the job-finding rate, benefit exhaustion creates a sharp spike in exits, and benefit duration also matters (not only benefit levels). At the same time, a fundamental identification challenge remained. Changes in unemployment insurance generosity are often endogenous to labor market conditions, as governments tend to extend benefits during economic downturns and tighten them during recoveries. This makes it difficult to isolate the causal effect of unemployment insurance from the underlying business cycle. To address this issue, subsequent studies increasingly relied on quasi-natural experiments, as advocated by Meyer (1989).

Building on Meyer's paper, a large literature exploited policy-driven quasi-natural experiments using a difference-in-differences approach. The strategy is to compare a treatment group, affected by the policy change, with a control group that is not, before and after the reform. The objective is to approximate a *ceteris paribus* comparison by isolating the effect of the policy change from other factors affecting both groups. For example, in the US, Card and Levine (2000) managed to estimate the link between UI and unemployment duration in the aftermath of a change in legislation. The state of New Jersey decided to extend for 6 months the UI benefits coverage period, from a typical 26-week period. The reform had only a modest observed effect on unemployment duration, which the authors attribute to the fact that most

claimants had already been unemployed when the extension was announced. Using hazard models to simulate a permanent reform known from the beginning of the unemployment spell, they estimate that a 13-week extension would increase the benefit exhaustion rate by about 7 percentage points and lengthen unemployment duration by approximately one week.

The distortionary effects of unemployment insurance appear to vary over the unemployment spell. An extensive literature documents a spike in the exit rate from unemployment at benefit exhaustion (Card et al., 2007b). One explanation is that some job seekers rationally postpone accepting a job until their benefits are exhausted. However, the existence of such spikes has been questioned. Card et al. (2007a) find a pronounced increase in the exit rate at the end of the maximum benefit duration, but a much smaller increase in the hazard rate (the rate at which unemployed workers find a job). They therefore argue that part of the observed spike may reflect measurement error, concluding that the "question remains open". Using higher-quality administrative data, subsequent studies did identify a genuine spike at benefit exhaustion, suggesting that the phenomenon is not merely the result of statistical measurement error (Boeri & van Ours, 2013, p. 542).

2.2 Minimum wage

The most important question surrounding the minimum wage is whether it has a negative impact on unemployment. To this, an economist of the 1960s and 1970s would more likely than not answer a convinced yes. Brown et al. (1982) concludes that "time series studies typically find that a 10 percent increase in the minimum wage reduces teenage employment by one to three percent". Card and Krueger (1995, pp. 7–11) and Dube (2026, pp. 155–157) argue that this view came after a shift from an institutionalist approach to a neoclassical view of the labor markets. While the institutionalists considered that wage was not the only (and not even the most important) feature of the labor market (Lester, 1946), neo-classical economic theory became the paradigm. Under the simple competitive model, wages are assumed to be at equilibrium and the labor market clear. Therefore, imposing a wage higher than the equilibrium leads inevitably to a drop in employment, because labor demand cannot sustain such a wage.

As for the unemployment insurance, the situation changed markedly in the wake of new methodological practices, which improved from the "time-series" analysis that presented limitations ignored by the profession at the time (Dube, 2026, p. 156). Perhaps the most influential study of this "second generation" was Card and Krueger (1994). The authors used the differences-in-differences approach consisting of comparing employment in fast-food restaurants in New Jersey, where the minimum wage increased, with neighboring Pennsylvania, where it remained unchanged. Using this natural experiment within a difference-in-differences framework, they found no evidence that employment declined relative to the control state.

The findings of Card and Krueger sparked a very informative, and sometimes tense debate. Neumark and Wascher (2000) rapidly brought an opposing view by conducting an analysis on the same experimental event. The authors relied on payroll data, which they considered as more reliable, and found a negative employment effect, although the results appeared less significant than in Card and Krueger (1994). Some economists also disagree on the definitive character of the findings, particularly on the fact that the fast food industry may not represent well low-wage employment (Borjas, 2024, pp. 117–123). Focusing on teen unemployment, two opposing studies took different positions, Card (1992) observing no negative employment effects, while Neumark and Wascher (1992) did observe them. Even today, the debate remains unsettled concerning the employment effects of minimum wage (Manning, 2021). Reviewing an extensive literature, Dube and Lindner (2024) reassert that "Overall, most U.S. evidence, especially more recent, higher quality estimates, do not suggest large adjustments to hours of work conditional on employment". Boeri and van Ours (2013, pp. 76–83) had the same interpretation of existing evidence.

Clearly, the literature seemed to attach a great importance to empirical studies. But where does the theory stand ? The principal theoretical explanation for how a higher minimum wage may increase employment is the existence of monopsony power. The term was first coined by Robinson (1933). In a monopsonistic labor market, firms face an upward-sloping labor supply, so hiring an additional worker raises the wage paid to existing workers, leading them to employ fewer workers than under perfect competition. A binding minimum wage can reduce the firm's marginal cost of labor, encouraging it to increase employment, provided the minimum wage remains below the competitive wage. Stigler (1946)

was among the first to point out that "If an employer has a significant degree of control over the wage rate he pays for a given quality of labor, a skillfully-set minimum wage may increase his employment and wage rate", although he was highly skeptical of a general minimum wage. Stigler rationalized this position by distinguishing between competitive and employer wage determination. Opposing this view, Lester (1947) called this view "unreal and misleading" and argued, based on empirical evidence, that wages for identical occupations differed substantially even within the same labor market, suggesting that firms possessed some degree of wage-setting power. Rather than relying on the unrealistic assumption of a single employer, the modern literature instead emphasizes "modern monopsony," in which search frictions, imperfect mobility, and informational frictions generate employer wage-setting power even in markets with many competing firms (Boeri & van Ours, 2013, pp. 67–68). Within these frictional labor markets, the same theoretical prediction remains: a moderate increase in the minimum wage may increase employment.

Another effect of the minimum wage is the increase in wages higher up the wage distribution. These are known as "spillover" effects. They mainly concern workers earning slightly above the minimum wage and can therefore contribute to a further reduction in wage inequality. The rationale behind these effects is that firms are pressured to raise the wages of workers who were previously paid at or just above the minimum wage. Otherwise, these workers would lose the wage advantage they previously had over lower-paid workers. A large literature has tried to estimate the magnitude of this phenomenon. For example, Fortin et al. (2021) find that spillover effects were typically larger in the 1980s than in the following decades, consistent with changes in minimum wage policies. In the United States, after a steep increase, the federal minimum wage has remained largely stagnant since the 1980s and has not been raised since 2009, although many states have set higher minimum wages.

2.3 Collective bargaining

Collective bargaining "aims at ensuring a fair sharing of the benefits of training, technology and productive growth (inclusive function), at maintaining social peace (conflict management function), and at guaranteeing adequate conditions of employment (protective function)" (OECD, 2019, p. 26). Unions, the main agent involved in this institution, bargain over different aspects of employment arrangements: wages, working hours, or safety standards and so on. The most salient fact about trade unions is the continuous fall in unions density for most OECD countries (OECD, 2019, pp. 33 - 44). While this could indicate a weakened role for collective bargaining, their coverage actually extends to non-unionized labor, sometimes by a large margin. For example, in 2017, the "excess coverage" of France was 90 %, meaning that 9 workers in 10 was covered by a collective agreement without being a member of a union. The role of unions in wage-setting has been debated for a long time. As trade unions constitute a monopoly-like organization in countries where the coverage rate is high, their ability to fix higher wages has been spotted by early literature. However, that aspect of unions seemed partial, as Freeman and Medoff (1985) pointed out. In their books, the authors argued that even though "the monopoly wage gains of trade unions cause economic inefficiency", the impact on GDP of this wage effect was "quite modest" (p. 57). Furthermore, they argue that another key aspect of unions is to increase productivity and to reduce turnover, coming from more efficient relations between employer and employees, what the authors coined as the "voice function" of the trade union.

