Threatening to Offshore in a Search Model of the Labor Market*

David M. Arseneau[†]
Federal Reserve Board

Sylvain Leduc[‡]
Federal Reserve Bank of San Francisco

This Draft: August 24, 2011

Abstract

We develop a two-country labor search model in which a multinational firm engages in production sharing by hiring both domestic and foreign labor in order to produce. The key innovation is the sequential nature of wage bargaining which allows the multinational to use the possibility of shifting production overseas as part of its outside option in wage negotiations. Within this environment, we derive a model-based estimate of the aggregate effect of the threat of offshoring on global wages and labor market allocations. We find that while the threat of offshoring lowers wages by as much as 5 percent in the source country, this lower wage reduces the unemployment rate by roughly 3 percentage points. In constrast, the threat of offshoring raises wages in the recipient country by 6 percent leading to an increase in the unemployment rate of 2 percentage points. These effects occur despite the fact that the existing amount of offshoring is calibrated to be very small in our model economy..

Keywords: Unemployment, Wage bargaining, Multinational, Outside option

JEL Classification: F16, F23, F41

*We thank Federico Ravena, Rui Castro, Jeff Campbell and seminar participants at the Université de Montréal, the Federal Reserve Bank of Cleveland, the Board of Governors, and the 2011 Econometric Society Meetings. The views expressed here are solely those of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System, the Federal Reserve Bank of San Francisco, or of any other person associated with the Federal Reserve System.

[†]email address: david.m.arseneau@frb.gov.

[‡]email address: sylvain.leduc@sf.frb.org

1 Introduction

Does the threat of offshoring have an important effect on wages and unemployment? Surveys generally indicate that the public thinks so.[1] A 2004 AP poll reported that nearly 70 percent of Americans think offshoring hurts the US economy. Moreover, anecdotal evidence supports this perception. In September 2010, Sergio Marchionne, CEO of the Italian automaker Fiat, explicitly threatened to pull all production out of Italy and offshore it to lower-cost plants located in Serbia and Poland and obtained major concessions from the unions in labor negotiations. [2] Clearly, in an environment of increased globalization the ease with which multinational firms can move production plants offshore should strengthen their outside options in wage negotiations.

Yet, standard models of international macroeconomics are ill-suited to capture some important channels through which offshoring can impact labor market outcomes. For instance, labor markets in standard models are assumed to be perfectly competitive and wages are determined in spot markets. As a result, fear that a firm may relocate a job abroad doesn't enter into the wage determination process in those frameworks. Yet, as the Fiat example suggests, one channel through which offshoring may have an important impact on wages is via the associated loss in workers' bargaining power and the decline in economic rent that accrues to them. In a recent attempt to quantify this channel, Blinder (2009) estimates that offshorability in the services sector, that is, the characteristics of a job that makes it more likely to be offshored, may lower wages by up to 14 percent for the service jobs most at risk of being moved abroad.

In this paper, we complement this empirical work by analyzing the effect of the threat of offshoring on wages and unemployment in an open economy model in which the labor market is subject to search frictions à la Mortensen/Pissarides and in which firms and workers bargaining over wages. Wage bargaining is essential to modeling the threat of offshoring. In our framework, multinational firms need to post vacancies to fill job openings, but can do so either in the domestic or foreign markets. Since firms operate both domestic and foreign plants, offshoring in our model captures an intra-firm production-sharing activity whereby the parent company is able to shift production from the domestic country to its foreign affiliates.

Within this environment, we model the threat of offshoring by introducing a sequential matching problem where firms first post vacancies in the domestic market (the day market), but have the outside option of waiting to subsequently fill the vacancies with foreign workers (the night market). We show that as a result of these sequential labor markets, the ability of the firm to exercise the

[1] Not surprisingly, this sentiment has worked its way into the political arena. Mankiw and Swagel (2005) called offshoring the single most important, and least understood, economic issue for the 2004 US presidential campaign. Most recently, in late 2010, the Obama administration proposed legislation, the Creating American Jobs and End Offshoring Act, that would impose a direct tax on firms that are engaged in offshoring domestic jobs.

[2] "Fiat: Marchionne's gamble", Financial Times, Sept. 29, 2010.

outside option of offshoring production is taken into account in the wage bargaining process and, *ceteris paribus*, lowers negotiated domestic wages. In contrast, the downward effect of offshoring on wages disappears if we assume that the domestic and foreign labor markets clear simultaneously. To isolate the effect of the threat of offshoring on labor market conditions, we can therefore look at the difference in equilibrium prices and allocations between the sequential and simultaneous labor market structures.

Our main result is that the threat of offshoring production can put significant downward pressure on wages in the source country, *even if the existing amount of offshoring is very small.* In our model, offshored production accounts for only one percent of total output,.but the possibility that jobs may be offshored lowers domestic wages by up to 5 percent compared to a world in which firms and workers do not internalize this outside option in the bargaining process. As a result of the fall in wages, the unemployment rate falls substantially, declining between 2 to 3 percentage points. For the foreign country, the recipient of offshored jobs, we find a quantitatively larger effect on wages, with the threat of offshoring raising wages roughly 6 percent.

Our paper adds to a young literature that builds on Davidson, Martin, and Matusz (1988) by embedding labor market search frictions into open economy models (see, e.g., Helpman and Itskhoki (*forthcoming*), Helpman, Itskhoki, and Redding (*forthcoming*), Boz, Durdu, and Li (2009), Dutt, Mitra, and Ranjan (2009), and Mitra and Ranjan (2010)). Much of this work has concentrated on the impact of labor market frictions on trade flows, although Mitra and Ranjan (2010) explicitly considers offshoring. Our work, like Felbermayr, Prat, and Schmerer (2010), differs in that it focuses instead on wage formation. In particular, what is unique about our work is that by concentrating specifically on the impact of the threat of offshoring on wage negotiation outcomes we are able to provide a model-based answer to a policy-relevant question that has thus far proved largely elusive. To this end, our model is also related to the earlier work of Borjas and Ramey (1995) who studied the impact of trade on firms' rent, wages, and employment in a model in which firms and unions bargain over pay and the number of workers employed. Finally, our results complement the perviously mentioned empirical findings of Blinder (2009) who classifies the offshorability of jobs and its impact on wages and employment.

The idea that the value of outside options is important in wage negotiations has recently been challenged by Hall and Milgrom (2008). They argue that threatening to walk away from the negotiating table once a match has been formed is not credible. Instead, the more credible threat is to extend bargaining: job-seekers' best option is to try to hold on for a better deal, while firms should delay negotiations as long as possible. This approach to wage bargaining lowers the influence of outside options on negotiated outcomes and is useful for solving the well known Shimer (2006) puzzle in dynamic labor search models. However, in the case of the firms' ability to move production offshore, the value of offshoring may be so high that the threat of terminating employment becomes credible as demonstrated by Fiat's threat to Italian workers. Moreover, using Swedish data, Lachowska (2010) presents empirical evidence indicating that outside options are important in the wage formation process.

The remainder of this paper is organized as follows. The next section presents the model. Section 3 describes the baseline calibration and presents the main results. In Section ?? we examine how the threat of offshoring influences the response of global wages and labor market allocations to a trade liberalization. Finally, Section 4 concludes.

2 The Model

We extend the textbook Pissarides (2000) labor search model to a two country setting. The key innovation is to introduce a multinational that engages in international production sharing into the model. The ability of the multinational to shift production internationally acts as an outside option in wage negotiations with workers. It is through this outside option that we introduce the threat effect of offshoring on global wages and labor market allocations. We assume that only the Home firms operates multinationally and is able to offshore production.

2.1 Households

There is a continuum of identical households in both the Home and Foreign economy. The representative household in each country consists of a continuum of measure one of family members. During a given time period, each member of the household either works, is actively searching for a job, or is out of the labor force enjoying leisure. Individuals in the Home country search for jobs with domestic firms while individuals in the Foreign country optimally allocate search activity across two separate labor markets: one for jobs in foreign-owned firms and one for offshored jobs in the foreign plant of the Home multinational, respectively. We rule out on-the-job search and assume that total household income in each country is divided evenly amongst all individuals, so each individual within a country has the same consumption. This later assumption follows Andolfatto (1996) and Merz (1995) and is common in general equilibrium search-theoretic models of labor markets.

Aggregate consumption in the Home country is measured by a composite consumption index that is a CES aggregate of both a domestic and foreign final good

$$c_t \equiv \left(\lambda^{\frac{1}{\zeta}} c_{\mathrm{H},t}^{\frac{(\zeta-1)}{\zeta}} + (1-\lambda)^{\frac{1}{\zeta}} c_{\mathrm{F},t}^{\frac{(\zeta-1)}{\zeta}} \right)^{\frac{\zeta}{\zeta-1}} \tag{1}$$

where the parameter $\lambda \in (0,1)$ governs the share of the Home final good in the composite consumption index and $\zeta > 0$ is the constant elasticity of substitution between the Home and Foreign final good, $c_{\mathrm{H},t}$ and $c_{\mathrm{F},t}$, respectively. There exists an identical consumption index denoting Foreign aggregate consumption, c_t^*, which aggregates Foreign consumption of the Home and Foreign produced final goods, $c_{\mathrm{H},t}^*$ and $c_{\mathrm{F},t}^*$, respectively.

We normalize $p_{\mathrm{H},t} = 1$, so that all goods are valued in terms of the Home produced final good. With this normalization, the aggregate consumption-based price index in the Home country is given by

$$p_t \equiv \left(\lambda + (1-\lambda) p_{\mathrm{F},t}^{(1-\zeta)}\right)^{1/(1-\zeta)} \tag{2}$$

where $p_{\mathrm{F},t}$ is the price of imports from the Foreign country relative to the price of domestically produced goods. Equivalently, $p_{\mathrm{F},t}$ is the terms of trade for the Home country.

Demand functions for the Home and Foreign final consumption goods are given by

$$c_{\mathrm{H},t} = \lambda \left(\frac{1}{p_t}\right)^{-\zeta} c_t, c_{\mathrm{F},t} = (1-\lambda)\left(\frac{p_{\mathrm{F},t}}{p_t}\right)^{-\zeta} c_t, \tag{3}$$

An atomistic individual in the representative household is engaged in one of three activities: work, actively searching for employment, or enjoying leisure. Since the foreign firm does not operate in the home country, Home workers only serach for jobs in Home firms. In terms of notation, let $s_{\mathrm{H},t}$ denote the time spent searching by agents in the Home country to achieve the desired level of employment with the domestic firm, $n_{\mathrm{H},t}$. The utility of the representative household is given by

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[u(c_t) - h\left(s_{\mathrm{H},t} + n_{\mathrm{H},t}\right)\right] \tag{4}$$

We assume that households can purchase state-contingent bonds b_{t+1} that are traded internationally, so that asset markets are complete. The household chooses sequences of consumption, investment, real bond holdings, and search activity to maximize lifetime utility subject to an infinite sequence of flow budget constraints

$$p_t c_t + p_t\left(k_{\mathrm{H},t+1} - (1-\delta)\, k_{\mathrm{H},t}\right) + \int p_{bt,t+1} b_{t+1} = w_t n_{\mathrm{H},t} + r_{\mathrm{H},t}^k k_{\mathrm{H},t} + s_{\mathrm{H},t}\chi + b_t + d_t \tag{5}$$

where: p_t is the aggregate price index in the Home country (as defined above); k_t is capital; δ is the rate of depreciation of the capital stock; w_t is the real wage paid to a worker in the Home country; χ is the unemployment benefit that accrues to individuals actively searching for employment; $p_{bt,t+1}$ is the price of an asset that pays one unit of the domestic consumption good in a particular state of nature at time $t+1$; r_t^k is the return on a unit of capital; and, finally, d_t denotes the dividend paid to households by intermediate goods producing firms.

The household also faces perceived laws of motion for the number of jobs at domestic firms.

$$n_{\mathrm{H},t+1} = (1-\rho) n_{\mathrm{H},t} + s_{\mathrm{H},t} k^w(\theta_{\mathrm{H},t}) \tag{6}$$

The probability that a searching individual will be matched in a job operated by the domestic intermediate goods producing firm is $k^w(\theta_{\mathrm{H},t})$, which in turn depends on labor market tightness. Labor market tightness is defined as $\theta_t = v_t/s_t$, where v_t is the number of vacancies posted by Home intermediate goods producing firm in the Home labor market. Finally, with fixed probability $\rho = \rho^o + (1-\rho^o)\rho^n$, which is known to both households and firms, an existing domestic job in the Home country is terminated at the beginning of period t. As will be discussed in more detail when describing the firm's problem, job termination may occur as a result of an existing job becoming obsolete, which occurs with probability ρ^o. Alternatively, even if a job remains operable, separation may occur with probability ρ^n.

As shown in Appendix A, combining the first order conditions on $s_{\mathrm{H},t}$ and $n_{\mathrm{H},t}$ yields an optimal search condition in the labor market for domestic intermediate goods production

$$\frac{h'(lfp_t) - \chi\frac{u'(c_t)}{p_t}}{k^w(\theta_{\mathrm{H},t})\frac{u'(c_t)}{p_{t+1}}} = E_t\left[\Lambda_{t+1|t}\left(w_{\mathrm{H},t+1} - \frac{h'(lfp_{t+1})}{\frac{u'(c_{t+1})}{p_t}} + (1-\rho)\frac{h'(lfp_{t+1}) - \chi\frac{u'(c_{t+1})}{p_{t+1}}}{k^w(\theta_{\mathrm{H},t+1})\frac{u'(c_{t+1})}{p_{t+1}}}\right)\right] \quad (7)$$

where we have used the notation $lfp_t = s_{\mathrm{H},t} + n_{\mathrm{H},t}$ to denote labor force participation.

In turn, we can let $\mathbf{W}_{\mathrm{H},\mathbf{t}}$ be the value to a worker of a domestic job and let $\mathbf{U}_{\mathrm{H},\mathbf{t}}$ be the value of unemployment. Define the value of a domestic job to a domestic worker, $\mathbf{W}_{\mathrm{H},\mathbf{t}}$, as

$$\mathbf{W}_{\mathrm{H},\mathbf{t}} = w_{\mathrm{H},\mathbf{t}} - \frac{h'(lfp_t)}{u'(c_t)/p_t} + E_t\left[\Lambda_{t+1|t}\left((1-\rho)\mathbf{W}_{\mathrm{H},\mathbf{t+1}} + \rho\mathbf{U}_{\mathrm{H},\mathbf{t+1}}\right)\right] \quad (8)$$

which says that the value of work in the domestic job market is the wage the worker earns from supplying domestic labor to the domestic firm net of the disutility of labor effort plus the continuation value of being in an employment relationship with a domestic firm. The continuation value takes into account the fact that the job may or may not survive exogenous job destruction in order to continue producing tomorrow. If the job does survive it brings in continuation value $\mathbf{W}_{\mathrm{H},\mathbf{t+1}}$, but if it does not the worker will receive continuation value $\mathbf{U}_{\mathrm{H},\mathbf{t+1}}$, which is the value of unemployment at the beginning of period $t+1$.

Similalry, define the value of unemployment in the beginning of the period, $\mathbf{U}_{\mathrm{H},\mathbf{t}}$, as

$$\mathbf{U}_{\mathrm{H},\mathbf{t}} = \chi - \frac{h'(lfp_t)}{u'(c_t)/p_t} + E_t\left[\Lambda_{t+1|t}\left((1-\rho)k^w(\theta_{\mathrm{H},\mathbf{t}})\mathbf{W}_{\mathrm{H},\mathbf{t+1}} + \left(1 - k^w(\theta_{\mathrm{H},\mathbf{t}})(1-\rho)\right)\mathbf{U}_{\mathrm{H},\mathbf{t+1}}\right)\right] \quad (9)$$

which says that with probability $k^w(\theta_{\mathrm{H},\mathbf{t}})$ the worker gets a job today. If he does get a job today he receives the unemployment benefit and suffers disutility of search, before getting the continuation value of the job tomorrow, provided it survives to produce. On the other hand, if the worker doesn't get a job today, he gets the continuation value of unemployment tomorrow.

2.1.1 Foreign Households

The Foreign household solve a similar problem but it involves allocating search activity across *two labor markets*: the one for jobs in the foreign-owned firms and the one for offshored jobs by the Home multinational. Hereafter, we will use foreign jobs to denote jobs in foreign-owned firms. In the morning, unemployed workers are sent to search for Foreign jobs and for offshored jobs by the multinational. In terms of notation, let $s^*_{\mathrm{F},t}$ denote search activity in the market for foreign jobs, and let $s^*_{\mathrm{H},t}$ denote search activity in the market for offshored jobs. If the search activity in the morning doesn't result in a match, we assume that, in the evening, the unemployed workers can search for offshored jobs. As a result, Foreign jobs, $n^*_{\mathrm{F},t}$, and offshored jobs, $n^*_{\mathrm{H},t}$, evolve according to the following laws of motions

$$n^*_{\mathrm{F},t+1} = (1-\rho^*)n^*_{\mathrm{F},t} + s^*_{\mathrm{F},t}k^w(\theta^*_{\mathrm{F},t}) \tag{10}$$

and

$$n^*_{\mathrm{H},t+1} = (1-\rho^*)n^*_{\mathrm{H},t} + \left(1-k^w(\theta^*_{\mathrm{F},t})\right)k^w(\widetilde{\theta}^*_{\mathrm{H},t})s^*_{\mathrm{F},t} + \Big(k^w(\theta^*_{\mathrm{H},t}) + \left(1-k^w(\theta^*_{\mathrm{H},t})\right)k^w(\widetilde{\theta}^*_{\mathrm{H},t})\Big)\, s^*_{\mathrm{H},t} \tag{11}$$

where $\theta^*_{\mathrm{F},t}$ ($\theta^*_{\mathrm{H},t}$) represents the degree of labor market tightness in the morning markets for foreign (offshored) jobs. In turn, $\widetilde{\theta}^*_{\mathrm{H},t}$ denote the degree of tightness in the offshore market in the evening.

While the law of motion for n^*_{F} has a similar interpretation to that for n_{H} above, the law of motion for jobs in the offshored market takes into account that unsuccessful job searchers in the morning's markets can search for offshored jobs in the evening market. An unsuccessful searcher in the morning's Foreign market can find an offshored job in the evening with probability $\left(1-k^w(\theta^*_{\mathrm{F},t})\right)k^w(\widetilde{\theta}^*_{\mathrm{H},t})$. Similarly, an unsuccessful searcher in the morning's offshore market can find an offshored job in the evening with probability $\left(1-k^w(\theta^*_{\mathrm{H},t})\right)k^w(\widetilde{\theta}^*_{\mathrm{H},t})$.

