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ORIGINAL ARTICLE

Is trade a blessing or a curse? A panel data analysis of the determinants of depressive disorders

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Abstract

Objectives Given the speculation of the market economy causing an epidemic of depression, this study aimed to examine the influence of international trade on the prevalence of depressive disorders.

Methods We used panel data from 1993 to 2015 covering 170 countries (n = 3787) and applied fixed effects regression models. We modeled the prevalence of depressive disorders as a function of international trade, adjusting for economic development, economic growth, and population size. Regime types, media freedom, and capital–labor ratio were included as moderators.

Results A 100% point increase in the value of international trade indicated a 0.09% point decrease in the prevalence of depressive disorders (− 0.09, confidence interval [CI] − 0.01 to − 0.18). However, this effect existed only for democratic countries (− 0.15, CI − 0.03 to − 0.28). The effect was more prevalent when the governments allowed the media more freedom (score of 100, − 0.31, CI − 0.17 to − 0.45) or when a country's capital–labor ratio of endowments was high (50,000, − 0.22, CI − 0.08 to − 0.35).

Conclusions Trade brings about positive mental health outcomes in democracies, countries having free media, or capital-abundant economies.

Keywords Capital–labor ratio · Democracy · Depression · Export · Import · Media · Trade

Introduction

Depressive disorders are characterized by a depressed mood, loss of interest or pleasure, disturbed sleep or appetite, reduced physical movement, poor concentration, and recurrent suicidal ideation. Depression can lead to suicide, cardiovascular death, stroke, lowered income or unemployment, and the dissolution of a marriage (Lépine and Briley 2011). The total estimated number of people living with depression increased by 18.4% between 2005 and 2015, and the World Health Organization predicts that by 2030, depression will be the leading cause of disease burden globally.

The broader literature examines the economic determinants of mental health, such as an economic crisis (Economou et al. 2013; Gili et al. 2013; McInerney et al. 2013), income inequality (Patel et al. 2018; Ribeiro et al. 2017), stock market dynamics (Engelberg and Parsons 2016; McInerney et al. 2013), and labor market conditions (Fiori et al. 2016; Lager and Bremberg 2009). However, few studies have examined how the trade market influences

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mental health or conducted cross-national analyses. Studies on global trade and health have focused on the effects of the international labor market and import competition on mental illness (Adda and Fawaz 2019; Colantone et al. 2019; Lang et al. 2019). Three points, however, merit further discussion. First, the claim that employment insecurity from import competition is associated with poorer mental health may be conditioned on the presence of a democratic government that can respond to public discontent. Second, in addition to competitive pressure from foreign labor, threats such as income inequality, food insecurity, and environmental pollution that emerge from global trade can influence individuals' mental health. Third, depression is determined not only by individuals' income and job status but also a country's political, social, and economic context. A country-level analysis is likely to overcome the limitations of an individual-level analysis. The present study, thus, aimed to evaluate how international trade influences the prevalence of depressive disorders, arguing that the effects of trade depend on a country's democratic status, media freedom, and position in the global supply chain.

Trade has been shown to have a positive impact on mental health. Theories of international trade show foreign trade leads to specialization in the areas of comparative advantage, and ultimately, to gains in social welfare. For one, access to new imported input enables firms to expand their domestic product portfolio through the introduction of greater variety, which generates substantial gains from trade. For another, trade fosters competition and encourages the efficient use of resources, which lowers prices, enhances variety, and improves product quality, increasing consumer welfare. Most studies support the positive effects of trade on output and growth (Singh 2010), social protection (Avelino et al. 2005), and improvements in dietary energy supply adequacy and diversity (Dithmer and Abdulai 2017). Furthermore, economic crises (Economou et al. 2013), social inequalities (Reiss 2013), and food insecurity (Nagata et al. 2019) are linked with mental distress. Thus, trade can alleviate the mental health impact of socioeconomic risk factors.

