World Development 183 (2024) 106712

Contents lists available at ScienceDirect

World Development

journal homepage: www.elsevier.com/locate/worlddev

Regular Research Article

Women's empowerment and child mortality☆

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ARTICLE INFO

Keywords:
Women's rights
Empowerment
Health
Child mortality
Banking
Institutions

ABSTRACT

This paper investigates the nexus between women's empowerment and child health, in particular examining whether having more rights, and which rights, leads to improvements in the well-being of children, as reflected by child mortality rates. We distinguish between civil rights, political rights, and economic rights. In our sample of 134 countries over the period 1950–2018, and employing 27 separate rights-based measures of empowerment, women's empowerment commonly contributes to a reduction in child mortality in high-income countries, however, low- and middle-income countries reveal striking differences across some measures. For example, while women's participation in public administration or employment in the public sector is associated with reduced child mortality, the opposite is observed for the right to run a business and access to banking. Results suggest that strong institutions are needed to ensure rights are translated into better welfare.

1. Introduction

Gender inequality is one of the root causes of child mortality (UN, 2014). Women's empowerment is often heralded as a core development objective and as the key to improving outcomes for the next generation, since women's resources and opportunities shape those of their children (Duflo, 2003; Holland & Rammohan, 2019; Jones et al., 2019; World Bank, 2011). Promotion of gender equality is therefore seen as a potent means of improving human development in poorer countries, and in particular, it is expected that empowering women should increase investment in children.

This paper examines the relation between women's empowerment and child mortality, specifically focusing on rights women have and on the ability to effectively use those rights. Recognizing that women's empowerment is often conceptualized as a process (Kabeer, 1999; Thorpe et al., 2016),[1] we investigate whether empowerment leads to a reduction in child mortality. While some evidence is suggestive of this (Besnier, 2020; Doku et al., 2020), the opposite may occur if, for example, the right to work, combined with poverty and lack of institutional support, forces women to spend less time on childcare (Makhlouf et al., 2017; Miller & Urdinola, 2010). In this paper we cover, in a unified fashion, several dimensions of empowerment, distinguishing between rights, their realizations, and socio-economic contexts of empowerment and by doing so aim to show where a particular 'dimension of empowerment' is enough on its own or where further support from policymakers is required.

We focus on civil, political and economic rights and freedoms, covering legal protection and property rights, rights to work and earn money, and political participation rights, among others.[2] These rights are less commonly linked with health when compared to education and access to medical care (Khazen & Guttman, 2021; Sandiford et al., 1995).[3] However, Burroway (2015) draws attention to land and property rights of women in low- and middle-income countries (LMIC),

☆ We thank Elena Shadrina, Martyna Śliwa, and the discussants and participants at the Essex Finance Centre (EFiC) 2023 Conference in Banking and Corporate Finance, HSE-Perm research seminar, and Royal Economic Society 2023 Annual Conference for their valuable comments. Dmitri V. Vinogradov acknowledges financial support from the Leverhulme Trust (grant RF-2020-581).

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[1] Section 2 provides a discussion of our theoretical framework.

[2] This classification follows the International Covenant on Economic, Social and Cultural Rights (United Nations, 1966b), the Universal Declaration of Human Rights (United Nations, 1948), and the International Covenant on Civil and Political Rights (United Nations, 1966a).

[3] In robustness checks, estimations include an index of health equality and measures for the use of safely managed drinking water services, use of safely managed sanitation services, births attended by skilled health staff, availability of hospital beds, child polio immunization, and breastfeeding of children.

https://doi.org/10.1016/j.worlddev.2024.106712
Accepted 1 July 2024
Available online 27 August 2024

using a cross-sectional approach to show these negatively correlate with child mortality; relatedly, in Allendorf (2007) land rights lead to women's empowerment and child health improvement in Nepal. Our objective is to examine whether a wide variety of women's rights and their realizations help improve child health, and to what extent this relates to the socio-economic context. Of course, a focus on women's rights is not new (e.g., Chaudhuri, 2013; Heaton, 2015; Koenen et al., 2006), with the literature showing *some* measures of women's empowerment may help improve child health. However, existing studies are to an extent disjoint, using different measures or indexes on non-overlapping sets of countries (the focus is usually on LMIC but country samples vary) and on cross-sectional or short time periods.[4] Moreover, studies like Jones et al. (2019), Makhlouf et al. (2017), Sha'ban et al. (2020), and Tait et al. (2020) imply the impact of institutions, rights and various measures of empowerment on child health may be contingent on the socio-economic context. The above heterogeneity of samples, variation in measurements and short-term perspective impede obtaining an overarching perspective on the role the empowerment of women plays at different levels of development, and which measures are most important for child health.

To offer such a perspective, we focus on both rights (declared) and their realizations (attained) — considering in a disaggregated manner a wide range of rights for a sample of 134 countries over almost seventy post-WWII years. For empowerment measures, we use data from the World Development Indicators (WDI) and the Varieties of Democracy project (V-Dem; VDEM, 2019); extending Besnier (2020), we employ, on top of the aggregate index of political empowerment, four additional indexes for the dimensions of social, political and economic empowerment of women, as well as 22 underlying measures of empowerment. We then estimate – separately for each of these measures and controlling for standard demographic and macroeconomic factors and political regime, as well as urbanization, health equality, political corruption, and conflict – the association these measures of empowerment have with child health. The latter is measured by the under-5 mortality rate from the global database of the UN Inter-Agency Group for Child Mortality Estimation (UNIGME; Makhlouf et al., 2017; You et al., 2010).

Through the above approach we obtain a common set of variables for a large sample of countries, enabling the split of the sample into LMIC and high-income countries (HIC), to address our hypothesized moderating role of socio-economic contexts.[5] To the best of our knowledge, this is the first systematic comparison of the impact of women's empowerment measures across these subsamples. We make a further contribution by extending the sample period back to 1950, while other panel studies mainly start at 1990.[6] Focusing on such a long period is important because the post-WWII period was crucial in terms of fostering women's empowerment (e.g., Carmichael et al. (2014) highlight the strong progress in reducing gender inequality over the past 60 years).

Our primary result is that many measures of women's empowerment are associated with a reduction in child mortality. This underscores the singular importance of empowerment for child health. However, it is critical that while this result typically holds for HIC,[7] the picture is more nuanced in the rest of the world. In LMIC, while improvements in women's political participation are often associated with a reduction in child mortality, some civil rights show either nil or a mortality-increasing association, and most economic rights are positively associated with child mortality (except for women's access to state jobs and business opportunities). The latter finding is consonant with concerns raised in Makhlouf et al. (2017) and Miller and Urdinola (2010) – the right to work, combined with economic hardship, long hours and consequent lack of childcare, may have an undesirable impact on child health; tellingly, it appears that having a state job, in contrast to working in the private sector, is free of this concern – such results emphasize the complex interaction between poverty and women's empowerment.

The disaggregated perspective we take is enlightening on two levels. First, the many different measures of empowerment, classified into three groups of rights, typically produce consistent results within each group. It usefully follows that heterogeneity of empowerment measures is limited and confined to broader differences between the identified larger groups of rights. This gives an overarching structure to previous disjoint findings that focused on some specific rights or aggregated indexes. Second, along with the more straightforward dimensions of empowerment – including better access to health services and education – political empowerment appears of crucial importance in reducing child mortality; the likely mechanism is the ability of women to promote and support policies that protect child health. In contrast, in LMIC, individual economic freedoms have an opposite impact, unless jobs and business opportunities are in the public sector. Taken as a whole, these observations emphasize the vital institutional role of the public sector as a transmission mechanism from women's empowerment to child health. This latter finding is novel and of crucial policy importance for LMIC.

The UN 2030 Agenda for Sustainable Development (UN, 2015) stresses both the reduction in child mortality and the empowerment of women, in particular through rights to economic resources. Presently, a shocking 5 million children per year die globally within a year after birth (UN, 2021), with infant mortality rates in developing countries being up to 50 times higher than in the developed world.[8] Ultimately, our study demonstrates the empowerment of women goes hand in hand with the reduction of poverty and strengthening of institutions, when targeting vitally needed benefits for children and their health.

The rest of the paper is set out as follows. Section 2 further discusses the extant literature and, in that context, provides the hypotheses to be tested. Section 3 presents the data and methods, while Section 4 provides the empirical results and their interpretation. Finally, Section 5 concludes.

2. Literature review and hypotheses development

2.1. Women's empowerment and child health

Both women and men can contribute to the upbringing and, consequently, the well-being of children. Men can play a significant role in the decision to have children (Goldscheider & Kaufman, 1996; Prata et al., 2009; Rasch & Lyaruu, 2005), determining the approach to child-raising – including the decision to breast-feed (Earle, 2000; Stremler & Lovera, 2004) – and maternal healthcare (Craymah et al., 2017; Kakaire et al., 2011).[9] While we recognize that in many families children are raised by women only or by men only, on average, studies indicate the role of men is typically subordinate to that played by women.

A large and growing body of evidence suggests that women place a relatively greater weight on child welfare, as well as on the provision of public goods needed for child health and compliance with public health measures (Doepke & Tertilt, 2009; Duflo, 2003; Moaddel et al., 2021; Rink & Barros, 2021). Gender socialization theory emphasizes, *inter alia*, that women are raised to be more caring of others and of their

[4] For a review, see Pratley (2016).

