Abstract

Wage outcomes for workers can very drastically across any number of characteristics. Some research focuses on skill differentials, education, local labor market conditions, and is frequently contradictory in attributing causal influences (See cite Borjas and Peri). The international nature of migration today necessitates broadening the theoretical framework to allow for differences in labor market characteristics that affect migration and unemployment at the country level. The search model employed in this paper fills the gap in existing work by tracking migrants between countries and separates out effects in both sending and receiving country as well as disaggregating workers into natives, prior migrants, new migrants, and returning migrants. Depending on the parameterization, allowing migration can both help and hurt the wages of all types of workers. At equilibrium in the baseline parameterization, meant to approximate conditions in the EU, the model predicts that migrants in their first employment match after migrating have wages that are lower than both natives and prior migrants. However, migrants in the second (or beyond) employment match post-migration do better than new migrants, and sometimes receive higher wages than their native counterparts. This pattern is corroborated in survey data taken from PIAAC surveys. The differing experiences of migrants across migration and employment histories can be predicted with the model, and from the model’s perspective, is determined largely, but not entirely, by costs to workers in the form of one time move costs as well as ongoing costs to living away from "home".
1 Introduction

The economic effects of migration and migrants are debated in the popular press and in academic literature. For example, people worry that increased migrant populations can lead to increased competition for jobs and lower wages. On the other hand, migrants often have complementary skills to native workers, and their presence increases welfare for all workers. In light of this debate, this paper seeks to provide a theoretical framework with which to evaluate the effects of migrant workers on wages of migrants and natives in both sending and receiving countries. These effects in existing literature can be difficult to assess because existing literature mostly utilizes natural experiments or examines only partial equilibrium—the specifics of particular events matter prevent a causal justification, and it is difficult to know what the overall effects might be in the long-run, for all types of workers.

First, there is evidence that migrants sometimes integrate and look like natives while at other times, they outperform their native counterparts in survey data from the PIAAC, as shown in Figures 1 - 6. At the same time, newly arrived migrants are frequently paid less than natives and more established fellow-migrants. Is it possible to model these stylized facts shown in the data, and in doing so, better understand what causes wage dispersion across migration status and the interconnectedness of migrants and natives in the labor market and their labor market outcomes? The theoretical search model in this paper shows that one key aspect in generating the wage dispersion observed in the data is the incorporation of move and flow costs to workers. These costs to workers lower the overall surplus from a given match, and workers then receive a lower wage when those costs are high. In particular, not surprisingly, costs faced every period have a larger impact on bargained wages than one-time costs to move. Additionally, differences in labor market characteristics across the two countries in the model have a smaller, but not insignificant, effect than the costs to workers on the wage outcomes. A relatively simple model of job search between two countries is able to generate the pattern of wage dispersion presented in the PIAAC survey data for all survey countries as well as a subset of only European countries. This is due to the fact that the model here incorporates general equilibrium effects and allows for evaluation of both natives and migrants.
I show in comparative statics exercises the predicted outcomes for migration and wages for changes in differences across countries in productivity, unemployment benefits, and other labor market characteristics. Following these exercises, an empirical parameterization of the model demonstrates the ability of the model to predict observed migration and wage conditions in Europe and other OECD countries. The canonical Diamond Mortensen Pissarides model (Mortensen and Pissarides (1994) and Mortensen (2011)), hereafter DMP, I modify in this paper is able to generate wage differentials across workers based solely on migration status. This helps to explain why workers who differ only by migration status, and not skill-level, are found to be differentially affected by migrants in empirical studies. I thus bridge the gap between the theoretical literature which, in effect, either does not account for migration or ignores migrants’ outcomes, with the empirical literature which is limited in scope to the particular area of study.

2 Existing Literature

Search models are useful to examine the existence of wage dispersion in economies, but have typically relied on either search costs or worker heterogeneity to generate different wages in equilibrium. For example, Gaumont et al. (2005) are able to generate no more than two wages in equilibrium in their models, while Albrecht and Vroman (2002) generates three equilibrium wages in the pooling equilibrium with heterogeneous workers. Existing work is typically limited to generating wages based solely on either worker or firm heterogeneity. A model of migration and wages without unemployment (Dustmann et al. (2012)) is able to generate the heterogenous effects on wages from migration cited in the empirical literature outlined below, but fails to capture the extensive margin of employment, and misses the job competition nature of migration. Baas et al. (2009) simulates a structural model of wage rigidities with migration in Europe, and finds no long-run effects on wages or unemployment overall and negative short-run effects on wages and unemployment overall due to heterogeneous effects on workers with different skill levels and migration status\(^1\).

