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9793
2022

June 2022

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CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
· from the RePEc website: www.RePEc.org
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CESifo *Working Paper No. 9793*

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Abstract

This paper summarizes the results from generalizing the simple two-city WFH model of Brueckner, Kahn and Lin (2021) through the addition of a group of non-remote workers, who must live in the city where they work. The results show that the main qualitative conclusions of BKL regarding the intercity effects of WFH are unaffected by this modification, with WFH yielding the same aggregate population and employment changes in the two cities and the same house-price and wage effects as in the simpler model. This conclusion is useful because it establishes the robustness of BKL's highly parsimonious model.

JEL-Codes: R120, R230.

Keywords: work-from-home, remote work, amenities, productivity.

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April 2022

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by

Jan K. Brueckner and S. Sayantani*

1. Introduction

Work-from-home (WFH) has increased since the onset of the coronavirus pandemic. Before the pandemic, 17 percent of U.S. employees worked from home 5 days or more per week, a share that increased to 44 percent during the pandemic.[1] Within a given city, WFH enables residents to work without physically traveling to their offices, thus reducing commuting cost and making suburban residential locations more attractive. Looking across cities, WFH enables employees to relocate to a different city while continuing to work remotely in their original city. Breaking the connection between residence and employment location offers an opportunity to rethink urban spatial models, which otherwise assume that people work in the city where they live.

Brueckner, Kahn and Lin (2021) (henceforth BKL) explore the intercity effects of the introduction of WFH, using a variant of the Rosen (1979)-Roback (1982) model. They analyze the patterns of WFH-induced changes in employment levels and populations as well as wages and housing prices across cities, exploring how two city characteristics affect the outcomes: productivity and amenities. When cities differ in productivity, BKL find that a shift to WFH causes some workers to relocate from high-productivity cities to low-productivity cities, which have cheaper housing, while maintaining their jobs in the original city. When cities differ instead in amenities, WFH leads to the opposite relocation pattern, with some workers relocating from low-amenity to high-amenity cities despite their expensive housing, while keeping their original jobs.

While the model used by BKL attempts to capture the shift in the spatial equilibrium arising from the introduction of WFH, it unrealistically assumes that all workers are able to

* We thank Amy Schwartz, Susan Wachter, and a referee for helpful comments and suggestions.

[1] Statistics are from https://www.statista.com/statistics/1122987/change-in-remote-work-trends-after-covid-in-usa/.

work remotely. The purpose of the current paper is to extend BKL's model to incorporate two kinds of workers, those who can work remotely and those who cannot. In the paper, only remote workers, whose jobs offer the option to telecommute, can now relocate to cities with better residential advantages while maintaining their jobs in other cities. Non-remote workers still have to live in the city where they work, implying that if they wish to relocate, they would need to change jobs. The research question that the current paper attempts to answer is how the intercity impacts of WFH differ in this more realistic scenario while keeping the other elements of BKL's model.

Their model has two cities, San Francisco (s) and Detroit (d), with city s having either higher productivity or higher amenities than city d. When city s has higher productivity, the movement of workers under WFH from city s to city d (where housing is cheap) pushes down the price of housing in city s while raising it in city d. Employment rises in city s despite the drop in its population, while employment falls in city d despite the increase in its population. With workers able to work in either city regardless of residential location, wages must be equalized between cities, and this new common wage is lower (higher) than the original wage in city s (city d).

The reverse patterns emerge when the advantage of city s lies in higher amenities. Relocation to city s raises its (already high) housing price and depresses the price in city d. Employment falls (rises) in city s (city d), and the new common wage is higher (lower) than the original wage in city s (city d).

While BKL's model is highly stylized, its assumption that all workers have the ability to work remotely can be viewed as especially unrealistic. As a result, introducing a second class of non-remote workers, who must live in the city where they work, is a high-priority modification of their model. The present paper investigates the effects of this modification, and the findings are noteworthy.[2] In particular, adding non-remote workers to the model *has no effect on the main theoretical conclusions of BKL*. In the differential-productivity case, WFH again leads to an decrease (increase) in the population and housing price in city s (city d), and an increase (decrease) in employment. In addition, the new common wage for remote workers is lower

[2] The analysis in this paper summarizes results presented in Sayantani (2021).

(higher) than their original wage in city s (city d). The spirit of BKL's conclusions is violated in only one respect: relocation of non-remote workers under WFH is in the opposite direction to the movement of remote workers, with the non-remote population rising in city s and falling in city d. These changes oppose those for remote workers but are not strong enough to the reverse the aggregate shift of population toward city d, thus maintaining BKL's result. The differential-amenity case yields parallel conclusions. Preservation of BKL's main results is an important conclusion because it shows that a simple model is robust to changes that make it more realistic.

BKL carry out an empirical test of their model's predictions, focusing on the case where cities differ in productivity. They find evidence of downward pressure on housing prices in high-productivity cities during the first year of the pandemic (when WFH increased), as predicted by the model. Since the present model yields the same housing-price predictions, BKL's empirical results can be viewed as affirming the current model as well. A fuller explanation of BKL's empirical results, along with a discussion of other empirical papers in the WFH literature, is contained in the section 5 of the paper.

The few other theoretical WFH models written in response to the pandemic are considerably more complex than the present model. For example, the model of Delventhal and Parkhomenko (2021) has two types of jobs, "telecommutable" and not, and two types of workers, high and low skill, whose preferences include idiosyncratic random terms. Workers with telecommutable jobs choose the division of their time between home and office work (which entails commuting costs), and their effective labor supply depends on floor space inputs at both sites, which they also choose. The model has mostly an intracity rather than intercity focus, and a calibrated version shows that a counterfactual increase in WFH productivity causes workers with telecommutable (non-telecommutable) jobs to move away from (toward) dense locations in the city. This net movement causes floor space prices to fall (rise) in locations with high (low) density. Welfare calculations show gains for all groups except for low-skill workers in non-telecommutable jobs.[3]

[3] Davis, Ghent and Gregory (2021) study the impact of WFH in a closely related model, which is also calibrated for simulation. Delventhal, Kwon and Parkhomenko (2022) use a simpler version of the Delventhal and Parkhomenko (2021) model without skill differences and focus the counterfactual analysis on Los Angeles

As in Delventhal and Parkhomenko (2021), the high-skill workers in the WFH model of Gokan, Kichko and Thisse (2021) split their time between office and less-productive home work, with office work generating a demand for "local consumption services" at the CBD (restaurant food, for example), which are produced by low-skill workers. In addition to working in this sector, low-skill workers also collaborate with high-skill workers in producing a tradable good. The analysis shows that, when the (exogenous) WFH share of high-skill labor is high, that group lives in the suburbs while residing in the city center when the WFH share is low.[4] The analysis also considers the effects of adding a second city to the model, with intercity commuting possible for high-skill workers. However, since this group must work in the office part of the time, physical and virtual intercity commuting then coexist, in contrast to the present case, where intercity commuting is entirely virtual.[5]

The rest of the paper proceeds as follows. Section 2 presents a general version of the model without imposing functional forms, yielding equilibrium conditions with and without WFH. Section 3 introduces explicit functional forms and derives closed-from equilibrium solutions. The analysis in section 4 then derives the changes in populations, employment levels, housing prices, wages and welfare levels in the two cities under WFH. Section 5 discusses the empirical WFH literature, and section 6 presents conclusions. Derivations of most results are contained in the online appendix.

2. The Model

2.1. Setup

The model has two cities, denoted s (San Francisco) and d (Detroit), with equal fixed land areas but different amenity levels and different worker productivity levels. Both amenities and productivity are higher in city s than in city d. The economy has two types of workers, denoted type 1 and type 2, which differ in their ability to work from home. Type-1 workers

rather than the entire country.

[4] Behrens, Kichko and Thisse (2021) develop a related model that pays greater attention to the production of office and home workspace, as in Delventhal and Parkhomenko (2021). They show how the WFH share affects wages, real estate prices, and inequality within the city.

[5] For theoretical work on telecommuting that preceded the pandemic, see Safirova (2002), Rhee (2008), and Larson and Zhao (2017).

are remote workers who can live and work in different cities with the introduction of WFH, while type 2 consists of non-remote workers who must live in the same city where they work. The employment of type i workers in city j is given by L_{ij}, while their population in the city is given by N_{ij}. A city's type-2 population and employment must be equal, but this equality is not required for type-1 workers. The total population of type-i workers is given by $\overline{N}_i$, which must equal both the sum of the type-i populations and the sum of the type-i employment levels across cities.

Workers consume land, denoted q, and a numeraire non-land good, denoted e, and they also value city amenities, denoted A. The common utility function is quasi-linear, given by $u(e_{ij}, q_j, Aj) \equiv A_j + e_{ij} + v(q_j)$ for a type-i worker living in city j, where A_j is the city's amenity level, with $A_s > A_d$. Note that because of quasi-linearity, land consumption is independent of income and is thus the same in city j for both worker types. Observe also that the units of amenities and non-housing consumption are chosen so that their linear utility coefficients are same and equal to unity.

A worker's wage depends on type and on city of residence, both of which may influence productivity. The wage of a type-i worker in city j is given by $w_{ij}(L_{1j}, L_{2j})$, with the employment levels of both types affecting each type's wage. Higher worker productivity in city s, which is assumed to apply only to type-1 (remote) workers, is captured in the levels of the type-1 wage functions, with $w_{1s}(\cdot) > w_{1d}(\cdot)$. By contrast, $w_{2s}(\cdot) = w_{2d}(\cdot) \equiv w_2(\cdot)$, so that, with employment levels held fixed, type-2 wages would be the same across cities. Once explicit functional forms are imposed, the type-1 productivity difference will be captured by different values of an intercept parameter in the wage function.

Denoting the unit housing price in city j by p_j, the budget constraint for a type-i worker in city j is $e_{ij} + p_j q_j = w_{ij}(L_{1j}, L_{2j})$. Eliminating e_{ij}, consumer utility can then be written as $A_j + w_{ij}(L_{1j}, L_{2j}) + v(q_j) - p_j q_j$. The first-order condition for choice of q_j is $v'(q_j) = p_j$, confirming that land consumption in a city is the same for both worker types. But with the city's land area fixed at unity, q_j then equals $1/(N_{1j} + N_{2j})$, the reciprocal of the total population. Net housing utility, which equals housing utility minus housing expenditure, is given by $v(q_j) - p_j q_j = v(q_j) - v'(q_j)q_j$, and the q_j solution then allows net utility to be written as a decreasing function of total population, $H(N_{1j}+N_{2j})$.[6] Utility can then be written as

$$utility_{ij} \;=\; A_j \;+\; w_{ij}(L_{1j},L_{2j}) \;+\; H(N_{1j}+N_{2j}), \qquad i=1,2,\;\; j=s,d. \tag{1}$$

2.2. Non-WFH equilibrium

In the equilibrium without WFH, employment levels equal populations for each worker type, with $L_{ij}=N_{ij},\;\; i=1,2,\;\; j=s,d$. In addition, consumer utility in (1) is equalized for each type of worker between the two cities via migration. The non-WFH equilibrium condition for remote (type-1) workers is then

$$A_s+w_{1s}(N_{1s},N_{2s})+H(N_{1s}{+}N_{2s}) = A_d+w_{1d}(\overline{N}_1{-}N_{1s},\overline{N}_2{-}N_{2s})+H(\overline{N}_1{-}N_{1s}{+}\overline{N}_2{-}N_{2s}), \tag{2}$$

where $N_{id} = \overline{N}_i - N_{is},\;\; i = 1,2$ has been used to eliminate the city-d populations. The non-WFH equilibrium condition for non-remote (type-2) workers is

$$A_s+w_2(N_{1s},N_{2s})+H(N_{1s}{+}N_{2s}) = A_d+w_2(\overline{N}_1{-}N_{1s},\overline{N}_2{-}N_{2s})+H(\overline{N}_1{-}N_{1s}{+}\overline{N}_2{-}N_{2s}). \tag{3}$$

Note that the type-2 wage functions in (3) lack a city subscript, as noted above. The city-s employment levels for the two worker types in the non-WFH equilibrium, N_{1s} and N_{2s}, are determined by simultaneously solving (2) and (3), and those solutions then give the types' city-d employment levels.

For comparison purposes, the single non-WFH equilibrium condition in BKL's model, where workers are all identical and able to work remotely, is given by

$$A_s \;+\; w_s(N_s) \;+\; H(N_s) \;=\; A_d \;+\; w_s(\overline{N}-N_s) \;+\; H(\overline{N}-N_s), \tag{4}$$

where $w_s(\cdot) > w_d(\cdot)$, N_s is the population of city s, and $\overline{N}$ is the economy's total population.

[6] The net housing utility expression $v(q_j){-}v'(q_j)q_j$ is increasing in q_j, with the derivative equal to $-v''(q_j)q_j > 0$, given $v'' < 0$. Since $q_j = 1/(N_{1j}+N_{2j})$ it then follows that net housing utility is decreasing in $N_{1j}+N_{2j}$, with $H' < 0$.

2.3. WFH equlibrium

Since type-1 workers can work from home in the equilibrium with WFH, they no longer need to reside in the city where they work. Hence, while type-2 employment equals the population of type-2 workers in each city, both cities can have unequal employment and population levels for type-1 workers.