Trade has been found to have a positive association with government spending on social security, because stakeholders actively seek social insurance mechanisms to protect themselves against the uncertainties resulting from an increase in international trade (Avelino et al. 2005). However, this effect depends on the presence of responsible governments. If the government stops fulfilling this function, then the so-called "losers" of global trade, who believe their interests, demands, and preferences are being consistently ignored, are likely to live in poverty and with mental illness. In the absence of appropriate redistribution policies, these "losers" may become susceptible to nationalist and radical-right parties' propaganda questioning the legitimacy of a liberal democracy itself (Colantone and Stanig 2018), which will generate social conflict and have a detrimental impact on mental health. A democracy emphasizes electoral competition that incentivizes representatives to respond to the wishes of the electorate—else, they risk a defeat at the polls—and encourages public involvement in policy making. As such, the positive effects of trade on mental health may exist only for democratic countries.

Trade can increase the variety of goods available to consumers and decrease the average cost of those goods, thus benefiting consumers (Dithmer and Abdulai 2017). However, trade may raise health risks related to foreign products or services. For example, food imports from the US can explain the rise in obesity prevalence among Mexican women, suggesting the unhealthiness of American food imports (Giuntella et al. 2020). Thus, trade can bring about food insecurity that contributes to poor mental health (Nagata et al. 2019). However, people with the ability to access, interpret, and use nutrition information can change their dietary behaviors and maintain a healthy body weight (Blitstein and Evans 2006), thereby avoiding the associated risks to mental health. There are effective channels for the delivery of nutrition information such as print media and web sites (Silk et al. 2008), but once the government has little incentive to tolerate media freedom, it becomes difficult for the media, such as the internet and traditional print, to spread information to a large audience. Consequently, consumers are exposed to higher mental health risks. Therefore, as the level of media freedom increases, the positive effects of trade on mental health would increase.

Trade fosters growth through its favorable effects on foreign investment inflows, technology transfer, and the accumulation of capital (Singh 2010). An increase in competition for foreign investment, however, can have a negative impact on mental health. Governments attempt to attract foreign investment by deliberately depressing wages and imposing the lowest labor and pollution standards (Cao and Prakash 2010; Olney 2013). Notably, inferior working conditions (Fiori et al. 2016; Lager and Bremberg 2009) and severe environmental problems, such as pollution and noise (Klompmaker et al. 2019; Wang and Yang 2016), are associated with an increased risk of poor mental health. Countries exporting labor- and resource-intensive products have relatively low levels of capital, technology, and skills. These countries have to rely on foreign investment as an important source of finance for boosting technological innovation and upgrading industries. They may seek to attract more foreign capital by lowering regulatory standards and, as a result, engage in a race to the bottom in wages and labor conditions (Davies and Vadlamannati

2013; Ross and Chan 2002). Thus, the positive effects of trade on mental health would be more prevalent if a country's capital–labor ratio of endowments is high.

Methods

The unit of analysis in this study was a "country-year." We collected a sample of 3787 country-years by screening all countries between 1993 and 2015. The sample was chosen for this duration, because it included nearly all data on the variables of interest and the covariates.

This study defined depressive disorders as any mood disorder that causes a persistent feeling of sadness, loss of interest and feelings of guilt, or low self-worth. This study measured the prevalence of depressive disorders using the Global Burden of Disease Study (GBD). International trade was defined as the sum of exports and imports of goods and services measured as a share of gross domestic product (% of GDP). We sourced this data from the World Bank.

A list of covariates, including economic development, economic growth, and population size, was also considered. First, the literature review indicated a positive correlation between a country's economic development and an epidemic of depression (Hidaka 2012). Thus, we used a natural logarithm form of GDP per capita capturing economic development. Second, the impact of the economic crisis on the prevalence rates of major depression has been reported to be pervasive (Economou et al. 2013). We used the World Bank's data on annual per capita GDP growth as a measure of the population's economic situation. Finally, the total population reflects the potential market size of the country, commonly used as an international labor migration determinant, i.e., the larger the population in the destination country, the larger is the labor market for immigrants (Lewer and Van den Berg 2008). Based on the findings from import competition in the prevalence of major depression (Lang et al. 2019), we considered this effect using a continuous variable for a country's population size defined as the mid-year population in millions.