\(^1\)In terms of wages, native workers are hurt in the short run, but gain in the long run from migration while non-native workers are hurt in both the short run and long run. Unemployment increases for both native and
Empirically, Borjas (1985), Card (1990), Borjas (2003), and Card et al. (2012) (to point out a small subset) captures part of an on-going discussion on the impact of migrants on wages in the receiving countries, but lack a unified theory explaining both disparate wage effects, and migration incentives.\footnote{For selected others, see Butcher and Card (1991), Gerfin et al. (2010), and Ottaviano and Peri (2012).} Empirical studies typically must differentiate across workers’ skills in order to estimate any effects of migrants on native workers. Migrants are found to have very little impact on native wages as in Card (1990) (short-run), Peri and Ysenov (2018), and Borjas (2013) (long-run); to pull down native wages in the directly competing native population as in Borjas (2003), Borjas (2005), Aydemir and Borjas (2011), and Borjas (2017); or to increase native wages as in Gerfin et al. (2010), Foged and Peri (2016), and Basso and Peri (2015). Ottaviano and Peri (2012) finds an important nuance to the wage effect on natives such that least skilled natives see wages fall while slightly higher skilled natives see wages rise following a migrant influx. New immigrants also have a negative effect on previous migrants’ wages. Further work finds a mix of effects depending on migration status: native workers are helped while existing immigrants are hurt by the arrival of new migrants\footnote{See Butcher and Card (1991), Manacorda et al. (2012), Docquier et al. (2014), Peri (2014), and Beerli and Peri (2017) for examples.}.

Using a similar methodology to the model employed here, Chassamboulli and Palivos (2013) and Chassamboulli and Palivos (2014), build a search and matching model to evaluate the effects on natives from migrant inflows in Greece and the US, respectively. They find that, native workers typically benefit from migration in terms of employment, but migration can have mixed effects on wages for native workers. Battisti et al. (2017) show that an influx of migrants in a multi-country study has welfare-improving effects on native workers. Finally, Ortega (2000) outlines a model structure similar to the model in this paper, but discusses only the effects on native workers of migration. None of these papers explicitly explores the migrants’ experience, and the effects on the country of origin of migrants is unknown. This paper similarly focuses on one labor market outcome, employment, but examines the effects on both migrants and natives in both sending and receiving countries.
3 Model

The modified DMP frictional labor search model in this paper builds off the foundation established in Sargent (2017). There are two countries. Workers from one country are permitted to search for work in either country, and move upon matching with an open vacancy\(^4\). Time is continuous, and all values represent total flow value for the given agent. Workers can be either employed or unemployed, and firms can have either filled or unfilled vacancies. Matches are one firm-one worker, and there is no on-the-job search. Firms post a vacancy based on the eventual firm hiring location, independent of the worker origin and unemployment location: They cannot target a particular worker type based on nationality or current location. All variables are denoted with a triplet \(\{i, j, k\} = H, F\) so that variable \(X\) is identified: \(X_{ij}^k\); where \(i\) denotes country of origin, \(j\) gives current location, and \(k\) gives the location of the job or benefit received.

Match characteristics are determined by the country in which the match occurs. Productivity, \(y_k\), costs to posting a vacancy, \(c_k\), worker bargaining power, \(\beta_k\), jobless benefits, \(b_k\), all depend only on the current location, not on workers’ migration history or status. All workers within a country, regardless of origin and previous unemployment location, have the same productivity or skill, \(y_k\), based upon location of employment, \(k\). Thus, the model can be viewed as applying to workers within skill/qualification groups, but does not account for skill heterogeneity among workers either within or between countries. Firms can be more/less productive, but this is based on their location, and not on any particular firm characteristics. Both countries share a single time discount factor for agents, \(r\), as well as job destruction rate, \(\delta\). Workers who will be moving face a move cost, \(\phi_{jk}\), and workers who live away from home face a flow cost, \(\tau_{ij}\), anytime they live abroad. Flow costs cover both explicit and implicit costs to living away from home: trips back to visit, discomfort with language and culture, and potential loss of both professional and social networks.

