

Wage setting policies reduce food insecurity but not among the unemployed: A multi-level analysis of 492,078 people in 139 countries

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Abstract

Background: Wage-setting policies, which increase earnings, may reduce the risk of food security, but the impact of these policies may vary depending on employment status.

Method: We estimated multilevel regression models, using data from the Gallup World Poll (2014-2017) and UCLA's World Policy Analysis Center, to examine the association between wage setting policy and food insecurity across 139 countries (n=492,078).

Results: Compared to countries with little or no minimum wage, the probability of being food insecure was 0.10 lower (95%CI: 0.02, 0.18) in countries with collective bargaining.

However, these associations varied across employment status. More generous wage setting policies (e.g., collective bargaining or high minimum wages) were associated with lower food insecurity among full-time workers (and to some extent part-time workers) but not those who are unemployed.

Conclusions: In countries with generous wage setting policies, employed adults had a lower risk of food insecurity but the risk of food insecurity for the unemployed was unchanged.

Wage setting policies may be an important intervention for addressing risks of food insecurity among low-income workers.

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Introduction

Food insecurity – “the uncertainty and insufficiency of food availability and access that are limited by resource constraints, and the worry or anxiety and hunger that may result from it”¹ – is a global problem, affecting the health of millions. Food insecure adults have higher risk of depression, diabetes, and cardiovascular disease^{2,3} while children that have grown up in food insecure homes have poorer health and education outcomes.^{4,5} Food insecurity can even lead to stunting and wasting,⁶ both of which increase the risk of mortality.⁷ While the last 100 years brought significant reductions in chronic food deprivation,⁸ improvements in these trends have now stalled,⁹ with Covid-19 threatening to increase food insecurity globally. In this context, developing policies to address food insecurity is a key priority because “ensur[ing] healthy lives and promot[ing] well-being for all” (United Nation's Sustainable Development Goal 3) is not possible without achieving food security.¹⁰

Food insecurity is largely rooted in socio-economic inequalities which undermine access to food.¹¹ A recent global analysis of 134 countries illuminated this point: food insecurity was more likely in households with low incomes and where one household member was unemployed.¹² This finding has been replicated in country-specific studies in high-income countries.^{13,14} Importantly, however, food insecurity has also been observed among the employed. Indeed, in a global dataset, over 50% of people who were food insecure were engaged in paid employment (authors’ calculations using Food and Agriculture Organization (FAO) data).¹⁵ Workers in more precarious positions in the labour market (e.g., part-time employment) were also at heightened risk.¹⁶ Employment status, length of contract, and wages may all affect food insecurity risk. It follows, then, that policies which increase wages may influence the risk of food insecurity.^{17,18}

Wage-setting policies often include rules that govern contract negotiations between employers and employees. Wage bargaining, for example, can occur (1) directly between an employer and an employee, (2) in the context of a minimum wage, which restricts the lowest amount someone can be paid for their labour, or (3) through collective bargaining arrangements, where wages are set by unions and firms together.¹⁹ Countries with collective bargaining or even high minimum wages may have lower food insecurity because these wage setting policies tend to increase earnings compared to countries that have less generous minimum wages or that do not regulate earnings at all.²⁰ Collective bargaining arrangements

could also reduce food insecurity through provision of non-income benefits, such as employer-paid health insurance, as healthcare costs increase the risk of food insecurity.²¹

Research into the impacts of wage-setting activities on food insecurity has been scarce. Some simulation studies suggest increasing the minimum wage would reduce food insecurity²² but there are significant gaps in our understanding of whether and how wage setting policies affect food insecurity. It is currently unclear, for example, whether the possible benefits of wage setting policies are concentrated among full-time workers.²³ Part-time workers may not fully benefit because they work fewer hours and therefore benefit less from minimum wages. People who are unemployed or who are in informal employment may not benefit at all, as they are not directly impacted by wage setting policies.²²

The net effect of wage setting policies on food insecurity may also depend on whether such policies create unemployment or lead to more part-time working, which in turn, may increase food insecurity. Whether minimum wages create unemployment remains a contested issue²⁴ but it is possible that some people may lose their jobs and that some firms may increase the number of part-time workers to reduce costs.²⁵ Thus, even if increasing the minimum wage improves earnings for some, others may lose out. This could mean food insecurity rises if the unemployed are not protected from experiencing food insecurity by other policies, such as unemployment insurance.

Lastly, when considering the impacts of wage setting policies, it is necessary to take into account the size of the informal economy,²⁶ that is, the share of the population working outside the reach of labour market regulations. Higher minimum wages, for example, may reduce the risk of food insecurity, but these reductions could be diminished if labour market informality is high because more people are not regulated by these policies.

This paper makes a significant contribution to understanding of the relationship between wage setting policies and food insecurity by addressing two main questions. First, are wage setting policies correlated with risk of food insecurity (RQ1)? In particular, we tested the hypothesis that food insecurity will be lower in countries with collective bargaining and higher minimum wage policies compared to countries with little or no minimum wage policies. Then, second, do associations between wage setting policies and food insecurity differ between full-time employed, part-time employed, and unemployed

(RQ2)? We also explored whether associations between wage setting policies and food insecurity were moderated by the size of the informal economy (RQ3).

Methods

Data

We used cross-sectional data from the Gallup World Poll (GWP) collected in each year from 2014 to 2017 in 147 countries. In these years, the GWP included the FAO's survey instrument for measuring food insecurity, the Food Insecurity Experience Scale (FIES),¹⁵ providing an experience-based measure of food insecurity. The GWP was conducted by telephone in countries where telephone coverage was at least 80% of the population and face-to-face questionnaires were used in contexts where this was not true. The survey aims to be nationally representative at the country level of the adult population (aged 15 and older). The FIES is used to produce a global measure of food insecurity as well as comparable country-level estimates of food insecurity around the world.¹² The FIES comprises eight 'Yes/No' questions designed to elicit whether respondents faced difficulty or uncertainty in accessing sufficient food over the past 12 months.¹⁵ We summed responses across the 8 questions (1=Yes, 0=No) and converted the total score into three binary categories of food insecurity:²⁷ any indication of food insecurity (1 or more 'Yes' responses), 'moderate/severe' food insecurity (4 or more 'Yes' responses), and 'severe only' food insecurity (7 or more 'Yes' responses). Each of these categories is examined separately because the influence of wage setting policies may differ in magnitude and strength of association across these indicators.¹³

The GWP also contains a measure of employment status, which we recoded as: employed full-time (reference = 0), employed part-time (coded as 1), or not employed (coded as 2). The data set does contain a measure of self-employment, however, it is self-reported, so could vary in meaning across different contexts. Whether or not wage setting policies affect people in self-employment may also differ by country context. These ambiguities introduce significant uncertainties in the analysis and interpretation of findings related to self-employment status, so, though we include self-employment as a category of employment in our regression models, we do not discuss it in the analysis. The GWP data set also provided data on respondent age, gender, marital status, social capital, social networks, and urban/rural location, which are all included in our models as covariates.