The WFH equal-utility condition for non-remote (type-2) workers is the same as condition (3) from the non-WFH model, except that type-1 employment levels, which are no longer equal to populations, are replaced by the employment variables L_{1s} and L_{1d} inside the type-2 wage function. The type-2 equal utility condition is then

$$A_s + w_2(L_{1s}, N_{2s}) + H(N_{1s}+N_{2s}) = A_d + w_2(\overline{N}_1 - L_{1s}, \overline{N}_2 - N_{2s}) + H(\overline{N}_1 - N_{1s} + \overline{N}_2 - N_{2s}), \tag{5}$$

where L_{1d} inside the RHS wage function has been eliminated using $L_{1s} + L_{1d} = \overline{N}_1$.

Being free to work in either city regardless of where they live, type-1 workers must be indifferent between work locations in equilibrium. This indifference requires equalization of wages for type-1 workers across cities, yielding

$$w_{1s}(L_{1s}, N_{2s}) \quad = \quad w_{1d}(\overline{N}_1 - L_{1s}, N_{2d}). \tag{6}$$

The wage expression appearing on the LHS of a type-1 equal-utility condition could be either $w_{1s}(L_{1s}, N_{2s})$ or $w_{1d}(\overline{N}_1 - L_{1s}, N_{2d})$, depending on where this city-s resident works, with the same statement applying to the RHS of the type-1 condition. But since these expressions are equal by (6), they cancel from the equation, regardless of which expression appears on a particular side of the equation. With the wage terms dropping out, the type-1 equal-utility condition becomes

$$A_s \; + \; H(N_{1s} + N_{2s}) \quad = \quad A_d \; + \; H(\overline{N}_1 - N_{1s} + \overline{N}_2 - N_{2s}). \tag{7}$$

Regardless of where they work, (7) ensures that the type-1 residents of the two cities have equal utilities.

Equations (5), (6), and (7) jointly determine the values of N_{1s}, N_{2s}, and L_{1s} in the WFH equilibrium. The population constraints then determine the corresponding city-d values. One implication of the equilibrium conditions, which also holds in BKL's model, is that, when the cities have the same amenity levels, housing prices are equalized under WFH. This conclusion follows because amenities then cancel in (7), which implies that city populations (the arguments of H) must be equal, which in turn implies equality of housing prices.

Another more remarkable implication of the equilibrium conditions concerns type-2 wages. While type-1 wages are equalized across cities under WFH, the equilibrium conditions *imply that the same conclusion applies to type-2 wages, which are also equalized.* This conclusion follows because using (7), the non-wage terms in the equilibrium condition (5) then cancel, so that the condition yields type-2 wage equality. Thus, while the ability to work remotely implies indifference across worksites (and hence equal wages) for type-1 workers, this condition in conjunction with utility-equalization for type-2 workers (via (5)) requires that type-2 wages must also be equalized even though indifference across worksites is not an original equilibrium condition for these workers.

For comparison with the previous conditions, the equilibrium conditions under WFH in BKL's identical-worker model are[7]

$$w_s(L_s) \;=\; w_d(\overline{N} - L_s) \tag{8}$$

$$A_s \;+\; H(N_s) \;=\; A_d \;+\; H(\overline{N} - N_s) \tag{9}$$

3. Explicit Functional Forms and Solutions

In this section, explicit functional forms for wages and utility from housing consumption are introduced. In order to derive the wage function, the following production function is assumed:

$$F(L_{1j}, L_{2j}) \;=\; a_{1j}L_{1j} \;-\; L_{1j}^2 \;+\; a_2L_{2j} \;-\; L_{2j}^2 \;+\; cL_{1j}L_{2j}, \quad j = s, d, \tag{10}$$

[7] While cities in the current model and that of BKL have no internal spatial structure or intracity commuting costs, BKL show how such costs can be added without altering the rest of their model's structure.

where c is a parameter capturing the degree of complementarity across worker types. The type-1 productivity parameters a_{1s} and a_{1d} satisfy $a_{1s} \geq a_{1d}$, indicating higher type-1 productivity in city s, while type-2 productivity parameter a_2 is the same across cities.

Normalizing the output price to 1, the wage functions are given by the marginal products of the two worker types i:[8]

$$w_{1j}(L_{1j}, L_{2j}) \;=\; a_{1j} \;-\; 2L_{1j} \;+\; cL_{2j}, \quad j = s, d \tag{11}$$

$$w_{2j}(L_{1j}, L_{2j}) \;=\; a_2 \;-\; 2L_{2j} \;+\; cL_{1j}, \quad j = s, d \tag{12}$$

The wage of a worker type is decreasing in its own employment level and increasing in employment of the other type via complementarity.

The utility from housing consumption is assumed to have the following functional form:

$$v(q_j) \;=\; \alpha \;-\; \beta/q_j, \quad j = s, d, \tag{13}$$

where α, β are positive (note that β is otherwise unrestricted in magnitude). This assumption implies $p_j = v'(q_j) = \beta/q_j^2$ from the first-order condition for housing consumption, yielding $p_j q_j = \beta/q_j$. Consequently, net housing utility is $v(q_j) - p_j q_j = \alpha - 2\beta/q_j$. Substituting $q_j = 1/(N_{1j} + N_{2j})$ yields

$$H(N_{1j} + N_{2j}) \;=\; \alpha \;-\; 2\beta(N_{1j} + N_{2j}), \quad j = s, d, \tag{14}$$

so that the H function has a convenient linear form. In addition, the housing price p_j is given by $\beta(N_{1j} + N_{2j})^2 \equiv p(N_{1j} + N_{2j})$, $j = s, d$, so that housing prices are increasing in the city populations (a result that holds generally).

[8] Parametric restrictions required for positive wages are assumed to hold.

3.1. Equilibrium non-WFH solutions

Substituting the wage functions from (11) and (12) and the H function from (14) into the non-WFH equilibrium conditions (2) and (3), and then solving these equations for N_{1s} and N_{2s} yields

$$N_{1s}^* \;=\; \frac{A_s - A_d}{2(4\beta + 2 - c)} + \frac{(a_{1s} - a_{1d})(1+\beta)}{(4\beta + 2 - c)(c+2)} + \frac{\overline{N}_1}{2} \;=\; L_{1s}^* \tag{15}$$

$$N_{2s}^* \;=\; \frac{A_s - A_d}{2(4\beta + 2 - c)} + \frac{(a_{1s} - a_{1d})(c-2\beta)}{2(4\beta + 2 - c)(c+2)} + \frac{\overline{N}_2}{2} \;=\; L_{2s}^*, \tag{16}$$

where the asterisks denote non-WFH equilibrium values and where the equality of populations and employment levels is noted. From (15) and (16), the total equilibrium population of city s without WFH equals

$$N_{1s}^* + N_{2s}^* \;=\; \frac{A_s - A_d}{4\beta + 2 - c} + \frac{a_{1s} - a_{1d}}{2(4\beta + 2 - c)} + \frac{\overline{N}}{2}, \tag{17}$$

where $\overline{N} = \overline{N}_1 + \overline{N}_2$ is the total population of the economy.

At this point, a parameter restriction must be imposed to generate further results. In particular, the complementarity parameter c is assumed to be small, satisfying $c < min\{2, 2\beta\}$. Without this assumption, few comparative results can be derived. Under this assumption, the denominator expressions in (15)–(17) are positive, implying that city s contains more than half of the type-1 workers and more than half of the economy's total population. However, the distribution of the non-remote, type-2 population depends on the source of the city-s advantage. If the advantage is only in amenities, with $A_s > A_d$ and $a_s = a_d$, then city s contains more than half of the type-2 workers. But if the advantage of city s is only in type-1 productivity ($A_s = A_d, a_s > a_d$), then city s contains less than half of the type-2 workers. Even in this case, though, the type-1 concentration in city s dominates, making its overall population larger than that of city d. With city s larger, its housing price is then higher than that of city d, with $p_s^* > p_d^*$. These results are summarized in the first two columns of Table 1.

Wage levels in the two cities, denoted w_{1s}^*, w_{1d}^*, w_{2s}^*, and w_{2d}^*, are found by substituting the population (hence employment) solutions from (15) and (16) (along with the corresponding solutions for city d) into the wage functions in (11) and (12). See the online appendix for explicit formulas.

3.2. Equilibrium WFH solutions

Substituting the wage functions from (11) and (12) and the H function from (14) into the equilibrium conditions (5), (6) and (7), and then solving these equations for N_{1s}, N_{2s}, and L_{1s} yields the following population solutions:

$$\widetilde{N}_{1s} = \frac{A_s - A_d}{4\beta} - \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N}_1}{2} \tag{18}$$

$$\widetilde{N}_{2s} = \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N}_2}{2}, \tag{19}$$

where the tildes denote WFH equilibrium values. In addition, the total population of city s equals

$$\widetilde{N}_{1s} + \widetilde{N}_{2s} = \frac{A_s - A_d}{4\beta} + \frac{\overline{N}}{2}. \tag{20}$$

Eq. (18) shows that, under WFH, more than half (less than half) of type-1 workers live in city s when the city has an amenity (type-1 productivity) advantage. From (19), exactly half (more than half) of type-2 workers live in city s when it has an amenity (type-1 productivity) advantage. From (20), more than half (exactly half) of economy's total population lives in city s when it has an amenity (type-1 productivity) advantage, with the type-1 and type-2 differences exactly canceling in the latter case. Since the population of city s is then at least as large the population of city d, housing prices satisfy $\widetilde{p}_s \geq \widetilde{p}_d$.

Turning to the type-1 employment solution from (5), (6), and (7), it equals

$$\widetilde{L}_{1s} = \frac{a_{1s} - a_{1d}}{(2+c)(2-c)} + \frac{\overline{N}_1}{2}, \tag{21}$$

so that exactly half (more than half) of type-1 workers are employed in city s when it has an amenity (type-1 productivity) advantage. Total employment in city s equals,

$$\widetilde{L}_{1s} + \widetilde{N}_{2s} = \frac{a_{1s} - a_{1d}}{2(2-c)} + \frac{\overline{N}}{2}, \tag{22}$$

which is equal to (greater than) half the economy's population when city s has an amenity (type-1 productivity) advantage.

These conclusions, along with a comparison of housing prices, are summarized in the third and fourth columns of Table 1, which also show employment and population comparisons (which were moot with WFH). Comparing (20) and (21), the population of city s is greater than (less than) its employment level when the city has an amenity (type-1 productivity) advantage. Using (19) and (20), these same comparisons also hold for the city's type-1 (as opposed to total) population and employment level.

Wage levels, which are uniform across cities for each type of worker, are denoted $\widetilde{w_1}$ and $\widetilde{w_2}$ and are found by substituting $\widetilde{L}_{1s}$ from (21) and $\widetilde{N}_{2s}$ from (19) (along with the corresponding solutions for city d) into the wage functions in (11) and (12).

4. Comparing the WFH and non-WFH Equilibria

This section derives the changes in populations, employment levels, housing prices, wages, and utility levels for each type of worker in each of the cities with the introduction of WFH. If city s is assumed to have a dual advantage, better amenities as well as higher type-1 productivity, many comparisons are ambiguous, as in BKL. However, assuming that city s offers only a single advantage, either in amenities or productivity, unambiguous comparisons can be made. The details of the calculations are presented in the online appendix.

4.1. City s has higher type-1 productivity

It is helpful to first review the main results of BKL for the case where city s has higher productivity for type-1 workers, who are the sole type in the economy. Without WFH, city s has a higher housing price and wage, as well as a higher population, than city d. When WFH becomes possible, workers relocate from city s, which has the higher housing price, to city d while keeping their city-s jobs, so that employment exceeds population in city s, falling short of population in city d. These population changes lead to a decrease in the housing price in city s and an increase in city d, while wages fall for original city-s residents and rise for original city-d residents (becoming equal across cities).

In the current model, when city s has higher productivity than city d for type-1 workers, the following conclusions, which are stated formally in Table 2, can be established. In the proposition, when "(BKL)" appears following a statement, the same (or an analogous) conclusion pertains in BKL's model.

Proposition 1. *When city s has a type-1 productivity advantage, introduction of WFH has the following effects:*

(i) *Total population falls in city s and rises in city d.* (BKL)

(ii) *Underlying these population changes are a decrease* (*increase*) *in the type-1 population and an increase* (*decrease*) *in the type-2 population of city s* (*city d*)*.*

(iii) *As a result of these total population changes, housing prices fall in city s and rise in city d.* (BKL)

(iv) *Total employment rises in city s and falls in city d.* (BKL)

(v) *Underlying these employment changes are increases in employment for both type-1 and type-2 workers in city s and corresponding decreases in city d.*

(vi) *The employment of remote workers exceeds* (*falls short of*) *their population in city s* (*city d*)*.* (BKL)

(vii) *The drop in type-1 employment and the increase in type-1 population in city d means that some original type-1 residents of city d switch to remote employment in city s, helping to explain its higher type-1 employment.* (BKL)

($viii$) *The original type-1 and type-2 workers in city s* (*city d*) *experience a decline* (*increase*) *in their wages.* (BKL)

(ix) *The welfare of both type-1 and type-2 workers remains unchanged with the introduction of WFH.*

Part (i) of the proposition says that, relative to the non-WFH equilibrium, total population increases in city s under WFH while decreasing in city d, a result also derived in BKL's model, where all workers are of type 1. From part (iv) of the proposition, these population changes are accompanied by opposing changes in total employment, which rises under WFH in city s and falls in city d, a result also present in BKL's model.

