Modeling Migration-Induced Unemployment

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Immigration is often blamed for increasing unemployment among local workers. However, standard models, such as the neoclassical model and the Diamond-Mortensen-Pissarides matching model, inherently assume that immigrants are absorbed into the labor market without affecting local unemployment. This paper presents a more general model of migration that allows for the possibility that not only the wages but also the unemployment rate of local workers may be affected by the arrival of newcomers. This extension is essential to capture the full range of potential impacts of labor migration on labor markets. The model blends a matching framework with job rationing. In it, the arrival of new workers can raise the unemployment rate among local workers, particularly in a depressed labor market where job opportunities are limited. On the positive side, in-migration helps firms fill vacancies more easily, boosting their profits. The overall impact of in-migration on local welfare varies with labor market conditions: in-migration reduces welfare when the labor market is inefficiently slack, but it enhances welfare when the labor market is inefficiently tight.

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1. Introduction

People are always worried about immigrants taking their jobs (Jenks 2001; Schildkraut 2010). Not surprisingly, then, immigration is always one of people's chief policy concerns (Card, Dustmann, and Preston 2012; Liaquat and Jost 2023). In fact, since the 1970s, specifically anti-immigration political parties have appeared and started to grow in Western countries, now attracting 11% of votes on average across these countries (Gethin, Martinez-Toledano, and Piketty 2022, p. 22). And far-right parties with anti-immigration platforms have become increasingly popular across European countries, all the more so in countries and at times in which the share of immigrants in the population is larger (Halla, Wagner, and Zweimuller 2017, figure 1).

People's worries might not be completely unfounded. A substantial empirical literature estimates that in the short run, the arrival of new workers in a labor market raises the unemployment rate of local workers (Hunt 1992; Angrist and Kugler 2003; Boustan, Fishback, and Kantor 2010; Glitz 2012; Dustmann, Schoenberg, and Stuhler 2017; Borjas and Monras 2017; Labanca 2016; Anastasopoulos et al. 2021).

Yet, by assumption, standard models of the labor market rule out the possibility that the unemployment rate of local workers may be affected by newcomers. In a neoclassical model of the labor market, there is no unemployment at all: anybody who wants to work can work. In a Diamond-Mortensen-Pissarides (DMP) model of the labor market—either the textbook model from Pissarides (2000) or the version with rigid wage from Hall (2005b)—there is some unemployment. But labor demand is perfectly elastic in the DMP models (Michaillat 2014); thus, newcomers are absorbed into the labor market without affecting other workers. Hence, the standard models cannot capture the phenomenon that newly arrived workers compete for jobs with local workers and make it more difficult for them to find employment.

Because they rule out the possibility that the local unemployment rate may be affected by migration, standard models cannot describe and explain the short-run response of unemployment to migration. They cannot predict when such response is likely to be severe and when it is likely to be mild. And they cannot be used to design compelling migration policies because they rule out what is in the public's mind one the most deleterious effects of migration. In particular, they cannot say whether migration policies should respond to the business cycle or the state of the local labor market because in the models, jobs are always plentiful.

This paper therefore presents a model that allows for migration-induced unemployment. In the matching model with job rationing from Michaillat (2012), the entry of migrants reduces labor-market tightness and therefore the job-finding rate of local workers. As a result, the arrival of migrants increases the unemployment rate of local workers—who might naturally feel that migrants take their jobs away.

In normal times, the mechanism is as follows. In the model the number of jobs available is somewhat limited. When new workers enter the labor force, it increases the number of jobseekers and reduces labor-market tightness. This makes hiring more attractive to firms, so they hire some more workers—some local and some newly arrived. While this additional hiring boosts labor-market tightness, tightness always remains below its level before migration because the number of jobs available is not sufficient to absorb all newcomers. Since labor-market tightness is lower, the job-finding rate of all jobseekers is lower, the unemployment rate goes up, and the employment rate goes down. That is, fewer local workers hold jobs. This mechanism is consistent with evidence from Germany that the local unemployment rate increases because of a reduced inflow of local workers into employment, not increased outflow of local workers from employment (Dustmann, Schoenberg, and Stuhler 2017).

In bad times, the lack of jobs is more stringent. This means that firms absorb fewer of the newcomers. More of the newcomers therefore remain jobless, which increases the competition for jobs. As a result, local workers are more negatively affected by in-migration in bad times. Formally, the elasticity of the employment rate with respect to in-migration is more negative in bad times. This might explain why the backlash against immigration seems stronger when the unemployment rate is elevated (Halla, Wagner, and Zweimuller 2017).

While in-migration always hurts workers, it always helps firms. This is because in-migration reduces labor-market tightness, so it makes it easier for firms to recruit workers. Easier recruiting in turn improves firm profits.

The overall effect of in-migration on local welfare—the sum of local labor income and local firm profits—depends on the state of the labor market. When the labor market is inefficiently slack, allowing in-migration always reduces local welfare. But in-migration improves local welfare when the labor market is inefficiently tight. In that case, the local labor income lost from in-migration is more than offset by the increase in firm profits.

Finally, the model provided in this paper can reconcile the immigration literature, which is currently divided. A first branch of the literature argues that the labor demand is downward-sloping so the number of jobs available in the labor market is somewhat limited (Borjas 2003). Under this perspective, the arrival of immigrants reduces the opportunities available to local workers. A second branch of the literature argues that the arrival of immigrants does not reduce the wage of local workers (Card 1990). Under this perspective, the arrival of immigrants does not affect local workers who are employed. This paper's model features a downward-sloping labor demand, so jobs are somewhat limited, and rigid wages, so competition between local and immigrant workers does not necessarily reduce the wages of employed workers. (The qualitative results are exactly the same whether wages are completely fixed or partially rigid in respond to migration.)

The novelty is that competition between local workers and immigrants is reflected not only in wages but also in labor-market tightness, which itself determines workers' job-finding rate and unemployment rate. So in-migration adversely affect local workers even when it does not affect local wages—because it raises the local unemployment rate and adversely affects local jobseekers. As such, the model reconciles the Borjasian and Cardian views of immigration.

While the analysis focuses on migration, it could also be applied to any other shocks to the size of the labor force. The model shows that any increase in labor force reduces labor-market tightness in the short run—an outward shift of the labor supply along a downward-sloping labor demand in an employment-tightness plane. Conversely, any decrease in labor force increases labor-market tightness in the short run—an inward shift of the labor supply along a downward-sloping labor demand in an employment-tightness plane. Thus the model helps explain why US labor-market tightness was especially high during World War 2, the Korean War, and the Vietnam War. A reason is that millions of workers were sent abroad on military duty instead of being the labor force at home. It also helps explain why labor-market tightness has been historically high in the recovery from the coronavirus pandemic. A reason is that the pandemic induced a drop in labor-force participation rate by more than 3 percentage points.

2. Migration-induced unemployment in natural and quasi experiments

This section presents evidence of migration-induced unemployment. The evidence comes from natural and quasi experiments in which newcomers arrive into local labor markets for plausibly exogenous reasons. The experiments—organized chronologically below, based on when the events occurred—involve a broad range of migrations: international migration, return migration, as well as domestic migration. They quite clearly find evidence that the local unemployment rate rises in response to in-migration.

2.1. US Great Depression

Boustan, Fishback, and Kantor (2010) studies the effect of internal migration in the United States during the Great Depression. Just like native workers protest immigration from abroad, locals in areas where the depression was less severe protested the arrival of migrants from other less fortunate regions. They accused newcomers of taking jobs away from them. For example, Californians tried to scare possible migrants away from the state: one billboard in Oklahoma carried the message "NO JOBS in California / If YOU are looking for work—KEEP OUT / 6 men for every job / No state relief available for non-residents" (Boustan, Fishback, and Kantor 2010, p. 720).

To assess the impact of internal migrants on existing residents, Boustan, Fishback, and

Kantor (2010) use variation in the generosity of New Deal programs and extreme weather events to instrument for migrant flows to and from US cities. They find that in-migration had little effect on the hourly earnings of existing residents, but they prompted some residents to move away from their city and others to lose weeks of work or access to relief jobs. They estimate that for every 100 arrivals, 19 residents moved out and 21 were displaced from relief job. They also find that just as in-migration diminished the work opportunities of local residents, out-migration improved those opportunities symmetrically.

2.2. War of Algeria

Hunt (1992) examines the repatriation to France of Algerians of European origin following Algerian independence in 1962. Hunt (1992, p. 566) finds that the arrival of 100 repatriates increase in the labor force raised pushed 20 natives into unemployment.

Borjas and Monras (2017) revisit the evidence using a more sophisticated empirical approach. They aim to estimate the impact of immigration in individual region-education cells of the French labor market. They confirm Hunt's findings for French repatriates, finding just slightly stronger effects.

Borjas and Monras (2017) also look at Algerian refugees who fled Algeria for France at the same time as European refugees. For these immigrants, they find larger effects: 27 natives were pushed into unemployment for every 100 refugees in any region-education cell.

2.3. Independence of Mozambique and Angola

Carrington and de Lima (1996) and Makela (2017) study how to return of half a million workers from Mozambique and Angola to Portugal in 1974–1976 affected the Portuguese labor market. This return led to a 15% increase in the size of the Portuguese civilian labor force. Carrington and de Lima (1996) finds that in 1981, the unemployment rate faced by returnees (14%) is much higher than that of locals (6%), indicating that it was difficult for returnees to get absorbed by the labor market. Moreover, Makela (2017) finds that in 1977, after the wave of migration subsided, the Portuguese unemployment rate is 3.3pp higher compared to a counterfactual outcome.

Makela (2017, p. 242) also reports that Portuguese workers were concerned about the return of these workers from the African colonies, especially because the Portuguese economy was slumping at that time. The returnees were accused of "stealing housing and jobs" from Portuguese residents.

2.4. Mariel Boatlift

Interestingly, the results from Card (1990)'s famous study are not inconsistent with migration-induced unemployment. Card (1990) studies the impact of the Cuban immigrants from the Mariel Boatlift on the Miami labor market in the 1980s. A first, well-known finding from the study is that "the Mariel immigration had essentially no effect on the wages or employment outcomes of non-Cuban workers in the Miami labor market" (Card 1990, p. 255). A second finding is that "perhaps even more surprising, the Mariel immigration had no strong effect on the wages of other Cubans" (Card 1990, p. 255).

A third, less-known finding is that the unemployment rate for Cuban workers increased drastically: "Unlike the situation for whites and blacks, there was a sizable increase in Cuban unemployment rates in Miami following the Mariel immigration. Cuban unemployment rates were roughly 3 percentage points higher during 1980-81 than would have been expected on the basis of earlier (and later) patterns" (Card 1990, p. 251). If labor markets are segregated by ethnicity, then we learn that a large increase in the labor force in the Cuban labor market result in a sharp increase in the unemployment rate in that labor market. The fact that the Cuban workers face a higher unemployment rate is evidence that the labor market could not absorb all new arrivals, and that jobs are somewhat rationed. Broadly, the arrival of 100 new Cubans in the labor force pushed 13 Cubans who were residing in the Miami in unemployment.

Relatedly, Anastasopoulos et al. (2021, figure 5) compute the response of labor-market tightness in Miami upon the arrival of Cuban immigrants from the Mariel Boatlift in the 1980s. Relative to the tightness in other comparable cities, they find that Miami tightness fell by 40% after the Mariel boatlift. This implies that it became much harder for local workers to find jobs after the boatlift.

2.5. Fall of the Berlin Wall

Glitz (2012) studies the return of 2.8 million ethnic Germans to Germany in the 15 years following the fall of the Berlin Wall. The key finding is that the immigrants had no effect on relative wages, but 31 native workers became unemployed for every 100 immigrants that found a job. Campos-Vazquez (2008) finds a similar number in the same empirical context.

Dustmann, Schoenberg, and Stuhler (2017) estimate the impact of Czech commuters who were allowed to work in German border towns in 1991–1993, just after the fall of the Iron Curtain. They find evidence of migration-induced unemployment again: for each 100 commuters that found a job, 71 German workers were relegated to unemployment. They also find that the increase in unemployment for German workers is caused by reduced inflows into employment—not increased outflows from employment. So German workers did not lose their jobs at a higher pace when Czech commuters arrived, but it became harder for German workers who did not have a job to find one.

Relatedly, D'Amuri, Ottaviano, and Peri (2010) estimates how West German workers were impacted by the arrival of ethnic Germans, East Germans, and foreigners into Germany in 1987–2001. They find that the arrival of new immigrants does not affect natives much, but it negatively affects previous immigrants, who were already working in West Germany. They find that for 100 new immigrants who found a job, 30–40 previous immigrants were pushed into unemployment.

2.6. Yugoslav Wars

Angrist and Kugler (2003) look at migration from former Yugoslavia into other European countries in the 1990s. With a basic OLS specification, Angrist and Kugler (2003, p. F318) finds that the entry of 100 immigrants in the labor force pushes 35 native workers into unemployment. With an IV specification, Angrist and Kugler (2003, p. F322) finds that the entry of 100 immigrants in the labor force pushes 83 native workers into unemployment.

Borjas and Monras (2017) also revisit the evidence from the migration of Yugoslavians to Europe in the 1990s using a region-education-cell strategy. They observe again migration-induced unemployment, although their results are weaker than the original results. By OLS, they find that 21 natives are pushed to unemployment when 100 refugees enter a region-education cell. By IV, they find that 47 natives enter unemployment when 100 refugees enter a region-education cell.

2.7. Arab Spring

Finally, Labanca (2016) examines the arrival of Arab Spring refugees into the Italian labor market in 2011. He finds that for every 100 refugees employed, 63–80 native Italian workers become unemployed.