The GWP data was merged with country-level measures of wage setting policy taken from UCLA's World Policy Analysis Center,²⁸ which produces a policy database constructed from the constitutional and legal provisions for workers in 193 countries. These data were collected in 2014, though policy change in this area is very stable and so very few countries would have changed between 2014 and 2017. For our analysis, we combined two variables contained in their database, the legislative context for wage-setting policies and the value of the minimum wage required by law, to create a new variable that had four non-overlapping categories. To increase comparability across countries, the minimum wage levels are expressed as Purchasing Power Parity Dollars (PPP\$), a currency conversion which adjusts for prices and therefore compares purchasing power. The four categories were defined as (1) Low (<PPP\$2 per day) or no minimum wage (19 countries; examples include Singapore and Bangladesh); (2) Moderate minimum wage set by law between PPP\$2 and PPP\$10 per day (58 countries; examples include Mexico and Ghana); (3) High minimum wage set by law above PPP\$10 per day (50 countries; examples include Morocco and the United States); and (4) Collective bargaining, where a minimum wage is not set by law but where wage negotiations are collectively organised (12 countries; examples included Bosnia Herzegovina and Sweden).

Lastly, we merged these data with GDP per capita, adjusted for purchasing power and inflation, which we obtained from the World Bank. We also merged data on informal employment, also from the World Bank. These data provide an estimate of the proportion of the non-agricultural labour force engaged in informal employment (all jobs in unregistered or unincorporated enterprises). These data were not available for 67 countries (48%) included in our merged GWP-UCLA dataset. After merging these datasets and excluding cases with missing individual-level and country-level data, our final analytic sample comprised 492,078 individuals spanning up to 139 countries for the years 2014-2017 for our main analyses and 72 countries and 257,032 individuals for RQ3 (a full list of countries is included in web appendix 1).

Statistical models

To evaluate the impact of wage-setting policy on food insecurity, we estimated separate multi-level, logistic regression models (with random intercepts) with standard errors clustered at the country-level to account for correlations between individuals living within the same country. The outcome variables across all models are the three measures of food insecurity

described above. The main predictor variable is the measure of wage setting policy. The analysis proceeds in two steps. First, we estimated whether food insecurity was, on average, lower in countries that have implemented specific wage-setting policies (RQ1). Second, we tested for possible heterogeneity in the association between wage-setting policy and food insecurity according to employment status (RQ2). To do this, we estimated a cross-level interaction term between employment status and the type of wage-setting policy in place in that country. For each of these models, we estimated the predicted probability of being food insecure and then calculated the marginal effect of the policies (predicted at the means), that is the average difference in the predicted probability of being food insecure between countries that have different types of wage setting policies.

Models were adjusted for possible confounders. These included age because earnings are correlated with age and with food insecurity (an age-squared term was also added to account for any non-linearities). We also controlled for gender because women tend to face higher risk of food insecurity but may also be underrepresented in the labour market and therefore less affected by labour market policies.¹² Marital status may also be a confounder because lone parents may face a higher risk of food insecurity and may also be less able to work.¹² People in rural areas face an elevated risk of food insecurity but may also be less likely to work for an employer.¹² Measures of social networks (respondent's satisfaction with their opportunities to make friends) and social capital (respondent's have people in their life they can count on) are included too because earlier work suggests these are correlated with both food insecurity and employment opportunities.¹² Finally, our models control for GDP per capita because richer countries, on average, will have less food insecurity than poorer countries and GDP may also correlate with wage setting policies.^{17,18} More details on all variables are provided in web appendix 2.

We also conducted an additional analysis which adds an interaction term between the proportion of people employed informally in the labour market and our measure of wage setting policy (RQ3). We did not include countries with collective bargaining in these models because none of these countries had data on labour market informality.

We also explored the robustness of our findings by conducting sensitivity tests, namely (1) excluding low-income countries (because very few low-income countries had high minimum wages or collective bargaining), retaining middle-income countries *only*, and then retaining

high-income countries *only*; (2) controlling for other policies that might be correlated with food insecurity (such as family, pension, and maternity- and paternity-leave policies, as defined by the World Policy Analysis Center); and (3) conducting a matching analysis at the country level – matching on economic development, population size, the degree of democracy, and their geographical location (continent) – and thereby focusing on those parts of the distribution where there is common support.²⁹

Results

Are wage setting policies associated with food insecurity (RQ1)?

More generous wage-setting policies were negatively associated with the predicted probability of food insecurity across all measures (any indication, moderate/severe, and severe), even after accounting for GDP and other control variables. In countries where there was no minimum wage or a low minimum wage, the probability of being moderately/severely food insecure was 0.31 (95% CI: 0.25-0.36) (see Table 1). Moderate or severe food insecurity was only slightly lower in countries with moderate minimum wage policies (0.29, 95% CI: 0.25-0.33). The probability of moderate or severe food insecurity was 0.25 (95% CI: 0.21-0.30) in countries with high minimum wages. Lastly, the probability of food insecurity was lower still at 0.21 (95% CI: 0.15-0.26) in countries with collective bargaining arrangements.

Statistical tests of the difference in the probability of food insecurity using countries with collective bargaining as the reference category are also reported in table 1. Countries with a moderate ($p = 0.016$) or no/low minimum wage ($p = 0.029$) had higher moderate or severe food insecurity. However, the null hypothesis could not be rejected when comparing countries with a high minimum wage to countries with collective bargaining ($p = 0.053$). Similar results for low/moderate/severe and severe only measures of food insecurity were observed (see Table 1). In sum, more generous minimum wages and collective bargaining arrangements were associated with less food insecurity.

Are the benefits of wage setting policies concentrated among full-time workers (RQ2)?