Each period, a constant fraction of matches, \(\delta\), are destroyed, and the total unemployment pool begins to search in either the home or foreign market. Next, matches occur with a

\(^4\)Workers from the other country are not permitted to move in order to illuminate the migration decision in the least convoluted way.
probability dependent on the number of vacancies offered by firms and the number of workers searching in that market. Newly matched workers move, if necessary. Finally production occurs and unemployment benefits for remaining unemployed workers are collected and wages paid.

The two labor markets are related through the unemployment pool and market tightness. The impact of each market on the other through the overlap of market tightness helps to explain the persistence in differences in unemployment rates observed in the data (See Table ??), and workers and firms do not take into account their own influence on the labor market when making individual search and job posting decisions.

Matching parameters can vary by worker origin, worker unemployed location, worker employed location, or remain uniform across countries. The probability of matching is independent of search effort, which is costless. The model presented here makes use of the Den Haan, Ramey, and Watson form of matching.\(^5\)

Matching brings together unemployed workers and open vacancies in the labor market, and places them randomly into a matched, filled job with an employed worker:

\[ M(u_k, v_k) = m(1, \frac{v_k}{u_k}) u_k = q_k(\theta_k) u_k. \] (1)

Market tightness, \( \theta = v/u \), is defined as the ratio of open vacancies to unemployed workers. The probability that an unemployed worker in country \( k \) matches with a firm in country \( k \) is given by \( q_k(\theta_k) \), and the probability that an unfilled vacancy in country \( k \) becomes filled is given by \( \theta_k q_k(\theta_k) \).

Matching is governed by \( Z_k \), the elasticity of matching in the country of the match:

\[ q_k(\theta_k) = (1 + \theta_k^{Z_k})^{-1/Z_k} \] (2)

with \( \partial q_i / \partial \theta_i < 0 \) and \( \partial q_i / \partial \theta_j < 0 \). Where, \( i \) indicates the workers’ origin country, \( j \) gives the

\(^5\)The Den Haan, Ramey, and Watson form of matching is chosen in order to utilize the probability limits built into the functional form without adding an additional parameter to the model as it requires only one rather than two as in more traditional Cobb-Douglas matching. The probability limits allow for model parameterization without concerns for generating matching probabilities greater than one, as is an issue with the more common Cobb-Douglas functional form.
workers’ unemployment location, and \( k \) indicates the job matching location.

Unemployed workers choose where to search, with the flow value of unemployment equal across searching in either country in equilibrium. This value is determined by workers’ country of origin, country of unemployment, and the net value of finding a job in either country:

\[
rU_{ij} = b_j - \tau_{ij} + \max_k \{ \theta_k q_k (\theta_k) (N^k_{ij} - U^k_{ij} - \phi_{jk}) \} 
\]

When \( i = j \) workers face no flow cost as they live in their country of origin, and \( \tau = 0 \); similarly, when workers match in their current unemployment location, \( j = k \), they face no flow cost. The trade off between job finding rates and the value of that job is seen in the second term. When the value of a job is high, more workers are likely to search in that market, thus offsetting overall value by lowering the job finding rate. These forces offset one another in equilibrium so that workers become indifferent between markets.

The flow value of employment to the worker, \( rN \), is given by the discounted value of the wage less the value of moving into unemployment in that country:

\[
rN^k_{ij} = w^k_{ij} + \delta (U_{ik} - N^k_{ij} - \tau_{ik}) 
\]

Upon loss of employment in country, \( k \), workers gain unemployment benefits, \( b_k \), and the value of unemployment, but lose the wage. These workers begin search in country \( k \), and only move if they are matched in the other country. Workers continue to face flow costs unless \( i = k \).

Firms choose whether to post a vacancy based on the cost to post as well as the probability weighted value of filling the vacancy without discriminating between workers of different locations or migration histories and status.
Thus the flow value of posting a vacancy, $rV$, is given by:

$$rV_i = -c_i + \frac{q^i(\theta^i)}{(u_{ii} + u_{ij})} [u_{ii}(J_{ii}^i - V_i) + u_{ij}(J_{ij}^i - V_i)]$$ (5)

in country $i$, and

$$rV_j = -c_j + \frac{q^j(\theta^j)}{(u_{ii} + u_{ij} + u_{jj})} [u_{ii}(J_{ii}^j - V_j) + u_{ij}(J_{ij}^j - V_j) + u_{jj}(J_{jj}^j - V_j)]$$ (6)

in country $j$.