Our three moderator variables were measured as follows. First, the study used the Polity IV Project as the main source of dictatorship measures. A dictatorship was defined as follows: when the chief executive is chosen in a regularized process of selection within the political elite and, once in office, the autocrat exercises power with few institutional constraints. The Polity IV data series scale regimes from − 10 to + 10, and we identified dictatorships as regimes with scores lower than 6 (< 6). We tested if the expected relation existed only for democratic countries using subgroup analysis. Second, media freedom was defined as the degree to which a country allowed the free flow of news and information. This research measured media freedom using the freedom of the press index of Freedom House. This index assesses the degree of print, broadcast, and internet freedom in every country, analyzing the events of each calendar year. For the present research, the index was rescaled into a range of 0–100: A score of "0" indicated least free, whereas "100," most free. Finally, we calculated a country's capital–labor ratio of endowments, dividing the gross capital formation consisting of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories by the total labor force composed of people aged 15 years and older who supply labor for the production of goods and services. The data were collected from the International Labour Organization. To confirm our arguments, two interaction terms were computed: "trade × media freedom" and "trade × capital–labor ratio of endowments." Table S1 in the Supplemental Material summarizes the variables, operationalization of the indicators, and data sources.

The study used panel data and applied fixed effects regression models based on the results of the Hausman test. The fixed effects model helps in the consideration of unobserved characteristics unique to entities that may bias the predictor and the outcomes. For example, scholars associate the variation in the prevalence of major depressive episode with latitude gradients (Patten et al. 2017), a time-invariant characteristic specific to each country. We used cluster-adjusted standard error, where the estimated variance of the parameters increased when the observations were in the same cluster, thereby accounting for within-cluster correlation.

Results

Figure 1 reveals a negative correlation between international trade and the prevalence of depressive disorders between 1993 and 2015. A 100% point increase in the value of international trade (% of GDP) indicated a 0.09% point decrease in the prevalence of depressive disorders (%) (− 0.09, confidence interval [CI] − 0.01 to − 0.18). Our theoretical expectations were also confirmed by the four additional controls: democratic countries, media freedom, a country's capital–labor ratio of endowments, and armed conflict (− 0.09, CI − 0.003 to − 0.17, model 2 of Table S2, Supplemental Material). The effect of trade on the prevalence of depressive disorders slightly declined by 0.004% points, indicating the minimal confounding effects of the four controls. Furthermore, the study restricted the samples to high- and mid-latitude countries, to account for the possibility of high and middle latitudes creating an enabling environment for depression—for example, low sunlight exposure has been associated with vitamin D deficiency—which can offset the influence of trade.