2.8. Nonexperimental evidence

Beside the experimental evidence described in this section, a few papers provide non-experimental evidence that the arrival of immigrants on a labor market reduces the employment rate of local workers.

Card (2001) uses the 1990 US Census to study the effects of immigration on occupation-specific labor market outcomes. He finds that occupation-specific wages and employment rates are systematically lower in cities with higher relative supplies of workers in a given occupation. Hence, immigration over the 1980s reduced wages and employment rates of low-skilled natives in gateway cities like Miami and Los Angeles.

TABLE 1. Job stealing is prevalent in popular perceptions

The growing number of these immigrants takes jobs away from people already here.	How likely is it?			
	Extremely	Very	Somewhat	Not at all
Hispanics	20%	29%	38%	13%
Asians	19%	30%	37%	13%

Source: 1992 American National Election Studies survey. The responses to the question about Hispanic workers (question Q4c) can be accessed at `https://electionstudies.org/data-tools/anes-variable/variable.html?year=1992&variable=V926238`. The responses to the question about Asian workers (question Q5c) can be accessed at `https://electionstudies.org/data-tools/anes-variable/variable.html?year=1992&variable=V926241`.

Borjas, Grogger, and Hanson (2007) use the 1960–2000 US Censuses to examine the correlation between immigration, black wages, and black employment rates. They find that when 100 immigrants arrive in the labor market for a particular skill group, 35 black workers were pushed out of employment. They also find that the wage of employed black workers fell, and the incarceration rate of blacks increased.

Edo (2015) uses microdata for France, 1990–2002, and finds that in the short run, immigrants increase the unemployment rate of native workers but do not reduce their wages.

Latif (2015) uses provincial panel data to examine the impact of permanent immigration on the unemployment rate in Canada. It fins that in the short run, immigration causes a raise in the unemployment rate. It also finds that this effect disappears in the long run.

Finally, Duzhak (2023) uses US state-level data to study the response of labor-market tightness to immigration. She finds that the slowdown in immigration between 2017 and 2021 raised the tightness of local labor markets. In 2022, the rebound in immigration helped lower labor-market tightness (which was inefficiently high at the time).

2.9. Discussion

A popular perception is that immigrants steal people's jobs (table 1). Halla, Wagner, and Zweimuller (2017, table C3) also report that voters worry about the negative effects of immigration on the labor market: Austrians think that immigrants threaten their labor market opportunities. And, as we have seen, there is ample evidence of migration-induced unemployment in natural and quasi experiments. Yet, academic economists tend to reject that notion (Raphael and Ronconi 2007). Federman, Harrington, and Krynski (2006, p. 302) note for instance:

> One of the central questions in the debate over immigration policy is whether immigrants adversely affect labor market outcomes for natives. Some Amer-

> icans believe they do, worrying that immigrants take jobs away from native workers. Most of the empirical evidence produced by economists, however, does not support these concerns.

The general perception by academics that immigration has no adverse effect on local workers might be an indirect consequence of not having models to think about the effect of immigration on unemployment. If such phenomenon was present in standard models, researchers might have paid more attention to the empirical findings in existing studies. Indeed, one of the main functions of models is to guide and stimulate empirical work about the phenomena that they describe (Kuhn 1957).

Because existing models only allow migration to affect wages, the empirical literature has focused on wages, which do not appear to respond much to immigration. This has created a puzzle: "The depth of public concern over immigration is somewhat puzzling, given that most studies find only small economic impacts on the native population" (Card, Dustmann, and Preston 2012, p. 78). The adverse impact of immigration on unemployment is not emphasized at all in economic research—but it is often there, offering a resolution of the puzzle.

The absence of migration-induced unemployment in existing migration models severely limits the scope of empirical inquiry about migration. A wonderful example of such limitation appears in a seminal paper by Scheve and Slaughter (2001). The paper documents people's perceptions about immigration. The authors candidly admit that they do not examine people's perception of job stealing because such perceptions would be inconsistent with the effects of immigration in standard models:

> The 1992 National Election Studies survey asked other questions about immigration that we do not analyze. For example, respondents were asked whether they think Asians or Hispanics 'take jobs away from people already here.' We do not focus on this question because its responses cannot clearly distinguish among our three competing economic models. All our models assume full employment, so no natives could have jobs 'taken away' by immigrants.

The response of respondents in the 1992 National Election Studies is presented in table 1. More than 80% of respondents are indeed worried that Hispanic and Asian immigrants take jobs away from them. It is quite possible that the existence of migration-induced unemployment has not received the attention it deserves just because standard models do not feature it.

Of course, not all studies find that migration affects unemployment. For example, Foged and Peri (2016) examine how less-educated natives were impacted by an exogenous inflow of low-skilled immigrants in Denmark between 1991 and 2008. They find that the native workers spend more time in unemployment as the result of the wave of immigration, but the estimates are not statistically significant. So they cannot reject the null hypothesis that immigration has no effect on unemployment (Foged and Peri 2016, figure 7 and table 8). Nevertheless, even to establish empirically that migration has zero effect on unemployment, it is useful to have a model in which migration may affect not only wages but also tightness and unemployment. The model describes the mechanism through which migration may affect unemployment in the short run. The model also predicts when the effect of migration on unemployment is likely to be severe and when it is likely to be mild. Regardless of the eventual findings, the model will be useful to empiricists who want to establish whether or not migration induces unemployment, because it explains through which channels and under which conditions migration may induce unemployment.

3. Model of the labor market

This section introduces the model of the labor market on which the analysis is based: the matching model with job rationing developed by Michaillat (2012). That model itself generalizes the baseline matching model of Diamond (1982), Mortensen (1982), and Pissarides (1985). The generalized model features both frictional and rationing unemployment—unlike the baseline model, which solely features frictional unemployment. Introducing rationing unemployment is required to generate migration-induced unemployment. Indeed, if jobs were not rationed, all newcomers would simply be absorbed by firms.

3.1. Assumptions

The labor market is composed of a mass 1 of firms and a labor force of size H. The matching function between unemployment workers and vacant jobs takes a Cobb-Douglas form:

$$m(U, V) = \omega \cdot U^{\eta} \cdot V^{1-\eta},$$

where U is the number of unemployed workers, V is the number of vacant jobs, and $\eta \in (0, 1)$ is the matching elasticity.

In the matching model wages are determined in a situation of bilateral monopoly so it is a wage norm and not an auctioneer that determines wages. The advantage is that the wage norm assumed can be shaped by evidence. US evidence suggests that immigration has small and generally insignificant effects on the wages of local workers (Friedberg and Hunt 1995; Ottaviano and Peri 2012; Card 2012). Hence, I begin by assuming that all workers are paid a same real wage $w > 0$, which does not respond to migration.[1]

[1]The model describes the impact of migration when all workers have the same productivity and are paid the same wage. Albert (2021) studies an additional mechanism that operates when newcomers accept lower wages than locals. Firms post vacancies, collect applications, and pick the worker who accepts the lowest wage among all applicants. Then, if a newcomer and a local both apply to the same job, the firm picks the cheaper

If the consensus evolves and it is concluded that wages systematically decrease with migration, the wage norm can be amended to capture this fact, as described by (19). Then the analysis can be repeated with the wage norm that responds to migration, as showed in section 4.3. It turns out that the qualitative results are exactly the same whether wages are completely fixed or partially rigid, as long as wages are not completely flexible in response to migration. Hence, all the results in sections 4–8 are obtained under the general wage norm (19).

Firms have a concave production function

$$y(P) = aP^{1-\alpha}, \tag{1}$$

where a governs labor productivity, P denotes the number of producers in the firm, and $\alpha \in (0,1)$ governs diminishing marginal returns to labor.

Firms also incur a recruiting cost of $\kappa > 0$ recruiters per vacancy and face a job-destruction rate $\lambda > 0$. The total number of recruiters in the firm is $R = \kappa V$ and the total number of workers is $L = R + P$.

3.2. Matching rates

Workers match with firms at a rate $f(\theta)$ given by

$$f(\theta) = \frac{m(U,V)}{U} = m(1,\theta) = \omega\theta^{1-\eta}. \tag{2}$$

The elasticity of the job-finding rate with respect to labor-market tightness simply is $\epsilon^f_\theta = d\ln f/d\ln\theta = (1-\eta)$.

Vacancies are filled with workers at a rate $q(\theta)$ given by

$$q(\theta) = \frac{m(U,V)}{V} = m(\theta^{-1},1) = \omega\theta^{-\eta}. \tag{3}$$

The elasticity of the vacancy-filling rate with respect to labor-market tightness simply is $\epsilon^q_\theta = d\ln q/d\ln\theta = -\eta$.

3.3. Labor supply

In the matching framework, the employment level is given by the following law of motion:

$$\dot{L}(t) = f(\theta)U(t) - \lambda L(t). \tag{4}$$

newcomer over the more expensive local. Through such wage competition, the arrival of new workers on a labor market increases the unemployment rate of locals. Albert (2021) finds that this mechanism operates with illegal immigrants, who accept much lower wages than native workers, but not with legal immigrants, because they are paid roughly the same as native workers.

That is, the employment level increases over time ($\dot{L} > 0$) if more jobseekers find jobs than employed workers lose their jobs ($f(\theta)U > \lambda L$). Conversely, employment decreases over time if more employed workers lose their jobs than jobseekers find jobs.

Since $U(t) = H - L(t)$, the law of motion (4) can be rewritten as the following differential equation:

$$\dot{L}(t) = f(\theta)H - [\lambda + f(\theta)]\,L(t).$$

The critical point of this differential equation is

$$L = \frac{f(\theta)}{\lambda + f(\theta)} H. \tag{5}$$

This positive relationship between employment and tightness is the locus of unemployment and tightness such that the number of new employment relationships created at any point in time equals the number of relationships dissolved at any point in time. It is the locus of points such that the employment level remains constant over time and labor-market flows are balanced. It is also isomorphic to the Beveridge curve.

The employment levels given by equations (4) and (5) are indistinguishable (Hall 2005a, pp. 398–399; Pissarides 2009, p. 236). In fact, Michaillat and Saez (2021, p. 31) find that when λ and $f(\theta)$ are calibrated to US data, the deviation between the two employment levels decays at an exponential rate of 62% per month. This means that about 50% of the deviation evaporates within a month, and about 90% within a quarter.

I therefore assume that at the time scale of the model, labor-market flows are always balanced, and the employment level is given by equation (5) at all times. This assumption is akin to the assumption that people are always rational in macroeconomic models, while neglecting the learning period that it takes for people to converge to a rational behavior. It is also akin to the assumption that people always know Nash or other equilibria in game theory, while neglecting the learning or coordination period that it takes to reach such equilibria.

The employment level consistent with balanced flows is the labor supply:

$$L^s(\theta, H) = \frac{f(\theta)}{\lambda + f(\theta)} H. \tag{6}$$

In the model, the labor supply holds at any point in time. The labor supply links employment to tightness and labor force. From the labor supply we can also relate the unemployment rate to tightness. The unemployment rate is $u = (H - L^s)/H = 1 - L^s/H$ so

$$u(\theta) = \frac{\lambda}{\lambda + f(\theta)}. \tag{7}$$

The elasticity of labor supply with respect to tightness satisfies

$$\epsilon_\theta^s = \frac{d\ln(L^s)}{d\ln(\theta)} = \epsilon_\theta^f - \frac{f(\theta)}{\lambda + f(\theta)}\epsilon_\theta^f = (1-\eta) - \frac{f(\theta)}{\lambda + f(\theta)}(1-\eta),$$

so it simplifies to

$$\epsilon_\theta^s = (1-\eta)\, u(\theta), \tag{8}$$

where $u(\theta)$ is the unemployment rate along the labor supply, given by (7). The elasticity of labor supply with respect to the labor force is

$$\epsilon_H^s = \frac{d\ln(L^s)}{d\ln(H)} = 1.$$

Since the unemployment rate satisfies $u(\theta) = 1 - L^s(\theta)/H$, the elasticity of the unemployment rate with respect to tightness is

$$\epsilon_\theta^u = \frac{d\ln(u)}{d\ln(\theta)} = \frac{-L^s/H}{1 - L^s/H} \cdot \epsilon_\theta^s = -\frac{1-u(\theta)}{u(\theta)} \cdot \epsilon_\theta^s.$$

Using the expression (8) for ϵ_θ^s then yields

$$\epsilon_\theta^u = -(1-\eta)\left[1 - u(\theta)\right]. \tag{9}$$

3.4. Recruiter-producer ratio

Because it takes time to fill vacancies and each vacancy requires the attention of a recruiter, firms must allocate a share of their workforce to recruiting. And because the model is cast on a time scale where labor-market flows are balanced, firms post vacancies to maintain their firm at a given desirable size. That is, they post V vacancies so the number of new hires $q(\theta)V$ just replaces the number of workers who left the firm λL.

Multiplying $\lambda L = q(\theta)V$ by the recruiting cost κ, and using $L = R + P$ and $R = \kappa V$, yields $\lambda\kappa(P + R) = q(\theta)R$. Dividing both sides by R then gives $\lambda\kappa(1 + \tau(\theta)^{-1}) = q(\theta)$, where $\tau(\theta) = R/P$ is the recruiter-producer ratio. The recruiter-producer ratio is therefore given by

$$\tau(\theta) = \frac{\lambda\kappa}{q(\theta) - \lambda\kappa}.$$

This means that

$$1 + \tau(\theta) = \frac{q(\theta)}{q(\theta) - \lambda\kappa}.$$

The recruiter-producer ratio $\tau(\theta)$ is positive and increasing on $[0, \theta_\tau)$, where θ_τ is defined by $q(\theta_\tau) = \lambda\kappa$; furthermore, $\tau(0) = 0$ and $\lim_{\theta \to \theta_\tau} \tau(\theta) = +\infty$.