[5] The classification into LMIC and HIC is provided by the World Bank. For more details, see Section 3 and Appendix B.

[6] Exceptions include Hornset and de Soysa (2022) which employs data from 1960.

[7] Although there are exceptions, for example, labor force participation.

[8] World Bank estimates for 2019 give infant mortality of 1.7 and 2.0 per 1,000 in San Marino and Iceland, respectively, whereby the worst rates of 117 and 117.2 per 1,000 are reported for Somalia and Nigeria.

[9] See Daniele (2021), Earle and Hadley (2018), Thapa and Niehof (2013), and Xue et al. (2018) for a comprehensive review.

Table 1
Impact of women's empowerment through civil, political and economic rights on child health.

	Improves child health	Deteriorates child health
Civil rights	• increased bargaining power • increased autonomy	• reduced male participation in birth and health issues
Political rights: civil society	• voice to promote allocation of resources • increased agency	
Political rights: public administration	• authority to allocate resources • role model • altering social norms/perceptions of women	
Economic rights	• control over material resources • increase in family resources • institutional support	• work-childcare tradeoff • lack of institutional support

children in particular. In Shohel et al. (2021) respondents justified the gendered distribution of household roles by being socialized with these gender norms and roles since childhood; moreover, they indicated they continue to practice such socialization with their children, thus such norms appear intergenerationally engraved. As a consequence, from a global perspective, men devote on average less time to childcare than women (Greig, 2009), although in countries that have adopted father-friendly policies, such as paid paternity leave, they may spend relatively more time caring for their children (Smith, 2001).

Given the outsized role women play in child-rearing and that women's and mothers' voices are often silenced (Zhao & Basnyat, 2021), it appears that women's empowerment will likely affect child health. The most widely accepted and overarching definition of empowerment views it as "the process by which those who have been denied the ability to make strategic life choices acquire such an ability" (Kabeer, 1999). Empowerment then is measured along the dimensions of resources (access to and future claims on them), agency (ability to define goals and act upon them), and achievements (well-being outcomes). Along with this, Pratley (2016) highlights the distinction between agency as ability to exert power to pursue and achieve objectives, and autonomy as the ability to make decisions free of control from others. Our primary focus is on rights women have and potentially use. While other factors, such as social norms, traditions and peer pressure, may hamper empowerment, rights are one aspect that can be legislatively changed. As discussed in the introduction, the link between child health and maternal education and health has been extensively investigated in the extant literature. While these represent the achievements empowerment may attain (Kabeer, 1999), they equally become resources to enable agency and attain further achievements (Thorpe et al., 2016). In our framework, achievements are represented by the well-being of children. As stressed by Kabeer (1999), the achievements dimension, especially with respect to achievements in areas that cannot be seen as a matter of choice (and, in our view, child health is one such area), is indispensable for the measurement and understanding of women's empowerment itself. The rights we consider to a large extent cover the resources (e.g., access to banking, ability to open a business, access to state jobs) and agency (e.g., freedom of movement, participation in civil society and political domains) dimensions of empowerment. In this sense, our study contributes to both the understanding of the implications of resources and agency dimensions of women's empowerment for the well-being of children, and the comprehension of the interlinkage between resources, agency and achievements within the women's empowerment paradigm.

Below we overview civil, political, and economic rights, their realizations, and the socio-economic conditions under which these rights and their realizations may affect child well-being. Main conclusions arising from this theoretical discussion are then summarized in Table 1.

2.2. Civil rights

We follow the International Covenant on Civil and Political Rights (United Nations, 1966a, Part III, Articles 6-27), which provides a separation between the two groups of rights in its very title. Although it does not offer explicit definitions to distinguish between the two, its structure helps identify civil rights as those referring to the general life and safety of a human-being, in contrast to political rights, which refer to the human-being's relation to the political life and administration in their country (see Section 2.3). The right to life, liberty, security, movement, justice, dignity, privacy, protection of family, as well as freedom from forced labor, torture, cruel treatment, and discrimination are examples of civil rights (see Articles 6–17, 23–24 and 26–27 of the Covenant). In our study we focus, particularly, on women's freedom of domestic movement, freedom from forced labor, access to justice, and access to public services.

As well as directly protecting health of mothers and children, empowerment of women through these rights may be beneficial indirectly. One potential mechanism is via increased self-esteem and bargaining power (Burroway, 2015), with women's ability to negotiate better conditions for themselves and their children contributing to improved child well-being. This rests on the view, discussed in the previous section, that women are typically the primary care-takers and are more likely to invest resources in basic family needs (e.g., education, nutrition, and health). Using data for 75 LMIC for 2012, Burroway (2015) finds evidence that women's land and property rights are associated with lower child mortality. While we cover property rights in Section 2.4 as relevant for economic activity, the argument of enhanced agency (derived from improved self-esteem and bargaining power) likely applies to civil rights.

A consonant argument relies on women's autonomy, which would increase through greater mobility, access to justice, and freedom from forced labor. Koenen et al. (2006) show that greater social and economic autonomy contributes to child well-being in the U.S. However, in a poorer country context, Mullany et al. (2005) and Thapa and Niehof (2013) find that the greater autonomy for women reduced husbands' participation in birth and health issues, suggesting an ambiguous impact on child health. Moreover, socio-cultural norms may reduce husbands' involvement (Thapa & Niehof, 2013). Such evidence provides a *prima facie* rationale for why the nexus between women's empowerment and child mortality may differ across levels of socio-economic development.

2.3. Political rights

We classify rights covered by the International Covenant on Civil and Political Rights (United Nations, 1966a) as political if they do not fall under the definition of civil rights in Section 2.2. These include the

right to freedom of thought, conscience and religion, to hold opinions and have freedom of expression, to enter associations and have peaceful assemblies, to vote and be elected, and to take part in public affairs (Articles 18–22 and 25 of the Covenant). In what follows, we will distinguish between rights that refer to civil society participation, and those that refer to participation in political governance and public administration.

2.3.1 Civil society participation

Participation in civil society adds to women's agency (Sundström et al., 2017). Within this dimension we include female suffrage, freedom of discussion of political issues for women and women's representation in the print and broadcast media, women's ability to participate in civil society organizations (CSOs) and in the civil society overall, and women's civil liberties. The key mechanism through which women's empowerment in this context can aid child health is by drawing attention and resources to child well-being via, for example, voting for relevant programs and parties. Indeed, extant research offers evidence of public spending on health being driven by female voters' preferences (Koenen et al., 2006; Miller, 2008) and that there is a close association between women's empowerment and political knowledge (Bleck & Michelitch, 2018).

Other relevant work includes Boehmer and Williamson (1996), showing that the number of years women possess the right to vote is associated with a commensurate reduction in infant mortality rates for a sample of LMIC in 1990. Lott and Kenny (1999) find that women's right to vote led to larger government spending and revenue in the U.S.[10] Miller (2008) relates U.S. state-level women's suffrage laws introduced between 1869 and 1920 to shifts in the voting behavior of legislators, public health spending, and child mortality. This latter study stresses that the widening of suffrage brought the advances of the 19th century bacteriological revolution to children through immediate increases in public health spending and hygiene campaigns, leading to a significant fall in child mortality.

According to surveys of political attitudes, women are also more likely to support policies aimed at a reduction of gender inequities and improvements in social welfare (e.g., Gidengil, 1995; Pratto et al., 1997). These studies suggest women vote differently from men given (i) differences in risk aversion, which might imply women vote for insurance through government spending, (ii) differences in acquired skills, whereby women focus more on housekeeping and childcare, and need greater protection in case of a divorce, and (iii) differences in income, also dictating women might prefer greater protection provided by the state.

Aside from voting, attention to child well-being can be obtained by public discussion and other forms of activism. Doyle and Patel (2008) discuss the prominent role of civil society organizations in global health initiatives and in promoting health interventions. Specifically, CSOs give voice to the concerns of people who otherwise happen to be marginalized in the political process. Given women's emphasis on child well-being, greater participation of women in CSOs can lead to more attention and funding directed at improving child health. As for public discussion, Wigley and Akkoyunlu-Wigley (2017) examine the impact of democracy and media freedom on child mortality in 168 countries over the period 1961–2011. They highlight the importance of media freedom in ensuring a more efficient allocation of resources to those in need through addressing two potential sources of imperfect information — the information available to the government and that available to citizens. Following this line of argument, we suggest that a greater proportion of female journalists coupled with their emphasis on child well-being should lead to both government and public being better informed about the rationale for child health policy interventions and influence the willingness and ability of the government to provide resources, which in turn should result in improved child mortality rates.

2.3.2 Political governance and public administration

The political dimension of women's empowerment represents women's rights and participation in the political domain. Within this dimension we focus on such indicators as political power in hands of women, female heads of states and heads of government, lower chamber female legislators, lower chamber gender quota, and overall political participation of women. Much of the above argumentation on women's support of children-orientated policies applies if women are elected to government, law-making or public administration positions.