The foreign household also invests in two different capital stocks, one for use in domestic jobs, $k^*_{f,t}$, rented to the Foreign firm at rate $r^{*k}_{f,t}$ and one for use in offshored jobs, $k^*_{h,t}$, rented to the multinational at rate $r^{*k}_{h,t}$. Optimization on the part of the Foreign household will yields an analogue to equation **??**, as well as two arbitrage conditions analogous to equation **??**, and two optimal search conditions analogous to equation 7. Details for the solution of the Foreign household's optimization problem are given in Appendix A.

Because unsuccessful Foreign searchers in the day market for Foreign jobs can search for offshored jobs in the night market, the definitions of the value functions for the Foreign worker differs from those of the Home worker. Let $\mathbf{U}^*_{\mathrm{F},\mathbf{t}}$ the value of unsuccessful search in the market for Foreign jobs. In the appendix we show that $\mathbf{U}^*_{\mathrm{F},\mathbf{t}}$ evolves as

$$\begin{aligned}\mathbf{U}^*_{\mathrm{F},\mathbf{t}} &= \chi^* - \frac{h'(lfp^*_t)}{u'(c^*_t)/p^*_t} + k^w(\theta^*_{\mathrm{F},\mathbf{t}})E_t\left[\Lambda^*_{t+1|t}\left((1-\rho^*)\mathbf{W}^*_{\mathrm{F},\mathbf{t+1}} + \rho^*\mathbf{U}^*_{\mathrm{F},\mathbf{t+1}}\right)\right] \\ &+ \left(1-k^w(\theta^*_{\mathrm{F},\mathbf{t}})\right)\widetilde{\mathbf{U}}^*_{\mathrm{H},\mathbf{t}}\end{aligned} \tag{12}$$

Notice that if an unemployed worker in the day market fails to make a match, which occurs with probability $\left(1-k^w(\theta^*_{\mathrm{F},\mathbf{t}})\right)$, he still gets the value of search in the market for offshored jobs, $\widetilde{\mathbf{U}}^*_{\mathrm{H},\mathbf{t}}$.

Similalry, let $\mathbf{W}^*_{\mathrm{F},\mathbf{t}}$ be the value to a worker of a domestic job, which is given by

$$\mathbf{W}^*_{\mathrm{F},\mathbf{t}} = w^*_{\mathrm{F},\mathbf{t}} - \frac{h'(lfp^*_t)}{u'(c^*_t)/p^*_t} + E_t\left[\Lambda^*_{t+1|t}\left((1-\rho^*)\mathbf{W}^*_{\mathrm{F},\mathbf{t+1}} + \rho^*\mathbf{U}^*_{\mathrm{F},\mathbf{t+1}}\right)\right] \tag{13}$$

which has a similar interpretation as above (8).

2.2 Production

Firms in the Home country are multinationals in the sense that they engage in international production sharing. The multinational operates plants in both countries which produce an intermediate input using both capital and labor. The intermediate inputs are then processed into a final good in the Home country, and this final good is, in turn, sold internationally. In contrast, firms in the Foreign country produce domestically, so offshoring activity is assumed to be North-South only.

Regardless of where production takes place, intermediate goods producing plants must undergo a costly hiring process for labor in a frictional market. Labor is then matched with capital, which is rented from domestic households in a frictionless market, and the two inputs are then used to produce the intermediate good. To match a worker with capital, plants in either country must first create a position by paying a sunk entry cost which involves putting a stock of capital in place for the worker to use in production.[3] Once a position is created and capital is put in place, it must then be filled with a worker, which requires posting a vacancy in a frictional labor market. Only after a vacant position is filled does production take place. We assume that the multinational respects local labor market institutions and pay workers a domestic currency wage when engaging in offshore production activity.

2.2.1 The Home Multinational Firm

The multinational firm residing in the Home country produces final output, denoted y_t, using intermediate goods produced both domestically, $y_{\mathrm{H},t}$, and abroad, $y^*_{\mathrm{H},t}$. Intermediate goods are produced at domestic plants using Home labor and capital, $y_{\mathrm{H},t} = z_{\mathrm{H},t}g(n_{\mathrm{H},t}, k_{\mathrm{H},t})$ and at foreign plants using Foreign labor and capital, $y^*_{\mathrm{H},t} = z^*_{\mathrm{H},t}g(n^*_{\mathrm{H},t}, k^*_{\mathrm{H},t})$, where $z_{\mathrm{H},t}$ and $z^*_{\mathrm{H},t}$ are technology shocks that

[3] This aspect of the model builds on Fujita and Ramey (2006) and Rosen and Wasmer (2005).

potentially differ across the multinational's domestic and foreign plants. The intermediate good produced by the foreign plant is potentially subject to an iceberg shipping cost, denoted Υ, so that in terms of general notation, the technology for the production of the final good is given by $y_t = f(y_{\mathrm{H},t}, (1-\Upsilon)y^*_{\mathrm{H},t})$. Once the intermediate goods are combined, the final output is sold in perfectly competitive goods markets both at home and abroad.

The multinational's optimization problem is to choose sequences of capital input and vacancy postings in each of the two distinctive labor markets to hit a target level of employment both domestically and abroad. The goal is to maximize discounted lifetime profits subject to the production technology and the respective perceived laws of motion for employment:

$$\Pi_t = \sum_{t=0}^{\infty} \beta^t \frac{\lambda_t}{\lambda_0} \quad [f(y_{\mathrm{H},t}, (1-\Upsilon)y^*_{\mathrm{H},t}) - (1-\tau^n_{\mathrm{H},t})w_{\mathrm{H},t}n_{\mathrm{H},t} - (1-\tau^{*n}_{\mathrm{H},t})q_t w^*_{\mathrm{H},t}n^*_{\mathrm{H},t} \tag{14}$$

$$-r^k_{\mathrm{H},t}k_{\mathrm{H},t} - q_t r^{k*}_{\mathrm{H},t}k^*_{\mathrm{H},t} - (1-\tau^v_{\mathrm{H},t})\gamma_{\mathrm{H}}v_{\mathrm{H},t} - (1-\tau^{*v}_{\mathrm{H},t})\gamma^*_{\mathrm{H}}v^*_{\mathrm{H},t}]$$

subject to:

$$y_{\mathrm{H},t} = z_{\mathrm{H},t}g(n_{\mathrm{H},t}, k_{\mathrm{H},t}) \tag{15}$$

$$y^*_{\mathrm{H},t} = z^*_{\mathrm{H},t}g(n^*_{\mathrm{H},t}, k^*_{\mathrm{H},t}) \tag{16}$$

$$n_{\mathrm{H},t+1} = (1-\rho)n_{\mathrm{H},t} + v_{\mathrm{H},t}k^f(\theta_{\mathrm{H},t}) \tag{17}$$

$$n^*_{\mathrm{H},t} = (1-\rho^*)n^*_{\mathrm{H},t} + (1-k^f(\theta_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})v_{\mathrm{H},t} + \left(k^f(\theta^*_{\mathrm{H},t}) + (1-k^f(\theta^*_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})\right) v^*_{\mathrm{H},t}. \tag{18}$$

As mentioned above, the wage paid to Foreign workers is paid in units of the foreign currency, so the intermediate goods producing firm must internalize movements in the real exchange rate, q_t, when making its optimal offshoring decision. The firms also faces taxes on its wage bills at Home and abroad, as well as on their vacancy-posting costs. We will use these tx instruments below to conduct policy experiments. Note that vacancy postings in the Foreign labor market, $v^*_{\mathrm{H},t}$, are a drain on real resources in the Home country.

The probability that a job posting will be matched with a Home worker in the domestic labor market and a Foreign worker employed in a job offshored from the Home country is given by $k^f(\theta_{\mathrm{H},t})$ and $k^f(\theta^*_{\mathrm{H},t})$, respectively. The parameters γ_{H} and γ^*_{H} denote the vacancy posting cost in the Home and Foreign market, respectively. Employment in the Home market is perceived by the firm to evolve according to (17), which says that employment at $t+1$ depends on the number of remaining jobs today plus the number of matches the firms expect to make by posting $v_{\mathrm{H},t}$ vacancies. Expression (18) has a similar interpretation, but it takes into account the fact that an unfilled vacancy in the morning Home market, which is expected by the firm to occur with probability $(1-k^f(\theta_{\mathrm{H},t}))$, can be offshored in the evening market and result in an employment relationship with probability $k^f(\widetilde{\theta}^*_{\mathrm{H},t})$. Similalry, vacancies posted in the day's offshored market result in a match with probability $k^f(\theta^*_{\mathrm{H},t})$. With probability $(1-k^f(\theta^*_{\mathrm{H},t}))$ the firm doesn't find a match in this market and it can search again in the evening market, finding a worker with the probability $k^f(\widetilde{\theta}^*_{\mathrm{H},t})$.

As shown in the appendix, the efficiency condition for $v_{\mathrm{H},t}$ and $v^*_{\mathrm{H},t}$imply the following relationships:

$$\mu_{\mathrm{H},t} = \frac{(1-\tau^v_{H,t})\gamma - \mu^*_{\mathrm{H},t}(1-k^f(\theta_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})}{k^f(\theta_{\mathrm{H},t})} \tag{19}$$

and

$$\mu^*_{\mathrm{H},t} = \frac{(1-\tau^{*v}_{H,t})\gamma^*}{\left(k^f(\theta^*_{\mathrm{H},t}) + (1-k^f(\theta^*_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})\right)}, \tag{20}$$

where $\mu_{\mathrm{H},t}$ and $\mu^*_{\mathrm{H},t}$ are the multipliers on (17) and (18), which capture the firm's costs of creating an extra vacancy in the two markets. Substituting (19) into equation (19) shows that the vacancy-creation cost in the Home market is reduced by the firm's ability to rollover an unfilled vacancy abroad. An unfilled vacancy in the Home market occurs with probability $(1-k^f(\theta_{\mathrm{H},t}))$. Rolling over that vacancy abroad costs $(1-\tau^{*v}_{H,t})\gamma^*$ and its expected duration is $\frac{1}{\left(k^f(\theta^*_{\mathrm{H},t})+(1-k^f(\theta^*_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})\right)}$.

As shown in Appendix B, the first order conditions for $v_{\mathrm{H},t}$ and $v^*_{\mathrm{H},t}$ can be substituted into the efficiency conditions for employment, $n_{\mathrm{H},t}$ and $n^*_{\mathrm{H},t}$,to obtain vacancy posting conditions necessary to fill operable, vacant jobs. The vacancy posting condition in the Home market is given by

$$\frac{(1-\tau^v_{H,t})\gamma - \mu^*_{\mathrm{H},t}(1-k^f(\theta_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})}{k^f(\theta_{\mathrm{H},t})} = E_t\left[\Lambda_{t+1|t}\left(\begin{array}{c} f_{n_{\mathrm{H}},t+1} - (1-\tau^n_{\mathrm{H},t+1})w_{\mathrm{H},t+1} \\ +(1-\rho)\left(\frac{(1-\tau^v_{H,t+1})\gamma - \mu^*_{\mathrm{H},t+1}(1-k^f(\theta_{\mathrm{H},t+1}))k^f(\widetilde{\theta}^*_{\mathrm{H},t+1})}{k^f(\theta_{\mathrm{H},t+1})}\right)\end{array}\right)\right] \tag{21}$$

Similarly, the vacancy posting condition for filling vacant, operable offshored jobs

$$\frac{(1-\tau^{*v}_{H,t})\gamma^*}{\left(k^f(\theta^*_{\mathrm{H},t}) + (1-k^f(\theta^*_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})\right)} = E_t\left[\Lambda_{t+1|t}\left(\begin{array}{c} f_{n^*_{\mathrm{H}},t+1} - (1-\tau^{*n}_{\mathrm{H},t+1})q_{t+1}w^*_{\mathrm{H},t+1} \\ +(1-\rho^*)\frac{(1-\tau^{*v}_{H,t+1})\gamma^*}{\left(k^f(\theta^*_{\mathrm{H},t+1})+(1-k^f(\theta^*_{\mathrm{H},t+1}))k^f(\widetilde{\theta}^*_{\mathrm{H},t+1})\right)}\end{array}\right)\right]. \tag{22}$$

The vacancy posting conditions simply say that, at the optimal choice, once a position is created the cost incurred by the firm to post vacancies in order to fill the vacant position is equated to the discounted expected value of profits from the match.

Finally, the optimal capital demand equations are given by

$$f_{k_{\mathrm{H}},t} = r^k_{\mathrm{H},t} \tag{23}$$

and

$$f_{k^*_{\mathrm{H}},t} = q_t r^{k^*}_{\mathrm{H},t} \tag{24}$$

Let $\mathbf{J}_{\mathrm{H},\mathbf{t}}$ be the value to the multinational firm of a domestic worker and let $\mathbf{V}_{\mathrm{H},\mathbf{t}}$ be the value of an unfilled vacancy opened by the multinational in the domestic job market. Define $\mathbf{J}_{\mathrm{H},\mathbf{t}}$ as

$$\mathbf{J}_{\mathrm{H},\mathbf{t}} = f_{n_{\mathrm{H}},t} - (1-\tau^{n}_{H,t})w_{\mathrm{H},\mathbf{t}} + E_t\left[\Lambda_{t+1|t}\left((1-\rho)\mathbf{J}_{\mathrm{H},\mathbf{t+1}} + \rho\mathbf{V}_{\mathrm{H},\mathbf{t+1}}\right)\right] \tag{25}$$

which says that the value of a domestic job is equal to the additional revenue the firms gets from additional production net of the wage that the firm must pay the additional worker. The firm also gets a continuation value from the formation of a job, which yields production tomorrow if the job survives. If it doesn't, then the firm gets the continuation value of the vacancy posting tomorrow.

Define the value of an unfilled match, $\mathbf{V}_{\mathrm{H},\mathbf{t}}$, as

$$\begin{aligned} \mathbf{V}_{\mathrm{H},\mathbf{t}} &= -(1-\tau^{v}_{H,t})\gamma + k^f(\theta_{\mathrm{H},\mathbf{t}})E_t\left[\Lambda_{t+1|t}\left((1-\rho)\mathbf{J}_{\mathrm{H},\mathbf{t+1}} + \rho\mathbf{V}_{\mathrm{H},\mathbf{t+1}}\right)\right] \\ &+ \left(1-k^f(\theta_{\mathrm{H},\mathbf{t}})\right)\widetilde{\mathbf{V}}^*_{\mathrm{H},\mathbf{t}} \end{aligned} \tag{26}$$

The value of a vacancy is the posting cost plus the continuation value of a matched vacancy provided it survives to produce in the next period weighted by the probability that the match is made. If the match does not survive, the unfilled vacancy continues to have value since under sequential bargaining a vacancy that is unfilled in the market for domestic workers can be posted in the offshore labor market in the evening and has a value $\widetilde{\mathbf{V}}^*_{\mathrm{H},\mathbf{t}}$.

Similarly, let $\mathbf{J}^*_{\mathrm{H},\mathbf{t}}$ be the value of an offshore worker to the multinational firm. Define the value to a firm of an offshored job as

$$\mathbf{J}^*_{\mathrm{H},t} = f_{n^*_{\mathrm{H}},t} - (1-\tau^{*n}_{H,t})q_t w^*_{\mathrm{H},t} + E_t\left[\Lambda_{t+1|t}\left((1-\rho^*)\mathbf{J}^*_{\mathrm{H},t+1} + \rho\mathbf{V}^*_{\mathrm{H},\mathbf{t+1}}\right)\right]$$

Notice that if a match does not survive, the firm gets the continuation value from being able to post a vacancy in the following day market for Home jobs,$\mathbf{V}_{\mathrm{H},\mathbf{t+1}}$.

Finally, define the value of an unfilled vacancy posted in the Foreign labor market, $\mathbf{V}^*_{\mathrm{H},t}$, as

$$\begin{aligned} \mathbf{V}^*_{\mathrm{H},t} &= -(1-\tau^{*v}_{H,t})\gamma^* + k^f(\theta^*_{\mathrm{H},t})E_t\left[\Lambda_{t+1|t}(1-\rho^*)\mathbf{J}^*_{\mathrm{H},t+1} + \rho^*\mathbf{V}^*_{\mathrm{H},t+1}\right] \\ &+ \left(1-k^f(\theta^*_{\mathrm{H},t})\right)\widetilde{\mathbf{V}}^*_{\mathrm{H},\mathbf{t}} \end{aligned} \tag{27}$$

With probability $\left(1-k^f(\theta^*_{\mathrm{H},t})\right)$ a vacancy posted in the day's offshored job market remains unfilled and has value $\widetilde{\mathbf{V}}^*_{\mathrm{H},\mathbf{t}}$.

2.2.2 The Foreign Firm

The firm in the Foreign country transforms a domestically-produced intermediate good, $y^*_{\mathrm{F},t}$, into a final good, y^*_t. The intermediate good is produced in a domestic plant using Foreign labor and capital, so that $y^*_{\mathrm{F},t} = z^*_{\mathrm{F},t}g^*(n^*_{\mathrm{F},t}, k^*_{\mathrm{F},t})$. Intermediate goods are transformed unit-for-unit into the final good, so that $y^*_t = f(y^*_{\mathrm{F},t}) = y^*_{\mathrm{F},t}$.

The foreign firm's optimization problem is to choose sequences of capital input and vacancy postings to hit a target level of domestic employment. The goal is to maximize discounted lifetime profits subject to the production technology and the law of motion for domestic employment.

$$\Pi_t^* = \sum_{t=0}^{\infty} \beta^{*t} \frac{\lambda_t^*}{\lambda_0^*} \left[f(y_{\mathrm{F},t}^*) - w_{\mathrm{F},t}^* n_{\mathrm{F},t}^* - r_t^{k^*} k_{\mathrm{F},t}^* - \gamma_{\mathrm{F}}^* v_{\mathrm{F},t}^* \right] \tag{28}$$

subject to:

$$y_{\mathrm{F},t}^* = z_{\mathrm{F},t}^* g(n_{\mathrm{F},t}^*, k_{\mathrm{F},t}^*) \tag{29}$$

$$n_{\mathrm{F},t+1}^* = (1-\rho^*) n_{\mathrm{F},t}^* + v_{\mathrm{F},t}^* k^f(\theta_{\mathrm{F},t}^*) \tag{30}$$

where the probability that a job posting will be matched with a Foreign worker in the foreign labor market is given by $k^f(\theta_{\mathrm{H},t}^*)$ and γ_{F}^* denotes the vacancy posting cost in the Foreign labor market.

The optimal capital accumulation equation is given by

$$f_{k_{\mathrm{F}}^*,t} = r_{\mathrm{F},t}^{k^*} \tag{31}$$

and the vacancy posting condition for the Foreign firm is given by

$$\frac{\gamma_{\mathrm{F}}^*}{k^f(\theta_{\mathrm{F},t}^*)} = E_t \left[\Lambda_{t+1|t}^* \left(f_{n_{\mathrm{F}}^*,t+1} - w_{\mathrm{F},t+1}^* + (1-\rho^*) \frac{\gamma_{\mathrm{F}}^*}{k^f(\theta_{\mathrm{F},t+1}^*)} \right) \right], \tag{32}$$

where $\mu_{\mathrm{F},t}^*$ is the multiplier on equation (30) and is equal to $\frac{\gamma_{\mathrm{F}}^*}{k^f(\theta_{\mathrm{F},t}^*)}$ at an optimum.

