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ABSTRACT

We ask how globalization affects a government's incentives to set labor standards for its workers. In a stylized equilibrium model of global value chains, we find two contrasting results. First, each country chooses stricter labor standards with globalization than it would under autarky, because labor standards are a normal good and the general increase in incomes from globalization increases demand for them. We call this the effect of `globalization in the large.' Second, if more countries join the world economy so that globalization increases at the margin, labor standards worsen (improve) at the margin if a country is competing with countries that are very similar to (different from) itself. We call this the effect of `globalization at the margin.' In equilibrium, labor standards are actually stricter than optimal because each country is able to pass some of the costs of its improved labor standards onto other countries (consumers of the final good, for example).

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1 Introduction

A widespread idea among critics of globalization is that globalization puts downward pressure on policies that provide protections for workers – one version of the 'race to the bottom.' As *The Economist* put it:

> GLOBALISATION sceptics often warn of the pernicious effects on labour standards of international competition for investment. In the race for foreign business, the argument goes, countries cut back on regulation and enforcement of decent working conditions in order to lower labour costs. (C.W., "Labour standards: Racing to the bottom: Countries skimp enforcement of decent working conditions to get FDI." *The Economist*, November 27, 2013.)

This line of argument has been put forward in the context of numerous examples. For example, the catastrophic collapse of the Rana Plaza apparel factory in Bangladesh in 2013, which killed 1,136 workers, and an earlier fire in another factory six months earlier that had killed more than 100 workers, have been argued by some to be the result of low safety standards which were encouraged by competition for contracts from Western multinationals; and further, after the disaster, heightened enforcement of safety rules seems to have driven some clients away, as 'Western companies are now placing orders in Vietnam, Indonesia and Cambodia instead,' thus illustrating the problem of competition between countries for capital.[1] Some commentators have argued that the (now discontinued) World Bank 'Ease of Doing Business' index – which tended to reward countries whose regulations were looser – tended to intensify this competition. The government of India embarked on a program in 2014 to slash regulation in order to move up in the index's rankings and attract more inward FDI. The following years saw a surge in workplace fires and accidents – 6,500 workplace deaths in the years 2015-2020 – that some commentators saw as a direct result of that change in policy.[2] More generally, Rodrik (1996) summarizes much of the early debate, and Drezner (2000)

[1] Grahame Lucas, "Opinion: Globalization responsible for factory tragedy." *DW*, April 28, 2014.

[2] R. Nagaraj (2021). "Rising industrial accidents: Fallout of boosting 'Ease of Doing Business'?" *Ideas for India* (www.ideasforindia.in), April 28, 2021.

provides many examples of this argument with a skeptical interpretation.

This paper[3] studies a stylized many-country equilibrium model in which employers choose what level of labor standards to provide and how to allocate their global value chains across countries. Without regulation, each employer provides the cost-minimizing bundle of working conditions and wage in each country required to attract workers, and allocates productive tasks across countries along the lines of comparative advantage. Each country's government has the ability to impose a stricter standard than the employers choose, and we study a Nash equilibrium in these policies. The process of globalization then takes the form of adding countries to the international economy, as they liberalize and open up to trade.

A first result is that each country chooses stricter labor standards with globalization than it would under autarky, with or without government regulation, because labor standards are a normal good and the general increase in incomes from globalization increases demand for them. We call this the effect of 'globalization in the large.' Second, if more countries join global value chains, so that globalization increases at the margin, labor standards worsen at the margin if a country is competing with countries that are very similar to itself, and improve at the margin if a country is competing with countries that are very different from itself. We call this the effect of 'globalization at the margin.' The idea that increased competition from similar countries can have a very different effect from competition with countries that are very different is very plausible given actual experience. For example, Ahn, Choi, and Chung (2022) show that when minimum wages increased suddenly in South Korea in 2017 and 2018, Korean firms with foreign affiliates reduced their domestic labor forces and moved some of their production activities to other countries, but only to subsidiaries in East Asia rather than those on other continents. Chan and Ross (2003) describe competition between Chinese cities for

[3]The term 'labor standards' can include, for example, regulations on working conditions, rules for firing workers, rules on discrimination and the use of child labor, and collective-bargaining rights. This paper focusses on regulation of working conditions, including safety and humane conditions on the job. Henceforth, we will refer to these as simply 'labor standards.' A companion paper, Im and McLaren (2023), focusses on collective-bargaining rights. The companion paper has an empirical component because of the existence of high-quality, internationally comparable data on collective-bargaining rights, which do not exist for working conditions.

FDI, and quote a labor leader summarizing the idea as follows: '. . . intense competition between countries to attract foreign investment is undermining respect for the labour standards. . . And it is particularly in labour-intensive industries that the competition is most vicious, not between North and South, but among nations of the South' (p.1023).

A final result from the model is on the efficiency of government-set labor standards. In the model, the labor standards chosen by private employers are efficient, while in the presence of global value chains labor standards set by government are actually stricter than optimal because each country is able to pass some of the costs of its improved labor standards onto other countries (consumers of the final good, for example). This cuts strongly against the race-to-the-bottom line of argument. On the other hand, with many countries of closely-substitutable worker skills, more competition between host countries weakens government labor standards. This is the case in which some form of the race-to-the-bottom argument holds, but even here, standards are strictly stronger than optimal.

Before turning to the model, we briefly review related work.[4]

Theoretical work on labor standards. Chau and Kanbur (2006) study equilibrium labor standards in a general-equilibrium model of LDC's that compete in an industrial-country export market. Larger countries have more of an incentive to tighten standards than small ones, owing to the terms-of-trade effect by which increases in the standard create increased local marginal costs, which are passed on to foreign consumers through a higher price. Labor standards are strategic substitutes or complements depending on the shape of the importing-country's demand curve. The terms-of-trade effect is closely related to our own finding that labor standards can be above the optimal level under globalisation. A related argument is made in Dehejia and Samy (2004). Felbermayr, Larch, and Lechthaler (2012) study equilibrium unemployment insurance policy in a trade model, and show that a country can impose a negative externality on trade part-

[4]Citizen activism is an important feature of the economics of labor standards and global value chains, but this study does not deal with it. Harrison and Scorse (2010) and Makioka (2021) study the effect of sweatshop activism on labor markets in Indonesia, and Koenig and Poncet (2019, 2022) study the effect of sweatshop activism on trade flows following the Rana Plaza disaster.

ners by making its unemployment insurance more generous, leading to more generous labor-market protection in more open economies. Chen and Dar-Brodeur (2020) study Nash equilibrium in national labor standards in an oligopoly trade model with labor monopsony power.[5] These approaches have in common that the cost of labor standards is partly borne by trade partners, providing an incentive for governments to be aggressive in setting them.