The extant research suggests increases in public spending on health may be driven by women legislators (Homan, 2017; Koenen et al., 2006; Quamruzzaman & Lange, 2016; Swiss et al., 2012). In particular, Quamruzzaman and Lange (2016) examine the impact of female political representation in national parliaments on child health, using a set of LMIC over the period 2003 to 2012. They explore whether female political representatives are more likely to support policies benefiting child health, as they (i) experience gender inequities and are more likely to support policies that empower women, and (ii) bear the primary childcare responsibilities and are more concerned about policies that, directly or indirectly, benefit child health. Employing individual-level survey data on infant death and measles vaccination, they find that female political representation (measured by the percentage of seats in national parliaments held by women) benefits child health.

Relatedly, Boehmer and Williamson (1996) find that the percentage of parliamentary seats held by women is negatively associated with the infant mortality rate for a sample of 96 less developed countries in 1990. Swiss et al. (2012) provide evidence, based on data from 102 developing countries from 1980 to 2005, that an increase in women's legislative representation improves child health, as measured by immunizations and child mortality rates. Likewise, Koenen et al. (2006) show that women's greater political participation (captured by an index including women's voter registration, women's voter turnout, women in elected office, and institutional resources available for women) is associated with a significantly lower percentage of low birthweight babies and lower teen birth rates (but not child mortality rates) in the U.S. in 2001. Homan (2017) finds that a higher proportion of women in state legislatures is associated with lower infant mortality rates in the U.S. from 1990 to 2012.

An additional channel for women in government and public administration to positively influence child health is through the role-model effect (Quamruzzaman & Lange, 2016), whereby examples of women in the public square inspire other women to pursue similar roles. Moreover, Beaman et al. (2009) discuss that exposure to women policymakers weakens stereotypes about gender roles in the public and domestic spheres. Both the 'confidence' and 'stereotype-weakening' effects can contribute to a greater role of women in public life and, consequently, to the allocation of more resources towards child welfare.

2.4. Economic rights

We identify economic rights as those related to economic interactions. Again, this approach relies on official classifications such as the International Covenant on Economic, Social and Cultural Rights (United Nations, 1966b, Part III, Articles 6–15). Our focus is on property rights, access to state jobs and state business opportunities, access to financial services, such as the ability to open a bank account, ability to register a business, and labor market participation.

The economic aspect of women's empowerment refers to women's control over material resources (Pratley, 2016). Economic rights act directly by expanding the opportunities to earn income, which would have a positive effect on child health (e.g., Koenen et al., 2006). However, the well-being impact of this income channel may be countermanded by the effects of parents spending less time with children. In particular, there may again be differential effects between LMIC and

[10] Incidentally, women's suffrage also encouraged members of the House of Representatives and the Senate to vote more liberally (Lott & Kenny, 1999).

HIC, with (on average) greater poverty and less institutional support in the former, dictating that women who can work spend relatively less time with their children. In a single-country setting, Miller and Urdinola (2010) find that increased coffee prices encouraged parents to work more, leaving them less time to spend on relatively time-expensive health activities such as observing good hygiene, traveling to (perhaps distant) medical facilities, and obtaining clean water.[11] In contrast and using multi-country approach, Quamruzzaman and Lange (2016) show that female labor force participation exerts a positive impact on child health.

This mixed empirical picture is likely a product of the complex environment of interrelationships affecting the economic rights-child health nexus. For example, larger extended families in LMIC may mute the countermanding effect. Likewise, Makhlouf et al. (2017) show countries with better institutions are able to ameliorate the impact of commodity price fluctuations on child mortality. Improved institutions are also shown to reduce male infant mortality in Pongou et al. (2017). On the other hand, the greater expense of professional childcare in HIC may dampen the income channel. In a poorer country context, a related strand of literature demonstrates the negative effects of having children on labor market outcomes, and in particular on careers, performance and earnings of women relative to men (Kleven et al., 2019, 2021; Lundborg et al., 2017). These observations stress the trade-off between career and childcare. Interestingly, analyzing survey data covering wage-employed and self-employed Americans, Gurley-Calvez et al. (2009) show that self-employed women work less and spend more time with children; the conclusion being that women are choosing self-employment to prioritize family over earnings.

2.5. Hypotheses

The previously discussed theoretical linkages between child health and women's empowerment through civil, political and economic rights are summarized in Table 1.[12] Our first hypothesis originates from the discussion in Section 2.1 that women place a greater weight on child health and welfare — specifically, we posit (**H1**): on average, women's empowerment is negatively associated with the child mortality rate. Alongside this, the overall discussion in Section 2 frequently stresses potential differences between LMIC and HIC, both economic and institutional. With this in mind, (**H1′**) is that the above association in LMIC is either less pronounced or reversed, relative to that in HIC. In particular, there may be less institutional support (e.g., provision of childcare) in LMIC.

Our following hypotheses deal with specific groups of rights and their realizations. For example, given the discussion in Section 2.2, the second hypothesis is posited as (**H2**): stronger civil rights for women are negatively associated with the child mortality rate. Again, (**H2′**), we anticipate a difference between LMIC and HIC: while the negative association is expected to be stronger in HIC, as, for example, there may be more male participation in birth and health issues, it may be weaker or reversed for LMIC, where socio-cultural norms or economic requirements may more readily prevent male partners' involvement.

Section 2.3 implies two hypotheses. First, (**H3**): stronger political rights for women, defined by their civil society participation, improve child health. Second, (**H4**): stronger political rights of women, defined by their participation in public administration and government, improve child health. To underline again the difference between the two groups in terms of underlying mechanisms: while civil society participation offers an opportunity to voice child welfare issues and exert pressure, actual participation in public administration gives the power to allocate resources, offering more direct influence.

Finally, Section 2.4 implies hypothesis (**H5**): on average, stronger economic rights reduce the child mortality rate. However, as with stronger civil rights, the association between stronger economic rights and child mortality is likely conditional on the level of development. Indeed, the countermanding impact of less parental time with children may even entirely outweigh any improvement in child health due to higher household income in LMIC, given greater poverty and less institutional support. In that case, we have (**H5′**) that stronger economic rights are positively associated with the child mortality rate in lower-income environments.

For convenience, the hypothesized associations of the rights and their realizations within each category are summarized in Table 2. As a preview, we also report here the estimated signs.[13] In brief, while women's empowerment measures are commonly associated with a reduction in child mortality in HIC, estimations also reveal some stark differences between LMIC and HIC in the directionality of estimated coefficients. Apart from directionality, our hypotheses also suggest differences in the magnitude of coefficients, which we present below in Section 4, along with the more detailed discussion of results.

3. Data and methods

Our key objective is to estimate the association between various measures of women's empowerment and the child mortality rate. For the dependent variable, the under-5 mortality rate is perhaps most commonly used series in the relevant literature (e.g., Makhlouf et al., 2017; Wigley, 2017) and we adopt the same practice. On the right-hand side, in addition to empowerment measures to which we return below, controls include frequently employed variables such as GDP per capita, education, and demographic factors such as share of population under 5, share of population over 65, and population density (see, inter alia, Makhlouf et al., 2017, and references therein). Note that we also include an electoral democracy (polyarchy) index as a control (see Hornset & de Soysa, 2022). These are used in our benchmark regressions but in later robustness checks we also consider other factors such as urbanization, a health equality index, and a political corruption index; these indexes help capture the quality of institutions beyond that reflected in the LMIC/HIC country divide. Moreover, we also later control for conflict using coups d'état, and over a shorter time period given data availability, for other controls proxying the access to and quality of healthcare and related services.

The empowerment measures are chosen to represent the earlier discussed dimensions of women's empowerment as comprehensively as possible, subject to the usual constraint of data availability. Several measures similar to ours have been used in the context of child mortality research earlier, while others have not been used so far.[14] For example, while Koenen et al. (2006) take account of access to certain public services such as medical care and education, and Boehmer and Williamson (1996) mention women's autonomy in general, civil rights (and especially those beyond access to health and education) have

[11] Indeed, Miller and Urdinola (2010) argue it is the relative price of health, rather than wealth, which is the more important determinant of mortality.

[12] The concepts in Table 1 are primarily theoretical and are drawn from the discussion in Sections 2.2 to 2.4. However, importantly these concepts align with our chosen empowerment measures. For example, in Table 1 we summarize that improved economic rights for women will potentially improve child health through control over material resources, increase in family resources and institutional support. These three concepts map on to measured empowerment variables including property rights, access to state jobs, and access to state business opportunities.

[13] Specifically, based on results presented later in Table 6 where control variables include GDP per capita, education, share of population under 5, share of population over 65, population density, electoral democracy (polyarchy) index, and conflict (i.e., coups d'état). We thank an anonymous reviewer for the suggestion of the latter two controls.

[14] For other approaches to measuring women's empowerment, see Mahmud et al. (2012) and Miedema et al. (2018).

Table 2
Determinants of under-5 mortality rate (expected vs estimated sign).

