Why Foreign Ownership May be Good for You*

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23 February 2011

Abstract

We develop a general equilibrium two-country model with heterogeneous producers and rent sharing at the firm level due to fairness preferences of workers. We identify two sources of a multinational wage premium. On the one hand, there is a pure composition effect because multinational firms are more productive, make higher profits, and therefore pay higher wages. On the other hand, there is a firm-level wage effect: A multinational firm pays higher wages in its home market than an otherwise identical national firm since it has higher global profits. We analyse how these two sources interact in determining the multinational wage premium in a setting with two identical countries, and show that in this case the wage premium is fully explained by firm characteristics. We then allow for technology differences between countries and find that a residual wage premium exists in the technologically backward country, but not in the advanced country.

JEL-Classification: D31, F12, F15, F16, H25

Key words: Multinational Firms, Wage Premium, Heterogeneous Firms

*We are grateful to Kunal Dasgupta, Donald Davis, Switgard Feuerstein, Holger Görg, Wilhelm Kohler, Peter Neary, and participants at the Princeton IES Summer Workshop, the Excellence Award Workshop in Kiel, the Aachen Workshop on International Production, the CESifo conference on Global Economy, the Göttingen Workshop on International Economics, the Annual Meeting by the International Economics Committee of the German Economic Association, the Annual Conference of the German Economic Association, the ETSG Annual Conference, the Midwest International Trade Meeting at Northwestern University, as well as seminar participants at the Universities of Aachen, Bergen, Dortmund, Gießen, Kiel, Regensburg, and Trier for helpful comments and suggestions. We also thank Harsh Mehta and Frank Pisch for excellent research assistance.

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1 Introduction

While the existence of a multinational wage premium is widely accepted as a stylised fact, the determinants of this premium are far from clear. One prominent line of reasoning attributes it to differences between multinational and national firms in terms of observable characteristics like productivity, composition of the workforce, or capital intensity. There is strong empirical evidence that such observable firm-specific factors are indeed important, but similarly that these characteristics are far from explaining the whole premium (Aitken, Harrison, and Lipsey, 1996). The unexplained residual can in fact be quite large, and a convincing explanation for its existence is so far missing. One promising approach in the empirical literature has been to consider country-specific factors along with firm-specific characteristics, and several studies have found this approach to be successful in shrinking the unexplained part of the multinational wage premium significantly.[1] In view of this empirical literature we propose in this paper a theoretical framework in which firm-specific and country-specific factors interact in determining the multinational wage premium.

We set up a general equilibrium two-country model, in which national and multinational firms coexist. Firms are heterogeneous due to differences in their productivity levels (see Melitz, 2003) and countries can differ in technology. There is rent sharing at the firm level due to fair wage preferences of workers, and hence more productive firms pay higher wages because they make higher profits.[2] Crucially, and relying on strong evidence from Budd, Konings, and Slaughter (2005) and Martins and Yong (2010), we assume that rent sharing in each country relates to a firm's global – rather than national – profits. There are two effects that can in principle lead to a multinational wage premium in our model. The first is a pure composition effect: Setting up a foreign production facility involves fixed costs, and hence only the most

[1]For instance, relying on empirical results for UK, Girma and Görg (2007) conclude that the nationality of the foreign investor is an important determinant of the multinational wage premium, while Girma, Greenaway and Wakelin (2001) show that the multinational wage premium in UK affiliates is more pronounced if the investor is from the US than if the investor is from Japan.

[2]In this respect, our model contributes to a growing literature that looks at wage inequality in models of heterogeneous firms (see Davis and Harrigan, 2007; Amiti and Davis, 2008; Egger and Kreickemeier, 2008; 2009; 2010; and Helpman, Itskhoki, and Redding, 2010).

productive firms find it profitable to become multinational (see Helpman, Melitz, and Yeaple, 2004). Due to this self-selection into foreign investment, multinational enterprises (MNEs) make higher profits than their national competitors, and they pay higher wages due to rent sharing at the firm level. Therefore, in every country the average wage paid by MNEs is higher than the average wage paid by national firms. The second effect is a firm-level wage effect: Since rent sharing relates to a firm's global profits, MNEs pay higher wages in their home market than an otherwise identical firm that does not choose MNE status. The firm-level wage effect interacts with the composition effect, since it influences the decision to become multinational and thereby the similarity of the pools of national and multinational firms with respect to their average productivity.

In a first step, we analyse the case of two symmetric countries and investigate how the two sources of a multinational wage premium interact. We show that the firm-level wage effect in this setting magnifies the compositional effect and further increases the multinational wage premium. In addition, we show that a decline in the impediments to multinational activity makes the populations of foreign multinationals and domestic firms more similar, and hence lowers the multinational wage premium. Notably, in a setting with identical countries the multinational wage premium disappears once we control for firm characteristics, or in other words there is no *residual* wage premium: A domestic plant of a foreign MNE pays the same wage as a domestic firm with the same productivity since in the symmetric equilibrium this firm necessarily is multinational as well, with the same level of profits as the foreign MNE.

In a second step, we extend our model by introducing country asymmetries in order to shed light on the interaction between firm-specific and country-specific factors in determining the multinational wage premium. We model country asymmetries in a stylised way by assuming that firms in the "advanced" country draw their productivity from a distribution with a higher expected value than those in the "backward" country, but countries are identical in all other respects. As our most important result, we find that in this case a residual MNE wage premium exists in the backward country, but not in the advanced country. Intuitively, this is due to the fact that the threshold productivity level necessary to become multinational is higher for MNEs with headquarters in the backward economy – a finding that is consistent with the stylised fact that foreign investment flows (on net) from more advanced to less advanced countries (see Markusen, 2002; UNCTAD, 2009). Therefore, (only) in the backward economy there exists a range of foreign multinationals and purely national firms with identical productivity levels. These MNEs pay higher wages than their otherwise identical national competitors since they have higher global profits, which they share with their workforce in both countries. It is for this reason that working for a foreign owned firm can be good for workers in backward countries, ceteris paribus.

The country-specificity of the residual wage premium is well in line with the observation that empirical support for a residual wage premium is strongest for developing, transition, and newly industrialized economies (see Aitken, Harrison, and Lipsey, 1996; Te Velde and Morrisey, 2003; Dobbelaere, 2004; Lipsey and Sjöholm, 2004; Harrison and Scorse, 2009), while evidence for the (most) advanced economies is less clear. For instance, Girma, Greenaway, and Wakelin (2001) and Griffith and Simpson (2004) find evidence for a multinational wage premium in UK industries, after controlling for firm characteristics. On the other hand, relying on data for Canada and Portugal, respectively, Globerman, Ries and Vertinsky (1994) and Almeida (2007) show that the multinational wage premium vanishes in these countries when controlling for firm and worker characteristics. Most starkly, Aitken, Harrison, and Lipsey (1996) point out that after controlling for firm-specific factors, an unexplained residuum of the multinational wage premium can be found for Mexico and Venezuela but not for the US.

To the best of our knowledge, by giving a role to country-specific factors in general equilibrium the theoretical framework developed in this paper is the first to allow for the existence of a *residual* multinational wage premium. There are however a small number of other studies that offer theoretical explanations for the multinational wage premium, all of them based on particular features of MNEs that are not shared by purely national firms. Fosfuri, Motta and Rønde (2001) and Glass and Saggi (2002) assume that MNEs use a superior technology to the one used by their local competitors in the host country, and that workers hired by the MNEs foreign affiliate acquire knowledge of this superior technology. In this setting, offering a wage premium can be optimal if it helps reducing job turnover and thus the risk of technology dissipation. Görg, Strobl, and Walsh (2007) and Malchow-Møller, Markusen, and Schjerning (2007) set up a model with on-the-job training and assume that (on average) MNEs have access to a more effective training technology in order to explain a multinational wage premium in the post-training period.[3] These papers provide convincing arguments, complementary to ours, for the empirical observation that MNEs pay higher wages to ex ante identical workers (at least in later periods of their firm-specific tenure). However, once controlling for firm-specific factors the wage premium vanishes in all of these settings, and hence the models are not well equipped to explain the existence of a residual multinational wage premium.

The remainder of the paper is organised as follows. Section 2 introduces the model and solves for the autarky equilibrium. In Section 3 we describe our assumptions regarding the open economy and analyse the decision of firms to become multinational. Section 4 solves for the open economy equilibrium with symmetric countries and offers first insights into firm-specific determinants of the multinational wage premium. Section 5 extends the model by introducing asymmetries in the productivity distribution of countries. The last section concludes.

2 The Closed Economy

As a preliminary step, we introduce our modeling framework for the case where international trade and multinational firms are absent. This section mainly serves the purpose to introduce the notation and the key features of our framework in the most transparent way. The framework combines elements of the heterogeneous firm models with firm-specific wage rates developed in earlier work of ours (Egger and Kreickemeier, 2008, 2009). We therefore focus on deriving the key relationships needed for the later analysis of the equilibrium with multinational firms, which is the main contribution of the current paper.

We consider an economy with a single factor of production, labour L, that is used in the production of differentiated intermediate goods v, which are sold under monopolistic compe-

[3] Scheve and Slaughter (2004) point to an additional rationale for why MNEs pay higher wages than their local competitors. They argue that a multinational wage premium may compensate workers for the greater labour market volatility associated with being employed in an MNE. However, they do neither present a full-fledged model for studying this effect nor do they provide conclusive evidence that the risk of job loss is indeed higher for workers in MNEs than for workers in other firms.

tition. A second sector produces homogeneous good Y under perfect competition, using the differentiated intermediates as inputs. The CES production function for final output is given by

$$Y = \left[M^{-(1-\rho)} \int_{v \in V} q(v)^{\rho} dv \right]^{1/\rho}, \quad 0 < \rho < 1, \tag{1}$$

with the measure of set V representing the mass of available intermediate goods M.[4] We take final output as the numeraire, and hence the CES price index P corresponding to the production function in Eq. (1) is normalised to one. Profit maximisation of final goods producers results in an isoelastic demand function for each variety of the intermediate good:

$$q(v) = \frac{Y}{M} p(v)^{-\sigma}, \tag{2}$$

where $\sigma \equiv 1/(1-\rho)$ equals the constant elasticity of substitution between varieties.