The flow value of a filled vacancy, $rJ$, to the firm is equal to the discounted value of productivity less the cost to posting and maintaining the vacancy, the wage payment, and the probability weighted value of the match dissolving:

$$rJ_{ij}^k = y_k - w_{ij}^k - c_k + \delta(V_k - J_{ij}^k)$$ (7)

Wages are bargained based on production surplus for the type of match, $S$, bargaining power, $\beta$, in job location $k$. Bargaining partially captures the large power of labor unions in many countries, and allows differences in outside options to migration to be reflected in wages through unemployment values and the variation in outside options for workers of different migration status.6

Workers employed in country $k$ receive share $\beta_k$ of the match surplus, $S_{ij}^k$, independent of country of origin and migration status and history where $S_{ij}^k = J_{ij}^k + N_{ij}^k - U_{ij}^k - V_{ij}^k$. Thus wages increase whenever total surplus increases, or when $\beta$ increases (holding the size of the surplus constant):

$$w_{ij}^k = \beta_k S_{ij}^k$$ (8)

Firms in country $k$ receive share $(1 - \beta_k)$ of the match surplus: $(1 - \beta_k)S_{ij}^k$.

---

6While it is possible to use wage posting in this model, the international focus of the motivation means that job markets of different forms can be captured by assigning more or less bargaining power to the two parties rather than relying on the reservation wage cut-offs in wage posting models.
The effects on wages of migration are not well-defined. On one hand, increased competition for jobs might decrease the overall surplus by decreasing the probability of any given worker matching, thus lowering the worker’s side of the surplus, but this is off-set by the increased probability for firms. This trade-off does not occur linearly, and the surplus size can vary due to changes in firm surplus, worker surplus, or both.

3.1 Equilibrium

In order to explore the effect on wages of migration, I employ a stationary equilibrium where worker flows between countries off-set one another so that the net migration is zero. Gross migration will vary based on the relative probabilities of finding a job, values of jobs, and the structural differences between the labor markets. There is no ex-ante reason that gross migration will be zero. The stationary equilibrium is found by setting changes in unemployment and population allocations to zero, and can be characterized in terms of market tightness determined by the labor market bargaining for wages and the free-entry condition for firms, \( rV = 0 \). Wages are thus determined by labor supply and demand as functions of parameters and market tightness.

Market tightness is defined for each country as:

\[
\theta_F = \frac{v_F}{u_{FF} + u_{FH}} \\
\theta_H = \frac{v_H}{u_{FF} + u_{FH} + u_H}
\]

(9) \hspace{1cm} (10)

Since the market tightnesses depend on overlapping subsets of the unemployment pool, the two labor markets are connected in ways that individual firms and workers do not take into account when making their own decisions. In search and matching models without migration, population is normalized to 1 so that \( v \) and \( u \) are both the vacancy (unemployment) level and rate. Here, migration means that equilibrium populations are not necessarily 1, nor can both countries be normalized, and so \( v \) and \( u \) reflect the levels only. Results presenting the unemployment rate adjust the number of unemployed workers for the equilibrium populations
in each country. Figure 8 shows the flows of workers across employment status and migration patterns.

(Figure 8 about here.)

Labor supply for workers, \( w_{ij}^k = \beta_k(y_k - c_k) + (1 - \beta_k)rU_{ij} \), gives a positive relationship between wages and market tightness. A larger market tightness (more open vacancies per unemployed worker) increases the probability an unemployed worker meets a vacancy, but also implies a larger value of unemployed workers for firms, increasing the wage to be paid.

Labor demand, \( w_{ij}^k = y_k - c_k - \frac{c_k(r+\delta)}{\theta_k(\theta_k)} \), gives a negative relationship between wages and market tightness. A larger market tightness lowers the probability the open vacancy will match with a worker, so the wage required for the firm’s zero profit condition is lower when \( \theta \) is larger. For example, increases in productivity increase labor demand, holding other wages and market tightnesses constant.