Labor standards also are included within the framework of domestic policies considered by Bagwell and Staiger (2001), who show that the terms-of-trade externalities created by those and other domestic policies can be neutralized by WTO rules.

Because working conditions are difficult to measure in a way that is consistent across countries and industries, there is a paucity of empirical work on the effect of globalization on labor standards. There is, however, an empirical literature on the effect of globalization on collective-bargaining rights. Two recent examples are Davies and Vadlamannati (2013) and Olney (2013), which study the effect of trade and FDI on bargaining rights in a cross-country panel, and find that there is strategic complementarity in labor rights. A rare empirical paper that stiudies the effect of globalization on working conditions is Robertson et al. (2009), which uses an unusual labor-force survey in Indonesia in which workers were asked, along with the more standard questions, whether or not working conditions (safety, medical benefits, and so on) had improved since the previous year. They find that affirmative answers to these questions are positively correlated across industries with wages, and that the industry that expanded sharply due to inward FDI, namely textiles and apparel, had much higher wages and more affirmative responses on the working-condition questions than the agriculture sector, which shrank. This suggestive evidence is consistent with an interpretation in which inward FDI improves both wages and working conditions.

Difference from the present paper. The other theoretical approaches to the race-to-the-bottom question focus on countries competing for export markets (with Davies and

[5]Chen and Dar-Brodeur (2020) model labor standards in an unusual and innovative way, as a minimum utility to be provided to each worker, leaving the employer to choose what combination of wage and working conditions to use.

Vadlamannati (2013) as the exception), but our setting is the competition between host countries for access to global value chains. In this respect, we draw from Grossman and Rossi-Hansberg (2008), Rodríguez-Clare (2010), Costinot, Vogel and Wang (2013), and Antras, Fort, and Tintelnot (2017), who model the equilibrium allocation of tasks across countries along the lines of comparative advantage. In addition, the above theoretical approaches all take the degree of globalization as given (except for Felbermayr, Larch, and Lechthaler (2012), which is focussed on a very different sort of policy), while we are interested in what happens when globalization *increases*. Finally, the difference between increased competition with more or less similar countries is a new addition.

2 Theory.

Here we present a simple, stylized model of international integration of labor markets with endogenous labor standards to see how increased integration of labor markets – 'globalization' – can affect the incentive for employers to provide quality working conditions, and for government to require more stringent conditions than employers would provide. We model the world economy as a market for tasks, taking inspiration from Grossman and Rossi-Hansberg (2008). To anticipate, we find that within this framework, globalization always provides improved labor standards compared to autarky, in contrast to the race-to-the-bottom hypothesis, but increases in market integration at the margin have a much more ambiguous effect. In particular, integration with a country with very similar skills will tend to erode labor standards, both standards provided voluntarily by employers and standards required by governments.

Suppose there are N countries: One, Two, Three, and so on (respectively, $i = 1, 2, 3, \ldots N$). Country i has L^i units of labor. Labor can be combined from these countries to produce output, which we will assume takes the form of a single, homogeneous consumption good, which will serve as a numeraire.

A producer of the consumption good must perform one unit each of tasks $z \in [0, 1]$ in order to produce one unit of output. The labor required to do one unit of task z

in country i is $A^i a_z^i$, where A^i is a country-specific cost term and a_z^i is a country- and task-specific cost shock. Denoting the wage in i by w^i, the cost of doing task z in country i is $A^i a_z^i w^i$. For each z, a_z^i is distributed Weibull, with shape parameter $\nu > 0$ and scale parameter 1. These values are independently distributed across tasks and countries.

The national cost term A^i is the product of two elements. The first, $\bar{A}^i$, is an exogenous shifter, which will be affected by initial conditions and by events such as natural disasters and civil war. The second, κ^i, is a measure of the quality of working conditions (as a mnemonic, think of κ^i as standing for 'conditions'). This includes management of the temperature in the workspace, adequate and clean bathrooms, break times for workers, and health and safety provisions on the job. These add to the workers' utility, holding the wage constant, but also increase costs for employers.

Clearly, we are assuming that improvements in working conditions κ^i worsen worker productivity. Of course, this is not true in all cases. Improved lighting, for example, can make the workplace more pleasant, prevent damage to workers' eyesight, and increase productivity all at once. We set aside the many forms of improvement that both increase worker satisfaction and improve productivity, because for those cases there is no trade-off.[6] What is left is κ^i, which encapsulates the forms of working conditions that do exhibit a trade-off.[7]

Each citizen's utility is a function $U(w^i, \kappa^i)$ of (i) the wage, w^i, for a worker in country i (note that with the single consumption good as numeraire we need make no distinction between a real and nominal wage), and (ii) working conditions κ^i. For example, suppose that $U(w^i, \kappa^i) = \xi(w^i) + \mu(\kappa^i)$, where ξ and μ are strictly increasing, strictly concave, and differentiable functions. This impllies that a worker will care more about working conditions relative to wages if the wage is high than if it is low: Good

[6] In a frictional search economy, Chau (2016) shows how sweatshop conditions can persist even if they are both bad for productivity and bad for worker welfare. The idea is that sweatshop conditions can also make it difficult for workers to search on the job for alternative employment, thus providing employers with lower turnover. If search is difficult enough, a worker may accept such a job rather than continuing to search for a non-sweatshop job.

[7] For the record, in their study of responsible sourcing in Costa Rica, Alfaro-Ureña et al. (2021) look for a positive productivity effect and find none.

working conditions are normal goods. We impose the following assumption, which amounts to a condition that these functions are 'sufficiently concave:'

Assumption 1. Both $x\xi'(x)$ and $x\mu'(x)$ are strictly decreasing in x.

This will be satisfied, for example, by $\xi(x) = -\exp(-\alpha x)$ and $\mu(x) = -\exp(-\beta x)$ for $x > 1/\alpha$ and $x > 1/\beta$ respectively.

2.1 Offshoring.

If working conditions are not regulated, an equilibrium of this economy will take the form of: a vector of wages $(w^1, \ldots, w^N)$, a vector of working conditions $(\kappa^1, \ldots, \kappa^N)$, and a consequent vector of worker utilities $(U^1, \ldots U^N)$ such that (i) each producer chooses an allocation of tasks across the N countries to minimize costs; (ii) for each task performed in each country, the chosen combination of wage and working conditions minimizes the cost of providing the given level of utility; and (iii) the resulting labor demands add up to the available labor supplies in each country.