The changes in total population mask opposing changes population for the two types of workers, as seen in part (ii) of the proposition. While type-1 population in city s falls (mirroring the change in the total), the city-s population of type-2 workers increases, with the reverse changes occurring in city d. By contrast, the employment changes for both worker types mirror the changes in total employment, as seen in part (v) of the proposition, with employment for both types rising in city s under WFH and falling in city d.

With the population of type-1 workers falling in city s under WFH (part (ii)) and their employment rising (part (v)), it follows that type-1 employment exceeds type-1 population in city s, as seen in part (vi) of the proposition. Since the reverse statement applies in city d (a drop in type-1 employment and an increase in type-1 population), it follows that some original type-1 residents of city d switch to remote employment in city s under WFH, as stated in part (vii) of the proposition. The same conclusion is derived in BKL, where all workers are of type 1.

Turning to the price and wage effects of WFH, the drop in the population of city s leads to a corresponding drop in the housing price, as stated in part (iii) of the proposition, with city d experiencing a price increase. The same price impact is present in BKL's model. As for wage changes, the uniform type-1 wage under WFH is lower than the original type-1 wage in city s and higher than the original type-1 wage in city d, as stated in part ($viii$) of the proposition, so that original type-1 residents experience a wage decrease (increase) in city s (city d). As explained earlier, the type-2 wage is also uniform across cities under WFH, and exactly the same statement applies to changes in type-2 wages across the cities. Wage changes in BKL follow this same pattern.

With the housing price and wages for both worker types falling in city s and rising in city d, the change in worker welfare is ambiguous a priori, as was true in BKL's model. But under the adopted functional forms, the price and wage effects exactly cancel for both types of workers, leaving welfare unchanged under WFH, as stated in part (ix) of the proposition.

The conclusions in Proposition 1 show that the main results of BKL also emerge when a second group of non-remote, type-2 workers is added to the model. Changes in total populations, total employment levels, housing prices, and wages in the two cities are qualitatively the same with or without the presence of a non-remote worker group. This is an important conclusion because it shows the robustness of results from a model much simpler analytically than the current one. The one pattern in the current model that runs at variance to the spirit of BKL findings concerns the relocation of type-2 workers under WFH. In particular, instead of following type-1 workers by moving from city s to city d under WFH, type-2 workers *move in the opposite direction*, from city d to city s. This movement, however, is not sufficient to offset the opposing movement of type-1 workers, so that total population falls in city s and rises in city d.

4.2. City s has higher amenities

In BKL, if city s has higher amenities than city d, then without WFH, city s has a higher housing price and lower wage, as well as a higher population, than city d. When WFH becomes possible, workers relocate from city d to city s, consuming its amenities while keeping their city-s jobs. Employment then falls short of population in city s, while exceeding the population in city d. These population changes lead to an increase in the housing price in city s and a decrease in city d, while wages rise for original city-s residents and fall for original city-d residents (becoming equal across cities). As can be seen, these changes under WFH are the reverse of the changes when the advantage of city s lies in type-1 productivity instead of amenities.

In the current model, when city s has higher amenities that than city d, the following conclusions, which are stated formally in Table 2, can be established:

Proposition 2. *When city s has higher amenities than city d, introduction of WFH has the following effects:*

- (i) *Total population rises in city s and falls in city d.* (BKL)
- (ii) *Underlying these population changes are an increase* (*decrease*) *in the type-1 population and a decrease* (*increase*) *in the type-2 population of city s* (*city d*).
- (iii) *As a result of these total population changes, housing prices rise in city s and fall in city d.* (BKL)
- (iv) *Total employment falls in city s and rises in city d.* (BKL)
- (v) *Underlying these employment changes are decreases in employment for both type-1 and type-2 workers in city s and corresponding increases in city d.*

(*vi*) *The employment of remote workers falls short of* (*exceeds*) *their population in city s* (*city d*)*.* (BKL)

(*vii*) *The drop in type-1 employment and the increase in type-1 population in city s means that some original type-1 residents of city s switch to remote employment in city d, helping to explain its higher type-1 employment.* (BKL)

(*viii*) *The original type-1 and type-2 workers in city s* (*city d*) *experience an increase* (*decrease*) *in their wages.* (BKL)

(*ix*) *The welfare of both type-1 and type-2 workers remains unchanged with the introduction of WFH.*

By comparison, it can been that the conclusions of Proposition 2 are the reverse of those in Proposition 1 while also mostly matching the main conclusions of BKL. Total population rises and total employment falls in city s under WFH, with the reverse changes occuring in city d. Despite the increase in total population, the type-2 population of city s falls under WFH, but the change is offset by a gain in the type-1 population, with the opposite changes occurring in city d. Employment changes for both worker types, however, mirror the changes in total employment in the two cities. With its type-1 population rising but type-1 employment falling, some original residents of city s switch to remote employment in city d. Housing prices rise in city s and fall in city d, while the original residents of both types in city s experience wage increases, with wages for both types falling in city d. WFH leaves the welfare of both worker types unchanged.

As in Proposition 1, the results of the current model contradict the spirit of BKL's results only in the relocation of type-2 workers, who move from city s to city d under WFH, in the opposite direction to the movement of type-1 workers. The broad similarity of results again shows the robustness of BKL's results to a major change in the model, an important conclusion.

4.3. Comparative statics

Explicit model solutions allow direct computation of comparative-static results, which are shown in Table 3. The parametric changes of interest are changes in the intercity type-1 productivity difference, $a_{1s} - a_{1d}$, the amenity difference, $A_s - A_d$, and the labor-complementarity parameter, c. First focusing on the case where city s has a type-1 productivity advantage, the analysis computes the effects of these parametric changes on the absolute non-WFH/WFH difference in the city-s populations of both types, equal to $N^*_{1s} - \widetilde{N}_{1s} > 0$ and $\widetilde{N}_{2s} - N^*_{2s} > 0$ for city s, and the same differences for city-d, $\widetilde{N}_{1d} - N^*_{1d} > 0$ and $N^*_{2d} - \widetilde{N}_{2d} > 0$. Also of interest are parametric effects on the absolute non-WFH/ WFH employment/population gaps for type-1 workers in both cities, equal to $\widetilde{L}_{1s} - N^*_{1s} > 0$ and $N^*_{1d} - \widetilde{L}_{1d} > 0$.

The signs of the effects are shown in the first two rows of Table 3. The first row shows that both non-WFH/WFH population gaps and the employment/population gaps are larger the higher is the type-1 productivity difference between the cities, a natural conclusion. The second row shows that the effect of a higher complementarity parameter is also positive in each case.

The next two rows of Table 2 pertain to the case where city s has an amenity advantage, showing the effects of the amenity difference and c on the non-WFH/WFH population and employment/population gaps. The previous absolute gap expressions are all multiplied by -1 to retain their positivity. The third row shows that all the gaps are larger the higher is the amenity difference between the cities, again a natural conclusion. The fourth row of the table shows that an increase in c reduces the type-1 population gaps in both cities, while raising the type-2 population gaps. The employment/population gaps are unaffected, however.

5. WFH Empirics

In addition to theoretical work, recent empirical studies also focus on WFH. Brueckner, Kahn and Lin (2021) contains an empirical component, and other papers with related empirical results include Althoff et, al. (2021), Bloom and Ramani (2021), and Gupta et al. (2021).

BKL's empirical work tests the predictions of their model, focusing mainly on house-price effects of WFH in high-productivity cities. As explained above, their model (as well as the current one) predicts a drop in population and house prices in high-productivity cities under WFH as remote workers relocate to cheaper, low-productivity cities. These hypotheses are tested using regressions that relate the county-level change in house prices from Zillow between 2020 and 2019 (when WFH surged) to county-level productivity, which is measured using an index computed by Albouy (2015). Since the potential for relocation depends on whether a county's jobs can be done remotely, the work-from-home potential of these jobs is computed using information from Dingel and Neiman (2020). The two resulting variables, measured at the county level, are denoted PROD and WFHPOT, and since both variables matter in generating the predicted relocation pattern, the main independent variable in the regression is the interaction variable PROD $\times$ WFHPOT, which is supplemented by various controls.

The regression results indeed show that the 2020-2019 house-price change is decreasing in the magnitude of the interaction variable, and the same result emerges when the dependent variable is the 2020-2019 change in rents. To look for the underlying population change that is predicted to drive these price effects, BKL use US Postal Service address-change data, computing the change in USPS outflows at the county level between 2020 and 2019. As predicted, the regression shows that the change in the USPS outflow is increasing in the magnitude of PROD $\times$ WFHPOT.[9]

BKL also test for an intracity, as opposed to intercity, effect of WFH by looking for changes in housing-price gradients. For workers who do not relocate between cities, WFH reduces commuting costs, making suburban locations more attractive. The resulting incentive for intracity relocation should then push up house prices in the suburbs (on a per square foot basis) while reducing them near the city center, thus flattening the urban price gradient. BKL estimate monthly zip-code-level price gradients for a large number of metro areas. The estimated gradients, which are negative, are then used as the dependent variable in a second-stage regression that relates the gradient's monthly magnitude to the work-from-home potential of jobs in the metro area's central county as well as controls, with the WFHPOT coefficient allowed to vary by month. The monthly coefficients are insignificant during 2019, but they turn positive in 2020, showing the predicted flattening of the price gradients under WFH (the positive coefficient means that the gradients become less negative).

BKL do not test one implication of their model, intercity wage equalization for remote workers, leaving that test for future work. Interestingly, the current model's implication that wages are equalized across cities *for both remote and non-remote workers under WFH* suggests a broadening of that empirical test to include all types of workers.

[9] BKL present additional regressions relating the monthly level of house prices (or rents) to the interaction variable, with its coefficient allowed to vary by month. The monthly coefficents are insignificant during 2019 but turn significantly negative in 2020, providing additional evidence for the predicted price and rent effects.

The paper by Gupta et al. (2021) presents results similar to BKL's evidence on changes in urban price gradients, making it the empirical paper most closely related to BKL. Also using Zillow data, the paper shows a flattening of both price and rent gradients between December 2019 and December 2020. As in BKL, the paper shows that the extent of flattening is positively related to the work-from-home potential of a metro area's jobs.

Bloom and Ramani (2021) also present related intracity results. They do not estimate price gradients but instead regress the February 2021-February 2020 change in zip-code populations, house prices and rents on distance to the CBD, metro-level WFH potential, and other controls. The distance effect is positive in each case (consistent with a flattening of price gradients), while WFH potential has a positive house-price effect and negative population and rent effects.[10]

Althoff et al. (2021) explore the effect of zip-code-level employment in industries with high WFH potential on monthly zip-code changes in population, rents, and foot traffic over the period from February 2020 to September 2021, showing negative effects in each case. This paper differs from those discussed previously by measuring WFH potential at a very disaggregated spatial level (zip codes as opposed to counties or metro areas).

Brynjolfsson et al. (2020) and Stanton and Tiwari (2021) explore issues farther afield from those studied in the previous papers. Brynjolfsson et al. (2020) present the results from individual-level surveys on the employment effects of the pandemic, distinguishing between a switch to remote work and layoffs or furloughs. They show that workers in states with high-WFH-potential jobs were more likely to switch to remote work than to lose employment. Bartik et al. (2020) present complementary findings from a firm-level survey showing the patterns of remote work early in the pandemic. Stanton and Tiwari (2021), recognizing the need for a home office under WFH, use American Consumer Survey data to explore the effect of remote work on the prices and sizes of the houses consumers choose, using the results to infer the extra income required to cover higher housing costs from switching to WFH.

[10] WFH potential enters in level form, but it should have been interacted with distance to properly capture the gradient effect.

6. Conclusion

This paper has summarized the results from generalizing the simple two-city WFH model of Brueckner, Kahn and Lin (2021) through the addition of a group of non-remote workers, who must live in the city where they work. The new results show that the main qualitative conclusions of BKL regarding the intercity effects of WFH are unaffected by this modification, with WFH yielding the same aggregate population and employment changes in the two cities and the same house-price and wage effects as in the simpler model. This conclusion is useful because it establishes the robustness of BKL's highly parsimonious model.

The paper has also discussed in detail the features of several other theoretical WFH home models as well as the findings of empirical papers focusing on WFH, including those of BKL. As a result, it is hoped that the paper will give the reader a good sense of the contributions of current theoretical and empirical research on WFH.