Measures of empowerment	Expected sign LMIC	Estimated sign LMIC	Expected sign HIC	Estimated sign HIC
Aggregate				
Women political empowerment **index**	−/+	×	−	−
Exclusion by gender **index**	+/−	+	+	+
Civil rights				
Freedom of domestic movement	−/+	+	−	−
Freedom from forced labor	−/+	×	−	−
Access to justice	−/+	+	−	−
Access to public services	−/+	−	−	−
Political rights: civil society				
Female suffrage	−	−	−	−
Freedom of discussion	−	+	−	x
CSO participation	−	×	−	−
Civil liberties	−	×	−	−
~ Female journalists	−	−	−	×
Civil society participation **index**	−	×	−	−
Political rights: public administration				
Political power	−	−	−	×
~ HOS female	−	−	−	×
~ HOG female	−	×	−	+
~ Lower chamber female legislators	−	−	−	×
~ Lower chamber gender quota	−	−	−	−
Political participation **index**	−	−	−	−
Economic rights				
Property rights	−/+	+	−	−
Access to state jobs	−/+	−	−	−
Access to state business opportunities	−/+	−	−	−
Access to banking	−/+	+	−	−
Ability to open business	−/+	+	−	−
~ Female labor force	−/+	+	−	×
~ Female labor force participation	−/+	+	−	+
~ Female to male labor force	−/+	+	−	+
Women Business & Law **index**	−/+	+	−	×

Notes: ~ – measure of a realization of the right; × – insignificant coefficient; aggregate indexes highlighted in bold. LMIC = low- and middle-income countries. HIC = high-income countries. Definitions of variables are in Appendix A. The list of countries in the LMIC and HIC subsamples is in Appendix B.

not been examined before. With respect to civil society participation, female suffrage was covered by Miller (2008) for the U.S. and Boehmer and Williamson (1996) and Swiss et al. (2012) for LMIC, while other measures we use have lacked attention. As for the participation of women in public administration, previous literature only studied the percentage of female legislators: Koenen et al. (2006) and Homan (2017) for the U.S., Quamruzzaman and Lange (2016) and Boehmer and Williamson (1996) for LMIC. Other measures that we use to represent this dimension of empowerment are new. Finally, out of economic rights we consider, only property rights (Burroway (2015) for LMIC), business ownership (Koenen et al. (2006) for the U.S.), and labor market participation (Koenen et al. (2006) for the U.S., and Boehmer and Williamson (1996) and Quamruzzaman and Lange (2016) for LMIC) have been previously touched upon. As far as we know, our approach results in the largest collection of women's empowerment measures employed in a study, and offers an opportunity to directly judge the similarity of impact of different measures within each class of rights, differences between classes, and across samples of different economic development. Appendix A provides more details about variables, definitions, and sources.

3.1. Data

Data are compiled from several sources. The under-5 mortality rate is obtained from the United Nations Inter-Agency Group for Child Mortality Estimation (UN IGME). Most women's empowerment measures come from the Varieties of Democracy (V-Dem) dataset (VDEM, 2019), with the exception of economic rights, where the majority of measures are from World Development Indicators (WDI), the primary World Bank collection of development indicators based on officially recognized international sources. Macroeconomic variables are from The Maddison Project Database, which offers long-term comparative economic growth and income level data. Population composition data are from the UN Population Division, whereas healthcare and related services data are from the World Health Organization and UNICEF.

The initial panel contains data on 194 countries, but to obtain a panel over the longest possible period (i.e.,1950–2018), our primary sample for analysis is reduced to 134 countries due to unavailability of some variables for some countries, particularly the under-5 mortality rate, GDP per capita, and education. This still obtains the largest panel employed to date to examine the child health–women's empowerment nexus.

Several of the hypotheses in Section 2.5 emphasize the level of economic development as a moderating influence on the association between women's empowerment and child mortality. To allow for this, we also create two subsamples: (i) low- and middle-income countries (LMIC) and (ii) high-income countries (HIC). The LMIC subsample includes 92 countries, whilst the HIC subsample includes 42 countries. The country list of the LMIC and HIC subsamples is provided in Appendix B. In later robustness tests, we also further disaggregate the LMIC into low-, lower-middle, and upper-middle income categories.

Summary statistics for all variables are reported in Table 3 for the full sample, as well as separately for the LMIC and HIC subsamples. The two key aggregate measures of empowerment are the women political empowerment index (takes a higher value if women have the same civil liberties as men, are not prevented from participation in civil society organizations, and are represented in formal political positions) and exclusion by gender index (takes a higher value if women, because of their gender, lack access to public services, state jobs, state business opportunities, if men dominate in political power, and if women do not enjoy same civil liberties as men). The latter variable thus clearly captures a broader spectrum of activities beyond political life. Both range from 0 to 1, and in our sample take the mean values of 0.61 and 0.44, respectively.

Table 3
Summary statistics.

	Full sample					LMIC subsample					HIC subsample				
	Obs	Mean	S.D.	Min	Max	Obs	Mean	S.D.	Min	Max	Obs	Mean	S.D.	Min	Max
Dependent variable															
Under-5 mortality rate	7797	86.40	84.84	2.04	420.56	5206	117.29	86.65	3.42	420.56	2591	24.33	28.38	2.04	309.26
Aggregate															
Women political empowerment **index**	7672	0.61	0.23	0.04	0.98	5147	0.53	0.21	0.04	0.96	2525	0.77	0.18	0.10	0.98
Exclusion by gender **index**	7797	0.44	0.28	0.02	0.98	5206	0.55	0.24	0.04	0.98	2591	0.23	0.21	0.02	0.98
Civil rights															
Freedom of domestic movement	7797	0.72	1.27	−4.72	2.52	5206	0.35	1.20	−4.72	2.52	2591	1.45	1.05	−3.57	2.51
Freedom from forced labor	7797	0.81	1.07	−4.30	3.00	5206	0.47	1.01	−4.30	2.78	2591	1.48	0.85	−2.27	3.00
Access to justice	7797	0.50	1.42	−4.06	3.47	5206	−0.13	1.04	−4.06	2.81	2591	1.75	1.24	−2.16	3.47
Access to public services	7734	0.28	1.36	−3.00	2.90	5143	−0.35	1.09	−3.00	2.54	2591	1.53	0.92	−1.62	2.90
Political rights: civil society															
Female suffrage	7797	84.38	35.43	0.00	100.00	5206	79.94	39.13	0.00	100.00	2591	93.30	24.12	0.00	100.00
Freedom of discussion	7797	0.47	1.52	−3.46	3.32	5206	−0.08	1.31	−3.46	3.32	2591	1.56	1.30	−2.52	3.27
CSO participation	7797	0.79	1.08	−3.01	2.52	5206	0.51	1.07	−3.01	2.40	2591	1.34	0.86	−1.53	2.52
Civil liberties	7797	0.77	1.22	−2.87	3.26	5206	0.40	1.09	−2.87	3.26	2591	1.51	1.13	−2.87	3.13
~ Female journalists	7794	27.86	13.86	1.25	72.38	5203	26.43	14.20	1.25	72.38	2591	30.72	12.70	7.00	67.17
Civil society participation **index**	7797	0.59	0.25	0.02	0.96	5206	0.52	0.24	0.02	0.96	2591	0.72	0.20	0.09	0.95
Political rights: public administration															
Political power	7797	0.47	1.23	−2.84	3.54	5206	0.13	1.10	−2.66	3.15	2591	1.15	1.18	−2.84	3.54
~ HOS female	7743	0.05	0.22	0.00	1.00	5206	0.02	0.13	0.00	1.00	2537	0.12	0.33	0.00	1.00
~ HOG female	4528	0.04	0.19	0.00	1.00	2530	0.03	0.18	0.00	1.00	1998	0.05	0.21	0.00	1.00
~ Lower chamber female legislators	6938	11.47	10.74	0.00	63.75	4458	10.19	10.08	0.00	63.75	2480	13.76	11.49	0.00	47.62
~ Lower chamber gender quota	7797	0.31	0.96	0.00	4.00	5206	0.40	1.09	0.00	4.00	2591	0.12	0.56	0.00	4.00
Political participation **index**	7672	0.64	0.28	0.05	1.00	5147	0.57	0.27	0.06	1.00	2525	0.77	0.23	0.05	1.00
Economic rights															
Property rights	7797	0.75	1.34	−3.82	2.86	5206	0.29	1.24	−3.82	2.63	2591	1.69	0.99	−2.28	2.86
Access to state jobs	7714	0.77	1.26	−2.92	3.42	5143	0.35	1.11	−2.92	3.12	2571	1.63	1.10	−2.38	3.42
Access to state business opportunities	7698	0.33	1.32	−2.91	3.08	5186	−0.17	1.14	−2.91	2.73	2512	1.35	1.04	−2.10	3.08
Access to banking	6111	0.89	0.32	0.00	1.00	4161	0.84	0.37	0.00	1.00	1950	0.98	0.14	0.00	1.00
Ability to open business	6111	0.91	0.29	0.00	1.00	4161	0.88	0.33	0.00	1.00	1950	0.98	0.14	0.00	1.00
~ Female labor force	3817	51.83	16.84	8.03	90.77	2638	52.05	19.32	8.03	90.77	1179	51.35	9.08	14.22	73.74
~ Female labor force participation	3817	41.30	9.32	9.57	56.03	2638	40.44	10.36	9.57	56.03	1179	43.21	5.99	10.79	50.63
~ Female to male labor force	3817	69.84	20.73	10.44	108.00	2638	68.37	23.33	10.44	108.00	1179	73.13	12.59	17.86	91.00
Women Business & Law **index**	3817	57.24	17.99	8.49	91.83	2638	54.90	19.71	8.49	91.83	1179	62.46	11.80	15.14	86.17
Control variables															
GDP pc	7797	9841.41	11 152.16	377.58	84 580.14	5206	4560.87	4206.12	377.58	29 766.00	2591	20 451.42	13 043.90	990.77	84 580.14
Education 15+	7797	6.15	3.45	0.06	13.61	5206	4.59	2.75	0.06	11.75	2591	9.30	2.40	2.47	13.61
Population under 5	7797	12.82	4.92	3.77	21.43	5206	15.08	3.97	3.95	21.43	2591	8.27	3.17	3.77	18.94
Population over 65	7797	6.64	4.59	1.45	27.58	5206	4.37	2.47	1.45	21.02	2591	11.21	4.47	2.03	27.58
Population density	7797	135.15	453.97	0.63	8225.00	5206	77.35	113.52	0.63	1239.74	2591	251.29	757.78	1.06	8225.00
Urban ratio	7117	50.24	24.04	2.23	100.00	4835	40.75	21.19	2.23	91.87	2282	70.36	15.97	27.67	100.00
Health equality	7797	0.30	1.55	−2.97	3.48	5206	−0.45	1.19	−2.97	3.48	2591	1.81	0.98	−1.61	3.44
Political corruption **index**	7797	0.48	0.31	0.01	0.97	5206	0.64	0.23	0.06	0.97	2591	0.17	0.18	0.01	0.83
Electoral democracy (polyarchy) **index**	7797	0.45	0.29	0.01	0.92	5206	0.32	0.21	0.03	0.91	2591	0.70	0.26	0.01	0.92
Coups d'état	7477	0.02	0.15	0.00	1.00	4973	0.03	0.17	0.00	1.00	2504	0.00	0.07	0.00	1.00
Drinking water	1755	64.40	31.56	1.43	100.00	1121	46.76	26.04	1.43	96.92	634	95.58	6.04	64.43	100.00
Sanitation	1858	53.33	31.17	1.12	100.00	1194	35.01	22.48	1.12	92.17	664	86.27	11.03	46.90	100.00
Births attended by skilled staff	2019	87.98	20.91	7.40	100.00	1169	80.11	24.61	7.40	100.00	850	98.81	1.91	85.80	100.00
Hospital beds	2788	4.53	3.45	0.10	19.90	1494	3.11	3.16	0.10	14.30	1294	6.16	3.03	1.20	19.90
Immunization (polio)	4837	79.35	22.63	1.00	99.00	3308	73.50	24.45	1.00	99.00	1529	92.00	9.60	16.00	99.00
Breastfeeding	530	33.94	20.49	0.11	88.40	508	33.91	20.45	0.11	88.40	22	34.82	21.77	2.30	84.50