Each intermediate goods producer operates a single domestic plant and has to bear a fixed beachhead cost f, in units of final output, in order to run a distribution system for the firm-specific variety of the good. Firms have constant firm-specific productivity $\phi(v)$, as in Melitz (2003). The marginal cost of firm v is given by $c(v) = w(v)/\left[\phi(v)\varepsilon(v)\right]$, with $w(v)/\varepsilon(v)$ being the wage per efficiency unit of labour, which is linked to the operating profits of firm v by a rent-sharing mechanism, as outlined below.

The profit maximisation problem of firms appears to be more complicated than in the standard monopolistic competition model since firms have discretion over the wage they pay. However, due to the rent sharing mechanism wages at the firm level are linked to (and increasing in) a firm's operating profits. Consider now a hypothetical equilibrium where the firm chooses the profit maximising level of output, *treating parametrically* the wage rate implied by the resulting level of profits. The only way a firm could lower this wage rate (which of course it would prefer, ceteris paribus) would be to reduce its profits, and so there is no room for the firm to exercise its monopsony power (see Amiti and Davis, 2008). Hence, facing (2), firms choose the profit-maximising price in a standard way as a constant markup over marginal cost $c(v)$:

$$p(v) = \frac{c(v)}{\rho}. \tag{3}$$

[4]Using technology (1) instead of the Ethier (1982) technology with external scale economies simplifies our analysis significantly, without affecting the main insights.

Wage and effort at the firm level are linked by a fair-wage effort mechanism along the lines of Akerlof and Yellen (1990). It is by assumption impossible to write binding contracts on effort, and hence the desired level of effort has to be elicited from workers via a wage offer. Workers condition their effort ε on the wage they are paid relative to the wage they consider to be fair, $\hat{w}$. If firms pay at least $\hat{w}$, workers provide the normal level of effort, which, for notational simplicity, is set equal to one. Effort decreases proportionally if the actual wage w falls short of $\hat{w}$. Formally, we have $\varepsilon = \min(w/\hat{w}, 1)$. Due to $w/\varepsilon = \hat{w}\ \forall w \leq \hat{w}$, profit maximising firms have no incentive to pay less than $\hat{w}$, so that we can safely follow Akerlof and Yellen (1990) in assuming that firms set wages at least as high as $\hat{w}$, implying that workers in all firms supply the maximum amount of labour efficiency units: $\varepsilon = 1$. Furthermore, with positive unemployment, which is ensured under mild parameter restrictions (see Egger and Kreickemeier, 2010), each firm can hire the profit maximising number of workers if they set $w = \hat{w}$, so this is what they do in equilibrium.[5]

The wage considered to be fair by a worker depends on two factors: first, the economic success of the firm in which the worker is employed and, second, the income opportunities outside the present job, represented by the average wage in the economy. We use operating profits as a measure of firm success, and with constant markup pricing they are a fraction $1/\sigma$ of firm revenues $r(v)$. The average wage is a fraction ρ of output per worker Y/L, due to a combination of markup pricing and the fact that labour is only used as a variable input. We now define the fair wage constraint as

$$\hat{w}(v) = \left(\frac{r(v)}{\sigma}\right)^{\theta} \left(\rho \frac{Y}{L}\right)^{1-\theta}, \tag{4}$$

where $\theta \in (0, 1)$ measures the importance of the firm-internal component in a worker's fairness considerations, and hence can be interpreted as a rent-sharing parameter. Since all firms pay the fair wage in equilibrium, it is immediate from (4) that firms with higher operating profits

[5] Howitt (2002) and Bewley (2005) provide an extensive discussion of the empirical evidence that supports the importance of fairness considerations for real world wage payments. Fehr and Falk (1999) have designed a laboratory experiment in order to investigate the relevance of imperfect contracting for the fair wage effort mechanism. They show that the inability to write a binding contract on the workers' effort is indeed crucial for this mechanism.

pay higher wages as long as θ is strictly positive. With $\theta = 0$ there would be no rent-sharing, with all workers receiving the same wage.

Combining (4) with the demand function for the closed economy in (2) leads to:

$$\frac{w(v_1)}{w(v_2)} = \left[\frac{\phi(v_1)}{\phi(v_2)}\right]^{\theta\xi} \tag{5}$$

with $\xi \equiv (\sigma - 1)/[1 + \theta(\sigma - 1)]$. Hence, in the closed economy the relative wage paid by two firms 1 and 2 can be expressed as a function of their relative productivity levels. As $\theta\xi < 1$, wages increase less than proportionally with firm productivity, and hence more productive firms have lower marginal cost. Using the fact that employment at the firm level $l(v)$ is equal to $r(v)/[p(v)\phi(v)]$, we furthermore find that for each firm v the wage rate $w(v)$ is directly proportional to operating profits per worker $r(v)/[\sigma l(v)]$. Hence, our framework is compatible with the empirical regularity of firm-specific wage rates that are increasing in firm profitability, usually measured as profits per worker (see Budd, Konings, and Slaughter, 2005; Martins and Yong, 2010).

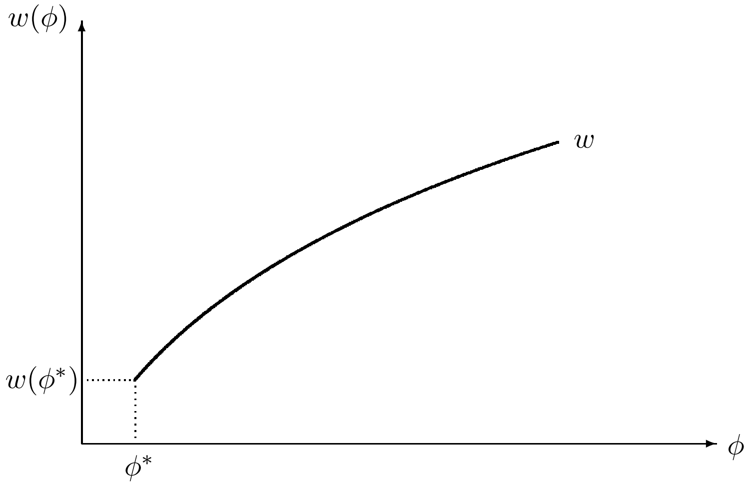

Figure 1: Wage profile in the closed economy

In complete analogy to Melitz (2003) in our model there is a *cutoff productivity* ϕ^* below which firms decide not to produce, implicitly defined by the zero profit condition $\pi(\phi^*) = r(\phi^*)/\sigma - f = 0$. We follow the by now common approach and assume that firm productivities follow a Pareto distribution with the cumulative distribution function $G(\phi) = 1 - (\phi/\bar{\phi})^{-k}$ and parameters k and $\bar{\phi}$. As is standard in a Melitz-type model with Pareto distributed productivities, the cutoff productivity ϕ^* is proportional to the average productivity $\tilde{\phi}$. The latter is implicitly determined by $\pi(\tilde{\phi}) = \Pi/M$, implying that the profit of the average firm equals the average profit per firm in the economy, $\bar{\pi}$. In particular, we get:

$$\tilde{\phi} = \left(\frac{k}{k-\xi}\right)^{\frac{1}{\xi}} \phi^*. \tag{6}$$

In order to ensure that the productivity average has a finite positive value, we assume $k > \xi$. The wage paid by the marginal firm can then be derived as follows:[6]

$$w(\phi^*) = \rho \left(\frac{k}{k-\xi}\right)^{\frac{1}{\sigma-1}} \phi^*. \tag{7}$$

Together, Eqs. (5) and (7) completely characterise the wage profile across firms, which is depicted in Figure 1. The endogenous cutoff productivity ϕ^* is linked to model parameters via the standard entry mechanism known from the dynamic Melitz (2003) framework, and it can be expressed as

$$\phi^* = \left[\frac{\xi f}{(k-\xi)\delta f_e}\right]^{\frac{1}{k}} \bar{\phi}, \tag{8}$$

where f_e are initial entry costs to participate in the productivity lottery, and δ is the exogenous probability of exit in each period, in which a firm is active (see Egger and Kreickemeier, 2009).

3 The Open Economy: Firm-Level Aspects

We now consider a world economy with two countries, 1 and 2, that have the same population size L but may differ in their productivity floors $\bar{\phi}_i$, $i = 1, 2$.[7] Market entry in both countries

[6]Noting that $Y = Mr(\tilde{\phi})$ holds by definition of $\tilde{\phi}$, while $Y = Mq(\tilde{\phi})$ follows from (1), we obtain $p(\tilde{\phi}) = 1$. Together with (3), this implies $w(\tilde{\phi}) = \rho\tilde{\phi}$. Accounting for (5) and (6), finally gives (7).

[7]One could as well allow for asymmetries in the population size of countries. But such endowment differences do not have an effect on the outcome of our analysis and hence we consider symmetry in this respect throughout our analysis.

follows the mechanism described in the previous section, but after observing the realisation of their productivity draw, firms now have three options open to them: They can shut down immediately, they can decide to open a production plant in their home country, incurring the fixed cost f, or they can decide to open two plants, one in their home country, and one in the other country, incurring overall fixed cost $f + F$. In this case, a firm becomes a horizontal multinational (see Markusen, 1984; 2002) and hence serves domestic as well as foreign consumers through local production. In order to facilitate our analysis, we exclude two other forms of foreign market penetration. First, we assume that transportation of intermediate goods is subject to prohibitvely high impediments and hence ignore trade as a possible alternative to horizontal investment. This is in contrast to the final goods sector, where trade is not subject to any impediments. Second, we assume that it is not attractive for firms to become a vertical multinational with headquarters in the home country and a single production facility in the foreign economy – for instance due to excessive fixed costs of doing so. As a consequence, becoming a horizontal multinational enterprise (*MNE* in short) is the only (relevant) option for a firm to serve foreign customers.