Table 1: **Intercity comparisons for both the non-WFH and WFH cases**

	Non-WFH		WFH	
City s advantage:	Productivity	Amenity	Productivity	Amenity
City-s populations	$N^*_{1s} > \frac{\overline{N_1}}{2}$	$N^*_{1s} > \frac{\overline{N_1}}{2}$	$\widetilde{N_{1s}} < \frac{\overline{N_1}}{2}$	$\widetilde{N_{1s}} > \frac{\overline{N_1}}{2}$
	$N^*_{2s} < \frac{\overline{N_2}}{2}$	$N^*_{2s} > \frac{\overline{N_2}}{2}$	$\widetilde{N_{2s}} > \frac{\overline{N_2}}{2}$	$\widetilde{N_{2s}} = \frac{\overline{N_2}}{2}$
	$N^*_{1s} + N^*_{2s} > \overline{N}$	$N^*_{1s} + N^*_{2s} > \overline{N}$	$\widetilde{N_{1s}} + \widetilde{N_{2s}} = \overline{N}$	$\widetilde{N_{1s}} + \widetilde{N_{2s}} > \overline{N}$
Housing prices	$p^*_s > p^*_d$	$p^*_s > p^*_d$	$\widetilde{p_s} = \widetilde{p_d}$	$\widetilde{p_s} > \widetilde{p_d}$
Type-1 employment in city s	Same as population		$\widetilde{L_{1s}} > \widetilde{N_{1s}}$	$\widetilde{L_{1s}} < \widetilde{N_{1s}}$
Type-2 employment in city s	Same as population		Same as population	
Total employment in city s	Same as population		$\widetilde{L_{1s}} + \widetilde{N_{2s}} >$ city s population	$\widetilde{L_{1s}} + \widetilde{N_{2s}} <$ city s population

Table 2: **Formal Statements of Propositions 1 and 2**

	City s has higher type-1 productivity*	City s has higher amenities*
(i)	$\widetilde{N_{1s}} + \widetilde{N_{2s}} < N_{1s}^* + N_{2s}^*$	$\widetilde{N_{1s}} + \widetilde{N_{2s}} > N_{1s}^* + N_{2s}^*$
(ii)	$\widetilde{N_{1s}} < {N_{1s}}^*, \quad \widetilde{N_{2s}} > {N_{2s}}^*$	$\widetilde{N_{1s}} > {N_{1s}}^*, \quad \widetilde{N_{2s}} < {N_{2s}}^*$
(iii)	$\widetilde{p_s} < p_s^*, \quad \widetilde{p_d} > p_d^*$	$\widetilde{p_s} > p_s^*, \quad \widetilde{p_d} < p_d^*$
(iv)	$\widetilde{L_{1s}} + \widetilde{N_{2s}} > N_{1s}^* + N_{2s}^*$	$\widetilde{L_{1s}} + \widetilde{N_{2s}} < N_{1s}^* + N_{2s}^*$
(v)	$\widetilde{L_{1s}} > N_{1s}^*, \quad \widetilde{N_{2s}} > N_{2s}^*$	$\widetilde{L_{1s}} < N_{1s}^*, \quad \widetilde{N_{2s}} < N_{2s}^*$
(vi)	$\widetilde{L_{1s}} > \widetilde{N_{1s}}$	$\widetilde{L_{1s}} < \widetilde{N_{1s}}$
(viii)	$w_{1s}^* > \widetilde{w_1} > w_{1d}^*, \quad w_{2s}^* > \widetilde{w_2} > w_{2d}^*$	$w_{1s}^* < \widetilde{w_1} < w_{1d}^*, \quad w_{2s}^* < \widetilde{w_2} < w_{2d}^*$
(ix)	$A_s + \widetilde{w_1} + \widetilde{H_s} = A_d + w_{1d}^* + H_d^*,$	$A_s + \widetilde{w_2} + \widetilde{H_s} = A_d + w_{2d}^* + H_d^*$

*For parts (i), (ii), (iv), (v), and (vi), the reverse statements apply in city d. In part (ix), $\widetilde{H} \equiv H(\widetilde{N_{1s}} + \widetilde{N_{2s}})$, with $\widetilde{H_d}$, ${H_s}^*$, ${H_d}^*$ defined analogously. Amenities, which are equal across cities, cancel in part (ix).

Table 3: **Comparative Statics**

City s has higher type-1 productivity						
	$N^*_{1s} - \widetilde{N_{1s}}$	$\widetilde{N_{2s}} - N^*_{2s}$	$\widetilde{N_{1d}} - N^*_{1d}$	$N^*_{2d} - \widetilde{N_{2d}}$	$\widetilde{L_{1s}} - N^*_{1s}$	$N^*_{1d} - \widetilde{L_{1d}}$
$a_s - a_d$	$+$	$+$	$+$	$+$	$+$	$+$
c	$+$	$+$	$+$	$+$	$+$	$+$

City s has higher amenities						
	$\widetilde{N_{1s}} - N^*_{1s}$	$N^*_{2s} - \widetilde{N_{2s}}$	$N^*_{1d} - \widetilde{N_{1d}}$	$\widetilde{N_{2d}} - N^*_{2d}$	$N^*_{1s} - \widetilde{L_{1s}}$	$\widetilde{L_{1d}} - N^*_{1d}$
$A_s - A_d$	$+$	$+$	$+$	$+$	$+$	$+$
c	$-$	$+$	$-$	$+$	0	0

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Online Appendix

A Non-WFH Equilibrium and Wage Computation

The non-WFH equilibrium condition for type-1 workers from (2) may be rewritten as

$$A_s+a_{1s}-2N_{1s}+cN_{2s}+\alpha-2\beta(N_{1s}+N_{2s}) = A_d+a_{1d}-2(\overline{N_1}-N_{1s})+c(\overline{N_2}-N_{2s})+\alpha-2\beta(2\overline{N}-(N_{1s}+N_{2s}))$$
$$\implies A_s-A_d+a_{1s}-a_{1d}-2N_{1s}(1+\beta)+N_{2s}(c-2\beta) = c\overline{N_2}-2\overline{N_1}-2\beta\overline{N_1}-2\beta\overline{N_2}+2N_{1s}(1+\beta)-N_{2s}(c-2\beta)$$
$$\implies A_s - A_d + a_{1s} - a_{1d} = (4N_{1s} + 2\overline{N_1})(1 + \beta) - (2N_{2s} - \overline{N_2})(c - 2\beta) \qquad \text{(A1)}$$

The non-WFH equilibrium condition for type-2 workers from (3) may be rewritten as

$$A_s+a_{2s}-2N_{2s}+cN_{1s}+\alpha-2\beta(N_{1s}+N_{2s}) = A_d+a_{2d}-2(\overline{N_2}-N_{2s})+c(\overline{N_1}-N_{1s})+\alpha-2\beta(2\overline{N}-(N_{1s}+N_{2s}))$$
$$\implies A_s-A_d+a_{2s}-a_{2d}-2N_{2s}(1+\beta)+N_{1s}(c-2\beta) = c\overline{N_1}-2\overline{N_2}-2\beta\overline{N_1}-2\beta\overline{N_2}+2N_{2s}(1+\beta)-N_{1s}(c-2\beta)$$
$$\implies A_s - A_d = (4N_{2s} + 2\overline{N_2})(1 + \beta) - (2N_{1s} - \overline{N_1})(c - 2\beta)$$
$$\implies N_{2s} = \frac{A_s - A_d}{4(1 + \beta)} + \frac{(2N_{1s} - \overline{N_1})(c - 2\beta)}{4(1 + \beta)} - \frac{\overline{N_2}}{2} \qquad \text{(A2)}$$

Substituting the expression for N_{2s} from (A2) in (A1) in order to solve (A1) and (A2) simultaneously yields

$$A_s-A_d+a_{1s}-a_{1d} = (4N_{1s}+2\overline{N_1})(1+\beta)-(2\left(\frac{A_s - A_d}{4(1 + \beta)} + \frac{(2N_{1s} - \overline{N_1})(c - 2\beta)}{4(1 + \beta)} - \frac{\overline{N_2}}{2}\right)-\overline{N_2})(c-2\beta) \qquad \text{(A3)}$$

Solving the above equation for N^*_{1s} yields

$$(4N_{1s}+2\overline{N_1})(1+\beta)-2\left(\frac{A_s - A_d}{4(1 + \beta)} + \frac{(2N_{1s} - \overline{N_1})(c - 2\beta)}{4(1 + \beta)} + \frac{\overline{N_2}}{2}\right)(c-2\beta)+\overline{N_2}(c-2\beta) = A_s-A_d+a_{1s}-a_{1d}$$
$$\implies 4N_{1s}(1-\beta)-2\overline{N_1}(1-\beta)-\frac{N_{1s}(c - 2\beta)^2}{1 + \beta}+\frac{\overline{N_1}(c - 2\beta)^2}{2(1 + \beta)} = A_s-A_d+a_{1s}-a_{1d}+\frac{(A_s - A_d)(c - 2\beta)}{2(1 + \beta)}$$
$$\implies N_{1s}(4(1-\beta)^2-(c-2\beta)^2) = 2\overline{N_1}(1-\beta^2)+\frac{\overline{N_1}(c - 2\beta)^2}{2(1 + \beta)}+\frac{(A_s - A_d)(c + 2)}{2}+(a_{1s}-a_{1d})(1+\beta)$$
$$\implies N_{1s} = \frac{\overline{N_1}}{2} + \frac{(A_s - A_d)(c + 2)}{8(1 - \beta)^2 - 2(c - 2\beta)^2} + \frac{(a_{1s} - a_{1d})(1 + \beta)}{4(1 - \beta)^2 - (c - 2\beta)^2} \qquad \text{(A4)}$$

Simplifying the above expression yields the following expression for N^*_{1s} (same as that in (15) from the text):

$$N^*_{1s} = \frac{A_s - A_d}{2(4\beta - c + 2)} + \frac{(a_{1s} - a_{1d})(1 + \beta)}{(4\beta - c + 2)(c + 2)} + \frac{\overline{N_1}}{2} \qquad \text{(A5)}$$

Substituting the expression for N^*_{1s} in (A2) and solving for N^*_{2s} yields

$$N_{2s} = \frac{A_s - A_d}{4(1 + \beta)}+\frac{(A_s - A_d)(c - 2\beta)}{4(4\beta - c + 2)(1 + \beta)}+\frac{\overline{N_1}(c - 2\beta)}{4(1 + \beta)}-\frac{\overline{N_1}(c - 2\beta)}{4(1 + \beta)}+\frac{(a_{1s} - a_{1d})(c - 2\beta)(1 + \beta)}{2(1 + \beta)(4\beta - c + 2)(c + 2)} \qquad \text{(A6)}$$

The above expression simplifies to the expression for N^*_{2s} in (16) from the text:

$$N^*_{2s} = \frac{A_s - A_d}{2(4\beta - c + 2)} + \frac{(a_{1s} - a_{1d})(c - 2\beta)}{2(4\beta - c + 2)(c + 2)} + \frac{\overline{N_2}}{2} \qquad \text{(A7)}$$

The total employment or population in city s under the non-WFH equilibrium is calculated as

$$N_{1s}^{*}+N_{2s}^{*} = \left(\frac{A_s - A_d}{2(4\beta - c + 2)} + \frac{(a_{1s} - a_{1d})(1+\beta)}{(4\beta - c + 2)(c+2)} + \frac{\overline{N_1}}{2}\right)+\left(\frac{A_s - A_d}{2(4\beta - c + 2)} + \frac{(a_{1s} - a_{1d})(c - 2\beta)}{2(4\beta - c + 2)(c+2)} + \frac{\overline{N_2}}{2}\right) \tag{A8}$$

The above expression simplifies to the expression for total population in (17) from the text:

$$N_{1s}^{*} + N_{2s}^{*} = \frac{\overline{N}}{2} + \frac{A_s - A_d}{4\beta - c + 2} + \frac{a_{1s} - a_{1d}}{2(4\beta - c + 2)} \tag{A9}$$

Recalling that $\overline{N_i} = N_{is} + N_{id}$ and $\overline{N} = \overline{N_s} + \overline{N_d}$ yields the following expressions for the type-1, type-2 and total population in city d under non-WFH equilibrium

$$\begin{aligned}
N_{1d}^{*} &= \frac{\overline{N_1}}{2} - \frac{A_s - A_d}{2(4\beta - c + 2)} - \frac{(a_{1s} - a_{1d})(1+\beta)}{(4\beta - c + 2)(c+2)} \\
N_{2d}^{*} &= \frac{\overline{N_2}}{2} - \frac{A_s - A_d}{2(4\beta - c + 2)} - \frac{(a_{1s} - a_{1d})(c - 2\beta)}{2(4\beta - c + 2)(c+2)} \\
N_{1d}^{*} + N_{2d}^{*} &= \frac{\overline{N}}{2} - \frac{A_s - A_d}{4\beta - c + 2} - \frac{a_{1s} - a_{1d}}{2(4\beta - c + 2)}
\end{aligned} \tag{A10}$$