A typical market labor supply and demand schedule is shown in Figure 7. In the stationary equilibrium, market tightness is determined by the firms’ and workers’ optimization, without accounting for particular migration actions. The effects of changes in parameters on equilibrium wages and market tightness work through shifts in the labor supply or demand decision, and are explored individually in the comparative statics below.

(Figure 7 about here.)

The stationary equilibrium is pinned down by the equality of job creation and destruction at the country-level, and requires two conditions. Equation 11 represents the flow out of employment for foreign workers into employment in the foreign country on the left hand side, and the flow out of foreign employment on the right hand side. The left hand side of Equation 11 is represented in Figure 8 by the summation of arrows 1 and 2. The right hand side is represented by arrow 3. Equation 12 equates the flow into and out of employment in the home country. The right hand side of Equation 12 is represented in Figure 8 by the summation of arrows 4, 5, and 6. The right hand side is represented by arrows 7 and 8. Together 11 and 12 establish the parity of creation and destruction in the world economy.
\[ \theta_F q^F(\theta_F)(u_{FF} + u_{FH}) = \delta n_F \]  
(11)

\[ \theta_H q^H(\theta_H)(u_{FF} + u_{FH} + u_F) = \delta n_H \]  
(12)

For population to be constant in equilibrium, the number of migrants into each country must equal the number of migrants out. Equation 13 is represented in the bottom panel of Figure 8 by the equality of arrow 2 and 4.\(^7\)

\[ \theta_F q^F(\theta_F)u_{FH} = \theta_H q^H(\theta_H)u_{FF} \]  
(13)

Table 1 establishes the different worker types based on nationality and migration history. Workers are categorized as foreign stayers, prior foreign migrants, foreign returning migrants, new migrants, or home workers. A foreign stayer is a foreign national who spent his/her previous unemployment spell in the foreign country, and is subsequently matched in the foreign country. A prior foreign migrant is a foreign native who migrated to the home country prior to his most recent unemployment spell, and subsequently matches in the home country. A returning migrant is a worker who previously migrated to the home country, lost employment, and subsequently matches in the foreign country. A home worker is always employed and unemployed in the home country due to the migration constraint on those workers. Employed workers are characterized as foreign workers, foreign migrant workers, or home workers. Foreign workers are foreign nationals employed in the foreign country. Foreign migrants are foreign nationals employed in the home country. Home workers are home nationals employed in the home country. Theoretically, each of these worker types will receive a different wage in equilibrium. In practice, some workers will receive the same wages depending on the parameterization of the model. Tracking workers and their employment status can be difficult given the overlap of the pool of workers available in each country. Workers employed in the home country must be divided into the two origin groups probabilistically.

\(^7\)This does not imply that populations must be equal.
Initial populations in each country are the number of staying workers who are employed and unemployed, plus the number who have moved. Workers who have moved can be either employed or unemployed abroad since migration can only happen once a match occurs. Initial populations are therefore given by:

\[
P^F_o = u_{FF} + u_{FH} + n_F + \frac{\theta_H q^H(\theta_H)(u_{FF} + u_{FH})}{\delta}
\]

\[
P^H_o = u_H + \frac{\theta_H q^H(\theta_H)u_{HH}}{\delta}
\]

### 3.2 Comparative Statics

Given the lack of analytical solution for market tightnesses and the indeterminate comparative statics above, a numerical parameterization of the model is performed. Parameters are chosen both for ease of comparability between the closed and open economy models as well as to match data and search and matching literature more generally. In the following exercises, the two countries are given symmetric baseline parameterizations and one parameter in the foreign country is changed to follow the change in stationary equilibrium resulting from that particular asymmetry. This does not describe the transition between the equilibria, but only gives a snapshot of the equilibrium once it has been attained.

The baseline parameterization is chosen for comparability across all specifications of the model. Population, \(P_o\), and productivity, \(y\), are set to one; matching elasticity, \(Z\), is 1.25 to match Petrosky-Nadeau and Zhang (2013); workers’ bargaining power, \(\beta\), and unemployment benefits, \(b\), are 0.5. Costs to firms to posting vacancies, \(c\), are set to the value in Albrecht and Vroman (2002) and Beine et al. (2013) at 0.3. The discount rate, \(\delta\), is set at 0.05 and the job destruction rate, \(r\), at 0.15 to match the literature. A summary can be found in Table 2.8

(Table 2 here.)