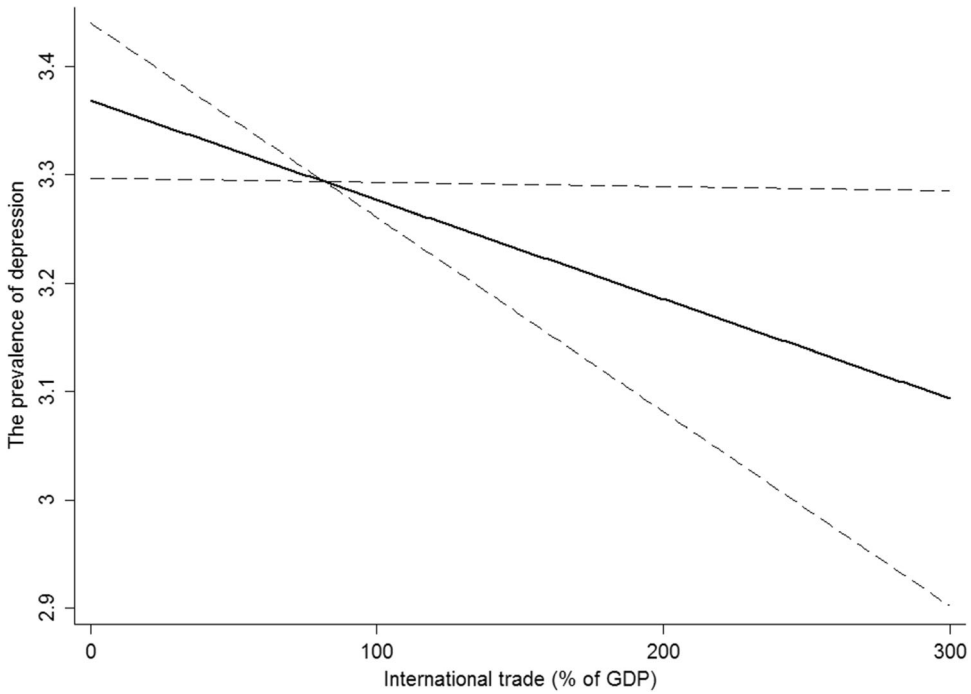

Fig. 1 Effects of International Trade on the Prevalence of Depression, 1993–2015. Linear prediction: − 0.09**, CI − 0.01 to − 0.18; *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$. GDP: gross domestic product, defined as the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. All results were based on panel data analysis with country and time fixed effects. Results correspond to model 1 of Table S2, Supplementary Material Source: the author

However, the results remained stable (− 0.12, CI − 0.02 to − 0.22, model 3 of Table S2, Supplemental Material). Finally, the results held even after an instrumental variable was used (− 0.90, CI − 0.30 to − 1.51, Figure S1, Supplemental Material).

Figure 2 shows that trade negatively related to the prevalence of depression only when the country ensured a democratic status to some extent. For example, the two regression lines displayed distinct slopes: one line was relatively flat and decreasing with international trade but its slope coefficient could not reach statistical significance (autocracies: − 0.02, CI − 0.11 to 0.07), whereas the other line exhibited a much steeper slope of − 0.15 (democracies: − 0.15, CI − 0.03 to − 0.28). After conducting robustness tests, we found that the correlation between the two variables became more negative when raising the threshold for the determinant of democracies as those with Polity IV scores from 6 to 10 (e.g., at 8: − 0.17, CI − 0.04 to − 0.30; at 10: − 0.22, CI − 0.07 to − 0.37, Figure S2, Supplemental Material). By contrast, the slope coefficient remained not statistically significant when an alternative threshold that identified autocracies was chosen (e.g., at 1: − 0.02, CI − 0.14 to 0.10, Figure S2, Supplemental Material). Finally, the results held even after a new dataset on regime type (Bjørnskov and Rode 2020) was used as an alternative to Polity IV data (democracies: − 0.16, CI − 0.04 to − 0.28; autocracies: − 0.02, CI − 0.11 to 0.06, Figure S3, Supplemental Material).

Figure 3 presents a negative linear relationship between the two variables when the governments allowed the media more freedom. For example, a line with a negative slope of 0.31 with media freedom at 100 (− 0.31, CI − 0.17 to − 0.45) dropped to 0.10 with media freedom at 50 (− 0.10, CI − 0.04 to − 0.17). However, when media freedom reached 0, the line was instead increasing with trade, but its slope coefficient did not reach statistical significance (0.10, CI − 0.03 to 0.24). The test for robustness confirmed that the negative linear relationship existed only for countries with greater freedom of the press when this study used an alternative index of media freedom from a practitioners' view, namely, the Press Freedom Index published by Reporters without Borders, in which media professionals, instead of local researchers, rate the countries (media control score of 0: − 0.08, CI − 0.01 to − 0.14, Figure S4, Supplemental Material).

Figure 4 shows the effect of trade on the prevalence of depressive disorders to be conditional on a country's capital–labor ratio of endowments. That is, the higher the capital–labor ratio of endowments (50,000), the more prevalent the effect (− 0.22, CI − 0.08 to − 0.35), compared with its counterpart (10,000, − 0.09, CI − 0.01 to − 0.16). Based on the Heckscher–Ohlin model, a labor–abundant country increases output of the good that uses that labor intensively and, thus, exports labor-intensive goods. Our study used data from the United Nations Conference on Trade and Development to calculate the percentage of labor- and resource-intensive manufacturing exports as an alternative measure of a country's factor endowments. We found that top countries exporting labor- and resource-intensive manufactures tended to decrease or