The wage for the original type-1 workers of city s is calculated as $w_{1s}(N_{1s}^{*}, N_{2s}^{*})$, which equals

$$\begin{aligned}
&a_{1s} - 2N_{1s}^{*} + cN_{2s}^{*} \\
&= a_{1s} - \frac{A_s - A_d}{4\beta - c + 2} - \frac{(a_{1s} - a_{1d})2(1+\beta)}{(c+2)(4\beta - c + 2)} - \overline{N_1} + \frac{c(A_s - A_d)}{2(4\beta - c + 2)} + \frac{c(a_{1s} - a_{1d})(c - 2\beta)}{(c+2)(4\beta - c + 2)} + \frac{c\overline{N_2}}{2} \\
&= a_{1s} + \frac{(A_s - A_d)(c-2)}{2(4\beta - c + 2)} + \frac{(a_{1s} - a_{1d})(c^2 - 2\beta c - 4 - 4\beta)}{2(c+2)(4\beta - c + 2)} + \frac{c\overline{N_2}}{2} - \overline{N_1} \\
&= \frac{(A_s - A_d)(c-2)}{2(4\beta - c + 2)} + \frac{a_{1s}(2(4\beta - c + 2) - (2\beta - c + 2)) + a_{1d}(2\beta - c + 2)}{2\beta - c + 2} + \frac{c\overline{N_2}}{2} - \overline{N_1}
\end{aligned} \tag{A11}$$

The above expression simplifies to the following expression for the type-1 wage in city s:

$$\begin{aligned}
w_{1s}(N_{1s}^{*}, N_{2s}^{*}) &= a_{1s} - 2N_{1s}^{*} + cN_{2s}^{*} \\
&= \frac{c\overline{N_2}}{2} - \overline{N_1} - \frac{(A_s - A_d)(2-c)}{2(4\beta - c + 2)} + \frac{(2\beta + 2 - c)a_{1d} + (6\beta + 2 - c)a_{1s}}{2(4\beta - c + 2)}
\end{aligned} \tag{A12}$$

The wage for the original type-1 workers of city d under the non-WFH equilibrium is calculated as $w_{1d}(N_{1d}^{*}, N_{2d}^{*})$, which equals

$$\begin{aligned}
&a_{1d} - 2N_{1d}^{*} + cN_{2d}^{*} \\
&= a_{1d} - 2(\overline{N_1} - N_{1s^{*}}) + c(\overline{N_2} - N_{2s}^{*}) \\
&= a_{1d} + a_{1s} - (a_{1s} - 2N_{1s}^{*} + cN_{2s}^{*}) - 2\overline{N_1} + c\overline{N_2} \\
&= a_{1s} + a_{1d} - 2\overline{N_1} + c\overline{N_2} - \left(\frac{c\overline{N_2}}{2} - \overline{N_1} - \frac{(A_s - A_d)(2-c)}{2(4\beta - c + 2)} + \frac{(2\beta + 2 - c)a_{1d} + (6\beta + 2 - c)a_{1s}}{2(4\beta - c + 2)}\right) \\
&= \frac{c\overline{N_2}}{2} - \overline{N_1} + \frac{(A_s - A_d)(2-c)}{2(4\beta - c + 2)} + \frac{(8\beta - 2c + 4)(a_{1s} + a_{1d}) - (6\beta + 2 - c)a_{1s} - (2\beta + 2 - c)a_{1d}}{24\beta - c + 2}
\end{aligned} \tag{A13}$$

Simplifying, the wage for the original type-1 workers of city d under the non-WFH equilibrium is given by

$$w_{1d}(N_{1d}^*, N_{2d}^*) = \frac{c\overline{N_2}}{2} - \overline{N_1} + \frac{(A_s - A_d)(2-c)}{2(4\beta - c + 2)} + \frac{(6\beta + 2 - c)a_{1d} + (2\beta + 2 - c)a_{1s}}{2(4\beta - c + 2)} \tag{A14}$$

The wage for the original type-2 workers of city s is calculated as $w_{2s}(N_{1s}^*, N_{2s}^*)$, which equals

$$\begin{aligned}
&a_2 - 2N_{2s}^* + cN_{1s}^* \\
&= a_2 - 2\left(\frac{A_s - A_d}{2(4\beta - c + 2)} + \frac{(a_{1s} - a_{1d})(c - 2\beta)}{2(4\beta - c + 2)(c+2)} + \frac{\overline{N_2}}{2}\right) + c\left(\frac{A_s - A_d}{2(4\beta - c + 2)} + \frac{(a_{1s} - a_{1d})(1+\beta)}{(4\beta - c + 2)(c+2)} + \frac{\overline{N_1}}{2}\right) \\
&\quad = a_2 - \frac{(A_s - A_d)}{4\beta - c + 2}\left(1 - \frac{c}{2}\right) + \frac{(a_{1s} - a_{1d})}{(c+2)(4\beta - c + 2)}(c + c\beta - c + 2\beta) + \frac{c\overline{N_1}}{2} - \overline{N_2}
\end{aligned} \tag{A15}$$

The above expression simplifies to the following expression for type-2 worker wage in city s:

$$w_{2s}(N_{1s}^*, N_{2s}^*) = a_2 - \frac{(A_s - A_d)(2-c)}{2(4\beta - c + 2)} + \frac{(a_{1s} - a_{1d})\beta}{4\beta - c + 2} + \frac{c\overline{N_1}}{2} - \overline{N_2} \tag{A16}$$

The wage for the original type-2 workers of city d under the non-WFH equilibrium is calculated as $w_{2d}(N_{1d}, N_{2d}^*)$, which equals

$$\begin{aligned}
&a_2 - 2N_{2d}^* + cN_{1d}^* \\
&= a_2 - 2(\overline{N_2} - N_{2s^*}) + c(\overline{N_1} - N_{1s}^*) \\
&= a_2 + a_{2s} - (a_{2s} - 2N_{2s}^* + cN_{1s}^*) - 2\overline{N_2} + c\overline{N_1} \\
&\quad = a_2 + a_2 - 2\overline{N_2} + c\overline{N_1} - \left(a_2 - \frac{(A_s - A_d)(2-c)}{2(4\beta - c + 2)} + \frac{(a_{1s} - a_{1d})\beta}{4\beta - c + 2} + \frac{c\overline{N_1}}{2} - \overline{N_2}\right)
\end{aligned} \tag{A17}$$

Simplifying, the wage for the original type-2 workers of city d under non-WFH equilibrium is given by

$$w_{2d}(N_{1d}^*, N_{2d}^*) = a_2 + \frac{c\overline{N_1}}{2} - \overline{N_2} + \frac{(A_s - A_d)(2-c)}{2(4\beta - c + 2)} - \frac{(a_{1s} + a_{1d})\beta}{4\beta - c + 2} \tag{A18}$$

B WFH Equilibrium and Wage Computation

Recall that the type-1 employment, type-1 population and the type-2 population in the WFH equilibrium are found by simultaneously solving equations (5),(6) and (7). Condition (6) from the text may be re-written as:

$$\begin{aligned}
a_{1s} - 2L_{1s} + cN_{2s} &= a_{1d} - 2(\overline{L_1} - L_{1s}) + c(\overline{N_2} - N_{2s}) \\
\implies 2L_{1s} + c(\overline{N_2} - n_{2s}) - a_{1s} + a_{1d} &= cN_{2s} + 2(\overline{L_1} - L_{1s}) \\
\implies 4L_{1s} - 2cN_{2s} - a_{1s} + a_{1d} &= 2\overline{L_1} - c\overline{N_2}
\end{aligned} \tag{A19}$$

Recalling that $\overline{L_1} = \overline{N_1}$, L_{1s} may be re-written in terms of N_{2s} as

$$L_{1s} = \frac{a_{1s} - a_{1d}}{4} + \frac{cN_{2s}}{2} + \frac{\overline{N_1}}{2} - \frac{c\overline{N_2}}{4} \tag{A20}$$

Condition (7) from the text may be re-written as:

$$\begin{aligned}
A_s + \alpha - 2\beta(N_{1s} + N_{2s}) &= A_d + \alpha - 2\beta(N_{1d} + N_{2d}) \\
\implies A_s - A_d &= 4\beta(N_{1s} + N_{2s} - \frac{\overline{N}}{2})
\end{aligned}$$

Hence, the total population in the WFH equilibrium in city s is

$$N_{1s} + N_{2s} = \frac{A_s - A_d}{4\beta} + \frac{\overline{N}}{2} \tag{A21}$$

Condition (5) may be re-written as:

$$\begin{aligned}
A_s + a_2 - 2N_{2s} + cL_{1s} + \alpha - 2\beta(N_{1s} + N_{2s}) &= A_d + a_2 - 2N_{2d} + cL_{1d} + \alpha - 2\beta(N_{1d} + N_{2d}) \\
\implies A_s - 2N_{2s}(1+\beta) + cL_{1s} - 2\beta N_{1s} &= A_d - 2N_{2d}(1+\beta) + cL_{1d} - 2\beta N_{1d} \\
\implies A_s - 2(1+\beta)(N_{2s} - \overline{N_2} + n_{2s}) + c(L_{1s} - \overline{N_1} + L_{1s}) - 2\beta(N_{1s} - \overline{N_1} + N_{1s}) &= A_d \\
\implies 2cL_{1s} - 4\beta(N_{1s} + N_{2s}) - 4N_{2s} &= (c - 2\beta)\overline{N_1} - 2(1+\beta)\overline{N_2} + A_d - A_s \qquad \text{(A22)}
\end{aligned}$$

Substituting the expression for L_{1s} from (A5) into the above equation yields

$$\begin{aligned}
&2c\left(\frac{2c(a_{1s} - a_{1d})}{4} + \frac{cN_{2s}}{2} + \frac{\overline{N_1}}{2} - \frac{c\overline{N_2}}{4}\right) - 4\beta(N_{1s} + N_{2s}) - 4N_{2s} = (c-2\beta)\overline{N_1} - 2(1+\beta)\overline{N_2} + A_d - A_s \\
&\implies \frac{2c(a_{1s} - a_{1d})}{4} + c^2N_{2s} + c\overline{N_1} - \frac{c^2\overline{N_2}}{2} - \frac{(A_s - A_d)4\beta}{4\beta} - \frac{4\beta(\overline{N_1} + \overline{N_2})}{2} - 4N_{2s} \\
&\qquad = (c - 2\beta)\overline{N_1} - 2(1+\beta)\overline{N_2} + A_d - A_s \\
&\implies \frac{c(a_{1s} - a_{1d})}{2} + c\overline{N_1} - (c - 2\beta)\overline{N_1} - \frac{c^2\overline{N_2}}{2} + 2(1+\beta)\overline{N_2} - 2\beta(\overline{N_1} + \overline{N_2}) = (4 - c^2)N_{2s} \\
&\implies (4 - c^2)N_{2s} = \frac{c(a_{1s} - a_{1d})}{2} + \frac{(4 - c^2)\overline{N_2}}{2} \qquad \text{(A23)}
\end{aligned}$$

Hence, as shown in (19) in the text, the type-2 worker employment/population in city s at the WFH equilibrium is given by

$$\widetilde{N_{2s}} = \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N_2}}{2} \tag{A24}$$

Substituting the expression for $\widetilde{N_{2s}}$ from (A24) into (A21) and solving for $\widetilde{N_{1s}}$ yields

$$\begin{aligned}
\widetilde{N_{1s}} + \widetilde{N_{2s}} &= \frac{A_s - A_d}{4\beta} + \frac{\overline{N}}{2} \\
\implies \widetilde{N_{1s}} &= \frac{A_s - A_d}{4\beta} + \frac{\overline{N_1} + \overline{N_2}}{2} - \widetilde{N_{2s}} \\
\implies \widetilde{N_{1s}} &= \frac{A_s - A_d}{4\beta} + \frac{\overline{N_1}}{2} + \frac{\overline{N_2}}{2} - \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N_2}}{2} \qquad \text{(A25)}
\end{aligned}$$

Hence, as shown in (18) in the text, the type-1 worker population in city s in the WFH equilibrium is given by

$$\widetilde{N_{1s}} = \frac{A_s - A_d}{4\beta} - \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N_1}}{2} \tag{A26}$$

Substituting the expression for $\widetilde{N_{2s}}$ from (A24) into (A20) and solving for $\widetilde{L_{1s}}$ yields

$$\begin{aligned}
\widetilde{L_{1s}} &= \frac{a_{1s} - a_{1d}}{4} + \frac{cN_{2s}}{2} + \frac{\overline{N_1}}{2} - \frac{c\overline{N_2}}{4} \\
&= \frac{a_{1s} - a_{1d}}{4} + \frac{c}{2}\left(\frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N_2}}{2}\right) + \frac{\overline{N_1}}{2} - \frac{c\overline{N_2}}{4}
\end{aligned}$$

$$
\begin{aligned}
&= \frac{a_{1s} - a_1 d}{4}\left(1 + \frac{c^2}{(2+c)(2-c)}\right) + \frac{\overline{N_1}}{2} && \text{(A27)}\\
&= \frac{a_{1s} - a_1 d}{(2+c)(2-c)} + \frac{\overline{N_1}}{2} && \text{(A28)}
\end{aligned}
$$

which equals the expression in (21) in text. Using (A26) and (A27), total employment in city s under the WFH equilibrium is given by

$$
\begin{aligned}
\widetilde{L_{1s}} + \widetilde{N_{2s}} &= \left(\frac{a_{1s} - a_{1d}}{(2+c)(2-c)} + \frac{\overline{N_1}}{2}\right) + \left(\frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N_2}}{2}\right)\\
&= \frac{a_{1s} - a_{1d}}{(2+c)(2-c)}\left(1 + \frac{c}{2}\right) + \frac{\overline{N}}{2}\\
&= \frac{a_{1s} - a_{1d}}{2(2-c)} + \frac{\overline{N}}{2}, \qquad \text{(A29)}
\end{aligned}
$$

as in (22) in the text.