Next we explored whether these policies benefitted full-time workers more than part-time workers and the unemployed. Wage-setting policies appeared beneficial for full-time workers but not the unemployed. The predicted probability of moderate or severe food insecurity

among the unemployed remained high, irrespective of wage setting policies (see Figure 1 and Web Appendix 3 for full models). By contrast, among those in full-time employment, the predicted probability of moderate or severe food insecurity was higher in countries without a minimum wage policy (0.31) than it was in countries with collective bargaining (0.17), a difference of 0.14 (Figure 1). Among part-time workers, the predicted probability of food insecurity was ~0.32 in countries without a minimum wage policy and ~0.22 in countries with collective bargaining, a difference of ~0.092. The risk of food insecurity was lower for both groups when they lived in collective bargaining countries compared to countries with little or no minimum wage, but the reduction was greater for full-time employees (0.14) than part-time employees (0.092) ($0.14 - 0.092 = \sim 0.047$, $p = 0.026$), suggesting the declines in food insecurity are concentrated among full-time employees.

[Figure 1 here]

If wage setting policies do not reduce food insecurity among the unemployed then any increase in unemployment due to the wage setting policy would undermine the overall reduction in food insecurity brought about by the policy. Formally modelling this relationship would go beyond the scope of this paper but we have conducted a counterfactual analysis to estimate how large the rises in unemployment would need to be to offset the reductions in food insecurity achieved through increasing the minimum wage (see Web Appendix 4 for more details). The models reported above suggest that moving from a low to a high minimum wage would reduce moderate/severe food insecurity by ~4 percentage-points. To offset these gains, the increase in unemployment would need to be very large, more than 10 percentage-points.

Is wage setting policy undermined by high levels of labour market informality (RQ3)?

Finally, we explored whether the size of the informal economy moderated the impact of wage-setting policy on food insecurity. The direct association between informal labour markets and food insecurity was positive: on average, countries with larger informal economies had higher levels of food insecurity (see Figure 2 and Web Appendix 5).

However, as shown in Figure 2, the association between the size of the informal economy and food insecurity appeared to vary according to the kind of wage-setting policies implemented. Among countries with a high or moderate minimum wage, an increase in the proportion of informal workers was clearly associated with higher levels of food insecurity

(see Figure 2 and Web Appendix 4). In countries with little or no minimum wage, the impact of the size of the informal economy on food insecurity was less clear. The association was still positive, but there was far more variation in countries' experience.

Sensitivity tests

We conducted a series of sensitivity analyses. First, the findings remained consistent when the models were re-estimated excluding low-income countries, in middle-income countries *alone* and in high-income countries *alone* (Web Appendix 6). Second, the results were unchanged after controlling for three other policies that could be associated with wage-setting policies (Web Appendix 7). Third, the results from the matching analysis were consistent with the findings reported above (see Web Appendix 8).

Discussion

This paper explored whether wage-setting policies were associated with lower risks of food insecurity. Generous minimum wages and collective bargaining were associated with lower levels of food insecurity. To illustrate our findings, one can consider Costa Rica and Panama. Both are Latin American countries with approximately the same GDP per capita and population size. Costa Rica, however, has a higher minimum wage (over \$10 PPP per day – albeit with some exceptions) while Panama has only a moderate minimum wage (somewhere between \$4.01 and \$10.00 PPP per day). Panama also has a much higher level of moderate and severe food insecurity (~30%) than Costa Rica (~18%), suggesting that if Panama increased its minimum wage, then food insecurity may reduce in the population.

These findings add to the growing literature highlighting the health effects of minimum wages and other wage setting policies³⁰ but they also reinforce earlier work highlighting how adults in precarious work face greater risks of food insecurity.³¹ Our results not only support these earlier findings, but they also suggest a policy remedy: when countries establish wage setting policies which seek to ensure financial security for low-income households then the risk of food insecurity appear to be lower.

Importantly, however, our results also suggest that wage-setting policies do not benefit everyone to the same degree. The unemployed and those in the informal economy appeared to benefit less from these policies. Part-time workers experienced lower risk of food insecurity but full-time employees experienced even lower risks, most likely because they

work more hours. When viewed together, these differences between full-time and part-time workers reinforces other research which has revealed how labour market segmentation can have consequences for poverty and, by implication, health.^{23,32}

Labour market segmentation between full-time workers, part-time workers, and the unemployed may be especially important in countries where there are fears that raising the minimum wage will increase unemployment or informality. These risks must be put into perspective, however. Our models suggested any increase in unemployment due to a higher minimum wage would need to be very large to offset the reductions in food insecurity (see Web Appendix 4). Such large rises in unemployment are unlikely because the impact of minimum wages on unemployment are very often negligible,²⁴ even in developing countries.³³ Thus, while pursuing higher minimum wages could create winners and losers in some contexts, it is very likely to lead to a net reduction in food insecurity. Of course, even in these contexts, it would be important to complement policies that increase wages with greater financial protection for the unemployed, which can also lower the risks of food insecurity.^{11,34}

There are a number of limitations to our analysis. First, whilst our data covered an unprecedentedly large number of countries, our measure of wage-setting policies did not vary over time, precluding any examination of how changes to wage setting policy affect food insecurity. While the matching analysis partially addresses this issue, in the absence of such changes, it is difficult to draw strong causal conclusions about the association between wage setting policies and food insecurity. Second, the data were not longitudinal data on individuals and so we were unable to test what happens to risk of food insecurity when people move into or out of employment under these different policy regimes. Future work will need to examine these issues in more detail.

Public health implications

Food insecurity is a major health problem that affects educational outcomes, depression, cardiovascular disease, and even mortality.^{4,5} These findings are important because they suggest that food insecurity, and in turn, these health outcomes, may be reduced by the implementation of collective bargaining or high minimum wages. However, the reverse may also be true, namely, that moving away from collective bargaining and higher minimum wages may lead to increasing food insecurity. Indeed, a number of countries have seen major

reconfigurations of their wage setting policies in recent decades. There has been a steady erosion of coverage by collective bargaining in Germany, the United Kingdom, and the USA.¹⁹ At the same time, minimum wages have frequently become less generous in real terms. This analysis suggests public health actors have a role to play in working with other agencies (including government departments) involved in setting labour market protections and wage policies. The retrenchment of wage setting policies not only exacerbates in-work poverty but, as this analysis suggests, may leave families facing insufficient food supplies and, in the worst cases, without enough to eat.³⁵