Regarding condition (i), for given κ^i values, task z will be performed in country i if and only if:

$$A^i a_z^i w^i \leq A^j a_z^j w^j$$

for $j \neq i$ (recalling that κ^i affects the value of A^i). To characterize the general equilibrium effects of this sorting, we can use a transformation developed for consumer theory by Anderson et al (1987) and applied to labor offshoring in Artuç and McLaren (2015, Section 5). It can be shown that, given the Weibull distribution of the a_z^i values, the cost-minimizing allocation of tasks to the N types of workers is equivalent to minimizing the cost of producing a unit of y output, where:

$$y = \left\{ \sum_{i=1}^{N} \phi^i (L^i)^\rho \right\}^{\frac{1}{\rho}}, \tag{1}$$

with $\rho = \nu/(1+\nu)$ and $\phi^i = \left(\Gamma(1+1/\nu)A^i\right)^{-\rho}$, where $\Gamma(\cdot)$ is the gamma function.

Thus, the offshoring equilibrium is equivalent to cost minimization with a CES production function. The implied elasticity of substitution between the different countries' labor supplies is $\sigma \equiv 1/(1-\rho) > 1$. This implies that, for any given working-condition vector $(\kappa^1, \ldots, \kappa^N)$, the wages must be equal to the marginal values of labor for the N labor supplies computed by evaluating the partial derivatives of (1) at the labor supply vector $(L^1, \ldots, L^N)$:

$$w^i = \phi^i \left(L^i\right)^{\rho-1} \left\{ \sum_{j=1}^{N} \phi^j (L^j)^\rho \right\}^{\frac{1-\rho}{\rho}}. \tag{2}$$

This takes care of equilibrium condition (iii) at the same time as (i). Note that because κ^i enters ϕ^i with an elasticity of $-\rho$ (because A^i is proportional to κ^i), condition (2) shows that any country that increases its labor standard will see a reduction in its wage.

Regarding equilibrium condition (ii), an employer will minimize the cost of doing task z in country i with respect to w and κ, subject to the constraint that the chosen combination provides workers with the utility level U^i that would be provided by competing employers. This implies solving:

$$\min_{w,\kappa} \left\{ w a_z^i \bar{A}^i \kappa \right\} \ni \xi(w) + \mu(\kappa) \geq U^i.$$

The first-order condition yields the equilibrium condition:

$$w^i \xi' \left(w^i\right) = \kappa^i \mu' \left(\kappa^i\right). \tag{3}$$

This first-order condition is illustrated in Figure 1. Assumption 1 ensures that the second-order condition holds, which means that the iso-utility curve in the figure ($\xi(w) + \mu(\kappa) = U^i$) is more concave than the iso-cost curve ($w a_z^i \bar{A}^i \kappa = C$). Henceforth, denote the unregulated equilibrium value of κ^i by $\left(\kappa^i\right)^*$.

On the other hand, in the case in which the working conditions are regulated by government, each government sets κ^i non-cooperatively to maximize its own citizens' welfare, taking the other countries' working conditions as given. In this case, taking policy as given, only condition (2) is needed to compute the equilibrium. Henceforth,

denote the Nash equilibrium value of government-set κ^i by $\left(\kappa^i\right)^{**}$. We will treat these policy variables $\left(\kappa^i\right)^{**}$ as minimum requirements, so that if $\left(\kappa^i\right)^{**} < \left(\kappa^i\right)^{*}$, the policy is non-binding.

2.2 Autarky.

Consider One in autarky. In this situation, all tasks must be performed by workers in One. Output is given by (1) with $L^i = 0$ for $i \neq 1$. Consequently, output per worker, which also is real income per worker, is equal to $(\phi^1)^{\frac{1}{\rho}} = \left(\Gamma(1+1/\nu)A^1\right)^{-1} = \left(\Gamma(1+1/\nu)\bar{A}^W\kappa^1\right)^{-1} = w^1$, and so $\frac{\partial w^1}{\partial \kappa^1} = -\frac{w^1}{\kappa^1}$. Very simply, a 10% increase in κ^1 results in a 10% reduction in the productivity of Oneish workers, which results in a 10% reduction in their real incomes.

Consequently, the welfare effect of a change in κ^1 as controlled by the Oneish government can be written as:

$$\frac{d}{d\kappa^1}\left[U\left(w^1,\kappa^1\right)\right] = -\frac{w^1\xi'\left(w^1\right)}{\kappa^1} + \mu'\left(\kappa^1\right). \tag{4}$$

The first term captures the income cost of a tighter labor standard, while the second term captures the direct utility benefit. Naturally, the optimal value of the labor standard will equate (4) to zero. Call this value $\left(\kappa^i_A\right)^{**}$, where the subscript indicates autarky. Note that in this autarky case the welfare-maximizing value of κ^W is what an unregulated employer would offer, since it minimizes the cost of providing a given level of utility to a worker (in other words, condition (4) is the same as (3)). Since $\left(\kappa^i_A\right)^{*} = \left(\kappa^i_A\right)^{**}$, under autarky there would be no need for government to set the labor standard.

2.3 Two-country globalization.

Now, suppose that One and Two are able to integrate their labor markets. Now output will be given by (1) with $L^i = 0$ for $i > 2$. For any value of κ^1, the wage in One will be greater than under autarky, by (2). Consequently, by (3) and Assumption

1, market-determined working conditions must be stricter than under autarky, or, using the subscript 2 to indicate an equilibrium with the two countries' labor markets integrated, $\left(\kappa_2^1\right)^* > \left(\kappa_1^1\right)^* = \left(\kappa_A^1\right)^*$.

Now, suppose that the working conditions are chosen by the government in One to maximize Oneish welfare. The marginal effect is:

$$\frac{d}{d\kappa^1}\left[U\left(w^1,\kappa^1\right)\right] = \xi'\left(w^1\right)\frac{dw^1}{d\kappa^1} + \mu'\left(\kappa^1\right). \tag{5}$$

To evaluate $\frac{dw^1}{d\kappa^1}$, one can take the derivative of (2), recalling that ϕ^i is a decreasing function of κ^i, but the following observations are an alternative route that makes the mechanism somewhat more transparent. First, note that, writing the general-equilibrium effect of κ^1 on w^i as $\frac{\partial w^i}{\partial \kappa^1}$, (2) shows that $\frac{\partial w^2}{\partial \kappa^1} < 0$ (again since ϕ^i is decreasing in κ^i). Consider the unit cost function, $c(w^1, w^2, \kappa^1)$ for final output derived from (1) (suppressing the other parameters as arguments since those are being held constant). In equilibrium, unit cost will always be equal to 1, so the equilibrium total derivative of the unit cost function will be equal to zero. An increase in κ^i raises the labor requirement for each task in i proportionally, so if ℓ^i is the unit demand for labor from country i, by the envelope theorem $\frac{\partial c}{\partial \kappa^1} = \frac{w^1\ell^1}{\kappa^1}$. At the same time, $\frac{\partial c}{\partial w^1} = \ell^1$ and $\frac{\partial c}{\partial w^2} = \ell^2$, so the equilibrium requires that $\frac{w^1\ell^1}{\kappa^1} + \ell^1\frac{\partial w^1}{\partial \kappa^1} + \ell^2\frac{\partial w^2}{\partial \kappa^1} = 0$. Since $\frac{\partial w^2}{\partial \kappa^1} < 0$, this implies that:

$$\frac{\partial w^1}{\partial \kappa^1} > -\frac{w^1}{\kappa^1}. \tag{6}$$

Suppose that the One government considered choosing $\kappa^1 = \left(\kappa_2^1\right)^*$, the value set by employers in the absence of regulation. Evaluating (5) at that value, recalling that (3) must hold there, condition (6) tells us that the marginal effect of an increase in κ^1 on One's welfare is strictly positive. Therefore, $\left(\kappa_2^1\right)^{**} > \left(\kappa_2^1\right)^*$.