The wedge $1+\tau(\theta)$ plays an important role in the analysis because it determines the gap between numbers of employees and producers in the workforce:

$$L = P + R = [1+\tau(\theta)]\,P. \tag{10}$$

The elasticity of $1+\tau$ with respect to θ satisfies

$$\epsilon_{\theta}^{1+\tau} = \epsilon_{\theta}^{q} - \epsilon_{\theta}^{q-\lambda\kappa} = -\eta - \frac{q(\theta)}{q(\theta)-\lambda\kappa}(-\eta),$$

so it simplifies to

$$\epsilon_{\theta}^{1+\tau} = \eta\tau(\theta). \tag{11}$$

3.5. Labor demand

Firms operate within the balanced-flow paradigm. By choosing how many vacancies to post, they determine their workforce, which they in turn choose to maximize flow real profits:

$$y(P) - wL = y(P) - [1+\tau(\theta)]\,wP.$$

The first-order condition of the firm's maximization problem is $y'(P) - [1+\tau(\theta)]\,w = 0$, or

$$(1-\alpha)aP^{-\alpha} = [1+\tau(\theta)]\,w. \tag{12}$$

With (10), the first-order condition (12) becomes

$$(1-\alpha)a\,[1+\tau(\theta)]^{\alpha}\,L^{-\alpha} = [1+\tau(\theta)]\,w,$$

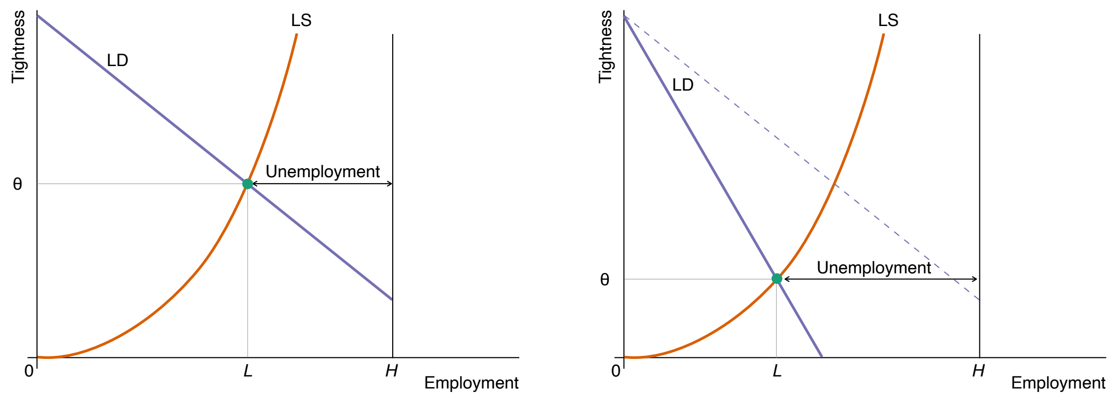
which then yields the firm's labor demand:

$$L^{d}(\theta, a) = \left\{\frac{(1-\alpha)a}{[1+\tau(\theta)]^{1-\alpha}\,w}\right\}^{\frac{1}{\alpha}}. \tag{13}$$

The labor demand gives the firm's employment level for any tightness and productivity. There is job rationing in the model because the labor demand is decreasing with tightness. The labor demand fluctuates in response to productivity shocks over the business cycle.

The elasticity of labor demand with respect to tightness, defined by $\epsilon_{\theta}^{d} = d\ln L^{d}/d\ln\theta$, admits the following expression:

$$\epsilon_{\theta}^{d} = -\frac{1-\alpha}{\alpha}\epsilon_{\theta}^{1+\tau} = -\frac{1-\alpha}{\alpha}\eta\tau(\theta). \tag{14}$$



A. Labor market in normal times

B. Labor market in bad times

FIGURE 1. Solution of the model

The labor demand curve is given by (13). The labor supply is given by (6). The solution of the model is at the intersection of the labor demand and supply curves.

3.6. Solution of the model

The model requires that firms maximize profits, and that employment is determined by the matching and separation processes. These requirements impose that labor demand equals labor supply:

$$L^d(\theta, a) = L^s(\theta, H).$$

The labor demand is strictly decreasing in θ while the labor supply is strictly increasing in θ. For any given H, the equation pins down a unique θ: the unique solution of the model. Therefore, the supply-equals-demand condition implicitly defines $\theta(H)$. Once we have $\theta(H)$, plugging into either labor supply or labor demand defines the employment level as a function of H, $L(H)$. The unemployment rate is then $u(\theta(H)) = \lambda/[\lambda + f(\theta(H))]$. The solution of the model is illustrated in figure 1.

4. Impact of in-migration on the labor market

Migration changes the labor force and therefore tightness, job-finding rate, and unemployment rate. Here we describe the impact of in-migration on the labor market.

4.1. Modeling in-migration

In-migration leads to a sudden increase in the number of workers in the labor force, so a sudden increase in H. By modeling a wave of in-migration as an increase in the labor force, I implicitly assume that local and migrant workers are the same: they have the same productivity, command the same wage, and are hired through the same channels by firms. This assumption is consistent with the evidence collected by Martins, Piracha, and Varejao (2018, p. 220) in Portuguese administrative data:

> These estimates imply that, even for narrowly defined jobs, employers do not substitute natives with immigrants. On the contrary, immigrants and natives are jointly hired and fired. This is true for all types of jobs considered, including lower skilled jobs.

Here the focus is on the short-term effects of in-migration, so the labor demand is assumed to remain unaffected by immigration. Assuming that labor demand is unaffected for instance rules out that firms adjust their capital stock when migrants arrive. It also rules out that migrants bring innovations to the production process that improve labor productivity. These are standard assumptions to describe the short run. In the long run, as firms adjust capital stock and production process, the impact of in-migration on the labor market will vanish because the labor demand will scale up with labor supply (Card 2012).

Additionally, as Greenwood and Hunt (1984, p. 957) note, "migrants may influence the price and profitability of locally provided goods and services due to the changed demand they may cause for such goods and services." Price changes on product markets could then influence labor demand. However, we assume that firms and workers bargain over real wages, so such price changes have no effect on labor demand. In other words, we allow for real wage rigidities but abstract from nominal wage rigidities, as is standard in matching models of the labor market (Shimer 2004; Hall 2005b; Hall and Milgrom 2008; Blanchard and Gali 2010; Michaillat 2012).

4.2. Impact of in-migration on local workers

I now determine the impact of in-migration on the prospects of local jobseekers. The main step is to compute the elasticity of tightness $\theta(H)$ with respect to the labor force H. From this, I will infer the elasticity of the job-finding rate $f(H)$ with respect to the labor force H.

Consider a small change in the size of the labor force generated by in-migration, $d\ln H$. This small change generates a small change in tightness, $d\ln\theta$. These changes generate small changes in labor supply and demand:

$$
\begin{aligned}
d\ln L^s &= \epsilon^s_\theta d\ln\theta + \epsilon^s_H d\ln H\\
d\ln L^d &= \epsilon^d_\theta d\ln\theta.
\end{aligned}
$$

Since the supply-equals-demand condition must hold both before and after in-migration,

$d\ln L^s = d\ln L^d$. This means that

$$\epsilon^s_\theta d\ln\theta + \epsilon^s_H d\ln H = \epsilon^d_\theta d\ln\theta.$$

In other words, the elasticity of tightness with respect to labor force, $\epsilon^\theta_H = d\ln\theta/d\ln H$, is given by

$$\epsilon^\theta_H = \frac{-\epsilon^s_H}{\epsilon^s_\theta - \epsilon^d_\theta} = \frac{-1}{\epsilon^s_\theta - \epsilon^d_\theta}. \tag{15}$$

Therefore, the elasticity of the job-finding rate with respect to the labor force, $\epsilon^f_H = d\ln f(\theta)/d\ln H = [d\ln f/d\ln\theta]\cdot[d\ln\theta/d\ln H]$, is given by

$$\epsilon^f_H = \frac{-(1-\eta)}{\epsilon^s_\theta - \epsilon^d_\theta}. \tag{16}$$

Finally, the elasticity of the unemployment rate with respect to the labor force, which is defined by $\epsilon^u_H = d\ln u/d\ln H$, is

$$\epsilon^u_H = \epsilon^u_\theta \cdot \epsilon^\theta_H = \frac{1-u(\theta)}{u(\theta)} \cdot \frac{\epsilon^s_\theta}{\epsilon^s_\theta - \epsilon^d_\theta}.$$

From this, I infer the semi-elasticity of the unemployment rate with respect to the labor force, which gives the percentage-point change in unemployment rate when the labor force changes by one percent:

$$\frac{du}{d\ln H} = u\cdot\epsilon^u_H = \frac{1-u(\theta)}{1-\epsilon^d_\theta/\epsilon^s_\theta}. \tag{17}$$

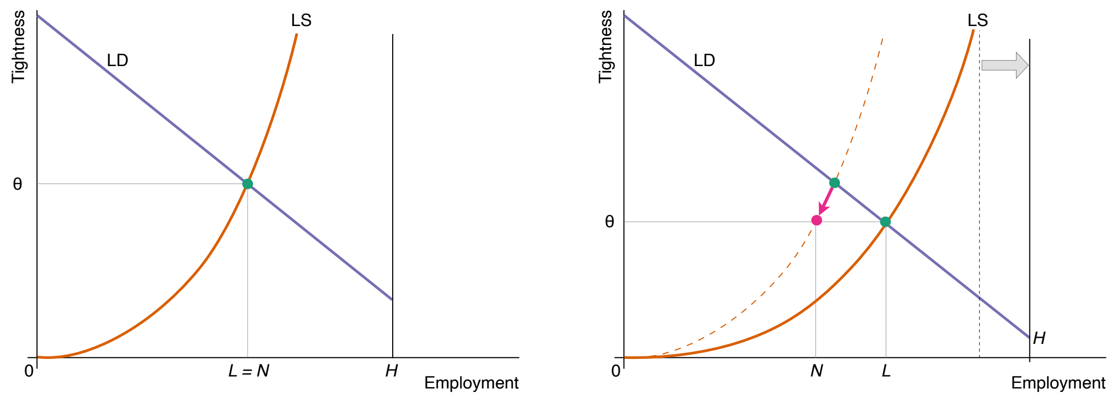
A last useful statistic is the elasticity of the employment rate $l = 1-u$ with respect to labor force, which is defined by $\epsilon^l_H = d\ln l/d\ln H$, and which follows from (17):

$$\epsilon^l_H = \frac{1}{1-u}\cdot\frac{-du}{d\ln H} = \frac{-1}{1-\epsilon^d_\theta/\epsilon^s_\theta}. \tag{18}$$

Collecting these results yields the following proposition:

PROPOSITION 1. *In-migration leads to a decrease in labor-market tightness, which causes a decrease in the job-finding rate of local workers, an increase in their unemployment rate, and a decrease in their employment rate.*

The proposition is a direct consequence from the facts that $\epsilon^s_\theta > 0$ and $\epsilon^d_\theta < 0$ and from (15), which shows that the elasticity of tightness with respect to the labor force is negative, from (16), which shows that the elasticity of the job-finding rate with respect to the labor



A. Initial situation

B. After in-migration

FIGURE 2. In-migration reduces the job-finding rate of local workers

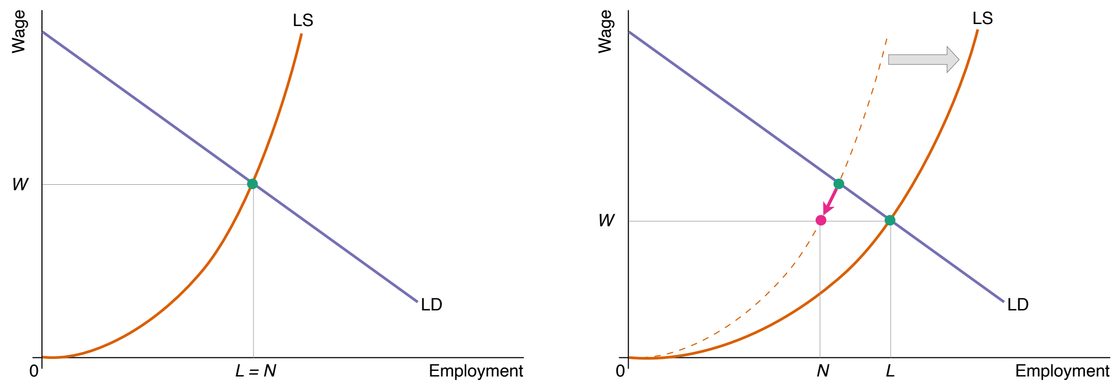
The labor demand curve is given by (13). The labor supply is given by (6). This graph illustrates the results from proposition 1.

force is negative, from (17), which shows that the semi-elasticity of unemployment rate with respect to the labor force is positive, and finally from (18), which shows that elasticity of the employment rate with respect to the labor force is positive.

The intuition for the proposition is simple. In-migration increases the number of available workers, but not the number of jobs, so it raises labor supply and not labor demand. Such increase in supply relative to demand leads to a decrease in tightness (figure 2).

To understand why tightness must fall after a wave of in-migration, let's think about what would happen if tightness did not respond. Then firms would want to employ the same number of workers as before, since the labor demand had not changed. But since tightness has not changed, jobseekers' job-finding rate has not changed. And since the pool of jobseekers increased after migrants joined the labor force, more jobseekers will end up with a job. (That is, labor supply is higher than labor demand at the current tightness.) Firms would respond to such excess of new hires by posting fewer vacancies, leading to a drop in tightness, until supply and demand are equalized.