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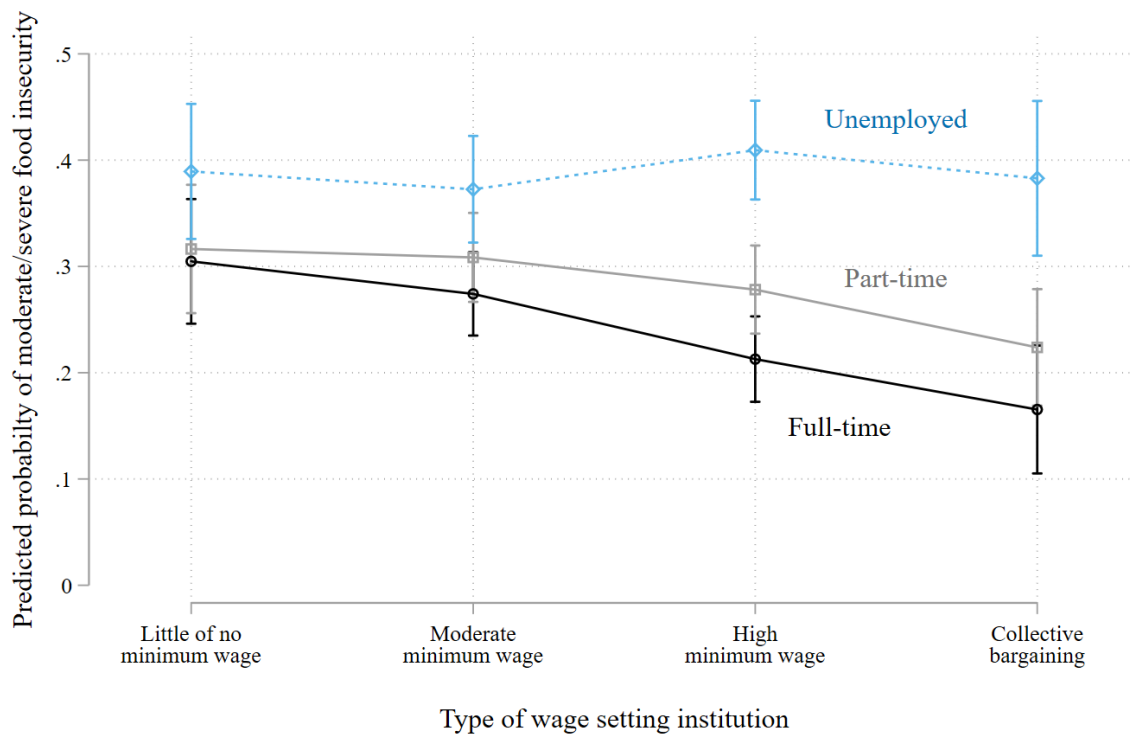
Figures and Tables

Figure 1: Predicted probability of moderate/severe food insecurity wage setting regime and by employment status

Figure 2: Change in predicted probability of moderate food insecurity associated with 1 percentage point increase in the size of the informal labour market by wage setting policy

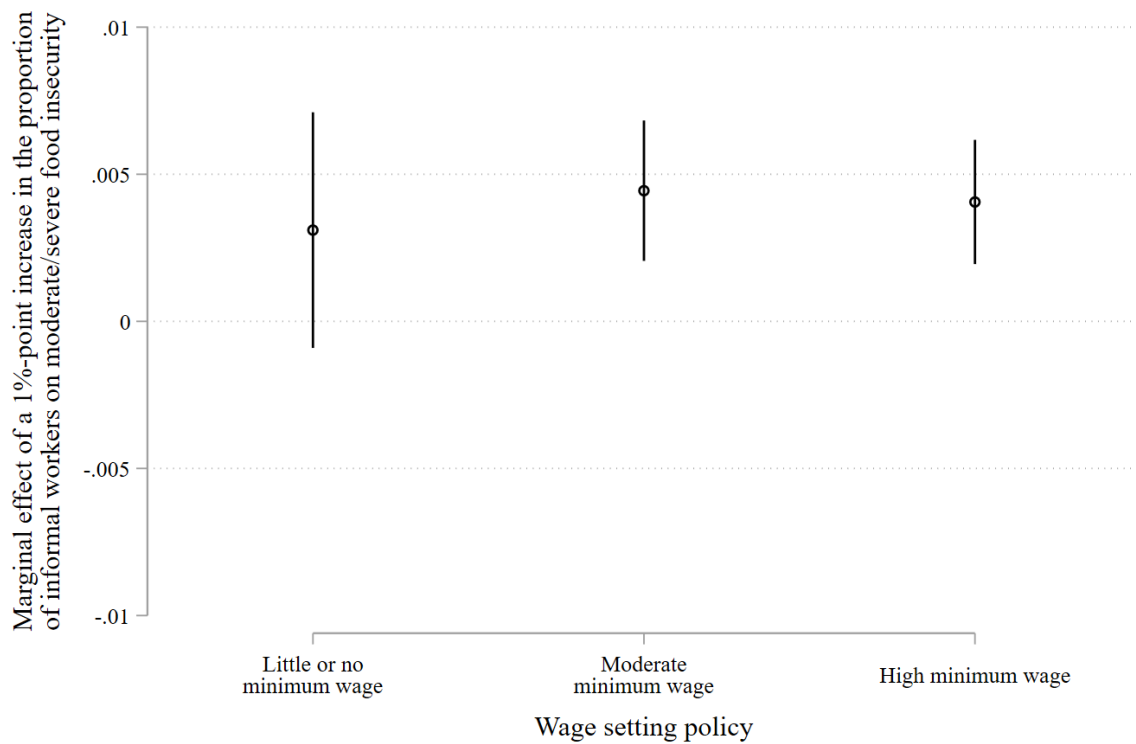
Table 1: Predicted probability of food insecurity by the type of wage setting policy and the difference in the predicted probability of food insecurity between countries with collective bargaining and other wage setting policies (Countries with Collective Bargaining as the reference)

Figure 1: Predicted probability of moderate/severe food insecurity wage setting regime and by employment status



Notes: Results reported in this figure are taken from column 2 of web appendix 3.

Figure 2: Change in predicted probability of moderate or severe food insecurity associated with 1 percentage point increase in the size of the informal labour market by wage setting policy



Notes: Results come from the model estimated in table 1 with two changes. First, we have added a measure of the size of the informal labour market and second we added an interaction term between this measure of labour market informality and wage setting policy. Data on labour market informality comes from World Bank.