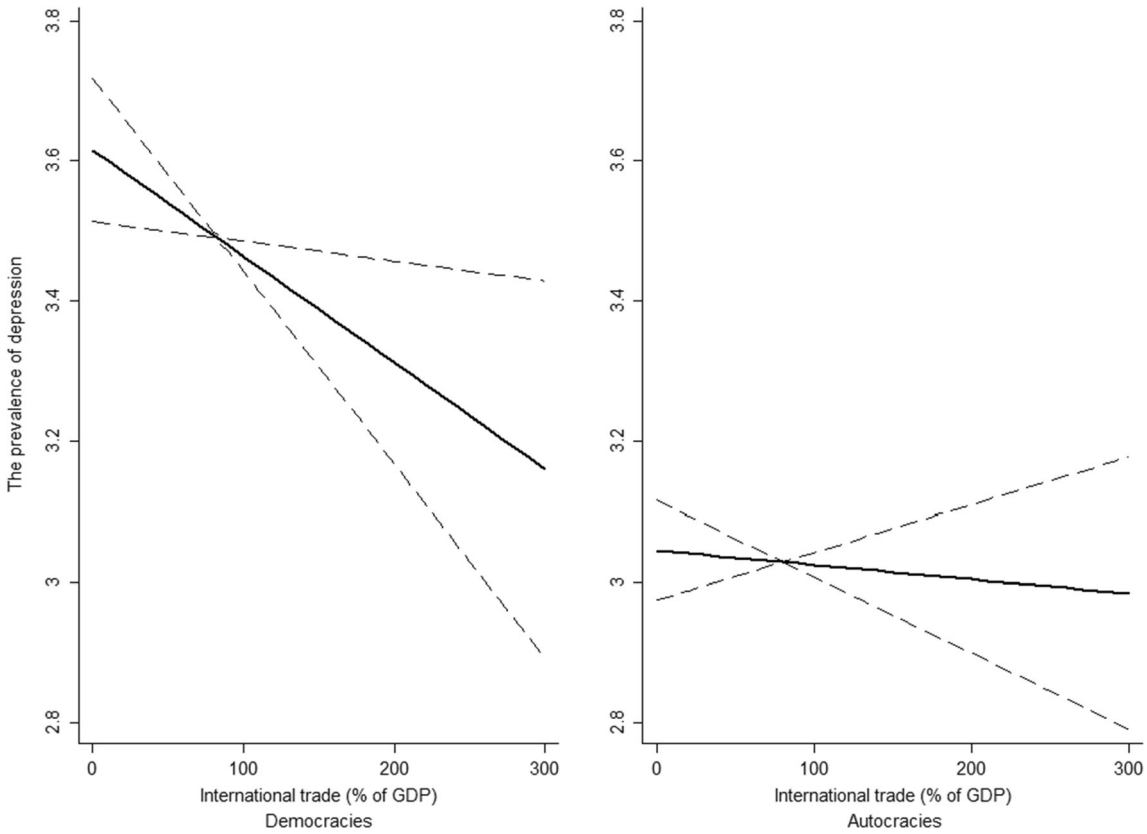

Fig. 2 Effects of International Trade on the Prevalence of Depression in Democracies and Non-democracies, 1993–2015. Linear prediction (democracies): − 0.15**, CI − 0.03 to − 0.28; linear prediction (non-democracies): − 0.02, CI − 0.11 to 0.07; *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$. GDP: gross domestic product, defined as the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. All results were based on panel data analysis with country and time fixed effects. Results illustrated in left and right panel correspond to model 1 and 2 of Table S3, Supplementary Material Source: the author

even reverse the effect of trade on the decreasing prevalence of depression (e.g., at 5%: − 0.10, CI − 0.01 to − 0.19; at 80%: 0.27, CI 0.02–0.52, Figure S5, Supplemental Material).

Discussion

This study investigated the relationship between a country's level of international trade and its prevalence of depressive disorders, adjusted for country-level covariates. We hypothesized that: (1) the prevalence of depressive problems would decline as the level of international trade increases; (2) a negative linear relationship would exist only for democratic countries; (3) a negative linear relationship would exist when the governments allow the media more freedom; and (4) the effect would be more prevalent in a country with higher capital–labor ratio of endowments. These hypotheses were supported by our findings.