The reason that the government sets a stricter standard than the unregulated market can be interpreted in terms of a terms-of-trade argument, analogous to the terms-of-trade benefit of tightening labor standards in the model of Chau and Kanbur (2006), although that is a model with no value chains, and which features trade only in final

goods. One way of thinking about it is that the reduction in worker productivity reduces the effective labor force in One, making One workers more scarce, and raising the price of an effective unit of One labor. Readers familiar with Dornbusch, Fisher and Samuelson (1977) will note that this case is almost exactly analogous to the case of a reduction in one country's labor supply in that model. That country's relative wage rises, with consequent increases in welfare for all of its workers. An alternative interpretation is that under autarky all of the costs of improved working conditions in One are borne by workers in One, but under trade a portion of those costs are born by citizens of Two. This cost shifting gives One an incentive to raise working standards beyond what they would otherwise be. This makes it analogous to the international externality of a domestic policy as analyzed in Bagwell and Staiger (2001). Henceforth, we will refer to this effect simply as a terms-of-trade effect for simplicity.

Note that none of this analysis has required any assumption about κ^2, and note as well that all of the analysis applies *mutatis mutandis* to Two. We can summarize as follows:

Proposition 1. When the labor market is integrated between One and Two, labor standards improve in both countries whether the standards are regulated by government or not. The improvement is greater for both countries if the standards are regulated by government. Formally:

$$\left(\kappa_A^i\right)^* = \left(\kappa_1^i\right)^* = \left(\kappa_1^i\right)^{**} < \left(\kappa_2^i\right)^* < \left(\kappa_2^i\right)^{**},$$

for $i = 1, 2$.

2.4 Multiple-country globalization, and a race to the top.

Now, suppose that N countries have an integrated labor market. Adding more countries increases the possibility of further gains from specialization, raising real incomes and thus further increasing the provision of labor standards by an unregulated market. At the same time, the terms-of-trade motive discussed in the two-country case provides

a persistent reason for each government to impose more stringent standards than the market would set. One might guess that this motive would be attenuated as more countries are added and each country becomes smaller relative to the relevant world market, but in the symmetric case that turns out not to be the case: As more countries are added, each country specializes in an increasingly narrow portion of the supply chain in which it has a comparative advantage, and retains market power as a result.

Formally, in analyzing policy-set working standards, we are looking for stable, symmetric Nash equilibria, which will be characterized by the first-order condition for each government:

$$\frac{dw^1}{d\kappa^1}\xi'\left(\omega(\kappa,N)\right) = -\mu'\left(\kappa\right), \tag{7}$$

where $\omega(\kappa, N)$ is the common wage with N countries if all countries choose working standards at the level κ; together with the stability condition that $\frac{dw^1}{d\kappa^1}\xi'\left(\omega(\kappa,N)\right) + \mu'\left(\kappa\right)$ be locally decreasing in κ. The comparison of the market equilibrium labor standards with these Nash equilibrium standards is summarized in the following:

Proposition 2. In the symmetric model:

(i) $\left(\kappa_N^1\right)^* > \left(\kappa_1^1\right)^* \forall N \geq 2$ and $\left(\kappa_1^1\right)^* < \left(\kappa_2^1\right)^* < \left(\kappa_3^1\right)^* < \left(\kappa_4^1\right)^* \ldots$.

(ii) $\left(\kappa_N^1\right)^{**} > \left(\kappa_N^1\right)^* \forall N \geq 2$ and $\left(\kappa_1^1\right)^{**} < \left(\kappa_2^1\right)^{**} < \left(\kappa_3^1\right)^{**} < \left(\kappa_4^1\right)^{**} \ldots .$.

Proof. Using (2), we take the derivative of w^1 with respect to κ^1:

$$\frac{dw^1}{d\kappa^1} = -\frac{\rho\phi^1}{\kappa^1}\left(L^1\right)^{\rho-1}\left\{\sum_{j=1}^{N}\phi^j(L^j)^\rho\right\}^{\frac{1-\rho}{\rho}} - \phi^1\left(L^1\right)^{\rho-1}\frac{\phi^1}{\kappa^1}\left(L^1\right)^{\rho}(1-\rho)\left\{\sum_{j=1}^{N}\phi^j(L^j)^\rho\right\}^{\frac{1-2\rho}{\rho}}. \tag{8}$$

Imposing symmetry so that $\bar{A}^i \equiv \bar{A}$, $\kappa^i \equiv \kappa$, and so $\phi^i \equiv \phi$, and simplifying, we obtain:

$$\frac{dw^1}{d\kappa^1} = -\frac{\phi^{\frac{1}{\rho}}}{\kappa}\left(\rho + \frac{1-\rho}{N}\right)N^{\frac{1-\rho}{\rho}}, \tag{9}$$

where we drop the country superscript for values that are the same across countries.[8]

[8]It should be emphasized that we are seeking a symmetric Nash equilibrium, so we take the derivative of an individual country's wage and welfare with respect to that country's labor standard, holding all other countries' labor standards constant, starting from a symmetric outcome. If the individual country's welfare derivative is zero, we have found a symmetric Nash equilibrium.

Imposing symmetry on (2) yields:

$$w = \phi^{\frac{1}{\rho}} N^{\frac{1-\rho}{\rho}}, \tag{10}$$

so we can write (9) as:

$$\frac{dw^1}{d\kappa^1} = -\frac{w}{\kappa}\left(\rho + \frac{1-\rho}{N}\right) > -\frac{w}{\kappa}. \tag{11}$$

The results follow from these conditions. We can use (10) to write

$$w = \omega(\kappa, N) \equiv (\Gamma(1+1/\nu)\bar{A}\kappa)^{-1} N^{\frac{1-\rho}{\rho}}, \tag{12}$$

The function ω is decreasing in κ and increasing in N.