Let $\mathbf{J}_{\mathrm{F},\mathbf{t}}^*$ be the value of a foreign worker to the foreign firm given by

$$\mathbf{J}_{\mathrm{F},t}^* = f_{n_{\mathrm{F}}^*,t} - w_{\mathrm{F},t}^* + E_t \left[\Lambda_{t+1|t}^* \left((1-\rho^*) \mathbf{J}_{\mathrm{F},t+1}^* + \rho^* \mathbf{V}_{\mathrm{F},t+1}^* \right) \right]$$

And define the value to a Foreign firm of an unfilled vacancy in the foreign labor market as

$$\mathbf{V}_{\mathrm{F},t}^* = -\gamma^* + E_t \left[\Lambda_{t+1|t}^* \left((1-\rho^*) k^f(\theta_{\mathrm{F},t}^*) \mathbf{J}_{\mathrm{F},t+1}^* \right) + (1 - (1-\rho^*) k^f(\theta_{\mathrm{F},t}^*)) \mathbf{V}_{\mathrm{F},t+1}^* \right].$$

2.3 Entry

As discussed in Fujita and Ramey (2007), a consequence of introducing the entry cost is that vacancies become a state variable.[4] The law of motion for vacancies posted by the multinational in the Home labor market is given by:

$$v_{\mathrm{H},t+1} = (1-\rho^o)\rho^n n_{\mathrm{H},t} + (1-\rho^o)(1-k^f(\theta_{\mathrm{H},t}))(1-k^f(\widetilde{\theta}_{\mathrm{H},t}^*)) v_{\mathrm{H},t} + ne_{\mathrm{H},t+1} \tag{33}$$

[4] Fujita and Ramey (2007) introduced an exogenous fixed cost of vacancy creation to introduce persistence into vacancy postings over the business cycle in an effort to better fit the data. Our purposes for introducing (an endogenous) cost of entry is entirely different. In our paper, for the threat of offshoring to have any effect it must be the case that free entry does not drive the value of the vacancy to zero in the steady state. Thus, our reasoning for introducing this feature into the model is totally different from Fujita and Ramey (2007).

which simply says that the stock of vacancies tomorrow is equal to newly opened vacancies resulting from existing non-obsolescent jobs that have exogenously separated (which occurs with probability $(1-\rho^o)\rho^n$) plus the stock of unfilled vacancies (in either the morning or evening markets) for non-obsolescent jobs from today (which occurs with probability $(1-\rho^o)(1-k^f(\theta_{\mathrm{H},t}))(1-k^f(\widetilde{\theta}^*_{\mathrm{H},t})))$, plus the vacancies associated with new entrants into the market, $ne_{\mathrm{H},t+1}$.

Free entry by the multinational into the Home labor market drives the value of an unfilled vacancy to the creation cost, which is given by the cost of putting capital in place. The free entry condition for the Home domestic labor market is given by

$$V_{\mathrm{H},t} = r^k_{\mathrm{H},t} k_{\mathrm{H},t} \tag{34}$$

where: $V_{\mathrm{H},t}$ is the value of an unfilled domestic vacancy to the Home multinational as defined above. Taken together, equations 33 and 34 pin down the value of an open vacancy and the number of entrants in the Home labor market.

Similarly, the law of motion for vacancies posted by the multinational in the offshore labor market is given by

$$v^*_{\mathrm{H},t+1} = (1-\rho^{o^*})\rho^{n^*} n^*_{\mathrm{H},t} + (1-\rho^{o^*})(1-k^f(\theta^*_{\mathrm{H},t}))(1-k^f(\widetilde{\theta}^*_{\mathrm{H},t}))v^*_{\mathrm{H},t} + ne^*_{\mathrm{H},t+1} \tag{35}$$

and the free entry condition is given by

$$V^*_{\mathrm{H},t} = q_t r^{k^*}_{\mathrm{H},t} k^*_{\mathrm{H},t} \tag{36}$$

Finally, the law of motion for vacancies posted by the Foreign firm is

$$v^*_{\mathrm{F},t+1} = (1-\rho^{o^*})\rho^{n^*} n^*_{\mathrm{F},t} + (1-\rho^{o^*})(1-k^f(\theta^*_{\mathrm{F},t}))v^*_{\mathrm{F},t} + ne^*_{\mathrm{F},t+1} \tag{37}$$

and the free entry condition is given by

$$V^*_{\mathrm{F},t} = r^{k^*}_{\mathrm{F},t} k^*_{\mathrm{F},t} \tag{38}$$

2.4 Matching Technology

Matches between unemployed individuals searching for jobs and firms searching to fill vacancies are formed according to a matching technology. There are three distinct labor markets in this model and each one requires its own matching function. All take a similar form.

Letting $m(s_{\mathrm{H},t}, v_{\mathrm{H},t})$ denote matches between the Home intermediate goods producing firm and Home workers, the evolution of total domestic employment in the Home country is given by

$$n_{\mathrm{H},t+1} = (1-\rho)n_{\mathrm{H},t} + m(s_{\mathrm{H},t}, v_{\mathrm{H},t}) \tag{39}$$

Using similar notation, the evolution of matches between Foreign workers employed by Foreign firms is given by

$$n^*_{\mathrm{F},t+1} = (1-\rho^*)n^*_{\mathrm{F},t} + m(s^*_{\mathrm{F},t}, v^*_{\mathrm{F},t}) \tag{40}$$

Finally, the evolution of offshored jobs from the Home country is given by

$$n^*_{\mathrm{H},t+1} = (1-\rho)n^*_{\mathrm{H},t} + m(s^*_{\mathrm{H},t}, v^*_{\mathrm{H},t}) + m(\widetilde{s}^*_{\mathrm{H},t}, \widetilde{v}^*_{\mathrm{H},t}), \tag{41}$$

The amount of searchers in the market for offshored jobs in the evening is given by $\widetilde{s}^*_{\mathrm{H},t} = (1 - k^w_{\mathrm{F},t}(\theta^*_{\mathrm{F},t}))s^*_{\mathrm{F},t} + (1 - k^w(\theta^*_{\mathrm{H},t}))s^*_{\mathrm{H},t}$: the sum of unsuccessful searchers in the morning markets. Similarly, the amount of vacancies in the evening is the sum of unfilled vacancies in the morning markets: $\widetilde{v}^*_{\mathrm{H},t} = (1 - k^f(\theta_{\mathrm{H},t}))v_{\mathrm{H},t} + (1 - k^f(\theta^*_{\mathrm{H},t}))v^*_{\mathrm{H},t}$.

2.5 Wage Determination

The wage paid in any given job is determined in via Nash bargain between a matched worker and firm pair. The equilibrium of the economy has a total of three wages: two paid by the multinational paid to domestic and offshore workers, respectively, and one paid by the Foreign firm to domestic workers.

In terms of notation, for the Home household let $W_{\mathrm{H},t}$ denote the value of a domestic job and let $U_{\mathrm{H},t}$ denote the value of the outside option, unemployment. For the Home multinational, let $J_{\mathrm{H},t}$ denote the value of a domestic operable job and let $V_{\mathrm{H},t}$ denote the value of the outside option, unemployment. Hence, the value of a domestic job to the Home household (*workers*) is given by $\mathbf{S}^{\mathbf{workers}}_{\mathrm{H},\mathbf{t}} = W_{\mathrm{H},t} - U_{\mathrm{H},t}$ and the value to the Home multinational (*firm*) is given by $\mathbf{S}^{\mathbf{firm}}_{\mathrm{H},\mathbf{t}} = J_{\mathrm{H},t} - V_{\mathrm{H},t}$. The analogous variables in for the Foreign domestic labor market are given by $W^*_{\mathrm{F},t}$, $U^*_{\mathrm{F},t}$, $J^*_{\mathrm{F},t}$, $V^*_{\mathrm{F},t}$, defining the surpluses $\mathbf{S}^{*,\mathbf{workers}}_{\mathrm{F},\mathbf{t}}$, and $\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{F},\mathbf{t}}$ for the Foreign household and the firm, respectively. Finally, the value of an offshored job to the Foreign household is given by $W^*_{\mathrm{H},t}$ while the outside option is denoted $U^*_{\mathrm{H},t}$, giving rise to the value of an offshored job $\mathbf{S}^{*,\mathbf{workers}}_{\mathrm{H},\mathbf{t}}$. For the Home multinational, the value of an offshored job is denoted $J^*_{\mathrm{H},t}$ while the outside option is given by $V^*_{\mathrm{H},t}$, defining the surplus $\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{H},\mathbf{t}}$. A key thing to note is that the outside option of walking away from a domestic labor market match potentially differs from the outside option of walking away from an international labor market match.

Two alternative economies are considered. In both firms engage in offshoring activity; instead, what differentiates the two economies is whether or not the possibility of engaging in an international employment relationship can be used as an outside option (threat) in domestic wage negotiations (or vice versa). We discuss this more in the following two subsections describing the economy with sequential versus simultaneous wage bargaining, respectively.

2.5.1 Simultaneous Wage Bargaining (No Threat of Offshoring)

We begin with an economy in which bargaining in the market for domestic jobs occurs simultaneously with bargaining in the market for offshored jobs. In this setup, the simultaneous nature of wage negotiations implies that the participation in the market for offshored (domestic) jobs does not factor into the outside option of firms and workers engaged in domestic (international) wage negotiations.

Under simultaneous bargaining, the wage for domestic workers employed by the multinational in the Home country is given by

$$\begin{aligned} w_{\mathrm{H},t} &= \frac{1-\eta}{1-\eta\tau^{n}_{\mathrm{H},t}}\chi + \frac{\eta}{1-\eta\tau^{n}_{\mathrm{H},t}}\left(f_{n_h,t} + (1-\tau^{v}_{\mathrm{H},t})\gamma\right) \\ &+ \frac{\eta}{1-\eta\tau^{n}_{\mathrm{H},t}}(1-\rho)E_t\left[\Lambda_{t+1|t}(1-k^{f}(\theta_{\mathrm{H},t}))\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t+1}}\right] \\ &- \frac{1-\eta}{1-\eta\tau^{n}_{\mathrm{H},t}}(1-\rho)E_t\left[\Lambda_{t+1|t}(1-k^{h}(\theta_{\mathrm{H},t}))\mathbf{S}^{\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t+1}}\right] \end{aligned} \tag{42}$$

The wage for domestic workers employed by the Foreign firm is given by

$$\begin{aligned} w^{*}_{\mathrm{F},t} &= \frac{1-\eta^{*}}{1-\eta^{*}\tau^{*n}_{\mathrm{H},t}}\chi^{*} + \frac{\eta^{*}}{1-\eta^{*}\tau^{*n}_{\mathrm{H},t}}\left(f_{n^{*}_{\mathrm{F}},t} + \gamma^{*}\right) \\ &+ \frac{\eta^{*}}{1-\eta^{*}\tau^{*n}_{\mathrm{H},t}}(1-\rho^{*})E_t\left[\Lambda^{*}_{t+1|t}(1-k^{f}(\theta^{*}_{\mathrm{F},t}))\mathbf{S}^{*\mathbf{firms}}_{\mathrm{F},\mathbf{t+1}}\right] \\ &- \frac{1-\eta^{*}}{1-\eta^{*}\tau^{*n}_{\mathrm{H},t}}(1-\rho^{*})E_t\left[\Lambda^{*}_{t+1|t}(1-k^{w}(\theta^{*}_{\mathrm{F},t}))\mathbf{S}^{*\mathbf{wor\,ker\,s}}_{\mathrm{F},\mathbf{t+1}}\right] \end{aligned} \tag{43}$$

Finally, the wage for Foreign workers employed in an offshored job by the Home multinational is given by

$$\begin{aligned} w^{*}_{\mathrm{H},t} &= \frac{1-\eta^{*}}{1-\eta^{*}\left(1-(1-\tau^{*n}_{\mathrm{H},t})q_t\right)}\chi^{*} + \frac{\eta^{*}}{1-\eta^{*}\left(1-(1-\tau^{*n}_{\mathrm{H},t})q_t\right)}\left(f_{n^{*}_{\mathrm{H}},t} + (1-\tau^{*v}_{\mathrm{H},t})\gamma^{*}_{\mathrm{H}}\right) \\ &+ \frac{\eta^{*}}{1-\eta^{*}\left(1-(1-\tau^{*n}_{\mathrm{H},t})q_t\right)}(1-\rho^{*})E_t\left[\Lambda_{t+1|t}\left(1-k^{f}(\theta^{*}_{\mathrm{H},t})\right)\mathbf{S}^{*\mathbf{firms}}_{\mathrm{H},\mathbf{t+1}}\right] \\ &- \frac{1-\eta^{*}}{1-\eta^{*}\left(1-(1-\tau^{*n}_{\mathrm{H},t})q_t\right)}(1-\rho^{*})E_t\left[\Lambda^{*}_{t+1|t}\left(1-k^{w}(\theta^{*}_{\mathrm{H},t})\right)\mathbf{S}^{*\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t+1}}\right] \end{aligned} \tag{44}$$

The general structure of all the Nash wage solutions under simultaneous bargaining is that the wage is a weighted average of the marginal productivity of an additional worker and the outside option of the worker. With regard to outside options under simultaneous bargaining, if the worker walks away from a match he/she receives the unemployment benefit, whereas if the firm walks away from a match it receives the value of an unfilled vacancy, which as shown in section 2.3 is driven to the sunk cost of creating the position in the first place through free entry.

2.5.2 Sequential Wage Bargaining (Threat of Offshoring)

The threat of offshoring is modeled through the introduction of a sequential bargaining problem whereby, in any given period, bargaining in purely domestic employment relationships (ie, domestic workers matched with domestic firms) occurs prior to bargaining in international employment relationships (ie, domestic firms matched with foreign workers). Thus, if a searching firm (worker) fails to match in the market for domestic employment there is always the possibility of subsequently making a match in the market for offshored jobs within the same period. In this setup, both sides of the search market take into account the possibility of entering into an employment relationship with a foreign worker (firm) in the respective outside option that enters into wage negotiations.

Under sequential bargaining, the wage for domestic employment relationships in the Home country is given by

$$\begin{aligned} w_{\mathrm{H},t} &= \frac{1-\eta}{1-\eta\tau^{n}_{\mathrm{H},t}}\chi + \frac{\eta}{1-\eta\tau^{n}_{\mathrm{H},t}}\left(f_{n_h,t} + (1-\tau^{v}_{\mathrm{H},t})\gamma + (1-k^{f}(\theta_{\mathrm{H},t}))(1-\tau^{*v}_{\mathrm{H},t})\gamma^{*}\right) \\ &+\frac{\eta}{1-\eta\tau^{n}_{\mathrm{H},t}}(1-\rho)E_t\left[\Lambda_{t+1|t}(1-k^{f}(\theta_{\mathrm{H},t}))\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t+1}}\right] \\ &-\frac{1-\eta}{1-\eta\tau^{n}_{\mathrm{H},t}}(1-\rho)E_t\left[\Lambda_{t+1|t}(1-k^{h}(\theta_{\mathrm{H},t}))\mathbf{S}^{\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t+1}}\right] \\ &-\frac{\eta}{1-\eta\tau^{n}_{\mathrm{H},t}}(1-\rho^{*})E_t\left[\Lambda_{t+1|t}(1-k^{f}(\theta_{\mathrm{H},t}))k^{f}(\widetilde{\theta}^{*}_{\mathrm{H},t})\mathbf{S}^{\mathbf{firms}}_{\mathrm{H}^{*}\mathrm{H},\mathbf{t+1}}\right] \end{aligned} \quad (45)$$

The wage for Foreign workers employed by the Foreign firm is given by

$$\begin{aligned} w^{*}_{\mathrm{F},t} &= \frac{1-\eta^{*}}{1-\eta^{*}\tau^{*n}_{\mathrm{H},t}}\chi^{*} + \eta^{*}\left(f_{n^{*}_{\mathrm{F}},t} + \gamma^{*}\right) \\ &+\frac{\eta^{*}}{1-\eta^{*}\tau^{*n}_{\mathrm{H},t}}(1-\rho^{*})E_t\left[\Lambda^{*}_{t+1|t}(1-k^{f}(\theta^{*}_{\mathrm{F},t}))\mathbf{S}^{*\mathbf{firms}}_{\mathrm{F},\mathbf{t+1}}\right] \\ &-\frac{1-\eta^{*}}{1-\eta^{*}\tau^{*n}_{\mathrm{H},t}}(1-\rho^{*})E_t\left[\Lambda^{*}_{t+1|t}(1-k^{w}(\theta^{*}_{\mathrm{F},t}))\mathbf{S}^{*\mathbf{wor\,ker\,s}}_{\mathrm{F},\mathbf{t+1}}\right] \\ &+\frac{1-\eta^{*}}{1-\eta^{*}\tau^{*n}_{\mathrm{H},t}}(1-\rho^{*})E_t\left[\Lambda^{*}_{t+1|t}(1-k^{w}(\theta^{*}_{\mathrm{F},t}))k^{w}(\widetilde{\theta}^{*}_{\mathrm{F},t})\mathbf{S}^{*\mathbf{wor\,ker\,s}}_{\mathrm{FH},\mathbf{t+1}}\right] \end{aligned} \quad (46)$$

Finally, the wage for Foreign workers employed in an offshored job by the Home multinational is given by

$$w_{\mathrm{H},t}^{*} = \frac{(1-\eta^{*})\,\chi^{*}}{1-\eta^{*}\left(1-(1-\tau_{\mathrm{H},t}^{*n})q_{t}\right)} + \frac{\eta^{*}\left(f_{n_{\mathrm{H}}^{*},t}+(1-\tau_{\mathrm{H},t}^{*v})\gamma^{*}+(1-k^{f}(\theta_{\mathrm{H},t}^{*}))(1-\tau_{\mathrm{H},t}^{*v})\gamma^{*}\right)}{1-\eta^{*}\left(1-(1-\tau_{\mathrm{H},t}^{*n})q_{t}\right)} \tag{47}$$
$$+ \frac{\eta^{*}}{1-\eta^{*}\left(1-(1-\tau_{\mathrm{H},t}^{*n})q_{t}\right)}(1-\rho^{*})E_{t}\left[\Lambda_{t+1|t}\left(1-k^{f}(\theta_{\mathrm{H},t}^{*})\right)\left(1-k^{f}(\widetilde{\theta}_{\mathrm{H},t}^{*})\right)\mathbf{S}_{\mathrm{H},\mathbf{t+1}}^{*\mathbf{firms}}\right]$$
$$- \frac{1-\eta^{*}}{1-\eta^{*}\left(1-(1-\tau_{\mathrm{H},t}^{*n})q_{t}\right)}(1-\rho^{*})E_{t}\left[\Lambda_{t+1|t}^{*}(1-k^{w}(\theta_{\mathrm{H},t}^{*}))(1-k^{w}(\widetilde{\theta}_{\mathrm{H},t}^{*}))\mathbf{S}_{\mathrm{H},\mathbf{t+1}}^{*\mathbf{wor}\ker\mathbf{s}}\right]$$