In the baseline parameterization, between 4.1 and 4.6 percent of the population migrates in equilibrium9. This is very close to the percentage of Europeans who have ever migrated for work according to Vandenbrande et al. (2006) which is 4 percent, on average. The range

---

8 Bounds and equilibrium values were found using a multiple complementarity solver in GAMS.

9 Migration rates range depending on whether the rate is as a percentage of the Home or Foreign population.
across countries varies from one percent to 14 percent. Wages for workers are highest for native Home workers and prior migrants followed by Foreign stayers while new migrants and returning migrants receive a much lower wage. The Home workers, Foreign stayers and prior migrants all receive a higher wage than the equivalently parameterized autarky model, but new migrants and returning migrants receive a lower wage. Even in this symmetric baseline parameterization, the wage heterogeneity based on migration status is evident. In particular, Home workers are not adversely affected in terms of lower wages from the increased population and competition for jobs resulting from in-migration. Foreign stayers also benefit from lowered competition for jobs when workers leave, while only new migrants and those who return are worse-off than they would have been from not migrating at all. In both countries, firms react to the ability of Foreign workers to migrate by opening up more vacancies per unemployed worker than when workers are unable to migrate. Detailed figures of the comparative statics described below can be found in the appendix.

Increasing productivity in the foreign country increases wages for all workers. The effect is most pronounced for the Foreign country in autarky and for return migrants and Foreign stayers with migration. Home workers and remaining migrants benefit from the increase in the Foreign country’s productivity, but by much less than other workers. Increasing unemployment benefits in the foreign country decreases wages for the Foreign country in autarky and for return migrants with migration. Unemployment benefits changes have little effect on workers in the Home country regardless of their nationality. Increasing job posting and maintenance costs to firms decreases wages for all workers. The effect is most pronounced for the Foreign country in autarky and Foreign stayers, return migrants, and Home workers with migration due to the decline in the match surplus from the increase in firms’ costs. Remaining and new migrants see little change, but the effect is still negative. Increasing bargaining power has little effect on wages in the migration model for realistic values of workers' bargaining power due to changes in firms’ job-posting behavior from the loss in their share of the surplus. In autarky, wages increase when workers’ bargaining power increases.

Increasing the costs workers face in their migration away from the Foreign country decreases wages for new and returning migrants since the match surplus for those workers falls
due to the costs they face. Prior migrants are treated like Home workers. Increasing return costs to workers has the same qualitative effects on wages, but the changes in wages are smaller than for leave costs since they face the costs at different points in their migration timeline. Workers who never migrate, regardless of country of origin, always have higher wages than the autarky case. Migrating workers are still better-off migrating, even with costs to move, for low levels of moving costs, but as costs increase, the opportunity of migration is outweighed by the costs to move away. Increasing return costs are never large enough to make migrant workers less well-off from the opportunity to migrate. Changes in flow costs to workers living away from their country of origin have interesting non-linear affects on wages for all workers in the migrating case. Changes in migration due to changes in leave costs are non-linear, and non-monotonic due to non-linearities in the probability of matching across national borders. Increases in return costs increase the migration rate, as more Foreign workers move to the Home country, and do not return. I now turn to an empirical approximation exercise to show how well the model is able to match data.

4 An Application of the Model

Returning to the data used in the introduction, I use a large scale survey from the OECD called the Program for the International Assessment of Adult Competencies (PIAAC). The PIAAC is "designed to assess adults in different countries over a broad range of abilities, from simple reading to complex problem solving skills." (Add website citation.). I utilize the questions covering country of birth, country of residence, years and age of migration (when applicable), and questions about earnings. Participants are chosen as a nationally representative sample of adults living in households in the given country.

Figures 1 - 6 show wage results for both the full survey extract as well as for the subset of European countries included in the survey. The survey data are unable to capture every moment from the model, but I can observe the wage outcomes for the analogous to natives, new migrants, and "old" migrants. Natives in sending countries are very infrequently ob-

\[10\] This makes intuitive sense: Leave costs are more influential in determining the migration decision whereas return costs are somehow lessened by benefits of the return to “home".
served, and I cannot distinguish between workers who stayed and those who are returning migrants. Despite this, the PIAAC provides a worthwhile exercise to show that the model is able to match with observed data and helps to explain why migrants might have different wage outcomes based on the costs they face, and the types of labor market conditions they leave behind.