3.1 Determination of Wages at the Firm Level

Under openness, the fair wage is determined in analogy to the closed economy case: For each plant, it is a weighted average of the firm's operating profits and the average wage income of the country in which the plant is located. The crucial question that needs to be considered at this stage is whether to use national or global firm profits in the fair wage constraint. There is evidence that rent sharing within multinational firms occurs at the global rather than the national level: Budd, Konings and Slaughter (2005) find evidence for the international dimension of rent sharing using European data, and Martins and Yang (2010) find similar evidence for a wider set of 47 countries, including many countries from outside Europe. In our framework, this evidence can be rationalised by modeling the fair wage as depending on the global operating profits of a multinational firm, which is what we do in the following.[8]

[8]Notably, the evidence on international rent sharing in Budd, Konings and Slaughter (2005) and Martins and Yang (2010) pertains to global firm profits *per worker*. This evidence is accommodated in our framework in the

We henceforth focus on country 1 firms, but analogous expressions hold for country 2 firms. In the case of a purely national firm (superscript n) we have, taking into account $w = \hat{w}$:

$$w_1^n(\phi) = \left(\frac{r_1^n(\phi)}{\sigma}\right)^\theta \left(\rho \frac{Y_1}{L}\right)^{1-\theta}. \tag{9}$$

In the case of a multinational firm (superscript m) we obtain for the wages set in countries 1 and 2, respectively:

$$\begin{aligned} w_{11}^m(\phi) &= \left(\frac{r_1^m(\phi)}{\sigma}\right)^\theta \left(\rho \frac{Y_1}{L}\right)^{1-\theta}, \\ w_{12}^m(\phi) &= \left(\frac{r_1^m(\phi)}{\sigma}\right)^\theta \left(\rho \frac{Y_2}{L}\right)^{1-\theta}, \end{aligned} \tag{10}$$

where $r_1^m = r_{11}^m + r_{12}^m$ are the total revenues of a multinational firm based in country 1, from both of its plants.[9]

There are two immediate consequences of the fair-wage specifications in (10). First, multinational firms with the same productivity level pay the same wage rate irrespective of their headquarters location. Second, there is wage differentiation between the two plants of a single multinational firm if per capita labour income $\rho Y/L$ differs in the two economies. In particular the following result is immediate:

Lemma 1. *Multinational firms pay lower wages in the market with the lower per capita income.*

There is a second wage differential of interest, namely the one between the wage a multinational firm pays its domestic workers and the wage that would be paid by a national firm with the same productivity. This differential is important since it influences the decision of a firm whether or not to become multinational. Fair wage constraints (9) and (10) imply

$$\frac{w_{11}^m(\phi)}{w_1^n(\phi)} = \left(\frac{r_{11}^m(\phi)}{r_1^n(\phi)}\left[1 + \frac{r_{12}^m(\phi)}{r_{11}^m(\phi)}\right]\right)^\theta, \tag{11}$$

sense that in equilibrium firms with higher wages have higher profits per worker as well.

[9] Assuming that (operating) profits of the domestic and foreign plant enter symmetrically in the fair-wage considerations of workers is useful for presenting the main insights from our analysis in the simplest possible way, but it is not essential for our results. In a richer framework with potentially more than one subsidiary per firm, a higher weight of profits specific to the plant in which the respective worker is employed could provide a rationale for the empirical finding of Martins and Yong (2010) that a given level of total firm profits has a weaker impact on wages if these profits are spread over more (foreign) plants.

and hence the wage paid by a multinational firm in its domestic market relative to the wage paid by an otherwise identical national firm increases ceteris paribus in the relative revenues these firms make in the domestic market.

Using the demand function for intermediates together with the markup-pricing condition gives a further relation between relative wages paid by national and multinational firms, and their relative domestic revenues:

$$\frac{r_{11}^m(\phi)}{r_1^n(\phi)} = \left(\frac{w_{11}^m(\phi)}{w_1^n(\phi)}\right)^{1-\sigma} . \tag{12}$$

Higher wages lead to higher marginal cost, ceteris paribus, which imply higher prices and lower revenues. Equations (11) and (12) can be jointly solved to give

$$\frac{w_{11}^m(\phi)}{w_1^n(\phi)} = [1+\Omega_1]^{\theta(1-\theta\xi)} , \tag{13}$$

$$\frac{r_{11}^m(\phi)}{r_1^n(\phi)} = [1+\Omega_1]^{-\theta\xi} , \tag{14}$$

where $\Omega_1 \equiv r_{12}^m(\phi)/r_{11}^m(\phi)$ is the ratio for a given multinational firm of the revenues in its foreign and domestic markets. A multinational firm has to pay higher wages in its home market than a national firm with the same productivity, and, as a result, it has lower revenues in its home market.

The interpretation of Ω_1 is helped by substituting for the respective revenues from the demand functions for intermediate goods. Straightforward calculations lead to

$$\Omega_1 = \frac{Y_2/M_{t2}}{Y_1/M_{t1}} \left(\frac{p_2^m(\phi)}{p_1^m(\phi)}\right)^{1-\sigma} = \frac{Y_2/M_{t2}}{Y_1/M_{t1}} \left(\frac{Y_2}{Y_1}\right)^{(1-\sigma)(1-\theta)} , \tag{15}$$

where M_{ti} is the number of firms (including foreign multinationals) selling in market i. One can see that relative revenues in the two markets do not depend on firm productivity, and hence are the same for *all* multinationals of country 1. We will therefore interpret Ω_1 henceforth as a general measure of *relative foreign market potential.* We can summarise the main insights as follows:

Lemma 2. *When becoming multinational, a firm is faced with higher wages in its domestic market, leading to lower domestic revenues. The size of this effect is independent of the productivity level of the firm.*

The relative foreign market potential as expressed in (15) has a straightforward interpretation. The first term gives the ratio of average revenues per firm in the two markets, and it is therefore a measure of relative market size. The second term is a measure of the relative competitive position of the MNE in the two markets. To see this, note that the term is decreasing in the relative price the multinational firm charges in its two markets, and this relative price can be seen as a measure of relative competitiveness since the price indices in the two markets are equal due to free trade in the final good. For a given relative market size, the relative price is higher in the market with higher income Y_i, and this effect is the larger the smaller θ and therefore the larger the effect of local labour market conditions on firm-specific wage rates. Specifically, a higher income in the destination market 2 reduces relative foreign market potential Ω_1 via the relative competitiveness effect, ceteris paribus, since it leads to a higher firm-specific wage in country 2.

3.2 The Decision to Become Multinational

In Helpman, Melitz and Yeaple (2004), differences in labour productivity across firms in combination with fixed foreign investment costs F lead to self selection of only the most productive firms into multinational status. There is an additional cost of having MNE status in our model, since – as we have just shown – with this status the *domestic* marginal costs of a firm increase. We now analyse how this extra cost affects the decision of firms to become multinational, deriving a condition for the "partitioning" of firms, with only the most productive ones self-selecting into MNE status.

In an equilibrium with partitioning of firms by their MNE status, the productivity of the marginal multinational firm ϕ_1^m is implicitly defined by the indifference condition

$$\frac{r_1^m(\phi_1^m)}{\sigma} - F = \frac{r_1^n(\phi_1^m)}{\sigma},$$

i.e. the marginal MNE with productivity ϕ_1^m would make the same profits as either a national or a multinational firm. Rearranging terms gives

$$\frac{r_{11}^m(\phi_1^m)}{r_1^n(\phi_1^m)}\left[1+\Omega_1\right] = 1 + \frac{\sigma F}{r_1^n(\phi_1^m)}.$$

Substituting $r_1^n(\phi_1^*) = \sigma f$ and considering (14) as well as $r_1^n(\phi_1^*)/r_1^n(\phi_1^m) = (\phi_1^*/\phi_1^m)^\xi$, we can rewrite the indifference condition in the following way:

$$[1+\Omega_1]^{1-\theta\xi} = 1 + \frac{F}{f}\left(\frac{\phi_1^*}{\phi_1^m}\right)^\xi. \tag{16}$$

Selection of only the best firms into multinational activitiy requires $\phi_1^*/\phi_1^m < 1$, which is equivalent to

$$\left[(1+\Omega_1)^{1-\theta\xi} - 1\right]\frac{f}{F} < 1, \tag{17}$$

and this is guaranteed if F/f is sufficiently large.[10] In the subsequent analysis we focus on parameter constellations for which condition (17) is fulfilled.

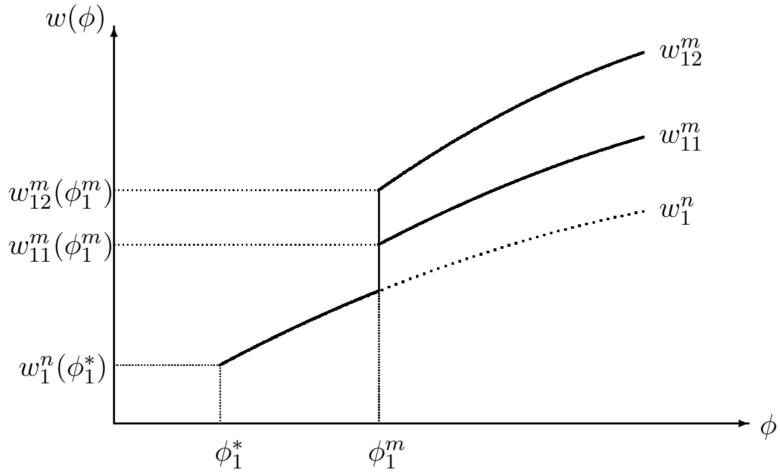

Figure 2: Wage profile across country 1 firms in the open economy

The wage paid by firms in country 1 as a function of their respective productivity is depicted in Figure 2. Within each regime (m and n, respectively), the relative wage of any two firms is still given by (5), and therefore wages are strictly increasing and concave in firm productivity within regimes (see Figure 1). Furthermore, we know from (13) that being multinational increases the wage a firm pays in its home market, ceteris paribus, and hence w_{11}^m lies strictly above w_1^n (the dotted part of w_1^n gives the wage a firm with productivity $\phi > \phi_1^m$ would have to pay if it were

[10]For example, it is easily checked that in the case of identical countries ($\Omega = 1$) self selection would occur in the case where the fixed costs are the same in both markets, i.e. $F = f$.

a national firm). Lastly, it follows from (10) that the intra-firm wage differential w_{12}^m/w_{11}^m is determined by Y_2/Y_1: The multinational firm has to pay a higher wage in the market with the higher labour income per capita in order to satisfy the fair wage constraint of the local workforce (see Lemma 1). Figure 2 depicts the case where per capita labour income is higher in country 2.