The other results in the proposition directly follow from the drop in tightness. Lower tightness means lower job-finding rate, so in-migration reduces the job-finding rate of the local workers. A lower job-finding rate means a higher unemployment rate, so in-migration increases the unemployment rate faced by local workers and decreases their employment rate. The underlying reason is that after an influx of new workers into the labor force, there is the same number of jobs but more jobseekers, so it becomes harder to find a job. As a result, a larger fraction of workers remains unemployed, and a smaller fraction is employed. Of course, since the unemployment rate increases and the size of



A. Borjasian model in employment-wage diagram

B. Effect of in-migration in the Borjasian model

FIGURE 3. Parallel with the Borjasian model of the labor market

the labor force increases, the number of unemployed workers increases sharply after in-migration—some of the unemployed are local workers and some are migrant workers.

In the model, the unemployment rate of local workers goes up after a wave of in-migration because it becomes harder for local jobseekers to find jobs, as they compete with newly arrived workers. The job-separation rate of local workers is unaffected, so local workers do not lose their jobs at a higher rate. But, once a local worker loses her job, she will remain unemployed longer since the job-finding rate is lower. This mechanism is consistent with the evidence provided by Dustmann, Schoenberg, and Stuhler (2017). The mechanism also reconciles the evidence presented in section 2, that in-migration induces local unemployment, and the evidence presented by Winter-Ebmer and Zweimuller (1999), that local workers are not displaced by immigrants in the sense that local workers are not laid off at a higher rate to be replaced by immigrant workers.

Given the comparative statics obtained in proposition 1, it is unsurprising that local workers feel that immigrants steal their jobs. First, the job-finding rate for local jobseekers falls when immigrants arrive. So it becomes harder for any one jobseeker to find a job. They have fewer jobs available to them because the number of available jobs did not scale up with the increase in labor-force participants. Second, the employment rate of local decreases when immigrants arrive. So local workers might feel that immigrants steal their jobs: the fraction of local workers how have a job is indeed lower, and the fraction who remain unemployed is higher. And the reason is that immigrant workers are now employed in some of the available jobs, relegating local workers to unemployment.

The model developed here shares a similarity with the Borjasian model of immigration: both have a downward-sloping labor demand curve (figure 3). This means that the number of jobs available in the labor market is somewhat limited, which explains why newly arrived workers compete for jobs with local workers, who face reduced opportunities. The novelty is that the adjustment to migration does not happen through wages but through labor-market tightness (compare figure 2B to figure 3B). Tightness itself determines the local job-finding rate and unemployment rate. In fact, in this basic version of the model, wages do not respond to migration at all, so just as in the Cardian perspective, the arrival of migrants does not reduce the local wage, and thus does not affect local workers who are employed. Here in-migration only affects local workers who are unemployed.

4.3. Impact of in-migration when wages respond

In general, tightness and wages both respond to migration. This section extends the model so wages also respond to migration. To capture the effect of migration on wages, I assume that the real wage is not constant but is a function of the size of the labor force:

$$w = \omega \cdot H^{-\beta}, \tag{19}$$

where $\beta \geq 0 \in [0, \alpha)$ captures the flexibility of wages with respect to migration. If $\beta = 0$, wages do not respond to migration at all. If $\beta > 0$, wages fall when new workers enter the labor force, because of wage competition. Since β is the elasticity of real wages with respect to the labor force, it can be estimated empirically (Borjas 2003, 2017).

What is the impact of in-migration when wages respond to migration? We follow the same steps as in section 4.2 but allow for a wage response. Consider a small change in the size of the labor force generated by in-migration, $d\ln H$. In addition to affecting the labor supply directly, this small change generates a small change in tightness, $d\ln\theta$, and a small change in wages, $d\ln W$. Combined, these changes generate small changes in labor supply and demand:

$$d\ln L^s = \epsilon^s_\theta d\ln\theta + \epsilon^s_H d\ln H$$
$$d\ln L^d = \epsilon^d_\theta d\ln\theta + \epsilon^d_W d\ln W.$$

Since the supply-equals-demand condition must hold both before and after in-migration, $d\ln L^s = d\ln L^d$, so

$$\epsilon^s_\theta d\ln\theta + \epsilon^s_H d\ln H = \epsilon^d_\theta d\ln\theta + \epsilon^d_W d\ln W.$$

The small wage change is given by $d\ln W = \epsilon^W_H d\ln H$. Given the wage norm (19), the elasticity of wages with respect to labor force is $\epsilon^W_H = -\beta$. Thus, $d\ln W = -\beta d\ln H$, the elasticity of tightness with respect to labor force is given by

$$\epsilon^\theta_H = -\frac{\beta\epsilon^d_W + \epsilon^s_H}{\epsilon^s_\theta - \epsilon^d_\theta} = -\frac{1-\beta/\alpha}{\epsilon^s_\theta - \epsilon^d_\theta}, \tag{20}$$

where the second equality comes from the fact that $\epsilon_H^s = 1$ and $\epsilon_W^d = -1/\alpha$, which can themselves be obtained from (6) and (13). Then, the elasticity of the job-finding rate with respect to the labor force is given by

$$\epsilon_H^f = -(1-\eta)\frac{1-\beta/\alpha}{\epsilon_\theta^s - \epsilon_\theta^d}, \tag{21}$$

The semi-elasticity of the unemployment rate with respect to the labor force, which gives the percentage-point change in unemployment rate when the labor force changes by one percent, is

$$\frac{du}{d\ln H} = [1-u(\theta)]\cdot\frac{1-\beta/\alpha}{1-\epsilon_\theta^d/\epsilon_\theta^s}. \tag{22}$$

And the elasticity of the employment rate with respect to labor force is:

$$\epsilon_H^l = -\frac{1-\beta/\alpha}{1-\epsilon_\theta^d/\epsilon_\theta^s}. \tag{23}$$

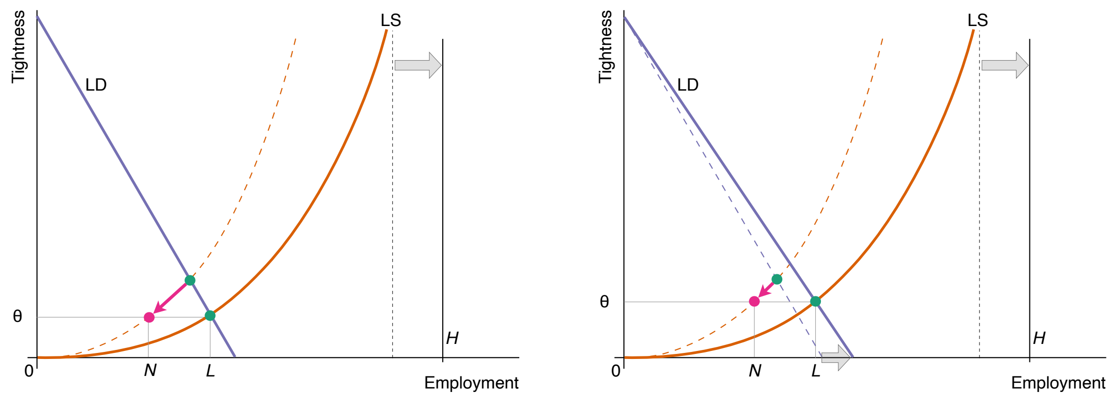
Collecting these results yields the following proposition:

PROPOSITION 2. *Even when wages fall after a wage of in-migration, in-migration leads to a decrease in labor-market tightness, which causes a decrease in the job-finding rate of local workers, an increase in their unemployment rate, and a decrease in their employment rate. However, all the effects are weaker than when wages do not respond to in-migration. Quantitatively, the effects are muted by a factor* $1-\beta/\alpha \in (0,1)$*, where* $\beta \in (0,\alpha)$ *is the positive elasticity of real wages with respect to the labor force and* $\alpha \in (0,1)$ *is the positive elasticity of the marginal product of labor with respect to employment.*

The proposition is obtained like proposition 1, but using equations (20), (21), (22), and (23). The main intuition for the results remains the same, except that here, tightness and wages both respond to migration. It is the combined drops in tightness and in wages that absorb the influx of migrants (figure 4), whereas in section 4.2 the influx of migrants was solely absorbed by a drop in tightness.

Here, both employed and unemployed local workers are hurt by in-migration. For unemployed workers, it is harder to find a job; for employed workers, labor income is reduced. However, the reduction in job-finding rate experienced by jobseekers is less severe than when wages do not respond. In that way, the drop in wages spreads the negative impact of in-migration across all workers—employed and unemployed.

Edo (2016) illustrates why different labor markets might see different wage response to immigration, and how tightness responds accordingly, just as predicted by the model. In France, certain contracts provide much stronger wage protection than others. As



A. Drop in tightness when wages do not fall B. Drop in tightness when wages fall

FIGURE 4. Joint response of tightness and wages to in-migration

The labor demand curve is given by (13). The labor supply is given by (6). In panel A, the real wage w does not respond to H: $\beta = 0$ in (19). In panel B, the real wage w falls when H increases: $\beta \in (0, \alpha)$ in (19).

predicted by the model, workers whose wages are protected see a significant increase in unemployment rate when immigrants enter the labor market: the arrival of 100 immigrants pushes 30–50 workers into unemployment (Edo 2016, p. 2). For workers whose wages are not protected, however, the impact of immigration is different: wages fall significantly but the unemployment rate is unaffected (Edo 2016, p. 3). Because most workers have contracts that protect their wages, in aggregate it is tightness and not wages that responds to immigration.

Borjas and Edo (2022) provide another example of markets in which the response of wages, and accordingly the response of tightness, varies. In France, they find that the labor market for female workers exhibited no wage response but strong tightness response. The labor market for male workers operated the other way around: no tightness response but sharp wage response.

4.4. Impact of in-migration in the DMP models

Standard matching models have constant marginal returns to labor instead of diminishing marginal returns ($\alpha = 0$). With constant returns to labor, the labor demand is degenerate: firm's optimal employment choice solely determines tightness. Setting $\alpha = 0$ in (13) gives

$$[1 + \tau(\theta)] \frac{a}{w} = 1, \tag{24}$$

which determines tightness in the model, independently from employment. This labor-demand relation holds irrespective of the wage-setting assumption. It holds for instance with rigid wages, as in Hall (2005b), or with the more traditional Nash bargaining, as in the textbook model (Pissarides 2000).

Here I analyze the DMP model in an employment-tightness diagram (figure 5B). It is more common to analyze the DMP model in an unemployment-vacancy diagram (figure 5A). However, the two presentations are equivalent. The labor demand curve in figure 5B and the job-creation curve in figure 5A both represent the tightness level defined by (24). The labor supply curve in figure 5B and the Beveridge curve in in figure 5A both represent the locus of points satisfying (6). Equation (6) links tightness θ to the employment level L. But since $\theta = v/u$ and $L = (1-u)H$, and since $f(\theta) = \omega\theta^{1-\eta}$, it is easy to rewrite it as a Beveridge curve linking the vacancy rate v to the unemployment rate u:

$$v(u) = \left(\frac{\lambda}{\omega} \cdot \frac{1-u}{u^{\eta}}\right)^{1/(1-\eta)}.$$

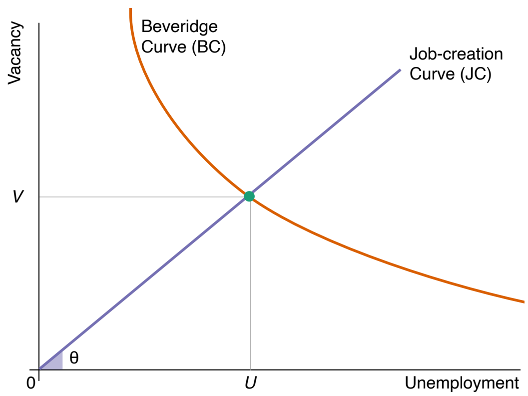
The Beveridge curve is decreasing and convex (Michaillat and Saez 2021, appendix A.1), as plotted in figure 5A.

There are two advantages to studying the DMP model in an employment-tightness diagram. First, we obtain a more interesting description of migration. In the unemployment-vacancy diagram, migration would not appear since it affects neither the job-creation curve nor the Beveridge curve. In the employment-tightness diagram, by contrast, a wave of in-migration shifts the labor supply curve (figure 5C). Second, in the employment-tightness diagram, the parallel between the DMP and Cardian models become clear (compare figure 5 to figure 6).

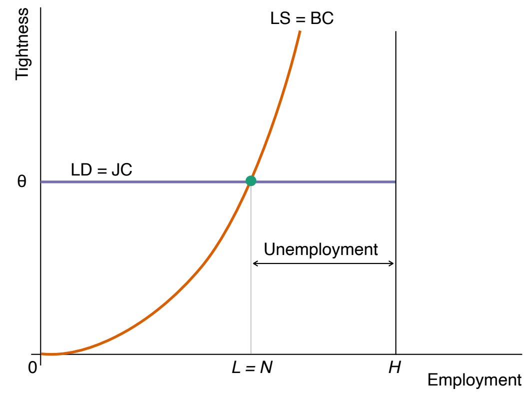
Let's turn to the effect of migration in the DMP model. The labor demand (24) does not involve labor force H, so labor-market tightness is the same irrespective of the amount of migration. This means that the employment rate is independent of labor force: migration has no effect on the unemployment rate. Figure 5C illustrates. An increase in the labor force from in-migration is absorbed entirely by firms, which post more vacancies and create more jobs. In fact, the vacancy rate is unaffected by migration, so the number of vacancies grows in proportion to the labor force. As a result, local workers are completely unaffected by migration.