In some cases, the PIAAC data show migrant workers relatively better-off than their native peers, while in other cases they are worse-off. From the model’s perspective, this distinction comes down to the relative characteristics of the sending and receiving labor markets, and the costs the workers face in moving and living away from "home". When workers leave a more generous labor market (in terms of unemployment benefits) they receive a relatively lower wage than when the markets are equally generous. Concurrently, they are also worse-off when costs to living away from home are high, and less affected when move costs are high. When they leave a less generous labor market, and when costs to living away from home are relatively low, workers are better off the longer they are in the new country, and new migrants are worse off (in terms of wages). For employment effects of these differences for workers see Sargent (2017).

In progress:

*This section will next parameterize the model to match labor market characteristics (productivity, unemployment benefits, job posting costs, workers’ bargaining power) to evaluate the model’s ability to predict the wages and migration from an example pair or pairs of countries. I can say, that in related work (Sargent (2017)), I find that the model is able to appropriately match migration and unemployment rates for the UK and Poland, and for a synthetic pair of “countries" made up of the weighted average of the top 5 sending and receiving countries in the EU. I do not yet have results for the model predicted wages for these countries’ parameterization.
5 Conclusion

Despite the media focus on the role of migration as a negative force for workers within the US and Europe, the model in this paper shows that migration is not necessarily bad for workers of any type. Additionally, migration does not always improve the wages of migrant workers compared to what they would receive in an autarkic world.

Wage effects for home workers are highly dependent on the mechanism for generating migration. Differences in labor market characteristics like productivity and unemployment benefits have varying effects on wages for native and migrant workers depending on both differences between countries, and which workers are observed. Migrant workers often suffer most from changes in costs to workers where wages do not act as compensation for increased costs faced from moving. Workers who never move on the other hand, are rarely negatively affected from increased migration. I thus provide a theoretical explanation for the mixed wage effects of migration on workers in Card (1991), Mancorda, Manning & Wadsworth (2012), and Peri et al (2013, 2014, 2016).
References


6 Figures & Tables (I apologize for the mess here)

Figure 1: Data Wages 1

Table 1: Worker Categorizations

<table>
<thead>
<tr>
<th>Category</th>
<th>Nationality</th>
<th>Most Recent</th>
<th>Next (Un)Employment</th>
<th>Migrating for Employment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Stayer</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>No</td>
</tr>
<tr>
<td>Prior Foreign Migrant</td>
<td>F</td>
<td>F</td>
<td>H</td>
<td>No</td>
</tr>
<tr>
<td>Foreign Returning Migrant</td>
<td>F</td>
<td>H</td>
<td>H</td>
<td>Yes</td>
</tr>
<tr>
<td>New Migrant</td>
<td>F</td>
<td>F</td>
<td>H</td>
<td>Yes</td>
</tr>
<tr>
<td>Home Worker</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>No</td>
</tr>
</tbody>
</table>
Table 2: Baseline Parameterization

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Closed</th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>( b )</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>( c )</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>( \beta )</td>
<td>0.26</td>
<td>0.26</td>
</tr>
<tr>
<td>( \phi_{FH} )</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>( \phi_{HF} )</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>( \tau )</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>( Z )</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>( r )</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>( \delta )</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>( P )</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Figure 3: Data Wages 3

Table 3: Baseline Outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Closed</th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta_F$</td>
<td>1.68</td>
<td>29.565</td>
</tr>
<tr>
<td>$\theta_H$</td>
<td>1.68</td>
<td>4.397</td>
</tr>
<tr>
<td>$m_1$</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>$m_2$</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>$m_3$</td>
<td>0.041</td>
<td></td>
</tr>
<tr>
<td>$w_{FFF}$</td>
<td>0.613</td>
<td>0.705</td>
</tr>
<tr>
<td>$w_{FFH}$</td>
<td>N/A</td>
<td>0.179</td>
</tr>
<tr>
<td>$w_{FFF}$</td>
<td>N/A</td>
<td>0.178</td>
</tr>
<tr>
<td>$w_{FHH}$</td>
<td>N/A</td>
<td>0.730</td>
</tr>
<tr>
<td>$w_{HHH}$</td>
<td>0.613</td>
<td>0.730</td>
</tr>
</tbody>
</table>
Figure 4: Europe Data Wages 1
Figure 5: Europe Data Wages 2
Figure 6: Europe Data Wages 3