4 The Open Economy with Symmetric Countries

We now turn to the analysis of the general equilibrium in the open economy. To this end, we start by focussing on the case where countries 1 and 2 are identical in all respects, implying that $\Omega_1 = \Omega_2 = 1$. The symmetry assumption allows us to neglect country indices in this section.

As analysed in Section 3, only firms with a productivity level higher than (or equal to) ϕ^m find it attractive to set up a second production facility in the foreign economy. Thus, the *ex ante* probability that a successful entrant will become multinational is given by $\chi \equiv [1 - G(\phi^m)]/[1 - G(\phi^*)] = (\phi^*/\phi^m)^k$. Since firms know their productivity levels before they decide upon their export status, χ also gives the *ex post* fraction of multinationals, and hence $M_t = (1+\chi)M$. Using (16) we find that with symmetric countries we can explicitly solve for χ:

$$\chi = \left[\left(2^{1-\theta\xi} - 1\right)\frac{f}{F}\right]^{\frac{k}{\xi}} \tag{18}$$

The share of firms becoming multinational decreases with higher cost of MNE status, as would be expected. Furthermore, with part of the firms being active in both countries, average profits per firm $\bar{\pi} = \Pi/M$ are larger than under autarky, and due to a standard selection effect à la Melitz (2003) the productivity cutoff is higher in the open economy with multinational presence than under autarky.[11]

We measure the multinational wage premium ω in a country, say country 1, as the ratio of two average wages: One is the average wage of workers employed in country-1 plants of multinational firms with headquarters in country 2 (*foreign firms*, denoted by superscript f), while the other is the average wage of workers employed in country-1 plants of all firms with headquarters in

[11] Derivations are standard, and along with explicit solutions for macro-variables like aggregate income and economy-wide employment they are available from the authors upon request.

country 1 (*home firms*, denoted by superscript h). In general equilibrium, both averages – and therefore ω – depend on the composition of the respective firm pools, as well as the relative wages paid by national and multinational firms. Total wage payments and employment levels for foreign firms are given by

$$W^f = \rho\chi M \int_{\phi^m}^{\infty} r^m(\phi) \frac{dG(\phi)}{1 - G(\phi^m)}$$

and

$$L^f = \chi M \int_{\phi^m}^{\infty} l^m(\phi) \frac{dG(\phi)}{1 - G(\phi^m)},$$

respectively, where we make use of the fact that wage payments are a fraction ρ of revenues in all firms. The resulting average wage is denoted by $w^f \equiv W^f/L^f$. For home firms, the respective variables are given by

$$W^h = W^f + \rho M \int_{\phi^*}^{\phi^m} r^n(\phi) \frac{dG(\phi)}{1 - G(\phi^*)}$$

and

$$L^h = L^f + M \int_{\phi^*}^{\phi^m} l^n(\phi) \frac{dG(\phi)}{1 - G(\phi^*)},$$

respectively, and the resulting average wage is denoted by $w^h \equiv W^h/L^h$. As shown in the appendix, ω can be computed from these expressions as:

$$\omega \equiv \frac{w^f}{w^h} = \frac{2^{-\theta\xi} - 2^{\frac{\theta\xi}{\sigma-1}} \left(1 - \chi^{-\frac{k-(1-\theta)\xi}{k}}\right)}{2^{-\theta\xi} - \left(1 - \chi^{-\frac{k-\xi}{k}}\right)} \tag{19}$$

It is easily checked that ω is equal to one if χ is equal to one, and larger than one otherwise. Furthermore, we find $d\omega/d\chi < 0$, and hence the multinational wage premium decreases monotonically in the share of firms that have MNE status. Using (18), we can furthermore relate ω to model parameters: The multinational wage premium is lower the lower the fixed cost F of FDI.

The main results from this section can be summarised as follows:

Proposition 1. *With symmetric countries and selection of the most productive firms into MNE status there exists a multinational wage premium, i.e.* $\omega > 1$. *The premium decreases monotonically in the proportion of firms that have MNE status.*

Intuitively, the multinational wage premium in (19) exists simply due to the fact that the pools of home and foreign firms differ in their composition: foreign firms, which by definition are all MNEs, are on average more productive than home firms. They make therefore higher profits, which via the rent-sharing mechanism lead to higher wages. The extent of self-selection into multinational status, and hence the size of this compositional effect, is influenced by the firm level wage effect identified earlier: firms of a given productivity have to pay a higher wage if they choose to become multinationals since their global profits are higher. With a higher χ the pools of foreign and home firms become more similar, thereby weakening the compositional effect that is responsible for the existence of the multinational wage premium. For $\chi = 1$ all firms engage in FDI and the premium vanishes.

Evidence in support of our result that MNEs are on average more productive than their domestic competitors, and also pay higher wages, is provided by Girma, Greenaway and Wakelin (2001). Furthermore, recollecting from Section 3.1 that multinational firms with the same productivity level pay the same wage rate irrespective of their headquarters location, the results in this section are also consistent with the observation in Heyman, Sjöholm, and Tingvall (2007) that foreign-owned firms tend to pay higher wages than domestically owned firms without foreign affiliates, but, on the other hand, they do not pay higher wages than domestically owned multinationals.

5 Asymmetric Countries and the Multinational Wage Premium

The analysis in the previous section has shed light on the role of firm characteristics for explaining the MNE wage premium, and there is indeed strong evidence that differences in firm characteristics can explain a substantial share of this premium (see Görg, Strobl, and Walsh, 2007). However, the empirical literature identifies country-specific factors as an additional set of relevant determinants of the MNE wage premium. For instance, Girma and Görg (2007) find that the wage payment of multinational firms crucially depends on the nationality of the foreign investor. This suggests that the MNE wage premium is governed by the economic fundamentals of the countries that are involved in the multinational activity. The role of these fundamentals cannot be studied adequately in a setting with symmetric countries, and hence we have to introduce some form of asymmetry in our model in order to shed further light on this issue. One possibility to capture country asymmetries is to assume differences in the technology distribution, and the simplest way to model this form of asymmetry is to assume different productivity floors, i.e. $\bar{\phi}_1 \neq \bar{\phi}_2$.[12]

We start our formal discussion by noting that the marginal firm's revenue equals σf in both markets, so that $r_1^n(\phi_1^*) = r_2^n(\phi_2^*)$ and, in view of (2),

$$\frac{Y_2}{M_{t2}} \left(\frac{w^n(\phi_2^*)}{\rho \phi_2^*} \right)^{1-\sigma} = \frac{Y_1}{M_{t1}} \left(\frac{w^n(\phi_1^*)}{\rho \phi_1^*} \right)^{1-\sigma} \tag{20}$$

must hold as long as the marginal firm in either economy is active in its domestic market only, which we assume throughout (see (17)). Together with the constant markup pricing condition, the fair wage constraint in (9) and the definition of Ω_1 in (15), we can then derive a simple relationship between the ratio of cutoff productivity levels, ϕ_1^*/ϕ_2^*, and the relative foreign market potential, Ω_1. This relationship is given by

$$\frac{\phi_1^*}{\phi_2^*} = \Omega_1^{\frac{1}{\sigma-1}} \tag{21}$$

Eq. (21) establishes that the cutoff productivity ratio is a monotonically increasing function of the relative foreign market potential, with ϕ_1^* being larger than ϕ_2^* if and only if country 1 has the larger foreign market potential. Intuitively, an increase in the cutoff productivity ratio lowers, all other things equal, the variable production costs of the marginal producer in country 1 relative to the marginal producer in country 2, leading to $r_1^n(\phi_1^*)/r_2^n(\phi_2^*) > 1$. Hence, the relative foreign market potential of country 1, as measured by Ω_1, must increase in order to re-establish the condition that revenues of the marginal producers are the same in the two economies (see (20)).

In the open economy, both the relative cutoff levels and the relative market potential are endogenous variables, of course. We now relate them to the exogenous difference in the countries' technology distributions, as measured by $\bar{\phi}_1/\bar{\phi}_2$. As shown in the appendix, we get

$$\frac{\phi_1^*}{\phi_2^*} = \left(\frac{f + \chi_1 F}{f + \chi_2 F} \right)^{\frac{1}{k}} \frac{\bar{\phi}_1}{\bar{\phi}_2}. \tag{22}$$

[12] The distribution with the higher productivity floor first-order stochastically dominates the other one. See Demidova (2008) for a more extensive discussion of technology differences between countries in a trade model with heterogeneous firms.

We cannot directly infer the nexus between relative productivity floors and relative cutoff productivities from (22), as the share of country-i firms that are multinational, χ_i, is itself endogenous. In analogy to (18) it is given by

$$\chi_i = \left\{ \left[(1+\Omega_i)^{1-\theta\xi} - 1 \right] \frac{f}{F} \right\}^{k/\xi}, \qquad i = 1, 2. \tag{23}$$

Acknowledging $\Omega_2 = 1/\Omega_1$, Eqs. (21) to (23) give a system of four equations in the four unknowns ϕ_1^*/ϕ_2^*, Ω_1, χ_1, and χ_2.