Recalling that $\overline{N_i} = N_{is} + N_{id}$ yields the following expressions for the type-1 and type-2 population and employment levels in city d under the WFH equilibrium:

$$
\begin{aligned}
\widetilde{N_{1d}} &= \overline{N_1} - \widetilde{N_{1s}}\\
&= \overline{N_1} - \left(\frac{A_s - A_d}{4\beta} - \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N_1}}{2}\right)\\
&= \frac{\overline{N_1}}{2} - \frac{A_s - A_d}{4\beta} + \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} \qquad \text{(A30)}
\end{aligned}
$$

$$
\begin{aligned}
\widetilde{N_{2d}} &= \overline{N_2} - \widetilde{N_{2s}}\\
&= \overline{N_2} - \left(\frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N_2}}{2}\right)\\
&= \frac{\overline{N_2}}{2} - \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} \qquad \text{(A31)}
\end{aligned}
$$

$$
\begin{aligned}
\widetilde{L_{1d}} &= \overline{N_1} - \widetilde{L_{1s}}\\
&= \overline{N_1} - \left(\frac{a_{1s} - a_{1d}}{(2+c)(2-c)} + \frac{\overline{N_1}}{2}\right)\\
&= \frac{\overline{N_1}}{2} - \frac{a_{1s} - a_{1d}}{(2+c)(2-c)} \qquad \text{(A32)}
\end{aligned}
$$

Using (A30)-(A32), the total population and total employment in city d in the WFH equilibrium are

$$
\begin{aligned}
\widetilde{N_{1d}} + \widetilde{N_{2d}} &= 2\overline{N} - \left(\frac{A_s - A_d}{4\beta} + \overline{N}\right)\\
&= \overline{N} - \frac{A_s - A_d}{4\beta}\\
\widetilde{L_{1d}} + \widetilde{N_{2d}} &= \left(\frac{\overline{N_1}}{2} - \frac{a_{1s} - a_{1d}}{(2+c)(2-c)}\right) + \left(\frac{\overline{N_2}}{2} + \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)}\right)\\
&= \overline{N} + \frac{a_{1s} - a_{1d}}{(2+c)(2-c)}\left(\frac{c}{2} - 1\right)
\end{aligned}
$$

$$= \overline{N} - \frac{a_{1s} - a_{1d}}{2(2+c)} \tag{A33}$$

The wage for the original type-1 workers of city s in the WFH equilibrium is calculated as:

$$\begin{aligned}
w_{1s}(\widetilde{L_{1s}}, \widetilde{N_{2s}}) &= a_{1s} - 2\widetilde{L_{1s}} + c\widetilde{N_{2s}} \\
&= a_{1s} - 2\left(\frac{a_{1s} - a_{1d}}{(2+c)(2-c)} + \frac{\overline{N_1}}{2}\right) + c\left(\frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N_2}}{2}\right) \\
&= a_{1s} + \frac{a_{1s} - a_{1d}}{(2+c)(2-c)}\left(\frac{c^2}{2} - 2\right) + \frac{c\overline{N_2}}{2} - \overline{N_1} \\
&= a_{1s} - \frac{a_{1s} - a_{1d}}{2} + \frac{c\overline{N_2}}{2} - \overline{N_1} \\
&= \frac{a_{1s} + a_{1d}}{2} + \frac{c\overline{N_2}}{2} - \overline{N_1}.
\end{aligned} \tag{A34}$$

The wage for the original type-2 workers of city s at the WFH equilibrium is calculated as:

$$\begin{aligned}
w_{2s}(\widetilde{L_{1s}}, \widetilde{N_{2s}}) &= a_2 - 2\widetilde{N_{2s}} + c\widetilde{L_{1s}} \\
&= a_2 - 2\left(\frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} + \frac{\overline{N_2}}{2}\right) + c\left(\frac{a_{1s} - a_{1d}}{(2+c)(2-c)} + \frac{\overline{N_1}}{2}\right) \\
&= a_2 - \frac{c(a_{1s} - a_{1d})}{(2+c)(2-c)} + \frac{c(a_{1s} - a_{1d})}{(2+c)(2-c)} - \overline{N_2} + \frac{c\overline{N_1}}{2} \\
&= a_2 - \overline{N_2} + \frac{c\overline{N_1}}{2}
\end{aligned} \tag{A35}$$

From (6) in the text, type-1 wages are equalized in city s and city d. Since the same conclusion was shown to hold for type-2 wages, the city-d wages are given by

$$w_{1d}(\widetilde{L_{1d}}, \widetilde{N_{2d}}) = w_{1s}(\widetilde{L_{1s}}, \widetilde{N_{2s}}) = \frac{a_{1s} + a_{1d}}{2} + \frac{c\overline{N_2}}{2} - \overline{N_1} \tag{A36}$$

$$w_{2d}(\widetilde{L_{1d}}, \widetilde{N_{2d}}) = w_{2s}(\widetilde{L_{1s}}, \widetilde{N_{2s}}) = a_2 - \overline{N_2} + \frac{c\overline{N_1}}{2} \tag{A37}$$

C Non-WFH and WFH comparisons

C.1 When city s only has a productivity advantage

Note that all the expressions used in this section assume $A_s = A_d \equiv A$ but $a_{1s} > a_{1d}$. To compare N_{1s}^* and $\widetilde{N_{1s}}$, note that using (A5) and (A26),

$$\begin{aligned}
& 2(2-c)(1+\beta) + c(4\beta - c + 2) > 0 \\
&\implies 2(2-c)(1+\beta) > -c(4\beta - c + 2) \\
&\implies \frac{1+\beta}{4\beta + 2 - c} > \frac{-c}{2(2-c)} \\
&\implies \frac{(a_{1s} - a_{1d})(1+\beta)}{(4\beta + 2 - c)(c+2)} > \frac{-c(a_{1s} - a_{1d})}{2(c+2)(2-c)} \\
&\implies N_{1s}^* = \frac{(a_{1s} - a_{1d})(1+\beta)}{(4\beta + 2 - c)(c+2)} + \frac{\overline{N_1}}{2} > \frac{-c(a_{1s} - a_{1d})}{2(c+2)(2-c)} + \frac{\overline{N_1}}{2} = \widetilde{N_{1s}}
\end{aligned} \tag{A38}$$

To compare N_{2s}^* and $\widetilde{N_{2s}}$, note that using (A7) and (A24),

$$\begin{aligned}
& c > -2 \\
\implies & 2c > -4 \\
\implies & 4\beta c - c^2 + 2c > 2c - 4\beta - c^2 + 2\beta \\
\implies & c(4\beta + 2 - c) > (c - 2\beta)(2 - c) \\
\implies & \widetilde{N_{2s}} = \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} > \frac{(c-2\beta)(a_{1s} - a_{1d})}{2(c+2)(4\beta + 2 - c)} = N_{2s}^*
\end{aligned} \tag{A39}$$

To compare $N_{1s}^* + N_{2s}^*$ and $\widetilde{N_{1s}} + \widetilde{N_{2s}}$, note that using (A9) and (A25),

$$\begin{aligned}
& 2(4\beta - c + 2) > 0 \\
\implies & \frac{a_{1s} - a_{1d}}{2(4\beta - c + 2)} > 0 \\
\implies & N_{1s}^* + N_{2s}^* = \frac{a_{1s} - a_{1d}}{2(4\beta + 2 - c)} + \frac{\overline{N}}{2} > \frac{\overline{N}}{2} = \widetilde{N_{1s}} + \widetilde{N_{2s}}
\end{aligned} \tag{A40}$$

To compare $\widetilde{N_{1s}}$ and $\widetilde{L_{1s}}$, note that using (A26) and (A28),

$$\begin{aligned}
& -\frac{c}{2} < 1 \\
\implies & \widetilde{N_{1s}} = \frac{c(a_{1s} - a_{1d})}{2(c+2)(2-c)} + \frac{\overline{N_1}}{2} < \frac{a_{1s} - a_{1d}}{(2+c)(2-c)} + \frac{\overline{N_1}}{2} = \widetilde{L_{1s}}
\end{aligned} \tag{A41}$$

To compare N_{1s}^* and $\widetilde{L_{1s}}$, note that using (A5) and (A28),

$$\begin{aligned}
& 2\beta + \beta c > 0 \\
\implies & 4\beta - c + 2 > 2 - c + 2\beta - \beta c \\
\implies & 4\beta - c + 2 > (1 + \beta)(2 - c) \\
\implies & \frac{a_{1s} - a_{1d}}{2 - c} > \frac{(a_{1s} - a_{1d})(1+\beta)}{(4\beta - c + 2)} \\
\implies & \widetilde{L_{1s}} = \frac{a_{1s} - a_{1d}}{2 - c} + \frac{\overline{N_1}}{2} > \frac{(a_{1s} - a_{1d})(1+\beta)}{(4\beta - c + 2)} + \frac{\overline{N_1}}{2} = N_{1s}^*
\end{aligned} \tag{A42}$$

To compare $N_{1s}^* + N_{2s}^*$ and $\widetilde{L_{1s}} + \widetilde{N_{2s}}$, note that using (A9) and (A29),

$$\begin{aligned}
& 4\beta + 2 - c > 2 - c \\
\implies & \frac{a_{1s} - a_{1d}}{2 - c} > \frac{a_{1s} - a_{1d}}{4\beta - c + 2} \\
\implies & \widetilde{L_{1s}} + \widetilde{N_{2s}} = \frac{a_{1s} - a_{1d}}{2(2-c)} + \frac{\overline{N}}{2} > \frac{a_{1s} - a_{1d}}{2(4\beta - c + 2)} + \frac{\overline{N}}{2} = N_{1s}^* + N_{2s}^*
\end{aligned} \tag{A43}$$

To compare $w_{1s}^* = w_{1s}(N_{1s}^*, N_{2s}^*)$ and $\widetilde{w_{1s}} = w_{1s}(\widetilde{L_{1s}}, \widetilde{N_{2s}})$, note that using (A12) and (A34),

$$\begin{aligned}
& a_{1s} > a_{1d} \\
\implies & 2\beta a_{1d} < 2\beta a_{1s} \\
\implies & a_{1d}\left(1 - \frac{2\beta - c + 2}{4\beta - c + 2}\right) < a_{1s}\left(\frac{6\beta - c + 2}{4\beta - c + 2} - 1\right) \\
\implies & \frac{a_{1s} + a_{1d}}{2} < \frac{a_{1s}(6\beta - c + 2)}{2(4\beta - c + 2)} + \frac{a_{1d}(2\beta - c + 2)}{2(4\beta - c + 2)}
\end{aligned}$$

$$\implies \widetilde{w_{1s}} = \frac{a_{1s}+a_{1d}}{2} + \frac{c\overline{N_2}}{2} - \overline{N_1} < \frac{a_{1s}(6\beta-c+2)}{2(4\beta-c+2)} + \frac{a_{1d}(2\beta-c+2)}{2(4\beta-c+2)} + \frac{c\overline{N_2}}{2} - \overline{N_1} = w_{1s}^* \quad \text{(A44)}$$

To compare $w_{1d}^* = w_{1d}(N_{1d}^*, N_{2d}^*)$ and $\widetilde{w_{1d}} = w_{1d}(\widetilde{L_{1d}}, \widetilde{N_{2d}})$, note that using (A14) and (A36),

$$\begin{aligned}
& a_{1s} > a_{1d} \\
\implies & 2\beta a_{1d} < 2\beta a_{1s} \\
\implies & a_{1s}\left(1 - \frac{2\beta+2-c}{4\beta-c+2}\right) > a_{1d}\left(\frac{6\beta+2-c}{4\beta+2-c} - 1\right) \\
\implies & \frac{a_{1s}+a_{1d}}{2} > \frac{a_{1d}(6\beta+2-c)}{2(4\beta+2-c)} + \frac{a_{1s}(2\beta+2-c)}{2(4\beta+2-c)}
\end{aligned}$$

$$\implies \widetilde{w_{1d}} = \frac{a_{1s}+a_{1d}}{2} + \frac{c\overline{N_2}}{2} - \overline{N_1} > \frac{a_{1d}(6\beta+2-c)}{2(4\beta+2-c)} + \frac{a_{1s}(2\beta+2-c)}{2(4\beta+2-c)} + \frac{c\overline{N_2}}{2} - \overline{N_1} = w_{1d}^* \quad \text{(A45)}$$

To compare $w_{2s}^* = w_{2s}(N_{1s}^*, N_{2s}^*)$ and $\widetilde{w_{2s}} = w_{2s}(\widetilde{L_{1s}}, \widetilde{N_{2s}})$, note that using (A14) and (A35),

$$\frac{(a_{1s}-a_{1d})\beta}{4\beta-c+2} > 0$$

$$\implies w_{2s}^* = a_2 - \frac{(a_{1s}-a_{1d})\beta}{4\beta-c+2} + \frac{c\overline{N_1}}{2} - \overline{N_2} > a_2 + \frac{c\overline{N_1}}{2} - \overline{N_2} = \widetilde{w_{2s}} \quad \text{(A46)}$$