Table 1: Predicted probability of food insecurity by the type of wage setting policy and the difference in the predicted probability of food insecurity between countries with collective bargaining and other wage setting policies (Countries with Collective Bargaining as the reference)

	Any indication of food insecurity	Moderate or severe food insecurity	Severe food insecurity
Wage setting policy	(1)	(2)	(3)
Collective bargaining (Reference category)	0.394 [0.332, 0.457]	0.208 [0.153, 0.262]	0.094 [0.060, 0.127]
High minimum wage	0.451 [0.413, 0.489]	0.255 [0.214, 0.295]	0.124 [0.092, 0.156]
<i>Difference between high minimum wage and reference category</i>	0.057 [-0.002, 0.116] <i>p</i> = 0.059	0.047 [-0.001, 0.095] <i>p</i> = 0.053	0.030* [0.001, 0.060] <i>p</i> = 0.049
Moderate minimum wage	0.489 [0.444, 0.533]	0.293 [0.252, 0.334]	0.154 [0.126, 0.182]
<i>Difference between moderate minimum wage and reference category</i>	0.095* [0.006, 0.183] <i>p</i> = 0.037	0.085* [0.009, 0.162] <i>p</i> = 0.029	0.060* [0.012, 0.109] <i>p</i> = 0.015
Little or no wage setting policy	0.493 [0.432, 0.555]	0.307 [0.249, 0.365]	0.163 [0.120, 0.206]
<i>Difference between little or no wage setting policy and reference category</i>	0.099* [0.004, 0.194] <i>p</i> = 0.049	0.099* [0.018, 0.181] <i>p</i> = 0.016	0.070* [0.017, 0.122] <i>p</i> = 0.010
Countries	139	139	139
Observations	492,078	492,078	492,078

Notes: Confidence intervals reported in parentheses. The estimated differences reported in the table are absolute differences in the predicted probability of food insecurity (predicted at the means), on average, between countries with collective bargaining and countries with other types of wage setting regime. Estimates come from a multilevel logistic regression model which controls for: sex, age, age-squared, marital status, whether respondents live in an urban or rural area, their employment status, whether there are children in the household under the age of 15, whether respondents are satisfied with their opportunities to make friends, whether respondents have people in their life they can count on, and GDP per capita (adjusted for purchasing power and inflation, measured on a log scale). The categories of the wage setting policy measure are defined as follows: Little or no wage setting policy: Countries with either (a) no minimum wage or (b) a very low minimum wage (<PPP\$2 per day); Moderate minimum wage: Countries with a minimum wage set by law between PPP\$2 and PPP\$10 per day; High minimum wage: Countries with a minimum wage set by law above PPP\$10 per day; Collective bargaining: Countries without a minimum wage but where wage negotiations are collectively organised.

* $p < 0.05$, ** $p < 0.01$

Web Appendices

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Web Appendix 1: List of countries included in the analyses

Country	N	Included in main analysis	Included in Informal Labour Market analysis	Country	N	Included in main analysis	Included in Informal Labour Market analysis
Afghanistan	3,654	x		Kuwait	3,734	x	
Albania	3,836	x	x	Laos	929	x	x
Algeria	2,804	x	x	Latvia	3,460	x	
Angola	870	x	x	Lebanon	3,915	x	
Argentina	3,633	x	x	Lesotho	1,885	x	x
Armenia	3,668	x	x	Liberia	3,780	x	x
Australia	3,886	x		Lithuania	3,008	x	
Austria	3,799	x		Luxembourg	3,922	x	
Azerbaijan	3,337	x	x	Macedonia	3,815	x	x
Bahrain	3,969	x		Madagascar	3,957	x	x
Bangladesh	3,910	x	x	Malawi	3,985	x	x
Belarus	3,566	x		Malaysia	1,929	x	
Belgium	3,978	x		Mali	3,913	x	x
Belize	478	x		Malta	3,872	x	
Benin	3,698	x	x	Mauritania	3,742	x	
Bhutan	1,997	x		Mauritius	2,864	x	x
Bolivia	3,699	x	x	Mexico	3,839	x	x
Bosnia Herzegovina	3,630	x	x	Moldova	2,649	x	x
Botswana	3,844	x		Montenegro	3,747	x	
Brazil	3,952	x	x	Morocco	3,858	x	x
Bulgaria	3,677	x		Myanmar	4,502	x	x
Burkina Faso	3,853	x	x	Namibia	1,940	x	x
Burundi	995	x	x	Nepal	3,918	x	x
Cambodia	4,553	x	x	Netherlands	3,936	x	
Cameroon	2,868	x	x	New Zealand	3,889	x	
Canada	3,087	x		Nicaragua	3,670	x	x
Chad	3,868	x		Niger	3,822	x	x
Chile	3,818	x	x	Nigeria	3,895	x	
China	3,721	x		Norway	3,900	x	
Colombia	3,865	x	x	Pakistan	4,490	x	x
Congo Brazzaville	3,674	x		Panama	3,571	x	x
Congo Kinshasa	3,849	x	x	Paraguay	3,748	x	x
Costa Rica	3,485	x	x	Peru	3,834	x	x
Croatia	3,561	x		Philippines	3,959	x	x
Cyprus	3,832	x		Poland	3,580	x	
Czech Republic	3,621	x		Portugal	3,835	x	
Denmark	3,877	x		Romania	3,615	x	

Dominican Republic	3,658	x	x	Russia	6,789	x	x
Ecuador	3,880	x	x	Saudi Arabia	3,891	x	
Egypt	3,928	x	x	Senegal	3,922	x	x
El Salvador	3,517	x	x	Serbia	3,582	x	x
Estonia	3,449	x		Sierra Leone	3,851	x	
Ethiopia	3,935	x		Singapore	2,833	x	
Finland	3,904	x		Slovakia	3,694	x	x
France	3,891	x		Slovenia	3,913	x	
Gabon	3,827	x		South Africa	3,923	x	x
Gambia	934	x	x	South Korea	3,602	x	
Georgia	3,682	x		Spain	1,961	x	
Germany	3,760	x		Sri Lanka	3,044	x	x
Ghana	3,854	x	x	Sudan	784	x	x
Greece	3,865	x		Sweden	3,860	x	
Guatemala	3,541	x	x	Switzerland	3,403	x	
Guinea	3,853	x		Tanzania	3,890	x	x
Haiti	1,704	x	x	Thailand	2,924	x	x
Honduras	3,489	x	x	Togo	3,777	x	x
Hungary	3,507	x		Trinidad and Tobago	455	x	
Iceland	1,526	x		Tunisia	3,848	x	x
India	11,426	x	x	Turkey	2,841	x	x
Indonesia	3,906	x	x	Uganda	3,863	x	x
Iran	3,847	x		Ukraine	3,264	x	x
Iraq	3,867	x		United Arab Emirates	6,173	x	
Ireland	3,930	x		United Kingdom	3,912	x	
Israel	3,576	x		United States	2,923	x	
Italy	3,925	x		Uruguay	3,475	x	x
Ivory Coast	3,842	x	x	Uzbekistan	3,857	x	
Jamaica	899	x		Venezuela	3,861	x	x
Japan	3,636	x		Vietnam	2,851	x	x
Jordan	3,963	x		Yemen	3,903	x	x
Kazakhstan	3,502	x		Zambia	3,883	x	x
Kenya	3,984	x	x				