Taking into account the endogeneity of χ_1 and χ_2, we can rewrite (22) as

$$\frac{\phi_1^*}{\phi_2^*} = C\left(B\left(\frac{\phi_1^*}{\phi_2^*} \right) \right) \frac{\bar{\phi}_1}{\bar{\phi}_2} \tag{22$'$}$$

where – from Eqs. (21) and (23) – the derivatives $B'(\phi_1^*/\phi_2^*)$ and $C'(B)$ are strictly positive. Implicit differentiation gives

$$\frac{d(\phi_1^*/\phi_2^*)}{d(\bar{\phi}_1/\bar{\phi}_2)} = \frac{C(\cdot)}{1 - (\bar{\phi}_1/\bar{\phi}_2)C'(\cdot)B'(\cdot)}$$

which is strictly positive if and only if $(\bar{\phi}_1/\bar{\phi}_2)C'(\cdot)B'(\cdot) < 1$. It can be shown that this condition holds in any equilibrium that leads to self-selection of the best firms into multinational status in both countries: $\chi_1 \in (0,1)$, $\chi_2 \in (0,1)$, i.e. if (17) holds for both countries (see appendix). Such an equilibrium exists if the difference in the productivity floors $\bar{\phi}_1$ and $\bar{\phi}_2$ is not too large and the fixed cost for additionally setting up a foreign production facility, F, is sufficiently high. Only in this case is the relationship between ϕ_1^*/ϕ_2^* and $\bar{\phi}_1/\bar{\phi}_2$ governed by (22). Since the cutoff productivities ϕ_i^* are equalised across countries if they have identical productivity floors $\bar{\phi}_i$, the previous analysis shows that the more advanced country (as measured by a higher $\bar{\phi}_i$) has the higher cutoff productivity ϕ_i^* and the higher share of firms that are multinational χ_i. It furthermore shows that the more advanced country has the higher foreign market potential Ω_i.

These results imply that the population of home firms differs in its composition between the two countries if $\bar{\phi}_1 \neq \bar{\phi}_2$, and that the same is true for the population of foreign firms. To say something more specific, we combine Eqs. (21) and (23), and furthermore use the relationship between χ_i and the multinational productivity cutoff, which is analogous to the case of symmetric countries: $\chi_i = (\phi_i^*/\phi_i^m)^k$. Solving for the relative multinational cutoff productivities, we get

$$\frac{\phi_1^m}{\phi_2^m} = \left\{ \left[\frac{(1+1/\Omega_1)^{1-\theta\xi} - 1}{(1+\Omega_1)^{1-\theta\xi} - 1} \right]^{1+\theta(\sigma-1)} \Omega_1 \right\}^{1/(\sigma-1)} . \tag{24}$$

As shown in detail in the appendix, $d(\phi_1^m/\phi_2^m)/d\Omega_1 < 0$. Since, as shown above, Ω_1 is increasing in $\bar{\phi}_1/\bar{\phi}_2$, the multinational productivity cutoff is higher in the technologically backward country. This means that it is more difficult to survive as a foreign multinational in the technologically advanced country, consistent with the stylised fact that foreign direct investment flows (on net) from more advanced to less advanced countries (see Markusen, 2002; UNCTAD, 2009).

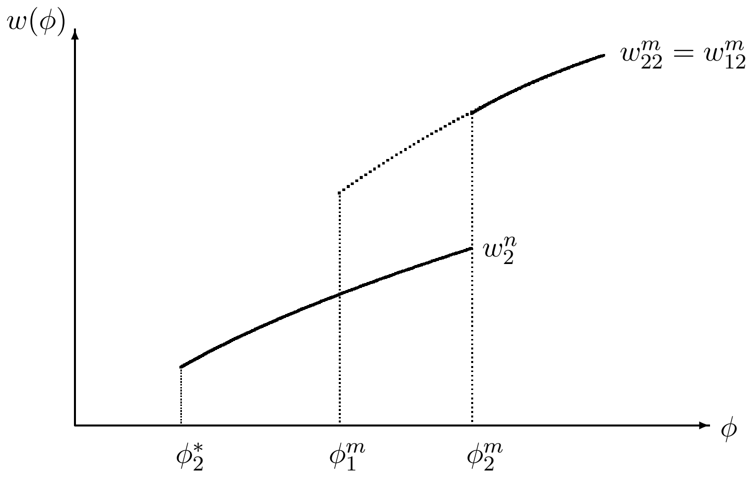

Figure 3: Residual wage premium in backward country 2

As an implication of the country-specific multinational cutoffs, in the technologically backward economy there is a subgroup of domestic *national* firms and foreign multinationals which have the same productivity levels. Hence, even if national and multinational firms use the same technology, they differ in their wage payments due to the wage premium that has to be paid by the multinational, according to (13). In other words, there is a *residual* wage premium – i.e. a premium that is not fully explained by firm characteristics – in the backward country. Figure 3 illustrates the residual wage premium, where country 2 is assumed to be the technologically backward country. In the productivity interval (ϕ_1^m, ϕ_2^m) there exists an overlap between national country-2 firms with wage payments $w_2^n(\phi)$ and foreign plants of multinational country-1

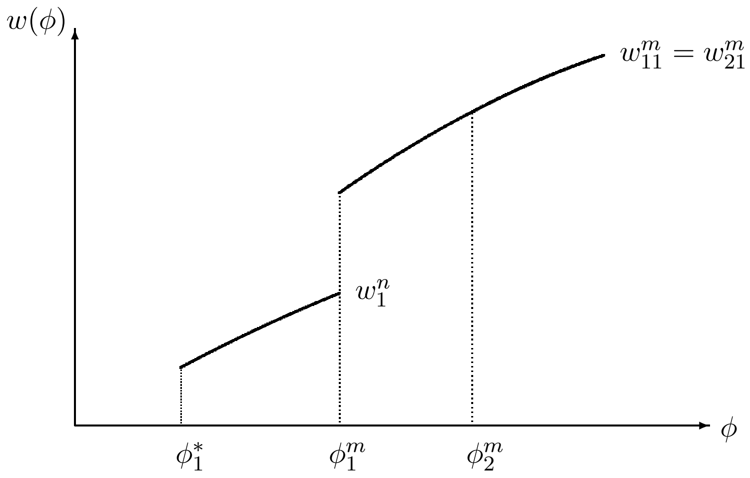

Figure 4: No residual wage premium in advanced country 1

firms with wage payments $w_{12}^m(\phi) > w_2^n(\phi)$. In contrast, no residual wage premium exists in the technologically advanced country, since there is no overlap between the populations of domestic national firms and foreign multinationals in terms of their productivity. This is illustrated in Figure 4.

From the empirical literature on wage payments in MNEs, we know that evidence on the existence of a residual wage premium varies significantly across countries. To be more specific, while the existence of such a residual premium in high-income countries is still under debate (see Globerman, Ries and Vertinsky, 1994; Almeida, 2007), there is convincing evidence that the respective residuum does exist and is sizable in developing, transition, and newly industrialised countries (see Aitken, Harrison, and Lipsey, 1996; Te Velde and Morrissey, 2003; Dobbelaere, 2004; Lipsey and Sjöholm, 2004; Harrison and Scorse, 2009). This is well in line with our model, which shows that the technology gap between the source and the host country of multinational activity is not only a key determinant of the investment decision of firms but also gives rise to a multinational wage premium in the technologically backward economy, which is not entirely captured by differences in firm and worker characteristics. In summary, we have:

Proposition 2. *The minimum productivity necessary to become an MNE is higher in the technologically backward country. Controlling for firm characteristics, a residual MNE wage premium* *exists in the technologically backward country but not in the technologically advanced country.*

The difference between countries in the composition of firm populations means that the size of the multinational wage premium is now country-specific as well. As shown in the appendix, the MNE wage premium with asymmetric countries is given for country 1 by

$$\omega_1 = \left(\frac{1+\Omega_2}{1+\Omega_1}\right)^{\frac{\theta\xi}{\sigma-1}} \left(\frac{\chi_1}{\chi_2}\right)^{\frac{\theta\xi}{k}} \frac{(1+\Omega_1)^{-\theta\xi} - (1+\Omega_1)^{\frac{\theta\xi}{\sigma-1}} \left(1-\chi_1^{-\frac{k-(1-\theta)\xi}{k}}\right)}{(1+\Omega_1)^{-\theta\xi} - \left(1-\chi_1^{-\frac{k-\xi}{k}}\right)}, \tag{25}$$

with ω_2 determined analogously. The MNE wage premium for the case of symmetric countries, as given by (19), is recovered as the special case with $\Omega_1 = \Omega_2 = 1$ and $\chi_1 = \chi_2$.

It is in general not clear whether the multinational wage premium is larger in the advanced or the backward economy. We can, however, derive results for small (i.e. marginal) differences between the two countries' productivity floors (see the appendix). In particular, we find the following:

Proposition 3. *For small technology differences, the advanced country has a higher multinational wage premium than the backward country if the share of multinationals in the two economies is small, and vice versa if the respective shares are large.*

As noted above, an increase in $\bar{\phi}_1/\bar{\phi}_2$ raises the cutoff productivity of foreign multinationals (relative to domestic ones) and thus increases the average wage paid by these multinationals in country 1 (relative to domestic multinationals in this economy). This effect contributes to an increase in ω_1. At the same time, there are two counteracting effects, as the least productive national firms in country 1 stop production and leave the market, while more domestic firms in country 1 find it attractive to become a multinational and thus offer a premium to their local workforce. The strength of these counteracting effects depends crucially on the share of multinationals prior to the increase in $\bar{\phi}_1/\bar{\phi}_2$: The existence of a firm-level wage effect implies that a firm shrinks *in its domestic market* if it starts serving foreign consumers as a multinational. Hence, the relative size of purely national firms with low productivity, and their individual weight in the determination of the average domestic wage is high if the share of multinational firms is high. The compositional effect at the lower bound of the productivity distribution of active firms therefore has a strong impact on the average domestic wage if χ_1 is large. In this case, ω_1 shrinks in $\bar{\phi}_1/\bar{\phi}_2$, while the opposite is true if χ_1 is small.