The impact of collective bargaining on the level of wages and employment depends critically on the level of centralization and the degree of coordination. Centralization is defined as the level at which the collective bargaining takes place (national, sectoral, or firm-level). A common view in the literature was that greater bargaining centralization would increase union bargaining power, leading to higher wages and lower employment This simplistic view was challenged by Calmfors and Driffill (1988). In this foundational theoretical study, the authors developed a stylized economy comprising 64 industries that produce differentiated goods. The degree of substitutability between goods depends on the proximity of industries within the market structure. Their model predicts that, initially, greater bargaining centralization increases real wages because unions gain bargaining power. However, if too many in the industry bargain through unions, the increase in wages has a larger impact on prices, which causes the real wage to recede. Also, as unions become larger, there will be a tendency to internalize macroeconomic features and create a "moderating effect". Therefore, either totally decentralized or completely centralized systems would deliver lower real wages (and thus, higher employment) than more intermediate arrangements. Although subsequent research has questioned the empirical validity of the Calmfors–Driffill hypothesis, the paper remains influential for demonstrating that the relationship between bargaining centralization and labor

market outcomes need not be monotonic (Bhuller et al., 2022).

Different theories explain the impact of unions on labor market outcomes. The *right to manage* model consists of a Nash bargaining in which unions and employers bargain only over the wage, while firms retain the right to determine employment. This wage-setting mechanism will also appear in the search-and-matching model described later. This introduction is based on Boeri and van Ours (2013). The model assumes identical workers and thus a unique reservation wage. Unions and employers meet to bargain over the wage. Since employment is not part of the agreement, employers retain the *right to manage* their workforce. Intuitively, each job creates a rent (or surplus) that is shared between workers and employers. The surplus for the worker, that is, its net gain from the agreement, is $w - w^r$, where w denotes the wage and w^r the reservation wage, i.e., the lowest wage at which accepting employment is preferred to remaining unemployed. Symmetrically, the firm's surplus is given by $R(L^d(w)) - wL^d(w)$, which represents its profit. Since all workers are identical, there is a single negotiated wage, allowing the revenue function to be written as $R(w)$. Following the work of Nash (1950), the Nash bargaining problem in this context is formally described by

$$w = \arg\max[L^d(w)(w - w^r)]^{\beta}[R(w) - wL^d(w)]^{1-\beta}, \tag{1}$$

where η and ϵ_w^{π} are, respectively, the inverse wage elasticity of labor demand and the elasticity of profits with respect to wages. Therefore, unions and employers bargain over the wage and choose it so as to maximize the Nash product, which reflects the weighted product of the workers' and firms' surpluses. Of course, the outcome depends critically on the value of β, which measures the bargaining power of unions. A higher value of β places greater weight on workers' surplus and therefore leads to a higher negotiated wage. The first-order condition is given by

$$\frac{w - w^r}{w} = \frac{\beta}{\frac{\beta}{\eta} + (1 - \beta)\epsilon_w^{\pi}}, \tag{2}$$

where w denotes the wage, π the firm's profits. The result is explicit: a greater bargaining power for unions increases the negotiated wage. Since firms determine employment after wage bargaining, the higher wage reduces labor demand and therefore equilibrium employment.

3 Search-and-matching models

The search-and-matching model provides a tractable framework for modeling the matching process between workers and firms. Because search and recruitment are both costly and time-consuming, labor markets fail to clear instantaneously. Coupled with the continuous creation and destruction of jobs, these frictions allow unemployment and vacancies to coexist even in equilibrium. The framework was synthesized in its canonical form by Mortensen and Pissarides (1994), and rapidly became a workhorse for studying unemployment, commonly referred to as the Diamond-Mortensen-Pissarides (DMP) model after the three Nobel laureates who developed its core theoretical foundations. The presentation of the model is kept to its most basic form on purpose, as the following sections are designed to extend the model by integrating features that are relevant for the analysis of each institution. Nevertheless, it should be understood that the model itself has been at the center of a large debate in the aftermath of its introduction. A subsection is specifically reserved for such considerations.

3.1 Basic framework

The model presented here is based on Pissarides (2000). The starting point of the model is a well-behaved matching function (exhibiting constant returns to scale) $m = m(uL, vL)$, which represents the number of jobs matches taking place per unit of time. This is a key element of the model because trade in the labor market is a decentralized activity and workers do not coordinate among themselves. The ratio of vacancies to unemployment, denoted θ, allows a more convenient way to write the arrival rate for firms, that is, the rate at which vacant jobs become filled. It is expressed by

$$q(\theta) = m(\frac{u}{v}, 1). \tag{3}$$

Incidentally, θ captures the "labor market tightness" and is defined by v/u. A slack labor market (low θ) means that there are a lot of unemployed and few vacancies. During an infinitesimal interval (and not at any point in time, because in this case the probability would be zero), denoted δt, a vacant job is matched to an unemployed worker with probability $q(\theta)\delta t$. Therefore, the mean duration of a vacant job is $1/q(\theta)$.

The DMP model is fundamentally a dynamic model concerned about the flows of workers in and out of unemployment. The flows of workers leaving and entering unemployment is expressed, respectively, by $u\theta q(\theta)L\delta t$ and $\lambda(1-u)L\delta t$ where λ denotes the exogenous job destruction rate. Therefore, the steady state is characterized by

$$u\theta q(\theta) = \lambda(1-u). \tag{4}$$

The meaning is quite intuitive: at equilibrium, the flow of workers becoming unemployed must be the same as the flow of unemployed starting to work so that mean unemployment is constant. Rearranging gives the unique unemployment rate

$$u = \frac{\lambda}{\lambda + \theta q(\theta)}, \tag{5}$$

which can be represented by the Beveridge Curve.

The second building block of the model is the job creation. This process takes place prior to the match and follows a number of assumptions (see Pissarides (2000), pp. 10-12 for more details). The most important is that firms are assumed to employ only one worker. Therefore, the profit maximization implies that entering the market should not be profitable which characterizes the zero-profit condition for firm entry. The firms solve the following Bellman equation for V,

$$rV = -pc + q(\theta)(J - V), \tag{6}$$

where p denotes the job's output, c the cost of opening a vacancy, r the interest rate, J the present-discounted value of expected profit from an occupied job, and V the present-discounted value of expected profit from a vacant job. The capital cost of the vacancy must be equal to the expected profit of the vacancy.