To evaluate (i), we need the equilibrium condition for market-determined working conditions. That condition is, from (3):

$$\omega(\kappa, N)\xi'\left(\omega(\kappa, N)\right) = \kappa^i \mu'\left(\kappa^i\right). \tag{13}$$

From Assumption 1, the left-hand side of (13) is an increasing function of κ and the right-hand side is a downward-sloping function of κ, so there is a unique equilibrium value of κ. Further, an increase in N shifts the left-hand side down as a function of κ, increasing the equilibrium value of κ. This establishes (i).

Next, to evaluate (ii), we note that the condition for Nash equilibrium working conditions, (7), becomes, from (11):

$$\omega(\kappa, N)\xi'\left(\omega(\kappa, N)\right)\left(\rho + \frac{1-\rho}{N}\right) = \kappa^i \mu'\left(\kappa^i\right). \tag{14}$$

Since, again from Assumption 1, the left-hand side is an increasing function of κ and the right-hand side is a decreasing function of κ, the Nash equilibrium is stable. Note that condition (14) is the same as condition (13) except that the left-hand side has been shifted down proportionally, so we conclude that the Nash equilibrium policy-set work-

ing conditions are more stringent for any N than the market-determined conditions. Further, since an increase in N shifts the left-hand side of (13) down, we conclude that the value of κ^{**} increases strictly with N. This establishes (ii). **Q.E.D.**

The results are summarized visually in Figure 2. Recall that in the case of autarky, the derivative of the real wage in one country with respect to its labor standard was exactly $-w/\kappa$. This is the pure productivity effect, and is the full effect on the wage if there is no change in the country's terms of trade. However, (11) shows that in the presence of other countries there is an additional effect, the terms-of-trade effect, which attenuates the reduction in a country's wage, represented by the factor in parentheses that multiplies $-w/\kappa$ and softens the wage reduction caused by improving labor conditions. This terms-of-trade effect was present in the two-country case, and we can see that in relative terms it actually becomes stronger the more countries there are in the integrated labor market, with the factor declining to a limit of $\rho < 1$. The reason for this is that the increase in any one country's κ increases unit costs of the final good, which raises prices for all consumers in each country, including the country that is increasing its κ; but this effect becomes smaller, the smaller each country is relative to the rest of the world economy. At the same time, as N becomes large, each country becomes specialized in an increasingly narrow portion of the value chain in which it has a comparative advantage compared to all other countries, implying that the country retains some market power no matter how many countries there are.

In short, in this symmetric model, the equilibrium looks much more like a race to the top than to the bottom, because integration gives each government an incentive to push some of the cost of its workers' working conditions on to others. Working conditions become progressively more strict as globalization proceeds (meaning, as N increases). Note, indeed, that this version of the model predicts regulated working conditions that are *excessively strict* from the point of view of economic efficiency.

2.5 A 'North-South' Example, and the emergence of a race to the bottom.

The assumptions considered so far imply that any two countries are as similar as any other two countries, because the labor requirements for each task in each country are drawn independently from the same distribution (as we have not allowed for aggregate differences across countries such as factor proportions). The results can be different in the event that some countries are closer substitutes than others, as some commentators such as Chan and Ross (2003) discussed above have emphasized. To see the point simply, consider an extreme example in which countries One and Two have independent productivity draws as before, but realized values of a_z^i for countries $i = 2$ through N are perfectly correlated, so that $a_z^i = a_z^2 \forall z$ for $i = 2, \ldots N$. We can think of this as a metaphor for a case in which 'North' (Country 1) must choose where to locate each task in any of several similar 'Southern' host countries ($i = 2, \ldots N$).

In this case, the equilibrium allocation of tasks is equivalent to minimizing cost with a CES production function in which effective labor for countries other than One is pooled:

$$y = \left\{ \phi^1 (L^1)^\rho + \Gamma^{-\rho} \left(\sum_{i=2}^{N} \frac{L^i}{\bar{A}^i \kappa^i} \right)^\rho \right\}^{\frac{1}{\rho}} = \left\{ \phi^1 (L^1)^\rho + \left(\sum_{i=2}^{N} (\phi^i)^{\frac{1}{\rho}} L^i \right)^\rho \right\}^{\frac{1}{\rho}}. \qquad (15)$$

In this case, workers in all of the Southern countries are perfect substitutes. Correcting the labor supply in each country for productivity allows us to add up the effective labor supplies across these countries in the inner sum in (15). Taking the derivative with respect to L^2 yields the wage in Two:

$$w^2 = (\phi^2)^{\frac{1}{\rho}} \left(\sum_{i=2}^{N} (\phi^i)^{\frac{1}{\rho}} L^i \right)^{\rho-1} \left\{ \phi^1 (L^1)^\rho + \left(\sum_{i=2}^{N} (\phi^i)^{\frac{1}{\rho}} L^i \right)^\rho \right\}^{\frac{1-\rho}{\rho}}. \qquad (16)$$

Focus on the case in which all 'Southern' countries are symmetric, so we impose $L^i = L^2$ for $i > 1$. In addition, assume that $\bar{A}^i = 1 \forall i > 1$. To eliminate a complication which is for our purposes just a nuisance, hold κ^1 fixed in what follows. Think of

One as a rich country that already has high labor standards; suppose that there is a technological maximum, $\bar{\kappa}$, and that One is already at that upper bound.

To analyze policy-set working conditions, we need the effect of a change in κ^2 on w^2, holding κ^i constant for $i \neq 2$. Any increase in κ^2 on its own will raise production costs on Two relative to other host countries, requiring a drop in Two wages relative to wages in other host countries in order for the market to clear. Taking the derivative of (16) with respect to κ^2, holding κ^i fixed for $i \neq 2$, recalling that ϕ^i is a function of κ^i, substituting in the symmetry of L^i and also the symmetry in chosen values of κ^i for $i > 1$, we find:

$$\frac{\partial w^2}{\partial \kappa^2} = -\frac{w^2}{\kappa^2}\left[1 - \frac{(1-\rho)}{N-1}\left(\frac{\phi^1 \left(L^1\right)^\rho}{\phi^1 \left(L^1\right)^\rho + \phi^2 \left((N-1)L^2\right)^\rho}\right)\right]. \tag{17}$$

Note that the expression in the square brackets must be positive and less than unity. Consequently, we conclude that an increase in Two's labor standard will lower Two's wage, but by less than would be the case in a closed economy. The difference vanishes in the limit as the number of countries becomes large. We can summarize the consequences for equilibrium labor standards as follows (with a visual summary in Figure 3):

Proposition 3. In the North-South version of the model with symmetric Southern countries:

(i) $\left(\kappa_N^2\right)^* > \left(\kappa_A^2\right)^* \forall N \geq 2$ and $\left(\kappa_A^2\right)^* < \left(\kappa_2^2\right)^* > \left(\kappa_3^2\right)^* > \left(\kappa_4^2\right)^* \ldots$.