We round off the discussion in this section by contrasting our theoretical findings with the empirical evidence in Aitken, Harrison, and Lipsey (1996), which to the best of our knowledge is the only paper that looks at multinational wage premia in a set of countries with differing technology characteristics. The countries considered in their study are Mexico, Venezuela, and the US . The key finding of their analysis is that, once controlling for firm-specific factors, the multinational wage premium vanishes in the US, while a residuum of significant size remains in Mexico and Venezuela. This finding is well in line with our theoretical findings in Proposition 2. At the same time, they document a higher multinational wage premium for Mexico and Venezuela than for the US, which they explain by larger wage spillovers of foreign MNEs on domestic firms in the more advanced economy. Proposition 3 offers a different explanation of this empirical finding by Aitken, Harrison, and Lipsey (1996) pointing to the role of differences in the composition of national as well as multinational firm populations.

6 Concluding Remarks

In this paper, we develop an analytically tractable general equilibrium model with multinational firms which allows us to think about the multinational wage premium in a systematic way. There is rent sharing at the firm level due to fairness preferences of workers, and we focus on the empirically relevant case that rent sharing within multinational firms occurs at the global rather than national level. In our framework two sources of a multinational wage premium exist. On the one hand, there is a pure composition effect because multinational firms are more productive, make higher profits, and therefore pay higher wages than purely national firms. On the other hand, there is a firm-level wage effect of being a multinational: MNEs pay higher wages in their home market than otherwise identical national firms since their global profits are higher.

We first analyse how these two sources interact in determining the multinational wage premium in a setting with two identical countries. We show that an MNE wage premium exists in this case, and that it is increasing in the costs of FDI. It is also shown that with symmetric countries the wage premium is fully explained by firm characteristics. Therefore, no scope for a residual wage premium exists in this case, and from a worker's perspective working for a foreign owned firm is not beneficial as such. We then allow for technology differences between countries and find that a residual wage premium does exist in the technologically backward country, but not in the advanced country. Hence, in our framework technologically backward countries are an environment in which it may be beneficial for individual workers to be employed by a foreign-owned firm: national firms co-exist with foreign multinational firms of the same productivity, and the wages paid by the latter are higher.

This paper provides novel insights into the interaction of firm-specific and country-specific factors in determining the multinational wage premium, with the findings from this analysis being well supported by empirical evidence. However, there are several directions in which this research could and should be extended in order to get a more comprehensive picture about the determinants of the multinational wage premium. On the one hand, by focussing exclusively on technology differences between the two economies as the country-specific determinant of the multinational wage premium, we abstract from other factors which may as well be important. For instance, it is broadly accepted among economists that institutional differences between Europe and the US are crucial for understanding the patterns of unemployment and wage inequality on both sides of the Atlantic. Such institutional differences are not accounted for in this paper in order to keep the analysis tractable. On the other hand, we do not account for vertical aspects in the foreign investment decision of firms, and hence abstract from one important form of multinational activity. Nor do we account for exporters, and thus exclude the proximity-concentration trade-off in the firms' decision upon the mode of foreign market entry. While simultaneously allowing for both vertical and horizontal investment motives as well as for exporting as an alternative mode of foreign market penetration would enrich our insights on the multinational wage premium, such an extension is far beyond the scope of this paper and therefore left for future research.

Appendix

The Multinational Wage Premium with Symmetric Countries

The expressions for W^f and W^h given in the main text can be simplified to yield

$$W^f = \rho M r^n(\phi^*) \frac{k}{k-\xi} 2^{-\theta\xi} \left[\left(2^{1-\theta\xi} - 1 \right) \frac{f}{F} \right]^{\frac{k-\xi}{\xi}}. \tag{26}$$

and

$$W^h = \rho M r^n(\phi^*) \frac{k}{k-\xi} \left[1 - \left(1 - 2^{-\theta\xi} \right) \left[\left(2^{1-\theta\xi} - 1 \right) \frac{f}{F} \right]^{\frac{k-\xi}{\xi}} \right] \tag{27}$$

Considering further that total employment in domestic firms and foreign multinationals is given by

$$L^h = AM \left[1 - \left(1 - 2^{-\frac{\theta\xi\sigma}{\sigma-1}} \right) \left[\left(2^{1-\theta\xi} - 1 \right) \frac{f}{F} \right]^{\frac{k-(1-\theta)\xi}{\xi}} \right] \tag{28}$$

and

$$L^f = AM 2^{-\frac{\theta\xi\sigma}{\sigma-1}} \left[\left(2^{1-\theta\xi} - 1 \right) \frac{f}{F} \right]^{\frac{k-(1-\theta)\xi}{\xi}}, \tag{29}$$

respectively, where

$$A \equiv l^n(\phi^*) \frac{k}{k-(1-\theta\xi)}. \tag{30}$$

Dividing (27) by (28) gives the average wage paid in domestic plants:

$$w^h = \frac{\rho r^n(\phi^*)}{A} \frac{k}{k-\xi} \frac{1 - \left[1 - 2^{-\theta\xi}\right] \left[\left[2^{1-\theta\xi} - 1\right] f/F \right]^{\frac{k-\xi}{\xi}}}{1 - \left[1 - 2^{-\frac{\theta\xi\sigma}{\sigma-1}}\right] \left[\left(2^{1-\theta\xi} - 1\right) f/F \right]^{\frac{k-(1-\theta)\xi}{\xi}}}, \tag{31}$$

while dividing (26) by (29) gives the average wage paid in the domestic plant of foreign multinationals:

$$w^f = \frac{\rho r^n(\phi^*)}{A} \frac{k}{k-\xi} \frac{2^{\frac{\theta\xi}{\sigma-1}}}{\left[\left(2^{1-\theta\xi} - 1\right) f/F \right]^{\theta}}. \tag{32}$$

Hence, the ratio between the two averages is given by

$$\frac{w^f}{w^h} = \frac{2^{\frac{\theta\xi}{\sigma-1}}}{\left[\left(2^{1-\theta\xi}-1\right)f/F\right]^{\theta}} \times \frac{1-\left[1-2^{-\frac{\theta\xi\sigma}{\sigma-1}}\right]\left[\left(2^{1-\theta\xi}-1\right)f/F\right]^{\frac{k-(1-\theta)\xi}{\xi}}}{1-\left[1-2^{-\theta\xi}\cdot\right]\left[\left(2^{1-\theta\xi}-1\right)f/F\right]^{\frac{k-\xi}{\xi}}} \tag{33}$$

Finally, accounting for (16) and (18) gives (19).

Derivation of Eq. (22)

In the case of asymmetric countries, total revenues of country-1 firms are given by

$$Y_1 = M_1 \int_{\phi_1^*}^{\phi_1^m} r_1^n(\phi) \frac{dG(\phi)}{1-G(\phi_1^*)} + \chi_1 M_1 \int_{\phi_1^m}^{\infty} r_1^m(\phi) \frac{dG(\phi)}{1-G(\phi_1^m)}. \tag{34}$$

Accounting for (2), (5), (14) and $r_1^m(\phi) = r_{11}^m(\phi) + r_{12}^m(\phi)$ as well as $r_{12}^m(\phi)/r_{11}^m(\phi) = \Omega_1$, we can rewrite the latter equation in the following way

$$\begin{aligned} Y_1 &= M_1 r_1^n(\phi_1^*) \left[\int_{\phi_1^*}^{\phi_1^m} \left(\frac{\phi}{\phi_1^*}\right)^{\xi} \frac{dG(\phi)}{1-G(\phi_1^*)} + (1+\Omega_1)^{1-\theta\xi} \chi_1 \int_{\phi_1^m}^{\infty} \left(\frac{\phi}{\phi_1 *}\right)^{\xi} \frac{dG(\phi)}{1-G(\phi_1^m)}\right] \\ &= M r_1^n(\phi_1^*) \frac{k}{k-\xi} \left\{1 + \left[(1+\Omega_1)^{1-\theta\xi} - 1\right] \chi_1 \left(\frac{\phi_1^m}{\phi_1^*}\right)^{\xi}\right\} \end{aligned} \tag{35}$$

which, in view of (16), simplifies to

$$Y_1 = M_1 r_1^n(\phi_1^*) \frac{k}{k-\xi} \left(1 + \frac{\chi_1 F}{f}\right). \tag{36}$$

Dividing the right-hand side of (36) by σ and substracting overall fixed cost expenditures $M_1 f + \chi_1 M_1 F$ gives total profits of domestic producers in country 1:

$$\Pi_1 = M_1 \left[\frac{r_1^n(\phi_1^*)}{\sigma} \frac{k}{k-\xi} - f\right] \left(1 + \frac{\chi_1 F}{f}\right). \tag{37}$$

Substituting $r_1^n(\phi_1^*) = \sigma f$ and accounting for $\Pi_1 = M_1 \bar{\pi}_1$ gives average profits $\bar{\pi}_1 = (1 + \chi_1 F/f)\,\bar{\pi}_{1a}$. Combining this zero cutoff profit condition with the standard free entry condition from Melitz (2003) and accounting for (8) further implies

$$\phi_1^* = \left[\frac{\xi f}{(k-\xi)\delta f_e} \left(1 + \frac{\chi_1 F}{f}\right)\right]^{\frac{1}{k}} \bar{\phi}_1. \tag{38}$$

Repeating the same steps as above for country 2, we get

$$\phi_2^* = \left[\frac{\xi f}{(k-\xi)\delta f_e}\left(1+\frac{\chi_2 F}{f}\right)\right]^{\frac{1}{k}} \bar{\phi}_2. \tag{39}$$

The latter two equations establish (22).