If wages respond to in-migration, the DMP model even predicts that in-migration reduces the unemployment rate (figure 5D). In equation (24), the wage w drops with in-migration, so tightness goes up with in-migration. In the textbook DMP model, wages are determined by bargaining. A reason for the wage drop is that migrants have worse outside options than local workers and cannot command the same wages (Chassamboulli and Peri 2015; Albert 2021). In that case, average wages fall, boosting labor demand.

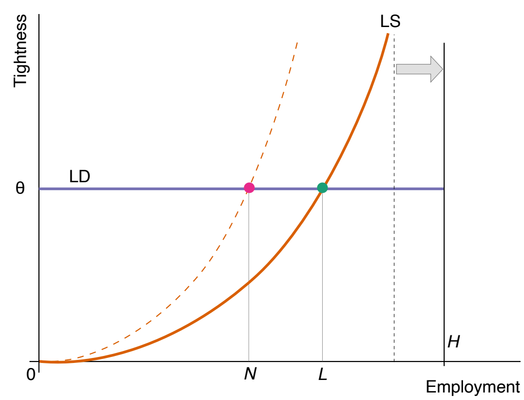
Just as in the DMP model presented in figure 5B, the Cardian model of the labor market has a horizontal labor demand curve (figure 6). The difference is that in the DMP model the demand curve is horizontal in an employment-tightness diagram, because the



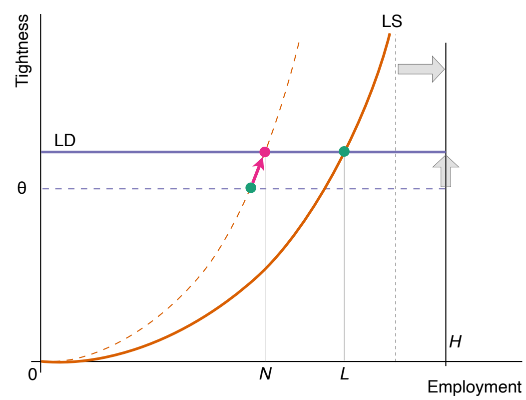
A. DMP model in an unemployment-vacancy diagram



B. DMP model in an employment-tightness diagram



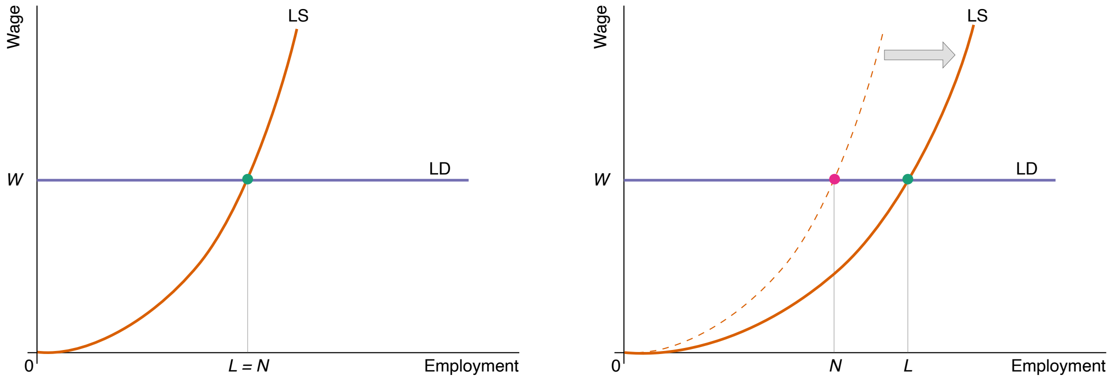
C. Effect of in-migration in DMP model if wages remain constant



D. Effect of in-migration in DMP model if wages fall

FIGURE 5. Impact of in-migration in a DMP model

The job-creation curve and labor demand curve represent the same locus of points They are given by (24). The Beveridge curve and labor supply curve represent the same locus of points. They are given by (6).



A. Cardian model in employment-wage diagram B. Effect of in-migration in the Cardian model

FIGURE 6. Parallel between the DMP model and Cardian model of the labor market

labor market is organized around a matching function, while in the Cardian model the demand curve is horizontal in an employment-wage diagram, because the labor market is competitive. The labor demand curve is horizontal in the Cardian model of immigration to capture the fact that immigration has no effect on local wages.

5. Impact of in-migration on firms

In-migration unambiguously hurts local workers in the short run. On the other hand, it unambiguously helps local firms:

PROPOSITION 3. *In-migration leads to an increase in employment, a reduction in the recruiter-producer ratio, and an increase in real profits. These results hold whether wages respond to migration or not.*

The beginning of the proposition follows from the facts that labor demand is decreasing with tightness, the recruiter-producer ratio is increasing with tightness, and tightness falls after an in-migration wave. This is true whether wages respond to in-migration or not (see propositions 1 and 2).

The impact of in-migration on real profits requires a little bit of algebra. Aggregate real profits are given by

$$\pi = aP^{1-\alpha} - [1 + \tau(\theta)]wP,$$

where the first term is firm's output and the second term is the real wage bill.

The first-order condition of the firm problem (12) links the real wage W to the number of producers P:

$$w = \frac{(1-\alpha)aP^{-\alpha}}{1+\tau(\theta)}.$$

Therefore the real wage bill is

$$[1+\tau(\theta)]wP = (1-\alpha)aP^{1-\alpha}.$$

Combining these results yields real profits as a function of the number of producers:

$$\pi = \alpha \cdot a \cdot P^{1-\alpha}. \tag{25}$$

This equation simply says that the economy's profit share π/y is α. Profits are therefore proportional to output.

After in-migration, employment L goes up, and tightness θ falls, so the recruiter-producer ratio $\tau(\theta)$ falls. Hence, the number of producers $P = L/[1+\tau(\theta)]$ goes up. Therefore, equation (25) shows that profits go up after a wave of in-migration. This result holds whether wages respond to migration or not.

The number of jobs in the economy increases after in-migration, as do firms' profits. Firm owners therefore always benefit from in-migration—unlike workers who always suffer from it. If workers own share of firms, of course, the impact of in-migration is murkier: in-migration reduces their labor income but raise their capital income. If workers own very little capital, then they are clearly negatively affected by in-migration.

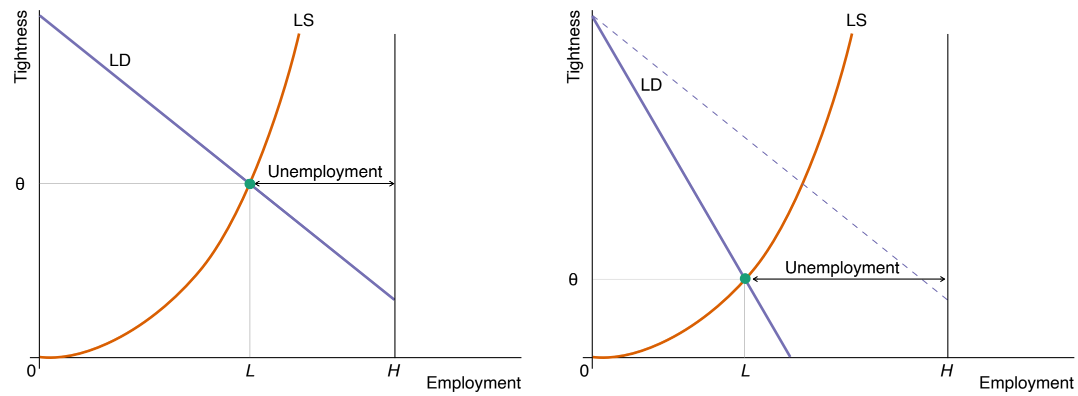
6. In-migration in good and bad times

Beyond the basic results from section 4, I now contrast the effects of in-migration on the labor market in good times—when tightness is high—and bad times—when tightness is low. This exercise helps better understand popular perceptions of immigration.

6.1. Modeling good and bad times

In the United States labor-market fluctuations are driven by labor-demand shocks, not labor-supply shocks (Michaillat and Saez 2015). I therefore model good and bad times as period with high and low labor demand. In this simple model labor demand is governed by the wage-to-productivity ratio, w/a (equation (13)). Good times are periods when the wage-to-productivity ratio is low so hiring workers is particularly profitable and the labor demand is elevated (figure 7A). Bad times are periods when the wage-to-productivity ratio is high so hiring workers is not very profitable and the labor demand is depressed (figure 7B).

What causes changes in the wage-to-productivity ratio, w/a? The typical cause of these fluctuations are fluctuations in productivity a under a fixed wage w. (Hall 2005b). Another possibility are fluctuations in productivity a under a partially rigid wage $w = \omega \cdot a^{\gamma}$, where $\gamma < 1$ measures the flexibility of real wages with respect to productivity (Blanchard and Gali



A. Good times: high productivity

B. Bad times: low productivity

FIGURE 7. Good and bad times in the labor market model

The labor supply is given by (6). A: The labor demand curve is given by (27) with a high a. B: The labor demand curve is given by (27) with a low a. This graph illustrates good and bad times in the model.

2010; Michaillat 2012, 2014; Landais, Michaillat, and Saez 2018a). Assuming an elasticity $\gamma < 1$ is in line with evidence found by Haefke, Sonntag, and van Rens (2013), and is sufficient to generate fluctuations in the wage-to-productivity ratio.[2]

In this section, I assume a wage norm that is as general as possible:

$$w = \omega \cdot a^{\gamma} \cdot H^{-\beta}, \tag{26}$$

where $\gamma \in [0, 1)$ governs the flexibility of real wages with respect to productivity and $\beta \in [0, \alpha)$ governs the flexibility of real wages with respect to the labor force. Then the wage-to-productivity ratio becomes

$$\frac{w}{a} = \omega \cdot a^{\gamma-1} \cdot H^{-\beta},$$

which is strictly decreasing in productivity and enters the labor demand as follows:

$$L^d(\theta, a) = \left\{ \frac{(1-\alpha)\, a^{1-\gamma} H^{\beta}}{[1+\tau(\theta)]^{1-\alpha}\, \omega} \right\}^{\frac{1}{\alpha}}. \tag{27}$$

The demand equation shows that labor demand is increasing in productivity a (since $\gamma < 1$). So good times are represented by a high labor productivity and bad times by a low labor productivity. I also allow real wages to decrease with in-migration ($\beta \geq 0$) but just as in proposition 2, that will not affect the qualitative results at all.

[2]In fact the elasticity of the wage with respect to productivity estimated by Haefke, Sonntag, and van Rens (2013) is low enough to generate realistic business cycles (Michaillat 2012, section 4.B).

In this basic model, all fluctuations are driven by productivity shocks. In reality, it is aggregate demand shocks and not technology shocks that drive fluctuations in labor demand (Michaillat and Saez 2015). Aggregate-demand shocks affect labor demand because they influence the utilization rate of workers, which would show in the productivity parameter a. So in a macroeconomic version of the model, aggregate demand shocks would materialize just like productivity shocks (Michaillat and Saez 2015, equation (9)). The analysis therefore carries over when aggregate-demand shocks are the source of labor-demand fluctuations.

6.2. Labor market in good and bad times

Figure 7 allows me to obtain a range of comparative statics describing the business cycle:

PROPOSITION 4. *Labor-market conditions deteriorate when productivity decreases: the labor-market tightness falls; the job-finding rate falls; the unemployment rate increases; the employment rate decreases. In these conditions, however, recruiting becomes easier: the vacancy-filling rate increases and the recruiter-producer ratio falls.*

Figure 7 shows that tightness drops when productivity decreases and labor-demand curve falls. All the other results follow since all the other quantities are functions of tightness.

The response of tightness to productivity could also be obtained by implicitly differentiating the equation $L^s(\theta, H) = L^d(\theta, a)$ with respect to a. Consider a small change in productivity, $d\ln a$. In addition to affecting the labor demand directly, this small change generates a small change in tightness, $d\ln\theta$. Combined, these changes generate small changes in labor supply and demand:

$$\begin{aligned} d\ln L^s &= \epsilon^s_\theta d\ln\theta \\ d\ln L^d &= \epsilon^d_\theta d\ln\theta + \epsilon^d_a d\ln a. \end{aligned}$$

Since the supply-equals-demand condition must hold both before and after the productivity shock, $d\ln L^s = d\ln L^d$, so

$$\epsilon^s_\theta d\ln\theta = \epsilon^d_\theta d\ln\theta + \epsilon^d_a d\ln a.$$

Given the expression (27), the elasticity of the labor demand with respect to productivity is $\epsilon^d_a = (1-\gamma)/\alpha$. Thus, the elasticity of tightness with respect to productivity is

$$\epsilon^\theta_a = \frac{1-\gamma}{\alpha\left(\epsilon^s_\theta - \epsilon^d_\theta\right)}.$$

From this, we find that the elasticity of the job-finding rate with respect to productivity is given by

$$\epsilon_a^f = \frac{(1-\eta)(1-\gamma)}{\alpha\left(\epsilon_\theta^s - \epsilon_\theta^d\right)}.$$

The semi-elasticity of the unemployment rate with respect to productivity, which gives the percentage-point change in unemployment rate when productivity changes by one percent, is

$$\frac{du}{d\ln a} = -\frac{1-\gamma}{\alpha} \cdot \frac{1-u}{1-\epsilon_\theta^d/\epsilon_\theta^s}.$$

And the elasticity of the employment rate with respect to productivity is:

$$\epsilon_a^l = \frac{1-\gamma}{\alpha - \alpha\left(\epsilon_\theta^d/\epsilon_\theta^s\right)}.$$

Equations (8) and (14) show that $\epsilon_\theta^s > 0$ while $\epsilon_\theta^d < 0$, so $\epsilon_\theta^s - \epsilon_\theta^d > 0$ and $1 - \epsilon_\theta^s/\epsilon_\theta^d > 0$. With wage rigidity, $1-\gamma > 0$, so $\epsilon_a^\theta > 0$, $\epsilon_a^l > 0$, and $du/d\ln a < 0$. In other words, when productivity drops, tightness and employment fall while unemployment rises.