Web Appendix 2: Descriptive statistics

Individual-level Variables	Individuals	Mean	Std. Dev	Min	Max
Food insecurity: Any	492,078	0.46		0	1
Food Insecurity: Moderate	492,078	0.28		0	1
Food Insecurity: Severe	492,078	0.15		0	1
Female	492,078	53.23		0	1
Age	492,078	41.70	17.87	15	101
Age-squared	492,078	2058.65	1687.32	225	10201
Single/never married	492,078	29.1		0	1
Married	492,078	51.58		0	1
Divorced/Widowed/Separated	492,078	13.7		0	1
Domestic partner	492,078	5.61		0	1
Rural	492,078	24.41		0	1
Small town	492,078	34.85		0	1
Suburb	492,078	10.26		0	1
Large city	492,078	30.48		0	1
Children under 15	492,078	52.23		0	1
Opportunities to make friends	492,078	78.94		0	1
Count on people to help	492,078	80.99		0	1
Full-time employed	492,078	27.2		0	1
Part-time employed	492,078	15.4		0	1
Self-employed	492,078	14.06		0	1
Unemployed	492,078	6.48		0	1
Economically inactive	492,078	36.87		0	1
Country-level Variables	Countries	Mean	Std. Dev	Min	Max
GDP per capita, adjusted for purchasing power and inflation (log scale)	139	8.57	1.52	5.43	11.57
Family policy	139	57.55		0	1
Old age pension policy	130	49.23		0	1
Maternity and Paternity leave	139	58.27		0	1
Size of informal labour force	72	61.61	24.99	5.9	96.2
Population (log scale)	139	16.44	1.55	12.72	21.04
Degree of democracy	136	3.77	11.06	-66	10
Little or no minimum wage	139	13.67		0	1
Moderate minimum wage	139	41.73		0	1
High minimum wage	139	35.97		0	1
Collective bargaining	139	8.63		0	1
Low income countries	139	17.27		0	1
Middle income countries	139	51.08		0	1
High income countries	139	31.65		0	1

Europe	139	33.09		0	1
Middle east and Africa	139	34.53		0	1
Asia	139	15.11		0	1
Americas	139	17.27		0	1

Web Appendix 3: Predicted probability of food insecurity by the type of wage setting policy and employment status

	Any indicator of food insecurity	Moderate or severe food insecurity	Severe food insecurity
Wage setting policy	(1)	(2)	(3)
<i>Employed full-time</i>			
Little or no wage setting policy	0.4949 [0.4293, 0.5604]	0.3047 [0.2461, 0.3633]	0.1613 [0.1191, 0.2034]
Moderate minimum wage	0.4636 [0.4198, 0.5074]	0.2742 [0.2349, 0.3134]	0.1406 [0.1144, 0.1668]
High minimum wage	0.4042 [0.3645, 0.4438]	0.2128 [0.1716, 0.2530]	0.0975 [0.0670, 0.1280]
Collective bargaining	0.3448 [0.2703, 0.4193]	0.1654 [0.1052, 0.2255]	0.0644 [0.0336, 0.0953]
<i>Employed part-time</i>			
Little or no wage setting policy	0.5088 [0.4447, 0.5729]	0.3164 [0.2560, 0.3768]	0.1682 [0.1221, 0.2143]
Moderate minimum wage	0.5149 [0.4670, 0.5597]	0.3085 [0.2666, 0.3503]	0.1581 [0.1292, 0.1871]
High minimum wage	0.4799 [0.4412, 0.5186]	0.2782 [0.2368, 0.3196]	0.1353 [0.1018, 0.1688]
Collective bargaining	0.4323 [0.3708, 0.49.38]	0.2238 [0.1690, 0.2786]	0.0977 [0.0619, 0.1334]
<i>Unemployed</i>			
Little or no wage setting policy	0.5816 [0.5166, 0.6467]	0.3893 [0.3258, 0.4529]	0.2106 [0.1625, 0.2588]
Moderate minimum wage	0.5816 [0.5317, 0.6322]	0.3726 [0.3224, 0.4228]	0.2088 [0.1717, 0.2460]

High minimum wage	0.6224 [0.5836, 0.6612]	0.4094 [0.3629, 0.4558]	0.2252 [0.1817, 0.2687]
Collective bargaining	0.5834 [0.5213, 0.6454]	0.3829 [0.3101, 0.4557]	0.2197 [0.1542, 0.2852]
Countries	139	139	139
Observations	492,078	492,078	492,078

Notes: Confidence intervals reported in parentheses. Estimates come from a multilevel logistic regression model which controls for: sex, age, age-squared, marital status, whether respondents live in an urban or rural area, their employment status, whether there are children in the household under the age of 15, whether respondents are satisfied with their opportunities to make friends, whether respondents have people in their life they can count on, and GDP per capita (adjusted for purchasing power and inflation, measured on a log scale). This model also includes an interaction term between wage setting policy and employment status. The categories of the wage setting policy measure are defined as follows: Little or no wage setting policy: Countries with either (a) no minimum wage or (b) a very low minimum wage (<PPP\$2 per day); Moderate minimum wage: Countries with a minimum wage set by law between PPP\$2 and PPP\$10 per day; High minimum wage: Countries with a minimum wage set by law above PPP\$10 per day; Collective bargaining: Countries without a minimum wage but where wage negotiations are collectively organised.

Web Appendix 4: Calculating the net effect on food insecurity using counterfactual scenarios

One possible issue with our model is that it assumes unemployment remains stable but this may not be true in some instances. Here we use one of our main models to calculate the main effect of moving from a low to high minimum wage setting and then to explore how much – according our model – would unemployment need to rise to offset decline in food insecurity generated by the increase in the minimum wage.