Notes: ~ – measure of a realization of the right; aggregate indexes highlighted in bold. LMIC = low- and middle-income countries. HIC = high-income countries. Definitions of variables are in Appendix A. The list of countries in the LMIC and HIC subsamples is in Appendix B.

3.2. Methods

We estimate the relationship between women's empowerment measures and the child mortality rate using the following model:

$$m_{i,t}^{5-} = \beta_0 + \beta_1 w_{i,t} + \Gamma_j X_{i,t} + \mu_i + \lambda_t + \epsilon_{i,t} \quad (1)$$

where $m_{i,t}^{5-}$ is the logarithm of under-5 mortality rate in country i in year t, $w_{i,t}$ is the logarithm of one of the 27 women's empowerment measures, and $X_{i,t}$ is a vector of j control variables, all per country i and year t. Using a panel approach (Kõlves et al., 2013), we include country fixed effects μ_i to capture time-invariant factors such as country size and geographical location, and time fixed effects λ_t to represent determinants that alter uniformly across countries over time, estimating model (1) for each empowerment factor separately to avoid potential multicollinearity. We also check the pairwise correlations between women's empowerment measures and the controls, finding that the average correlation coefficient ranges from 0.065 for population density to 0.422 for the electoral democracy (polyarchy) index. Given our approach and these correlations, there is not a further issue of multicollinearity to address. Although common in the literature to employ fixed effects, this only allows for within-effects, and one might also use a random effects model to allow for between-effects (Bell & Jones, 2015). Employing a Hausman specification test (Hausman, 2015), we compare fixed and random models for each estimation, this approach finding that fixed effects is always the preferred model.

Note that estimation of model (1) is carried out with Driscoll and Kraay (1998) standard errors that are robust to very general forms of cross-sectional and temporal dependence, as well as heteroscedasticity and autocorrelation. This approach addresses violations of the classical assumptions for the error term but still assumes exogenous regressors. Thus, in later robustness tests, we use the first lag of all regressors (see Wigley, 2017) and also an instrumental variables (IV) approach. The latter follows Lewbel (2012), a technique that allows the identification of structural parameters in a regression model with potentially endogenous regressors without using external instruments, as the instruments themselves are constructed as simple functions of the model's data.[15]

4. Empirical results

Given we estimate model (1) separately for each of the 27 women's empowerment indicators, for compactness, we only report the coefficients (i.e., the estimated β_1s) for the empowerment measures and thus each upcoming results table represents 81 separate estimations (i.e., 27 regressions each for the three samples: whole sample, LMIC and HIC).[16] Although we do not report effects of individual controls,[17] note the impact of our control variables is typically consistent with the literature. For example, focusing on our low- and middle-income country subsample, GDP per capita, seen as a key measure of development, presents a negative and statistically significant coefficient, in line with other studies such as Pritchett and Summers (1996) and Wigley and Akkoyunlu-Wigley (2017). Education also has a negative and statistically significant association, as expected, given similar findings in Gonzalez and Quast (2011) and Huebener (2019). In terms of demographic controls, the share of population under 5 has a positive impact whilst the share of population over 65 has a negative impact, with these two variables capturing the age of population (see Gonzalez & Quast, 2011; Ruhm, 2000). A higher proportion of the latter variable represents better health conditions, reducing child mortality. Additionally, population density presents a negative association with child mortality given a greater scattering of people may increase the cost, as well as reduce the quality of providing public goods such as healthcare, education, and sanitation (see Ross, 2006).[18]

4.1. Benchmark results

Table 4 presents results for the full sample, as well as for the subsamples of low- and middle-income countries (LMIC) and high-income countries (HIC) separately. Each line presents an estimate of β_1 (in column "Coeff") in model (1) with the relevant explanatory variable, $w_{i,t}$, given in column "Measures of empowerment". As noted in Section 3.2, we employ a country and time fixed-effect regression with Driscoll–Kraay corrected standard errors. The dependent variable in all regressions is the logarithm of under-5 mortality rate, and explanatory variables are also in logarithms except for binary variables. Control variables include GDP per capita, education, share of population under 5, share of population over 65, population density, and the electoral democracy (polyarchy) index.

To begin, the full sample results in Table 4 columns 2 and 3 show evidence that (**H1**) is supported by the data. For example, the statistically significant coefficient of 0.073 for the exclusion by gender index demonstrates that, at a whole sample level, women's empowerment can reduce child mortality. Results in these columns also demonstrate that (**H2**), (**H3**) and, in particular, (**H4**) have some support and confirm that stronger civil (i.e., access to public services), civil society (i.e., civil liberties) and public administration (e.g., lower chamber female legislators and lower chamber gender quota) rights and realizations are negatively associated with the child mortality rate. However, it is worth noting that some empowerment measures (e.g., access to justice and female suffrage) are insignificant for the whole sample (Nb: differences between the LMIC and HIC subsamples are discussed below). It is also important to consider that (**H5**) for economic rights and realizations is not always supported. In particular, while the sign and significance of access to state jobs and access to state business opportunities strongly indicate a negative association with child mortality, this is not the case for the other measures (e.g., property rights, access to banking, ability to open a business, and female labor force measures) which are significant and positive.

To investigate further, Table 4 also shows subsample results for LMIC (columns 5 and 6) and HIC (columns 8 and 9). (**H1′**) posits that improved empowerment reduces child mortality more in HIC than in LMIC. Again, there is evidence to support this hypothesis with the women political empowerment index presenting significant coefficients of 0.079 and −0.302 for LMIC and HIC, respectively. This moderation by the level of economic development can be seen elsewhere; for example, hypothesis (**H2′**), suggesting that the association of stronger civil rights with child mortality fades or is reversed in lower-income countries, is also supported. This can be observed in variables such as freedom of domestic movement, which presents a positive and significant coefficient (i.e., 4.878) for LMIC but a negative and significant coefficient (i.e., −9.875) for HIC. Within civil rights, there are women's empowerment measures (i.e., access to public services) that are negatively associated with child mortality in LMIC, however, the negative association is stronger for HIC.

The dichotomy between LMIC and HIC continues when examining civil society, public administration, and economic rights and realizations. Consider first that whilst female suffrage is negative and

[15] All estimations are carried out in Stata version 15.