The value of an occupied job, J, follows a similar reasoning and is captured by the condition,

$$rJ = p - w - \delta(J - V). \tag{7}$$

The capital cost of the occupied job must be equal its net expected profit. Combining equations (6) and (7), and by noting that at equilibrium, rents from vacant jobs are driven to zero, we obtain the job creation condition,

$$p - w - \frac{(r+\delta)pc}{q(\theta)} = 0. \tag{8}$$

Now that the demand side has been explored, the model needs to integrate the supply side decision. The workers influence the equilibrium through wages, while it is assumed the intensity of search is fixed. The worker can be in two states: employed or unemployed. For each of those states, he solves the corresponding bellman equations,

$$rU = z + \theta q(\theta)(W - U), \tag{9}$$
$$rW = w + \lambda(U - W), \tag{10}$$

where z denotes the real return enjoyed by a unemployed during his job search. The permanent income of the unemployed is the unemployment revenue increased by the prospect of finding a job at some point, which accounts for $1/q(\theta)$). For the employed, the permanent income is downgraded by the risk of losing his job, with a probability λ. Solving those two equations for rU and rW yields the following rewritten

expressions,

$$rU = \frac{(r+\lambda)z + \theta q(\theta)w}{r+\lambda+\theta q(\theta)}, \tag{11}$$

$$rW = \frac{\lambda z + (r+\theta q(\theta))w}{r+\lambda+\theta q(\theta)}. \tag{12}$$

The last element needed to close the model is the wage determination. Because of the frictions, a separation is costly for both the firm and the worker. This creates a local monopoly situation and the underlying rent has to be shared through a Nash bargaining problem, already defined in the previous section.[1] The solution is the wage fixed after the match. It is assumed that the job output is strictly higher than the sum of expected returns, so that both the worker and the firm have an incentive to agree on a wage. Let β denote the bargaining power of the worker, the bargained wage is defined by

$$w = \text{argmax}(W-U)^{\beta}(J-V)^{1-\beta}. \tag{13}$$

The wage is such that it maximizes the weighted product of each side's net gain from the job occupation. U and V can be interpreted as "threat points", since it is the revenue the agents will obtain by walking out of the bargaining. A higher β, meaning a higher bargaining power, leads to a higher wage since W (the value of working for the worker) takes a higher importance in the maximization and a higher wage increases W. Solving the bargaining problem and rearranging (by making use of the previous conditions) gives the wage equation,

$$w = (1-\beta)z + \beta p(1+c\theta). \tag{14}$$

The steady-state equilibrium is defined by the equations (5), (8) and (14).

3.2 Criticism and Extensions

One of the most debated issues has been the ability of the model to match the observed labor market dynamics. Shimer (2005) was the first to point out that the canonical DMP model was unable to feature enough volatility in response to aggregate shocks. To substantiate his claim, the author developed a stochastic search-and-matching model in the sense that exogenous variables, namely labor productivity p and job destruction rate δ, follow a Markov process. This stochastic specification allows the model to analyze how aggregate shocks propagate through the labor market, a feature that will also prove useful when studying trade shocks (see Section 6). While the model is correct qualitatively for the case of labor productivity shocks (a higher labor productivity goes with a tighter labor market), problems arise in the quantitative analysis. Under plausible calibration (i.e. consistent with US data), labor market tightness volatility is substantially lower than what data indicates (0.035 vs 0.382). In other words, the model features an elasticity of labor market tightness with respect to labor productivity that is too low. Without contesting the merits of the "search model approach", the author argues that the wage determination process captured by the Nash bargaining problem leads to wages that are not rigid enough, which suggests that wages adjust too much, and consequently unemployment and vacancies too little.

In response to Shimer's critique, numerous approaches tried to reconcile the architecture of the model with the seemingly inconsistent vacancies-unemployment volatility. This strand of literature is now very rich, which stands as a strength of the model: it has been studied so extensively that its limits are known and solutions have been proposed. Instead of reviewing each approach individually, a common strategy is to introduce mechanisms that reduce the *fundamental surplus*, as highlighted by Ljungqvist and Sargent (2017). This surplus can be interpreted as the economy's resource constraint associated with creating a match and is defined by $y-z$ in the case of the baseline model. By considering the elasticity of labor market tightness with respect to labor productivity,

$$\eta_{\theta,y} = \frac{(r+\delta)+\beta\theta q(\theta)}{\alpha(r+\delta)+\beta\theta q(\theta)}\frac{y}{y-z} \tag{15}$$

where $\beta = (1+r)^{-1}$ is here the discount factor and α, denoting the elasticity of matching with respect to unemployment, is bounded by values broadly agreed upon in the literature. The first factor of equation

[1] See p. 7

(15) being "constrained", the amplification sources can come only from the second factor, which features the *fundamental surplus*. A low fundamental surplus implies low matching surplus and low profits. Therefore, when the fundamental surplus is small, a 1 percent change in labor productivity induces a larger percentage change in labor market tightness. When the surplus takes small values, the rise is amplified, which leads to a larger elasticity, and hence a higher volatility. Conceptually, following a negative productivity shock, the resources available to finance vacancy creation are already limited. Since the expected value of a filled vacancy declines, firms reduce vacancy posting whenever the expected profits no longer cover the vacancy creation cost (the free-entry condition). The resulting decline in vacancies reduces labor market tightness and increases unemployment.

To address the volatility puzzle, and other shortcomings, numerous extensions have been built upon the canonical model presented in section 3.1. Wage posting, search effort and on-the-job search are covered in the next sections when the models make use of them. However, a large range of extensions, such as worker and firm heterogeneity, directed search, endogenous job destruction, alternatives to the free-entry condition, are beyond the scope of this paper. While those extensions seem to provide valuable tools to study labor market institutions, the objective is to manipulate a baseline model, plus certain additions, that can be integrated into a trade model.

3.3 Search-and-matching models and Labor Market Institutions

3.3.1 Unemployment insurance

Search models are widely used to study Unemployment Insurance (UI) because it directly affects the job search behavior of the unemployed by altering his incentives to accept a job at a given wage. In other words, it alters his reservation wage. The literature focuses largely on partial equilibrium search models, which ignore the indirect effects on wages from UI. The general idea remains the same, with an important difference: wages are not determined through Nash bargaining. Instead, firms post wages and job seekers decide to accept it or not when the offer arrives.

Tatsiramos and van Ours (2012) provides a formal explanation of a job search model employed to explain the mechanisms behind UI. They consider a stationary framework, that is, with constant benefits. All variables have the same meaning as previously, except that μ denotes the exogenous job arrival rate. The Bellman equations of the worker and the unemployed are given, respectively, by

$$rW = w + \lambda(U - W), \tag{16}$$

$$rU = b + \mu \int_{w_R}^{\infty} [W - U] dF(w), \tag{17}$$

The value function of being employed has the same meaning as the basic DMP model. For the unemployed value function, the asset value U is equal to the benefits level and the foreseen value of finding a job, given a distribution function $F(w)$ from which is drawn the wage w. After manipulating equations (16) and (17), one can derive the reservation wage, defined as follows

$$w_R = b + \frac{\mu}{r + \lambda} \int_{w_R}^{\infty} [1 - F(w)]\, dw. \tag{18}$$

Finally, in such an environment, the hazard rate, meaning the expected frequency with which acceptable offers are found and defined as $q = \mu[1-F(w)]$, is closely related to the average duration of unemployment $D = \frac{1}{\mu[1-F(w_R)]}$. The analysis is straightforward. An increase in the unemployment benefits b leads to a one-to-one increase in the reservation wage. In turn, the mean unemployment spell increases, because the probability of accepting an offer drops.