Mental health has been causally linked with poverty and deprivation, income inequality, occupational stress, food insecurity, and environmental problems, all of which are likely to be affected by global trade (Corrigall et al. 2008). We add to this literature by linking these risk factors to three aspects of analysis, showing that trade market effects are mediated by the extent to which people's voices are heard (regime types), access to information (media freedom), and a nation's position in the global supply chain (factor endowments).

First, democracy reduces the likelihood of lack of political participation on a large scale that may increase depression through the suppression of people's rights, hopes, and aspirations (Safaei 2006); and increases the representation of the least advantaged members of society (Wigley and Akkoyunlu-Wigley 2011). Our study, too, by arguing that democracy is essentially a contentious process of voicing political opinions, especially for "losers" in international trade, contributes to the evidence on the influence of trade on mental health advantage. For example, the effect of trade on the decreasing trend of

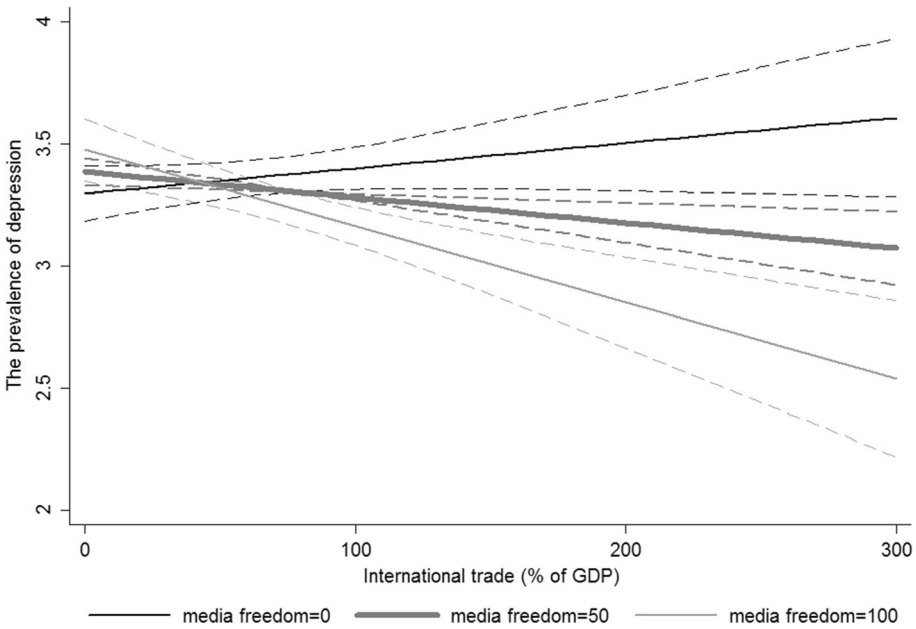

Fig. 3 Effects of International Trade on the Prevalence of Depression Are Moderated by Media Freedom, 1993–2015. Linear prediction (media freedom = 0): 0.10, CI − 0.03 to 0.24; linear prediction (media freedom = 50): − 0.10***, CI − 0.04 to − 0.17; linear prediction (media freedom = 100): − 0.31***, CI − 0.17 to − 0.45; *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$. GDP: gross domestic product, defined as the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. All results were based on panel data analysis with country and time fixed effects. Results correspond to model 1 of Table S4, Supplementary Material. Source: the author