2.6 Equilibrium

Taking as given the trade costs, Υ, and government policy, $\{\tau_{H,t}^{n},\ \tau_{H,t}^{*n},\ \tau_{H,t}^{v}$, and $\tau_{H,t}^{*v}\}$, a private sector equilibrium is made up of the endogenous processes $\{c_t,\ c_t^{*},\ p_{bt,t+1},\ p_{bt,t+1}^{*},\ r_{\mathrm{H},t}^{k},\ r_{\mathrm{H},t}^{k^{*}},\ r_{\mathrm{F},t}^{k^{*}},\ k_{\mathrm{H},t},\ k_{\mathrm{H},t}^{*},\ k_{\mathrm{F},t}^{*},\ w_{\mathrm{H},t},\ w_{\mathrm{H},t}^{*},\ w_{\mathrm{F},t}^{*},\ s_{\mathrm{H},t},\ s_{\mathrm{H},t}^{*},\ s_{\mathrm{F},t}^{*},\ \theta_{\mathrm{H},t},\ \theta_{\mathrm{H},t}^{*},\ \theta_{\mathrm{F},t}^{*},\ n_{\mathrm{H},t},\ n_{\mathrm{H},t}^{*},\ n_{\mathrm{F},t}^{*},\ V_{\mathrm{H},t},\ V_{\mathrm{H},t}^{*},\ V_{\mathrm{F},t}^{*},\ ne_{\mathrm{H},t},\ ne_{\mathrm{H},t}^{*},\ ne_{\mathrm{F},t}^{*},\ z_{\mathrm{H},t},\ z_{\mathrm{H},t}^{*},\ z_{\mathrm{F},t}^{*},\ \frac{1}{p_t},\ \frac{p_{\mathrm{F},t}^{*}}{p_t^{*}},\ q_t\}$ that satisfy: the risk sharing arrangement

$$q_t = \frac{u'(c_t)}{u^{*\prime}(c_t^{*})} \tag{48}$$

the definitions of the price indexes in the Home and Foreign country (2 equations); the Home Euler equation (**??**), and its Foreign counterpart (1 equation); the Home arbitrage condition given by equation (**??**) and its foreign counterparts (2 equations); optimal search behavior on the part of the Home household, represented by equation (7), and the Foreign counterparts (2 equations); optimal capital accumulation on the part of the Home firm, equations (23) and (24) and the Foreign counterpart (1 equation); optimal search behavior for the Home firm, equations (21) and (22), and the Foreign counterpart (1 equation); the wage equations, given by equations (**??**) through (44) in absence of the threat of offshoring and by equations (45) through 47) when the threat of offshoring is present; the laws of motion for vacancies and the free entry conditions, given by equations (33) through (38); the laws of motion for employment, given by (39) through (41); and the exogenous process for technology in each country;

$$z_{\mathrm{H},t} = \rho_z z_{\mathrm{H},t-1} + \varrho_t \tag{49}$$

$$z_{\mathrm{H},t}^{*} = \rho_z z_{\mathrm{H},t-1}^{*} + \varrho_t \tag{50}$$

$$z_{\mathrm{F},t}^{*} = \rho_z^{*} z_{\mathrm{F},t-1}^{*} + \varrho_t^{*} \tag{51}$$

Finally, we have the resource constraints for each of the two countries, which are given below for the Home and Foreign country, respectively.

$$f(z_{\mathrm{H},t}g(n_{\mathrm{H},t},k_{\mathrm{H},t}),(1-\tau)z_{\mathrm{H},t}^{*}g(n_{\mathrm{H},t}^{*},k_{\mathrm{H},t}^{*})) = \lambda\left(\frac{1}{p_t}\right)^{-\zeta}\left(c_t+\left(\frac{1}{q_t}\right)^{-\zeta}c_t^{*}\right) \tag{52}$$

$$+k_{\mathrm{H},t+1} - (1-\delta)k_{\mathrm{H},t} + \gamma_{\mathrm{H},t}v_{\mathrm{H},t} + \gamma^*_{\mathrm{H},t}v^*_{\mathrm{H},t} + V_{\mathrm{H},t}ne_{\mathrm{H},t} + V^*_{\mathrm{H},t}ne^*_{\mathrm{H},t}$$

$$\begin{aligned} f(z^*_t g(n^*_{\mathrm{F},t}, k^*_{\mathrm{F},t})) &= (1-\lambda)\left(\frac{p^*_{\mathrm{F},t}}{p^*_t}\right)^{-\zeta}\left(q_t^{-\zeta}c_t + c^*_t\right) + k^*_{\mathrm{F},t+1} - (1-\delta^*)k^*_{\mathrm{F},t} \\ &+ k^*_{\mathrm{H},t+1} - (1-\delta^*)k^*_{\mathrm{H},t} + \gamma^*_{\mathrm{F},t}v^*_{\mathrm{F},t} + V^*_{\mathrm{F},t}ne^*_{\mathrm{F},t} \end{aligned} \tag{53}$$

Note that the total cost of entry into each market shows up in the resource constraint.

All told, the system is 34 equations in 34 unknowns.

3 Quantitative Analysis

In this section, we derive a model-based estimate of the quantitative magnitude of the effect that the threat of offshoring has on global wages and labor market allocations. We begin with a description of the baseline parameterization and then present the main results.

3.1 Calibration

The parameter values used in the baseline model are summarized in Table 1. The Home country is calibrated to US data, where the existing labor search literature acts as a guide on parameter values. For the Foreign country, we mostly use Mexican data to guide our calibration. Our strategy is to parameterizethe foreign country so that its labor market is more rigid than the Home one. According to the OECD index of employment protection, this description would apply to the Mexican labor market relative to labor markets in the United States. In 2008, the OECD index ranked the US labor market as the most flexible of the 40 countries studied, with Mexico's labor market being ranked one of the most rigid.

Production. The functional form of the production function for the final good produced by the multinational is a CES aggregate of the domestic and offshored intermediate goods.

$$y_t = \left(\Gamma\left(y_{\mathrm{H},t}\right)^{\vartheta} + (1-\Gamma)\left(y^*_{\mathrm{H},t}\right)^{\vartheta}\right)^{\frac{1}{\vartheta}}$$

In contrast, Foreign final goods production is assumed to be linear, $y^*_t = z^*_{\mathrm{F},t}y^*_{\mathrm{F},t}$. For the multinational, we assume $\vartheta = 0$, so that production is a Cobb-Douglas aggregate of (imperfectly substitutable) domestic and offshored intermediate inputs. The share of domestically-produced inputs into final production of the multinational is set to $\Gamma = 0.99$, in line with the BEA's data on the sales of US multinationals' affiliates in Mexico back to their US parent companies as a ratio of the total sales of US parent companies.

Intermediate goods production is a Cobb-Douglas aggregate of capital and labor input for plants operated by the multinational (located domestically and abroad) and the Foreign firm, respectively.

$$y_{\mathrm{H},t} = z_{\mathrm{H},t} n_{\mathrm{H},t}^{\alpha} k_{\mathrm{H},t}^{1-\alpha} \qquad y_{\mathrm{H},t}^{*} = z_{\mathrm{H},t}^{*} n_{\mathrm{H},t}^{*\alpha} k_{\mathrm{H},t}^{*1-\alpha} \qquad y_{\mathrm{F},t}^{*} = z_{\mathrm{F},t}^{*} n_{\mathrm{F},t}^{*\alpha^{*}} k_{\mathrm{F},t}^{*1-\alpha^{*}}$$

Labor's share for the multinational is set to $\alpha = 0.7$, while intermediate goods production in the Foreign country is assumed to be more labor intensive, so that $\alpha^{*} = 0.85$. Note that we assume that plants operated by the multinational located in the Foreign country use capital more intensively than domestic plants operated by the Foreign firm.

With regard to technology, we assume that the level of aggregate technology is symmetric across the two countries, so that $z_{\mathrm{H}} = z_{\mathrm{H}}^{*} = z_{\mathrm{F}}^{*} = 1$. This contrasts with much of the literature on offshoring in which technological differences are the primary source of offshoring activity. Nonetheless, we impose this assumption in order to highlight the role of labor market institutions in driving the (intensive) offshoring decision and, hence, the main results in the paper.

Captial Accumulation. The rate of depreciation for capital in both the Home and Foreign country is $\delta = \delta^{*} = 0.02$.

Preferences. The model is calibrated to quarterly data, so we set the subjective discount factor to $\beta = \beta^{*} = 0.99$, yielding an annual real interest rate of about 4 percent.

The functional form for instantaneous utility is standard

$$u(c_t, lfp_t) = \frac{1}{1-\sigma} c_t^{1-\sigma} - \frac{\kappa}{1+1/\iota} lfp_t^{1+1/\iota} \tag{54}$$

where the risk aversion parameter is set to $\sigma = \sigma^{*} = 2$ for both the Home and Foreign household, consistent with much of the existing literature.

For the subutility function over participation, we introduce asymmetry to reflect differences in long run labor force participation rates observed across countries. We calibrate the Home country to US data; specifically, we set $\iota = 0.18$ following Arseneau and Chugh (2008) who showed that this value for the elasticity of labor force participation with respect to the real wage delivers participation dynamics over the business cycle that match the U.S. data. Similarly, the scale parameter is set to $\kappa = 18.6$ to deliver a steady-state participation rate of 66 percent in the US. For the Foreign country, we maintain a symmetric elasticity of participation, $\iota^{*} = 0.18$, under the assumption that the business cycle dynamics of participation do not differ much across countries. However, we introduce asymmetry into the scale parameter in order to deliver a lower participation rate in the Foreign country than in the US. We set $\kappa^{*} = 58.7$ to deliver a steady-state participation rate of 59.2 percent, which is the average in annual Mexican data (1980 to 2008) taken from the World Bank World Development Indictors (WDI).

The elasticity of substitution between Home and Foreign goods in the final consumption basket is symmetric across countries and set to $\zeta = \zeta^{*} = 0.5$. With regard to the weights of domestic and foreign goods in the final consumption good, λ and λ^* are chosen so that the import to GDP ratio is 12 and 26 percent in the Home and Foreign country, respectively. These numbers correspond to the average share of imports in GDP for the US and Mexico (1980 to 2010), respectively, taken from Haver Analytics.

Labor Markets. For each of the segmented labor markets (one in the Home country and two in the Foreign country) we assume a Cobb-Douglas matching function of the following general form:

$$m(s_t, v_t) = \psi s_t^{\xi} v_t^{1-\xi}$$

For the Home country, the elasticity of matches with respect to unemployed job seekers is set to $\xi = 0.50$, which is in the midpoint of estimates typically used in the literature and is in line with results reported in Petrongolo and Pissarides (2001). Following much of the existing literature, we impose symmetry between the elasticity of the matching function and the Home worker's bargaining power, so that $\eta = 0.5$. The job obsolescence rate is set to $\rho^o = 0.0075$ and the separation rate is set to $\rho^n = 0.017635$. Together these probabilities imply that the total job separation rate $\rho = \rho^o + (1 - \rho^o)\rho^n = 0.025$, which is in line with Shimer (2005) who calculates the average duration of a job to be two-and-a-half years. Matching efficiency in the Home country, $\psi = 0.56$, is chosen so that the quarterly job-filling rate of a vacancy is 90 percent, in line with Andolfatto (1990). We set the cost of posting a vacancy to target a steady state level of market tightness in the home country of $\theta_{\mathrm{H},t} = 0.3$ which is a touch below the the measure obtained from JOLTS data. The resulting value is $\gamma_{\mathrm{H}} = 3.47$. Finally, we calibrate the worker's outside option in the Home country to 40 percent of the wages of employed individuals in the Home household, implying a value of $\chi = 0.379$. The resulting implied aggregate unemployment rate for the Home country in our baseline calibration is roughly 6.5 percent.

For Foreign country, there is little in the way of data to guide us in calibrating the labor market of the countries to which the U.S. primarily offshores. In light of this our strategy is as follows. We impose cross-country symmetry in the matching elasticity parameter, so $\xi^* = \xi = 0.5$, the average duration of a job, so that $\rho^{*o} = \rho^o$, $\rho^{*n} = \rho^n$, and the job filling probabilities, so that $\gamma_{\mathrm{F}}^* = 5.45$ and $\gamma_{\mathrm{H}}^* = 4.40$ implying $k_{\mathrm{F}}^* = k_{\mathrm{H}}^* = 0.9$. We then introduce asymmetry aimed at capturing the general perception that that the countries to which the US offshores have labor markets that are more frictional.

First, workers in the Foreign country are assumed to have *less bargaining power* in wage negotiations relative to US workers, so that $\eta^* = 0.25$. Next, we calibrate matching efficiency in the market for domestic and offshore jobs to hit an unemployment rate of 12 percent, the average level of Mexican unemployment using data from the WDI. The resulting values are $\psi_{\mathrm{H}}^* = \psi_{\mathrm{F}}^* = 0.40$. Finally, we assume that the US is more generous in its provision of unemployment benefits relative to a country such as Mexico. Accordingly we calibrate χ^* to a replacement rate of 20 percent of the wages of employed individuals. The resulting value is $\chi^* = 0.18$.

Trade Costs. We assume that there are no trade costs in the baseline calibration, so that $\tau = \tau^* = 0$.

3.2 Main Result

The main results are presented in Table 2. For each variable of interest, the first two columns of numbers present steady state prices and allocations for the economy in which offshoring *is used as a threat* in wage negotiations for the Home and Foreign country, respectively. The third and fourth columns present similar numbers for the economy in which outsourcing *is not used as a threat.* Finally, the last two columns in the table show the percentage difference in each variable when moving from the "no threat" to the "threat" economy.

There are two things that stand out about the baseline economy in which offshoring is used as a threat in wage negotiations. First, there are differences in wages across countries despite the fact that the two counties have similar levels of steady state technology. In particular, when converted into common currency units, workers in the country with the country with relatively smaller labor market frictions—the Home country in the Baseline calibration—earn a wage that is roughly 25 percent higher ($w_{\mathrm{H},t}/(q_t w^*_{\mathrm{H},t}) = 1.25$). While a higher wage paid by multinationals for domestic relative to offshored workers is qualitatively consistent with data from the BLS, quantitatively our estimate is smaller than that observed in the actual data. (The data show that domestic workers earn four times the wage of foreign workers in offshored jobs.) Thus, there is room for improvement in the model along this dimension.

Intuitively, the reason for this is relatively-straight forward when the fact that job creation itself is a fundamental part of the production technology is taken into account.[5] Thus, despite similarities across the two countries in the technology for transforming labor input into the final good, owing to the smaller labor market frictions the Home country is more efficient at generating labor matches in the first place. In this sense, the Home country enjoys a technological advantage in transforming leisure into final output, hence it's workers enjoy a higher wage.

The second thing to notice is that the Home country enjoys a terms of trade advantage over the Foreign country. This owes in part to home bias in the utility function for domestically produced goods, but it also reflects differences in real labor market frictions across the two countries.

We turn now to the main results of the paper concerning the effect of the threat of offshoring on global wages and labor market allocations. As shown in the two right-hand columns in the top panel of the table, there is an asymmetric effect on aggregate wages across the two countries.[6] The

[5] This point is made clearly in Arseneau and Chugh (2009), in which the authors define a search-based notion of the marginal rate of transformation in a general equilibrium search model.

[6] The aggregate wage is an average of the wages in the market for domestic and offshored jobs, weighted by the

treat of offshoring depresses the aggregate wage in the source country by roughly 6-1/4 percent, while it boosts aggregate wages in the recipient country by about 7-1/2 percent.

In terms of thinking about implications for global labor market allocations, households in the Home country respond to the lower wage by reducing labor force participation. In contrast, the multinational firm redirects search activity toward the domestic labor market in order to take advantage of the lower wage. Hence, domestic job creation increases. The end result is that the drop in labor force participation is primarily accommodated by movements from search activity into leisure so that the unemployment rate declines. Our baseline estimate reveals that the threat of offshoring reduces aggregate unemployment in the source country by about 4-1/4 percentage points relative to an economy in which the threat of offshoring does not factor into wage negotiations. Despite the lower wage, the increase in employment boosts household income allowing consumption in the Home country to rise by about 3/4 percent.

For the recipient country, the higher wage induces more labor force participation on the part of the Foreign household and reduces search activity of both the multinational and the Foreign firm. Accordingly, job creation in the Foreign economy declines pushing the unemployment rate up 2-3/4 percentage points. Increases from the higher wage more than offsets the loss in household income from higher unemployment, resulting in a modest increase in consumption.

In summary, the response of global wages to the threat of offshoring in our model confirms general intuition: the wages of workers in the source country fall while the wages of workers in the recipient country rise. However, the results with respect to global labor market allocations are less intuitive. We find that, contrary to popular opinion, the threat of offshoring actually boosts employment it the source country and reduces employment in the recipient country.

3.3 Welfare Costs

We measure the welfare costs of exploiting the threat of offshoring in wage negotiations as the percent increase in steady state consumption that the household would require in order to be as well off in utility terms as under the allocation that obtains when offshoring cannot be used as a threat in wage negotiations. In order to do this, however, we need to account for distortions introduced into the labor markets across the two countries given our calibration. We do this by first calculating the welfare costs associated with the allocations that prevail under the threat of offshoring relative to the socially efficient allocation. We then calculate the welfare costs associated with the allocations that prevail in absence of the threat of offshoring again relative to the socially efficient allocation and then subtract the two. The resulting measure reveals the percent of steady

relative size of each labor market in aggregate employment.

state consumption that the representative agent requires in order to be indifferent to whether or not the threat of offshoring is used in wage negotiations, controlling for any fundamental distortions introduced through the choice of calibrated parameters.

In terms of notation, for the Home country let $\widetilde{U}$ be utility for the Home household under the reference allocation – that is, the allocation that obtains in the solution to the social planners problem. Let c^{Threat} and lfp^{Threat} denote allocations that obtain in the "threat" economy. Our measure of the welfare cost of the allocation under the threat of offshoring relative to the allocations under the social planners problem is given by ω^{Threat}, which is implicitly defined as that which solves the following

$$u\left((1+\omega^{Threat}/100)c^{Threat}, lfp^{Threat}\right) = \widetilde{U}$$

Thus, ω^{Threat} can interpreted as the percent increase in steady state consumption that would be required to make the Home household exactly indifferent to the allocation that prevails when the threat of offshoring is used in wage negotiations and the socially efficient allocation. A similar equation defines the welfare cost, $\omega^{*Threat}$, for the Foreign household.