Derivation of (22′) and the relationship between ϕ_1^*/ϕ_2^* and $\bar{\phi}_1/\bar{\phi}_2$

Let us define

$$C(B) \equiv \left\{ \frac{1+\left[(1+B)^{\xi/(\sigma-1)}-1\right]^{k/\xi}(f/F)^{(k-\xi)/\xi}}{1+\left[(1+B^{-1})^{\xi/(\sigma-1)}-1\right]^{k/\xi}(f/F)^{(k-\xi)/\xi}} \right\}^{1/k}, \tag{40}$$

with

$$B = B\left(\frac{\phi_1^*}{\phi_2^*}\right) \equiv \left(\frac{\phi_1^*}{\phi_2^*}\right)^{\sigma-1}. \tag{41}$$

Then, accounting for $1-\theta\xi = \xi/(\sigma-1)$ and Eq. (23), we can rewrite (22) as (22′).

Differentiating $C(\cdot)$ with respect to ϕ_1^*/ϕ_2^* gives

$$\begin{aligned}(\bar{\phi}_1/\bar{\phi}_2)C'B' = \Bigg\{ & \frac{\left[(1+B)^{\xi/(\sigma-1)}-1\right]^{k/\xi}(f/F)^{(k-\xi)/\xi}}{1+\left[(1+B)^{\xi/(\sigma-1)}-1\right]^{k/\xi}(f/F)^{(k-\xi)/\xi}} \frac{(1+B)^{\xi/(\sigma-1)}}{(1+B)^{\xi/(\sigma-1)}-1}\frac{B}{1+B} \\ & + \frac{\left[\left(1+B^{-1}\right)^{\xi/(\sigma-1)}-1\right]^{k/\xi}(f/F)^{(k-\xi)/\xi}}{1+\left[(1+B^{-1})^{\xi/(\sigma-1)}-1\right]^{k/\xi}(f/F)^{(k-\xi)/\xi}} \frac{(1+B^{-1})^{\xi/(\sigma-1)}}{(1+B^{-1})^{\xi/(\sigma-1)}-1}\frac{B^{-1}}{1+B^{-1}} \Bigg\},\end{aligned}$$

where $(\bar{\phi}_1/\bar{\phi}_2)^{-1} = C(\phi_1^*/\phi_2^*)^{-1}$ has been assumed, according to (22′). Noting that $\chi_1 < 1$ implies $f/F < \left[(1+B)^{\xi/(\sigma-1)}-1\right]^{-1}$, while $\chi_2 < 1$ implies $f/F < \left[\left(1+B^{-1}\right)^{\xi/(\sigma-1)}-1\right]^{-1}$, we can make use of

$$\begin{aligned}\left[(1+B)^{\xi/(\sigma-1)}-1\right]^{k/\xi}(f/F)^{(k-\xi)/\xi} &< (1+B)^{\xi/(\sigma-1)}-1, \\ \left[\left(1+B^{-1}\right)^{\xi/(\sigma-1)}-1\right]^{k/\xi}(f/F)^{(k-\xi)/\xi} &< \left(1+B^{-1}\right)^{\xi/(\sigma-1)}-1.\end{aligned}$$

Hence, we have

$$\begin{aligned}(\bar{\phi}_1/\bar{\phi}_2)C'B' < & \frac{(1+B)^{\xi/(\sigma-1)}-1}{(1+B)^{\xi/(\sigma-1)}}\frac{(1+B)^{\xi/(\sigma-1)}}{(1+B)^{\xi/(\sigma-1)}-1}\frac{B}{1+B} \\ & + \frac{\left(1+B^{-1}\right)^{\xi/(\sigma-1)}-1}{(1+B^{-1})^{\xi/(\sigma-1)}}\frac{(1+B^{-1})^{\xi/(\sigma-1)}}{(1+B^{-1})^{\xi/(\sigma-1)}-1}\frac{B^{-1}}{1+B^{-1}}\end{aligned} \tag{42}$$

or, equivalently,

$$(\bar{\phi}_1/\bar{\phi}_2)C'B' < \frac{B}{1+B} + \frac{1}{1+B} = 1. \tag{43}$$

This implies that $\chi_1 < 1, \chi_2 < 1$ are sufficient for $(\bar{\phi}_1/\bar{\phi}_2)C'B' < 1$ as stated in the main text.

FDI Cutoffs and Relative Foreign Market Potential

Let us define

$$\Phi(\Omega_1) \equiv \left[\frac{(1+1/\Omega_1)^{1-\theta\xi}-1}{(1+\Omega_1)^{1-\theta\xi}-1}\right]^{1+\theta(\sigma-1)} \Omega_1. \tag{44}$$

Differentiating $\Phi(\Omega_1)$ gives

$$\frac{d\Phi(\cdot)}{d\Omega_1} = -\frac{[1+\theta(\sigma-1)]\,\Phi(\cdot)\,[(1+\Omega_1)^{1-\theta\xi}-1]}{(1+1/\Omega_1)^{1-\theta\xi}-1}\left\{\frac{(1-\theta\xi)(1/\Omega_1^2)\,(1+1/\Omega_1)^{-\theta\xi}\left[(1+\Omega_1)^{1-\theta\xi}-1\right]}{[(1+\Omega_1)^{1-\theta\xi}-1]^2}\right.$$
$$\left. + \frac{(1-\theta\xi)(1+\Omega_1)^{-\theta\xi}\left[(1+1/\Omega_1)^{1-\theta\xi}-1\right]}{[(1+\Omega_1)^{1-\theta\xi}-1]^2}\right\} + \frac{\Phi(\cdot)}{\Omega_1}.$$

Substituting $1-\theta\xi = 1/[1+\theta(\sigma-1)]$ and rearranging terms, we further obtain

$$\frac{d\Phi(\cdot)}{d\Omega_1} = -\frac{\Phi(\cdot)}{\Omega_1}\left\{\frac{(1/\Omega_1)\,(1+1/\Omega_1)^{-\theta\xi}\left[(1+\Omega_1)^{1-\theta\xi}-1\right]}{[(1+\Omega_1)^{1-\theta\xi}-1]\,[(1+1/\Omega_1)^{1-\theta\xi}-1]}\right.$$
$$\left. + \frac{\Omega_1(1+\Omega_1)^{-\theta\xi}\left[(1+1/\Omega_1)^{1-\theta\xi}-1\right]}{[(1+\Omega_1)^{1-\theta\xi}-1]\,[(1+1/\Omega_1)^{1-\theta\xi}-1]} - 1\right\}$$
$$= -\frac{\Phi(\cdot)}{\Omega_1}\left\{\frac{1}{1+\Omega_1}\frac{(1+1/\Omega_1)^{1-\theta\xi}}{(1+1/\Omega_1)^{1-\theta\xi}-1} + \frac{\Omega_1}{1+\Omega_1}\frac{(1+\Omega_1)^{1-\theta\xi}}{(1+\Omega_1)^{1-\theta\xi}-1} - 1\right\}. \tag{45}$$

Noting that

$$\frac{(1+1/\Omega_1)^{1-\theta\xi}}{(1+1/\Omega_1)^{1-\theta\xi}-1} > 1, \qquad \frac{(1+\Omega_1)^{1-\theta\xi}}{(1+\Omega_1)^{1-\theta\xi}-1} > 1 \tag{46}$$

it follows that $\Phi'(\Omega_1) < 0$. In view of (24), this further implies $d(\phi_1^m/\phi_2^m)/d\Omega_1 < 0$.

Derivation of Eq. (25)

Total wage payments to country 1 workers in domestic plants are given by

$$W_1^{n+m} = \rho M_1 \int_{\phi_1^*}^{\phi_1^m} r_1^n(\phi) \frac{dG(\phi)}{1-G(\phi_1^*)} + \rho \chi_1 M_1 \int_{\phi_1^m}^{\infty} r_{11}^m(\phi) \frac{dG(\phi)}{1-G(\phi_1^m)}. \tag{47}$$

Proceeding as in the case of symmetric countries, we get

$$W_1^{n+m} = \rho M_1 r_1^n(\phi_1^*) \frac{k}{k-\xi} \left\{ 1 - \left[1 - (1+\Omega_1)^{-\theta\xi}\right] \left[\left[(1+\Omega_1)^{1-\theta\xi} - 1 \right] \frac{f}{F} \right]^{\frac{k-\xi}{\xi}} \right\}. \tag{48}$$

Total wage payments to country 1 workers in local plants of foreign multinationals are given by

$$\begin{aligned} W_1^m &= \rho \chi_2 M_2 \int_{\phi_2^m}^{\infty} r_{21}^m(\phi) \frac{dG(\phi)}{1-G(\phi_2^m)} \\ &= \rho M_2 r_1^n(\phi_1^*) \frac{k}{k-\xi} \Omega_2 \left(1+\Omega_2\right)^{-\theta\xi} \left\{ \left[(1+\Omega_2)^{1-\theta\xi} - 1 \right] \frac{f}{F} \right\}^{\frac{k-\xi}{\xi}}. \end{aligned} \tag{49}$$