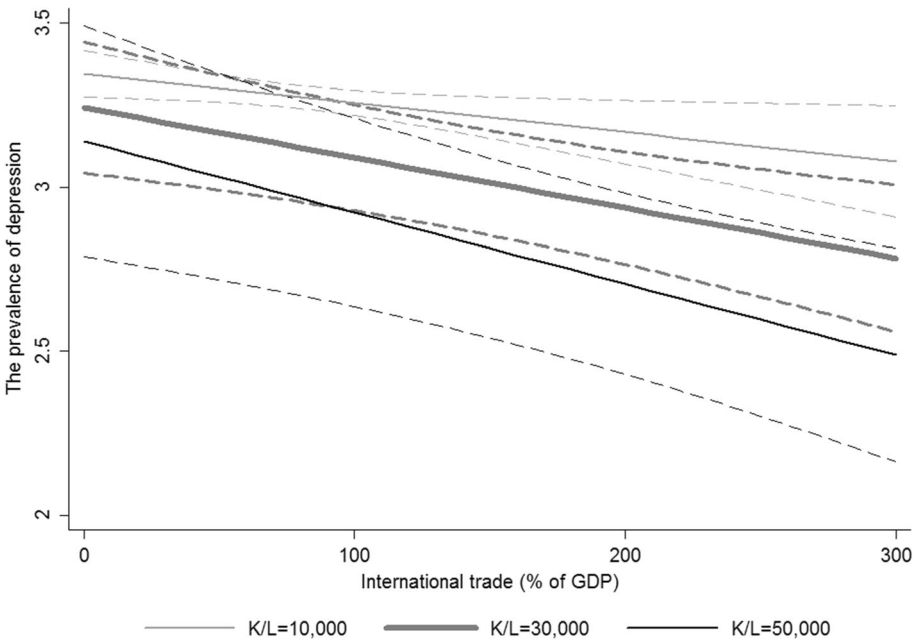

Fig. 4 Capital-labour Ratio Increases the Marginal Effect of International Trade on the Decreasing Prevalence of Depression, 1993–2015. *K/L* capital-labour ratio; linear prediction (K/L = 10,000): − 0.09**, CI − 0.01 to − 0.16; linear prediction (K/L = 30,000): − 0.15***, CI − 0.06 to − 0.25; linear prediction (K/L = 50,000): − 0.22***, CI − 0.08 to − 0.35; *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$. GDP: gross domestic product, defined as the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. All results were based on panel data analysis with country and time fixed effects. Results correspond to model 2 of Table S4, Supplementary Material. Source: the author

depression increased by 0.06% points in democracies, compared to all countries. However, democracy had no significant impact on the prevalence of depressive disorders, consistent with the finding on a weak empirical link between democracy and mental health (Wise and Sainsbury 2007).

Second, media freedom has pronounced effects on mental health. We proposed that a free media is an effective mechanism for delivering health information, thus alleviating mental health risks among consumers. Our results showed the effect of trade on the decreasing trend of depression in countries with higher levels of media freedom (− 0.31 for media freedom at 100), to be stronger than the results for democracies (− 0.15), or all countries (− 0.09). These findings suggest that we should account for the unique characteristics of each democracy, instead of treating democracy as a single and ideal form for achieving optimal health.

Third, import competition worsens workers' labor market conditions, such as an increase in the probability of job displacement, lower wage growth, and reduced job satisfaction, which may exacerbate individuals' mental distress (Adda and Fawaz 2019; Colantone et al. 2019; Lang et al. 2019). Import competition leads to mental health inequality across and within industries. Colantone et al. (2019) showed import competition disproportionately affecting specific groups of workers in an industry in the form of short job tenures, temporary contracts, and blue-collar or tradable jobs. Adda and Fawaz (2019) found that the effects of import competition on health are more specific to those areas, where manufacturing jobs are more routine oriented. By contrast, we presented the detrimental effects of trade on mental illness in labor-abundant economies, arguing that intense competition to attract foreign investment leads the governments to lower regulatory controls, associated with an increased risk of mental disorders. Our results complement new literature that has been looking at the impact of global trade on mental health.

We also found a positive correlation between a country's GDP per capita and the prevalence of depression: an increase in the natural log form of GDP per capita by 1 indicated a 0.09% point increase in the prevalence of depressive disorders (0.09, CI 0.01–0.17), indicating depression as a disease of modernity (Hidaka 2012). The result for democratic countries, however, was not statistically significant. A possible explanation is that most of the economically developed countries are democracies, which reduced the impact on the increasing trend of depression. Furthermore, population size had a negative effect on combating depression in high- and mid-latitude countries representing the economically developed societies: population increase by ten million resulted in a 0.03% point increase in the prevalence of depressive disorders (0.03, CI 0.01–0.06). However, we found no statistically significant relationship on analyzing all countries. This suggests that import competition depends not only on the potential market size but also on the labor incomes of destination countries (Lewer and Van den Berg 2008).