Similarly, let $c^{NoThreat}$ and $lfp^{NoThreat}$ denote allocations that obtain in the "no threat" economy. Our measure of the welfare cost of the allocation in absence of the threat of offshoring is given by $\omega^{NoThreat}$, which is implicitly defined as that which solves the following

$$u\left((1+\omega^{NoThreat}/100)c^{NoThreat}, lfp^{NoThreat}\right) = \widetilde{U}$$

A similar equation defines the welfare cost, $\omega^{*NoThreat}$, for the Foreign household.

Our measure of the welfare cost of the threat of offshoring is then defined for the Home household as: $\omega = \omega^{NoThreat} - \omega^{Threat}$. Similarly,we define the welfare cost for the Foreign household in a similar manner as $\omega^* = \omega^{*NoThreat} - \omega^{*Threat}$.

Under the baseline calibration, we find $\omega = 1.49$ and $\omega^* = 1.27$. In other words, the Home and Foreign household are both better off as a result of the threat of offshoring. Moreover, for the Home economy the welfare gains due to the threat of offshoring are an order of magnitude larger than typical estimates of the welfare costs of business cycles. The gains are similar for the Foreign household.

4 Conclusion

We developed a two-country labor search model to assess the role of the threat of offshoring for global wages and labor market allocations. Our model features a multinational firm in the Home country that operates both domestic and foreign production plants, so that the parent company can shift production from the domestic country to foreign affiliates. Foreign firms produce only domestically. Regardless of where it produces, each firm must hire labor in a frictional labor market; labor market frictions, in turn, give rise to an explicit role for bargaining in the wage formation process. We exploit this feature of the model to assess how the threat of offshoring influences wage formation and the resulting implications for global labor market allocations. To model the threat of offshoring we allow for a sequential bargaining problem in which bargaining over the wage in the market for domestic labor relationships takes place prior to bargaining over the wage in offshored jobs. In this sequential setup, multinational firms exploit the outside option of walking away from a match and instead shifting production across boarders to influence the bargained wage.

Our main finding is that the threat of offshoring has a quantitatively significant effect both on global wages as well as global labor market allocations that generate significant welfare effects in both countries. Specifically, we find that the use of the threat of offshoring in wage negotiations depresses bargained wages in the source country and boosts bargained wages in the recipient country relative to an outcome in which the threat of offshoring is not used as an outside option in wage negotiations. While consumption is higher in both countries, the lower bargained wage reduces unemployment in the source country. In contrast, the higher bargained wage raises unemployment in the recipient country. We find that the relatively large effects occur despite the fact the the existing amount of offshoring is calibrated to be small in our model economy.

References

ANDOLFATTO, DAVID. 1996. "Business Cycles and Labor-Market Search." *American Economic Review,* Vol. 86, pp. 112-132.

ARSENEAU, DAVID M., AND SANJAY CHUGH. 2008. "Tax Smoothing with Frictional Labor Markets ." Federal Reserve Board of Governors IFDP 965.

BURSTEIN, ARIEL, CHRISTOPHER KURZ, AND LINDA TESAR. 2008. "Trade, Production Sharing, and the International Transmission of Business Cycles." *Journal of Monetary Economics,* Vol. 55, pp. 775-795.

DAVIDSON, CARL, LAWRENCE MARTIN, AND STEVEN MATUSZ . 1999. "Trade and Search Generated Unemployment." *Journal of International Economics,* Vol. 48, pp. 271-299.

DAVIS, STEVEN J, R. JASON FABERMAN, AND JOHN HALTIWANGER. 2006. "The Flow Approach to Labor Markets: New Data Sources and Micro-Macro Links." *Journal of Economic Perspectives,* Vol. 20, pp. 3-26.

DUTT, PUSHAN, DIVASHISH MITRA, AND PRIYA RANJAN. 2009. "International Trade and Unemployment: Theory and Cross-National Evidence." *Journal of International Economics,* Vol. 78(1), pp. 32-44.

ECKEL, CARSTEN, AND HARTMUT EGGER. 2009. "Wage Bargaining and Multinational Firms." *Journal of International Economics,* Vol. 77, pp. 206-214.

FELBERMAYR, G., JULIEN PRAT, AND HANS-JORGE SCHMERER. 2010. "Globalization and Labor Market Outcomes: Wage Bargaining, Search Frictions, and Firm Heterogeneity ." IZA Discussion Paper No. 3363.

FUJITA, SHIGERU, AND GARY RAMEY. 2007. "Job Matching and Propagation." *Journal of Economic Dynamics and Control,* Vol. 31 (11), pp. 3671-3698.

HALL, ROBERT E., AND PAUL MILGROM. 2008. "The Limited Influence of Unemployment on the Wage Bargain." *American Economic Journal* , Vol. 98(4), pp. 1653-1674.

HELPMAN, ELHANAN, AND OLEG ITSKHOKI. "Labor Market Rigidities, Trade, and Unemployment." *Review of Economic Studies,* Forthcoming.

HELPMAN, ELHANAN, OLEG ITSKHOKI AND STEPHEN REDDING. "Unequal Effects of Trade on Workers with Different Abilities." *Journal of the European Economic Association,* Forthcoming.

HELPMAN, ELHANAN, OLEG ITSKHOKI AND STEPHEN REDDING. "Inequality and Unemployment in a Global Economy." *Econometrica,* Forthcoming.

LACHOWSKA, MARTA. 2010. "The Importance of Outside Options for Wage Formation: Survey Evidence ." Stockholm University Working Paper

MERZ, MONIKA. 1995. "Search in the Labor Market and the Real Business Cycle." *Journal of Monetary Economics,* Vol. 36, pp. 269-300.

Mitra, Divashish and Priya Ranjan. “Offshoring and Unemployment: The Role of Search Frictions and Labor Mobility." *Journal of International Economics,* Forthcoming.

Pissarides, Christopher. 2000. *Equilibrium Unemployment Theory* .MIT Press.

A Details of the Household Problem

We describe the details of the Home household and the Foreign household in the following two subsections.

A.1 Home Households

The household in the Home country searches in a domestic labor market for jobs operated domestically by the multinational. The Home household's problem is to choose sequences of c_t, $k_{\mathrm{H},t+1}$, b_{t+1}, $s_{\mathrm{H},t}$, and $n_{\mathrm{H},t+1}$ to maximize:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[u(c_t) - h\left(s_{\mathrm{H},t} + n_{\mathrm{H},t}\right)\right]$$

subject to:

$$p_t c_t + p_t\left(k_{\mathrm{H},t+1} - (1-\delta)k_{\mathrm{H},t}\right) + \int p_{bt,t+1} b_{t+1} = w_{\mathrm{H},t} n_{\mathrm{H},t} + r^k_{\mathrm{H},t} k_{\mathrm{H},t} + s_{\mathrm{H},t}\chi + b_t + d_t$$

$$n_{\mathrm{H},t+1} = (1-\rho)n_{\mathrm{H},t} + s_{\mathrm{H},t} k^w(\theta_{\mathrm{H},t})$$

Let λ_t denote the multiplier on the budget constraint and μ_t denote the multiplier on the law of motion for domestic jobs. The first order conditions with respect to c_t, $k_{\mathrm{H},t+1}$, b_{t+1}, $s_{\mathrm{H},t}$, and $n_{\mathrm{H},t+1}$ are:

$$u'(c_t) - p_t \lambda_t = 0 \tag{55}$$

$$-\lambda_t + \beta E_t (1 - \delta + r^k_{\mathrm{H},t+1})\lambda_{t+1} = 0 \tag{56}$$

$$-\lambda_t p_{bt,t+1} + \beta E_t \lambda_{t+1} = 0 \tag{57}$$

$$-h'\left(s_{\mathrm{H},t} + n_{\mathrm{H},t}\right) + \lambda_t \chi + \mu_t k^w(\theta_{\mathrm{H},t}) = 0 \tag{58}$$

$$-\beta E_t h'\left(s_{\mathrm{H},t+1} + n_{\mathrm{H},t+1}\right) + \beta E_t \lambda_{t+1} w_{\mathrm{H},t+1} - \mu_t + \beta(1-\rho)E_t \mu_{t+1} = 0 \tag{59}$$

Combining equations 55 and 57 yields a standard consumption Euler equation

$$\frac{u'(c_t)}{p_t} = \beta E_t \left[\frac{1}{p_{bt,t+1}} \frac{u'(c_{t+1})}{p_{t+1}}\right]$$

where we define $\Lambda_{t+1|t} = \beta E_t \left[\frac{u'(c_{t+1})}{u'(c_t)} \frac{p_t}{p_{t+1}}\right]$.

Combining 55, 57, and 56 yields the no arbitrage condition between capital and bonds

$$\frac{1}{p_{bt,t+1}} = E_t (1 - \delta + r^k_{\mathrm{H},t+1})$$

In order to derive the optimal search conditions, solve equation 58 for μ_t to get

$$\mu_t = \frac{1}{k^w(\theta_{\mathrm{H},t})}\left[h'_t(s_{\mathrm{H},t} + n_{\mathrm{H},t}) - \chi\lambda_t\right]$$

We can now use this expression in equation 59 to get

$$\left(\frac{1}{k^w(\theta_{\mathrm{H},t})}\right)\left(h'\left(s_{\mathrm{H},t}+n_{\mathrm{H},t}\right)-\chi\lambda_t\right)=\beta E_t\left[w_{\mathrm{H},t+1}\lambda_{t+1}-h'\left(s_{\mathrm{H},t+1}+n_{\mathrm{H},t+1}\right)+(1-\rho)E_t\mu_{t+1}\right]$$

Using the fact that $\lambda_t = u'_t/p_t$ This equation can be re-expressed as

$$\frac{h'(lfp_t)-\chi\frac{u'(c_t)}{p_t}}{k^w(\theta_{\mathrm{H},t})\frac{u'(c_t)}{p_t}}=E_t\left[\Lambda_{t+1|t}\left(w_{\mathrm{H},t+1}-\frac{h'(lfp_{t+1})}{\frac{u'(c_{t+1})}{p_{t+1}}}+(1-\rho)\frac{h'(lfp_{t+1})-\chi\frac{u'(c_{t+1})}{p_{t+1}}}{k^w(\theta_{\mathrm{H},t+1})\frac{u'(c_{t+1})}{p_{t+1}}}\right)\right]$$

which is equation 7 in the main text.

A.2 Foreign Households

The household in the Foreign country searches in two differentiated labor markets: one for jobs operated by domestic firms and one for offshored jobs operated by the Home multinational. The Foreign household's problem is to choose sequences of c^*_t, k^*_{t+1}, b^*_{t+1}, $s^*_{\mathrm{H},t}$, $s^*_{\mathrm{F},t}$, $n^*_{\mathrm{H},t+1}$, and $n^*_{\mathrm{F},t+1}$ to maximize:

$$E_0\sum_{t=0}^{\infty}\beta^t\left[u^*(c^*_t)-h^*\left(s^*_{\mathrm{H},t}+s^*_{\mathrm{F},t}+n^*_{\mathrm{H},t}+n^*_{\mathrm{F},t}\right)\right]$$

subject to:

$$p^*_tc^*_t+k^*_{t+1}-(1-\delta)k^*_t+\int p_{bt,t+1}b^*_{t+1}=w^*_{\mathrm{H},t}n^*_{\mathrm{H},t}+w^*_{\mathrm{F},t}n^*_{\mathrm{F},t}+r^{*k}_tk^*_t+\left(s^*_{\mathrm{H},t}+s^*_{\mathrm{F},t}\right)\chi^*+b^*_t+d^*_t$$

$$n^*_{\mathrm{H},t+1}=(1-\rho^*)n^*_{\mathrm{H},t}+\left(1-k^w(\theta^*_{\mathrm{F},t})\right)k^w(\widetilde{\theta}^*_{\mathrm{H},t})s^*_{\mathrm{F},t}+\left(k^w(\theta^*_{\mathrm{H},t})+\left(1-k^w(\theta^*_{\mathrm{H},t})\right)k^w(\widetilde{\theta}^*_{\mathrm{H},t})\right)s^*_{\mathrm{H},t}$$

$$n^*_{\mathrm{F},t+1}=(1-\rho^*)n^*_{\mathrm{F},t}+k^w(\theta^*_{\mathrm{F},t})s^*_{\mathrm{F},t}$$

The household efficiency conditions are given by

$$\frac{u^{*\prime}(c^*_t)}{p^*_t}=\beta E_t\left[\frac{1}{p_{bt,t+1}}\frac{u^{*\prime}(c^*_{t+1})}{p^*_{t+1}}\right]$$

$$\frac{1}{p_{bt,t+1}}=E_t(1-\delta^*+r^{*k}_{t+1})$$

$$\frac{h^{*\prime}(lfp^*_t)-\chi^*\frac{u^{*\prime}(c^*_t)}{p^*_t}}{k^w(\theta^*_{\mathrm{H},t})\frac{u^{*\prime}(c^*_t)}{p^*_t}}=E_t\left[\Lambda^*_{t+1|t}\left(w^*_{\mathrm{H},t}-\frac{h^{*\prime}(lfp^*_{t+1})}{\frac{u^{*\prime}(c^*_{t+1})}{p^*_{t+1}}}+(1-\rho^*)\frac{\mu^*_{h,t+1}}{\frac{u^{*\prime}(c^*_{t+1})}{p^*_{t+1}}}\right)\right]$$

and

$$\frac{h^{*\prime}(lfp^*_t)-\chi^*\frac{u^{*\prime}(c^*_t)}{p^*_t}}{k^w(\theta^*_{\mathrm{F},t})\frac{u^{*\prime}(c^*_t)}{p^*_t}}=E_t\left[\Lambda^*_{t+1|t}\left(w^*_{\mathrm{F},t+1}-\frac{h^{*\prime}(lfp^*_{t+1})}{\frac{u^{*\prime}(c^*_{t+1})}{p^*_{t+1}}}+(1-\rho^*)\frac{\mu^*_{f,t+1}}{\frac{u^{*\prime}(c^*_{t+1})}{p^*_{t+1}}}\right)\right]$$

B Details of the Firm Problem

We describe the details of the Home multinational firm and the Foreign firm in the following two subsections.

B.1 The Home Multinational

The multinational firm in the Home country uses both domestic and foreign labor and capital inputs to produce through the production function $f(y^i_{h,t}, (1-\tau)y^{*i}_{h,t})$. When the multinational offshores production to the foreign country it must incur an iceburg cost, $0 \leq \tau \leq 1$, which represents the fraction of production abroad that is lost in transforming it into the final good.

In this setup, the multinational chooses sequences of vacancy postings in each of the two distinctive labor markets to hit a target level of production domestically and abroad in order to maximize discounted lifetime profits subject to the production technology and the respective laws of motion for employment. We assume the Home multinational deflates profits by the domestic CPI, p_t, in the Home country.

$$\Pi_t = \sum_{t=0}^{\infty} \beta^t \frac{\lambda_t}{\lambda_0} \qquad [f(y_{\mathrm{H},t}, (1-\Upsilon)y^*_{\mathrm{H},t}) - (1-\tau^n_{H,t})w_{\mathrm{H},t}n_{\mathrm{H},t} - (1-\tau^{*n}_{H,t})q_t w^*_{\mathrm{H},t}n^*_{\mathrm{H},t}$$
$$-r^k_{\mathrm{H},t}k_{\mathrm{H},t} - q_t r^{k*}_{\mathrm{H},t}k^*_{\mathrm{H},t} - (1-\tau^v_{H,t})\gamma_{\mathrm{H}}v_{\mathrm{H},t} - (1-\tau^{*v}_{H,t})\gamma^*_{\mathrm{H}}v^*_{\mathrm{H},t}]$$

subject to:

$$y_{\mathrm{H},t} = z_{\mathrm{H},t}g(n_{\mathrm{H},t}, k_{\mathrm{H},t})$$

$$y^*_{\mathrm{H},t} = z^*_{\mathrm{H},t}g(n^*_{\mathrm{H},t}, k^*_{\mathrm{H},t})$$

$$n_{\mathrm{H},t+1} = (1-\rho)n_{\mathrm{H},t} + v_{\mathrm{H},t}k^f(\theta_{\mathrm{H},t})$$

$$n^*_{\mathrm{H},t} = (1-\rho^*)n^*_{\mathrm{H},t} + (1-k^f(\theta_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})v_{\mathrm{H},t} + \left(k^f(\theta^*_{\mathrm{H},t}) + (1-k^f(\theta^*_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})\right)v^*_{\mathrm{H},t}$$

Associate the multipliers $\mu_{\mathrm{H},t}$, and $\mu^*_{\mathrm{H},t}$ to the Home and offshored employment constraints, respectively. The first-order conditions with respect to $v_{\mathrm{H},t}$, $n_{\mathrm{H},t}$, $k_{\mathrm{H},t}$, $v^*_{\mathrm{H},t}$, $n^*_{\mathrm{H},t}$, and $k^*_{\mathrm{H},t}$, respectively, are

$$\mu_{\mathrm{H},t} = \frac{(1-\tau^v_{H,t})\gamma - \mu^*_{\mathrm{H},t}(1-k^f(\theta_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})}{k^f(\theta_{\mathrm{H},t})} \tag{60}$$

$$\mu_{\mathrm{H},t} = E_t\left[\Lambda_{t+1|t}\left(f_{n_{\mathrm{H}},t+1} - (1-\tau^n_{H,t+1})w_{\mathrm{H},t+1} + (1-\rho)\mu_{\mathrm{H},t+1}\right)\right] \tag{61}$$

$$f_{k_{\mathrm{H}},t} = r^k_{\mathrm{H},t} \tag{62}$$

$$\mu^*_{\mathrm{H},t} = \frac{(1-\tau^{*v}_{H,t})\gamma^*}{\left(k^f(\theta^*_{\mathrm{H},t}) + (1-k^f(\theta^*_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})\right)} \tag{63}$$

$$\mu^*_{\mathrm{H},t} = E_t\left[\Lambda_{t+1|t}\left(f_{n^*_{\mathrm{H}},t+1} - (1-\tau^{*n}_{H,t+1})q_{t+1}w^*_{\mathrm{H},t+1} + (1-\rho^*)\mu^*_{\mathrm{H},t+1}\right)\right] \tag{64}$$

$$f_{k^*_{\mathrm{H}},t} = r^{k*}_{\mathrm{H},t} \tag{65}$$

Combining the optimality conditions 60 and 61 yields the job creation condition for the creation of domestic jobs,

$$\frac{(1-\tau^v_{H,t})\gamma - \mu^*_{\mathrm{H},t}(1-k^f(\theta_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})}{k^f(\theta_{\mathrm{H},t})} = E_t\left[\Lambda_{t+1|t}\left(\begin{array}{c} f_{n_{\mathrm{H}},t+1} - (1-\tau^n_{\mathrm{H},t+1})w_{\mathrm{H},t+1} \\ +(1-\rho)\left(\frac{(1-\tau^v_{H,t+1})\gamma - \mu^*_{\mathrm{H},t+1}(1-k^f(\theta_{\mathrm{H},t+1}))k^f(\widetilde{\theta}^*_{\mathrm{H},t+1})}{k^f(\theta_{\mathrm{H},t+1})}\right)\end{array}\right)\right] \tag{66}$$