Conversely, the elasticity of the vacancy-filling rate with respect to productivity is

$$\epsilon_a^q = -\frac{\eta(1-\gamma)}{\alpha\left(\epsilon_\theta^s - \epsilon_\theta^d\right)}.$$

The elasticity of the recruiter-producer ratio with respect to productivity is

$$\epsilon_a^\tau = \frac{\eta(1-\gamma)(1+\tau)}{\alpha\left(\epsilon_\theta^s - \epsilon_\theta^d\right)}.$$

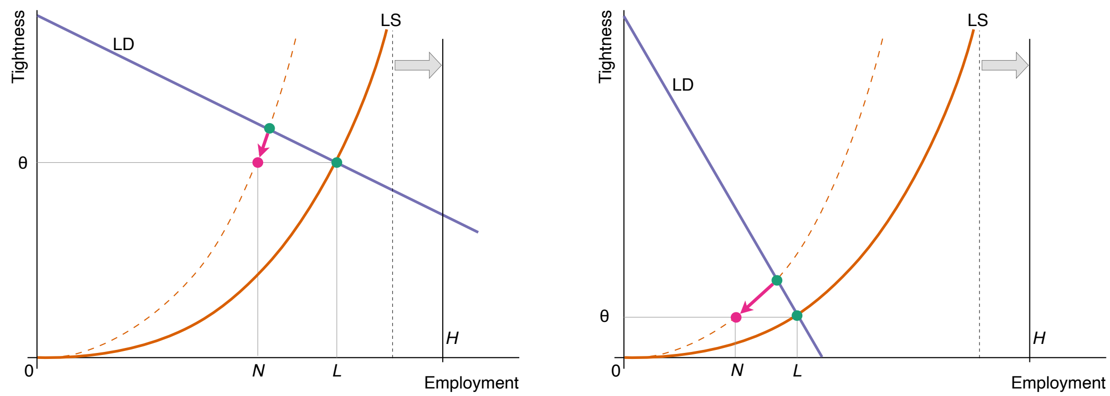
For the same reasons as above, $\epsilon_a^q < 0$ and $\epsilon_a^\tau > 0$. When productivity drops, the recruiter-producer ratio drops, so it becomes easier and cheaper for firms to recruit workers.

6.3. Impact of in-migration in good and bad times

I now examine how the amount of unemployment induced by migration varies over the business cycle. A wave of in-migration increases the unemployment rate, so it reduces the local employment rate. As such, the model produces the type of job stealing that local workers commonly complain about. In addition, such job stealing is worse in bad times:

PROPOSITION 5. *The elasticity of the employment rate with respect to the labor force is*

$$\epsilon_H^l(\theta) = -\frac{\alpha-\beta}{\alpha + (1-\alpha)\cdot\frac{\eta}{1-\eta}\cdot\frac{\tau(\theta)}{u(\theta)}}. \tag{28}$$



A. Small employment drop in good times

B. Larger employment drop in bad times

FIGURE 8. Effects of in-migration in good and bad times

The labor supply is given by (6). The labor demand curve is given by (27), with a high a in good times and a low a in bad times, and with $\beta = 0$ for simplicity. This graph illustrates why in-migration has a more negative effect on local workers in bad times than in good times.

The elasticity is negative, but its amplitude is decreasing with tightness. As a result, when labor-market conditions deteriorate, the elasticity becomes more negative. The elasticity tends to 0 *when tightness tends to* θ_τ*, it equals* $-(\alpha - \beta) < 0$ *when tightness is efficient, and it tends to* $-(\alpha - \beta)/\alpha < -(\alpha - \beta)$ *when tightness goes to* 0*. If wages do not respond to migration* ($\beta = 0$)*, the elasticity is* $-\alpha$ *when tightness is efficient and it falls to* -1 *when tightness goes to* 0.

PROOF. The elasticity (28) is obtained from (23), (8), and (14). Since $\tau(\theta)$ is increasing with θ while $u(\theta)$ is decreasing with θ, the amplitude of $\epsilon^l_H(\theta)$ is decreasing with tightness. When $\theta \to 0$, $\tau(\theta) \to 0$, so $\epsilon^l_H \to -(1-\beta/\alpha)$. When tightness is efficient, $\eta\tau(\theta) = (1-\eta)u(\theta)$, so $\epsilon^l_H \to -(\alpha - \beta)$. When $\theta \to \theta_\tau$, $\tau(\theta) \to \infty$, so $\epsilon^l_H \to 0$. □

The proposition shows that job stealing is more prevalent in bad times. Formally, the percentage reduction in employment rate due to a one-percent increase in the labor force is larger in bad times, when tightness is low (figure 8).

The worst-case scenario occurs when the labor market is the slackest. Then, if wages do not respond to migration, a one-percent increase in the labor force leads to a one-percent decrease in employment rate. The reason is that when the labor market is extremely slack, job rationing is the most stringent, so the number of jobs is almost fixed. With a fixed number of jobs, employment rate and labor force are related by $l \cdot H$ = constant so the elasticity of the employment rate with respect to the labor force is -1.

The model therefore predicts that job stealing is more prevalent in bad times. Because the number of jobs is more limited in bad times, in-migration will reduce the local employment rate more drastically in bad times. Local workers are therefore likely to be more opposed to in-migration in bad times, because it hurts their labor-market prospects more. In line with this prediction, Halla, Wagner, and Zweimuller (2017, table 5A) find that the shift of Austrian voters toward the far-right, anti-immigration FPO party in response to immigration is stronger when the local unemployment rate is higher. The effect of immigration on voting patterns is about twice as large in local labor markets with unemployment rates in the top quartile compared to those with unemployment rates in the bottom quartile.

Hunt (1992) finds that a 1 percentage point increase in the labor force caused by the arrival of repatriates from Algeria raised the unemployment rate of French workers by 0.2 percentage points. This corresponds to an elasticity of the employment rate with respect to the labor force of −0.2, since the employment rate is very close to 1 in France at the time.[3] Since might seems low, but the labor market was also extremely tight in France at the time. When repatriation started in 1962, the unemployment rate in France was only 1% (Hunt 1992, table 1). Proposition 5 predicts that the elasticity would be less negative when in good times. So the very tight labor market in France in the 1960s might explain why the repatriation only had muted effects on the local employment rate.

Edo and Ozguzel (2023) find that immigration has a negative effect on employment in the short run, but this negative effect is weaker in regions that are experiencing good economic conditions than in depressed regions. This is in line with the result from proposition 5.

7. Impact of in-migration on local welfare

In the short run in-migration hurts local workers—especially in bad times—but helps local firms. To understand the overall impact of in-migration, I now assess the effect of in-migration on local welfare—the welfare of local workers plus local firm owners.

7.1. Computing local welfare

In the model there is only one consumption good, produced by firms, which goes to local workers through local labor income, to immigrant workers through their labor income, and to firm owners through local profits. The goal is to assess how in-migration impacts local welfare, which is determined by the sum of local labor income and local profits.

We denote the local labor force as H, and the total labor force as μH, where $\mu \geq 1$ captures the growth of the labor force due to in-migration. Broadly, $\mu - 1 \geq 0$ is the percentage change in the labor force caused by in-migration.

Aggregate real profits are given by $\pi = y(P) - [1 + \tau(\theta)]wP$. Output can be rewritten as a function of the marginal product of labor: $y(P) = y'(P)P/(1-\alpha)$. Moreover, on the

[3]The exact relation is $\epsilon^l_H = d\ln l/d\ln H = d\ln 1 - u/d\ln H = -[du/d\ln H]/(1-u)$. But $1 - u \approx 1$ in France at the time (Hunt 1992, table 1), so $\epsilon^l_H \approx -du/d\ln H$.

labor demand, the marginal product of labor is always related to the wage and recruiter-producer ratio: $y'(P) = [1+\tau(\theta)]w$. Combining these results I express real profits as a function of the wage bill wL:

$$\pi(\theta) = \left[\frac{1}{1-\alpha} - 1\right][1+\tau(\theta)]wP = \frac{\alpha}{1-\alpha}wL. \tag{29}$$

From (29), I express local profits as a function of the scale of in-migration μ and the employment rate $l = 1-u$:

$$\pi = \frac{\alpha}{1-\alpha} wl\mu H.$$

The local labor income is just the real wage times local employment:

$$wlH.$$

Here for simplicity, we leave out distributional considerations from social welfare, so local welfare is completely determined by local income. Distributional considerations can be excluded by assuming that workers and firm owners have the same linear utility function. They can also be excluded by assuming that workers have access to firm profits, so everyone consumes the same. Workers have access to profits if workers own all firms and therefore receive their profits, or if profits are fully taxed and redistributed to workers. In any case, adding both types of income gives local welfare:

$$\mathcal{W} = wHl\left[\frac{\alpha}{1-\alpha}\mu + 1\right] = \frac{H}{1-\alpha}\left[\alpha\mu + 1 - \alpha\right] wl. \tag{30}$$

7.2. Elasticity of welfare with respect to in-migration

From expression (30), I compute the elasticity of local welfare with respect to in-migration, allowing not only employment but also wages to respond to migration:

$$\epsilon_{\mu}^{\mathcal{W}} = \frac{d\ln(\mathcal{W})}{d\ln(\mu)} = \frac{d\ln(w)}{d\ln(\mu)} + \frac{d\ln(l)}{d\ln(\mu)} + \frac{\alpha\mu}{\alpha\mu + 1 - \alpha}$$

Combining this expression with the elasticity (23) of employment with respect to the labor force, and the elasticity $d\ln w / d\ln\mu = -\beta$ assumed in (26), I get

$$\epsilon_{\mu}^{\mathcal{W}} = \frac{d\ln(\mathcal{W})}{d\ln(\mu)} = \frac{\alpha\mu}{\alpha\mu + 1 - \alpha} - \beta - \frac{1-\beta/\alpha}{1-\epsilon_{\theta}^{d}/\epsilon_{\theta}^{s}}. \tag{31}$$

7.3. Effect of infinitesimal in-migration on welfare

As first step, I assess whether any in-migration might ever improve welfare. To do that, I determine whether the elasticity $\epsilon_{\mu}^{\mathcal{W}}$ might ever be positive at $\mu = 1$. (Recall that μ

goes from $\mu = 1$ to $\mu > 1$ when in-migration starts.) That is, I compute the effect of an infinitesimal wave of in-migration on welfare.

Setting $\mu = 1$ in (31) and using (14) and (8), I find:

$$\epsilon_{\mu}^{\mathcal{W}} = (\alpha - \beta)\left[1 - \frac{1}{\alpha + (1-\alpha)\frac{\eta}{1-\eta}\frac{\tau(\theta)}{u(\theta)}}\right]. \tag{32}$$

When $\theta \to \theta_\tau$, $\tau(\theta) \to \infty$, so $\epsilon_{\mu}^{\mathcal{W}} \to \alpha - \beta > 0$. Thus, when the labor market is at its tightest (at which point all workers are recruiters), then in-migration is desirable.

When $\theta \to 0$, $\tau(\theta) \to 0$, so $\epsilon_{\mu}^{\mathcal{W}} \to (\alpha-\beta)(1-1/\alpha) < 0$. Hence, when the labor market is at its slackest (at which point all workers are unemployed), then in-migration is undesirable.

Given that τ/u is strictly increasing in $\theta \in (0, \theta_\tau)$, $\epsilon_{\mu}^{\mathcal{W}}$ is continuous and strictly increasing in θ, and there exists a unique $\theta_m \in (0, \theta_\tau)$ at which $\epsilon_{\mu}^{\mathcal{W}} = 0$, and in-migration improves welfare at any $\theta > \theta_m$ while in-migration reduces welfare at any $\theta < \theta_m$.

Solving for $\epsilon_{\mu}^{\mathcal{W}}(\theta) = 0$ with (32), we obtain

$$\frac{\eta}{1-\eta} \cdot \frac{\tau(\theta)}{u(\theta)} = 1. \tag{33}$$

But this condition is just the efficiency condition in the model (Michaillat and Saez 2019, lemma 1). The tightness θ_m is just the tightness that maximizes the number of producers and consumption for a given labor force—the efficient tightness θ^*. It is easy to see why. Consumption is determined by the number of producers,

$$P = \frac{L}{1+\tau(\theta)} = \frac{1-u(\theta)}{1+\tau(\theta)} H.$$

Maximizing the number of producers is the same as maximizing the share of labor that is productive,

$$\frac{1-u(\theta)}{1+\tau(\theta)}.$$

The elasticity of $1-u(\theta)$ with respect to tightness is $(1-\eta)u(\theta)$ (equation (9)). The elasticity of $1+\tau(\theta)$ with respect to tightness is $\eta\tau(\theta)$ (equation (11)). The number of producers is maximized for a given labor force when its elasticity with respect to tightness is 0, or

$$\eta\tau(\theta) = (1-\eta)u(\theta).$$

To highlight the parameters that determine the efficient tightness, I can re-express (33) as in Michaillat and Saez (2022, equation (29)):

$$1 = \frac{\eta}{1-\eta} \cdot \frac{\lambda\kappa}{q(\theta) - \lambda\kappa} \cdot \frac{\lambda + f(\theta)}{\lambda},$$

which, after reshuffling terms, gives

$$(1-\eta)\, q(\theta) = \lambda\kappa + \eta\kappa f(\theta).$$

Dividing both sides by $(1-\eta)q(\theta)$ and noting that $f(\theta)/q(\theta) = \theta$, I get

$$1 = \frac{\kappa}{1-\eta}\left[\frac{\lambda}{q(\theta)} + \eta\theta\right]. \tag{34}$$

This is just the efficiency condition in a standard DMP matching model in which the interest rate is 0 and the social value of unemployment is 0 (Michaillat and Saez 2021, equation (16)). Such efficiency condition is obtained by combining the job-creation curve, given in Pissarides (2000, equation (1.24)), with the Hosios (1990) condition.