Our underlying model is model 2 from web appendix 3. We start by estimating the level of moderate or severe food insecurity given the average employment structure in our sample (27.29% are employed full-time, 15.38% are employed part-time, 13.92% are self-employed, 6.28% are unemployed, and 37.13% are economically inactive).

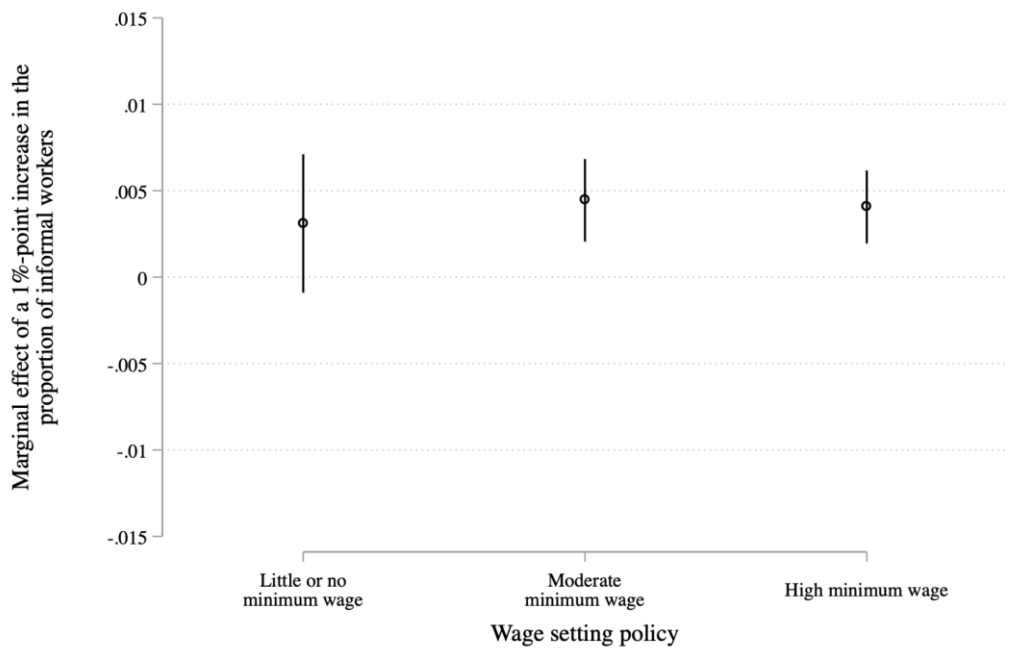
We start by taking the association between each employment status and moderate or severe food insecurity for countries with little or no minimum wage and we use these parameters (combined with the employment structure noted above) to calculate the proportion of the population that are moderately or severely food insecure, finding that ~29.66% of the population are moderately or severely food insecure (95% CI: 26.39, 32.94).

We then use the association between each employment status and moderate or severe food insecurity for countries with a high minimum wage (alongside the same employment structure) to calculate the proportion of moderately or severely food insecure people in a country with a high minimum wage. We find that ~25.84% of the population are moderately or severely food insecure (95% CI: 23.52, 28.17).

But, this assumes the structure of employment remains unchanged. We then explore what would happen if the unemployment rate increased as a result of these reforms. We start by estimating a 5 percentage-point increase in the unemployment rate (a 2 percentage-point reduction in full-time workers, a 2 percentage-point reduction in part-time workers, and a 1 percentage-point reduction in self-employed workers). We find that the proportion of moderately or severely food insecure people increases to ~26.28% (95% CI: 24.21, 28.35). Note that the confidence intervals from the estimate do not overlap the point estimates from our first model, suggesting that even a 5 percentage-point increase in unemployment would not remove the gains of increasing the minimum wage. Indeed, even if unemployment increased by 10 percentage-points (a 4 percentage-point reduction in full-time workers, a 4 percentage-point reduction in part-time workers, and a 2 percentage-point reduction in self-employed workers), moderate or severe food insecurity would only rise to ~26.96% (95% CI: 25.09, 28.83), which is still lower than our estimate of the prevalence of food insecurity in a low minimum wage setting (although note that the point estimate of this last estimate does still slightly within the confidence intervals of the low-minimum wage setting estimate). What is clear from this analysis is that, at least in our data, it would require a very large shift in unemployment to offset the gains in food insecurity achieved by increasing the minimum or even implementing collective bargaining.

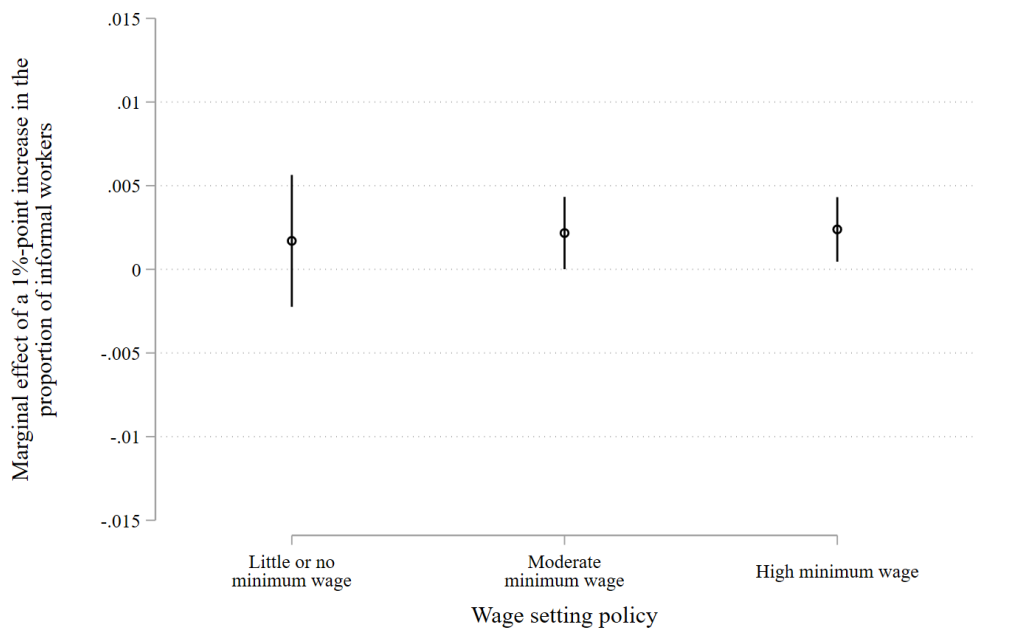
Web Appendix 5: Change in predicted probability of food insecurity associated with 1 percentage point increase in the size of the informal labour market by wage setting policy

A. Severe food insecurity



Notes: Results come from the model estimated in table 1 with two changes. First, we have added a measure of the size of the informal labour market and second we added an interaction term between this measure of labour market informality and wage setting policy.