(ii) $\left(\kappa_N^2\right)^{**} > \left(\kappa_N^2\right)^*$ and $\left(\kappa_N^2\right)^{**} > \left(\kappa_A^2\right)^{**} \forall N \geq 2$. Further, $\left(\kappa_A^2\right)^{**} < \left(\kappa_2^2\right)^{**} > \left(\kappa_3^2\right)^{**} > \left(\kappa_4^2\right)^{**} \ldots$.

(iii) As $N \to \infty$, $\left(\kappa_N^2\right)^*, \left(\kappa_N^2\right)^{**} \to \left(\kappa_A^2\right)^*$.

Proof.

If all countries from 2 to N choose the same value of κ^i as Country 2, the resulting wage for each of those contries can be written from (16) as:

$$\begin{aligned} w^2 = & \quad \tilde{\omega}(\kappa^2, N) \\ \equiv & \quad \gamma(\kappa^2)^{-1}\left((N-1)\gamma(\kappa^2)^{-1}L^2\right)^{\rho-1}\left\{\phi^1(L^1)^\rho + \left((N-1)\gamma(\kappa^2)^{-1}L^2\right)^\rho\right\}^{\frac{1-\rho}{\rho}}, \end{aligned} \tag{18}$$

as long as $N > 1$, where $\gamma = \Gamma(1 + 1/\nu)^{-1}$. The function $\tilde{\omega}$ is decreasing in both κ^2 and N.

The equilibrium condition for market-determined labor standards is then:

$$\tilde{\omega}(\kappa^2, N)\xi'\left(\tilde{\omega}(\kappa^2, N)\right) = \kappa^2\mu'\left(\kappa^2\right). \tag{19}$$

Assumption 1 ensures that the left-hand side of (19) is increasing in κ^2 and the right-hand side is decreasing, so that there is a unique solution for κ^2. An increase in N shifts the left-hand side up as a function of κ^2, lowering the equilibrium value of κ^2. Further, it is easy to check that in the case of a closed economy the wage in Country 2 is equal to $\gamma(\kappa^2)^{-1}$ (which can be obtained by setting $L^1 = 0$ in (18)), which is less than $\tilde{\omega}(\kappa^2, N)$ for any value of N. This ensures that the autarchic working conditions are below the working conditions in the open economy for any value of N. This ensures (i).

For (ii), the Nash equilibrium condition for policy-determined working conditions is, using (17):

$$\tilde{\omega}(\kappa^2, N)\xi'(\tilde{\omega}(\kappa^2, N))\left[1 - \frac{(1-\rho)}{(N-1)}\left(\frac{\phi^1\left(L^1\right)^\rho}{\phi^1\left(L^1\right)^\rho + \gamma(\kappa^2)^{-1}\left((N-1)L^2\right)^\rho}\right)\right] = \kappa^2\mu'(\kappa^2). \tag{20}$$

Because the expression in the square brackets is decreasing in κ^2, we cannot rule out the possibility that the left-hand side of (20) is decreasing in κ^2, but if it is, the stability condition for Nash Equilibrium ensures that the right-hand side is steeper. Whether the left-hand is increasing or decreasing in κ^2, we therefore know that it intersects the right-hand side from below. Since the left-hand side of (20) takes a lower value than the left-hand side of (19) for any value of κ^2, this ensures that $\left(\kappa_N^2\right)^{**} > \left(\kappa_N^2\right)^{*} \forall N$. Further, the left-hand side of (20) is increasing in N, so any increase in N results in a lower labor standard. This establishes that $\left(\kappa_2^2\right)^{**} > \left(\kappa_3^2\right)^{**} > \left(\kappa_4^2\right)^{**} \ldots$ is satisfied. Finally, to compare Autarky with globalization for any number of countries, note that under Autarky, as noted in Section 2.2, the policy outcome would be the same as

the employer-chosen outcome, for which the equilibrium condition is (3). If we write $\tilde{\omega}(\kappa)$ for the wage under Autarky as a function of the working conditions, then the left-hand side of (3) becomes $\tilde{\omega}(\kappa)\xi'(\tilde{\omega}(\kappa))$, which (recalling Assumption 1) can be seen to be greater than the left-hand side of (20) for any value of κ, implying that $\left(\kappa_N^2\right)^{**} > \left(\kappa_A^2\right)^{**} \forall N \geq 2$. This establishes (ii).

Finally, in the limit as $N \to \infty$, (17) becomes $-\frac{w^2}{\kappa^2}$, and from (18), $\tilde{\omega}(\kappa^2, N) \to \gamma(\kappa^2)^{-1}$, which is the autarchic wage. This establishes (iii).

Q.E.D.

Note that (i) indicates a non-monotonic response to globalization: The effect of integrating with one country strengthens labor standards, but each subsequent similar country weakens them. If Two is integrated only with One, the analysis is the same as before: The gains from trade raise real wages, increasing the demand for quality working conditions, which will then be provided by the market, and further providing an incentive for the Twoish government to require even better working conditions because a portion of the cost can be passed on to One. However, if Three and other Southern competitors join the integrated market, competition between their workers and the workers in Two with their similar skills will push down wages in Two, attenuating the demand for quality working conditions. Further, the incentive of Two's government to require more stringent working conditions is attenuated by the fact that any increase in κ^2 tends to drive the demand for Two labor toward competitor countries. If enough countries are competing for the same work, all of the benefit of the globalization accrues to One, and the countries of the South fall back to their autarky condition. In addition, in the limit with many countries, increases in κ^2 would lower Twoish workers' productivity without providing any terms-of-trade benefit at all, and so the standards chosen by the market and by the government will be the same.

This is all summarized in Figure 3. After autarky is broken by the move from 1 country to 2, any further increases in globalization result both in weakening of labor standards in Two by private employers in the case without regulation, and in the weakening of regulation in the case where working conditions are regulated. Eventually,

with enough countries competing against each other, both wages and working conditions return to autarky levels. This can be interpreted as race-to-the-bottom behavior, but it should also be noted that even in this case, for any given N, the labor standards implemented by employers or imposed by governments will be stricter than those that would have been observed under autarky (indicated by the broken horizontal line).

3 Summary.

Within the model of international labor-market integration and labor-standard setting presented here, we find a prediction that, compared to autarky, globalization produces *upward* pressure on labor standards, whether the standards are market-driven or the product of government regulation. However, an increase in integration of labor markets that are already to some extent globalized has more ambiguous effects. Increased integration with countries whose skill mix is complementary tends to improve both market-driven and regulated labor conditions, while integration with countries whose skill mix is very similar will tend to have the opposite effect. Indeed, if enough competition arises from similar countries, a host-country government will abandon any attempt to regulate labor standards (Proposition 3, part (ii)).