In his seminal contribution, Mortensen (1977) rejected this result taken alone, prevalent at the time, by arguing that previous search models were incomplete because they ignored future layoffs. Even workers who are currently employed enjoy a higher utility because they risk ending up in a situation where they receive UI if they lose their jobs. UI enters the search process through two mechanisms. First, remaining unemployed feels less painful, which increases the value of experiencing unemployment. Second, employment yields a higher expected utility because it preserves eligibility for future unemployment

insurance in the event of a layoff.[2] Furthermore, Mortensen introduced two key features: dynamic UI (benefits are terminated at a certain point) and search effort, denoted s, which complement the worker's reservation wage. The model considered in the paper manipulates an *escape rate*, which is analogous to the hazard rate introduced above, the only difference being the inclusion of endogenous search effort,

$$q = \mu s(1 - F(w)). \tag{19}$$

The escape rate increases with more time allocated to the search (higher s) and decreases with a higher reservation wage ($1-F(w)$ is lower, or to put it differently: the worker restricts further the range of wages he would accept). Mortensen considers 4 workers' states. All cases are considered for more generous UI (both in levels and duration).

- For newly laid-off workers, the reservation wage increases and the search becomes less intense. Thus, the escape rate drops unambiguously. In other words, the "traditional disincentive effect dominates".
- For workers close to exhausting benefits, the value of remaining unemployed falls rapidly, which lead to a lower reservation wage and higher search intensity. This captures a well-known spike in job finding near benefit exhaustion.
- For the exhaustees, the escape rate jumps because the standard disincentive disappears.
- For new entrants or quitters, even though they don't receive benefits today, future employment makes them eligible for potential UI. Consequently, their escape rate increases. This process sheds light on the so-called "entitlement effects".

Those mechanisms make clear that the aggregate effect of unemployment benefits is theoretically ambiguous.

Even though the equilibrium search model has been ignored deliberately so far, it constitutes a very valuable tool to understand the effect of UI on the unemployment rate. Starting from the wage equation (14), higher benefits (translating into a higher z) brings the wage higher because the bargaining position of the worker improves through more important threat points. If the worker walks out, UI ensures him a more comfortable situation. A higher wage decreases firm's profit and thus incites the firm to open less vacancies through the job creation equation (8). By definition, this makes the labor market more slack (lower θ), which means that there are less job opportunities per unemployed workers. Therefore, the unemployment rate goes up, as predicted by equation (5). To conclude, the analysis of UI through the job search model offers a textbook example of its conceptual power and allows a neat comprehension of the mechanisms with a very simple model.

3.3.2 Minimum wage

Contrary to other institutions, fewer studies initially covered the assessment of minimum wages. Highlighting this situation, Holmlund (2014) speculates whether the cause was not technical but "ideology-driven".

Flinn (2006) develops a search-and-matching model with a binding minimum wage. The author considers two cases: one with an exogenous contact rate and another with an endogenous contact rate, where the contact rate has the same conceptual meaning as the job arrival rate. In the exogenous case, no matching function is specified and the contact rate is assumed to be constant, independently of labour market tightness. In this setting, the minimum wage has unambiguous theoretical predictions:

- Matches for which the firm, now required to pay the binding minimum wage, would earn a negative surplus are not formed. This is the standard employment effect of the minimum wage.
- For firms whose matches still generate a positive surplus, employment is maintained, but the negotiated wage is replaced by the minimum wage whenever the latter is binding. These workers are the direct beneficiaries of the policy in this model and this creates an additional incentive to search for a job. The value of employment is increased.

[2] Those effects appear in equations (11) and (12): introducing UI raises z, which is positively linked to both rU and rW.

- By assumption, workers whose Nash-bargained wage already exceeds the minimum wage are unaffected. This prediction contrasts with the empirical literature, which often documents wage spillover effects above the minimum wage.

When the contact rate is endogenous, the employment effect becomes ambiguous. To see why, the job creation condition is given by

$$\psi = q(k;\omega)\tilde{G}(r)(J - V_v), \tag{20}$$

where ψ is the cost of maintaining an open vacancy, V_v is the value of a vacant job, $q(k;\omega)$ is the contact rate, $\tilde{G}(r)$ is the probability that a contact results in an acceptable match, and $J - V_v$ is the capital gain from converting a vacancy into a filled job. This condition is closely related to the job creation condition presented in Equation (8). Labor market tightness is denoted by k. The crucial difference from the exogenous-contact-rate case is that the contact rate is now determined in equilibrium through the matching function. The standard negative channel remains: a higher minimum wage reduces firms' expected profits, lowering vacancy creation and therefore labor market tightness. In addition, a higher minimum wage reduces the proportion of acceptable matches, $\tilde{G}(r)$, as some low-productivity matches are no longer profitable. However, the increase in wages also raises the expected return to labor market participation. As a result, unemployed individuals, even previously inactive workers, have stronger incentives to search for jobs, increasing search activity. Consequently, the overall employment effect depends on the relative strength of these opposing forces and is therefore ambiguous.

However, the theoretical possibility that an increase in minimum wage may lead to an increase in employment is debated. This result arises from the fact that minimum wage truncates the wage distribution upside, which provides additional incentive to search for a job (the value of being employed increases. Reviewing the literature, Melo et al. (2025) note that such a propagation channel is possible mostly from restricted search models. Particularly, the authors argue that "the simple prediction that arises from the restrictive focus on job search among the jobless is the cornerstone of models of the minimum wage and job search, and of the arguments that search-and-matching models can explain non-negative employment effects of minimum wages". The reliability of the search models is not actually contested, but rather some assumptions made by the profession.

A pertinent extension of the model is the addition of on-the-job search. In the baseline model, workers search only when they are unemployed. If workers are allowed to search while employed, job-to-job transitions are predominantly directed towards more productive or better-paid jobs (Dube, 2026, p. 55). In other words, companies *poach* workers, from less-paid jobs, who then climb the job-ladder. These reallocations tend to occur more frequently when labor market is tight rather than during economic downturns (Haltiwanger et al., 2018). The first version of the model featuring on-the-job search was introduced by Burdett and Mortensen (1998).The model admits a unique equilibrium characterized by a non-degenerate wage distribution, thereby rejecting the prediction of a unique equilibrium wage. However, as argued by Flinn and Mabli (2009) in a draft paper, adding a binding minimum wage to such a model would simply shift the entire wage distribution upward, increasing workers' utility without generating any employment effects. This prediction contrasts with both the empirical evidence and most theoretical models, which generally find that binding minimum wages generate at least some employment effects. Flinn and Mabli discuss a model with productivity heterogeneity where match-specific productivity is drawn from a common distribution. While all workers face the same productivity distribution, the realized productivity differs across worker-firm matches. Moreover, wages are bargained through the Nash solution and are not posted. The paper finds three distinct effects of the minimum wage:

- The usual employment effects described in Flinn (2006)
- The minimum wage also modifies the Nash bargaining problem by increasing workers' outside option. Consequently, wages increase even above the statutory minimum, generating the spillover effects documented empirically.
- Dynamic bargaining further implies that, after a match is formed, another firm may arrive and attempt to poach the worker. The prospect of future outside offers gives workers additional bargaining power, allowing firms to compensate lower initial wages with greater future wage growth. Flinn and Mabli refer to this mechanism as a compensating differential. A binding minimum wage limits firms' ability to offer such contracts, leading to higher entry wages but flatter wage profiles.