B. Any degree of food insecurity



Notes: Results come from the model estimated in table 1 with two changes. First, we have added a measure of the size of the informal labour market and second we added an interaction term between this measure of labour market informality and wage setting policy.

Web Appendix 6: Predicted probability of moderate or severe food insecurity by the type of wage setting policy and by the level of economic development

	Middle- and High- Income Countries	Middle-Income Countries	High-Income Countries
Wage setting policy	(1)	(2)	(3)
Little or no wage setting policy	0.2419 [0.1616, 0.3223]	0.3200 [0.1820, 0.4578]	0.1009 [0.4614, 0.1557]
Moderate minimum wage	0.2547 [0.2069, 0.3026]	0.3400 [0.2813, 0.3987]	0.0978 [0.0821, 0.1135]
High minimum wage	0.1796 [0.1455, 0.2137]	0.2522 [0.1923, 0.3122]	0.07490 [0.0580, 0.0918]
Collective bargaining	0.1257 [0.0874, 0.1640]	0.1037 [0.0945, 0.1129]	0.0539 [0.0393, 0.0686]
Countries	115	71	44
Observations	406,030	245,120	160,910

Notes: Confidence intervals reported in parentheses. Estimates come from a multilevel logistic regression model which controls for: sex, age, age-squared, marital status, whether respondents live in an urban or rural area, their employment status, whether there are children in the household under the age of 15, whether respondents are satisfied with their opportunities to make friends, whether respondents have people in their life they can count on, and GDP per capita (adjusted for purchasing power and inflation, measured on a log scale). The categories of the wage setting policy measure are defined as follows: Little or no wage setting policy: Countries with either (a) no minimum wage or (b) a very low minimum wage (<PPP\$2 per day); Moderate minimum wage: Countries with a minimum wage set by law between PPP\$2 and PPP\$10 per day; High minimum wage: Countries with a minimum wage set by law above PPP\$10 per day; Collective bargaining: Countries without a minimum wage but where wage negotiations are collectively organised.

Web Appendix 7: Predicted probability of food insecurity, moderate or severe food insecurity, and severe food insecurity by the type of wage setting policy, controlling for other policies

	Any indicator of food insecurity	Moderate or severe food insecurity	Severe food insecurity
Wage setting policy	(1)	(2)	(3)
Little or no wage setting policy	0.4893 [0.4048, 0.5737]	0.3195 [0.2197, 0.4192]	0.1579 [0.0924, 0.2234]
Moderate minimum wage	0.5092 [0.4649, 0.5534]	0.3482 [0.2973, 0.3991]	0.1851 [0.1491, 0.2211]
High minimum wage	0.4387 [0.3941, 0.4832]	0.1953 [0.1594, 0.2312]	0.0894 [0.0655, 0.1133]
Collective bargaining	0.3806 [0.3060, 0.4552]	0.1240 [0.0877, 0.1603]	0.0535 [0.0340, 0.0730]
Countries	130	130	130
Observations	458,310	458,310	458,310

Notes: Confidence intervals reported in parentheses. Estimates come from a multilevel logistic regression model which controls for: sex, age, age-squared, marital status, whether respondents live in an urban or rural area, their employment status, whether there are children in the household under the age of 15, whether respondents are satisfied with their opportunities to make friends, whether respondents have people in their life they can count on, and the level of economic development according to the World Bank. These models also control for pension policy, family policy, and maternity and paternity leave policy. The categories of the wage setting policy measure are defined as follows: Little or no wage setting policy: Countries with either (a) no minimum wage or (b) a very low minimum wage (<PPP\$2 per day); Moderate minimum wage: Countries with a minimum wage set by law between PPP\$2 and PPP\$10 per day; High minimum wage: Countries with a minimum wage set by law above PPP\$10 per day; Collective bargaining: Countries without a minimum wage but where wage negotiations are collectively organised. The sample size is smaller in these models because there is missing values on some of these policy measures.

Web Appendix 8: Contrasting the predicted probability of food insecurity by the type of wage setting policy using countries with Collective Bargaining as the baseline, in a matched sample

Countries that have and have not implemented generous wage setting policies may be different in other ways that could be correlated with the risk of food insecurity. We therefore implement a matching procedure as a way of trimming outlier countries from our analysis, thereby focussing on the overlapping parts of the distribution of countries with and without generous wage setting policies. Our treatment variable has been coded as a binary to simplify the matching procedure, where 0 = countries moderate, little or no minimum wages and 1 = countries with high minimum wages of collective bargaining. We match on the level of economic development (according to the World Bank), population size, the degree of democracy, and their continent using Coarsened Exact Matching²⁹. There are 26 possible strata across this combination of variables and we find matched observations in 9 of them. This leaves us with 70 countries and excludes the remaining 69.

	Any indicator of food insecurity	Moderate or severe food insecurity	Severe food insecurity
Wage setting policy	(1)	(2)	(3)
Moderate, little, or no wage setting policy	0.5471 [0.4850, 0.6090]	0.3296 [0.2698, 0.3893]	0.1759 [0.1332, 0.2187]
High minimum wages or Collective Bargaining	0.3790 [0.3143, 0.4438]	0.1914 [0.1412, 0.2416]	0.0866 [0.0554, 0.1178]
Difference between the two groups	0.1680** [0.0780, 0.2578]	0.1382** [0.0600, 0.2164]	0.0894** [0.0369, 0.1418]
Countries	70	70	70
Observations	247,986	247,986	247,986

Notes: Standard errors reported in parentheses. Estimates come from a multilevel logistic regression model which controls for: sex, age, age-squared, marital status, whether respondents live in an urban or rural area, their employment status, whether there are children in the household under the age of 15, whether respondents are satisfied with their opportunities to make friends, whether respondents have people in their life they can count on. The categories of the wage setting policy measure are defined as follows: Little or no wage setting policy: Countries with either (a) no minimum wage or a very low minimum wage (<PPP\$2 per day) and a moderate minimum wage, that is countries with a minimum wage set by law between PPP\$2 and PPP\$10 per day or (b) high minimum wage countries with a minimum wage set by law above PPP\$10 per day or countries with collective bargaining, that is, countries without a minimum wage but where wage negotiations are collectively organised.

* p<0.05, ** p<0.01