[16] The issue of multiple comparisons is not discussed enough in the literature. Given that we are examining some quite distinct empowerment measures (e.g., access to banking and freedom of domestic movement) and with some different ex-ante theoretical implications (see Table 2), particularly across our LMIC and HIC subsamples and different groups of rights, we maintain that multiple comparison is not likely a serious issue in our context. However, exact p-values for all estimations are available on request. We thank an anonymous reviewer for this point.

[17] Further results available on request from authors.

[18] The electoral democracy (polyarchy) index is also included as a control but is often found to be insignificant. However, to ensure we are not conflating any potential impact of women's empowerment measures with democracy, we keep the index as a control in all regressions — see Hornset and de Soysa (2022).

Table 4
Women's empowerment and the under-5 mortality rate, 1950–2018.

Measures of empowerment, $\omega_{i,t}$ in Eq. (1)	Full sample			LMIC subsample			HIC subsample		
	Coeff	t-stat	Obs/N	Coeff	t-stat	Obs/N	Coeff	t-stat	Obs/N
Aggregate									
Women political empowerment **index**	0.019	0.708	7672/134	0.079***	2.675	5147/92	−0.302***	−3.675	2525/42
Exclusion by gender **index**	0.073***	5.080	7797/134	0.017	0.911	5206/92	0.025	1.639	2591/42
Civil rights									
Freedom of domestic movement	1.594*	1.718	7797/134	4.878***	4.050	5206/92	−9.875***	−5.304	2591/42
Freedom from forced labor	1.321	1.363	7797/134	1.079	0.970	5206/92	−3.624	−1.505	2591/42
Access to justice	1.052	1.226	7797/134	5.46***	4.759	5206/92	−3.883***	−2.794	2591/42
Access to public services	−6.882***	−4.782	7734/133	−3.575*	−1.772	5143/91	−6.698***	−3.383	2591/42
Political rights: civil society									
Female suffrage	−0.033	−1.420	7797/134	−0.042*	−1.809	5206/92	−0.229***	−3.605	2591/42
Freedom of discussion	1.431	1.424	7797/134	3.487***	3.667	5206/92	−1.588	−1.048	2591/42
CSO participation	0.5	0.506	7797/134	2.033	1.517	5206/92	−0.563	−0.358	2591/42
Civil liberties	−4.541***	−6.012	7797/134	−0.402	−0.336	5206/92	−5.279***	−4.345	2591/42
~ Female journalists	−0.01	−0.415	7794/134	−0.009	−0.386	5203/92	0.057*	1.897	2591/42
Civil society participation **index**	−0.007	−0.262	7797/134	0.014	0.560	5206/92	−0.082	−1.340	2591/42
Political rights: public administration									
Political power	−1.406	−1.353	7797/134	0.678	0.635	5206/92	−0.551	−0.377	2591/42
~ HOS female	−0.033*	−1.805	7743/134	−0.095***	−3.387	5206/92	0.019	0.753	2537/42
~ HOG female	0.049***	2.870	4528/112	−0.034*	−1.923	2530/76	0.067**	2.642	1998/36
~ Lower chamber female legislators	−0.336***	−4.125	6938/134	−0.247**	−2.286	4458/92	−0.336***	−2.682	2480/42
~ Lower chamber gender quota	−0.025***	−3.746	7797/134	−0.015**	−2.251	5206/92	−0.053***	−6.225	2591/42
Political participation **index**	−0.024*	−1.712	7672/134	0.007	0.387	5147/92	−0.094***	−3.092	2525/42
Economic rights									
Property rights	2.27**	2.169	7797/134	5.631***	3.867	5206/92	−9.471***	−5.109	2591/42
Access to state jobs	−5.158***	−7.158	7714/133	−2.921***	−3.027	5143/91	−3.871***	−3.236	2571/42
Access to state business opportunities	−6.433***	−6.924	7698/134	−4.986***	−4.380	5186/92	−5.636***	−3.445	2512/42
Access to banking	0.166***	4.179	6111/132	0.227***	8.400	4161/90	−0.245***	−3.906	1950/42
Ability to open business	0.07**	2.121	6111/132	0.123***	4.511	4161/90	−0.245***	−3.906	1950/42
~ Female labor force	0.12***	3.194	3817/132	0.082**	2.158	2638/91	0.036	0.442	1179/41
~ Female labor force participation	0.302***	5.656	3817/132	0.289***	6.613	2638/91	0.171**	2.650	1179/41
~ Female to male labor force	0.322***	8.049	3817/132	0.31***	10.419	2638/91	0.168***	2.767	1179/41
Women Business & Law **index**	0.1***	2.880	3817/132	0.082**	2.263	2638/91	−0.013	−0.140	1179/41

Notes: Obs/N = number of observations/number of countries in the sample. Coeff is the coefficient on the relevant empowerment measure estimated from model (1) and t-stat represents *t*-statistic of that coefficient. LMIC = low- and middle-income countries. HIC = high-income countries. Definitions of variables are in Appendix A. The list of countries in the LMIC and HIC subsamples is in Appendix B.

* $p < 0.10$

** $p < 0.05$

*** $p < 0.01$

significant (i.e., −0.042 at the 10 percent level) for LMIC, it then presents a more negative significant coefficient (i.e., −0.229 at the 1 percent level) for HIC. Additionally, while civil liberties are insignificant for LMIC, they have a negative and significant coefficient of −5.279 for HIC, suggesting that such rights only reduce child mortality when the level of economic development is high enough. On the other hand, stronger public administration empowerment in LMIC is typically associated with a reduction in child mortality and sometimes with a greater magnitude than in HIC; for example, when having a female Head of State (HOS) or Head of Government (HOG).

Turning to economic rights and realizations, earlier we posited (**H5′**) that stronger economic rights are positively associated with the child mortality rate in lower-income environments, if the impact of higher household income is outweighed by that of less parental time with children. Strikingly, (**H5′**) is supported for property rights, access to banking, and ability to open a business in LMIC, where all present positive and significant (typically at the 1 percent level) coefficients. These can be contrasted with access to state jobs and access to state business opportunities, that exhibit negative and significant associations with child mortality in the LMIC subsample, suggesting conditions of employment/contracts with state institutions favor the flexibility and provision that supports childcare. Finally, despite the more mixed picture for LMIC, many of the economic measures show greater empowerment (e.g., property rights, access to banking, ability to open a business) in HIC improves child health.[19]

[19] Exceptions include two female labor force measures.

4.2. Robustness

As a next step, we estimate (1) with additional controls: specifically, the urban ratio, health equality index, and political corruption index, in addition to our benchmark control variables. In doing so, we follow the literature suggesting that the quality of institutions helps control for those time-varying factors that might capture the impact of political interventions beyond those already included such as improvements in health and education and embedded in the traditional controls – including the electoral democracy (polyarchy) index – we use in (1) (see a discussion of institutional factors contained in Makhlouf et al., 2017; Ross, 2006; Wigley & Akkoyunlu-Wigley, 2017, for example). In our analysis these additional institutional measures are political corruption and urban population ratio variables. For the same purpose, we also employ the health equality index that reflects the availability of high quality basic healthcare to all.[20]

Table 5 once again reports results for the full sample, and the LMIC and HIC subsamples. Adding further institutional controls does not substantially change results for the whole sample; given the 27

[20] The health equality index we use not only measures the quality of health services but also the distribution of these services. Other measures for access to and quality of healthcare and related services (e.g., births attended by skilled health staff) are also used in the literature, however, the data on these variables is limited. Later on in this robustness section we employ some of these controls over a shorter time period and with fewer countries, given their availability.

Table 5
Women's empowerment and the under-5 mortality rate, 1950–2018 — with additional controls for urbanization, health equality, and political corruption.