To compare $w_{2d}^* = w_{2d}(N_{1d}^*, N_{2d}^*)$ and $\widetilde{w_{2d}} = w_{2d}(\widetilde{L_{1d}}, \widetilde{N_{2d}})$, note that using (A14) and (A37),

$$-\frac{(a_{1s}-a_{1d})\beta}{4\beta-c+2} < 0$$

$$\implies w_{2d}^* = a_2 - \frac{(a_{1s}-a_{1d})\beta}{4\beta-c+2} + \frac{c\overline{N_1}}{2} - \overline{N_2} < a_2 + \frac{c\overline{N_1}}{2} - \overline{N_2} = \widetilde{w_{2d}} \quad \text{(A47)}$$

Using (A5), (A7) and (A8), utility of original type-1 workers in city s in the non-WFH equilibrium (which equals the utility in city d) is given by

$$\begin{aligned}
& A + w_{1s}^* + \alpha - 2\beta(N_{1s}^* + N_{2s}^*) \\
& = A + a_{1s} - 2N_{1s}^* + cN_{2s}^* + \alpha - 2\beta\left(\frac{a_{1s}+a_{1d}}{2(4\beta-c+2)} + \frac{\overline{N}}{2}\right) \\
& = A + a_{1s} - \frac{a_{1s}-a_{1d}}{4\beta-c+2}\left(\frac{2(1+\beta)}{c+2} - \frac{c(c-2\beta)}{2(2+c)} + \beta\right) - \overline{N_1} + \frac{c\overline{N_2}}{2} + \alpha - \beta\overline{N} \\
& = A + \frac{a_{1s}+a_{1d}}{2} + \frac{c\overline{N_2}}{2} - \overline{N_1} + \alpha - \beta\overline{N} \qquad \text{(A48)}
\end{aligned}$$

Using (A34) and A(25), welfare of type-1 workers in city s under WFH is given by

$$A + w_{1s}(\widetilde{L_{1s}}, \widetilde{N_{2s}}) + \alpha - \beta(\widetilde{N_{1s}} + \widetilde{N_{2s}}) = A + \frac{a_{1s}+a_{1d}}{2} + \frac{c\overline{N_2}}{2} - \overline{N_1} + \alpha - \beta\overline{N} \quad \text{(A49)}$$

Hence, as stated in the text, the computations above yield the same utility for type-1 workers with and without WFH.

Using (A5), (A7), and (A8), the utility of original type-2 workers in city s in the non-WFH equilibrium is given by

$$
\begin{aligned}
& A + w_{2s}(N_{1s}^*, N_{2s}^*) + \alpha - 2\beta(N_{1s}^* + N_{2s}^*) \\
& = A + a_2 - 2N_{2s}^* + cN_{1s}^* + \alpha - \frac{\beta(a_{1s} - a_{1d})}{4\beta - c + 2} - 2\beta\overline{N} \\
& = A + a_2 + \frac{\beta(a_{1s} - a_{1d})}{4\beta - c + 2} - \overline{N_2} - \frac{\beta(a_{1s} - a_{1d})}{4\beta - c + 2} + \frac{c\overline{N_1}}{2} + \alpha - 2\beta\overline{N}
\end{aligned}
$$

$$
= A + a_2 + \frac{c\overline{N_1}}{2} - \overline{N_2} + \alpha - \beta\overline{N} \tag{A50}
$$

Using (A35) and (A25), the utility of original type-2 workers in city s under WFH is given by

$$
A + w_{2s}(\widetilde{L_{1s}}, \widetilde{N_{2s}}) + \alpha - \beta(\widetilde{N_{1s}} + \widetilde{N_{2s}}) = A + a_2 - \overline{N_2} + \frac{c\overline{N_1}}{2} + \alpha - \beta\overline{N} \tag{A51}
$$

Hence, as stated in the text, welfare is the same for type-2 workers with and without WFH.

C.2 When city s only has an amenity advantage

Note that all the expressions used in this section assumes $A_s > A_d$ but $a_{1s} = a_{1d} \equiv a_1$. To compare N_{1s}^* and $\widetilde{N_{1s}}$, note that using (A5) and (A26),

$$
\begin{aligned}
& 4\beta + 4 > 2c \\
& \implies 4\beta < 4\beta + 4 - 2c \\
& \implies 4\beta < 2(4\beta + 2 - c) \\
& \implies \frac{A_s - A_d}{4\beta} > \frac{A_s - A_d}{2(4\beta + 2 - c)} \\
& \implies \widetilde{N_{1s}} = \frac{A_s - A_d}{4\beta} + \frac{\overline{N_1}}{2} > \frac{A_s - A_d}{2(4\beta + 2 - c)} + \frac{\overline{N_1}}{2} = N_{1s}^*
\end{aligned} \tag{A52}
$$

To compare N_{2s}^* and $\widetilde{N_{2s}}$, note that using (A7) and A(24),

$$
\begin{aligned}
& 0 < \frac{A_s - A_d}{2(4\beta - c + 2)} \\
& \implies \widetilde{N_{2s}} = \frac{\overline{N_2}}{2} < \frac{A_s - A_d}{2(4\beta + 2 - c)} + \frac{\overline{N_2}}{2} = N_{2s}^*
\end{aligned} \tag{A53}
$$

To compare $N_{1s}^* + N_{2s}^*$ and $\widetilde{N_{1s}} + \widetilde{N_{2s}}$, note that using (A9) and (A25),

$$
\begin{aligned}
& 4\beta < 4\beta - c + 2 \\
& \implies \frac{A_s - A_d}{4\beta} > \frac{A_s - A_d}{4\beta + 2 - c}
\end{aligned}
$$

$$
\implies \widetilde{N_{1s}} + \widetilde{N_{2s}} = \frac{A_s - A_d}{4\beta} + \frac{\overline{N}}{2} > \frac{A_s - A_d}{4\beta + 2 - c} + \frac{\overline{N}}{2} = N_{1s}^* + N_{2s}^* \tag{A54}
$$

To compare $\widetilde{N_{1s}}$ and $\widetilde{L_{1s}}$, note that using (A26) and (A28),

$$\begin{aligned} 0 &< \frac{A_s - A_d}{2(4\beta + 2 - c)} \\ \implies \widetilde{L_{1s}} = \frac{\overline{N_2}}{2} &< \frac{A_s - A_d}{2(4\beta + 2 - c)} + \frac{\overline{N_2}}{2} = \widetilde{N_{1s}} \end{aligned} \tag{A55}$$

To compare N^*_{1s} and $\widetilde{L_{1s}}$, note that using (A5) and (A28),

$$\begin{aligned} 0 &< \frac{A_s - A_d}{2(4\beta - c + 2)} \\ \implies \widetilde{L_{1s}} = \frac{\overline{N_1}}{2} &< \frac{A_s - A_d}{2(4\beta + 2 - c)} + \frac{\overline{N_1}}{2} = N^*_{1s} \end{aligned} \tag{A56}$$

To compare $N^*_{1s} + N^*_{2s}$ and $\widetilde{L_{1s}} + \widetilde{N_{2s}}$, note that using (A9) and (A29),

$$\begin{aligned} 0 &< \frac{A_s - A_d}{2(4\beta - c + 2)} \\ \implies \widetilde{L_{1s}} + \widetilde{N_{2s}} = \frac{\overline{N}}{2} &< \frac{A_s - A_d}{2(4\beta + 2 - c)} + \frac{\overline{N}}{2} = N^*_{1s} + N^*_{2s} \end{aligned} \tag{A57}$$

To compare $w^*_{1s} = w_{1s}(N^*_{1s}, N^*_{2s})$ and $\widetilde{w_{1s}} = w_{1s}(\widetilde{L_{1s}}, \widetilde{N_{2s}})$, note that using (A12) and (A34),

$$\begin{aligned} \frac{c-2}{4\beta - c + 2} &< 0 \\ \implies -\frac{(A_s - A_d)(2-c)}{2(4\beta - c + 2)} &< 0 \end{aligned}$$

$$\implies w^*_{1s} = a_1 - \frac{(A_s - A_d)(2-c)}{2(4\beta - c + 2)} + \frac{c\overline{N_2}}{2} - \overline{N_1} < a_1 + \frac{c\overline{N_2}}{2} - \overline{N_1} = \widetilde{w_{1s}} \tag{A58}$$

To compare $w^*_{1d} = w_{1d}(N^*_{1d}, N^*_{2d})$ and $\widetilde{w_{1d}} = w_{1d}(\widetilde{L_{1d}}, \widetilde{N_{2d}})$, note that using (A14) and (A36),

$$\begin{aligned} \frac{2-c}{4\beta - c + 2} &> 0 \\ \implies \frac{(A_s - A_d)(2-c)}{2(4\beta - c + 2)} &> 0 \end{aligned}$$

$$\implies w^*_{1d} = a_1 + \frac{(A_s - A_d)(2-c)}{2(4\beta + 2 - c)} + \frac{c\overline{N_2}}{2} - \overline{N_1} > a_1 + \frac{c\overline{N_2}}{2} - \overline{N_1} = \widetilde{w_{1d}} \tag{A59}$$

To compare $w^*_{2s} = w_{2s}(N^*_{1s}, N^*_{2s})$ and $\widetilde{w_{2s}} = w_{2s}(\widetilde{L_{1s}}, \widetilde{N_{2s}})$, note that using (A14) and (A35),

$$\begin{aligned} \frac{c-2}{4\beta + 2 - c} &< 0 \\ \implies -\frac{(A_s - A_d)(2-c)}{2(4\beta + 2 - c)} &< 0 \end{aligned}$$

$$\implies w_{2s}^* = a_2 - \frac{(A_s - A_d)(2-c)}{2(4\beta+2-c)} + \frac{c\overline{N_1}}{2} - \overline{N_2} < a_2 + \frac{c\overline{N_1}}{2} - \overline{N_2} = \widetilde{w_{2s}} \tag{A60}$$

To compare $w_{2d}^* = w_{2d}(N_{1d}^*, N_{2d}^*)$ and $\widetilde{w_{2d}} = w_{2d}(\widetilde{L_{1d}}, \widetilde{N_{2d}})$, note that using (A14) and (A37),

$$\frac{2-c}{4\beta+2-c} > 0$$
$$\implies \frac{(A_s - A_d)(2-c)}{2(4\beta+2-c)} > 0$$

$$\implies w_{1d}^* = a_2 + \frac{(A_s - A_d)(2-c)}{2(4\beta+2-c)} + \frac{c\overline{N_1}}{2} - \overline{N_2} > a_2 + \frac{c\overline{N_1}}{2} - \overline{N_2} = \widetilde{w_{2d}} \tag{A61}$$

Using (A5), (A7) and (A8), the utility of original type-1 workers in city s in the non-WFH equilibrium (which equals the utility in city d) is given by

$$\begin{aligned}
&A_s + w_{1s}^* + \alpha - 2\beta(N_{1s}^* + N_{2s}^*)\\
&= A_s + a_1 - 2N_{1s}^* + cN_{2s}^* + \alpha - 2\beta\left(\frac{A_s - A_d}{4\beta+2-c} + \frac{\overline{N}}{2}\right)\\
&= A_s + a_1 - \frac{A_s - A_d}{4\beta+2-c} - \overline{N_1} + \frac{c(A_s - A_d)}{2(4\beta+2-c)} + \frac{c\overline{N_2}}{2} - \frac{2\beta(A_s - A_d)}{4\beta+2-c} - \beta\overline{N} + \alpha\\
&= A_s + a_1 - \overline{N_1} + \frac{c\overline{N_2}}{2} - \frac{A_s - A_d}{2} - \beta\overline{N} + \alpha\\
&= \frac{A_s + A_d}{2} + a_1 + \frac{c\overline{N_2}}{2} - \overline{N_1} + \alpha - \beta\overline{N}
\end{aligned} \tag{A62}$$

Using (A34) and (A25), the utility of type-1 workers in city s under WFH is given by

$$\begin{aligned}
&A_s + \widetilde{w_{1s}} + \alpha - 2\beta(\widetilde{N_{1s}} + \widetilde{N_{2s}})\\
&= A_s + \frac{a_1 + a_1}{2} + \frac{c\overline{N_2}}{2} - \overline{N_1} - 2\beta\left(\frac{A_s - A_d}{4\beta} + \frac{\overline{N_1} + \overline{N_2}}{2}\right) + \alpha\\
&= \frac{A_s + A_d}{2} + a_1 + \frac{c\overline{N_2}}{2} - \overline{N_1} + \alpha - \beta\overline{N}
\end{aligned} \tag{A63}$$

Hence, as stated in the text, the computations above yield the same utility for the type-1 workers with and without WFH.