3.3.3 Collective bargaining

An early attempt to model collective bargaining inside an equilibrium search model is offered by Pissarides (1986). The model specification is mostly similar to the basic one presented above, with an important distinction: the wage is not bargained through a Nash process but imposed unilaterally by unions. The union's maximisation program is given

$$Y = \frac{1}{r+s+p(\theta)}[(r+p(\theta)]w + sz - \alpha r(w-z)] \tag{21}$$

$$s.t. \quad \frac{p(\theta)(y-w)}{\theta(r+s)} = k \tag{22}$$

where r denotes discount rate, s the exogenous job destruction rate, $p(\theta)$ the matching technology, α the weight attached to the unemployed ($\alpha = 1$ meaning the union only cares about unemployed workers) in their decision and k the cost of a vacancy in the first period. The constraint describes the equilibrium job creation equation, given the free-entry condition. As the program makes clear, while unions fix the wage, firms react by adjusting the employment level (or the number of vacancies), which unions take into account when setting the wage. The main result of the paper is that unions choose the socially efficient wage (meaning that a central planner could not improve the situation) only if they care exclusively about the unemployed. If the union also cares about employed workers, the negotiated wage becomes excessively high. The intuition is straightforward: employed workers benefit more, in present value, from a higher wage, whereas unemployed workers benefit more from an increase in employment. In the model, this is illustrated by the special case with $\alpha = 0$, which leads to higher wages because the negative effect of w inside the union's utility function disappears. Consequently, if the preferences of employed workers weigh too heavily in the union's objective, insufficient consideration is given to employment, leading to wages above the socially efficient level. This conclusion is consistent with the classic "right-to-manage" model, in which an excessive wage markup reduces employment. There is also a clear link with bargaining centralization: a highly centralized bargaining system is more likely to internalize the employment consequences of wage increases and therefore exercise greater wage restraint.

While the previous approach manages to make unions explicit in a search-and-matching model, Boeri and Burda (2009) provides a framework closer to the equilibrium model in the sense of Pissarides (2000), by taking most of its specification. The so-called "rigid wages" are bargained between a trade union and an employer organization through a Nash bargaining problem. The wage schedule depends on the workers' skills and the labor market tightness. Therefore, unions here consider employment in their negotiation with employers. Also, workers and firms meeting at an individual level take the wage as given. The main implication of the model is the rigidity implied by the bargaining at a higher level, which cannot respond efficiently.

Another way to model collective bargaining inside a search-and-matching model could be to use the concept of *two-tier bargaining*. The system allows individual bargaining to deviate upwards from collectively bargained wage, which is effectively a wage floor. The deviations depend on the firm-level productivity and thus, the discussion would be quite similar to the minimum wage section, except that the wage floor is not imposed by government but by negotiations between unions and employer organizations, which can be modeled as above. The model would be very relevant for countries like Belgium, where the state-imposed centralized collective bargaining negotiates essentially a wage floor for each industry. However, this system is not very effective and sharper systems, either centralized or decentralized, or with a degree of centralization dependent of the sectors, would be preferred (Boeri, 2014). This joins the paper of Calmfors and Driffill (1988), previously discussed.

There is also the possibility of considering the strategic timing of negotiations and whether unions can bargain continuously to extract as much surplus as possible from the firms. This approach is developed by Krusell and Rudanko (2016). The authors consider a discrete-time model in which employment evolves according to

$$n_{t+1} = (1-\delta)\left(n_t + \mu(\theta_t)(1-n_t)\right), \tag{23}$$

where n_t denotes the stock of matches. The remaining variables have their usual interpretation. Unlike the standard Mortensen–Pissarides model, wages are set unilaterally by a monopoly union rather than through bargaining. The union recognises that higher wages reduce vacancy creation through the

firms' job creation condition, creating a trade-off between extracting rents from firms and promoting employment.

An important distinction concerns whether the union can commit to future wages.

- With commitment, the union chooses the entire sequence of wages $\{w_t\}_{t=0}^{\infty}$ once and for all. Since only firms with existing matches have already incurred the cost of creating jobs, rents can only be extracted from these incumbent firms. Consequently, hiring is inefficient only in the initial period, while vacancy creation is efficient thereafter (Proposition 1).
- Without commitment, the union re-optimises wages every period. Firms anticipate that future unions will raise wages once new matches have been created, reducing the future profitability of vacancies. This dynamic hold-up problem discourages vacancy creation already today, so hiring remains inefficient in every period and steady-state unemployment exceeds the efficient level (Proposition 2). This result relies on the assumption that the union's optimal wage policy becomes more distortionary as the stock of existing matches increases.

The paper uses the model for estimating quantitatively the effects of the rigidity induced by unions in this setup. The results show higher wages than in an efficient model (that is, without the union) and a higher unemployment as well.

3.4 Closing assessment

Search-and-matching models provide a coherent framework for analyzing the main labor market institutions. Beyond reproducing empirical regularities, they identify the mechanisms through which institutions affect labor market outcomes, such as reservation wages, search intensity, vacancy creation, or wage bargaining. The literature has also shown that these institutions can be incorporated formally into equilibrium search models, although most contributions study them in isolation. In practice, labor markets are shaped by multiple institutions operating simultaneously, and their effects may interact. Understanding how different institutional arrangements complement or offset one another therefore remains an important avenue for future research.

An important feature of many labor market institutions is that they reduce the *fundamental surplus* generated by a worker-firm match, as described by Ljungqvist and Sargent (2017), either by increasing the worker's outside option or by reducing firms' expected profits when they are not directly affecting wages, as the cases of collective bargaining and minimum wages showed. As a result, these institutions may weaken incentives for job creation and slow labor-market adjustment following adverse shocks. Institutions such as unemployment insurance, minimum wages, and collective bargaining can therefore affect employment dynamics, although the magnitude (and in some cases even the direction of these effects) remains debated. For instance, higher minimum wages may increase labor-force participation or productivity, while more generous unemployment insurance may improve job matching through entitlement or search-quality effects. Overall, although their intrinsic employment effects remain contested, labor market institutions appear, at least theoretically and within search-and-matching models, to shape the propagation of trade shocks by influencing the incentives governing job creation, job destruction, and wage determination. Consequently, the model predicts that heavier institutions may amplify the response of labor market tightness to a given shock, which explains why labor markets presenting a lower *fundamental surplus* could be hit harder during economic downturns.

4 Interaction between Shocks and Institutions

Labor market institutions have been studied extensively empirically as well as theoretically, the search-and-matching model providing an elegant and useful framework. Despite this analytical arsenal, identification remains an issue because of endogeneity issues. The simple cross-country comparison ignores the potential link between institutions and labor market outcomes. Intuitively, it would make sense that a country experiencing higher risks of layoff (or job destruction) offers more generous unemployment benefits. And whether one is the consequence of the other is not straight-forward. It is possible that some structural features of the economy, independent of institutions, make job destruction more likely, which prompted at some point government to adjust the generosity of unemployment insurance, the level of minimum wage, or the centralization of wage bargaining. This view highlights that causality could

run in the opposite direction to what is typically assumed: labor market institutions may be the consequence of structural economic conditions rather than their cause. This section considers the interaction of institutions and shocks as a strategy to mitigate the endogeneity issue.

Blanchard and Wolfers (2000), in an influential study, explored the idea of combining labor market institutions with shocks. Their work was motivated by a methodological difficulty surrounding the rise of European unemployment in the 1960s: labor market institutions alone could not explain the evolution of unemployment. Although some institutions may contribute to a more rigid labor market and therefore to higher unemployment, they underwent an "employment-friendly" evolution after the 1970s, without a corresponding decline in unemployment. Furthermore, adverse shocks provide a convincing explanation for the rise in unemployment during this period, but would fail to explain why some countries recovered faster and why others (Spain, France, ...) took much more time. Therefore, the authors adopted a combined approach, arguing that labor market institutions shape how economies respond to adverse shocks.