Measures of empowerment, $\omega_{i,t}$ in Eq. (1)	Full sample			LMIC subsample			HIC subsample		
	Coeff	t-stat	Obs/N	Coeff	t-stat	Obs/N	Coeff	t-stat	Obs/N
Aggregate									
Women political empowerment **index**	0.004	0.111	7033/133	0.073***	3.231	4801/91	−0.364***	−3.878	2232/42
Exclusion by gender **index**	0.065***	5.142	7117/133	0.055***	3.341	4835/91	0.024	1.166	2282/42
Civil rights									
Freedom of domestic movement	0.475	0.529	7117/133	4.346***	4.818	4835/91	−11.177***	−4.687	2282/42
Freedom from forced labor	−1.481	−1.360	7117/133	−0.237	−0.172	4835/91	−7.616***	−3.994	2282/42
Access to justice	0.858	1.351	7117/133	3.794***	5.282	4835/91	−2.715	−1.467	2282/42
Access to public services	−8.766***	−4.888	7058/132	−7.003***	−3.097	4776/90	−8.612***	−4.728	2282/42
Political rights: civil society									
Female suffrage	−0.033	−1.461	7117/133	−0.037	−1.591	4835/91	−0.272***	−2.855	2282/42
Freedom of discussion	1.418*	1.765	7117/133	3.269***	3.608	4835/91	−2.217	−1.397	2282/42
CSO participation	1.033	1.130	7117/133	1.997*	1.751	4835/91	−0.305	−0.216	2282/42
Civil liberties	−3.976***	−3.347	7117/133	−1.589	−1.154	4835/91	−5.576***	−3.903	2282/42
~ Female journalists	−0.05**	−2.534	7114/133	−0.044**	−2.420	4832/91	0.056	1.533	2282/42
Civil society participation **index**	−0.006	−0.226	7117/133	0.017	0.734	4835/91	−0.117**	−2.112	2282/42
Political rights: public administration									
Political power	−0.262	−0.258	7117/133	0.856	1.157	4835/91	−0.23	−0.150	2282/42
~ HOS female	−0.008	−0.406	7081/133	−0.062**	−2.025	4835/91	0.018	0.648	2246/42
~ HOG female	0.035**	2.108	4120/111	−0.031	−1.315	2348/75	0.037	1.617	1772/36
~ Lower chamber female legislators	−0.255***	−2.874	6355/133	−0.282***	−2.755	4168/91	−0.189	−1.050	2187/42
~ Lower chamber gender quota	−0.03***	−5.873	7117/133	−0.022***	−4.007	4835/91	−0.042***	−4.784	2282/42
Political participation **index**	−0.017	−1.291	7033/133	0.001	0.125	4801/91	−0.076**	−2.136	2232/42
Economic rights									
Property rights	−0.011	−0.012	7117/133	3.892***	3.786	4835/91	−11.77***	−5.037	2282/42
Access to state jobs	−4.416***	−7.702	7048/132	−2.496***	−3.027	4776/90	−3.913**	−2.632	2272/42
Access to state business opportunities	−7.482***	−6.697	7047/133	−7.197***	−4.875	4825/91	−6.424***	−2.828	2222/42
Access to banking	0.167***	4.403	6111/132	0.221***	8.298	4161/90	−0.197***	−3.553	1950/42
Ability to open business	0.071**	2.059	6111/132	0.126***	3.889	4161/90	−0.197***	−3.553	1950/42
~ Female labor force	0.139***	5.899	3817/132	0.096***	3.165	2638/91	0.172*	1.782	1179/41
~ Female labor force participation	0.314***	10.244	3817/132	0.297***	8.190	2638/91	0.35***	4.730	1179/41
~ Female to male labor force	0.354***	11.166	3817/132	0.334***	10.111	2638/91	0.319***	4.800	1179/41
Women Business & Law **index**	0.122***	5.599	3817/132	0.098***	3.340	2638/91	0.127	1.347	1179/41

Notes: Obs/N = number of observations/number of countries in the sample. Coeff is the coefficient on the relevant empowerment measure estimated from model (1) and t-stat represents t-statistic of that coefficient. LMIC = low- and middle-income countries. HIC = high-income countries. Definitions of variables are in Appendix A. The list of countries in the LMIC and HIC subsamples is in Appendix B.

* $p < 0.10$

** $p < 0.05$

*** $p < 0.01$

empowerment measures, we find only six qualitative differences comparing with Table 4, some of which suggest more evidence for the child mortality-reducing association of women's empowerment (e.g., female journalists presents a significant coefficient of −0.05). Similarly, the HIC subsample shows only seven qualitative differences compared to Table 4, the majority of which provide more evidence for child mortality reduction (e.g., freedom from forced labor and civil society participation index) and may suggest institutions play more of an effective role in HIC. By contrast, there are fewer changes in the LMIC subsample. However, controlling for institutions reveals a significant child mortality-reducing association of women's empowerment measured by the exclusion by gender index and female journalists, whereas CSO participation becomes positive and significant at the 10 percent level and two other previously child mortality-reducing variables become insignificant (i.e., female suffrage and HOG female).[21] Moreover, the not-so-good news is that previously observed positive and significant association between economic rights and child mortality in the LMIC subsample is robust to the inclusion of additional controls. This is consistent with the work-childcare trade-off that we have identified as a key channel through which economic rights can adversely impact child health. Importantly, we still find that access to state jobs and access to state business opportunities exhibit negative and significant associations with child mortality in the LMIC subsample, underlining that when institutions are effective in LMIC, these support child health.

As a further robustness check, we assess the inclusion of conflict on our benchmark results. Specifically, Table 6 complements Table 4 by additionally controlling for coups d'état during a given observation year. Coups d'état are defined as "overt attempts by the military or other elites within the state apparatus to unseat the sitting head of state using unconstitutional means" (see Appendix A) and is one of the few existing conflict measures to provide values from 1950, the beginning of our sample period. Again, where changes occur relative to the benchmark sample, these overwhelmingly provide more support for the child mortality-reducing association of women's empowerment across our full, LMIC and HIC samples. For example, for LMIC, the statistically significant coefficient of 0.036 for the exclusion by gender index provides further evidence that (**H1**) is supported by the data. Results in Table 6 also demonstrate additional support for (**H2**), (**H3**) and (**H4**) with changes, *inter alia*, to freedom from forced labor (a significant coefficient of −4.434 in HIC), female journalists (negative and significant coefficients for full sample and LMIC), and the political participation index (a significant coefficient of −0.048 in LMIC), respectively. In terms of differences between LMIC and HIC, it should be noted that Table 6 still clearly provides support for (**H1′**), (**H2′**) and (**H5′**).

Table 7, additionally, splits the lower- and middle-income subsample in low-, lower-middle, and upper-middle income categories (i.e., LIC, Lower-MIC, and Upper-MIC, respectively). Overall, the results in Tables 4 and 7 suggest that it is the distinction between HIC and other countries (i.e., LMIC) that matters most (rather than the

[21] The role of institutions in LMIC is perhaps emphasized by the disappearance of the negative and significant association of female suffrage and female heads of government with child mortality, which is most likely because having female suffrage and a female HOG per se indicates stronger institutions, hence controlling for the latter removes the significance of the former.

Table 6
Women's empowerment and the under-5 mortality rate, 1950–2018 — coups d'etat.

Measures of empowerment, $\omega_{i,t}$ in Eq. (1)	Full sample			LMIC subsample			HIC subsample		
	Coeff	t-stat	Obs/N	Coeff	t-stat	Obs/N	Coeff	t-stat	Obs/N
Aggregate									
Women political empowerment **index**	−0.046	−1.362	7407/134	0.011	0.345	4936/92	−0.261***	−2.686	2471/42
Exclusion by gender **index**	0.081***	6.407	7477/134	0.036**	2.012	4973/92	0.047***	2.886	2504/42
Civil rights									
Freedom of domestic movement	0.655	0.660	7477/134	3.781***	3.061	4973/92	−9.498***	−4.170	2504/42
Freedom from forced labor	−1.298	−1.101	7477/134	−1.638	−1.146	4973/92	−4.434*	−1.971	2504/42
Access to justice	0.292	0.350	7477/134	4.069***	3.625	4973/92	−4.284***	−2.916	2504/42
Access to public services	−8.824***	−6.028	7415/133	−5.054**	−2.426	4911/91	−8.134***	−5.703	2504/42
Political rights: civil society									
Female suffrage	−0.041*	−1.705	7477/134	−0.059**	−2.459	4973/92	−0.218***	−2.918	2504/42
Freedom of discussion	1.866*	1.744	7477/134	4.042***	3.519	4973/92	−1.605	−1.030	2504/42
CSO participation	−0.491	−0.589	7477/134	1.159	0.889	4973/92	−2.275*	−1.673	2504/42
Civil liberties	−5.457***	−5.529	7477/134	−1.39	−1.132	4973/92	−5.929***	−5.148	2504/42
~ Female journalists	−0.06***	−3.001	7474/134	−0.057**	−2.544	4970/92	0.044	1.261	2504/42
Civil society participation **index**	−0.035	−1.358	7477/134	−0.008	−0.323	4973/92	−0.142**	−2.294	2504/42
Political rights: public administration									
Political power	−3.379***	−3.498	7477/134	−2.185***	−2.798	4973/92	−1.349	−0.909	2504/42
~ HOS female	−0.016	−0.868	7423/134	−0.067**	−2.103	4973/92	0.008	0.335	2450/42
~ HOG female	0.05***	2.738	4385/108	−0.016	−0.776	2431/72	0.065**	2.609	1954/36
~ Lower chamber female legislators	−0.348***	−3.810	6718/134	−0.311***	−2.856	4291/92	−0.097	−0.758	2427/42
~ Lower chamber gender quota	−0.025***	−4.092	7477/134	−0.015**	−2.572	4973/92	−0.048***	−5.879	2504/42
Political participation **index**	−0.066***	−4.265	7407/134	−0.048***	−3.384	4936/92	−0.078**	−2.102	2471/42
Economic rights									
Property rights	1.566	1.451	7477/134	4.058***	2.916	4973/92	−8.085***	−3.894	2504/42
Access to state jobs	−6.125***	−8.262	7395/133	−3.713***	−6.566	4911/91	−4.85***	−4.167	2484/42
Access to state business opportunities	−9.039***	−7.248	7378/134	−7.344***	−5.280	4953/92	−7.567***	−3.391	2425/42
Access to banking	0.158***	3.960	6068/132	0.221***	8.401	4127/90	−0.239***	−4.061	1941/42
Ability to open business	0.059*	1.781	6068/132	0.114***	4.290	4127/90	−0.239***	−4.061	1941/42
~ Female labor force	0.122***	3.387	3805/132	0.088**	2.482	2629/91	0.038	0.464	1176/41
~ Female labor force participation	0.304***	5.815	3805/132	0.297***	7.246	2629/91	0.168**	2.630	1176/41
~ Female to male labor force	0.322***	8.118	3805/132	0.316***	10.744	2629/91	0.167**	2.754	1176/41
Women Business & Law **index**	0.102***	3.040	3805/132	0.089**	2.592	2629/91	−0.013	−0.142	1176/41

Notes: Obs/N = number of observations/number of countries in the sample. Coeff is the coefficient on the relevant empowerment measure estimated from model (1) and t-stat represents *t*-statistic of that coefficient. LMIC = low- and middle-income countries. HIC = high-income countries. Definitions of variables are in Appendix A. The list of countries in the LMIC and HIC subsamples is in Appendix B.