Using (A5), (A7) and (A8), the utility of original type-2 workers in city s in the non-WFH equilibrium is given by

$$\begin{aligned}
&A_s + w_{2s}^* + \alpha - 2\beta(N_{1s}^* + N_{2s}^*)\\
&= A_s + a_2 - 2N_{2s}^* + cN_{1s}^* + \alpha - 2\beta\left(\frac{A_s - A_d}{4\beta-c+2} + \frac{\overline{N}}{2}\right)\\
&= A_s + a_2 - \frac{A_s - A_d}{4\beta+2-c} + \frac{c(A_s - A_d)}{2(4\beta+2-c)} - \frac{2\beta(A_s - A_d)}{4\beta-c+2} - \beta\overline{N} - \overline{N_2} + \frac{c\overline{N_1}}{2} + \alpha\\
&= \frac{A_s + A_d}{2} + a_2 + \frac{c\overline{N_1}}{2} - \overline{N_2} + \alpha - \beta\overline{N}
\end{aligned} \tag{A64}$$

Using (A35) and (A25), the utility of original type-2 workers in city s is given by

$$
\begin{aligned}
& A_s + \widetilde{w_{2s}} + \alpha - 2\beta(\widetilde{N_{1s}} + \widetilde{N_{2s}}) \\
&= A_s + a_2 + \frac{c\overline{N_1}}{2} - \overline{N_2} - 2\beta\left(\frac{A_s - A_d}{4\beta} + \frac{\overline{N}}{2}\right) + \alpha \\
&= \frac{A_s + A_d}{2} + a_2 + \frac{c\overline{N_1}}{2} - \overline{N_2} + \alpha - \beta\overline{N} \qquad \text{(A65)}
\end{aligned}
$$

Hence, as stated in the text, utility is the same for type-2 workers with and without WFH.

D Comparative-Static Results

D.1 When city s only has a productivity advantage

When WFH is introduced, the change in type-1 worker population in city s is given by

$$
\begin{aligned}
N_{1s}^* - \widetilde{N_{1s}} &= \frac{(a_{1s} - a_{1d})(1+\beta)}{4(4\beta + 2 - c)(c+2)} - \frac{-c(a_{1s} - a_{1d})}{2(2+c)(2-c)} \\
&= (a_{1s} - a_{1d})\left(\frac{1+\beta}{(4\beta + 2 - c)(c+2)} + \frac{c}{2(2+c)(2-c)}\right) \qquad \text{(A66)}
\end{aligned}
$$

The change in type-1 worker population in city d is also given by

$$
\widetilde{N_{1d}} - N_{1d}^* = (a_{1s} - a_{1d})\left(\frac{1+\beta}{(4\beta - c + 2)(c+2)} + \frac{c}{2(2+c)(2-c)}\right)
$$

Partially differentiating $(N_{1s}^* - \widetilde{N_{1s}})$ and $(\widetilde{N_{1d}} - N_{1d}^*)$ with respect to the difference of productivities between the two cities yields

$$
\frac{\partial(N_{1s}^* - \widetilde{N_{1s}})}{\partial(a_{1s} - a_{1d})} = \frac{\partial(\widetilde{N_{1d}} - N_{1d}^*)}{\partial(a_{1s} - a_{1d})} = \frac{1+\beta}{(4\beta + 2 - c)(c+2)} + \frac{c}{2(2+c)(2-c)} > 0
$$

Also, partially differentiating $(N_{1s}^* - \widetilde{N_{1s}})$ and $(\widetilde{N_{1d}} - N_{1d}^*)$ with respect to the degree of complementarity between worker types yields

$$
\begin{aligned}
& \frac{\partial(N_{1s}^* - \widetilde{N_{1s}})}{\partial c} = \frac{\partial(\widetilde{N_{1d}} - N_{1d}^*)}{\partial c} \\
&= (a_{1s} - a_{1d})\frac{\partial}{\partial c}\left(\frac{1+\beta}{4\beta c + 8\beta - c^2 + 4}\right) + \frac{\partial}{\partial c}\left(\frac{c}{2(4-c^2)}\right) \\
&= (a_{1s} - a_{1d})\left(-\frac{(1+\beta)(4\beta - 2c)}{(4\beta c + 8\beta - c^2 + 4)^2}\right) + \left(\frac{8 + 2c^2}{4(4-c^2)^2}\right) \\
&= (a_{1s} - a_{1d})\left(\frac{2c + 2\beta c - 4\beta - 4\beta^2}{(4\beta c + 8\beta - c^2 + 4)^2} + \frac{8 + 2c^2}{4(4-c^2)^2}\right) \qquad \text{(A67)}
\end{aligned}
$$

Given that $c \approx 0$, assuming $c = 0$ for computational simplicity reduces the above equation to

$$
\frac{\partial(N_{1s}^* - \widetilde{N_{1s}})}{\partial c} = \frac{\partial(\widetilde{N_{1d}} - N_{1d}^*)}{\partial c} = \frac{-4\beta^2 - 4\beta}{(8\beta + 4)^2} + \frac{1}{8} = \frac{-32\beta^2 - 32\beta + (8\beta + 4)^2}{8(8\beta + 4)^2} = \frac{4\beta^2 + 4\beta + 2}{(8\beta + 4)^2} > 0 \qquad \text{(A68)}
$$

The changes in type-2 worker population in city s and city d are given by

$$\widetilde{N_{2s}} - N_{2s}^* = N_{2d}^* - \widetilde{N_{2d}} = \frac{c(a_{1s} - a_{1d})}{2(2+c)(2-c)} - \frac{(c-2\beta)(a_{1s} - a_{1d})}{2(4\beta - c + 2)(c+2)} \tag{A69}$$

Assuming $c = 0$ for computational simplicity and partially differentiating with respect to the difference of productivities between the two cities yields

$$\frac{\partial(\widetilde{N_{2s}} - N_{2s}^*)}{\partial(a_{1s} - a_{1d})} = \frac{\partial N_{2d}^* - \widetilde{N_{2d}}}{\partial(a_{1s} - a_{1d})} = \frac{2\beta}{16\beta + 8} > 0 \tag{A70}$$

Also, partially differentiating $(\widetilde{N_{2s}} - N_{2s}^*)$ and $(N_{2d}^* - \widetilde{N_{2d}})$ with respect to the degree of complementarity between the two worker types yields

$$\begin{aligned} \frac{\partial(\widetilde{N_{2s}} - N_{2s}^*)}{\partial c} &= \frac{\partial(N_{2d}^* - \widetilde{N_{2d}})}{\partial c} \\ &= \frac{(a_{1s} - a_{1d})}{2}\left(\frac{4+c^2}{(4-c^2)^2}\right) - \frac{a_{1s} - a_{1d}}{2}\left(\frac{8\beta + 4 + 8\beta^2 + c^2 - 4\beta c}{(4\beta c + 8\beta - c^2 + 4)^2}\right) \\ &= \frac{(a_{1s} - a_{1d})}{2}\left(\frac{4+c^2}{(4-c^2)^2} - \frac{8\beta + 4 + 8\beta^2 + c^2 - 4\beta c}{(4\beta c + 8\beta - c^2 + 4)^2}\right) \end{aligned} \tag{A71}$$

Assuming $c = 0$ for computational simplicity reduces the above equation to

$$\begin{aligned} \frac{\partial(\widetilde{N_{2s}} - N_{2s}^*)}{\partial c} &= \frac{\partial(N_{2d}^* - \widetilde{N_{2d}})}{\partial c} \\ &= \frac{(a_{1s} - a_{1d})}{2}\left(\frac{1}{4} - \frac{8\beta + 4 + 8\beta^2}{(8\beta + 4)^2}\right) = 2(a_{1s} - a_{1d})\left(\frac{32\beta^2 + 32\beta}{16(8\beta + 4)^2}\right) > 0 \end{aligned} \tag{A72}$$

The changes in type-1 employment in city s and city d are given by

$$\widetilde{L_{1s}} - N_{1s}^* = N_{1d}^* - \widetilde{L_{1d}} = \frac{a_{1s} - a_{1d}}{4 - c^2} - \frac{(1+\beta)(a_{1s} - a_{1d})}{4\beta c - 8\beta - c^2 + 4} \tag{A73}$$

Assuming $c = 0$ for computational simplicity and partially differentiating with respect to the difference of productivities between the two cities yields

$$\frac{\partial(\widetilde{L_{1s}} - N_{1s}^*)}{\partial(a_{1s} - a_{1d})} = \frac{\partial N_{1d}^* - \widetilde{L_{1d}}}{\partial(a_{1s} - a_{1d})} = \frac{4\beta c + 8\beta - c^2 + 4 - (1+\beta)(4-c^2)}{(4-c^2)(4\beta c + 8\beta - c^2 + 4)} = \frac{4\beta}{4(8\beta + 4)} > 0 \tag{A74}$$

Also, partially differentiating $(\widetilde{L_{1s}} - N_{1s}^*)$ and $(N_{1d}^* - \widetilde{L_{2d}})$ with respect to the degree of complementarity between the the worker types yields

$$\frac{\partial(\widetilde{L_{1s}} - N_{1s}^*)}{\partial c} = \frac{\partial(N_{1d}^* - \widetilde{L_{1d}})}{\partial c} = \frac{\partial \widetilde{L_{1s}}}{\partial c} - \frac{\partial N_{1s}^*}{\partial c} = \frac{(a_{1s} - a_{1d})2c}{(4-c^2)^2} + \frac{(a_{1s} - a_{1d})(1+\beta)(4\beta - 2c)}{4\beta c + 8\beta - c^2 + 4}$$

Assuming $c = 0$, the expression above simplifies to

$$\frac{\partial(\widetilde{L_{1s}} - N_{1s}^*)}{\partial c} = \frac{(a_{1s} - a_{1d})(1+\beta)\beta}{2\beta + 1} > 0 \tag{A75}$$

D.2 When city s only has an amenity advantage

When WFH is introduced, the changes in type-1 worker population in city s is given by

$$\begin{aligned}
\widetilde{N_{1s}} - N_{1s}^* &= \frac{A_s - A_d}{4\beta} - \frac{A_s - A_d}{2(4\beta + 2 - c)} \\
&= (A_s - A_d)\left(\frac{1}{4\beta} - \frac{1}{2(4\beta + 2 - c)}\right) \\
&= (A_s - A_d)\left(\frac{4\beta - c + 2 - 2}{4\beta(4\beta + 2 - c)}\right) \\
&= \frac{(A_s - A_d)(4\beta - c)}{4\beta(4\beta + 2 - c)}
\end{aligned} \tag{A76}$$

The changes in type-1 worker population in city d is also given by

$$N_{1d}^* - \widetilde{N_{1d}} = \frac{(A_s - A_d)(4\beta - c)}{4\beta(4\beta - c + 2)} \tag{A77}$$

Partially differentiating with respect to the difference of amenities between the two cities yields

$$\frac{\partial(\widetilde{N_{1s}} - N_{1s}^*)}{\partial(A_s - A_d)} = \frac{\partial(N_{1d}^* - \widetilde{N_{1d}})}{\partial(A_s - A_d)} = \frac{4\beta - c}{4\beta(4\beta - c + 2)} > 0 \tag{A78}$$

Also, partially differentiating with respect to the degree of complementarity between worker types yields

$$\begin{aligned}
\frac{\partial(\widetilde{N_{1s}} - N_{1s}^*)}{\partial c} &= \frac{\partial(N_{1d}^* - \widetilde{N_{1d}})}{\partial c} \\
&= \frac{A_s - A_d}{4\beta}\left(\frac{(2 - c + 4\beta)(-1) + (c - 4\beta)(-1)}{(4\beta - c + 2)^2}\right) = \frac{-2(A_s - A_d)}{4\beta(4\beta - c + 2)^2} < 0
\end{aligned} \tag{A79}$$

The changes in type-2 worker population in cities s and d are given by

$$N_{2s}^* - \widetilde{N_{2s}} = \widetilde{N_{2d}} - N_{2d}^* = \frac{A_s - A_d}{2(4\beta - c + 2)} \tag{A80}$$

Partially differentiating with respect to the difference of amenities between the two cities yields

$$\frac{\partial(N_{2s}^* - \widetilde{N_{2s}})}{\partial(A_s - A_d)} = \frac{\partial(\widetilde{N_{2d}} - N_{2d}^*)}{\partial(A_s - A_d)} = \frac{1}{2(4\beta - c + 2)} > 0 \tag{A81}$$

Also, partially differentiating with respect to the degree of complementarity between worker types yields

$$\frac{\partial(N_{2s}^* - \widetilde{N_{2s}})}{\partial c} = \frac{\partial(\widetilde{N_{2d}} - N_{2d}^*)}{\partial c} = -\frac{A_s - A_d}{4(4\beta - c + 2)^2}(-1) = \frac{A_s - A_d}{4(4\beta - c + 2)^2} > 0 \tag{A82}$$

The changes in type-1 employment in cities s and d are given by

$$N_{1s}^* - \widetilde{L_{1s}} = \widetilde{L_{1d}} - N_{1d}^* = \frac{A_s - A_d}{4\beta} \tag{A83}$$

Partially differentiating with respect to the difference of amenities between the two cities yields

$$\frac{\partial(N_{1s}^* - \widetilde{L_{1s}})}{\partial(A_s - A_d)} = \frac{\partial(\widetilde{L_{1d}} - N_{1d}^*)}{\partial(A_s - A_d)} = \frac{1}{4\beta} > 0 \tag{A84}$$

Also, partially differentiating with respect to the degree of complementarity between worker types yields

$$\frac{\partial(N_{1s}^* - \widetilde{L_{1s}})}{\partial c} = \frac{\partial(\widetilde{L_{1d}} - N_{1d}^*)}{\partial c} = 0 \tag{A85}$$