Similarly, combining the optimality conditions 63 and 64 yields the optimal off-shoring condition

$$\frac{(1-\tau^{*v}_{H,t})\gamma^*}{\left(k^f(\theta^*_{\mathrm{H},t}) + (1-k^f(\theta^*_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})\right)} = E_t\left[\Lambda_{t+1|t}\left(\begin{array}{c} f_{n^*_{\mathrm{H}},t+1} - (1-\tau^{*n}_{\mathrm{H},t+1})q_{t+1}w^*_{\mathrm{H},t+1} \\ +(1-\rho^*)\frac{(1-\tau^{*v}_{H,t+1})\gamma^*}{\left(k^f(\theta^*_{\mathrm{H},t+1}) + (1-k^f(\theta^*_{\mathrm{H},t+1}))k^f(\widetilde{\theta}^*_{\mathrm{H},t+1})\right)}\end{array}\right)\right]. \tag{67}$$

B.2 The Foreign Firm

The firm in the Foreign country uses only domestic labor to produce through the production function $f(n^*_{f,t}, k^*_t)$. The foreign firm chooses sequences of vacancy postings in the domestic labor market to hit a target level of production in order to maximize discounted lifetime profits subject to the production technology and the law of motion for domestic employment.

$$\Pi^*_{it} = \sum_{t=0}^{\infty} \beta^{*t}\frac{\lambda^*_t}{\lambda^*_0}\left[f(y^*_{\mathrm{F},t}) - w^*_{\mathrm{F},t}n^*_{\mathrm{F},t} - r^{k*}_{\mathrm{F},t}k^*_{\mathrm{F},t} - \gamma^*_{\mathrm{F}}v^*_{\mathrm{F},t}\right]$$

subject to:

$$y^*_{\mathrm{F},t} = z^*_{\mathrm{F},t}g(n^*_{\mathrm{F},t}, k^*_{\mathrm{F},t})$$

$$n^*_{\mathrm{F},t+1} = (1-\rho^*)n^*_{\mathrm{F},t} + v^*_{\mathrm{F},t}k^f(\theta^*_{\mathrm{F},t})$$

The foreign firms job creation curve is given by

$$\frac{\gamma^*}{k^f(\theta^*_{\mathrm{F},t})} = E_t\left[\Lambda^*_{t+1|t}\left(f_{n^*_{\mathrm{F}},t+1} - w^*_{\mathrm{F},t+1} + (1-\rho^*)\frac{\gamma^*}{k^f(\theta^*_{\mathrm{F},t+1})}\right)\right]$$

The capital demand equation is given by

$$f_{k^*_{\mathrm{F}},t} = r^{k*}_{\mathrm{F},t}$$

C Sequential Wage Bargaining

C.1 Value Functions

C.1.1 Households

Let $\mathbf{W}_{\mathrm{H},\mathbf{t}}$ be the value to a worker of a domestic job and let $\mathbf{U}_{\mathrm{H},\mathbf{t}}$ be the value of unemployment. Define the value of a domestic job to a domestic worker, $\mathbf{W}_{\mathrm{H},\mathbf{t}}$, as

$$\mathbf{W}_{\mathrm{H},\mathbf{t}} = w_{\mathrm{H},\mathbf{t}} - \frac{h'(lfp_t)}{u'(c_t)/p_t} + E_t\left[\Lambda_{t+1|t}\left((1-\rho)\mathbf{W}_{\mathrm{H},\mathbf{t+1}} + \rho\mathbf{U}_{\mathrm{H},\mathbf{t+1}}\right)\right]$$

which says that the value of work in the domestic job market is the wage the worker earns from supplying domestic labor to the domestic firm net of the disutility of labor effort plus the continuation value of being in an employment relationship with a domestic firm. The continuation value takes into account the fact that the job may or may not survive exogenous job destruction in order to continue producing tomorrow. If the job does survive it brings in continuation value $\mathbf{W}_{\mathrm{H},\mathbf{t+1}}$, but if it does not the worker will receive continuation value $\mathbf{U}_{\mathbf{t+1}}$, which is the value of unemployment at the beginning of period $t+1$.

Define the value of unemployment in the beginning of the period, $\mathbf{U}_{\mathbf{t}}$, as

$$\mathbf{U}_{\mathrm{H},\mathbf{t}} = \chi - \frac{h'(lfp_t)}{u'(c_t)/p_t} + E_t\left[\Lambda_{t+1|t}\left((1-\rho)k^w(\theta_{\mathrm{H},\mathbf{t}})\mathbf{W}_{\mathrm{H},\mathbf{t+1}} + \left(1-k^w(\theta_{\mathrm{H},\mathbf{t}})(1-\rho)\right)\mathbf{U}_{\mathrm{H},\mathbf{t+1}}\right)\right] \tag{68}$$

which says that with probability $k^w(\theta_{\mathrm{H},\mathbf{t}})$ the worker gets a job today. If he does get a job today he receives the unemployment benefit and suffers disutility of search, before getting the continuation value of the job tomorrow, provided it survives to produce. On the other hand, if the worker doesn't get a job today, he gets the continuation value of unemployment tomorrow.

The definitions of the value functions for the Foreign worker are a bit different due to the sequential nature of search. Let $\mathbf{W}^*_{\mathrm{F},\mathbf{t}}$ be the value to a worker of a domestic job and let $\mathbf{U}^*_{\mathrm{F},\mathbf{t}}$ be the value of not making a match in the marker for domestic jobs. Define the value of a domestic job to a domestic worker, $\mathbf{W}^*_{\mathrm{F},\mathbf{t}}$, as

$$\mathbf{W}^*_{\mathrm{F},\mathbf{t}} = w^*_{\mathrm{F},\mathbf{t}} - \frac{h'(lfp^*_t)}{u'(c^*_t)/p^*_t} + E_t\left[\Lambda^*_{t+1|t}\left((1-\rho^*)\mathbf{W}^*_{\mathrm{F},\mathbf{t+1}} + \rho^*\mathbf{U}^*_{\mathrm{F},\mathbf{t+1}}\right)\right]$$

which has a similar interpretation as above.

Define the value of unsuccessful search in the market for domestic jobs, $\mathbf{U}^*_{\mathbf{f},\mathbf{t}}$, as

$$\begin{aligned}\mathbf{U}^*_{\mathrm{F},\mathbf{t}} &= k^w(\theta^*_{\mathrm{F},\mathbf{t}})\left(\chi^* - \frac{h'(lfp^*_t)}{u'(c^*_t)/p^*_t} + E_t\left[\Lambda^*_{t+1|t}\left((1-\rho^*)\mathbf{W}^*_{\mathrm{F},\mathbf{t+1}} + \rho^*\mathbf{U}^*_{\mathrm{F},\mathbf{t+1}}\right)\right]\right) \\ &+ \left(1-k^w(\theta^*_{\mathrm{F},\mathbf{t}})\right)\left(\mathbf{1}[\mathbf{SB}]\widetilde{\mathbf{U}}^*_{\mathrm{H},\mathbf{t}} + (1-\mathbf{1}[\mathbf{SB}])\left(\chi^* - \frac{h'(lfp^*_t)}{u'(c^*_t)/p^*_t} + E_t\left[\Lambda^*_{t+1|t}\mathbf{U}^*_{\mathrm{F},\mathbf{t+1}}\right]\right)\right)\end{aligned} \tag{69}$$

where $\mathbf{1}[\mathbf{SB}]$ is an indicator variable that takes on the value of one if there is sequential bargaining and is zero under simultaneous bargaining. Notice that under sequential bargaining if the foreign worker looses a job at the beginning of the period he/she can immediately begin searching in the market for domestic jobs at the beginning of the next period and therefore get the value of search in the offshore labor market.

Let $\mathbf{W}^*_{\mathrm{H},\mathbf{t}}$ be the value to a Foreign worker of a job with the multinational firm and let $\mathbf{U}^*_{\mathrm{H},\mathbf{t}}$ be the value of unsuccessful search in the market for offshored jobs. Define the value of an offshored job to a Foreign worker, $\mathbf{W}^*_{\mathrm{H},\mathbf{t}}$, as

$$\mathbf{W}^*_{\mathrm{H},\mathbf{t}} = w^*_{\mathrm{H},\mathbf{t}} - \frac{h'(lfp^*_t)}{u'(c^*_t)/p^*_t} + E_t\left[\Lambda^*_{t+1|t}\left((1-\rho^*)\mathbf{W}^*_{\mathrm{H},\mathbf{t+1}} + \rho^*\left(\mathbf{1}[\mathbf{SB}]\mathbf{U}^*_{\mathrm{F},\mathbf{t+1}} + (1-\mathbf{1}[\mathbf{SB}])\mathbf{U}^*_{\mathrm{H},\mathbf{t+1}}\right)\right)\right]$$

Finally, define the value of unsuccessful search in the market for offshored jobs in the evening, $\widetilde{\mathbf{U}}^*_{\mathrm{H},t}$, as

$$\begin{aligned}\widetilde{\mathbf{U}}^*_{\mathrm{H},t} &= \chi^* - \frac{h'(lfp^*_t)}{u'(c^*_t)/p^*_t} + k^w(\widetilde{\theta}^*_{\mathrm{H},t})E_t\left[\Lambda^*_{t+1|t}\left((1-\rho^*)\mathbf{W}^*_{\mathrm{H},t+1}\right)\right] \\ &+ \left(1-(1-\rho^*)k^w(\widetilde{\theta}^*_{\mathrm{H},t})\right)E_t\left[\Lambda^*_{t+1|t}\mathbf{U}^*_{\mathrm{F},\mathbf{t+1}}\right]\end{aligned} \tag{70}$$

Under sequential bargaining the Foreign household can use the possibility of finding work with the multinational firm as a threat in negotiating wages with the domestic firm. With simultaneous bargaining this outside option is shut down.

The value of being unemployed in the day's market for offshored jobs is:

$$\mathbf{U}^*_{\mathrm{H},\mathbf{t}} = \chi^* - \frac{h'(lfp^*_t)}{u'(c^*_t)/p^*_t} + k^w(\theta^*_{\mathrm{H},\mathbf{t}})E_t\left[\Lambda^*_{t+1|t}\left((1-\rho^*)\mathbf{W}^*_{\mathrm{H},\mathbf{t+1}} + \rho^*\mathbf{U}^*_{\mathrm{H},\mathbf{t+1}}\right)\right] \tag{71}$$

$$\begin{aligned}&+ \left(1-k^w(\theta^*_{\mathrm{H},\mathbf{t}})\right)k^w(\widetilde{\theta}^*_{\mathrm{H},t})E_t\left[\Lambda^*_{t+1|t}\left((1-\rho^*)\mathbf{W}^*_{\mathrm{H},t+1}\right)\right] \\ &+ \left(1-k^w(\theta^*_{\mathrm{H},\mathbf{t}})\right)\left(1-(1-\rho^*)k^w(\widetilde{\theta}^*_{\mathrm{H},t})\right)E_t\left[\Lambda^*_{t+1|t}\mathbf{U}^*_{\mathrm{H},\mathbf{t+1}}\right]\end{aligned} \tag{72}$$

C.1.2 Firms

Let $\mathbf{J}_{\mathrm{H},\mathbf{t}}$ be the value to the multinational firm of a domestic worker and let $\mathbf{V}_{\mathrm{H},\mathbf{t}}$ be the value of an unfilled vacancy opened by the multinational in the domestic job market. Define $\mathbf{J}_{\mathrm{H},\mathbf{t}}$ as

$$\mathbf{J}_{\mathrm{H},\mathbf{t}} = f_{n_{\mathrm{H}},t} - (1-\tau^n_{H,t})w_{\mathrm{H},\mathbf{t}} + E_t\left[\Lambda_{t+1|t}\left((1-\rho)\mathbf{J}_{\mathrm{H},\mathbf{t+1}} + \rho\mathbf{V}_{\mathrm{H},\mathbf{t+1}}\right)\right] \tag{73}$$

which says that the value of a domestic job is equal to the additional revenue the firms gets from additional production net of the wage that the firm must pay the additional worker. The firm also gets a continuation value from the formation of a job, which yields production tomorrow if the job survives. If it doesn't, then the firm gets the continuation value of the vacancy posting tomorrow.

Define the value of an unfilled match, $\mathbf{V}_{\mathrm{H},\mathbf{t}}$, as

$$\begin{aligned}\mathbf{V}_{\mathrm{H},\mathbf{t}} &= -(1-\tau^{v}_{H,t})\gamma + k^{f}(\theta_{\mathrm{H},\mathbf{t}})E_t\left[\Lambda_{t+1|t}\left((1-\rho)\mathbf{J}_{\mathrm{H},\mathbf{t+1}} + \rho\mathbf{V}_{\mathrm{H},\mathbf{t+1}}\right)\right] \\ &+ \left(1-k^{f}(\theta_{\mathrm{H},\mathbf{t}})\right)\left(\mathbf{1}[\mathbf{SB}]\widetilde{\mathbf{V}}^{*}_{\mathrm{H},\mathbf{t}} + (1-\mathbf{1}[\mathbf{SB}])\,E_t\left[\Lambda_{t+1|t}\mathbf{V}_{\mathrm{H},\mathbf{t+1}}\right]\right)\end{aligned} \tag{74}$$

The value of a vacancy is the posting cost plus the continuation value of a matched vacancy provided it survives to produce in the next period weighted by the probability that the match is made. If the match does not survive, the unfilled vacancy continues to have value. Moreover, under sequential bargaining, a vacancy that is unfilled in the market for domestic workers can be posted in the Foreign labor market.

$\widetilde{\mathbf{V}}^{*}_{\mathrm{H},t}$ is defined as:

$$\widetilde{\mathbf{V}}^{*}_{\mathrm{H},t} = -(1-\tau^{*v}_{H,t})\gamma^{*} + k^{f}(\widetilde{\theta}^{*}_{\mathrm{H},t})E_t\left[\Lambda_{t+1|t}\left((1-\rho^{*})\mathbf{J}^{*}_{\mathrm{H},t+1}\right)\right] \tag{75}$$

$$+\left(1-(1-\rho^{*})k^{f}(\widetilde{\theta}^{*}_{\mathrm{H},t})\right)E_t\left[\Lambda_{t+1|t}\mathbf{V}_{\mathrm{H},\mathbf{t+1}}\right] \tag{76}$$

Let $\mathbf{J}^{*}_{\mathrm{H},\mathbf{t}}$ be the value of an offshore worker to the multinational firm. Define the value to a firm of an offshored job as

$$\mathbf{J}^{*}_{\mathrm{H},t} = f_{n^{*}_{\mathrm{H}},t} - (1-\tau^{*n}_{H,t})q_t w^{*}_{\mathrm{H},t} + E_t\left[\Lambda_{t+1|t}\left((1-\rho^{*})\mathbf{J}^{*}_{\mathrm{H},t+1} + \rho^{*}\left(\mathbf{1}[\mathbf{SB}]\mathbf{V}_{\mathrm{H},\mathbf{t+1}} + (1-\mathbf{1}[\mathbf{SB}])\,\mathbf{V}^{*}_{\mathrm{H},\mathbf{t+1}}\right)\right)\right]$$

Define the value of an unfilled vacancy posted in the Foreign labor market in the morning, $\mathbf{V}^{*}_{\mathrm{H},t}$, as

$$\begin{aligned}\mathbf{V}^{*}_{\mathrm{H},\mathbf{t}} &= -(1-\tau^{v}_{H,t})\gamma^{*} + k^{f}(\theta^{*}_{\mathrm{H},t})E_t\left[\Lambda_{t+1|t}\left((1-\rho^{*})\mathbf{J}^{*}_{\mathrm{H},\mathbf{t+1}} + \rho^{*}\mathbf{V}^{*}_{\mathrm{H},\mathbf{t+1}}\right)\right] \\ &- \left(1-k^{f}(\theta^{*}_{\mathrm{H},t})\right)(1-\tau^{*v}_{H,t})\gamma^{*} + \left(1-k^{f}(\theta^{*}_{\mathrm{H},t})\right)k^{f}(\widetilde{\theta}^{*}_{\mathrm{H},t})E_t\left[\Lambda_{t+1|t}\left((1-\rho^{*})\mathbf{J}^{*}_{\mathrm{H},t+1}\right)\right] \\ &\left(1-k^{f}(\theta^{*}_{\mathrm{H},t})\right)\left(1-(1-\rho^{*})k^{f}(\widetilde{\theta}^{*}_{\mathrm{H},t})\right)E_t\left[\Lambda_{t+1|t}\mathbf{V}^{*}_{\mathrm{H},\mathbf{t+1}}\right]\end{aligned} \tag{77}$$

Let $\mathbf{J}^{*}_{\mathrm{F},\mathbf{t}}$ be the value of a foreign worker to the foreign firm defined as

$$\mathbf{J}^{*}_{\mathrm{F},t} = f_{n^{*}_{\mathrm{F}},t} - w^{*}_{\mathrm{F},t} + E_t\left[\Lambda^{*}_{t+1|t}\left((1-\rho^{*})\mathbf{J}^{*}_{\mathrm{F},t+1} + \rho^{*}\mathbf{V}^{*}_{\mathrm{F},t+1}\right)\right]$$

Finally, define the value to a Foreign firm of an unfilled vacancy in the foreign labor market as

$$\mathbf{V}^{*}_{\mathrm{F},t} = -\gamma^{*} + E_t\left[\Lambda^{*}_{t+1|t}\left((1-\rho^{*})k^{f}(\theta^{*}_{\mathrm{F},t})\mathbf{J}^{*}_{\mathrm{F},t+1}\right) + (1-(1-\rho^{*}))k^{f}(\theta^{*}_{\mathrm{F},t})\mathbf{V}^{*}_{\mathrm{F},t+1}\right]$$

C.2 Surplus With Simultaneous Bargaining, $(\mathbf{1}[\mathbf{SB}] = 0)$

C.2.1 Households

Define the surplus of a match to a Home worker as $\mathbf{S}^{\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t}} = \mathbf{W}_{\mathrm{H},\mathbf{t}} - \mathbf{U}_{\mathrm{H},\mathbf{t}}$, which in is given by the following expression regardless of sequential or simultaneous bargaining

$$\mathbf{S}^{\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t}} = w_{\mathrm{H},\mathbf{t}} - \chi + (1-k^{w}(\theta_{\mathrm{H},\mathbf{t}})(1-\rho)E_t\left[\Lambda_{t+1|t}\mathbf{S}^{\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t+1}}\right]$$