Figure 7: Labor Supply and Demand
Figure 8: Worker Flows
7 Equilibrium Values

Labor Supply

\[ w_{11}^1 = \frac{(r+\delta)(b_1(1-\beta_1) + (y_1 - c_1)(1 + \theta_1 q_1)}{r + \delta + (r + \delta + \beta_1 - 1)\theta_1 q_1} \]
\[ w_{12}^1 = \frac{(r+\delta)(b_2(1-\beta_2) + (y_2 - c_2)(1 + \theta_2 q_2))}{r + \delta + (r + \delta + \beta_2 - 1)\theta_2 q_2} \]
\[ w_{22}^1 = \frac{(r+\delta)(b_1(1-\beta_1) + (y_1 - c_1)(1 + \theta_1 q_1))}{r + \delta + (r + \delta + \beta_2 - 1)\theta_2 q_2} \]

\[ w_{11}^2 = -((c_2 - y_2)\beta_2(r + \delta)(r + q_1(\beta_1 + \delta)\theta_1) + q_2((c_2 - y_2)\beta_2(r + \delta)^2 + q_1(-ry_2\beta_1\beta_2 - (y_2\beta_2 + \beta_1(-c_1 + y_1 + (c_1 - y_1 + y_2)\beta_2))\delta + c_2\beta_2(\delta\beta_1 + (1 + \delta))\theta_1)\theta_2 - b_2(-1 + \beta_2)(r + \delta)^2 + r\delta + q_1\beta_1\beta_2 + q_1\delta\theta_1 + q_2\delta^2)\)/((r + \delta)(r + \delta) + q_1(\beta_1 + \delta)\theta_1 + q_2(\beta_2 + \delta) + q_1(\beta_1 + \beta_2)\delta\theta_1)\theta_2) \]

\[ w_{12}^2 = (-c_1 - y_1)\beta_1(r + \delta)^2(r + q_1\beta_1) + q_2((-c_1 - y_1)\beta_1(r + \delta)(r + \delta) + q_1(\beta_1 + \beta_2) + (c_2 - y_2)(-1 + \beta_1)\beta_2 + y_1\beta_1(1 + \beta_2)\delta - c_1\beta_1(\delta\beta_2 + (r + \delta)\theta_1)\theta_2 - b_2(-1 + \beta_1)(r + \delta)^2 + r\delta + q_1(\beta_1 + \delta\theta_1))\)/((r + \delta)(r + \delta) + q_1(\beta_1 + \delta)\theta_1 + q_2(\beta_2 + \delta) + q_1(\beta_1 + \beta_2) + (\beta_1 + \beta_2)\delta))\]

Labor Demand

\[ w_{ij}^k = y_k - c_k - \frac{c_k(r+\delta)}{q_k(\theta_k)} \]

Unemployment, Employment, Vacancies

\[ u_{FF} = (P_o^F\ q_F\delta_\theta_F)/(q_F\theta_F + q_H\theta_H)(\delta + q_F\theta_F + q_H\theta_H) \]
\[ u_{FH} = (P_o^H\ q_H\theta_H)/(q_F\theta_F + q_H\theta_H)(\delta + q_F\theta_F + q_H\theta_H) \]
\[ u_{HH} = (P_H^\delta)/(\delta + q_H\theta_H) \]
\[ n_F = (P_o^F\ q_F\theta_F)/(\delta + q_F\theta_F + q_H\theta_H) \]
\[ n_H = (q_H\theta_H + P_o^F\delta + P_o^H\delta + P_o^H\ q_F\theta_F + (P_o^F + P_o^H)q_H\theta_H)/(\delta + q_H\theta_H)(\delta + q_F\theta_F + q_H\theta_H) \]
\[ v_F = (P_o^F\delta)/(\delta + q_F\theta_F + q_H\theta_H) \]
\[ v_H = (\delta\theta_H(P_o^F\delta + P_o^H\delta + P_o^H\ q_F\theta_F + (P_o^F + P_o^H)q_H\theta_H))/(\delta + q_H\theta_H)(\delta + q_F\theta_F + q_H\theta_H) \]
8 Appendix

Wages vs Foreign Productivity

Wages vs Foreign Unemployment Benefits
**Note: Wage figure is incorrect. 8/22**