This all suggests an interpretation of the effect on host-country labor standards of, say, China's market reforms that allowed the country to join the world economy. Under this model, we should expect a positive effect on labor standards in China, but a negative effect on countries that compete for the same parts of global value chains as China. On the other hand, if a developing country joins a developed country's global value chains, such as through a trade agreement, the effect on its labor standards should be positive. Mexico is an example of a country that experienced both effects almost at the same time. As of the early 1990's, it was a close competitor to China; Utar and Torres-Ruiz (2013) show signs of intense competition in Mexico for export markets following the rise of China as a trade power, and Chan and Ross (2003) emphasize that particular pair of countries as a particularly good example of countries competing for

foreign capital. At the same time, Mexico became more entwined with US value chains due to the North American Free Trade Agreement (NAFTA), which went into force in 1995. By the logic of our model, China joining the WTO should have produced negative pressure on labor standards in Mexico, but NAFTA should have had the opposite effect. It is impossible to prove causation in this sort of question, but Chan and Ross (2003) do argue that Mexico's competition with China was part of the reason for weak labor protections in Mexico during this period, while Bensusán (2020) describes improvements in labor rights in Mexico later on – including, for example, legal protection against mandatory pregnancy tests for woman workers – in response to Mexico's trade relations with the US.

In this sense, the model offers a concise general-equilibrium formulation of the race to the bottom, but *only under specific conditions*, and always with the qualification that in an open economy, labor standards, either from private-sector behavior or from regulation, will exceed those under autarky.

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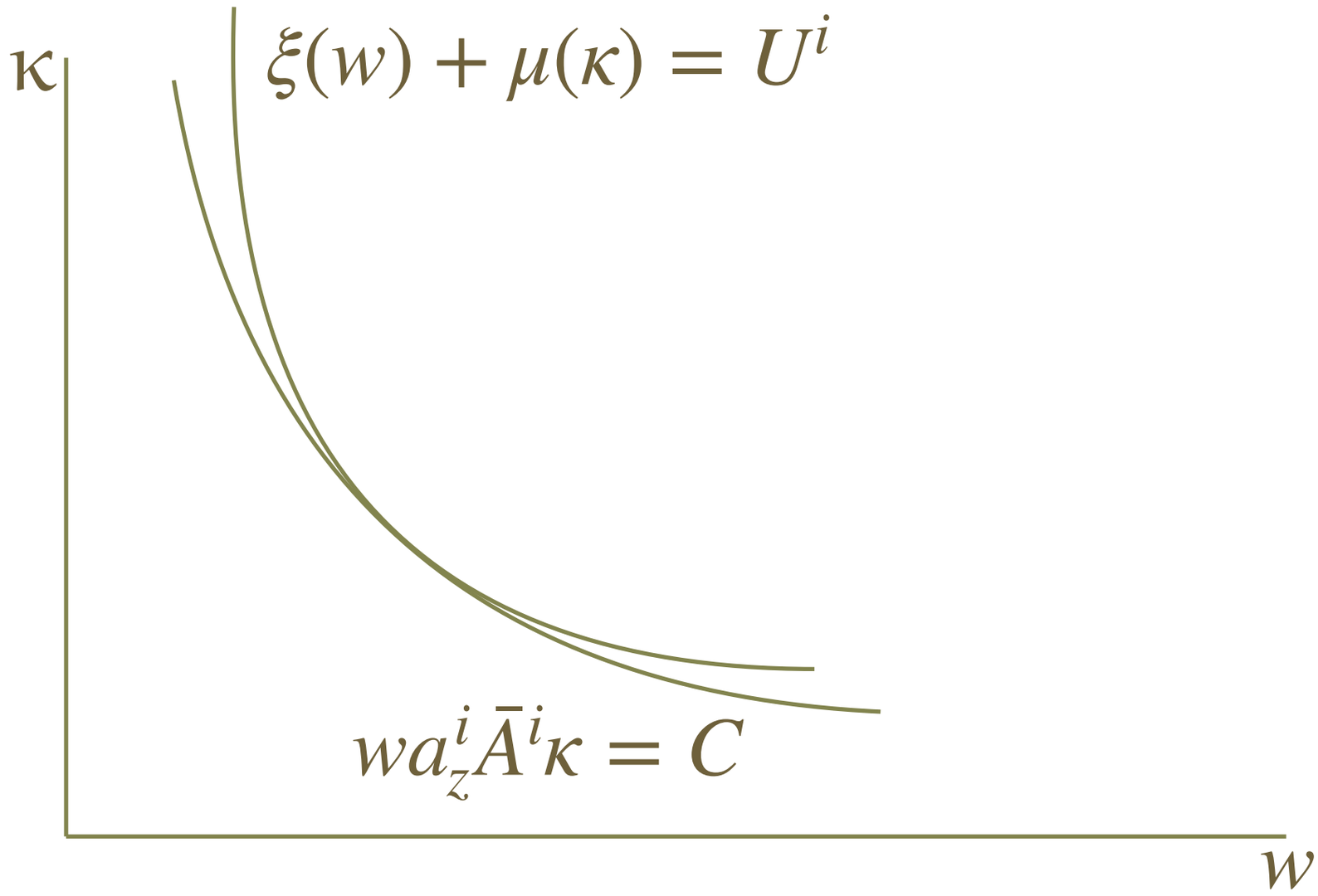

Figure 1: Cost-minimizing working conditions.