In contrast, the definitions of the surpluses for Foreign workers is dependant on whether labor markets clear sequentially or simultaneously. When $\mathbf{1}[\mathbf{SB}] = 0$ the expressions for the surplus of a foreign domestic job, $\mathbf{S}^{*,\mathbf{hh}}_{\mathrm{F},\mathbf{t}} = \mathbf{W}^{*}_{\mathrm{F},\mathbf{t}} - \mathbf{U}^{*}_{\mathrm{F},\mathbf{t}}$, and an international labor market relationship, $\mathbf{S}^{*,\mathbf{hh}}_{\mathrm{H},\mathbf{t}} = \mathbf{W}^{*}_{\mathbf{H},\mathbf{t}} - \mathbf{U}^{*}_{\mathbf{H},\mathbf{t}}$, are defined respectively as

$$\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{F},\mathbf{t}} = w^{*}_{\mathrm{F},t} - \chi^{*} + (1 - k^{w}(\theta^{*}_{\mathrm{F},t}))(1-\rho^{*})E_t\left[\Lambda^{*}_{t+1|t}\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{F},\mathbf{t+1}}\right]$$

and

$$\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t}} = w^{*}_{\mathrm{H},t} - \chi^{*} + (1 - k^{w}(\theta^{*}_{\mathrm{H},t}))(1-\rho^{*})E_t\left[\Lambda^{*}_{t+1|t}\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t+1}}\right]$$

C.2.2 Firms

When $\mathbf{1}[\mathbf{SB}] = 0$ the expressions for the surplus of a Home job, $\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t}} = \mathbf{J}_{\mathrm{H},\mathbf{t}} - \mathbf{V}_{\mathrm{H},\mathbf{t}}$, and an international labor market relationship, $\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{H},\mathbf{t}} = \mathbf{J}^{*}_{\mathrm{H},\mathbf{t}} - \mathbf{V}^{*}_{\mathrm{H},\mathbf{t}}$, are defined respectively as

$$\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t}} = f_{n_{\mathrm{H}}t} - (1-\tau^{n}_{H,t})w_{\mathrm{H},\mathbf{t}} + (1-\tau^{v}_{H,t})\gamma + (1-k^{f}(\theta_{\mathrm{H},\mathbf{t}}))(1-\rho)E_t\left[\Lambda_{t+1|t}\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t+1}}\right]$$

and

$$\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{H},\mathbf{t}} = f_{n^{*}_{\mathrm{H}},t} - (1-\tau^{*n}_{H,t})q_t w^{*}_{\mathrm{H},t} + (1-\tau^{*v}_{H,t})\gamma^{*} + (1-k^{f}(\theta^{*}_{\mathrm{H},t}))(1-\rho^{*})E_t\left[\Lambda_{t+1|t}\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{H},\mathbf{t+1}}\right]$$

In contrast, the definition of the surplus of a domestic labor market relationship to the Foreign firm is given by the following expression regardless of sequential or simultaneous bargaining

$$\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{F},\mathbf{t}} = f_{n^{*}_{\mathrm{F}},t} - w^{*}_{\mathrm{F},t} + \gamma^{*} + (1-k^{f}(\theta^{*}_{\mathrm{F},t}))(1-\rho^{*})E_t\left[\Lambda^{*}_{t+1|t}\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{F},\mathbf{t+1}}\right]$$

C.3 Surplus Under Sequential Bargaining, ($\mathbf{1}[\mathbf{SB}] = 1$)

C.3.1 Households

Under sequential bargaining, the surpluses of the Foreign household change to reflect the sequential nature of search. However, as mentioned above, the surplus of a domestic job for the Home household, $\mathbf{S}^{\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t}}$ does not change from what was reported above.

In order to derive an expression for the surplus of an employment relationship to the Foreign household with the foreign firm, $\mathbf{S}^{*\mathbf{wor\,ker\,s}}_{\mathrm{F},\mathbf{t}}$, substitute $\mathbf{U}^{*}_{\mathrm{H},\mathbf{t}}$ given by equation (**??**) directly into expression (69) for $\mathbf{U}^{*}_{\mathrm{F},\mathbf{t}}$ to get

$$\begin{aligned}\mathbf{U}^{*}_{\mathrm{F},\mathbf{t}} &= \chi^{*} - \frac{h'(lfp^{*}_t)}{u'(c^{*}_t)/p^{*}_t} + k^{w}(\theta^{*}_{\mathrm{F},\mathbf{t}})(1-\rho^{*})E_t\left[\Lambda_{t+1|t}\mathbf{W}^{*}_{\mathrm{F},t+1}\right] + \left(1 - k^{w}(\theta^{*}_{\mathrm{F},t})(1-\rho^{*})\right)E_t\left[\Lambda_{t+1|t}\mathbf{U}^{*}_{\mathrm{F},\mathbf{t+1}}\right] \\ &+ \left(1-k^{w}(\theta^{*}_{\mathrm{F},\mathbf{t}})\right)k^{w}(\widetilde{\theta}^{*}_{\mathrm{H},\mathbf{t}})(1-\rho^{*})E_t\left[\Lambda_{t+1|t}\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{FH},\mathbf{t+1}}\right]\end{aligned}$$

where $\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{FH},\mathbf{t}} = \mathbf{W}^{*}_{\mathrm{F},\mathbf{t}} - \mathbf{U}^{*}_{\mathrm{H},\mathbf{t}}$ is the value to the Foreign worker of working in a domestic job net of the value of searching in the market for offshored jobs. We can subtract the above expression from the definition for $\mathbf{W}^*_{\mathrm{F},\mathbf{t}}$ to derive a recursive expressions for the surplus of a domestic employment relationship.

$$\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{F},\mathbf{t}} = w^*_{\mathrm{F},\mathbf{t}} - \chi^* + (1-\rho^*)E_t\left[\Lambda^*_{t+1|t}(1-k^w(\theta^*_{\mathrm{F},\mathbf{t}}))\left(\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{F},\mathbf{t+1}} - k^w(\widetilde{\theta}^*_{\mathrm{H},t})\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{FH},\mathbf{t+1}}\right)\right]$$

We follow a similar methodology to derive the following expression for the surplus of an international employment relationship to the Foreign household, $\mathbf{S}^{*,\mathbf{hh}}_{\mathrm{H},\mathbf{t}}$ to get

$$\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t}} = w^*_{\mathrm{H},t} - \chi^* + (1-\rho^*)E_t\left[\Lambda^*_{t+1|t}(1-k^w(\theta^*_{\mathrm{H},t}))\left(\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t+1}} - k^w(\widetilde{\theta}^*_{\mathrm{H},t})\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t+1}}\right)\right]$$

Finally, we need a recursive expression for to define the surplus of an international employment relationship relative to searching in the domestic labor market.

$$\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{FH},\mathbf{t}} = w^*_{\mathrm{H},t} - \chi^* + (1-\rho^*)E_t\left[\Lambda^*_{t+1|t}\left(1-(1-k^w(\theta^*_{\mathrm{F},t}))k^w(\widetilde{\theta}^*_{\mathrm{H},t})\right)\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{FH},\mathbf{t+1}} - k^w(\widetilde{\theta}^*_{\mathrm{H},t})\mathbf{S}^{*,\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t+1}}\right]$$

C.3.2 Firms

Under sequential bargaining, the surpluses of the multinational change to reflect the sequential nature of search. However, as mentioned above, the surplus of a domestic job for the Foreign firm, $\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{F},\mathbf{t}}$ does not change from what was reported above.

In order to derive an expression for the surplus of a domestic employment relationship to the multinational, $\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t}}$, substitute $\mathbf{V}^*_{\mathrm{H},\mathbf{t}}$ from equation (**??**)directly into expression (74) for $\mathbf{V}_{\mathrm{H},\mathbf{t}}$ to get

$$\begin{aligned}
\mathbf{V}_{\mathrm{H},\mathbf{t}} &= -(1-\tau^v_{H,t})\gamma - (1-k^f(\theta_{\mathrm{H},t}))(1-\tau^{*v}_{H,t})\gamma^* \\
&+ E_t\left[\Lambda_{t+1|t}\left(k^f(\theta_{\mathrm{H},t})(1-\rho)\mathbf{J}_{\mathrm{H},\mathbf{t+1}} + \left(1-k^f(\theta_{\mathrm{H},t})(1-\rho)\right)\mathbf{V}_{\mathrm{H},\mathbf{t+1}}\right)\right] \\
&+ E_t\left[\Lambda_{t+1|t}(1-\rho^*)\left(1-k^f(\theta_{\mathrm{H},t})\right)k^f(\widetilde{\theta}^*_{\mathrm{H},t})\mathbf{S}^{\mathbf{firms}}_{\mathrm{H^*H},\mathbf{t}}\right]
\end{aligned}$$

where $\mathbf{S}^{\mathbf{firms}}_{\mathrm{H^*H},\mathbf{t}} = \mathbf{J}^*_{\mathrm{H},\mathbf{t}} - \mathbf{V}_{\mathrm{H},\mathbf{t}}$ is the value to the multinational of employing a domestic worker net of the value of searching in the market for offshored jobs. We can subtract the above definition from $\mathbf{J}_{\mathrm{H},\mathbf{t}}$ to derive a recursive expressions for the surplus of a domestic employment relationship.

$$\begin{aligned}
\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t}} &= f_{n_{\mathrm{H}},t} - (1-\tau^n_{H,t})w_{\mathrm{H},t} + (1-\tau^v_{H,t})\gamma + (1-k^f(\theta_{\mathrm{H},t}))(1-\tau^{*v}_{H,t})\gamma^* \\
&+ E_t\left[\Lambda_{t+1|t}(1-k^f(\theta_{\mathrm{H},t}))\left((1-\rho)\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t+1}} - k^f(\widetilde{\theta}^*_{\mathrm{H},t})(1-\rho^*)\mathbf{S}^{\mathbf{firms}}_{\mathrm{H^*H},\mathbf{t+1}}\right)\right]
\end{aligned}$$

We follow a similar methodology to derive the following expression for the surplus of an international employment relationship to the multinational, $\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{H},\mathbf{t}}$ to get

$$\begin{aligned}
\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{H},\mathbf{t}} &= f_{n^*_{\mathrm{H}},t} - (1-\tau^{*n}_{H,t})q_t w^*_{\mathrm{H},t} + (1-\tau^{*v}_{H,t})\gamma^* + (1-k^f(\theta^*_{\mathrm{H},t}))(1-\tau^{*v}_{H,t})\gamma^* \\
&+E_t\left[\Lambda_{t+1|t}(1-k^f(\theta^*_{\mathrm{H},t}))\left((1-\rho^*)\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{H^*t}} - k^f(\widetilde{\theta}^*_{\mathrm{H},t})(1-\rho^*)\mathbf{S}^{*,\mathbf{firms}}_{\mathrm{H^*t}}\right)\right]
\end{aligned}$$

Finally, we need to define the surplus of an offshored job relative to hiring a domestic worker to do the job.

$$\begin{aligned}
\mathbf{S}^{\mathbf{firms}}_{\mathrm{H^*H},\mathbf{t}} &= f_{n^*_{\mathrm{H}},t} - (1-\tau^{*n}_{\mathrm{H},t})q_t w^*_{\mathrm{H},t} + (1-\tau^{v}_{H,t})\gamma + (1-k^f(\theta_{\mathrm{H},t}))(1-\tau^{*v}_{H,t})\gamma^* \\
&+ E_t\left[\Lambda_{t+1|t}\left((1-\rho^*)\left(1-(1-k^f(\theta_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})\right)\mathbf{S}^{\mathbf{firms}}_{\mathrm{H^*H},\mathbf{t+1}} - (1-\rho^*)k^f(\widetilde{\theta}^*_{\mathrm{H},t})\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t+1}}\right)\right]
\end{aligned}$$

These continuation values will help in expressing the Nash wage solution in the next section.

C.4 Nash Bargaining Under Simultaneous Bargaining, ($\mathbf{1}[\mathbf{SB}] = 0$)

The Nash bargaining rule is

$$\mathbf{S}^{\mathbf{h}}_{\mathbf{h},\mathbf{t}} = \frac{\eta}{1-\eta}\mathbf{S}^{\mathbf{f}}_{\mathbf{h},\mathbf{t}}$$

Begin by plugging in the solution for $\mathbf{S}^{\mathbf{h}}_{\mathbf{h},\mathbf{t}}$ on the left-hand side.

$$w_{\mathrm{H},t} - \chi + (1-\rho)E_t\left[\Lambda_{t+1|t}(1-k^w(\theta_{\mathrm{H},t}))\mathbf{S}^{\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t+1}}\right] = \frac{\eta}{1-\eta}\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t}}$$

Next, we can substitute in for $\mathbf{S}^{\mathbf{f}}_{\mathbf{h},\mathbf{t}}$ on the right hand side and solve the resulting expression for $w_{h,t}$ to get

$$\begin{aligned}
w_{\mathrm{H},t} &= \frac{1-\eta}{1-\eta\tau^n_{\mathrm{H},t}}\chi + \frac{\eta}{1-\eta\tau^n_{\mathrm{H},t}}\left(f_{n_h,t} + (1-\tau^v_{\mathrm{H},t})\gamma\right) \\
&+ \frac{\eta}{1-\eta\tau^n_{\mathrm{H},t}}(1-\rho)E_t\left[\Lambda_{t+1|t}(1-k^f(\theta_{\mathrm{H},t}))\mathbf{S}^{\mathbf{firms}}_{\mathbf{h},\mathbf{t+1}}\right] \\
&- \frac{1-\eta}{1-\eta\tau^n_{\mathrm{H},t}}(1-\rho)E_t\left[\Lambda_{t+1|t}(1-k^w(\theta_{\mathrm{H},t}))\mathbf{S}^{\mathbf{wor\,ker\,s}}_{\mathrm{H},\mathbf{t+1}}\right]
\end{aligned}$$

The analogous wage expression for the foreign worker in a foreign job would be

$$\begin{aligned}
w^*_{\mathrm{F},t} &= (1-\eta^*)\chi^* + \eta^*\left(f_{n^*_{\mathrm{F}},t} + \gamma^*\right) \\
&+\eta^*(1-\rho^*)E_t\left[\Lambda^*_{t+1|t}(1-k^f(\theta^*_{\mathrm{F},t}))\mathbf{S}^{*\mathbf{firms}}_{\mathrm{F},\mathbf{t+1}}\right] \\
&-(1-\eta^*)(1-\rho^*)E_t\left[\Lambda^*_{t+1|t}(1-k^w(\theta^*_{\mathrm{F},t}))\mathbf{S}^{*\mathbf{wor\,ker\,s}}_{\mathrm{F},\mathbf{t+1}}\right] \\
&+(1-\eta^*)(1-\rho^*)E_t\left[\Lambda^*_{t+1|t}(1-k^w(\theta^*_{\mathrm{F},t}))k^w(\widetilde{\theta}^*_{\mathrm{F},t})\mathbf{S}^{*\mathbf{wor\,ker\,s}}_{\mathrm{FH},\mathbf{t+1}}\right]
\end{aligned}$$

Finally, for the wage paid to Foreigners working for the multinational, the bargaining rule is

$$\mathbf{S}^{*\mathbf{h}}_{\mathbf{h},\mathbf{t}} = \frac{\eta^*}{1-\eta^*}\mathbf{S}^{\mathbf{f}}_{\mathbf{f},\mathbf{t}}$$

To solve for the wage, begin by plugging in the solution for $\mathbf{S}^{*\mathbf{h}}_{\mathbf{h},\mathbf{t}}$ on the left-hand side.

$$w^*_{h,t} - \chi^* + (1-\rho^*)E_t\left(\Lambda^*_{t+1|t}(1-k^h(\theta^*_{h,t}))\mathbf{S}^{\mathbf{h}}_{\mathbf{h},\mathbf{t+1}}\right) = \frac{\eta^*}{1-\eta^*}\mathbf{S}^{\mathbf{f}}_{\mathbf{f},\mathbf{t}}$$

We can substitute in the definition for $\mathbf{S^{f}_{f,t}}$ on the right hand side and derive the following expression for the wage.

$$
\begin{aligned}
w^*_{h,t} &= \frac{1-\eta^*}{1-\eta^*\left(1-(1-\tau^{*n}_{\mathrm{H},t})q_t\right)}\chi^* + \frac{\eta^*}{1-\eta^*\left(1-(1-\tau^{*n}_{H,t})q_t\right)}\left(f_{n^*_h,t}+(1-\tau^{*v}_{H,t})\gamma^*\right) \\
&+\frac{\eta^*}{1-\eta^*\left(1-(1-\tau^{*n}_{H,t})q_t\right)}(1-\rho^*)E_t\left[\Lambda_{t+1|t}\left(1-k^f(\theta^*_{h,t})\right)\mathbf{S^{f}_{f,t+1}}\right] \\
&-\frac{1-\eta^*}{1-\eta^*\left(1-(1-\tau^{*n}_{H,t})q_t\right)}(1-\rho^*)E_t\left[\Lambda^*_{t+1|t}(1-k^h(\theta^*_{h,t}))\mathbf{S^{*h}_{f,t+1}}\right]
\end{aligned}
$$

C.5 Nash Bargaining Under Sequential Bargaining, $(\mathbf{1}[\mathbf{SB}]=1)$

Similar algebra to the subsection above yields an expression for the domestic wage paid by the multinational to Home workers $w_{h,t}$ to get

$$
\begin{aligned}
w_{\mathrm{H},t} &= \frac{1-\eta}{1-\eta\tau^n_{\mathrm{H},t}}\chi + \frac{\eta}{1-\eta\tau^n_{\mathrm{H},t}}\left(f_{n_h,t}+(1-\tau^v_{\mathrm{H},t})\gamma+(1-k^f(\theta_{\mathrm{H},t}))(1-\tau^{*v}_{\mathrm{H},t})\gamma*\right) \\
&+ \frac{\eta}{1-\eta\tau^n_{\mathrm{H},t}}(1-\rho)E_t\left[\Lambda_{t+1|t}(1-k^f(\theta_{\mathrm{H},t}))\mathbf{S}^{\mathbf{firms}}_{\mathrm{H},\mathbf{t+1}}\right] \\
&- \frac{1-\eta}{1-\eta\tau^n_{\mathrm{H},t}}(1-\rho)E_t\left[\Lambda_{t+1|t}(1-k^h(\theta_{\mathrm{H},t}))\mathbf{S}^{\mathbf{workers}}_{\mathrm{H},\mathbf{t+1}}\right] \\
&- \frac{\eta}{1-\eta\tau^n_{\mathrm{H},t}}(1-\rho^*)E_t\left[\Lambda_{t+1|t}(1-k^f(\theta_{\mathrm{H},t}))k^f(\widetilde{\theta}^*_{\mathrm{H},t})\mathbf{S}^{\mathbf{f}}_{\mathrm{H^*H},\mathbf{t+1}}\right]
\end{aligned}
$$