Using data from 20 countries covering the period 1960 to 2000, the paper estimates a panel regression in which adverse macroeconomic shocks interact with labor market institutions, including unemployment insurance, employment protection legislation, the tax wedge, and collective bargaining institutions. The result is that labor market institutions explain well the evolution of unemployment when interacting with the shocks. The interaction terms generally display the expected sign and are statistically significant across the preferred specifications. However, the robustness of the results is weaker when alternative measures of institutions are used or when institutions are allowed to vary over time. In these specifications, several coefficients become smaller or lose statistical significance. The choice of indicators seems to have an influence on the magnitude of the results and letting the indicators vary make them less significant. If institutions truly interact with shocks in the way the paper suggests, using more accurate, time-varying data should improve the fit. The concern is that institutional indicators may have been constructed with knowledge of unemployment outcomes, introducing an element of endogeneity into the measurement itself. For example, knowing that Spain experienced persistently high unemployment could unconsciously encourage researchers to construct indicators portraying its labor market institutions as particularly rigid. In a different paper, Blanchard (2007) pointed out that the design of precise indicators to measure labor market institutions was an important condition to "declare intellectual victory" over the debate.

Not only is the interaction between shocks and institutions convincing, but also the *nature* of shocks. More precisely, the economic environment is a critical element in the impact of labor market institutions. Ljungqvist and Sargent (1998) proposed the idea that "turbulent times" may reveal some vulnerabilities of heavily institutionalized labor markets. The authors build a model with search intensity, wage posting, exogenous job destruction and finite life-time. In addition, workers accumulate skills when they are employed and base their decisions upon it to decide to accept a wage offer or choose their search intensity if they are unemployed, and decide whether quitting or not if they are employed. Solutions to the model involve an optimal search intensity and a wage reservation. Furthermore, two types of economy are considered: a laissez-faire economy and a welfare-economy, in which the steady states depend on labor market institutions, captured by unemployment insurance and government budget's constraint. Government budget must be at equilibrium.

In the absence of shocks, both economies behave almost identically. Unemployment spells are very close and reservation wage is slightly higher in the welfare state. Interestingly, a worker who became extremely skillful loses his job, will be very picky because he wants to find a well-paid job to compensate a potential long unemployment period. Since this type of jobs is difficult to find, he will decline to search intensively. This mechanism highlights a potential weakness for the welfare economy.

When confronted with a sudden and transitory shock, characterized by a 20-fold increase in the job destruction rate, divergence in the economies appears. While both economies experience an immediate rise in unemployment, the welfare economy takes much more time to come back to the steady state, which creates a more persistent unemployment rate. Finally, when the shock becomes more permanent (a sign of settled "turbulence"), the welfare economy exhibits a substantial rise in unemployment (compared to the transitory shock) while the unemployment rate is slightly lower in the laissez-faire economy. Moreover, long-term unemployment increases by a large margin in the welfare economy. Therefore, the "turbulent" economic times have revealed what the authors call a "time bomb". When the authors revisited their work with a different modeling approach, the findings were confirmed (Ljungqvist & Sargent, 2004).

5 Trade shocks

At first sight, any exogenous shock could serve to study labor market institutions. However, trade shocks possess characteristics that make them particularly attractive. Unlike firm-specific or purely idiosyncratic shocks, they simultaneously affect labor demand across sectors, induce substantial worker reallocation, and originate largely outside domestic labor market institutions. Consequently, they provide a more informative setting in which to observe how different institutional environments shape labor market adjustment. The purpose of this section is to combine the theoretical insights developed in the first part of the paper and examine whether the existing literature provides the necessary foundations for interpreting trade shocks as one of the forms of economic "turbulence" that may reveal the role of labor market institutions.

5.1 Trade models incorporating search frictions

Literature features some attempts to bring together labor market frictions and trade. Davidson et al. (1999) combines the model specifications of the two economic fields. The model consists of two countries, two sectors and two types of agents (workers and entrepreneurs). Trade models usually consider capital and labor as factors of production, which is not the case in the standard search models (Pissarides, 2000, pp. 23 – 26). To tackle this issue, the authors attribute the capital to the entrepreneurs and the labor to the workers. Thus, the supply side is mostly preserved from the search-and-matching model, and the demand side is ruled by the capital market. The main theoretical novelty is the division of the labor market into two submarkets. The arrival rate, denoted e, is assumed exogenous but higher for one sector than the other. In other words, matching is easier in one of the two sectors. No agents receive income while searching. Separation rate, denoted b, is an exogenous shock as well. The product markets are assumed frictionless and competitive.

The factors returns play a central role in the model. The agents prefer matching in the sector that offers the highest expected lifetime utility. Those value functions are given by

$$\rho V^i_{sh} = e^i_h(V^i_{eh} - V^i_{sh}) \text{ for the searcher} \tag{24}$$

$$\rho V^i_{eh} = \alpha^i_h P_h - b_h(V^i_{eh} - V^i_{sh}) \text{ for the agent currently matched} \tag{25}$$

where α^i_h denotes the share of revenue of type-i agent for sector h, ρ the discount rate, V^i_{eh} and V^i_{sh} denote the expected lifetime utility of a searcher of type-i in sector h and the expected lifetime utility of a matched agent of type i in sector h, respectively. Revenue shares are determined through Nash bargaining, which evenly splits the match surplus between workers and entrepreneurs. Another way to put it: workers and entrepreneurs have the same bargaining power.

In autarkic equilibrium, mobile factors must be indifferent between searching in either sector. This "fundamental equilibrium condition" equalizes expected lifetime utilities across sectors and implies that the composition of the searching population is identical in both sectors (Lemma 1). As a consequence, the equilibrium relative price is pinned down exclusively by exogenous labor market parameters, namely sectoral job arrival and separation rates, and is independent of endogenous variables such as unemployment (Lemma 2). The authors conclude that labor-market frictions constitute an independent source of comparative advantage. Because workers and entrepreneurs allocate their search effort according to expected lifetime returns, sectors characterized by higher job-finding rates or lower separation rates require lower compensation to attract factors. These labor-market characteristics reduce production costs and generate lower autarky prices, allowing countries to specialize according to differences in matching efficiency and labor turnover rather than differences in technologies or factor endowments. Therefore, the paper suggests that trade shocks could alter comparative advantage if they have heterogeneous effects on labor-market frictions, for instance by changing job-finding or separation rates across sectors or countries.

While Davidson et al. (1999) innovated by integrating labor market frictions into a simple trade model, the main downside of the paper's model is the simplistic view of the demand side of the labor markets, and thus the supply side of the economy. The model does not consider profits but considers that capital matches with labor instead of a matching process between workers and jobs. Helpman and Itskhoki (2010) goes one step further by considering a richer model featuring a monopolistic demand and an explicit variable that captures the frictions. This reaches a degree of sophistication closer to the spirit of an equilibrium search-and-matching framework. The authors analyse a 2 countries model with a sector of differentiated goods and a homogeneous sector. The demand side of the economy is defined by the

quasi-linear utility function

$$U = q_0 + \frac{1}{\xi} Q^{\xi}, \tag{26}$$

where q_0 denotes the homogeneous good and the real consumption index of the continuum of brands in the differentiated sector Q is expressed by the CES aggregator

$$Q = \left[\int_{\omega \in \Omega} q(\omega)^{\beta} d\omega \right]^{\frac{1}{\beta}}. \tag{27}$$

The parameters ξ and β control the elasticity of substitution between the two types of goods and the brands inside the differentiated sector, respectively. The authors apply industry heterogeneity of Melitz (2003) to describe firms' profits.