The following proposition summarizes the results:

PROPOSITION 6. *In any labor market that is inefficiently slack, allowing in-migration reduces local welfare. In any labor market that is inefficiently tight, allowing in-migration improves local welfare. When the labor market is efficient, in-migration has no first-order effect on local welfare. These results hold whether wages respond to migration or not.*

When the labor market is inefficiently slack, a further decrease in tightness—keeping labor force constant—reduces welfare. From the perspective of local workers, a drop in tightness caused by in-migration is equivalent to a drop in tightness keeping labor force constant. The welfare generated by the labor-force increase, keeping tightness constant, goes to migrants and does not count toward local welfare. Hence, in-migration reduces local welfare when the labor market is inefficiently slack by further reducing tightness. Conversely, in-migration improves local welfare when the labor market is inefficiently tight by bringing tightness toward efficiency.

The result that immigration improves welfare when the labor market is excessively tight explains why governments have historically relied on immigration to address labor shortages in their economies. Halla, Wagner, and Zweimuller (2017, section 5.1) provide an example of such policy. In the postwar boom of the 1950s and 1960s, growing labor shortages were hindering the Austrian economy. To alleviate those shortages, the Austrian government enacted policies designed to attract foreign workers from southern Europe. More immigrant workers were allowed in regions of Austria where unemployment was particularly low, as proposition 6 would recommend.

7.4. Optimal migration over the business cycle

Proposition 6 shows that in-migration improves welfare when the labor market is too tight. I now turn to the next question: what is the optimal amount of in-migration when the labor market is initially too tight? The question boils down to finding the migration factor μ^* such that the elasticity $\epsilon_\mu^{\mathcal{W}} = 0$. At that migration factor, local welfare is maximized so migration is optimal.

Using (31), the optimality condition $\epsilon_\mu^{\mathcal{W}} = 0$ becomes

$$\frac{\alpha\mu}{\alpha\mu + 1 - \alpha} - \beta = \frac{\alpha - \beta}{\alpha - \alpha\epsilon_\theta^d / \epsilon_\theta^s}.$$

Using the expressions (8) and (14) for the elasticities of demand and supply with respect to tightness, I rewrite the condition as

$$\frac{\alpha\mu}{\alpha\mu + 1 - \alpha} - \beta = \frac{\alpha - \beta}{\alpha + (1 - \alpha)\frac{\eta}{1-\eta} \cdot \frac{\tau(\theta)}{u(\theta)}}. \tag{35}$$

Since tightness is itself a function of the migration factor μ, the optimal in-migration is the solution to a fixed-point problem. The optimal amount of in-migration $\hat{\mu} > 1$ solves the fixed-point equation (35). The left-hand side of the equation is an increasing function of μ. At $\mu = 1$, the left-hand side is $\alpha - \beta$, so at optimum in-migration $\hat{\mu} > 1$, the left-hand side is strictly greater than $\alpha - \beta$. The implication is that at optimum in-migration, the right-hand side is also strictly greater than $\alpha - \beta$. This requires the denominator of the right-hand side to be less than 1, and accordingly

$$\frac{\eta}{1 - \eta} \cdot \frac{\tau(\theta)}{u(\theta)} < 1.$$

Hence, the labor-market tightness must be strictly less than the efficient tightness θ^*, which is defined by (33). The proposition below follows:

PROPOSITION 7. *At optimum in-migration, the labor market is inefficiently slack. Therefore, in-migration improves welfare whenever the labor market is inefficiently tight, and the optimal amount of in-migration brings the labor market to an inefficiently slack situation.*

Equation (35) defines the optimum in-migration only implicitly, but it nevertheless offers interesting insights. The most important one is that if migration is the only tool available to policymakers, and if policymakers aim to maximize local welfare, then the labor market should always be inefficiently slack. Otherwise migration is suboptimal: more in-migration would improve welfare.

What is the intuition for the result that optimal migration brings the labor market to a slack situation? At the efficient tightness, a drop in tightness reduces labor income, but this reduction is entirely offset by an increase in local profits, so local welfare (the sum of labor income and profits) is unaffected. As in-migration increases, the share of labor income going to local workers shrinks, while all profits continue to go to local firm owners. So as in-migration increases, the profit motive plays an increasingly large role in welfare. This means that at the efficient tightness θ^*, if in-migration is already positive, a decrease in tightness raises local profits more than it reduces labor income—which means that a drop in tightness raises welfare. Accordingly, it is optimal to allow some more in-migration to reduce tightness further, into the slack territory: $\hat{\theta} < \theta^*$.

7.5. Feasibility of a cyclical immigration policy

Given the documented effects of migration on unemployment, a cyclical migration policy would be desirable. Such cyclical immigration policy should not be difficult to implement. In fact, in 2008 France enacted a policy that makes it easier to hire immigrant workers for firms facing a high labor-market tightness (Signorelli 2024). The policy was targeted to narrow skills, but it is conceivable that a similar policy could be implemented based on the national labor-market tightness.

In the United States, such cyclical policy could be implemented very much like unemployment insurance. The duration of unemployment insurance is automatically extended when the unemployment rate in a given state reaches specific thresholds (Marinescu 2017). Typically, unemployment benefits last for 26 weeks. When the state unemployment rate reaches 6.5%, the duration of benefits in the state is automatically extended by 13 weeks, to reach 39 weeks. And when the state unemployment rate further increases to 8%, to the duration of benefits in the state is automatically extended by 20 weeks, to reach 46 weeks.

A system similar to the unemployment insurance system could be implemented for immigration policies. The number of immigrants authorized in the country or in specific states, or the number of specific visas, could depend on the national unemployment rate or the unemployment rate in specific states. More immigrants would be allowed to enter when the labor market is inefficiently tight. This would alleviate recruiting difficulties for firms and improve social welfare. When the labor market is inefficiently slack, as it was for instance in the aftermath of the 2008 financial crisis, immigration could be curbed, which would protect local workers who are already struggling to find jobs. Such policy would again improve welfare.

8. Political support and opposition to immigration

The previous sections looked at the positive and normative implications of the migration model. This section turns to the political implications of the model. The model predicts the impact of migration in the short run on two constituencies— workers and firm owners—as well as the overall impact of migration on local welfare. From this, it is easy to infer the political support that immigration might receive from different groups under different circumstances.

8.1. Opposition to immigration from pro-labor parties

Let's focus further on pro-labor parties, that design their political programs solely to improve the welfare of workers. Since immigration always hurts the welfare of local workers, such parties are expected to always oppose immigration.

Moreover, since the elasticity of the employment rate with respect to the labor force is more negative in bad times, the model suggests that opposition to immigration from pro-labor parties, and accusations of job stealing, are louder in bad times.

For the same reasons, labor unions should also be opposed to immigration, since immigration reduces labor income. Indeed, we know that the American Federation of Labor was consistently pushing for restrictions on immigration at the end of the nineteenth century and onset of the twentieth century (Foner 1964). After World War 2, German unions also opposed the entry of foreign workers by arguing that they competed for jobs with native workers (Alesina and Tabellini 2024, p. 24).

8.2. Support for immigration from pro-business parties

Let's now turn to pro-business parties. These political parties design their political programs to improve the welfare of business and firm owners. Since immigration always improves the profits of firms, such parties are expected to favor immigration.

Pro-business parties typically belong to what Gethin, Martinez-Toledano, and Piketty (2022) call the "merchant right." These parties, such as the Republican Party, now often have anti-immigration views and promote anti-immigration policies. This is inconsistent with the model's prediction.

But Gethin, Martinez-Toledano, and Piketty (2022) offer a possible reconciliation. While high-income and high-education voters typically supported the merchant right, the last decades have witnessed a drastic shift. Low-education voters have now joined the high-income voters to support these right-wing parties. Voters with low education, however, face much higher unemployment than voters with high education. For example, in the United States, the average unemployment rate is 2.7% for workers with a college degree, whereas it is 9.3% for workers who dropped out of high school (Cairo and Cajner 2018, table 6). The reason is that jobs are much less stable for workers with low education, so they cycle much more often through unemployment, and therefore spend much more time looking for jobs. This means that these workers are much more exposed to job competition from immigrants than highly educated workers. This would be especially true if immigrants are less educated than the average local worker. In this context, the merchant-right parties may have taken an anti-immigration stance to cater to their new constituency of less educated voters (at the expense of their business-minded voters).

9. Reconciling the Cardian and Borjasian perspectives on immigration

The section explains how the model can bridge the gap between the two strands of the immigration literature: the Cardian view and the Borjasian view.

9.1. The two branches of the immigration literature

The immigration literature is sharply divided. A first branch of the literature argues that the labor demand is downward-sloping so the number of jobs available in the labor market is somewhat limited (Borjas 2003). Under this perspective, the arrival of immigrants reduces the opportunities available to local workers. A second branch of the literature argues that the arrival of immigrants does not reduce the wage of local workers (Card 1990). Under this perspective, the arrival of immigrants does not affect local workers who are employed.

Because this model is based on the matching framework, it is more flexible than the neoclassical model, and it allows us to reconcile the Cardian and Borjasian perspectives on immigration. In a matching model, both tightness and wage may adjust to equilibrate the market—not just the wage, as in a neoclassical model (Michaillat and Saez 2015).

First, the labor demand curve is downward sloping in the model, just as in the Borjasian perspective (figure 1A). This means that the number of jobs available in the labor market is somewhat limited, and will explain why immigrants take jobs away from local workers.

The novelty is that the adjustment to immigration does not happen only through wages but also through labor-market tightness, which itself determines workers' job-finding rate and the unemployment rate (figure 4B). In fact, in the basic version of the model, wages do not respond to immigration, so just as in the Cardian perspective, the arrival of immigrants does not reduce the wage of local workers, and thus does not affect locals who are employed (figure 4A).

9.2. A general theory of migration

In fact, the model offers a general theory of migration, which captures the effects of migration not only on local wages but also on the local unemployment rate. The model can of course describe the effects typically described with a neoclassical model of the labor market; in addition, it can describe effects that cannot be described in the neoclassical framework.

For instance, with a linear production function, the labor demand is horizontal. If the wage is also fixed, then tightness is unaffected by migration. In this purely Cardian case, the arrival of new workers in a labor market would affect neither local wages nor the local unemployment (figure 9A).

With a concave production function, the labor demand becomes downward sloping. Then, if wages drop enough when immigrants arrive, the model can produce a purely

Borjasian scenario, whereby local wages drop with immigration, but the unemployment rate is unaffected (figure 9B). In that case, just like in the Cardian and Borjasian traditions, all adjustment to immigration occurs through wages. There is no adjustment of tightness or unemployment rate.

In the neoclassical model, the Cardian and Borjasian views are incompatible, because the Borjasian view requires a downward-sloping labor demand (figure 3) while the Cardian view requires a horizontal labor demand (figure 6). In the matching model, however, they are compatible. A wave of immigration might increase the unemployment rate of local workers without affecting their wages (figure 9C).

Because the model is quite flexible, it can be tailored appropriately as new evidence becomes available. It can also be tailored to specific labor markets that operate in specific ways. For instance, if immigration reduces wages in a certain labor market, then the wage mechanism can be calibrated so wages fall when the labor force increases, as in (19). The model then produces the most general response to immigration: a drop in local wages combined with an increase in the local unemployment rate (figure 9D).

9.3. Calibration of the model

In theory, the matching model can capture all possible effects of immigration on the labor market: drop in local wages or not, and rise in local unemployment rate or not, occurring together or separately. In practice, the model should therefore be calibrated based on the relevant evidence. The empirical response of wages to immigration can be captured through the elasticity β in the wage norm (19). The empirical response of tightness and the unemployment rate can be captured through the slope of the labor demand, itself determined by the parameter α in the productivity function (1).

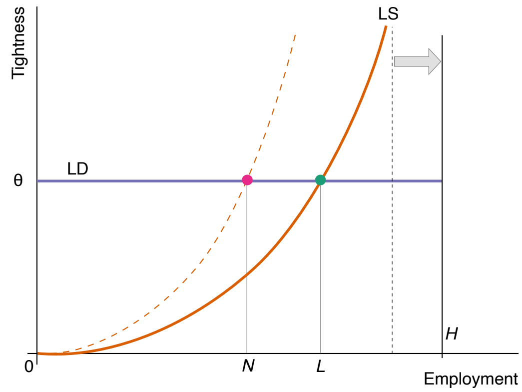
10. Conclusion

To conclude, this section applies the paper's model and findings to the current immigration debate and to other labor-supply shocks. It also connects the results on the effects of migration to results on the effects of unemployment insurance and public employment.