The study examined how international trade, democracy, and freedom relate to mental health. One implication is that in states in the Global South that establish flawed democracies, control the media, or rely on labor-intensive industries, the positive effect of trade on decreasing the prevalence of depression is lower. First, for states with flawed democracies, direct means of state access through politicians and civil servants tend to be impeded, and democratic mobilization through social movements is absent (Piper and von Lieres 2015). Thus, elected representatives are unlikely to heed public opinion and social interests. Second, the development of digital technology in these economies has enhanced efficiency in manufacturing industries and set up an intellectual property rights regime (Kshetri 2017). Digital connectivity, though, can be used by governments to control the flow of news and information (Deibert 2015). Third, labor-intensive industries use a vast amount of unskilled labor, thus making it possible for agglomerations in less-developed countries to operate as satellite outposts of agglomerations in more-developed countries, the former often marked by inferior working conditions and severe environmental problems (Giljum and Eisenmenger 2004; Scott 2006). As hypothesized, the three structural problems that countries in the Global South generally contend with reduced the benefits from international trade and led to the so-called trade curse.

Another implication relates to the backlashes against free trade. The rise of trade protectionism in Western Europe is because of a stronger import shock that has lead so-called "losers" of globalization to vote for radical-right parties with strong protectionist stances (Colantone and Stanig 2018). In the US, the high salience of offshoring, which reflects growth in competitive pressures from globalization and results in a sentiment towards protectionism, has influenced more legislators to vote against free trade (Owen and Notes 2017). Our findings suggest that an opposition to free trade may bring about adverse mental health outcomes. Hence, we should favor free trade under some specific conditions as appropriate redistribution policies aimed at compensating the losers of globalization. It is likely to be achieved in the context of democracies that facilitate representation in the structures of government (Figures S6 and S7, Supplemental Material).

This study has a number of limitations. First, countries were observed over a relatively short period, and not all countries were included, whereas more cases are required for causal inference. The use of GBD, World Bank, and other sources of data allowed us to analyze 170 countries

for the given period. Second, we used only one measure from the GBD study due to the absence of other consistent and comprehensive datasets on depression. The GBD is not without its critics. Despite its advancements in 2017, the data still reflects a degree of incompleteness and methodological limitations, which will bias the results. In future research, we could test the validity of proposed arguments when more complete prevalence data become available in low- and middle-income regions. Third, the operationalization of variables was limited by the absence of established standards. For example, the threshold for the determinant of democracies may be arbitrary. Furthermore, measuring a country's capital–labor ratio of endowments may not ensure that a country will produce and export the specific good that exploits the country's abundant factor. However, our results remained robust to the change in the threshold or use of the percentage of labor-intensive exports as alternative measures. Fourth, despite tests of other mechanisms (Figures S6–S9, Supplemental Material), no data exist for unpacking the pathway underlying how a free media would influence the extent to which people understand health information, thus reducing trade-related food insecurity and poor mental health. In future research, we could test theoretical expectations when data become available. Fifth, it is possible that individual-level mechanisms, such as consumption habits, individual religious beliefs and practices, and access to education and health, may be a source of bias in our results. In future research, cross-national population health surveys and hierarchical regression could examine the interaction between variables at the individual and national levels. Finally, we need to consider a more sophisticated causal pathway. For example, a capital-abundant country, owing to scarce labor resources, may pay closer attention to the health status of its labor force, thereby increasing health expenditure that can alleviate the risk of poor mental health from trade. Thus, a theoretical and empirical analysis of the combined causality could be explored.

At least two policy implications warrant consideration. First, efforts to guide governments to decrease the prevalence of depressive disorders could start with an increase in their respective country's international trade. Second, reducing prevalence through trade might be more effective if the use of such strategies is conditional on a country's democratic status, media freedom, or capital–labor ratio of endowments. If states in the Global South can establish mature democracies, loosen control over the media, and develop capital-intensive industries and exports through a skilled human resource base in attracting investment, the positive effects of trade on decreasing the prevalence of depression will be more prevalent.

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Availability of data and materials The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Compliance with ethical standards

Conflict of interest We declare no competing interests.

Ethics approval and consent to participate Our data were not collected from human subjects and, thus, ethics approval is not required for this paper.

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