In the context of this paper's argument, the most interesting contribution of the model lies in its labor market component. Helpman and Itskhoki construct the model by keeping most of the intellectual foundation from the basic job search framework described in section 3, except that the model is static and not dynamic. Consequently, there is no job destruction and outside options from the bargaining process, since workers do not face a risk of losing their job once they are hired at a bargained wage. Some of those restrictions are left when the authors discuss the specific role of unemployment insurance, which is addressed below in this section.

Let H be the number of matches, m the matching efficiency, N the number of workers searching for a job, and V the number of vacancies. The model starts with a Cobb-Douglas matching function $H_{0j} = m_{0j} V_{0j}^{\chi} N_{0j}^{1-\chi}$ for the homogeneous sector in country j and $H_j = m_j V_j^{\chi} N_j^{1-\chi}$ for the differentiated sector in country j. The labor market tightness is defined by $x = H/N$[3], which plays the role of the worker's job arrival rate in the static environment. The firm's job-filling probability consists of $m^{1+\alpha} x^{-\alpha}$, where $\alpha = (1-\chi)/\chi > 0$. Furthermore, the paper considers a search process featuring perfect mobility for searchers and perfect immobility for matched workers. The interpretation can be that there is no on-the-job search from one sector to another, which is an important element in the case of a trade shock. This seems justified by the fact that a worker is unlikely to reallocate directly from one sector to another without going through unemployment for some period. Different sectors require more likely than not different skills, especially specialized export-leading sectors, while a worker may want to climb the job ladder in his own sector first, rather than opting for a complete change of career. Labor market frictions differ across countries and sectors to allow the kind of heterogeneity needed to conduct analysis in trade pattern and match the data better (unemployment varies across countries).

For what follows, distinguishing between sectors becomes necessary. Importantly, firms selling homogeneous goods employ only one worker[4], while firms in the differentiated sector can employ many workers, meaning wage bargaining differs across sectors. It follows the usual Nash bargaining process in the homogeneous sector, where the rent is shared equally because there is no outside options and bargaining power is assumed to be 1/2. Therefore, wages and profits are normalized to $\pi_0 = w_0 = 1/2$. In the differentiated sector, the Nash bargaining problem breaks down because firms can hire many workers. Moreover, the firm's revenue function is concave in the number of workers (h_j), which means that the departure of one worker changes the marginal value of every remaining worker's job. Workers inside the firm are not perfect substitutes and since this information is known, they gain bargaining power over the surplus that depends on how many other workers are also bargaining simultaneously. To formalize the bargaining process, the authors adopt the framework of Stole and Zwiebel (1996a, 1996b). The main takeaway lies in the role of the CES demand elasticity parameter in the goods market, denoted β. This parameter controls the firms' demand function curvature, and mechanically, how a firm's revenue depends on its output/employment level. Since the loss of a worker departure depends on the revenue function curvature, the bargaining power of the worker is governed by β. A lower β implies more concavity, and makes the departure of a worker less painful. This explains why the worker's bargaining share is defined as $\frac{\beta}{1+\beta}$.

The authors build a variable a that captures directly what they refer to as rigidity and influence

[3] For keeping the notations light, the subscripts do not appear when equations remain the same for both sectors.

[4] This is also assumed by Pissarides (2000).

directly labor market tightness. Those connections are described by

$$x_{0j} = a_{0j}^{-1/\alpha}, \qquad a_{0j} = \frac{2v_{0j}}{m_{0j}^{1+\alpha}}, \tag{28}$$

$$x_j = [2a_j^{-1}b_j]^{1/\alpha}, \qquad a_j = \frac{2v_j}{m_j^{1+\alpha}}, \tag{29}$$

where v_j ($v_0 j$) describes the cost per vacancy posted in country j's differentiated (homogeneous) sector and b the hiring cost. The higher a_j, the more rigid the labor market. Two channels can increase rigidity: lower matching efficiency or higher vacancy costs. In other words, labor market tightness is pinned down by frictions. Notice that $b_{0j} = 1/2$, which highlights the symmetry between equations (28) and (29). For completeness, $b_j = v_j V_j / H_j$.

The model predicts that "A reduction in labor market frictions in country j 's differentiated sector raises its welfare and reduces the welfare of its trade partner" (Proposition 1). A lower a_j implies a lower b_j, which acts like a firm-level productivity improvement. This makes the country's firms more competitive in both domestic and export markets, which changes the composition of the industry (less foreign companies). Moreover, the findings of Davidson et al. (1999) about comparative advantage are confirmed.

Finally, Helpman and Itskhoki provide an extension to their model with unemployment benefits. According to the authors, the pair (x_j, b_j) is sufficient to integrate unemployment insurance. Contrary to the previous specifications, workers can use positive outside options as threat points. Therefore, two channels work in opposite directions. With higher unemployment benefits, workers are more willing to search in a less-tight labor market, which pushes x_j down and decrease the cost of hiring, since workers may be more tolerant for a lower wage because the labor market is more slack. On the other hand, workers may use their improved bargaining position to ask for higher wages, which increase the cost of hiring. Therefore, the effects on b_j, the cost of hiring, are ambiguous and those channels were already identified in the labor literature.

The common approach of those two papers is to consider frictions not as a potential shock propagator but rather as the very source of the trade relations. As section 2 made clear, labor market institutions may increase frictions, and thus have an effect on a country trade specialization and welfare. Search-and-matching models provide the theoretical link between labor market institutions and international trade by showing how institutional differences shape labor market frictions and, consequently, comparative advantage. However, explaining trade patterns through labor market frictions is conceptually distinct from using trade shocks to identify the effects of labor market institutions. While the former treats frictions as a determinant of trade, the latter views trade shocks as exogenous disturbances that reveal how institutions shape labor market adjustment. Bridging these two perspectives constitutes the next step in the literature.

5.2 Pattern bargaining

Economic environment in general, and trade shocks in particular, may shape labor market institutions. This is the classic issue of endogeneity: if institutions respond to economic shocks, it becomes difficult to disentangle whether differences in labor market outcomes are caused by institutional arrangements or by the shocks that simultaneously influence them. A solution would be to formalize the channel through which trade shocks affect labor market institutions, allowing one to more accurately follow the transmission to outcomes such as wages, unemployment, or labor force participation. One interesting path is the export-led *pattern bargaining*, defined as "a strategy where the industries and enterprises most exposed to international competition go first to set a pattern that lowers wages, or restrains the wage increases to all workers" (Bhuller et al., 2022). Because wage negotiations are anchored in the sectors most exposed to international competition, this institutional feature can potentially explain, to some extent, why trade shocks generate heterogeneous effects across countries.

Barth et al. (2023) study the role of coordination (and by extension, pattern bargaining) in the effects of the China shock in Europe and found that countries with a high degree of coordination experienced almost no employment effect, while other countries did. The authors argue that this highlights the moderating wage-setting role of unions in countries featuring pattern bargaining. Export-led sectors face

international competition as well as the other national sectors on the labor market and cannot adjust wages as freely as those sectors. Therefore, if institutionalized, pattern bargaining permits the tradable goods sectors to moderate wage adjustment economy-wide and thus, to stay competitive vis-à-vis all their competitors (foreign and local). However, reviewing the existing literature on the topic, Calmfors (2025) points out that formal economic models do not support this traditional intuition, despite a large consensus from the economists in favor of this wage-setting institution.