The analogous wage expression for the foreign worker in a foreign job is

$$
\begin{aligned}
w^*_{f,t} &= (1-\eta^*)\chi^*+\eta^*\left(f_{n^*_f,t}+\gamma^*\right) \\
&+ \eta^*(1-\rho^*)E_t\left[\Lambda^*_{t+1|t}(1-k^f(\theta^*_{f,t}))\mathbf{S^{*f}_{f,t+1}}\right] \\
&- (1-\eta^*)(1-\rho^*)E_t\left[\Lambda^*_{t+1|t}(1-k^h(\theta^*_{f,t}))\mathbf{S^{*h}_{f,t+1}}\right] \\
&+ (1-\eta^*)(1-\rho^*)E_t\left[\Lambda^*_{t+1|t}(1-k^h(\theta^*_{f,t}))k^h(\theta^*_{f,t})\mathbf{S^{*h}_{fh,t+1}}\right]
\end{aligned}
$$

Finally, the wage paid by the multinational to Foreign workers employed in offshored jobs is

$$
\begin{aligned}
w^*_{\mathrm{H},t} &= \frac{1-\eta^*}{1-\eta^*\left(1-(1-\tau^{*n}_{\mathrm{H},t})q_t\right)}\chi^* + \frac{\eta^*}{1-\eta^*\left(1-(1-\tau^{*n}_{\mathrm{H},t})q_t\right)}\left(f_{n^*_h,t}+(1-\tau^{*v}_{H,t})\gamma^*\right) \\
&+ \frac{\eta^*}{1-\eta^*\left(1-(1-\tau^{*n}_{\mathrm{H},t})q_t\right)}(1-\rho^*)E_t\left[\Lambda_{t+1|t}\left(1-k^f(\theta^*_{\mathrm{H},t})\right)\left(1-k^f(\widetilde{\theta}^*_{\mathrm{H},t})\right)\mathbf{S}^{*\mathbf{firms}}_{\mathrm{H},\mathbf{t+1}}\right] \\
&- \frac{1-\eta^*}{1-\eta^*\left(1-(1-\tau^{*n}_{\mathrm{H},t})q_t\right)}(1-\rho^*)E_t\left[\Lambda^*_{t+1|t}(1-k^w(\theta^*_{\mathrm{H},t}))(1-k^w(\widetilde{\theta}^*_{\mathrm{H},t}))\mathbf{S}^{*\mathbf{workers}}_{\mathrm{H},\mathbf{t+1}}\right]
\end{aligned}
$$

C.6 Solving the System

All told, the wage system $\{w_{h,t}, w^*_{h,t}, w^*_{f,t}\}$ is a function of: (1.) $\mathbf{S^{h}_{h,t}}$, the surplus to Home workers of having a domestic job net of the value of unemployment; (2.) $\mathbf{S^{f}_{h,t}}$, the surplus to the multinational of having a domestic employee working in a job net of the value of an unfilled vacancy in the domestic labor market; (3.) $\mathbf{S^{*f}_{f,t}}$, the surplus to the Foreign firm of having a domestic worker net of the value of an unfilled vacancy; (4.) $\mathbf{S^{*h}_{f,t}}$, the surplus to Foreign workers of having a domestic job net of the value of search in the market for domestic jobs; (5.) $\mathbf{S^{*h}_{fh,t}}$, the surplus to Foreign workers of having an offshored job net of the value of search in the market for domestic jobs; and (6.) $\mathbf{S^{f}_{fh,t}}$, the surplus to the multinational of offshoring a job net of the value of an unfilled vacancy in the market for domestic jobs.

D Social Planner's Problem

The social planner chooses sequences of $\{c_{H,t}, c_{F,t}, c^*_{H,t}, c^*_{F,t}, k_{h,t+1}, k^*_{h,t+1}, k^*_{f,t+1}, n_{h,t+1}, n^*_{h,t+1}, n^*_{f,t+1}, s_{h,t}, s^*_{h,t}, s^*_{f,t}, v_{h,t}, v^*_{h,t}, v^*_{f,t}, ne_{h,t}, ne^*_{h,t}, ne^*_{f,t}\}$ to maximize an equally weighted average of discounted lifetime Home and Foreign utility subject to the laws of motion for the respective employment stocks and the resource constraint. The social planners problem is

$$E_0 \sum_{t=0}^{\infty} \beta^t u\left(c(c_{H,t}, c_{F,t}) - h\left(s_{h,t} + n_{h,t}\right)\right) \tag{78}$$

$$+u^*\left(c^*(c^*_{H,t}, c^*_{F,t}) - h^*(s^*_{h,t} + s^*_{f,t} + n^*_{h,t} + n^*_{f,t})\right) \tag{79}$$

subject to:

$$n_{h,t+1} = (1-\rho)n_{h,t} + m(s_{h,t}, v_{h,t}) \tag{80}$$

$$n^*_{h,t+1} = (1-\rho^*)n^*_{h,t} + m^*(s^*_{h,t}, v_{h^*,t}) \tag{81}$$

$$n^*_{f,t+1} = (1-\rho^*)n^*_{f,t} + m^*(s^*_{f,t}, v^*_{f,t}) \tag{82}$$

$$v_{h,t+1} = (1-\rho^o_h)\rho^n_h n_{h,t} + (1-\rho^o_h)(1-k^f\left(v_{h,t}/s_{h,t}\right))v_{h,t} + ne_{h,t+1} \tag{83}$$

$$v^*_{h,t+1} = (1-\rho^{*o}_h)\rho^{*n}_h n^*_{h,t} + (1-\rho^{*o}_h)(1-k^f(v^*_{h,t}/s^*_{h,t}))v^*_{h,t} + ne^*_{h,t+1} \tag{84}$$

$$v^*_{f,t+1} = (1-\rho^{*o}_f)\rho^{*n}_f n^*_{f,t} + (1-\rho^{*o}_f)(1-k^f(v^*_{f,t}/s^*_{f,t}))v^*_{f,t} + ne^*_{f,t+1} \tag{85}$$

$$f\left(n_{h,t}, k_{h,t}, n^*_{h,t}, k^*_{h,t},\right) = c_{H,t} + c^*_{H,t} + k_{h,t+1} - (1-\delta)k_{h,t} + \gamma v_{h,t} + \gamma^* v^*_{h,t} + \Gamma ne_{h,t} + \Gamma^* ne^*_{h,t} \tag{86}$$

$$f\left(n^*_{f,t}, k^*_{f,t}\right) = c_{F,t} + c^*_{F,t} + +k^*_{f,t+1} - (1-\delta^*)k^*_{f,t} + k^*_{h,t+1} - (1-\delta^*)k^*_{h,t} + \gamma^* v^*_{f,t} + \Gamma^* ne^*_{f,t} \tag{87}$$

Let and $\Upsilon_{h,t}$, $\Upsilon^*_{h,t}$, $\Upsilon^*_{f,t}$, $\Phi_{h,t}$, $\Phi^*_{h,t}$, $\Phi^*_{f,t}$, Ψ_t, Ψ^*_t be the multipliers on the laws of motion for employment stocks, vacancies, and the aggregate global resource constraints for the Home and Foreign countries, respectively. The resulting first order conditions are:

$$\frac{\partial u\left(c(c_{H,t}, c_{F,t})\right)}{\partial c_{H,t}} - \Psi_t = 0 \tag{88}$$

$$\frac{\partial u\left(c(c_{H,t}, c_{F,t})\right)}{\partial c_{F,t}} - \Psi^*_t = 0 \tag{89}$$

$$\frac{\partial u^*\left(c^*(c^*_{H,t}, c^*_{F,t})\right)}{\partial c^*_{H,t}} - \Psi_t = 0 \tag{90}$$

$$\frac{\partial u^*\left(c^*(c^*_{H,t}, c^*_{F,t})\right)}{\partial c^*_{F,t}} - \Psi^*_t = 0 \tag{91}$$

$$\beta \Psi_{t+1} f_{k,t+1} - \Psi_t + \beta \Psi_{t+1}(1-\delta) = 0 \tag{92}$$

$$\beta \Psi_{t+1} f_{k^*_h,t+1} - \Psi^*_t + \beta \Psi^*_{t+1}(1-\delta^*) = 0 \tag{93}$$

$$\beta\Psi^*_{t+1} f_{k^*_f,t+1} - \Psi^*_t + \beta\Psi^*_{t+1}(1-\delta^*) = 0 \tag{94}$$

$$-\beta h'_{t+1} + \Upsilon_{h,t} - \beta(1-\rho)\Upsilon_{h,t+1} - \beta(1-\rho^o_h)\rho^n_h \Phi_{h,t+1} + \beta f_{n_h,t+1}\Psi_{t+1} = 0 \tag{95}$$

$$-\beta h'^*_{t+1} + \Upsilon^*_{h,t} - \beta(1-\rho^*)\Upsilon^*_{h,t+1} - \beta(1-\rho^{*o}_h)\rho^{*n}_h \Phi^*_{h,t+1} + \beta f_{n^*_h,t+1}\Psi_{t+1} = 0 \tag{96}$$

$$-\beta h'^*_{t+1} + \Upsilon^*_{f,t} - \beta(1-\rho^*)\Upsilon^*_{f,t+1} - \beta(1-\rho^{*o}_f)\rho^{*n}_f \Phi^*_{f,t+1} + \beta f_{n^*_f,t+1}\Psi^*_{t+1} = 0 \tag{97}$$

$$-h'_t + m_s(s_{h,t}, v_{h,t})\Upsilon_{h,t} + (1-\rho^o_h)k^f_s\left(v_{h,t}/s_{h,t}\right)\frac{v_{h,t}}{s^2_{h,t}}\Phi_{h,t} = 0 \tag{98}$$

$$-h'^*_t + m^*_s(s^*_{h,t}, v^*_{h,t})\Upsilon^*_{h,t} + (1-\rho^{*o}_h)k^f_s\left(v^*_{h,t}/s^*_{h,t}\right)\frac{v^*_{h,t}}{s^{*2}_{h,t}}\Phi^*_{h,t} = 0 \tag{99}$$

$$-h'^*_t + m^*_s(s^*_{f,t}, v^*_{f,t})\Upsilon^*_{f,t} + (1-\rho^{*o}_f)k^f_s\left(v^*_{f,t}/s^*_{f,t}\right)\frac{v^*_{f,t}}{s^{*2}_{f,t}}\Phi^*_{f,t} = 0 \tag{100}$$

$$m_v(s_{h,t}, v_{h,t})\Upsilon_{h,t} - \frac{1}{\beta}\Phi_{h,t-1} + (1-\rho^o_h)\left[1 - k^f\left(\frac{v_{h,t}}{s_{h,t}}\right) - \frac{v_{h,t}}{s_{h,t}}k^f_v\left(\frac{v_{h,t}}{s_{h,t}}\right)\right]\Phi_{h,t} + \gamma\Psi_t = 0 \tag{101}$$

$$m^*_v(s^*_{h,t}, v^*_{h,t})\Upsilon^*_{h,t} - \frac{1}{\beta}\Phi^*_{h,t-1} + (1-\rho^{*o}_h)\left[1 - k^f\left(\frac{v^*_{h,t}}{s^*_{h,t}}\right) - \frac{v^*_{h,t}}{s^*_{h,t}}k^f_v\left(\frac{v^*_{h,t}}{s^*_{h,t}}\right)\right]\Phi^*_{h,t} + \gamma^*\Psi_t = 0 \tag{102}$$

$$m^*_v(s^*_{f,t}, v^*_{f,t})\Upsilon^*_{f,t} - \frac{1}{\beta}\Phi^*_{f,t-1} + (1-\rho^{*o}_f)\left[1 - k^{*f}\left(\frac{v^*_{f,t}}{s^*_{f,t}}\right) - \frac{v^*_{f,t}}{s^*_{f,t}}k^{*f}_v\left(\frac{v^*_{f,t}}{s^*_{f,t}}\right)\right]\Phi^*_{f,t} + \gamma^*\Psi^*_t = 0 \tag{103}$$

$$-\frac{1}{\beta}\Phi_{h,t-1} - \Gamma\Psi_t = 0 \tag{104}$$

$$-\frac{1}{\beta}\Phi^*_{h,t-1} - \Gamma^*\Psi_t = 0 \tag{105}$$

$$-\frac{1}{\beta}\Phi^*_{f,t-1} - \Gamma^*\Psi^*_t = 0 \tag{106}$$

Table 1: Baseline Calibration

Home Country			**Foreign Country**	
Parameter	Value	Description	Value	Parameter
		Production		
z	1	Steady state technology	1	z^*
ϑ	0	Elasticity of substitution between domestic and offshored labor		
Γ	0.90	Share of domestic intermediate good in final production		
α	0.70	Share of labor in intermediate goods production	0.85	α^*
		Capital Accumulation		
δ	0.02	Depreciation rate for capital stock	0.02	δ^*
		Preferences		
β	0.99	Discount factor	0.99	β^*
σ	2	Risk aversion	2	σ^*
ι	0.18	Elasticity of participation	0.18	ι^*
κ	18.6	Scale parameter for subutility of leisure	58.7	κ^*
ζ	0.5	Elasticity of substitution between Home and Foreign goods	0.5	ζ^*
λ	0.73	Share of domestically-produced goods in consumption basket	0.80	λ^*
		Labor Market		
ξ	0.50	Elasticity of matching function	0.50	ξ^*
η	0.50	Worker's bargaining power	0.25	η^*
ρ^o	0.0075	Probability of job obsolescence	0.0075	ρ^{*o}
ρ^n	0.017635	Probability of job separation	0.017635	ρ^{*n}
ψ	0.56	Matching efficiency	0.40	$\psi_h^* = \psi_f^*$
γ_h	3.47	Vacancy posting cost in domestic labor market	5.45	γ_f^*
		Vacancy posting cost in offshored labor market	4.40	γ_h^*
χ	0.379	Unemployment benefit	0.183	χ^*
		Trade Costs and Policy		
Υ	0	Iceburg cost		
$\tau_{H,t}^n$	0	Wage tax paid by multinational on domestic employees		
$\tau_{H,t}^{*n}$	0	Wage tax paid by multinational on foreign employees		
$\tau_{H,t}^v$	0	Vacancy tax paid by multinational on domestic job creation		
$\tau_{H,t}^{*v}$	0	Vacancy tax paid by multinational on foreign job creation		

Table 2: Main Results

	Threat of Offshoring		**No Threat of Offshoring**		**Pct. Change**	
	Home	Foreign	Home	Foreign	Home	Foreign
			Aggregate Variables			
w	1.472	0.8916	1.503	0.836	-2.16	6.24
c	0.7869	0.4998	0.7793	0.4927	0.97	1.41
LFP	0.6600	0.5900	0.6644	0.5887	-0.44	0.13
UE	0.0667	0.1220	0.1020	0.0980	-3.53	2.39
			Sector-specific Variables			
w_h	1.472	0.8916	1.503	0.836	-2.16	6.23
w_f		0.8916		0.8301		6.89
s_h	0.044	0.0006	0.0562	0.0004	-27.81	25.40
s_f		0.0714		0.0577		19.17
v_h	0.0171	0.0143	0.0130	0.0186	24.11	-30.09
v_f	0.0001		0.0002		-27.52	
n_h	0.6160	0.0042	0.6067	0.0042	1.51	-1.45
n_f		0.5139		0.5269		-2.54
			International Relative Prices			
ToT	0.3051	3.278	0.3001	3.333	1.64	-1.67
q	2.479	2.479	2.501	2.501	-0.89	-0.89

Table 3: Decomposition

	% Δ in Steady State Values		
	Allocation Effect	Threat Effect	**Total**
$\mathbf{C}\,(\omega)$	-0.01	15.68	15.66
$\mathbf{S^F_{d,t+1}}\,(\omega)$	24.85	0	24.85
$\mathbf{S^W_{d,t+1}}\,(\omega)$	23.72	0	23.72
$\mathbf{S^F_{o,t+1}}\,(\omega)$	0	-66.39	-66.39
$\mathbf{S^W_{o,t+1}}\,(\omega)$	0	0	0
Total	48.56	-50.71	-2.16

Table 4: Sensitivity Analysis

	% Δ in Steady State Values									
			Home				Foreign			
	w	c	LFP	UE	ω	w^*	c^*	UE^*	LFP^*	ω^*
Technology Parameters										
Share of Domestic Intermediate Good in Final Production, (Γ)										
$\Gamma = 0.93$	−3.97	0.91	−0.37	−2.79	1.40	6.28	1.29	2.37	0.10	1.10
$\Gamma = 0.99$ (Baseline)	−2.16	0.97	−0.29	−1.82	1.49	6.24	1.41	2.33	0.07	1.27
Substitutability Between Domestic and Offshored Intermediate Goods, (ϑ)										
$\vartheta = -0.25$	−2.42	0.97	−0.31	−1.96	−1.48	6.25	1.38	0.08	2.34	−1.24
$\vartheta = 0$ (Baseline)	−2.16	0.97	−0.29	−1.82	1.49	6.24	1.41	2.33	0.07	1.27
Preference Parameters										
Substitutability Between Home and Foreign Consumption Bundles, (ζ)										
$\zeta = 0.5$ (Baseline)	−2.16	0.97	−0.29	−1.82	1.49	6.24	1.41	2.33	0.07	1.27
$\zeta = 1.5$	−2.12	0.83	−0.26	−1.80	1.20	6.24	1.10	0.34	0.14	0.94
Labor Market Parameters										
Bargaining Power of Foreign Workers, (η^*)										
$\eta^* = 0.15$	−4.77	2.26	−0.74	−3.29		10.17	3.65	2.07	0.05	
$\eta^* = 0.25$ (Baseline)	−2.16	0.97	−0.29	−1.82	1.49	6.24	1.41	2.33	0.07	1.27
$\eta^* = \eta = 0.5$	0.01	−0.55	0.59	−0.10	0.76	2.34	−1.00	0.14	2.56	1.20
Foreign Unemployment Benefit, (χ^*)										
$\chi^* = 0$	−2.94	1.42	−0.44	−2.31		7.80	2.18	2.33	0.02	
$\chi^* = 0.2$ (Baseline)	−2.16	0.97	−0.29	−1.82	1.49	6.24	1.41	2.33	0.07	1.27
$\chi^* = \chi = 0.4$	−1.35	0.50	−0.15	−1.23	−0.75	4.68	0.62	2.33	0.14	0.40