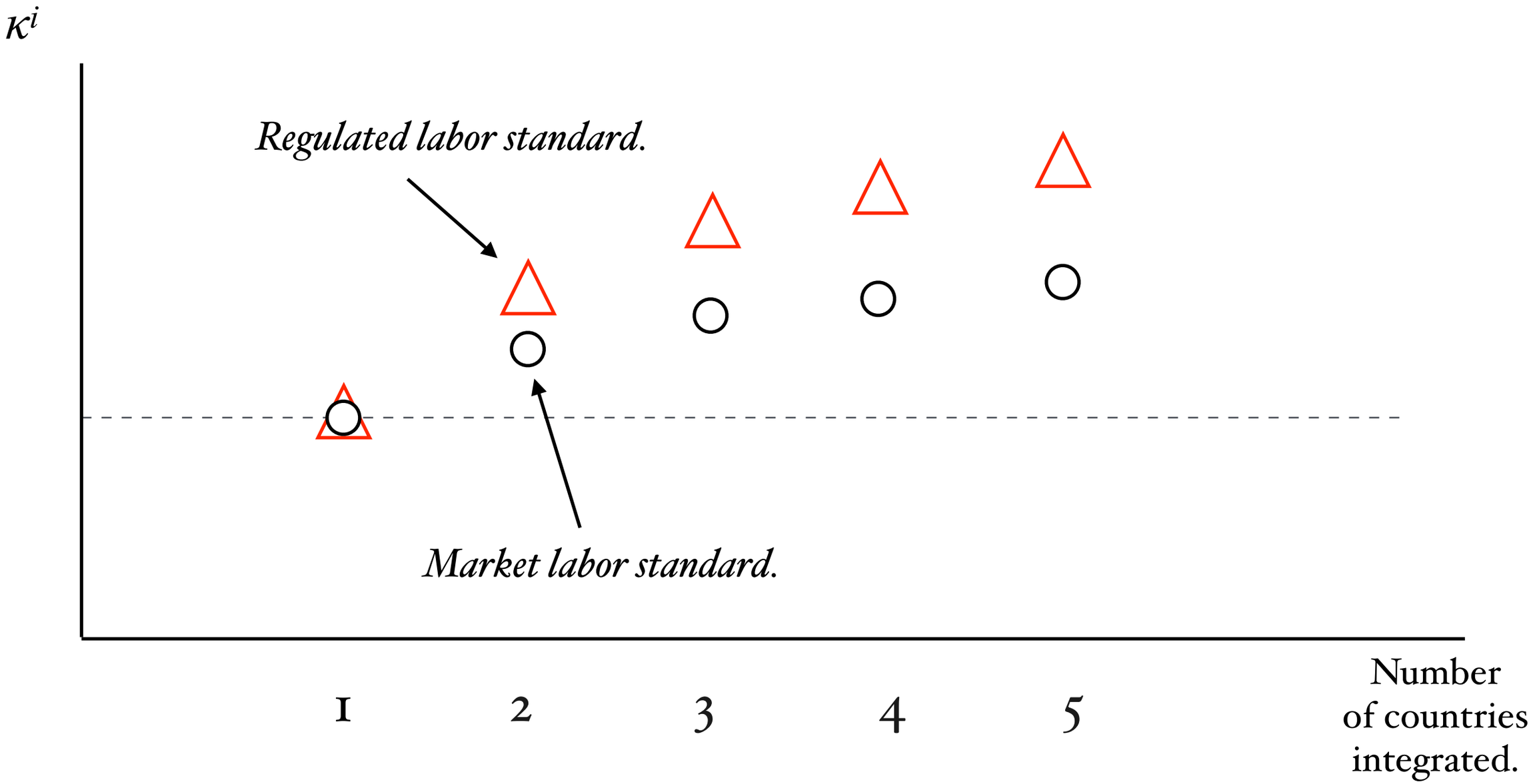

Figure 2: Symmetric countries.

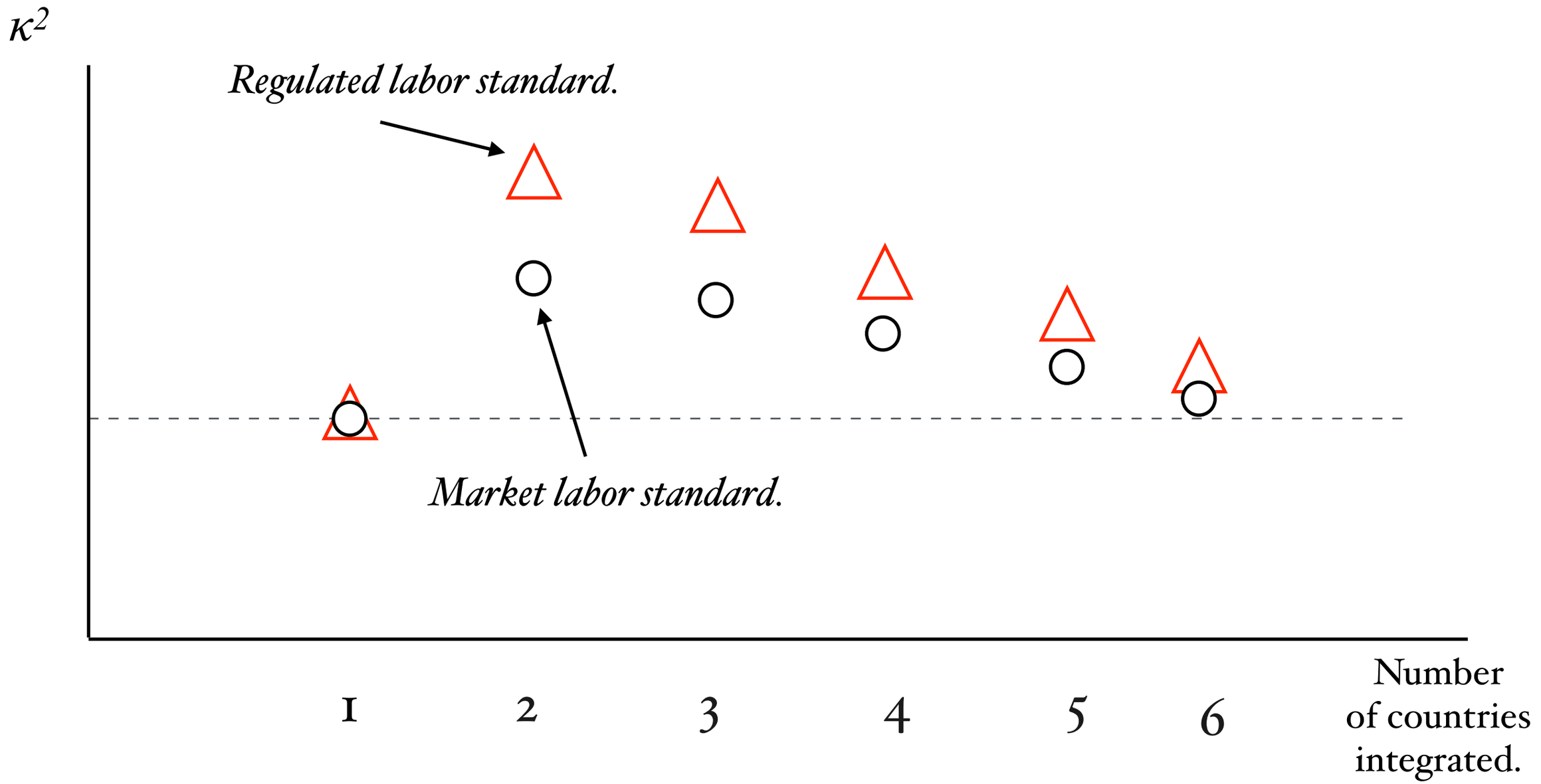

Figure 3: A North-South Model.