* $p < 0.10$

** $p < 0.05$

*** $p < 0.01$

distinction between LIC, Lower-MIC, and Upper-MIC) when observing moderation by the level of economic development.[22] Taken at face value, the results in these tables suggest a 'step' change rather than a graduated alternative due to economic development (i.e., it particularly matters whether a country is an HIC or not).[23]

In Appendix C we report further robustness checks for our baseline HIC and LMIC subsamples, including both lagged regressors (see Table A2) and an IV approach (see Table A3) to address any potential endogeneity, with results remaining qualitatively similar. Additionally, Table A4 presents our benchmark results for the latest two decades of our sample period (i.e., 2000–2018), as a comparator for where data availability allows us to employ additional controls for access to and quality of healthcare and related services, reported in subsequent tables.[24] Specifically, Table A5 provides such estimates controlling for the use of safely managed drinking water services, use of safely managed sanitation services, and births attended by skilled health staff; Table A6 additionally controls for availability of hospital beds; Table A7 for child polio immunization; and, finally, Table A8 for breastfeeding of children. The number of countries available for panel estimation declines as we introduce more controls but the overall result again remains qualitatively the same — women's empowerment measures are typically associated more with a reduction of child mortality in HIC than LMIC.

5. Conclusions

Our objective is to investigate the nexus between women's empowerment and child mortality, complementing previous research that has mostly focused on the linkages between health, education rights, and child welfare. Theoretical considerations suggest women's empowerment may act towards reducing child mortality by adding extra income opportunity, confidence, within-family and extra-family bargaining power, political influence and by increasing public resources directed towards child health. Against these channels, the trade-off between childcare and the time spent on other activities (e.g., paid employment) may provide a negative association. We argue that the resulting association these two countermanding forces produce can

[22] Interpretations of coefficients and their statistical significance require extra care as the additional disaggregation reduces the number of countries in each panel regression quite substantially (i.e., LIC contains 22 countries, Lower-MIC contains 37 countries, and Upper-MIC contains 33 countries) and, consequently, reduces the available degrees of freedom.

[23] The step change is perhaps unsurprising given the World Bank classifications of low income (LIC), lower-middle income (Lower-MIC) and upper-middle income (Upper-MIC) countries are more closely clustered than the high income (HIC) classification.

[24] We thank an anonymous reviewer for this suggestion. Many variables for access to and quality of healthcare and related services are only available for relatively short time periods and a reduced number of countries. We estimate our benchmark model from 2000 onwards and then estimate variants, adding in the new controls above and attempting to maintain a reasonable number of countries in the panel. By the time we add the control 'Breastfeeding', we can no longer delineate between LMIC and HIC.

Table 7
Women's empowerment and the under-5 mortality rate, 1950–2018 — low-, lower-middle and upper-middle-income countries.

Measures of empowerment, $w_{i,t}$ in Eq. (1)	LIC subsample			Lower-MIC subsample			Upper-MIC subsample		
	Coeff	t-stat	Obs/N	Coeff	t-stat	Obs/N	Coeff	t-stat	Obs/N
Aggregate									
Women political empowerment **index**	0.108*	1.870	1211/22	−0.019	−0.800	2086/37	0.17***	4.208	1850/33
Exclusion by gender **index**	0.013	0.146	1223/22	0.031	0.600	2118/37	0.001	0.036	1865/33
Civil rights									
Freedom of domestic movement	1.589	0.643	1223/22	0.861	0.441	2118/37	10.405***	5.867	1865/33
Freedom from forced labor	2.538*	1.692	1223/22	−2.994*	−1.769	2118/37	4.628***	3.517	1865/33
Access to justice	3.585	1.217	1223/22	3.512*	1.961	2118/37	7.684***	5.011	1865/33
Access to public services	2.984	0.612	1160/21	−0.751	−0.321	2118/37	−9.08***	−3.138	1865/33
Political rights: civil society									
Female suffrage	−0.06*	−1.863	1223/22	0.115***	3.132	2118/37	−0.145***	−3.857	1865/33
Freedom of discussion	3.47**	2.593	1223/22	−1.74*	−1.778	2118/37	5.431***	3.220	1865/33
CSO participation	7.753***	2.828	1223/22	−6.679***	−3.771	2118/37	10.802***	5.270	1865/33
Civil liberties	2.333	0.579	1223/22	1.918*	1.826	2118/37	−7.808***	−3.611	1865/33
~ Female journalists	0.059	0.961	1223/22	0.1***	3.020	2118/37	−0.197***	−8.725	1862/33
Civil society participation **index**	0.156***	4.580	1223/22	−0.11***	−4.021	2118/37	0.09***	3.208	1865/33
Political rights: public administration									
Political power	2.307	0.737	1223/22	−0.547	−0.384	2118/37	1.88	0.970	1865/33
~ HOS female	−0.148***	−2.653	1223/22	−0.099**	−2.432	2118/37	−0.045	−1.032	1865/33
~ HOG female	−0.011	−0.187	543/21	−0.07***	−2.965	1080/32	0.109***	2.734	907/23
~ Lower chamber female legislators	−0.479	−1.552	973/22	−0.322*	−1.715	1785/37	0.119	0.996	1700/33
~ Lower chamber gender quota	0.001	0.064	1223/22	−0.009	−1.497	2118/37	−0.033***	−2.667	1865/33
Political participation **index**	0.029	0.924	1211/22	0.024	1.235	2086/37	0.006	0.338	1850/33
Economic rights									
Property rights	1.483	0.403	1223/22	3.859**	2.098	2118/37	6.187***	5.118	1865/33
Access to state jobs	0.734	0.284	1160/21	−7.166***	−3.379	2118/37	−0.568	−0.439	1865/33
Access to state business opportunities	−3.366	−1.146	1223/22	−7.734***	−3.946	2118/37	−0.281	−0.217	1845/33
Access to banking	0.068**	2.680	1007/21	0.281***	8.326	1700/37	0.311***	5.300	1454/32
Ability to open business	−0.032	−1.269	1007/21	0.133***	2.830	1700/37	0.207***	4.704	1454/32
~ Female labor force	−0.275***	−3.595	609/21	−0.076***	−2.868	1073/37	0.207	1.269	956/33
~ Female labor force participation	−0.47***	−3.879	609/21	−0.052	−1.521	1073/37	0.511***	2.909	956/33
~ Female to male labor force	−0.295***	−3.167	609/21	0.167***	3.194	1073/37	0.442***	3.004	956/33
Women Business & Law **index**	−0.277***	−3.660	609/21	−0.042	−1.481	1073/37	0.224	1.421	956/33

Notes: Obs/N = number of observations/number of countries in the sample. Coeff is the coefficient on the relevant empowerment measure estimated from model (1) and t-stat represents *t*-statistic of that coefficient. LIC = low-income countries. Lower-MIC = lower-middle-income countries. Upper-MIC = upper-middle-income countries. The classification of countries in the LIC, Lower-MIC and Upper-MIC subsamples follows the World Bank 2020 classification of countries by the gross national income (GNI) per capita, where countries were assigned to four income groups based on their 2019 GNI per capita as follows: (i) low income with GNI per capita of $1,035 or less; (ii) lower-middle income with GNI per capita between $1,036 and $4,045; (iii) upper-middle income with GNI per capita between $4,046 and $12,535; and (iv) high income with GNI per capita of $12,536 and above. Definitions of variables are in Appendix A.

* $p < 0.10$

** $p < 0.05$

*** $p < 0.01$

depend on the level of social, economic and institutional development of a country.

Employing a new international dataset with 27 women's empowerment measures, empirical results support the institutional view: several empowerment indicators are associated with a reduction of child mortality in high-income countries, yet in low- and middle-income countries relatively more measures show nil or an opposite association. This novel conclusion derives from the comparison of potential channels on a comprehensive scale and at different levels of income, a combination missing from previous studies. Our findings imply that the crucial fostering of women's empowerment should go hand in hand with the development of institutions that provide, for example, public childcare services and other support for mothers. Moreover, a promising direction would be education directed at fathers and broader families to change current cultural norms and habits — the further empowerment of women, and the concomitant improvement in child health, would also include freedom from the pressures exerted by such informal institutions. More research is needed in this direction.

CRediT authorship contribution statement

Neil M. Kellard: Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Yousef Makhlouf:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Anna Sarkisyan:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Dmitri V. Vinogradov:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix. Supplementary material

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.worlddev.2024.106712.

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