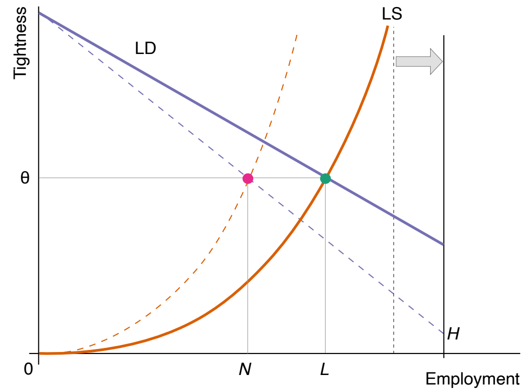
10.1. Application to the recovery of the coronavirus pandemic

In the United States the labor market has been incredibly tight in the recovery from the coronavirus pandemic (figure 10B). Labor-market tightness reached a value of 2 in 2022, a level it had not reached since the end of World War 2.

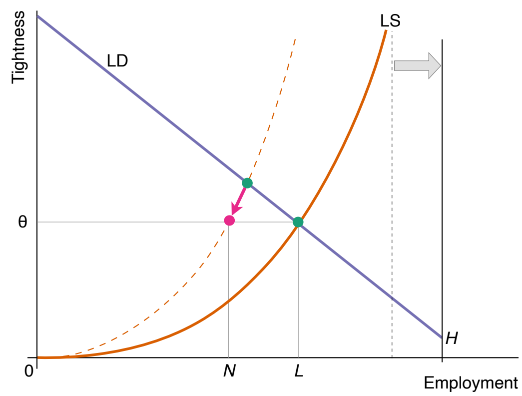
A natural response to such inefficiently tight labor market is to tighten monetary policy, which the Fed did in 2022Q2, one year after the labor market turned inefficiently tight (Board of Governors of the Federal Reserve System 2024). However, the labor market has



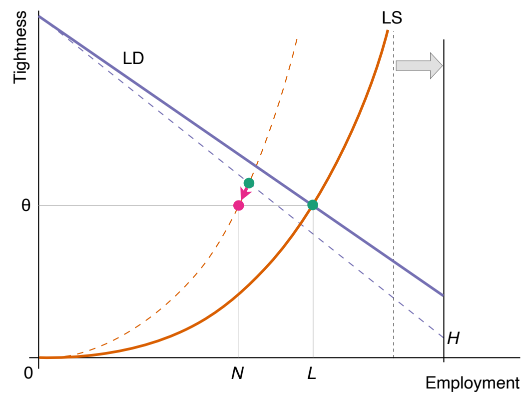
A. Purely Cardian scenario ($\alpha = 0$, $\beta = 0$): no response of wages or tightness



B. Purely Borjasian scenario ($\alpha > 0$, $\beta = \alpha$): drop in wages, no response of tightness



C. Cardo-Borjasian scenario ($\alpha > 0$, $\beta = 0$): no response of wages, drop in tightness



D. General scenario ($\alpha > 0$, $\beta \in (0, \alpha)$) : drop in wages, drop in tightness

FIGURE 9. Possible effects of immigration in a matching model

The labor supply is given by (6). In The labor demand curve is given by (13). In panel A, the production function is linear and the real wage does not respond to migration: $\alpha = 0$ in (1) and $\beta = 0$ in (19). In panel B the production function is concave and the real wage is flexible with respect to migration: $\alpha > 0$ in (1) and $\beta = \alpha$ in (19). In panel C, the production function is concave and the real wage does not respond to migration: $\alpha > 0$ in (1) and $\beta = 0$ in (19). In panel D, the production function is concave and the real wage is somewhat rigid with respect to migration: $\alpha > 0$ in (1) and $\beta \in (0, \alpha)$ in (19).

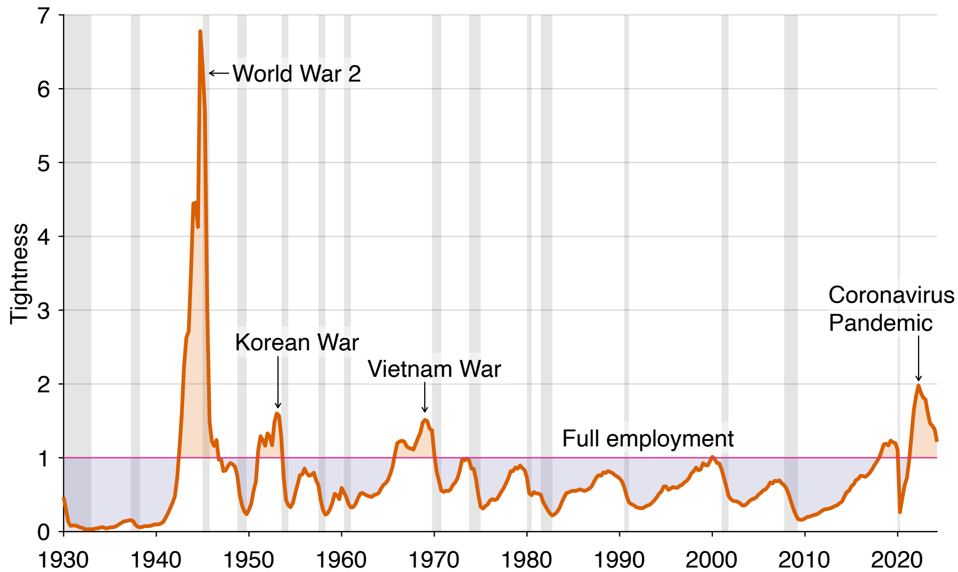
been slow to cool, maybe because monetary policy percolates only slowly to the labor market (Coibion 2012). In 2024Q2, the labor market is still inefficiently tight, albeit much closer to efficiency. Given such delays in deciding to tighten monetary policy, and then delays for monetary policy to reach the labor market, allowing for some more immigration between 2021Q2 and 2024Q2 would have rapidly cooled the labor market and improved the welfare of US workers.

10.2. Application to other labor-supply shocks

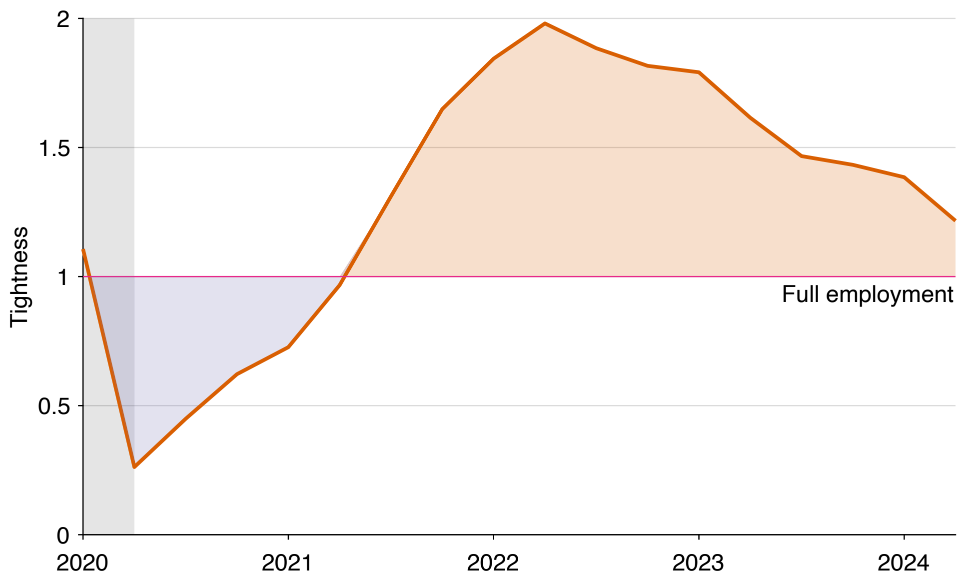
This paper uses the model to study one specific type of labor-supply shock: labor migration that triggers an increase in the size of the labor force. But there is nothing special about migration in the model. It is just a sudden change in the size of the labor force. Any other changes in the size of the labor force could be analyzed with the same model.

20th century wars. For instance, labor-market tightness was particularly elevated during World War 2, the Korean War, and the Vietnam War in the United States (figure 10A). This model explains why. Part of the reason, described in Michaillat (2014), is that the government spends and hires a lot during wars, which boosts labor demand and increases tightness. Another part of the reason, which is the focus of this paper, is that millions of potential labor force participants were sent abroad on military duty (US Department of Veteran Affairs 2023). As this paper shows, such drastic reduction in labor force will lead to elevated labor-market tightness and reduced unemployment rate among the workers who stayed in the United States.

Returning US soldiers in 1945. Conversely, the return of US soldiers from World War 2 put sharp downward pressure on labor-market tightness, making it much harder for non-veterans and especially women to find work. A lot of American women joined the labor force during the war to contribute to the war effort and wartime production. But when veterans returned, there were not enough jobs for everyone, so veterans and women competed for the same jobs. It became much harder for women to find jobs, especially as veterans were oftentimes given priority over women. Hence, the mechanism proposed here can explain why the female share of job placements dropped drastically when WWII veterans began to rejoin the civilian workforce (Rose 2018). One might think that, maybe, women left the labor force when veterans returned home but this is not what happened: "Reductions in female labor supply, on the other hand, appear to have been a smaller factor. Women continued to apply for work in large numbers and swelled the unemployment compensation rolls" (Rose 2018, p. 676). In that case, the incumbent workers (women) were not pushed into unemployment by a sudden wave of immigration but by the sudden return of veterans.



A. Labor-market tightness in the United States, 1930–2024



B. Labor-market tightness in the United States, 2020–2024

FIGURE 10. The US labor market has been inefficiently tight during major wars and in the recovery from the pandemic

Source: Figures 8 and 12 from Michaillat and Saez (2024).

Note: Labor-market tightness is the ratio of job vacancies to jobseekers. The gray areas are NBER-dated recessions. The labor market is at full employment or efficient when tightness equals 1. It is inefficiently slack when tightness is below 1. And it is inefficiently tight when tightness exceeds 1.

Coronavirus pandemic. Beside major wars, another example of a drastic drop in labor-force participation and subsequent elevated labor-market tightness in the United States is the recovery from the coronavirus pandemic. The pandemic triggered a sharp drop in labor-force participation, from 63.3% in February 2020 down to 60.1% in March 2020, which has not completely subsided in September 2024 (US Bureau of Labor Statistics 2024). At the same time, labor-market tightness reached levels not seen since the end of World War 2 (figure 10A). Part of the reason might be the elevated aggregate demand generated by the fiscal stimulus during the pandemic. But another part of the reason is that a reduction in labor force leads to higher labor-market tightness, as described in this paper.

Out-migration. The paper's results could also be applied to out-migration, such as the Irish emigration studied by Boyer, Hatton, and O'Rourke (1994), or the Mexican emigration studied by Hanson (2007). Of course, in the model, out-migration would be modeled as a reduction in labor force, which would have the opposite effect of in-migration. For instance, out-migration would raise labor-market tightness, which would increase the job-finding rate of remaining workers and reduce their unemployment rate.

10.3. Connection to results on unemployment insurance and public employment

Finally, I connect the effects of migration on the labor market to the effects of unemployment insurance and public employment. Migration, unemployment insurance, and public employment shift labor supply relative to labor demand (migration, unemployment insurance) or labor demand relative to labor supply (public employment), so their effects are connected.

Public employment. Equation (18) shows that the effect of in-migration on employment is determined by the ratio between the elasticities of labor supply and demand with respect to tightness, $\epsilon^d_\theta/\epsilon^s_\theta$. This ratio captures the relative slopes of supply and demand. This ratio also determines the size of the public-employment multiplier λ, as showed by Michaillat (2014, equation (8)):

$$\lambda = 1 - \frac{1}{1 - \epsilon^s_\theta/\epsilon^d_\theta} = \frac{1}{1 - \epsilon^d_\theta/\epsilon^s_\theta} = \epsilon^l_H. \tag{36}$$

Equation (36) shows that the public-employment multiplier is the same as the elasticity of local employment with respect to the labor force when wages do not respond to migration. It is for the same reasons that the public-employment multiplier is positive and larger in bad times and that the elasticity of local employment with respect to in-migration is negative and lower in bad times. Because the number of jobs in the private sectors is somewhat limited, creating public-sector jobs will increase employment. And because the number of jobs in the private sectors is somewhat limited, the arrival of migrants will take some jobs away from local workers and reduce local employment.

When the labor market is more depressed, the crowding out of private jobs by public jobs is less because private firms are not hurt much by public vacancies. This is because there are so many workers looking for jobs. At the same time, private firms will not benefit much from the presence of migrant jobseekers. Again, this is because there are already so many jobseekers available. So private firms will not create many jobs when migrants arrive in bad times; therefore, migrants end up taking jobs away from local workers.

Unemployment insurance. Because of job rationing, migration affects local workers. Via the same mechanism, the macro effect of unemployment insurance on unemployment is less than its micro effect (Landais, Michaillat, and Saez 2018b). When a jobseeker receives unemployment insurance that is less generous, she searches more intensely, which improves the chances that she finds a job. If all jobseekers do that, however, competition for jobs becomes fiercer. There is a rat race for jobs, and the return on each unit of search effort falls. As a result, the additional number of jobseekers who find jobs after the reduction in unemployment insurance is not as much as what the increased search effort would suggest. Similarly, if many migrants enter the labor market, competition for jobs becomes fiercer, tightness and the job-finding rate fall, so it is more difficult for local jobseekers to find jobs. This induces locals to feel that their jobs are taken away.

Furthermore, just like the arrival of migrants has larger effects on the employment rate of local workers in bad times, when tightness is low, the gap between macro and micro effects of unemployment insurance is larger in bad times. This is because jobs are scarcer in bad times, so the rat race is stronger among jobseekers.

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