Let us now turn to the employment levels in the respective groups of firms. Total employment in local plants of domestic firms is given by

$$\begin{aligned} L_1^{n+m} &= M_1 \int_{\phi_1^*}^{\phi_1^m} l_1^n(\phi) \frac{dG(\phi)}{1-G(\phi_1^*)} + \chi_1 M_1 \int_{\phi_1^m}^{\infty} l_{11}^m(\phi) \frac{dG(\phi)}{1-G(\phi_1^m)} \\ &= A_1 M_1 \left\{ 1 - \left[1 - (1+\Omega_1)^{-\frac{\theta\xi\sigma}{\sigma-1}}\right] \left[\left[(1+\Omega_1)^{1-\theta\xi} - 1 \right] \frac{f}{F} \right]^{\frac{k-(1-\theta)\xi}{\xi}} \right\}, \end{aligned} \tag{50}$$

where A_1 is defined as in (30), with $l_1^n(\phi_1^*)$ instead of $l^n(\phi^*)$. Total employment in local plants of foreign multinationals is given by

$$\begin{aligned} L_1^m &= \chi_2 M_2 \int_{\phi_2^m}^{\infty} l_1^m(\phi) \frac{dG(\phi)}{1-G(\phi_2^m)} \\ &= A_1 M_1 \Omega_2 \left(1+\Omega_2\right)^{-\frac{\theta\xi\sigma}{\sigma-1}} \left\{ \left[(1+\Omega_2)^{1-\theta\xi} - 1 \right] \frac{f}{F} \right\}^{\frac{k-(1-\theta)\xi}{\xi}}. \end{aligned} \tag{51}$$

Dividing (48) by (50), we obtain the average wage paid by local plants of domestic producers in country 1:

$$w_1^{n+m} = \frac{\rho r_1^n(\phi_1^*)}{A_1} \frac{k}{k-\xi} \frac{1 - \left[1-(1+\Omega_1)^{-\theta\xi}\right] \left[\left[(1+\Omega_1)^{1-\theta\xi} - 1 \right] f/F \right]^{\frac{k-\xi}{\xi}}}{1 - \left[1-(1+\Omega_1)^{-\frac{\theta\xi\sigma}{\sigma-1}}\right] \left[\left[(1+\Omega_1)^{1-\theta\xi} - 1 \right] f/F \right]^{\frac{k-(1-\theta)\xi}{\xi}}}. \tag{52}$$

Furthermore, dividing (49) by (51), gives the average wage paid by local plants of foreign multinationals in country 1:

$$w_1^m = \frac{\rho r_1^n(\phi_1^*)}{A_1}\frac{k}{k-\xi}\frac{(1+\Omega_2)^{\frac{\theta\xi}{\sigma-1}}}{\left\{\left[(1+\Omega_2)^{1-\theta\xi}-1\right]f/F\right\}^{\theta}}. \tag{53}$$

Hence, the ratio of the two averages can be expressed as

$$\begin{aligned}\frac{w_1^m}{w_1^{m+n}} = & \frac{(1+\Omega_2)^{\frac{\theta\xi}{\sigma-1}}}{\left\{\left[(1+\Omega_2)^{1-\theta\xi}-1\right]f/F\right\}^{\theta}} \\ & \times \frac{1-\left[1-(1+\Omega_1)^{-\frac{\theta\xi\sigma}{\sigma-1}}\right]\left[\left[(1+\Omega_1)^{1-\theta\xi}-1\right]f/F\right]^{\frac{k-(1-\theta)\xi}{\xi}}}{1-\left[1-(1+\Omega_1)^{-\theta\xi}\right]\left[\left[(1+\Omega_1)^{1-\theta\xi}-1\right]f/F\right]^{\frac{k-\xi}{\xi}}},\end{aligned} \tag{54}$$

which, accounting for (23), can be reformulated to (25).

Small technology differences and the size of ω_1

Note first that using (23) we can rewrite Eq. (25) in the following way

$$\omega_1 = \underbrace{\left(\frac{(1+\Omega_1)^{1-\theta\xi}-1}{(1+\Omega_1)^{1-\theta\xi}-\Omega_1^{1-\theta\xi}}\right)^{\theta}}_{\equiv B_1(\Omega_1)} \underbrace{\frac{1+(1+\Omega_1)^{\frac{\theta\xi\sigma}{\sigma-1}}\left\{\left(\left[(1+\Omega_1)^{1-\theta\xi}-1\right]f/F\right)^{-\frac{k-(1-\theta)\xi}{\xi}}-1\right\}}{1+(1+\Omega_1)^{\theta\xi}\left\{\left(\left[(1+\Omega_1)^{1-\theta\xi}-1\right]f/F\right)^{-\frac{k-\xi}{\xi}}-1\right\}}}_{B_2(\Omega_1)}. \tag{55}$$

Since we know that the first derivative of Ω_1 with respect to $\bar{\phi}_1/\bar{\phi}_2$ is positive, it is immediate that the sign of $d\omega_1/d\Omega_1 \times d\Omega_1/d(\bar{\phi}_1/\bar{\phi}_2)$ equals the sign of $d\omega_1/d\Omega_1$. Hence, in order to determine how small (marginal) technology differences affect the size of ω_1, we can differentiate the wage premium in (55) with respect to Ω_1 and evaluate the resulting expression at $\Omega_1 = 1$.

For this purpose, we first differentiate $B_1(\Omega_1)$, $B_2(\Omega_1)$ and evaluate the resulting expression at $\Omega_1 = 1$. This gives

$$B_1'(1) = \frac{\theta(1-\theta\xi)}{2^{1-\theta\xi}-1} > 0$$

and

$$B_2'(1)=\frac{B(1)}{2}\left\{\frac{\theta\sigma}{1+\theta(\sigma-1)}\,\frac{2^{\frac{\theta\xi\sigma}{\sigma-1}}\left(\hat{\chi}_1^{-\frac{k-(1-\theta)\xi}{k}}-1\right)}{1+2^{\frac{\theta\xi\sigma}{\sigma-1}}\left(\hat{\chi}_1^{-\frac{k-(1-\theta)\xi}{k}}-1\right)}-\frac{\theta(\sigma-1)}{1+\theta(\sigma-1)}\frac{2^{\theta\xi}\left(\hat{\chi}_1^{-\frac{k-\xi}{k}}-1\right)}{1+2^{\theta\xi}\left(\hat{\chi}_1^{-\frac{k-\xi}{k}}-1\right)}\right.$$
$$\left.+\frac{(1-\theta\xi)2^{1-\theta\xi}}{2^{1-\theta\xi}-1}\left[\frac{k-\xi}{\xi}\,\frac{2^{\theta\xi}\hat{\chi}_1^{-\frac{k-\xi}{k}}}{1+2^{\theta\xi}\left(\hat{\chi}_1^{-\frac{k-\xi}{k}}-1\right)}-\frac{k-(1-\theta)\xi}{\xi}\,\frac{2^{\frac{\theta\xi\sigma}{\sigma-1}}\hat{\chi}_1^{-\frac{k-(1-\theta)\xi}{k}}}{1+2^{\frac{\theta\xi\sigma}{\sigma-1}}\left(\hat{\chi}_1^{-\frac{k-(1-\theta)\xi}{k}}-1\right)}\right]\right\},$$

respectively, where $\hat{\chi}_1\equiv\left[\left(2^{1-\theta\xi}-1\right)f/F\right]^{k/\xi}$, and thus equals χ in (18). Putting together and noting that $B_1(1)=1$, we get

$$\begin{aligned}\left.\frac{d\omega_1}{d\Omega_1}\right|_{\Omega_1=1}&=B_1'(1)B_2(1)-B_1(1)B_2'(1)\\&=\frac{\omega_1|_{\Omega_1=1}}{2}\left[b_1+b_2+2b_3\right],\end{aligned}\tag{56}$$

where

$$b_1\equiv\frac{\theta\sigma}{1+\theta(\sigma-1)}\,\frac{2^{\frac{\theta\xi\sigma}{\sigma-1}}\left(\hat{\chi}_1^{-\frac{k-(1-\theta)\xi}{k}}-1\right)}{1+2^{\frac{\theta\xi\sigma}{\sigma-1}}\left(\hat{\chi}_1^{-\frac{k-(1-\theta)\xi}{k}}-1\right)}-\frac{\theta(\sigma-1)}{1+\theta(\sigma-1)}\frac{2^{\theta\xi}\left(\hat{\chi}_1^{-\frac{k-\xi}{k}}-1\right)}{1+2^{\theta\xi}\left(\hat{\chi}_1^{-\frac{k-\xi}{k}}-1\right)},$$

$$b_2\equiv\frac{(1-\theta\xi)2^{1-\theta\xi}}{2^{1-\theta\xi}-1}\frac{k-\xi}{\xi}\left[\frac{2^{\theta\xi}\hat{\chi}_1^{-\frac{k-\xi}{k}}}{1+2^{\theta\xi}\left(\hat{\chi}_1^{-\frac{k-\xi}{k}}-1\right)}-\frac{2^{\frac{\theta\xi\sigma}{\sigma-1}}\hat{\chi}_1^{-\frac{k-(1-\theta)\xi}{k}}}{1+2^{\frac{\theta\xi\sigma}{\sigma-1}}\left(\hat{\chi}_1^{-\frac{k-(1-\theta)\xi}{k}}-1\right)}\right],$$

and

$$b_3\equiv\frac{\theta(1-\theta\xi)}{2^{1-\theta\xi}-1}\left[1-\frac{2^{\frac{\theta\xi}{\sigma-1}}\hat{\chi}_1^{-\frac{k-(1-\theta)\xi}{k}}}{1+2^{\frac{\theta\xi\sigma}{\sigma-1}}\left(\hat{\chi}_1^{-\frac{k-(1-\theta)\xi}{k}}-1\right)}\right].$$

It is immediate that $b_1>0$ if $\hat{\chi}_1=0$, while $b_1=0$ if $\hat{\chi}_1=1$. Furthermore, $b_2+2b_3=0$ if $\hat{\chi}_1=0$, while $b_2+2b_3<0$ if $\hat{\chi}_1=1$. This proves that $d\omega_1/d\Omega_1|_{\Omega_1=1}>0$ if $\hat{\chi}_1$ is close to zero, while $d\omega_1/d\Omega_1|_{\Omega_1=1}<0$ if $\hat{\chi}_1$ is close to one.[13]

[13] From Eq. (18) we can deduce that $\hat{\chi}_1=0$ if F/f goes to infinity, while $\hat{\chi}_1=1$ if F/f approaches $2^{1-\theta\xi}-1$.

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