Since pattern bargaining is initially thought as a protection from exposed sectors to sustain international competition, research should verify that countries featuring this kind of institution have a larger share of exportation in the national output and are indeed more often hit by trade shocks or more badly hurt by them. Otherwise, this is simply a way for the export-led sectors to maintain an economic rent over the other sectors.

6 Discussion

This section mobilizes the observations made throughout the literature review to propose a meaningful research agenda.

6.1 Trade Models and Labor Market Institutions: a Research Agenda

A promising avenue for future research would be to use the search-and-matching model as a structural approach for empirical research by embedding it within an international trade model to quantify how labor-market institutions modify the propagation of a large external cost shock. This would combine the major strands of literature and the research gap reviewed in this paper. Search-and-matching models have the necessary foundations to model labor market institutions, whose effects should be analyzed in interaction with aggregate shocks to fully capture the economic environment. International trade is a particularly relevant setting, as trade shocks have been widely studied and naturally allow for cross-country comparisons.

The contributions of Davidson et al. (1999) and Helpman and Itskhoki (2010) demonstrated the theoretical possibility of incorporating labor search frictions into an international environment. However, this approach remains limited to introducing selected search frictions, rather than employing a complete equilibrium model. Modeling the trade shock as an exogenous disturbance (such as a decline in labor productivity or an increase in vacancy posting costs) within the search-and-matching model would be a straightforward approach, but it inevitably abstracts from the mechanisms through which trade itself affects labor market outcomes.

The literature raises an important question: Is it better to consider trade shocks as exogenous inside an equilibrium search-and-matching model or to incorporate a rich job search component inside a trade model ? Each approach has its own downsides and difficulties.

Search-and-matching models are effective for studying aggregate shocks and as this paper reviewed, labor market institutions fit well inside this framework. Actually, the literature is so developed that the main remaining step may be to put together different institutions in the same environment to explore their interaction. This echoes a fundamental idea in the literature of the 1980s and 1990s even though their reduced-form approach seems inadequate compared to a structural approach. However, a serious difficulty would be that trade shocks are inherently heterogeneous across industries and aggregate variations are more compatible with an equilibrium job search model in relatively simple settings. Adding too advanced extensions would complicate considerably the presence of labor market institutions, which indicates that a certain balance has to be found in this regard.

On the other hand, while the international trade literature appears to naturally move toward models with enhanced labor market components (Davidson & Matusz, 2010), combining trade, job search, and labor market institutions in a tractable and dynamic environment remains challenging. One of the challenges is the potential interaction between trade outcomes and labor market institutions. As the example of pattern bargaining made clear, there is a great deal of endogeneity. It must be stressed that using trade models is only a part of the broader agenda of identifying the role of institutions in the labor markets. Labor reallocation, trade mechanism, and the welfare effects of trade can be abstracted in this context. Therefore, there is a potential to simplify existing trade models to focus on the issue discussed.

There can be a way to reconcile those apparent overwhelming tasks. The existing literature provides the theoretical building blocks for relating institutions to the *fundamental surplus* and for studying their interaction with aggregate shocks. A closer and more realistic objective would be to build a measure of an institutional wedge affecting this surplus. The intuition is that institutions modify the resources available from a worker-firm match: unemployment insurance raises workers' outside options, while wage floors or collective bargaining can affect the division of the match surplus and firms' expected profits. These mechanisms can therefore be summarized, at least as a first approximation, by their effect on the *fundamental surplus*. This strategy could address two different issues spotted by the literature: the lack of effective indicators for representing institutions and a simplifying technical device that can directly enter a trade model.

In more concrete terms, the idea would be to build an equilibrium search-and-matching model with interacting labor market institutions, carefully isolating the *fundamental surplus* and comparing its predictions with actual labor market outcomes (for instance, unemployment and wage levels and their respective volatilities). Then, if the model proves to be in line with data, a companion model with the same structure but without the labor market institutions can be used to build the institutional wedge in the *fundamental surplus*. Of course, the counterfactual would remain theoretical and dependent on the assumptions of the model. However, existing institutional indicators also rely on necessarily simplified classifications that do not directly measure the economic mechanisms of interest. For instance, wage-setting coordination is measured on a 1–5 scale by OECD, but the difference between a country classified as 3 and one classified as 1 does not provide a direct quantitative measure of the economic effect of greater coordination.

6.2 A Concrete Application

A particularly interesting recent trade shock is the 2022 energy shock that occurred in the aftermath of Russia's invasion of Ukraine. The shock provides several of the conditions required for a difference-in-differences strategy. The shock was sudden and externally generated, and its effects on European countries' energy costs and imports can be measured using detailed data. Furthermore, the heterogeneity of the effects can be explained by energy mix and the energy consumption of firms. This heterogeneity could therefore help identify the role of labor market institutions. The fact that other OECD countries, such as the US, Australia and Canada have not been hit by a shock of the same magnitude may help the analysis. While energy prices declined substantially from their initial peak, they remained elevated relative to the pre-2022 period, allowing the analysis to capture not only the immediate response to the shock but also its more persistent effects on firms and workers.

Why would energy shocks be suitable for the study of labor market institutions ? The main answer is that the typical debates in this matter concern mechanisms that are captured directly in a search-and-matching model. Inflation increases the pressure applied from workers to firms for higher wages, especially through collective bargaining. On the other hand, firms may face higher costs, which limit their profits. In other terms, the surplus from the match is reduced at a time where workers would need a larger share of it. By definition, as explained in this paper, labor market institutions already have an effect on the size of the surplus and its repartition. In the spirit of Blanchard and Wolfers (2000), the interaction could provide a useful source of identification.

7 Conclusion

The role of labor market institutions is central to the functioning of the economy, given the breadth of their effects on labor market outcomes. Moreover, search-and-matching models provide a useful framework for generating predictions consistent with the mechanisms identified by empirical studies and complementary theoretical approaches. All the institutions considered in this paper operate, at least partly, through the job-search process. To summarize, minimum wages and collective bargaining directly affect the surplus generated by a match and how it is shared, while unemployment insurance alters search incentives and, in turn, the worker's outside option in wage bargaining. This paper has reviewed how the literature uses search-and-matching models to describe the key mechanisms of labor market institutions, providing a unifying theoretical approach.

Simple cross-country regressions carry serious identification problems in general, and institutions provide a revealing example. In addition to the initial difficulty of measuring institutions, isolating their actual effects on labor market outcomes is especially complicated by standard econometric considerations: unemployment and wages are determined by many factors beyond institutions alone. There are also specific endogeneity concerns, as institutions may themselves respond to labor-market conditions rather than being purely exogenous determinants of them. To address these difficulties, this paper highlights the importance of studying the interaction between shocks and institutions and of considering the broader economic environment in which their effects on the labor market emerge. Moreover, as the studies of minimum wages and unemployment insurance make clear, dynamic analyses are often more informative than static comparisons of institutional environments at a single point in time.

Trade shocks provide a particularly promising setting for such an approach. As the intensity and nature of globalization evolve, tariffs, geopolitical events, and other disruptions provide new opportunities to study how labor-market institutions shape adjustment to external shocks. Trade models incorporating search frictions provide an insightful approach to bridging the theoretical gap between international trade and search-and-matching models. Building on these contributions, the research agenda proposed in this paper suggests that institutional effects could be studied through their interaction with trade shocks and, more broadly, through their effect on the fundamental surplus. Even though closing the debate seems unlikely, bringing economics closer to clarity may help the profession to eventually declare, in the words of economist Olivier Blanchard, an "intellectual victory."

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